ENTERED

RECEIVED

JAN 5 2015

NMED
Hazardous Waste Bureau

DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS MISSION SUPPORT GROUP (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

30 December 2014

Colonel Heather L. Buono
Commander, 27 SOMSG
110 E Alison Avenue Suite 1098
Cannon AFB NM 88103

Mr. John E. Kieling
Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East Bldg 1
Santa Fe NM 87505-6063

Dear Mr. Kieling

Cannon AFB is pleased to submit the *Final Corrective Action Complete Proposals for Sites: SWMU 71, SWMU 126, and SWMU 101* for your review. If you have any questions regarding this submittal, please contact Ms. Laura Peters, Restoration Program Manager at (575) 784-0491.

Sincerely,

Heather L. Buono

HEATHER L. BUONO, Colonel, USAF
Commander

Attachment:
Corrective Action Complete Proposal for: SWMU 71, SWMU 126, and SWMU 101

cc:
NMED, Dave Cobrain

CORRECTIVE ACTION COMPLETE PROPOSALS FOR SITES SWMU 71, SWMU 126, AND SWMU 101

CANNON AIR FORCE BASE
NEW MEXICO
RCRA PERMIT No. NM7572124454

Performance Based Remediation
Contract Number: FA8903-13-C-0008

Prepared for

AIR FORCE CIVIL ENGINEER CENTER
2261 Hughes Ave., Suite 155
JBSA – Lackland AFB, Texas 78236-9853

October 27, 2014

Prepared by:

FPM Remediations, Inc.
584 Phoenix Drive
Rome, NY 13441

URS **Group, Inc.**
7720 N 16th Street, Suite 100
Phoenix, AZ 85020-4493

TABLE OF CONTENTS

Introduction 1

A. Facility Description 2

B. History of Investigation 2

C. SWMU Descriptions 2

1. SWMU 71, Recovered JP-4 Fuel Tank No. 390 (TU071) 2
   - Location – SWMU 71 2
   - History / Current and Anticipated Future Land Use – SWMU 71 3
   - Evaluation of Relevant Information – SWMU 71 4
   - Basis of Determination – SWMU 71 4
2. SWMU 126, Inactive Underground Storage Tank No. 3 (TU126) 4
   - Location – SWMU 126 4
   - History / Current and Anticipated Future Land Use – SWMU 126 4
   - Evaluation of Relevant Information – SWMU 126 5
   - Basis of Determination – SWMU 126 6
3. SWMU 101, Wastewater Lagoons 1 & 2 (SI101) 6
   - Location – SWMU 101 6
   - History / Current and Anticipated Future Land Use – SWMU 101 6
   - Evaluation of Relevant Information – SWMU 101 6
   - Basis of Determination – SWMU 101 8

D. References 9

List of Attachments

I. Maps and Figures

- Figure I-1 Site Location Map
- Figure I-2 Site Map, SWMU 71 – Recovered JP-4 Fuel Tank No. 390 (TU071)
- Figure I-3 Site Map, SWMU 126 – Inactive Underground Storage Tank No. 3 (TU126)
- Figure I-4 Site Map, SWMU 101 – Wastewater Lagoons 1 & 2 (SI101)

II. TU071 Tank Closure Report

III. TU126 Tank Closure Report

IV. SMWU 101 – Sewage Lagoons (SI101) No Further Action Report

TABLE OF CONTENTS

List of Acronyms

µg/L	micrograms per liter
AFB	Air Force Base
AOC	Area of Concern
CAC	Corrective Action Complete
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measure Study
COC	Chemicals of Concern
HHRA	Human Health Risk Assessment
HSWA	Hazardous and Solid Waste Amendments
LTM	long term monitoring
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NFA	No Further Action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMEID	New Mexico Environmental Improvement Division
NMGWQS	New Mexico Groundwater Quality Standard
No.	number
OWS	oil/water separator
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SWMU	Solid Waste Management Unit
TPH	total petroleum hydrocarbons
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC(s)	volatile organic compound(s)

CORRECTIVE ACTION COMPLETE PROPOSALS

Introduction

The United States Air Force (USAF) and Cannon Air Force Base (AFB) (Permittee) is requesting Corrective Action Complete (CAC) Without Controls status for Solid Waste Management Units (SWMUs) 71 and 126 and CAC With Controls status for SWMU 101 from the New Mexico Environment Department (NMED) in with accordance the New Mexico Hazardous Waste Act (Section 74-4-1 et seq., New Mexico Statutes Annotated 1978, as amended, 1992) and the New Mexico Hazardous Waste Management Regulations 20.4.1 New Mexico Administrative Code (NMAC). These three SWMUs are listed in the Permitte's Resource Conservation and Recovery Act (RCRA) Part B Permit pursuant to 40 Code of Federal Regulations 270.42(c) of the Hazardous and Solid Waste Amendments of 1984.

If approved, the Permittee requests NMED to initiate a modification of Cannon AFB's RCRA permit to adjust the content of the three corrective action tables (Attachment 1 of Cannon AFB's RCRA Permit). The tables list the status of SWMUs at the Base, and their content is as follows:

- **Table 1** – List of SWMUs Requiring Corrective Action (corrective action may be necessary to characterize and/or remediate past releases of hazardous wastes or hazardous constituents)
- **Table 2** – List of SWMUs with Corrective Action Complete, With Controls (corrective action has been completed, and further corrective action is not currently required; controls are required)
- **Table 3** – List of SWMUs with Corrective Action Complete, Without Controls (corrective action has been completed, and further corrective action is not currently required; no controls are required)

The proposed modification would grant CAC Without Controls status for two SWMUs. The following SWMUs would move from Table 1 to Table 3:

- SWMU 71 – Recovered JP-4 Fuel Tank Number (No.) 390 (USAF Site TU071)
- SWMU 126 – Inactive Underground Storage Tank No. 3 (USAF Site TU126)

The proposed modification would also grant CAC With Controls for one SWMU. The following SWMU would move from Table 1 to Table 2:

- SWMU 101 – Wastewater Lagoons 1 & 2 (USAF Site SI101)

The three SWMUs addressed by this document are listed in the following table:

Section D Sub-section	SWMU / AOC	USAF Site Name	Description/Name
1	SWMU 71	TU071	Recovered JP-4 Fuel Tank No. 390
2	SWMU 126	TU126	Inactive Underground Storage Tank No. 3
3	SWMU 101	SI101	Wastewater Lagoons 1 & 2

CORRECTIVE ACTION COMPLETE PROPOSALS

A. Facility Description

Cannon AFB is located in Curry County, New Mexico, approximately 7 miles west of the City of Clovis. The Base encompasses approximately 4,320 acres of land. Cannon AFB is situated in a nearly flat plain sloping gently (10 to 15 feet per mile) to the east and southeast. Elevations in the vicinity of Cannon AFB range from 4,250 feet to 4,350 feet above mean sea level.

Cannon AFB dates to 1929, when Portair Field was established on the site as a civilian passenger terminal for early commercial transcontinental flights. In 1942 the Army Air Corps took control of the civilian airfield and it became known as the Clovis Army Air Base. In early 1945, the Base was renamed Clovis Army Air Field, where flying, bombing, and gunnery classes continued until the Base was de-activated in May 1947.

The Base was reassigned to the Tactical Air Command and formally reactivated as Clovis AFB in 1951. The Base was renamed Cannon AFB in 1957. Several Fighter-Bomber Groups and Tactical Fighter Wings have occupied the Base since 1951. In June 2006, it was announced that Cannon AFB would transfer from the Air Combat Command and become an Air Force Special Operations Command installation.

B. History of Investigation

The United States Environmental Protection Agency (USEPA) issued the Hazardous and Solid Waste Amendments (HSWA) Module IV to Cannon AFB's RCRA Operating Permit effective December 17, 1989. The HSWA module required investigation of the SWMUs in the permit at Cannon AFB. In January 1996, NMED received authorization for corrective action under the HSWA and became the administrative authority for this action.

Section C of this document briefly describes the location and history of each SWMU. Detailed descriptions of the investigative results for each SWMU appear in the original investigative reports and/or administrative records. References for these sources are provided in **Section D**.

C. SWMU Descriptions

The following subsections describe the location, history, and land use conditions for each SWMU. A summary of relevant information from previous investigations and a basis for CAC determination for the sites are also presented in this section. A site map showing the location of the SWMUs is presented as **Figure I-1** in **Attachment I**.

1. SWMU 71, RECOVERED JP-4 FUEL TANK NO. 390 (TU071)

Location – SWMU 71

Tank 390 was formerly located in the Bulk Storage Area in the Cantonment Area, Cluster H (A.T Kearney, Inc. 1987) (**Figure I-1** in **Attachment I**). A site map is presented as **Figure I-2** in **Attachment I**.

History / Current and Anticipated Future Land Use – SWMU 71

SWMU 71 (Tank 390) was an underground 2,000-gallon steel tank that began operation in 1976. The tank was used to store JP-4 fuel that escaped through pressure relief valves in the piping attached to the bulk fuel storage tanks. The fuel was periodically removed from the tank and returned to the bulk JP-4 storage tanks (Cannon AFB, 1995). The tank was never used to store waste.

The inspection report completed at the time of the tank removal indicated the following: the UST was a 2,000-gallon steel tank containing JP-4; a Tracer leak detection and monitoring system was operational on both the tank and piping; and the tank and piping were observed to be in very good condition with no visual evidence of a leak (**Attachment II**).

An underground storage tank (UST) Closure Notice was provided for Tank 390 via telephone to the NMED on January 8, 1991. The notification call was received by Mr. Joe Harerra (see a copy of the UST Closure Notice: Memorandum of Telephone Call/Verbal Notice in **Attachment II**). The tank was removed on January 14, 1991. A letter was sent to Mr. Ron Castleberry with the New Mexico Environmental Improvement Division (NMEID) describing the UST removal activity (see **Attachment II**). The required NMEID UST closure report forms were submitted with the letter. The NMEID UST removal reporting forms were submitted to NMEID on January 28, 1991. Copies of all forms are included in **Attachment II**.

Tank 390 was removed successfully on January 14, 1991. The tank was inspected by Mr. Rick Crow with Cannon AFB and found to be sound with no evidence of any leaks. Photographs were taken of the removal activities and of the removed tank. These photographs are included in **Attachment II**. Two soil samples were collected: one at 2 feet below ground surface and one at the bottom of the excavation. Soil samples were analyzed via USEPA Method 8240 for volatile organic compounds (VOCs). All results were non-detect (below the method detection limits). Copies of the laboratory reports are included in **Attachment II**.

In the 2000 Management Action Plan (Cannon AFB 2000) and the 2001 Management Action Plan (Cannon AFB 2001), SWMU 71 was identified by the USAF to be appropriate for No Further Action (NFA). In January 2004, NMED reviewed the NFA permit modification request and concluded that SWMU 71 may qualify for NFA; however, NMED indicated that the NFA petition conclusions should be documented in a report (NMED 2004). SWMU 71 was identified in Cannon's RCRA Permit decision letter dated February 27, 2006 (NMED 2006) as requiring additional corrective action before the site can be petitioned for CAC. A Site-Specific Health and Safety Plan/Accident Prevention Plan for Final Closure of SWMUs 70, 71, 126, and 128 was developed in December 2008 for final closure of SWMU 71 (North Wind 2008). The Work Plan for Final Closure of SWMUs 70 and 71 indicated that UST removal records had been located for SWMU 71 and a CAC Proposal should be prepared for the site (North Wind 2010). Since the UST removal paperwork had been located (see **Attachment II**), further field work was not performed.

In 1991 a new oil/water separator (OWS) was installed at the former Tank No. 390 location (URS Greiner Woodward-Clyde 2000a). The new OWS was installed in a concrete vault

covered with a steel grate. Further information regarding the installation of this OWS could not be located. Current land use is industrial and is related to the bulk fuel storage system, therefore land use classification will remain industrial.

Evaluation of Relevant Information – SWMU 71

The USEPA RCRA Facility Investigation Guidance (USEPA 1989) defines a SWMU as follows:

"A SWMU is any discernible unit at which solid or hazardous wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous wastes. Such units include any area at a facility at which hazardous wastes or hazardous constituents have been routinely and systematically released. A SWMU does not include an accidental spill from production areas and units in which wastes have not been managed (e.g., product storage areas)."

Because Tank 390 was never used for the management of wastes, it was not a SWMU. In addition, the Tank 390 UST was removed per NMEID protocol on January 14, 1991. The tank was in good condition with no evidence of leakage. Soil samples were collected from the soil around and beneath the tank. These samples were analyzed for VOCs via USEPA 8240. All results were non-detect. All UST removal documentation is attached in **Attachment II**. Therefore, a Class 3 modification to the Cannon AFB RCRA Part B permit pursuant to 40 CFR 270.42(c) is warranted for closure of SWMU 71.

Basis of Determination – SWMU 71

SWMU 71 (TU071) is proposed for CAC Without Controls. The SWMU was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other CERCLA hazardous substances. Additionally, the SWMU was characterized in accordance with applicable state and/or federal regulations, and the available data indicated that contaminants do not pose an unacceptable level of risk under current and projected land use.

2. SWMU 126, INACTIVE UNDERGROUND STORAGE TANK NO. 3 (TU126)

Location – SWMU 126

This UST for heating oil was located on the southwest side of Building 163 (**Figure I-1** in **Attachment I**). A site map is presented as **Figure I-3** in **Attachment I**.

History / Current and Anticipated Future Land Use – SWMU 126

The heating oil tank for Building 163 originally held diesel fuel (A.T. Kearney Inc. 1987). In the 2000 Management Action Plan (Cannon AFB 2000) and the 2001 Management Action Plan (Cannon AFB 2001), SWMU 126 was identified by the USAF to be appropriate for No Further Action (NFA). In January 2004, NMED reviewed the NFA permit modification request and concluded that the SWMU may qualify for NFA; however, the UST must be closed in

accordance with NMED UST regulations (NMED 2004). SWMU 126 was identified in Cannon's RCRA Permit decision letter dated February 27, 2006 (NMED 2006) as requiring additional corrective action before the site could be petitioned for CAC. A Site-Specific Health and Safety Plan/Accident Prevention Plan for Final Closure of SWMUs 70, 71, 126, and 128 was developed in December 2008 for final closure of SWMU 126 (North Wind 2008). The UST removal paperwork was subsequently located (see **Attachment III**), so further field work was not performed.

Building 163 was demolished in 1987. The heating oil tank for Building 163 was removed successfully on November 4, 1991 under the supervision of Mr. Harry Gunn with the NMEID, Underground Storage Tank Bureau Prevention/Inspection Section. **Attachment III** contains copies of the NMEID UST removal report forms. Soil samples were collected from 2 feet below the bottom of the tank at the north and south ends. The samples were analyzed for total recoverable petroleum hydrocarbons via USEPA Method 418.1. The soil sample analytical result from the north end of the tank was 22 milligrams per kilogram (mg/kg). The soil sample analytical result from the south end of the tank was 34 mg/kg. These concentrations are well below the NMED Risk Assessment Guidance for Site Investigations and Remediation (NMED 2012) concentration of 1,000 mg/kg for diesel fuel and heating oil under the residential direct exposure scenario. The concentrations detected in the soil also are below the total petroleum hydrocarbons (TPH) screening guidelines for vapor migration (1,000 mg/kg TPH) listed in the same guidance. The laboratory reports are included in **Attachment III**.

Current land use is industrial. The footprint of Building 160 covers the former UST location. The former location of the UST is beneath the building slab in the east corner of the building (see **Figure I-3**). Land use classification will remain industrial.

Evaluation of Relevant Information – SWMU 126

The area mis-identified as SWMU 126 was actually a heating oil tank installed in 1958 associated with Building 163. This building was demolished in 1985 and Building 164 subsequently was constructed in its place. The UST was formerly located to the southwest of Building 163/164. The UST was removed in accordance with NMED UST regulations on November 4, 1991. Subsequent to the removal of the UST, Building 160 was constructed to the southwest of Building 164 over the former UST location (A.T. Kearney, Inc. 1987).

The USEPA RCRA Facility Investigation Guidance (USEPA 1989) defines a SWMU as follows:

"A SWMU is any discernible unit at which solid or hazardous wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous wastes. Such units include any area at a facility at which hazardous wastes or hazardous constituents have been routinely and systematically released. A SWMU does not include an accidental spill from production areas and units in which wastes have not been managed (e.g., product storage areas)."

Because the heating oil tank was never used for the management of wastes, it was not a SWMU. Additionally, the UST was removed per NMEID requirements in 1991. No contamination above NMED Soil Screening Levels remained at the site (see analytical report in **Attachment III**).

Therefore, a Class 3 modification to the Cannon AFB RCRA Part B permit pursuant to 40 CFR 270.42(c) is warranted for closure of SWMU 126.

Basis of Determination – SWMU 126

SWMU 126 (TU126) is proposed for CAC Without Controls. The SWMU has never been used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other CERCLA hazardous substances. Additionally, the SWMU was characterized in accordance with current applicable state and/or federal regulations, and the available data indicated that contaminants do not pose an unacceptable level of risk under current and projected land use (see UST removal documentation in **Attachment III**).

3. SWMU 101, WASTEWATER LAGOONS 1 & 2 (SI101)

Location – SWMU 101

SWMU 101 is located directly west of the wastewater playa lake in the east central portion of Cannon AFB (**Figure I-1** in Attachment I). A site map is presented as **Figure I-4** in **Attachment I**.

History / Current and Anticipated Future Land Use – SWMU 101

The former Sewage Lagoons were constructed in 1966. Lagoon 1 has historically been referred to as the north lagoon while Lagoon 2 has historically been referred to as the south lagoon. The lagoons consisted of two unlined surface impoundments (the north and south lagoons) that received combined sanitary and industrial wastewater from base facilities. The lagoons had concrete-lined banks and unlined earthen bottoms, operated in series, and had a combined surface area of approximately 39 acres. In 1998, a new wastewater treatment plant was put into operation at Cannon AFB. Although sewage discharge to the lagoons stopped in 1998, the base continued to discharge treated wastewater to the former lagoons in order to allow them to dry gradually (Bhate 2013).

Evaluation of Relevant Information – SWMU 101

SWMU 101 was investigated in 1992 during the Appendix I RCRA Facility Investigation (RFI) (W-C 1992). Based on the results, the lagoons were recommended for continued annual groundwater monitoring. A Corrective Measures Study (CMS) identified potential corrective actions (Foster Wheeler Environmental 2001). A Human Health Risk Assessment (HHRA) and an ecological risk assessment were conducted as part of the CMS to determine the requirements for contaminant containment and source control. The HHRA concluded that there is no potential risk to receptors from groundwater at SWMU 101. Groundwater beneath SWMU 101 is not used by industrial workers, nor does it discharge naturally through seeps or springs in the area to potentially affect ecological receptors. Groundwater monitoring at SWMU 101 indicated metals were the only analytes detected, and results showed all concentrations were below respective maximum contaminant levels (MCLs). Fate and transport modeling was performed in the CMS to support the risk assessment, and corrective action alternatives were evaluated to simulate

contaminant migration through the vadose zone. The fate and transport of Chemicals of Concern (COCs) that exceeded risk-based screening criteria were modeled based on the current, normal site conditions. Results of the 50-year simulations for the current conditions at Cannon AFB predicted vertical contaminant migration would not reach groundwater. The modeling illustrated that degradation of groundwater, due to COCs in sludge, was unlikely under current, normal conditions.

The CMS recommended sludge removal from the former north lagoon, in-place consolidation in the former south lagoon, and closure using an engineered cover with a biotic barrier as voluntary corrective actions for closing the lagoons. The same corrective measure to close the lagoons permanently was recommended in two separate reports, Sludge Management, Compliance Evaluation, and Requirements Identification Phase III (Ecology and Environment, Inc. 1998) and Sewage Lagoons Closure Final Specifications (United States Army Corps of Engineers [USACE] 2002). The recommended corrective measures involved dewatering, consolidation, and compaction of the contaminated material, followed by installation of a protective cover. The cover design assumed that the contaminated media at the site consisted of approximately 2 feet of sludge overlying a 1-foot layer of impacted soil.

In 2003, a voluntary corrective measure was implemented at SWMU 101 to construct an engineered earthen cover to minimize any potential threat to human health and the environment associated with contaminated material within the lagoons. Sludge and the underlying contaminated soil from the north lagoon were excavated and consolidated into the south lagoon. The south lagoon area was then graded and compacted to prepare a substrate. Finally, a 20-acre engineered earthen cover system with a biotic barrier of recycled, crushed concrete and a 6-inch erosion/vegetation layer was installed over the south lagoon area to reduce infiltration of moisture into the underlying layer of contaminated material. The Final Construction Completion Report for the Remedial Action at SWMU 101 - Sewage Lagoons (Foster Wheeler Environmental 2006) documents these activities. A detailed summary of the site's background and history, results of previous investigations, corrective measures, and status is presented in the NFA report for SWMU 101 dated July 2008 (USACE 2008) (**Attachment IV**). In a November 25, 2009 letter, NMED indicated that SWMU 101 is eligible for a Class III Permit Modification (NMED 2009) (**Attachment IV**). Currently, a shallow earthen drainage swale surrounds the capped area, which is surrounded by a five-strand barbed-wire fence to control access.

Monitoring wells MW-E, MW-F, MW-G, and MW-H were initially installed and monitored for groundwater field parameters on a quarterly basis. These wells were first sampled for laboratory parameters during the 1992 RFI (W-C 1992). The wells subsequently became part of the long term monitoring program (LTM) for Cannon AFB. Currently these wells are sampled biennially in accordance with the direction received from NMED regarding LTM at Cannon AFB (NMED 2008). The next sampling event is scheduled to occur in Summer 2014.

Historical sampling data for these four wells indicate metals (with the exception of thallium) and VOCs were detected at concentrations below their respective residential screening levels. Thallium was detected at estimated quantities above the MCL of 2 micrograms per liter (µg/L) in 2012. Concentrations of thallium identified at SWMU 101 ranged from 3.06 µg/L to 4.65 µg/L. Due to the analytical method utilized, thallium concentrations were estimated. To achieve a

lower method of detection limit for thallium, it was recommended that USEPA Method 6020A be used during subsequent LTM sampling events with the next to occur in 2014. It should be noted that thallium was not identified in the monitoring wells associated with SWMU 101 prior to 2012. Nitrates were identified in MW-G at concentrations exceeding the MCL and New Mexico Groundwater Quality Standard (NMGWQS) prior to the decommissioning of SWMU 101. However, since SWMU 101 was decommissioned, nitrate levels have decreased to concentrations below the MCL and NMGWQS. Therefore, a Class 3 modification to the Cannon AFB RCRA Part B permit pursuant to 40 CFR 270.42(c) is warranted for closure of the SWMU 101.

Basis of Determination – SWMU 101

The results of previous investigations, risk evaluations, and completion of the voluntary corrective measure at the Sewage Lagoons, SWMU 101, support a recommendation of CAC With Controls for SWMU 101. The SWMU has been characterized and remediated in accordance with applicable state and/or federal regulations, and the available data indicated that contaminants do not pose an unacceptable level of risk under current and projected land use.

D. References

A.T. Kearney. 1987. Preliminary Review/VSI Report RCRA Facility Assessment. Cannon AFB, Clovis, New Mexico. July.

Bhate. 2013. 2012 Biennial Groundwater Monitoring Report and Annual Landfill Inspection Report, Landfills LF-03, LF-04, LF-05, LF-25, and Former Sewage Lagoons. Cannon Air Force Base, New Mexico. April.

Cannon AFB. 1995. Management Action Plan. August.

Cannon AFB. 2000. Management Action Plan. December.

Cannon AFB. 2001. Management Action Plan. December.

Ecology and Environment, Inc. 1998. Sludge Management Compliance Evaluation and Requirements Identification Phase III Customer Concept Document. Cannon Air Force Base, New Mexico.

Foster Wheeler Environmental. 2001. Revised Corrective Measures Study Report for SWMU 101 – Sewage Lagoons. Cannon Air Force Base, New Mexico.

Foster Wheeler Environmental. 2006. Final Construction Completion Report for the Remedial Action at SWMU 101 – Sewage Lagoons. Cannon Air Force Base, New Mexico.

NMED. 2004. Letter from NMED to Cannon AFB re No Further Action Petition, January.

NMED. 2006. Letter from NMED to Cannon AFB re Final Permit Decision: Class 3 Permit Modification for No Further Action Status for 32 Solid Waste Management Units/Areas of Concern, February 27. www.nmenv.state.nm.us/HWB/cafbperm.html.

NMED. 2008. Letter from NMED to Cannon AFB re Long Term Monitoring at Solid Waste Management Units 105, 104, 97, and 101. March 26.

NMED. 2009. Letter from NMED to Cannon AFB re Partial Approval of Corrective Action Complete Proposals (July, 2008). November 25.

NMED. 2012. Risk Assessment Guidance for Site Investigations and Remediation, Volume 2. New Mexico Environmental Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program. June.

North Wind. 2008. Site Specific Health and Safety Plan/Accident Prevention Plan for Final Closure of Solid Waste Management Units 70, 71, 126, and 128. December.

North Wind. 2010. Work Plan for Final Closure of Solid Waste Management Units 70, and 71 at Cannon AFB, NM. June.

URS Greiner Woodward-Clyde. 2000a. Hazardous and Solid Waste Amendments/Corrective Action-Related Permit Modification Request No Further Action Proposals, Cannon AFB, NM, Permit No. NM7572124454, Volume II of III. July.

United States Army Corps of Engineers (USACE). 2002. Sewage Lagoons Closure Final Specifications. Cannon Air Force Base.

USACE. 2008. No Further Action Report, SWMU 101 - Sewage Lagoons. Cannon Air Force Base, New Mexico. July.

United State Environmental Protection Agency (USEPA). 1989. RCRA Facility Investigation (RFI) Guidance, Volume I of IV, Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations, USEPA 530/SW-89-031. May.

Woodward-Clyde Consultants, Inc. (W-C). 1992. Remedial Investigation Report for 18 Solid Waste Management Units. Cannon Air Force Base, New Mexico.

Attachment I

Maps and Figures

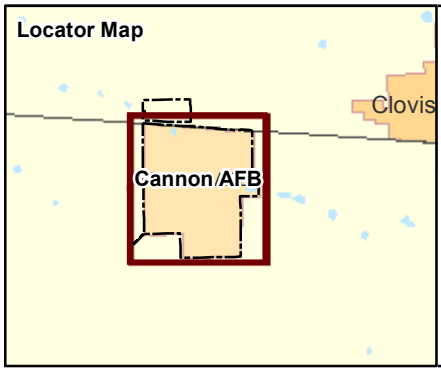
Figure I-1 Site Location Map

Figure I-2 Site Map, SWMU 71 – Recovered JP-4 Fuel Tank No. 390 (TU071)

Figure I-3 Site Map, SWMU 126 – Inactive Underground Storage Tank No. 3 (TU126)

Figure I-4 Site Map, SWMU 101 – Wastewater Lagoons 1 & 2 (SI101)

Locator Map



Legend

Base Boundary

Site Boundary

SWMU = Solid Waste Management Unit

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

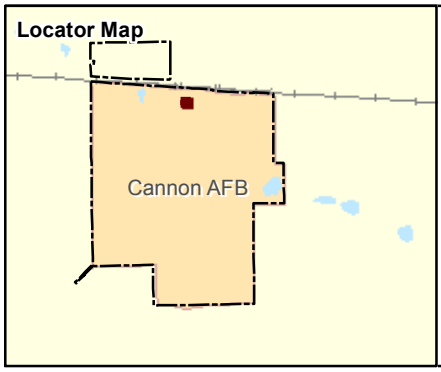
N

2,000 1,000 0 2,000 Feet

Site Location Map
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 8/12/2014	Project No. 23446539	Figure I-1
Checked By: MS	Revision: 0		

Z:\cannon\Figures\cac\I-1.mxd



Legend

Base Boundary

Site Boundary

SWMU = Solid Waste Management Unit

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

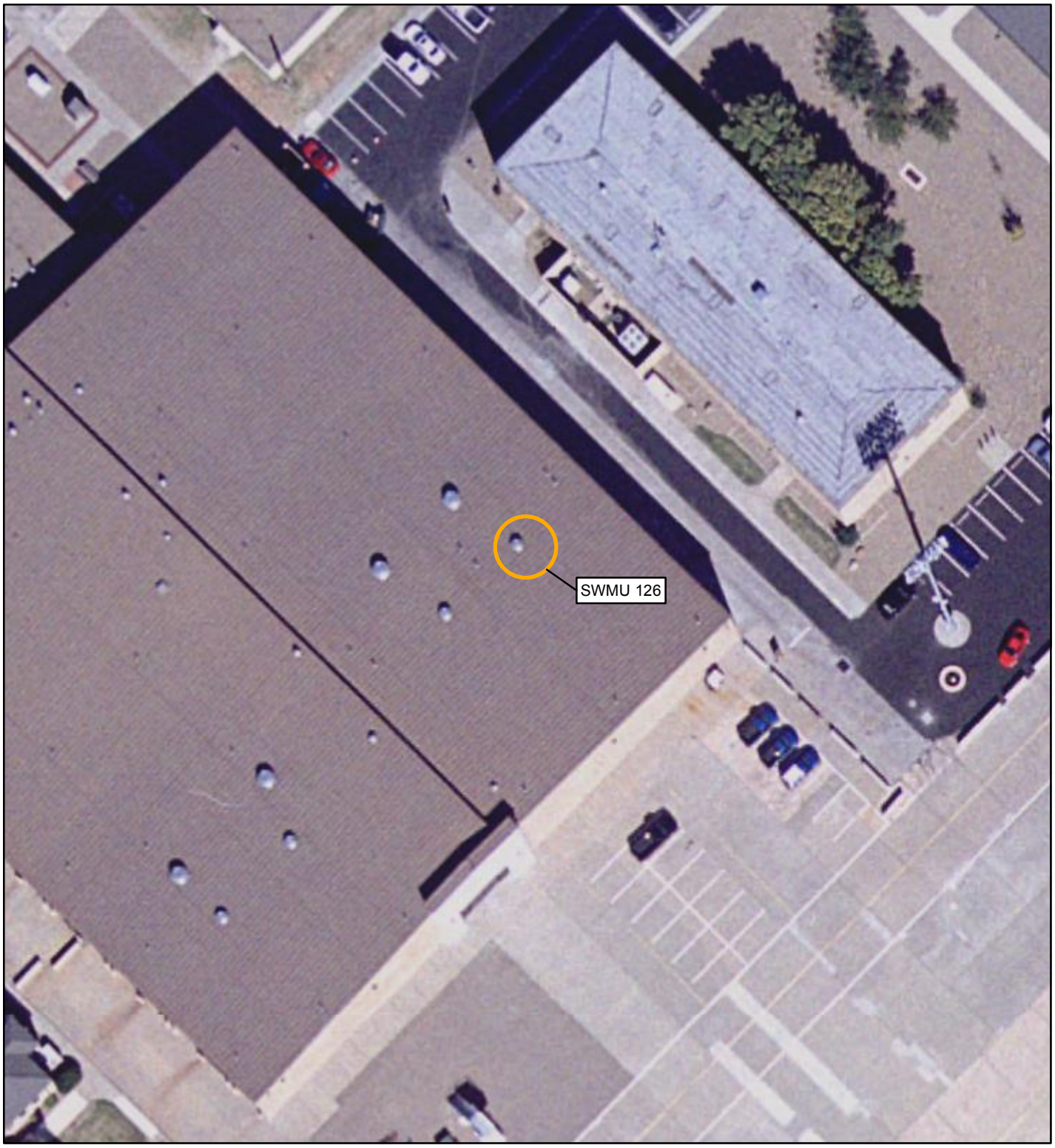
N

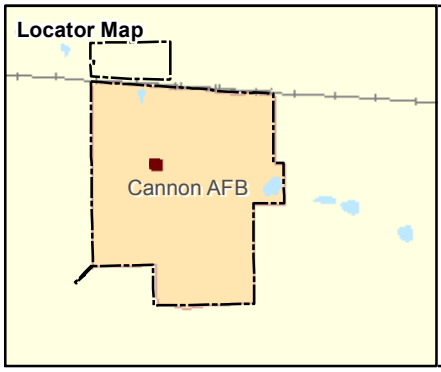
50 25 0 50 Feet

Site Map, SWMU 71
Recovered JP-4 Fuel Tank No. 390
(TU071)
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 6/13/2014	Project No. 23446539	Figure I-2
Checked By: MS	Revision: 0		

Z:\cannon\Figures\cac\I-2.mxd





Legend

Base Boundary

Site Boundary

SWMU = Solid Waste Management Unit

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

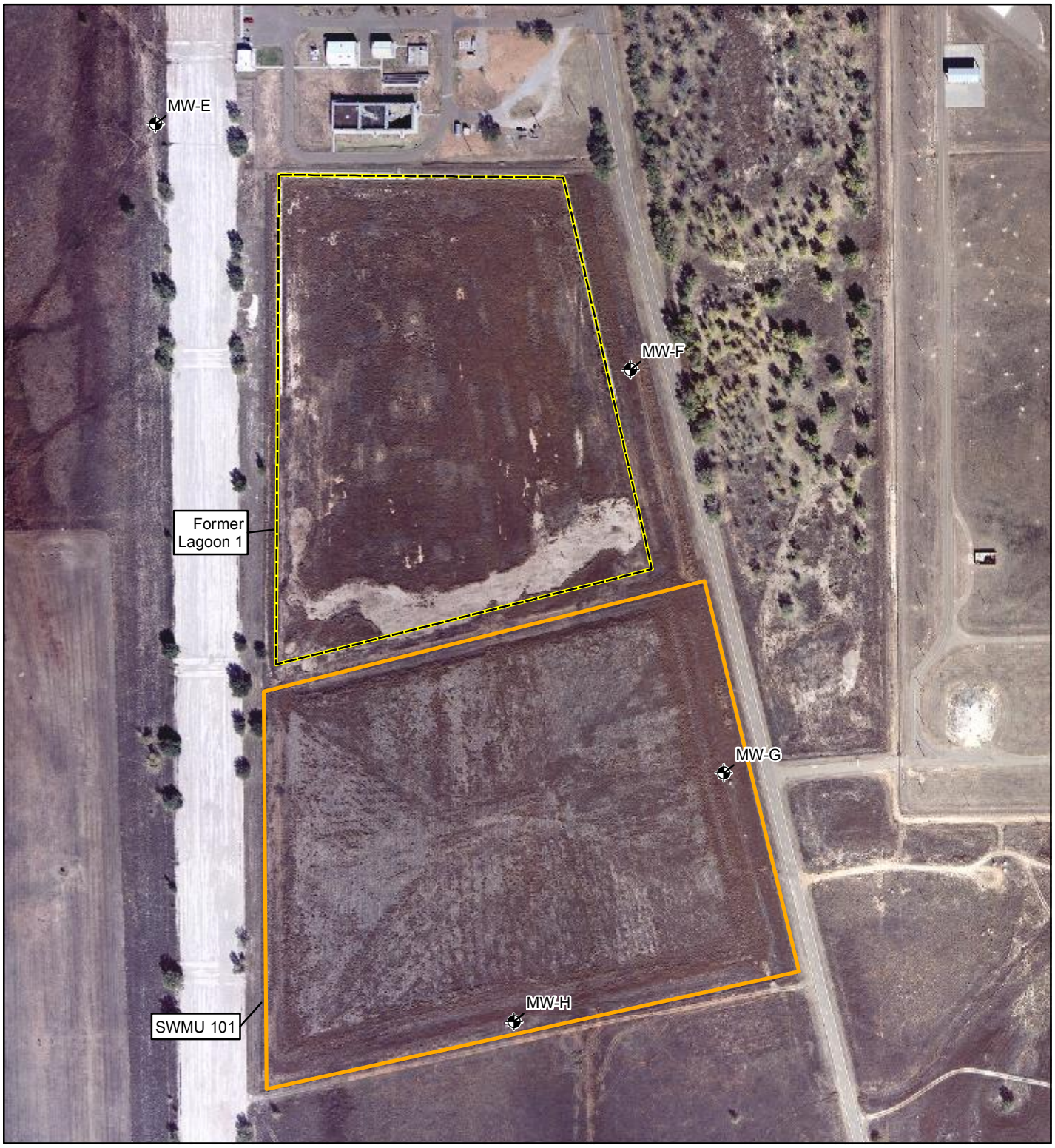
N

50 25 0 50 Feet

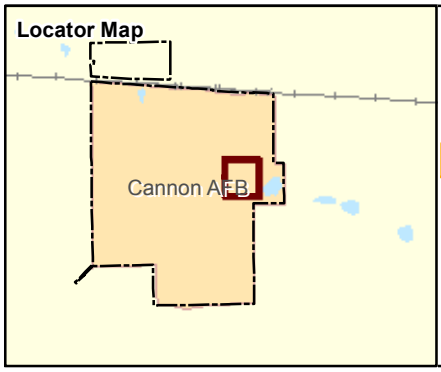
Site Map, SWMU 126
Inactive Underground Storage Tank No. 3 (TU126)
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 6/13/2014	Project No. 23446539	Figure I-3
Checked By: MS	Revision: 0		

Z:\cannon\Figures\cac\I-3.mxd



Locator Map



Legend

- Monitoring Well Location
- Base Boundary
- Site Boundary

SWMU = Solid Waste Management Unit

Map projection: NAD83 State Plane Feet New Mexico East (FIPS 3001)

N

300 150 0 300 Feet

Site Map, SWMU 101
Wastewater Lagoons 1 and 2 (SI101)
Cannon Air Force Base, New Mexico

Drawn By: DPG	Date: 8/12/2014	Project No. 23446539	Figure I-4
Checked By: MS	Revision: 0		

Z:\cannon\Figures\cac\I-4.mxd

Attachment II

SWMU 71 (TU071) Tank Closure Report

Includes NMEID Report Forms, Laboratory Analytical Results for Soil Samples Collected During the Removal of Recovered JP-4 Fuel Tank No. 390 (TU071) (SWMU 71), and Photographs of Removal Process.

DEV/Crow/2739/pap/10 Jan 90/0065v/pg-6

file
9157
PP

1 0 JAN 1991

FROM: 27 CSG/DEV

SUBJ: Removal of Underground Storage Tank

TO: 27 TFW/LGCK (SSgt Hagood)

1. On 7 Jan 91 this office was informed of an underground storage tank scheduled to be removed on 8 Jan 91. The tank is a 2000 gallon tank located in the POL area and is registered with the New Mexico Environmental Improvement Division (NMEID). Being a regulated tank and contained a regulated product, it can not be removed without proper notification to NMEID and a NMEID inspector present when it is pulled.

2. A 30-day advance notification is required to NMEID so the inspector can schedule his visit. DEV made the required notification on 8 Jan 91. Three calls have been made to the inspector to schedule a time for him to visit the site. So far we have been unable to contact the inspector. Whenever contact is made and a schedule has been set, Contract Management will be notified so coordination can be made with the contractor. The Bioenvironmental Office will also need to be notified so soil samples can be taken and sent for analysis.

SIGNED
JIMMIE N. RICHARDS, GS-12
Chief, Environmental Management

cc: DEEC

Dev File

DEV/JR

NEW MEXICO
HEALTH AND ENVIRONMENT
DEPARTMENT

1190 St. Francis Drive
Santa Fe, New Mexico 87503

GARREY CARRUTHERS
Governor

CARLA L. MUTH
Secretary

MICHAEL J. BURKHART
Deputy Secretary

UST CLOSURE NOTICE:

Memorandum of Telephone Call/Verbal Notice

Date: 8 Jan 91

Owner name, address, phone:
(as on registration form)

Cannon AFB.
27CSG/DEV
Clovis, N.M.

Facility name, address, phone:
(as on registration form)

~~Cannon Air Force Base~~
US AIR FORCE
27 CSG/CC
Cannon Air Force Base, NM, 88103

Tank location if not at street address:

POL Area

Contractor name, address, phone:

Jim Sena Construction 472-3106
P.O. Drawer 350
Santa Rosa, N.M. 88435

Number and size of tanks to be pulled:

1 - 2,000 gal.

Plans for assessment of releases:

Tracer Leak Detection System is installed.
Soil Samples will be collected at 2' and bottom of hole.
Samples will be analyzed for BTX.

Planned date of pull:
14 Jan 91

Comments:

(Note: inform notifier they must also contact local fire marshall.)

Call received by:

Name Joe Harerra Title

EQUAL OPPORTUNITY EMPLOYER

DEV/Crow/2739/pap/16 Jan 91/0065V/pg-12

file 9B7 pp

16 JAN 1991

FROM: 27 CSG/DEV

SUBJ: Removal of Underground Storage Tank (UST), Contract No. F29605-90-C0019

TO: 27 TFW/LGCK

1. Contact has been made and authority given to proceed with the removal of the tank at the POL area, by the district representative of New Mexico Environmental Improvement Division in charge of the UST Program.

2. Cannon will be required to take pictures of the job before, during, and after the tank removal. In addition, soil samples must be collected. The tank will need to be retained only if it has been leaking, otherwise, it can be disposed of after the photos have been taken. Coordination has been made with DEEC.

2. Direct any questions to Mr. Rick Crow x2739 or Mr. Jim Richards x4639.

SIGNED
JIMMIE N. RICHARDS, GS-12
Chief, Environmental Management

DEV File

DEV JNR

18 JAN 1991

FROM: 27CSG/DEEC

SUBJ: Removal Underground Storage Tank, Project 86-0045B, Contract #90-C0019

TO: 27TFW/LGCK

1. On 14 Jan 91 this office was advised by Mr. Rick Crow, 27CSG/DEV, that authority had been given to proceed with removal of the underground storage tank. Authority was granted by the district representative of the New Mexico Enviromental Improvement Division.

2. The site supervisor, Mr. Eddie Sena was advised of this decision at 0800 on 14 Jan 91. Excavation of the tank began at 1000 on 14 Jan 91. Lt. Hepner of Bioenvironmental, 27MED/SGPB, took two samples of the soil at approximately 1010. Samples were taken of the soil at a depth of two feet.

3. Excavation of the tank was completed and the tank was removed at 1630. The tank was carried to a location immediately outside the POL perimeter fence and placed there for inspection.

4. At 0800 on 15 Jan 91 a visual inspection was conducted of the tank and the area from which the tank was removed. Inspection was performed by Mr. Rick Crow, 27CSG/DEV and Mr. Michael Rierson, 27CSG/DEEC. The tank and the area from which the tank was removed were in good condition and showed no signs of leakage.

5. Lt. Hepner 27MED/SGPB arrived at the site at 1030 on 15 Jan 91 and took two samples from the soil on which the tank had been setting.

6. Pictures were taken before, during, and after tank removal. A total of seventeen pictures were taken. These pictures were turned over to Mr. Crow, 27CSG/DEV for their files and records, on 17 Jan 91.

7. This tank shows no sign of leakage and will be turned over to DRMO for proper disposal. The site supervisor, Mr. Eddie Sena, has been advised that the tank must turned in to DRMO as stated in the specifications of this contract.

SIGNED

C BRUCE HALE, GS-12
Chief, Contract Management

Atch
27CSG/DEV Ltrs (2)
27TFW/LGCK Ltr

cc: 27CSG/DEV
Jim Sena Const.

14 Jan 91

20[illegible] gal tank [illegible] removed. Arrow points to tank [illegible]
[illegible]-0045 A/B

14 Jan 91

Stack on 2000 gal underground tank to be removed
86-0045 A/B

14 Jan 91

Stack on 2000 gal underground tank to be removed by Contractor
Project 86-0045 A/B

14 Jan 91

Stack on 2000 gal underground tank to be removed by Contractor Project 86-0045 A/B

14 Jan 91

2000 gal underground tank to be removed
Project 86-0045 A/B

14 Jan 91

Excavation of 2000 gal tank in progress.

14 Jan 91

Excavation in Progress
3" Pipe - Unknown. Pipe in poor condition.

14 Jan 91

Excavation in Progress

14 Jan 91

3" Pipe in poor condition. Possible leakage. Pipe abandoned! Full of dirt.

15 Jan 91

Pit after tank removed

15 Jan 91

Pit after tank removed
Contractor leveling Pit preparing to to remove saddles.

15 Jan 91

Pit after tank removed
Arrows point to saddle

15 Jan 91

Pit after 2000 gal Tank Removed. No sign of leakage

15 Jan 91

2000 gal Tank
No sign of leakage

15 Jan 91

2000 gal tank - Removed.
Tank in excellent condition.

15 JAN 91

Mr Rick Crow (DEU)
Inspects Tank
No sign of leakage

15 JAN 91

15 Jan 91

Mr Crow Inspects Tank

15 JAN 91

DEV/Crow/2739/PAP/0065V/PG-17

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 27TH COMBAT SUPPORT GROUP (TAC)
CANNON AIR FORCE BASE, NM 88103

28 JAN 1991

Mr. Ron Castleberry
New Mexico Environmental Improvement Division
315 North Atkinson
Roswell, New Mexico 88201

Dear Mr. Castleberry

Attached is the paperwork concerning the closure of Tank 390 at the Petroleum, Oils, and Lubricants (POL) Area. Jim Sena Construction of Santa Rosa, New Mexico was the contractor on this job. The tank was pulled on 14 Jan 91 and will be disposed of through the Cannon Defense Reutilization and Marketing Office.

The tank and piping were both in very good condition. A leak detection and monitoring system was operational on the tank and piping with no visible evidence of any leakage. Soil samples were collected two (2) feet below the surface and at the bottom of the hole. These samples will be analyzed for Benzene, Toluene, and Xylene (BTX). The Bioenvironmental Office monitored for explosive vapors before the tank was removed with no evidence appearing. Several photographs were taken throughout the removal process.

Cannon AFB appreciates your assistance on the removal of this tank. Questions concerning any segment of the removal process may be directed to Mr. Jim Richards at 784-4639 or Mr. Rick Crow at 784-7239.

SIGNED
THOMAS N. CHAPMAN, Colonel, USAF
Commander

1 Atch
Notification Paperwork

DEV/MR DED ___

Readiness is our Profession

UST Bureau/EID
1190 St. Francis Drive
Santa Fe, New Mexico 87053

I.D. Number	STATE USE ONLY C-7929
Date Received	31 Dec 90

GENERAL INFORMATION

Notification is required by Federal law for all underground tanks that have been used to store regulated substances since January 1, 1974, that are in the ground as of May 8, 1986, or that are brought into use after May 8, 1986. The information requested is required by Section 9002 of the Resource Conservation and Recovery Act (RCRA), as amended.

The primary purpose of this notification program is to locate and evaluate underground tanks that store or have stored petroleum or hazardous substances. It is expected that the information you provide will be based on reasonably available records, or, in the absence of such records, your knowledge, belief, or recollection.

Who Must Notify? Section 9002 of RCRA, as amended, requires that, unless exempted, owners of underground tanks that store regulated substances must notify designated State or local agencies of the existence of their tanks. Owner means —

(a) in the case of an underground storage tank in use on November 8, 1984, or brought into use after that date, any person who owns an underground storage tank used for the storage, use, or dispensing of regulated substances; and

(b) in the case of any underground storage tank in use before November 8, 1984, but no longer in use on that date, any person who owned such tank immediately before the discontinuation of its use.

What Tanks Are Included? Underground storage tank is defined as any one or combination of tanks that (1) is used to contain an accumulation of "regulated substances," and (2) whose volume (including connected underground piping) is 10% or more beneath the ground. Some examples are underground tanks storing: 1. gasoline, used oil, or diesel fuel, and 2. industrial solvents, pesticides, herbicides or fumigants.

What Tanks Are Excluded? Tanks removed from the ground are not subject to notification. Other tanks excluded from notification are:
1. farm or residential tanks of 1,100 gallons or less capacity used for storing motor fuel for non-commercial purposes;
2. tanks used for storing heating oil for consumptive use on the premises where stored;
3. septic tanks;
4. pipeline facilities (including gathering lines) regulated under the Natural Gas Pipeline Safety Act of 1968, or the Hazardous Liquid Pipeline Safety Act of 1979, or which is an intrastate pipeline facility regulated under State law;
5. surface impoundments, pits, ponds, or lagoons;
6. storm water or wastewater collection systems;
7. flow-through process tanks;
8. liquid traps or associated gathering lines directly related to oil or gas production and gathering operations;
9. storage tanks situated in an underground area (such as a basement, cellar, mine working, drift, shaft, or tunnel) if the storage tank is situated upon or above the surface of the floor.

What Substances Are Covered? The notification requirements apply to underground storage tanks that contain regulated substances. This includes any substance defined as hazardous in section 101 (14) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) (but not including those substances regulated as hazardous waste under Subtitle C of RCRA) and includes petroleum, e.g., crude oil or any fraction thereof which is liquid at conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute).

Where To Notify? Completed notification forms should be sent to the address given at the top of this page.

When To Notify? 1. Owners of underground storage tanks in use or that have been taken out of operation after January 1, 1974, but still in the ground on May 8, 1986. 2. Owners who bring underground storage tanks into use after May 8, 1986, must notify within 30 days of bringing the tanks into use.

Penalties: Any owner who knowingly fails to notify or submits false information shall be subject to a civil penalty not to exceed $10,000 for each tank for which notification is not given or for which false information is submitted.

INSTRUCTIONS

Please type or print in ink all items except "Signature" in Section V. This form must by completed for each location containing underground storage tanks. If more than 5 tanks are owned at this location, photocopy the reverse side, and staple continuation sheets to this form.

Indicate number of continuation sheets attached: 0

I. OWNERSHIP OF TANK(S)

Owner Name (Corporation, Individual, Public Agency, or Other Entity): U.S. AIR FORCE

Street Address:

County: CURRY

City: CANNON AFB | State: NM | ZIP Code: 88103

Area Code: | Phone Number:

Type of Owner (Mark all that apply ☒):
- ☒ Current
- ☐ Former
- ☐ State or Local Gov't
- ☒ Federal Gov't (GSA facility I.D. no. F29605)
- ☐ Private or Corporate
- ☐ Ownership uncertain

II. LOCATION OF TANK(S)

(If same as Section I, mark box here ☐)

Facility Name or Company Site Identifier, as applicable: CANNON AFB

Street Address or State Road, as applicable: 27 CSG/CC

County: CURRY

City (nearest): CLOVIS | State: NM | ZIP Code: 88101

Indicate number of tanks at this location: 14

Mark box here if tank(s) are located on land within an Indian reservation or on other Indian trust lands ☐

III. CONTACT PERSON AT TANK LOCATION

Name (If same as Section I, mark box here ☐): RICK CROW

Job Title: ENVIRONMENTAL COORDINATOR

Area Code: 505 | Phone No.: 784-2739

IV. TYPE OF NOTIFICATION

☒ Mark box here only if this is an amended or subsequent notification for this location

V. CERTIFICATION (Read and sign after completing Sections VI.)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete.

Name and official title of owner or owner's authorized representative	Signature	Date Signed
THOMAS N. CHAPMAN, Colonel, USAF		

CONTINUE ON REVERSE SIDE

Owner Name (from Section I) CANNON AFB Location (from Section II) _____ Page No 2 of 2

VI. DESCRIPTION OF UNDERGROUND STORAGE TANKS (Complete for each tank at this location)

Tank Identification No. (e.g., ABC-123), or Arbitrarily Assigned Sequential Number (e.g., 1,2,3...)	Tank No. 390	Tank No.	Tank No.	Tank No.	Tank
1. Status of Tank (Mark all that apply ☒)					
Currently in Use	☐	☐	☐	☐	☐
Temporarily Out of Use	☐	☐	☐	☐	☐
Permanently Out of Use	XX	☐	☐	☐	☐
Brought into Use after 5/8/86	☐	☐	☐	☐	☐
2. Estimated Age (Years)	Unknown				
3. Estimated Total Capacity (Gallons)	2000				
4. Material of Construction (Mark one ☒)					
Steel	XX	☐	☐	☐	☐
Concrete	☐	☐	☐	☐	☐
Fiberglass Reinforced Plastic	☐	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
5. Internal Protection (Mark all that apply ☒)					
Cathodic Protection	☐	☐	☐	☐	☐
Interior Lining (e.g., epoxy resins)	☐	☐	☐	☐	☐
None	XX	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
6. External Protection (Mark all that apply ☒)					
Cathodic Protection	☐	☐	☐	☐	☐
Painted (e.g., asphaltic)	☐	☐	☐	☐	☐
Fiberglass Reinforced Plastic Coated	☐	☐	☐	☐	☐
None	XX	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
7. Piping (Mark all that apply ☒)					
Bare Steel	XX	☐	☐	☐	☐
Galvanized Steel	☐	☐	☐	☐	☐
Fiberglass Reinforced Plastic	☐	☐	☐	☐	☐
Cathodically Protected	☐	☐	☐	☐	☐
Unknown	☐	☐	☐	☐	☐
Other, Please Specify					
8. Substance Currently or Last Stored in Greatest Quantity by Volume (Mark all that apply ☒)					
a. Empty	☐	☐	☐	☐	☐
b. Petroleum					
Diesel	☐	☐	☐	☐	☐
Kerosene	☐	☐	☐	☐	☐
Gasoline (including alcohol blends)	☐	☐	☐	☐	☐
Used Oil	☐	☐	☐	☐	☐
Other, Please Specify	JP-4				
c. Hazardous Substance	☐	☐	☐	☐	☐
Please Indicate Name of Principal CERCLA Substance OR Chemical Abstract Service (CAS) No.					
Mark box ☒ if tank stores a mixture of substances	☐	☐	☐	☐	☐
d. Unknown	☐	☐	☐	☐	☐
9. Additional Information (for tanks permanently taken out of service)					
a. Estimated date last used (mo/yr)	11 / 90	/	/		
b. Estimated quantity of substance remaining (gal.)	0				
c. Mark box ☒ if tank was filled with inert material (e.g., sand, concrete)	☐	☐	☐	☐	☐

TANK CLOSURE WORKSHEET
(COMPLETE AFTER CLOSURE)

Tank Owner Cannon Air Force Base Phone 784-4348
Mailing Address 27 CSG/CC
Tank Address POL Area
Contractor Name Jim Sena Const Co. Inc. Phone 472-3106
Address Drawer 350 Santa Rosa N. Mex. 88435
Contractor Name Jim Sena Phone 472-3106
Address Drawer 350 Santa Rosa N. Mex 88435

Tank Closure Date 4 Jan 91 # of Tanks Closed (1)

****

I. Tank Closure Initial Procedures (check measures complied with):
- yes Obtain recommended safety equipment for all personnel
- yes Contact Fire Marshall or other fire officials
- yes Bond or ground equipment
- yes Drain product from piping and tank
- yes Disconnect, then cap or remove piping
- yes Remove all residual product from tank
- yes Excavate to tank top
- yes Remove all tank fixtures
- ____ Properly purge or inert tank of all flammable vapors using approved method
- ____ Continually monitor for explosive vapors while tank is being removed

II. Tank Removal
- yes Create vent hole
- yes Excavate tank using all safety precautions
- yes Clean and inspect tank
- yes Check excavation for evidence of leaks and notify EID and other proper authorities if leak is found
- ____ Check vapor levels in tank before transporting
- ____ Dispose of tank in approved manner

Tank disposal location _____
City State

How did you assess site for leakage? _____
Closure report kept at _____
NOTE: Immediately report any evidence of leakage to EID at 827-0188

I hereby state that the above information is correct

Eddie [illegible]
Signature of owner or contractor performing work

****

FOR EID USE ONLY
Notification Received _____ Approved By _____
Inspection Date _____ Inspector _____

Environmental Improvement Division
Underground Storage Tank Bureau
Prevention/Inspection Section
1190 St. Francis Drive
Santa Fe, New Mexico 87503
(505) 827-0216

NEW MEXICO HEALTH AND ENVIRONMENT DEPARTMENT

INSPECTION REPORT

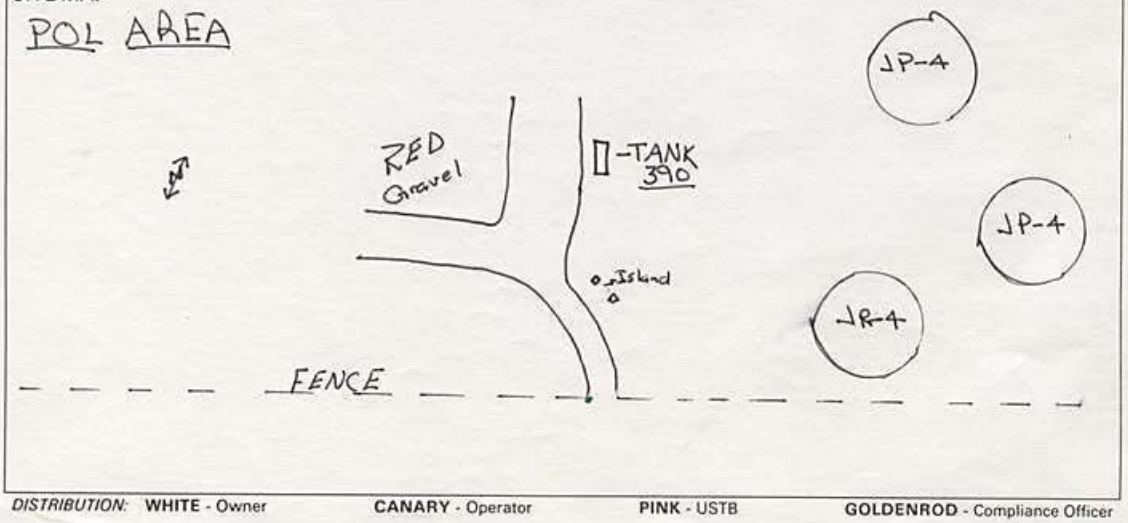
DATE	CASE NUMBER	OPENING CONFERENCE TIME
14 JAN 91		

INSPECTION TYPE: ☐ COMPLIANCE ☐ REINSPECTION ☒ TANK CLOSURE ☐ INSTALLATION ☐ REPAIR ☐ COMPLAINT ☐ MODIFICATION

Facility Name 1. CANNON AIR FORCE BASE	Facility No.	Phone No. 7842739
Address CANNON AIR FORCE BASE NEW MEXICO		ZIP Code 88103
Owner Name 2. U.S. AIR FORCE	Owner No.	Phone No. 784-2739
Address CANNON AIR FORCE BASE		ZIP Code 88103
Facility Operator 3. CANNON AIR FORCE BASE		Phone No. 784-2739
Address 27 CSG/DEV		ZIP Code 88103
Contractor Name 4. JIM SENA CONSTRUCTION		Phone No. 472-3106
Address P. O. DRAWER 350, SANTA ROSA, NEW MEXICO		ZIP Code 88435

TANK NO.	SIZE	CONTENTS	INSTALLATION DATE	TANK CONSTRUCTION	PIPING CONSTRUCTION	TANK RELEASE DETECTION	PIPING RELEASE DETECTION	TANK STATUS
390	2000	JP-4	Unknown	Steel	Steel	Leak and Monitoring	Leak and Monitoring	Closed

SITE MAP



DISTRIBUTION: **WHITE** - Owner **CANARY** - Operator **PINK** - USTB **GOLDENROD** - Compliance Officer

		Yes	No	Unk.	N/A
1. All applicable tanks on site are registered.	1.	X			
2. Proper notification was made for the following:	2.				
a. Closure	a.	X			
b. Installation	b.				X
c. Modification	c.				X
d. Repair	d.				X
3. Tanks closed properly.	3.	X			
4. Tanks installed properly.	4.				X
5. Tanks repaired/modified properly.	5.				X
6. Release detection — tanks:	6.				
a. Inventory records combined with annual tank tightness testing	a.		X		
b. Manual tank gauging	b.		X		
c. Automatic tank gauging	c.		X		
d. Vapor monitoring	d.	X			
e. Ground water monitoring	e.	X			
f. Interstitial monitoring	f.		X		
7. Release detection — piping.	7.	X			
8. Certified tank installers.	8.				X
9. All required records are maintained.	9.	X			
10. Evidence of release/spill.	10.		X		

COMMENTS:

The Tracer Leak Detection and Monitoring System was operational on both tank and piping with no evidence of a release. The tank and piping were both in very good condition with no evidence of a leak. Soil samples were obtained at 2' below the surface and at the bottom of the hole. Samples will be analyzed for BTX. The tank will be disposed of through the Defense Reutilization and Marketing Office at Cannon AFB, NM according to all disposal rules.

CLOSING CONFERENCE:	DATE	TIME
Compliance Officer's Signature		Date

On-Site Representative's Signature: Dick Crow Date: 22 Jan 91

DISTRIBUTION: **WHITE** - Owner **CANARY** - Operator **PINK** - USTB **GOLDENROD** - Compliance Officer

DEV/CROW/2739/pap/0065V/pg-16

file 9137

STAFF SUMMARY SHEET

	TO	ACTION	SIGNATURE (Surname), GRADE AND DATE		TO	ACTION	SIGNATURE (Surname), GRADE AND DATE
1	27 CSG/ JA	Info	Taylor Hall Capt 24 Jan 91	6			
2	27 CSG/ CV	Info		7			
3	27 CSG/ CC	Sign	Thomas N. Chugan 24 Jan 91	8			
4	27 CSG/ DEV	Return		9			
5				10			

SURNAME OF ACTION OFFICER AND GRADE	SYMBOL	PHONE	TYPIST'S INITIALS	SUSPENSE DATE
Crow, GS-11	DEV	2739	pap	

SUBJECT: Underground Storage Tank Removal at the POL Area

DATE: 23 JAN 1991

SUMMARY

1. Attached at Tab 1 is a letter to Mr. Ron Castleberry from the Roswell Office of the New Mexico Environmental Improvement Division (NMEID) concerning the removal and closure of a regulated underground storage tank (UST) located at the POL area. At Tab 2 is the necessary paperwork for proper notification required by the NMEID.

2. The removal process went very smooth with no signs of any leakage or any other problems. The tank and associated piping were in very good condition and will be disposed of through DRMO.

3. The closure of this tank will result in one less UST to be regulated by the State and will no longer require annual fees.

RECOMMENDATION

4. Recommend 27 CSG/CC sign the letter at Tab 1 and Notification papers marked at Tab 2.

Lawrence Nygren

LAWRENCE NYGREN, GM-13
Deputy Base Civil Engineer

2 TABS
1. Ltr to NMEID
2. Notification Papers

AF FORM SEP 84 1768 PREVIOUS EDITION WILL BE USED. *U.S. GOVERNMENT PRINTING OFFICE: 1990-260-987:83446

Tank 396 POL

BULK MATERIAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

WORKPLACE OR SITE IDENTIFIER: 0028 SUPS 153A

BASE: CANNON AFB

ORGANIZATION: 27 SUPS

WORKPLACE OR SITE: POL underGround STORAGE

DATE COLLECTED (YYMMDD): 910111

BLDG. NO./LOCATION: N/A

ROOM/AREA: STORAGE AREA

MAIL REPORTS TO (circle if change)

ORIGINAL	0028	27 MED GP/SGPB CANNON AFB NM 88103
COPY 1		
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC): CARLTON A. FORBES SSGT 90730

SIGNATURE: [signature]

AUTOVON: 681 2314

REASON FOR SUBMISSION: M F

A-ACCIDENT/INCIDENT C-COMPLAINT F-FOLLOWUP/CLEANUP
R-ROUTINE BACKGROUND/PERIODIC SURVEY O-OTHER

OEHL PID

SOURCE BEING SAMPLED: Soil Located Around POL STORAGE TANK 2FT under SURFACE

EXISTING CONTROLS (Personal protective equipment, Engineering, Administrative): N/A

SAMPLE COLLECTION DATA

OEHL SAMPLE NO				
BASE SAMPLE NO			E91 0004	
	A	CHECK FOR	☐ MAJOR COMPONENTS	☐ MAJOR COMPONENTS
	B	NAME	BTEX EPA METHOD 8240	
		NIOSH NO.		
	C	NAME		
		NIOSH NO.		
	D	NAME		
		NIOSH NO.		
	E	CHECK FOR	☐ HAZARDOUS/TOXIC WASTE	☐ HAZARDOUS/TOXIC WASTE
MATERIAL NAME				
LOT NUMBER				
NSN (FSN)				
SPECIFICATION (MIL or FED)				
MANUFACTURER'S NAME				
DESCRIPTON OF MATERIAL USAGE (Heated, brushed, sprayed, etc.)				
SUPPORTING SAMPLES	OEHL SAMPLE NO.			
	BASE SAMPLE NO.			
	SAMPLE TYPE			

COMMENTS: PRIORITY UST REMOVAL PROJECT

AF FORM JAN 81 2751

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AFB, TEXAS, 78235-5501

REPORT OF ANALYSIS

BASE SAMPLE NO: GS910004 OEHL SAMPLE NO: 91002705

SAMPLE TYPE: SOIL

SITE IDENTIFIER: SUPS153A DATE RECEIVED: 910123

DATE COLLECTED: 910114 DATE REPORTED: 910227

RESULTS

Test	Results	Units	EPA Method
Methyl Isobutyl Ketone	<57	ug/g	
Benzene	<6.0	ug/g	
Bromodichloromethane	<6.0	ug/g	
Bromoform	<6.0	ug/g	
Bromomethane	<11	ug/g	
Carbon Tetrachloride	<6.0	ug/g	
Chlorobenzene	<6.0	ug/g	
Chloroethane	<11	ug/g	
Chloroform	<5.0	ug/g	
Chloromethane	<11	ug/g	
1,1-Dichloroethane	<6.0	ug/g	
1,1-Dichloroethene	<6.0	ug/g	
1,2-Dichloroethane	<6.0	ug/g	
1,2-Dichloropropane	<6.0	ug/g	
Toluene	<6.0	ug/g	
Vinyl chloride	<11	ug/g	
Methylene chloride	<6.0	ug/g	
trans-1,2-Dichloroethene	<6.0	ug/g	
Trichlorofluoromethane	<6.0	ug/g	
1,1,1-Trichloroethane	<6.0	ug/g	
cis-1,3-Dichloropropene	<6.0	ug/g	EPA8010
Trichloroethylene	<6.0	ug/g	
1,1,2-Trichloroethane	<6.0	ug/g	
Tetrachloroethylene	<6.0	ug/g	
1,1,2,2-Tetrachloroethan	<6.0	ug/g	
Ethyl Benzene	<6.0	ug/g	EPA8020
2-Chloroethylvinyl ether	<11	ug/g	
Chlorodibromomethane	<6.0	ug/g	
Carbon Disulfide	<6.0	ug/g	EPA 8240
trans-1,3-Dichloropropen	<6.0	ug/g	

TO:

27 MEDICAL GROUP (TAC)/SGPB
CANNON AFB NM 88103-5300

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AFB, TEXAS, 78235-5501

REPORT OF ANALYSIS

BASE SAMPLE NO: GS910004 OEHL SAMPLE NO: 91002705

SAMPLE TYPE: SOIL

SITE IDENTIFIER: SUPS153A DATE RECEIVED: 910123

DATE COLLECTED: 910114 DATE REPORTED: 910227

RESULTS

Test	Results	Units	EPA Method
2-Hexanone	<57	ug/g	
m-Xylene	NP	ug/g	
o-Xylene	NP	ug/g	
p-Xylene	NP	ug/g	
Styrene	<6.0	ug/g	
Xylenes (Total)	<6.0	ug/L	NSW8240
Vinyl Acetate	<57	ug/g	EPA 8240
Acetone	<110	ug/L	
Acrolein	<57	ug/L	
Acrylonitrile	<57	ug/L	
Methyl Ethyl Ketone	<110	ug/L	

Analytical method used: EPA Method 8240

NP : Test Not Performed

Comments:

< - Signifies none detected and the detection limits.

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AFB, TEXAS, 78235-5501

REPORT OF ANALYSIS

BASE SAMPLE NO: GS910004 OEHL SAMPLE NO: 91002705

SAMPLE TYPE: SOIL

SITE IDENTIFIER: SUPS153A DATE RECEIVED: 910123

DATE COLLECTED: 910114 DATE REPORTED: 910227

RESULTS

Test	Results	Units	EPA Method

Analyzed by: Biosphesics, Inc.

Reviewed by: MW

Michael J. Wantland, MSgt, USAF
NCOIC Occupational Chemistry Branch

Tank 390 POL 9-B-7

BULK MATERIAL SAMPLING DATA

(Use this space for mechanical imprint)

OEHL USE ONLY

WORKPLACE OR SITE IDENTIFIER: 0028 SUPS 153A

BASE: CANNON AFB

ORGANIZATION: 27 SUPS

WORKPLACE OR SITE: POL under Ground STORAGE

DATE COLLECTED (YYMMDD): 91/10/1/1/4/1

BLDG. NO./LOCATION: N/A

ROOM/AREA: STORAGE AREA

MAIL REPORTS TO (circle if change)

ORIGINAL	0028	27 MED GP/SGPB CANNON AFB NM 88103
COPY 1		
COPY 2		

SAMPLE COLLECTED BY (Name, Grade, AFSC): CARTON A. Forbes SSgt 90730

SIGNATURE: [signature]

AUTOVON: 681 2314

REASON FOR SUBMISSION: M F

A-ACCIDENT/INCIDENT C-COMPLAINT F-FOLLOWUP/CLEANUP
R-ROUTINE BACKGROUND/PERIODIC SURVEY O-OTHER

OEHL PID

SOURCE BEING SAMPLED: SOIL Located Around POL STORAGE TANK 10FT under SURFACE

EXISTING CONTROLS (Personal protective equipment, Engineering, Administrative): N/A

SAMPLE COLLECTION DATA

OEHL SAMPLE NO				
BASE SAMPLE NO			6S91 0006	
	A	CHECK FOR	☐ MAJOR COMPONENTS	☐ MAJOR COMPONENTS
	B	NAME	BTEX EPA METHOD 8240	
		NIOSH NO.		
	C	NAME		
		NIOSH NO.		
	D	NAME		
		NIOSH NO.		
	E	CHECK FOR	☐ HAZARDOUS/TOXIC WASTE	☐ HAZARDOUS/TOXIC WASTE
MATERIAL NAME				
LOT NUMBER				
NSN (FSN)				
SPECIFICATION (MIL or FED)				
MANUFACTURER'S NAME				
DESCRIPTON OF MATERIAL USAGE (Heated, brushed, sprayed, etc.)				
SUPPORTING SAMPLES	OEHL SAMPLE NO.			
	BASE SAMPLE NO.			
	SAMPLE TYPE			

COMMENTS: PRIORITY UST REMOVAL PROJECT

AF FORM JAN 81 2751

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AFB, TEXAS, 78235-5501

REPORT OF ANALYSIS

BASE SAMPLE NO: GS910006 OEHL SAMPLE NO: 91002706

SAMPLE TYPE: SOIL

SITE IDENTIFIER: SUPS153A DATE RECEIVED: 910123

DATE COLLECTED: 910114 DATE REPORTED: 910227

RESULTS

Test	Results	Units	EPA Method
trans-1,3-Dichloropropen	<6.0	ug/g	
2-Hexanone	<57	ug/g	
m-Xylene	NP	ug/g	
o-Xylene	NP	ug/g	
p-Xylene	NP	ug/g	
Styrene	<6.0	ug/g	
Xylenes (Total)	<6.0	ug/L	NSW8240
Acetone	<110	ug/L	
Acrolein	<57	ug/L	
Methyl Isobutyl Ketone	<57	ug/g	
Methyl Ethyl Ketone	<110	ug/L	

Analytical method used: EPA Method 8240

NP : Test Not Performed

Comments:

< - Signifies none detected and the detection limits.

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AFB, TEXAS, 78235-5501

REPORT OF ANALYSIS

BASE SAMPLE NO: GS910006 OEHL SAMPLE NO: 91002706

SAMPLE TYPE: SOIL

SITE IDENTIFIER: SUPS153A DATE RECEIVED: 910123

DATE COLLECTED: 910114 DATE REPORTED: 910227

RESULTS

Test	Results	Units	EPA Method
Acrylonitrile	<57	ug/L	
Benzene	<6.0	ug/g	
Bromodichloromethane	<6.0	ug/g	
Bromoform	<6.0	ug/g	
Bromomethane	<11	ug/g	
Carbon Tetrachloride	<6.0	ug/g	
Chlorobenzene	<6.0	ug/g	
Chloroethane	<11	ug/g	
Chloroform	<5.0	ug/g	
Chloromethane	<11	ug/g	
1,1-Dichloroethane	<6.0	ug/g	
1,1-Dichloroethene	<6.0	ug/g	
1,2-Dichloroethane	<6.0	ug/g	
1,2-Dichloropropane	<6.0	ug/g	
Toluene	<6.0	ug/g	
Vinyl chloride	<11	ug/g	
Methylene chloride	<6.0	ug/g	
trans-1,2-Dichloroethene	<6.0	ug/g	
Trichlorofluoromethane	<6.0	ug/g	
1,1,1-Trichloroethane	<6.0	ug/g	
cis-1,3-Dichloropropene	<6.0	ug/g	EPA8010
Trichloroethylene	<6.0	ug/g	
1,1,2-Trichloroethane	<6.0	ug/g	
Tetrachloroethylene	<6.0	ug/g	
1,1,2,2-Tetrachloroethan	<6.0	ug/g	
Ethyl Benzene	<6.0	ug/g	EPA8020
2-Chloroethylvinyl ether	<11	ug/g	
Chlorodibromomethane	<6.0	ug/g	
Carbon Disulfide	<6.0	ug/g	EPA 8240
Vinyl Acetate	<57	ug/g	EPA 8240

TO:

27 MEDICAL GROUP (TAC)/SGPB
CANNON AFB NM 88103-5300

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY
BROOKS AFB, TEXAS, 78235-5501

REPORT OF ANALYSIS

BASE SAMPLE NO: GS910006 OEHL SAMPLE NO: 91002706

SAMPLE TYPE: SOIL

SITE IDENTIFIER: SUPS153A DATE RECEIVED: 910123

DATE COLLECTED: 910114 DATE REPORTED: 910227

RESULTS

Test	Results	Units	EPA Method

Analyzed by: Biospherics, Inc.

Reviewed by: _____

Michael J. Wantland, MSgt, USAF
NCOIC Occupational Chemistry Branch

Attachment III

SWMU 126 (TU126) Tank Closure Report

Includes NMEID Report Forms, Laboratory Analytical Results for Soil Samples Collected During the Removal of Inactive Underground Storage Tank No. 3 (TU126) (SWMU 126), and Photographs of Removal Process.

Environmental Improvement Division
Underground Storage Tank Bureau
Prevention/Inspection Section
1190 St. Francis Drive
Santa Fe, New Mexico 87503

(505) 827-0216

INSPECTION REPORT

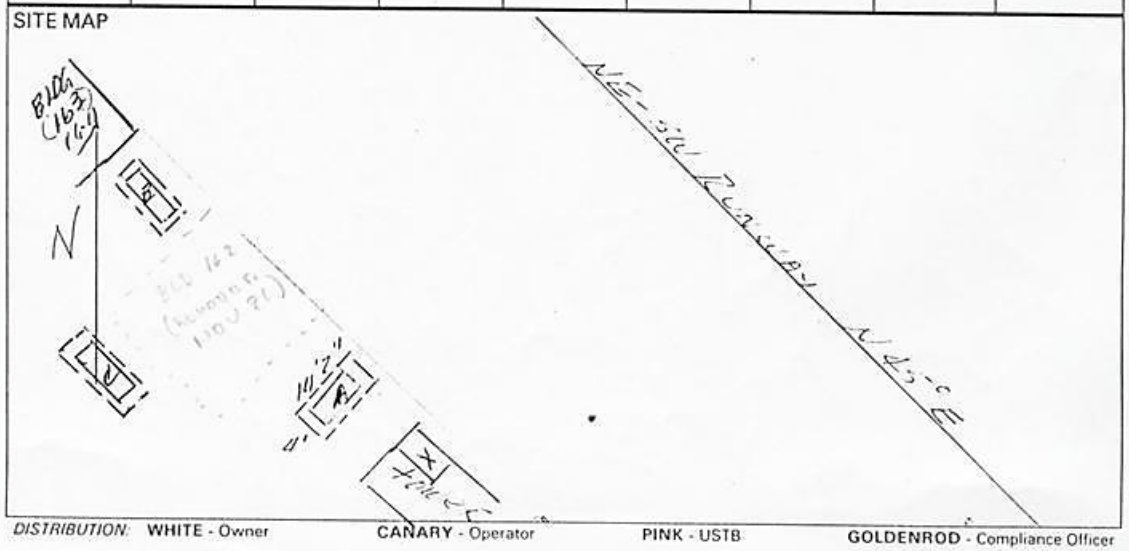
DATE	CASE NUMBER	OPENING CONFERENCE TIME
Nov 04 1991	026	

INSPECTION TYPE: ☐ COMPLIANCE ☐ REINSPECTION ☒ TANK CLOSURE ☐ INSTALLATION ☐ REPAIR ☐ COMPLAINT ☐ MODIFICATION

Facility Name: 1. Cannon AFB	Facility No.: 6759001	Phone No.: 784-4639
Address: Bldg 140, 27CES/DEV Clovis		ZIP Code: 88103-3251
Owner Name: 2. U.S. Air Force	Owner No.: 6759	Phone No.: 784-4639
Address: Cannon AFB, NM		ZIP Code: 88103
Facility Operator: 3. U.S. Air Force		Phone No.: 784-4639
Address: 27CES/DEV Cannon AFB NM		ZIP Code: 88103
Contractor Name: 4. Southern General Contractors (Max Fraziem)		Phone No.: 915-534-9181
Address: 1201 N. Mesquite/El Paso Tx (Clovis N.M.)		ZIP Code: 79902

TANK NO.	SIZE	CONTENTS	INSTALLATION DATE	TANK CONSTRUCTION	PIPING CONSTRUCTION	TANK RELEASE DETECTION	PIPING RELEASE DETECTION	TANK STATUS
A	1400gal	Heating Oil	1953 ~~1943~~	Steel	Steel	None	None	#146 A
B	1400gal	"	1953 ~~1943~~	"	"	"	"	
C	1500gal	"	1955 ~~1943~~	"	"	"	"	

SITE MAP



DISTRIBUTION: WHITE - Owner CANARY - Operator PINK - USTB GOLDENROD - Compliance Officer

Mexico Underground Storage Tank Bureau **INSPECTION REPORT** 026

		Yes	No	Unk.	N/A
1. All applicable tanks on site are registered.	1.	X			
2. Proper notification was made for the following:	2.				
a. Closure	a.	X			
b. Installation	b.				X
c. Modification	c.				X
d. Repair	d.				X
3. Tanks closed properly.	3.	X			
4. Tanks installed properly.	4.			X	
5. Tanks repaired/modified properly.	5.				X
6. Release detection — tanks:	6.				
a. Inventory records combined with annual tank tightness testing	a.	X			
b. Manual tank gauging	b.	X			
c. Automatic tank gauging	c.	X			
d. Vapor monitoring	d.				X
e. Ground water monitoring	e.				X
f. Interstitial monitoring	f.				X
7. Release detection — piping.	7.		X		
8. Certified tank installers.	8.				X
9. All required records are maintained.	9.	X			
10. Evidence of release/spill.	10.		X		

COMMENTS:

b.c. old style float system was used on tank "A". Tank "A" had been abandoned in place by asphalt and caliche pad. During removal an old sewer line was cut and a small amount of sewage drained into the tank pit.

Soil samples were taken at 2 feet below these tanks at both ends.

Samples were sent for lab analysis EPA 418.1

CLOSING CONFERENCE:	DATE Nov 08 1991	TIME 10:00 AM
Compliance Officer's Signature		Date 11-08-91

On-site Representative's Signature: John F. Eckhoff Date: Nov 8 1991

DISTRIBUTION: WHITE - Owner CANARY - Operator PINK - USTB GOLDENROD - Compliance Officer

ENRECO
LABORATORIES GROUP
6661-A Canyon Drive • Amarillo, Texas 79110 • Telephone (806) 353-4425 • Facsimile (806) 352-6454

ceived: 11/13/91

ENRECO LAB REPORT
Results by Sample

Work Order # 91-11-074
Continued From Above

MPLE ID S91-0950 TANK B - NORTH FRACTION 03A TEST CODE TRPH NAME TRPH 418.1
Date & Time Collected 11/04/91 Category

PARAMETER	RESULT	M D L	UNITS
TRPH 418.1	22	5	MG/KG

Tank B: 163

Demolished BLDG IN 87

Notes and Definitions for this Report:

EXTRACTED 11/15/91
DATE RUN 11/15/91
ANALYST CM

MPLE ID S91-0951 TANK B - SOUTH FRACTION 04A TEST CODE TRPH NAME TRPH 418.1
Date & Time Collected 11/04/91 Category

PARAMETER	RESULT	M D L	UNITS
TRPH 418.1	34	5	MG/KG

Notes and Definitions for this Report:

EXTRACTED 11/15/91
DATE RUN 11/15/91
ANALYST CM

MPLE ID S91-0952 TANK C - EAST FRACTION 05A TEST CODE TRPH NAME TRPH 418.1
Date & Time Collected 11/04/91 Category

Tank C: 162 (Hangar)

Sample -126

PARAMETER	RESULT	M D L	UNITS
TRPH 418.1	40	5	MG/KG

MEMO ON THE USTs AT FACILITIES 140, HANGAR 162 AND 163

MEMO:

1. HISTORY: I'm including these three buildings in the same report because they set in a row along the flightline. Furthermore, all three buildings appear on the same project drawing, which is quite helpful, since I could not locate any other drawings for 163. Building 163 was demolished in early 87 and 140 in October 91. Hangar 162 was picked up intact and moved as is during the weekend of 2 and 3 November 91. It was then parked on private property to the south of the base to be sold.

All three fuel oil tanks were removed with the same contract, on 4 Nov. 91, and the excavations were found to be free of contamination. The tanks for 140 and 163 were installed in late 1958 and remained full of oil until two months before removal. Even though they had been out of service for years because of conversion to natural gas, the fuel oil had never been removed. The UST at 162 was installed in 1955 and removed from service in 1957 when the building was converted to gas. Some time after removal it was filled with water because that is what we found when we uncovered it. After getting verbal approval from the local representative of NMED, Mr. Harry Gunn , personnel from LFM pumped the water down the sanitary sewer.

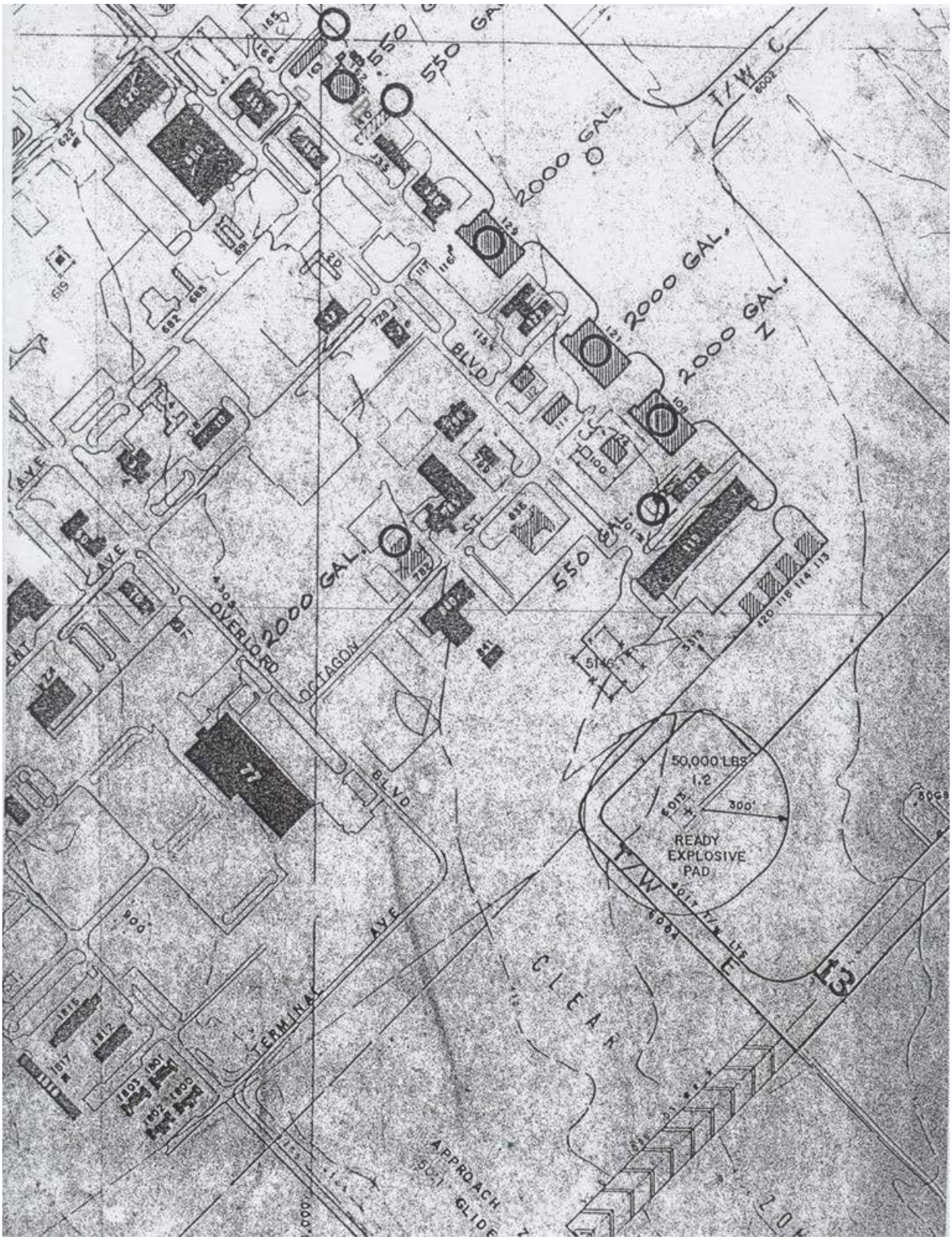
Upon excavation all three sites were visually inspected found to be free of contamination. Furthermore no holes or leaks were found in the tanks. All three tanks had tar coatings on them. The UST's for 140 and 163 were 4 foot in diameter and 14 feet long. The UST for 162 was 5 foot in diameter and 14 feet long.

NOTE: The soil samples from the UST at 140 were labeled 140A, the samples from the UST at 163 were labeled 140B, those from hangar 162 were labeled 140C. This was done by Harry Gunn of NMED.

2. SUMMARY: These three sights are clean and can be removed from the list of tank sites to be checked for contamination.

JOHN F. EKHOFF, Capt. USAF
Environmental Engineer.

NOV. 08, 1991.


550 GAL.
550 GAL.
2000 GAL.
2000 GAL.
2000 GAL.
2000 GAL.
2000 GAL.
550 GAL.
T/W C
T/W E
T/W
BLVD
ST.
OVERLORD
OCTAGON
BLVD
AVE
TERMINAL
AVE
77
50,000 LBS
1.2
300'
READY
EXPLOSIVE
PAD
CLEAR
APPROACH
50:1 GLIDE
E3

Attachment IV

SMWU 101 – Sewage Lagoons (SI101) No Further Action Report

Includes No Further Action Report and response letters addressing SWMU 101 from NMED.

CANNON AFB
NEW MEXICO

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 1475

NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

RON CURRY
Secretary

JON GOLDSTEIN
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

November 25, 2009

Ronald Lancaster
Chief, Asset Management
27 SOCES/CEA
506 N. DL Ingram Blvd.
Cannon AFB, New Mexico 88103-5003

RE: PARTIAL APPROVAL
CORRECTIVE ACTION COMPLETE PROPOSALS (JULY, 2008)
CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO
EPA ID #NM7572124454
HWB-CAFB-08-004

Dear Mr. Lancaster:

The New Mexico Environment Department (NMED) has received Cannon Air Force Base's (Permittee) *Corrective Action Complete Proposals* (Proposal), dated July, 2008. NMED partially approves the Proposal with the following exceptions.

No due date C

Further corrective action is required for Area of Concern (AOC) A and for Solid Waste Management Unit (SWMU) 129. The Permittee is referred to NMED's letter dated September 14, 2009 regarding the requirement for further corrective action for AOC A and SWMU 129.

Corrective action is not currently required for AOCs B and C or for SWMUs 79, 86, 87, 88, 89, 90, and 124. Controls have been successfully implemented and no further corrective action is currently required for SWMUs 97, 104, and 105. The Permittee may request a Class 3 Permit Modification for these two AOCs and ten SWMUs. The requirements to submit a Class 3 permit modification are at 20.4.1.900 NMAC, incorporating 40 CFR 270.42(c)..

By submitting the Notice of Permit Modification Request to NMED the Permittee initiates the process for Correction Action Complete determinations. The process is described in 40 CFR 270.42(c). The Permittee must send a Notice of Permit Modification to all persons on the facility's mailing list and to appropriate units of State and local governments and publish a Notice of Permit Modification in a major local newspaper of general circulation within seven (7) days from the date that NMED receives the Permit Modification Request. The date that the Notice of Modification is published in the major local newspaper begins a 60-day period for public comment as announced in the publication. The announcement will include a date, time and place for a public meeting on the modification request that is no earlier than 15 days after the publication and no later and 15 days before the close of the 60-day comment period.

Upon close of the Permittee's 60-day public comment period, NMED will review any comments, draft proposed modifications to the permit and attached tables, prepare a statement of basis for modifying the Permit and subsequently publish its intent to approve a Class 3 permit modification. The public notice includes a 60-day comment period. NMED will review and respond to any comments received before granting or denying the permit modification.

As a cost saving measure the Permittee may request a Class 3 Permit Modification for SWMU 101 concurrently with the above two AOCs and ten SWMUs.

The Permittee must note the correct titles to proposed Permit attachments Table 1, Table 2 and Table 3. The Permittee has reversed the order of Tables 2 and 3 in the Proposal and in the *Final No Further Action Report, SWMU 101 – Sewage Lagoons, Cannon Air Force Base, New Mexico* (July 2008).

TABLE 1. LIST OF SOLID WASTE MANAGEMENT UNITS (SWMUs) AND AREAS OF CONCERN (AOCs) REQUIRING CORRECTIVE ACTION

TABLE 2. LIST OF SOLID WASTE MANAGEMENT UNITS (SWMUs) AND AREAS OF CONCERN (AOCS) WITH CORRECTIVE ACTION COMPLETE WITH CONTROLS STATUS

TABLE 3. LIST OF SOLID WASTE MANAGEMENT UNITS (SWMUs) AND AREAS OF CONCERN (AOCS) WITH CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS STATUS

Please contact Pat Stewart at (505) 476-6059, should you have any questions.

Sincerely,

John E. Kieling
Program Manager
Permits Management Program
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
N. Dhawan, NMED HWB
P. Stewart, NMED HWB
H. Hanson, CAFB

File: CAFB 2009 and Reading
HWB-CAFB-08-007

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

NEW MEXICO ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

SUSANA MARTINEZ
Governor

JOHN A. SANCHEZ
Lieutenant Governor

DAVE MARTIN
Secretary

RAJ SOLOMON, P.E.
Deputy Secretary

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

February 23, 2011

Colonel Stephen A. Kimball, Commander
27th Special Operations Mission Support Group
110 E. Sextant Avenue, Suite 1091
Cannon Air Force Base, New Mexico 88103

RE: CORRECTIVE ACTION COMPLETE PROPOSALS
(SWMUS 2, 4, 6, 10, 50, 72, 75, 81, 82, 96, 98, 102, 105 AND 125)
CANNON AIR FORCE BASE, NEW MEXICO, OCTOBER 2010
EPA ID #NM7572124454
HWB-CAFB-08-006

Dear Col. Kimball:

The New Mexico Environment Department (NMED) has reviewed Cannon Air Force Base's (Permittee's) *Corrective Action Complete Proposal (SWMUs 2, 4, 6, 10, 50, 72, 75, 81, 82, 96, 98 102, 105 AND 125) Cannon Air Force Base, New Mexico, October 2010* (Proposal) and the Permittee's Response to Notice of Disapproval Comments dated February 14, 2011 (RTC). NMED hereby approves the Proposal and the RTC.

Corrective action is not required for SWMUs 10, 50, 72, 75, 81, 98, 106, and 125. Controls have been successfully implemented and no further corrective action is currently required for SWMUs 2, 4, 6, 82, 96, and 102. The Permittee may request a Class 3 permit modification for these fourteen SWMUs. The requirements to submit a Class 3 permit modification may be found at 20.4.1.900 NMAC, incorporating 40 CFR 270.42(c).

By submitting a permit modification request to NMED the Permittee initiates the process for Correction Action Complete determinations. The process is described in 40 CFR 270.42(c). The Permittee must send the permit modification request to all persons on the facility's mailing list

and to appropriate units of state and local governments and publish the notice of permit modification request in a major local newspaper of general circulation within seven days from the date that NMED receives the permit modification request. The date that the notice of modification request is published in the major local newspaper begins a 60-day period for public comment as announced in the publication. The announcement will include a date, time and place for a public meeting on the modification request that is no earlier than 15 days after the publication and no later and 15 days before the close of the 60-day comment period.

At the close of the Permittee's 60-day public comment period, NMED will consider and respond to any comments received. Upon continued approval, NMED will draft proposed modifications to the permit and attached tables, prepare a statement of basis for modifying the Permit and subsequently publish its intent to approve a Class 3 permit modification. The public notice includes a 60-day comment period.

As a cost saving measure, the Permittee may request a Class 3 permit modification for SWMU 101 concurrently, as well as for other AOCs and SWMUs listed in NMED's letter dated November 25, 2009.

Please contact Dave Cobrain at (505) 476-6055, if you have any questions.

Sincerely,

John E. Kieling
Program Manager
Permits Management Program
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
N. Dhawan, NMED HWB
R. Lancaster, CAFB
A. Lafuente, CAFB
K. Walker, CAFB

File: CAFB 2011 CAC Proposal/Approval/Instructions

CANNON AFB
NEW MEXICO

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 996

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

REPLY TO
ATTENTION OF

Environmental Remediation Branch

Mr. Gerald Pelfrey, P.G.
Environmental Restoration Program Manager
27th SOCES/CEVR
Cannon AFB, New Mexico 88103-5003

Dear Mr. Pelfrey:

Please refer to the enclosed three copies of the Sewage Lagoons, Solid Waste Management Unit (SWMU) 101 No Further Action (NFA) Final Report. This report presents a comprehensive summary of the work completed to date at this SWMU 101, at Cannon Air Force Base (AFB), New Mexico, to support a consideration of NFA by the New Mexico Environment Department (NMED).

The U.S. Army Corps of Engineers, Omaha District prepared this document in accordance with NMED, as authorized by the Environmental Protection Agency, to implement the federal Resource Conservation and Recovery Act (RCRA) hazardous waste program as part of the corrective action program activities. Corrective action activities have been conducted in accordance with Cannon AFB's Hazardous Waste Facility Permit.

A letter to accompany this submission of this report to the NMED is also enclosed. If you have any concerns, please contact Mr. Hector Santiago, Project Manager for this project at telephone number (402) 995-2738.

Sincerely,

Randal K. Petersen, P.E.
Chief, Environmental Remediation Branch
Planning, Programs and Project Management Division

Enclosures

FINAL
NO FURTHER ACTION REPORT

SWMU 101—Sewage Lagoons
CANNON AIR FORCE BASE, NEW MEXICO

Prepared for:
27th SOCES/CEVR
Cannon Air Force Base
New Mexico

Prepared by:

U.S. Army Corps of Engineers

Omaha District

Omaha, Nebraska

July 2008

TABLE OF CONTENTS

List of FIGURES iii

List of TABLES iii

List of Acronyms and Abbreviations iv

EXECUTIVE SUMMARY 1

1.0 REPORT PURPOSE AND SCOPE 4
- 1.2 Regulatory Framework 4
- 1.3 Site History 4
- 1.4 Document Organization 5

2. BACKGROUND INFORMATION 6
- 2.1 SWMU 101, Sewage Lagoons 6

3.0 PREVIOUS INVESTIGATIONS AND SITE ACTIVITIES 7
- 3.1 Hydrogeologic Investigation – 1985 7
- 3.2 Remedial Investigation – 1991 to 1992 7
- 3.3 Supplemental Sludge Sampling - 1998 8
- 3.4 RCRA Groundwater Monitoring – 1998 through 2001 8
- 3.5 Corrective Measures Study - 2000 9

4.0 VOLUNTARY CORRECTIVE ACTION 10
- 4.1 Evaluation of Site Conditions 11
- 4.2 Pre-Voluntary Corrective Action Site Characterization 12
- 4.3 Voluntary Corrective Action Activities 13
  - 4.3.1 Grading and Drainage 13
  - 4.3.2 Demolition and Removal 14
  - 4.3.3 Excavation and Handling of Contaminated Material 14
  - 4.3.4 Sludge Consolidation and Random Fill 14
  - 4.3.5 Soil Barrier Layer Construction 14
  - 4.3.6 Biota Barrier Construction 15
  - 4.3.7 Erosion/Vegetation layer Construction 15
  - 4.3.8 Site Revegetation and Fence Construction 15
  - 4.3.9 Confirmation Samples 15

5.0 SITE CONCEPTUAL MODEL 16
- 5.1 Soils and Geology 16
- 5.2 Groundwater 17
- 5.3 Surface Water 18
- 5.4 Nature and Extent of Contamination 18
- 5.5 Contaminant Fate and Transport 19
- 5.6 Human Health Risk Evaluation 20
- 5.7 Screening-Level Ecological Risk Assessment 22
- 5.8 Post-Voluntary Correction Action Conditions and Associated Risk 23
- 5.9 Risk Characterization 24

TABLE OF CONTENTS (continued)

Page

6.0 CONCLUSIONS AND RECOMMENDATIONS **26**

7.0 REFERENCES **28**

FIGURES **30**

TABLES **33**

LIST OF FIGURES

Figure 1-1 Location of Cannon AFB

Figure 1-2 Location of SWMU 101, Sewage Lagoons

LIST OF TABLES

Table 3-1 Previous Investigation Sampling Programs at SWMU 101

Table 3-2 Groundwater Monitoring Results, Well E, Upgradient Well

Table 3-3 Groundwater Monitoring Results, Well F, Downgradient Well

Table 3-4 Groundwater Monitoring Results, Well G, Downgradient Well

Table 3-5 Groundwater Monitoring Results, Well H, Downgradient Well

Table 5-1 Summary of Risks and Hazards to Potential Human Receptors at the Sewage Lagoons (SWMU 101)

Table 5-2 Summary of Risk to Ecological Receptors at SWMU 101

LIST OF ACRONYMS AND ABBREVIATIONS

ACI	Arrowhead Contracting, Inc.
AFB	Air Force Base
Base	Cannon AFB
bgs	below ground surface
CAFB	Cannon Air Force Base
CAO	corrective action objective
CFR	Code of Federal Regulation
cm/sec	centimeters per second
CMS	Corrective Measures Study
COCs	chemicals of concern
COPC	chemicals of potential concern
COPEC	chemicals of potential ecological concern
cy	cubic yards
E & E	Ecology and Environment Inc.
ELCR	excess lifetime cancer risk
EPA	Environmental Protection Agency
ESQ	ecological screening quotient
ft	feet
FWEC	Foster Wheeler Environmental Corporation
gpf	gallons per feet
gpm	gallons per minute
HHRA	human health risk assessment
HHSLs	human health screening levels
HI	hazard index
HQ	hazard quotient
MCLs	maximum contaminant levels
mg/kg	milligrams per kilogram
mg/L	milligrams per liter

LIST OF ACRONYMS AND ABBREVIATIONS (continued)

NFA	no further action
NMED	New Mexico Environment Department
PCB	Polychlorinated biphenyl
Permit	Hazardous Waste Facility Permit
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SBL	soil barrier layer
SESOIL	Seasonal Soil Compartment Model
SLERA	screening-level ecological risk assessment
SMCL	secondary maximum contaminant level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWPPP	Stormwater Pollution Prevention Plan
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TtEC	Tetra Tech EC, Inc.
USACE	U.S. Army Corps of Engineers
USGS	United States Geological Survey
VCA	voluntary corrective action
VOC	volatile organic compound

EXECUTIVE SUMMARY

This No Further Action (NFA) Report presents a comprehensive summary of the work completed to date at the Sewage Lagoons, Solid Waste Management Unit (SWMU) 101, at Cannon Air Force Base (AFB), New Mexico, to support a consideration of NFA by the New Mexico Environment Department (NMED). A Voluntary Corrective Action (VCA) was completed as a Base-initiated risk-based management decision consisting of sludge and contaminated soil removal at the site. Previous investigations of the site and the Corrective Measures Study (CMS) indicated that the primary contamination at the site consisted of arsenic, dieldrin, polychlorinated biphenyl (PCB) -1260 and endrin aldehyde in the area of the former sewage lagoons. Closure efforts during the VCA included sludge removal from the former north lagoon, in-place consolidation in the former south lagoon, and closure using an engineered permanent cover with a biotic barrier. The cover design assumed that the contaminated media at the site consisted of approximately 2' of sludge overlying a 1' thick layer of soil. Prior to the VCA, work at the facility included a Remedial Investigation (RI), the CMS, and associated supplemental data collection activities to support characterization of the site prior to the VCA. The locations of Cannon AFB and the sewage lagoons are shown on Figures 1-1 and 1-2, respectively.

NMED is authorized by the U.S. Environmental Protection Agency (EPA) to implement the federal RCRA hazardous waste program and oversee the corrective action program activities conducted in accordance with Cannon AFB's Hazardous Waste Facility Permit (Permit). NMED issued a RCRA Permit to Cannon AFB on December 17, 1989. Cannon AFB's Draft RCRA Part B Permit Application, submitted in July 1999 (revised in November 2005), refers to the status of various assessment, investigation, and remediation projects for a number of SWMUs on the Base.

During the spring of 2000, Foster Wheeler Environmental Corporation (FWEC) conducted a field investigation as part of the CMS for SWMU 101. The focus of the CMS was to research, evaluate, and select corrective action alternatives to prevent future impact to human health and the environment. Additional data were required to support the CMS and preliminary remedial design work. Therefore, to characterize the sludge and underlying soil within the Sewage Lagoons, chemical and geotechnical analyses were performed on native soil and sludge samples.

The CMS identified and evaluated three potential correction action alternatives to prevent future impact to human health and the environment. The three alternatives evaluated were:

- Alternative 1 – No Action
- Alternative 2 – Sludge Dewatering In-Place, Consolidation, Compaction and Cover
- Alternative 3 – In-situ Bioremediation Through Composting

The preferred alternative chosen for further examination was Alternative 2. The alternative met the correction action objectives, conformed to the design criteria and provided the additional benefit of restoring the north lagoon for stormwater management.

The primary contaminants of concern at SWMU 101 were arsenic, dieldrin, PCB-1260 and endrin aldehyde, specifically in the area of the former sewage lagoons. The risk assessment, which was performed as part of the CMS, evaluated two of the three corrective action alternatives. The No Action alternative was evaluated quantitatively in both the Human Health

Risk Assessment (HHRA) and Screening Level Ecological Risk Assessment (SLERA). The second alternative, Sludge Dewatering In-Place, Consolidation, Compaction, and Cover, was evaluated qualitatively in the HHRA and SLERA. The third alternative, In-situ Bioremediation Through Composting, was deemed ineffective in reducing the levels of metals in sludge at the sewage lagoons and therefore, was not evaluated in the risk assessment.

Based on the results of the HHRA risk calculations, there is no risk to industrial workers due to exposure to sludge and soil at SWMU 101 under the second alternative. The SLERA showed that because this alternative required all of the affected soil and sludge in the north lagoon to be consolidated in the south lagoon, risk to ecological receptors in the north lagoon would be eliminated. However, a potentially complete exposure pathway for burrowing animals would still exist in the south lagoon. Therefore, it was recommended that a bio-barrier be used in the south lagoon to ensure that this exposure pathway is no longer complete for ecological receptors.

The Construction Completion Report (Tetra Tech EC Inc. (TtEC) 2005) documented the construction activities performed for remedial action at SWMU 101. TtEC conducted the remedial action and the objective was to design and implement a cover system for the Sewage Lagoons as part of a voluntary corrective measure to close the site. All field activities were performed according to USACE and Cannon AFB requirements and the approved Work Plan (FWEC, 2003). The USACE Albuquerque District personnel provided construction management oversight.

A summary of the VCA field activities and previous investigations is presented below to support the recommendation for the future of the Sewage Lagoons, SWMU 101.

- In 1985, a hydrogeologic investigation was conducted and four monitoring wells were installed, prior to the Sewage Lagoons being designated as a SWMU. One well was installed upgradient, and three wells were installed downgradient. The wells were sampled quarterly for only field parameters of pH, temperature and conductivity.
- Results of the 1991 RI showed that sludge samples from the lagoon areas contained low levels of pesticides and PCBs, but they were most likely as a result of base activities that transferred these contaminants through the sanitary sewer to the lagoons.
- The 1991 RI recommended to continue annual groundwater monitoring of the four wells for volatile organics, metals, pesticides, nitrate, sulfate and total dissolved solids (TDS). This recommendation was made to support site closure.
- Annual groundwater samples were taken from 1998 to 2001 from wells Well E, Well F, Well G, and Well H at SWMU 101. The groundwater was sampled and analyzed yearly by the United States Geological Survey (USGS) and analyzed by USACE's Southwestern Division Laboratory, located in Dallas, Texas. Iron was the only analyte detected above EPA's secondary maximum contaminant level (SMCL) of 0.30 milligrams per liter (mg/L).
- The results of the 1997 Supplemental Sludge Sampling effort showed that levels of analytes did not exceed RCRA limits for hazardous constituents. Additional sludge samples were recommended to adequately characterize the sludge prior to any corrective action.
- In 2000, a CMS was performed which included sludge and native soil sampling. Sludge results were less than Toxicity Characteristic Leaching Procedure (TCLP) levels;

therefore, it was considered non-hazardous, and it was determined that it would not require off-site disposal during removal.

- In 2000, the CMS reported that concentrations of pesticides decreased with depth. None of the soil was determined to be hazardous and it was determined that it would not require off-site disposal during removal.
- The CMS evaluated three alternatives; no action, sludge dewatering in-place, consolidation, compaction, and cover; and in-site bioremediation through composting. The recommended corrective action was sludge dewatering in-place, consolidation, compaction and cover. The alternative met the corrective action objectives (CAOs) conformed to the conceptual design criteria, and provided the additional benefit of restoring the north lagoon for stormwater management.
- Fate and transport modeling was performed during the CMS to support the risk assessment and the evaluation of the corrective alternatives. Results of the 50-year simulations predicted that vertical pollution migration does not reach groundwater.
- Risk characterization was evaluated during the CMS and showed negligible risk to industrial workers due to exposure to chemicals in the sludge or soil, but indicated there may be risk to ecological receptors that reside or visit the site.
- A VCA was performed during 2003-2004. Soils and sludge were removed from the former north lagoon and consolidated into the former south lagoon. The material was graded, compacted, and covered with a 20-acre, 42" thick soil barrier layer.
- Confirmation samples taken after excavation activities showed no contamination and no potential for leaching to groundwater.

The results of previous investigations, risk evaluations, and completion of the VCA at the Sewage Lagoons, SWMU 101, support a recommendation of NFA for this SWMU in accordance with NMED NFA Criterion #5:

> The site was characterized/remediated in accordance with applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

1.0 REPORT PURPOSE AND SCOPE

This NFA Report presents a comprehensive summary of the work completed to date at the Sewage Lagoon, SWMU 101, at Cannon AFB, New Mexico, to support a consideration of NFA by the New Mexico Environment Department (NMED). A VCA was completed as a Base-initiated risk-based management decision consisting of in-place sludge dewatering, consolidation, compaction and a cover system. Previous investigations of the site and the CMS indicated that the primary contamination at the site consisted of arsenic, dieldrin, PCB-1254, and endrin aldehyde in soil and sludge in the area of the former sewage lagoons. Prior to the VCA, work at the facility included a RI, the CMS, and the associated supplemental data collection activities to support characterization of the site. The locations of Cannon AFB and the Sewage Lagoons are shown in Figures 1-1 and 1-2, respectively.

1.2 Regulatory Framework

NMED is authorized by the EPA to implement the federal RCRA hazardous waste program and oversee the corrective action program activities conducted in accordance with Cannon AFB's Hazardous Waste Facility Permit (Permit). NMED issued a RCRA Permit to Cannon AFB on December 17, 1989 (revised in 2005). Cannon AFB's Draft RCRA Part B Permit Application, submitted in July 1999, refers to the status of various assessment, investigation, and remediation projects for a number of SWMUs on the Base.

Based on the sites investigations and CMS conducted to date, the primary chemicals of concern (COCs) at SWMU 101 are volatile organic compounds, metals, pesticides, nitrate, sulfate and total dissolved solids in the groundwater. As a result, an interim monitoring program was implemented to support site closure and to comply with RCRA requirements.

An ecological survey showed that concentrations of inorganic chemicals produced elevated ecological screening values for potential ecological receptors. However, there was no risk identified to human health from exposure to surface or subsurface soil or sludge at the site. To prevent exposure to ecological receptors, sludge removal from the former north lagoon, in-place consolidation in the former south lagoon, and closure using an engineered cover with a biotic barrier was recommended as the corrective action for closing the lagoons from the corrective actions that were evaluated in the CMS: No Action; Sludge Dewatering In-Place, Consolidation, Compaction and Cover; and In-Situ Bioremediation Through Composting.

1.3 Site History

Cannon AFB is located in Curry County, New Mexico, approximately 7 miles west of the city of Clovis (Figure 1-1). Cannon AFB occupies 4,320 acres, primarily consisting of the airfield and associated operations, maintenance, and support facilities that are located northwest of the airfield. Housing facilities are located in the former northwest portion of the Base, west of U.S. Highway 277, and north of U.S. Highway 60. Additional Base support facilities, such as the munitions storage area, and current fire department training area, are located south and east of the airfield.

Cannon (CAFB), New Mexico, which has been in existence for 64 years, lies in the high plains of eastern New Mexico, near the Texas Panhandle. Its primary mission is to host the 27th Fighter Wing; an F-16 fighter wing capable of day and night operations.

SWMU 101, Sewage Lagoons, was constructed in 1966 and consisted of two unlined surface impoundments, operating in series, received combined sanitary and industrial wastewater from Base facilities. The lagoons had concrete-lined banks and unlined earthen bottoms and were located on the east-central part of the base between an abandoned north-south abandoned runway and perimeter road. The lagoons had a total surface area of 32 acres and were separated by a 12-foot-wide levee. In 1998, a new wastewater treatment plant was put into operation at Cannon AFB. Sewage discharge to the lagoons stopped in 1998, but the Base continued to discharge treated wastewater to the lagoons in order to prevent direct exposure to the underlying sludge. In early 1998, the Base stopped discharging treated wastewater to the lagoons and allowed them to dry. The lagoons are currently inactive and no longer support base operations. Efforts during the VCA included sludge removal from the former north lagoon, dewatering, in-place consolidation in the former south lagoon, and closure using an engineered cover with a biotic barrier. The cover design assumed that the contaminated media at the site consisted of approximately 2' of sludge overlying a 1' thick layer of soil.

1.4 Document Organization

This report is organized as follows:

- Section 1 contains the report purpose and organization.
- Section 2 summarizes the description and history for the sewage lagoons.
- Section 3 provides a background, previous investigations and site activities.
- Section 4 provides a description of the VCA.
- Section 5 provides a summary of the site conceptual model, contamination assessment, HHRA, ecological risk assessment, and a description of the current conditions of the site.
- Section 6 presents the conclusion and recommendations for the SWMU 101.
- Section 7 lists the references used to develop this report.

2. BACKGROUND INFORMATION

This section presents background information and a description of the sewage lagoons, in addition to the results of the CMS report. Previous investigations of the sewage lagoons are discussed in Section 3.

2.1 SWMU 101, Sewage Lagoons

The Sewage Lagoons were identified as SWMU 101 in the Cannon AFB Hazardous Waste Permit dated November 14, 1989. The Sewage Lagoons consisted of two unlined surface impoundments that were used from 1966 to 1998 and received combined sanitary and industrial waste from base facilities. The lagoons were located on the east-central part of the base between an abandoned north-south abandoned runway and perimeter road. The lagoons had a total surface area of 32 acres and were separated by a 12-foot-wide levee. In 1998, a new wastewater treatment plant was put into operation at Cannon AFB. Sewage discharge to the lagoons stopped in 1998, but the Base continued to discharge treated wastewater to the lagoons in order to prevent direct exposure to the underlying sludge. In early 1998, the Base stopped discharging treated wastewater to the lagoons and allowed them to dry.

The CMS identified and evaluated three potential correction action alternatives to prevent future impact to human health and the environment. The three alternatives evaluated were:

- Alternative 1 – No Action
- Alternative 2 – Sludge Dewatering In-Place, Consolidation, Compaction and Cover
- Alternative 3 – In-site Bioremediation Through Composting

The preferred alternative chosen for further examination was Alternative 2. The alternative met the correction action objectives, conformed to the design criteria and provided the additional benefit of restoring the north lagoon for stormwater management.

To characterize the sludge and underlying soil within the Sewage Lagoons before removal, chemical and geotechnical analyses were performed on native soil and sludge samples collected during the CMS.

Sludge and soil samples were analyzed for RCRA Metals, volatile organic compounds (VOCs), pesticides, PCBs, nitrate, TCLP Pesticides and Metals (sludge only) and Total Organic Carbon. TCLP results for sludge samples indicated that there was no potential for leachate to exceed regulatory levels. Low levels metals were detected in the soil at concentrations that tended to decrease with depth. Analytical results for soil indicated that the soil would be considered nonhazardous and would not require offsite disposal during removal action.

The preferred alternative was implemented as a voluntary corrective action by Cannon AFB. The cover system was designed to minimize any potential threat to human health and the environment by removing the sludge and underlying contaminated soil from the former north lagoon, referred to as the North Lagoon Area, consolidating the excavated material into the former south lagoon, referred to as the South Lagoon Area, grading and compacting the sludge and soil material to prepare the substrate, and constructing a 42-inch-thick engineered earthen cover system.

3.0 PREVIOUS INVESTIGATIONS AND SITE ACTIVITIES

This section presents an overview of the investigations prior to the VCA-related activities in 2005. Previous investigations covered in this section include the following:

- Hydrogeologic Investigation – 1985
- Remedial Investigation – 1991 to 1992
- Supplemental Sludge Sampling – 1998
- CMS – 2001
- Annual Groundwater Monitoring – 1998 to 2001

3.1 Hydrogeologic Investigation – 1985

From 1984 through 1985, William Matotan and Associates conducted a hydrogeological investigation at the Sewage Lagoons (William Matotan and Associates, 1985). At the time of the investigation, the Sewage Lagoons had not yet been designated a SWMU. This investigation included the installation of four monitoring wells: one upgradient and three downgradient of the Sewage Lagoons. These wells were sampled quarterly and analyzed for field parameters only, including pH, temperature, and conductivity.

3.2 Remedial Investigation – 1991 to 1992

The objective of the RI conducted by Woodward-Clyde (Woodward-Clyde, 1992) was to evaluate the nature and extent of the presence of potentially hazardous contaminants at 18 Cannon AFB sites, including the Sewage Lagoons. Field activities consisted of:

- Collecting eight sludge samples and three surface water samples for chemical analyses
- Measuring the static water level, purging completely and collecting groundwater samples from four monitoring wells for chemical analysis

The sampling objective at the Sewage Lagoons was to provide information regarding the nature and extent of contamination present in the wastewater sludge, the treated wastewater within the lagoons, and the groundwater downgradient of the SWMU. The data collected from the sludge, surface water, and groundwater samples were used to further evaluate the extent of potential contamination, if present, and to perform a baseline risk assessment to determine if the area poses a risk to human health or the environment.

Four sludge samples from the north lagoon and four sludge samples from the south lagoon were collected. Sludge samples were analyzed for TCLP parameters, VOCs, semivolatile organic compounds (SVOCs), metals, PCBs, and pesticides. The VOCs acetone and 2-butanone and the SVOC bis(2-ethylhexyl)phthalate were the only organic compounds identified as being present in the sludge samples collected during the RI. It is possible that the detections of these compounds are attributable to laboratory contamination since they were detected in up to 14 of the method blanks analyzed during the RI. Metals were detected above the site background levels for soil. The pesticides 4,4-DDD, 4,4'-DDE, and chlordane, and PCB-1254 were detected in the sludge samples from both the north and south lagoons. These pesticides and PCB-1254 were uniformly detected at low concentrations throughout the lagoons and are most likely the

result of an accumulation of materials from various base activities transferred to the lagoons through the sanitary sewer. Two sludge samples were also analyzed for TCLP parameters to evaluate the leachability of detected chemicals. None of the chemicals exceeded the TCLP criteria.

Four groundwater samples were collected from existing monitoring wells E, F, G, and H at the Sewage Lagoons during the RI. Wells F, G, and H are located downgradient from the Sewage Lagoons, and well E is located upgradient of the site. Groundwater samples were analyzed for Appendix IX constituents. Metals were the only analytes detected and results showed all concentrations were below respective maximum contaminant levels (MCLs).

Three surface water samples were collected and were analyzed for Appendix IX constituents. Various metals and sulfide were detected in all three surface water samples. Lead, copper, mercury, silver and zinc were detected or above either the acute or chronic EPA Ambient Water Quality Criteria for surface water. The sample located near the wastewater flow splitting pool reported the most detects of metals.

As a result of this investigation, the only recommendation made for ongoing work at the Sewage Lagoons was to continue annual groundwater monitoring for VOCs, metals, pesticides, nitrate, sulfate, and TDS. According to the RI report, the recommendation for an interim monitoring program was made to support site closure until the regulatory framework was resolved. Groundwater monitoring has been conducted on an annual basis to fulfill the requirements of RCRA.

3.3 Supplemental Sludge Sampling - 1998

The objective of the sampling conducted by (Ecology and Environment, Inc. (E & E) in 1997 was to support the preliminary evaluation of corrective action alternatives (E & E, 1998). Three sludge samples were collected and analyzed for total nitrogen, total solids, volatile solids, metals, and pathogens. Analytical results indicated that the levels of analytes detected did not exceed RCRA limits for hazardous constituents. E & E concluded that additional sludge samples were required to adequately characterize the sludge during the corrective action process of the Sewage Lagoons.

To propose the appropriate method of excavation and transferal, disposal area, and sludge hauling requirements, the sludge quantity was also investigated by E & E. The sludge volume in the lagoons during the 1997 investigation was estimated to be 165,000 cubic yards (cy).

3.4 RCRA Groundwater Monitoring – 1998 through 2001

As a result of the 1992 Woodward Clyde RI program, recommendations were made for annual groundwater sampling of the four monitoring wells (Well E, Well F, Well G, and Well H) at SWMU 101. The groundwater was sampled and analyzed yearly by the USGS, starting in 1998. Samples were analyzed for VOCs, metals, nitrate, sulfate and TDS and were analyzed by USACE's Southwestern Division Laboratory, located in Dallas, Texas. Analytical results are shown in Tables 3-2 through 3-5. Iron was the only analyte detected above EPA's SMCL. The SMCL for iron is 0.30 mg/L.

3.5 Corrective Measures Study - 2000

During the Spring of 2000, FWEC conducted a field investigation as part of the CMS for SWMU 101. The focus of the CMS was to research, evaluate, and select corrective action alternatives to prevent future impact to human health and the environment.

As part of the CMS, human health and ecological risk assessments were evaluated in order to determine the level at which contaminant and source control would be required. Additional data were required to support the CMS and preliminary remedial design work. Therefore, to characterize the sludge and underlying soil within the Sewage Lagoons, chemical and geotechnical analyses were performed on native soil and sludge samples. This additional data collection is further described in Section 4.2.

The CMS identified and evaluated three potential correction action alternatives to prevent future impact to human health and the environment. The three alternatives evaluated were:

- Alternative 1 – No Action
- Alternative 2 – Sludge Dewatering In-Place, Consolidation, Compaction and Cover
- Alternative 3 – In-site Bioremediation Through Composting

The preferred alternative chosen for further examination was Alternative 2. The alternative met the correction action objectives, conformed to the design criteria and provided the additional benefit of restoring the north lagoon for stormwater management.

4.0 VOLUNTARY CORRECTIVE ACTION

The CMS of SWMU101 at Cannon AFB was a voluntary program aimed at achieving closure of the Sewage Lagoons, which were active from 1966 through 1998. The CMS report for SWMU 101 was prepared in 2001 (FWEC, 2001) and its purpose was to identify and evaluate potential corrective action alternatives to prevent future impact to human health and the environment.

The Construction Completion Report (TtEC 2005) documents the construction activities conducted for remedial action at SWMU 101. TtEC conducted the remedial action and the objective was to design and implement a cover system for the Sewage Lagoons as part of a VCA to close the site. All field activities were performed according to USACE and Cannon AFB requirements and the approved Work Plan (FWEC, 2003). The USACE Albuquerque District personnel provided construction management oversight.

The cover system was designed to minimize any potential threat to human health and the environment by removing the sludge and underlying contaminated soil from the former north lagoon, referred to as the North Lagoon Area, consolidating the excavated material into the former south lagoon, referred to as the South Lagoon Area, grading and compacting the sludge and soil material to prepare the substrate, and constructing a 42-inch-thick engineered earthen cover system. The construction activities included:

- Grading and drainage
- Demolition and removal of concrete and piping
- Excavation and handling of contaminated material from the North Lagoon Area
- In-place consolidation of excavated material, random fill, and grading in the South Lagoon Area
- Construction of a 20-acre, 42-inch-thick engineered earthen cover (soil barrier layer)
- Installation of the biota barrier and erosion/vegetation layers
- Site revegetation and fencing

Complete removal of the concrete-lined banks of the former south lagoon and removal of the piping only from the former north lagoon was required in the Work Plan. However, instead, the concrete slabs covering the earthen banks of the southern half of the North Lagoon Area were also removed. Materials from the exposed earthen berms in the North Lagoon Area and the earthen berms surrounding the South Lagoon Area, approximately 20,000 cy, were used to construct the soil-barrier layer of the soil cover system. The berm material was tested and approved using the same requirements as offsite materials and resulted in cost savings to the project. During construction, permits were obtained and completed for construction activities. A National Pollutant Discharge Elimination System (NPDES) Stormwater Construction Permit was obtained since the construction area at SWMU 101 was greater than 5 acres. The permit included clearing, grading and excavation activities. A Stormwater Pollution Prevention Plan (SWPPP) was prepared for construction activities and the plan was followed during construction. The SWPPP was presented in the Final Work Plan (FW 2003).

According to the work plan, approximately 70,000 cy of contaminated material was to be excavated from the North Lagoon Area and placed in the South Lagoon Area. However, the thickness of the sludge and the layers of underlying contaminated soil were less than anticipated, resulting in approximately 60,200 cy. The variance in depth was attributed to evaporation of the

lagoons, beginning in 1999 through the initiation of construction. The sludge contained relatively little moisture and was consolidated without the need for dewatering.

During the excavation of the southern section of the North Lagoon Area, a subgrade "'trench" of sludge trending east-west was discovered below the established limits of the contaminated soil layer. This material, approximately 13,200 cy, was placed in the south Lagoon Area. The over-excavated area was backfilled with stockpiled material left over from former runway work at Cannon AFB. This stockpile is commonly referred to as the Keel material and was located adjacent and west of SWMU 101. TtEC conducted post excavation confirmation soil sampling. Hagar & Associates, P.C. Land Surveyors completed the post excavation topographical and sample location surveys. According to the sludge layer as-built survey, the total amount of fill materials placed in the South Lagoon Area, including concrete rubble, polyvinyl chloride (PVC) piping, sludge and soil, was 73,400 cy.

ACI (Arrowhead Contracting Inc,) excavated approximately 60,200 cy of sludge and contaminated soil materials from the North Lagoon Area and consolidated this with the South Lagoon Area material. The 13,200 cy of additional sludge material excavated from the North Lagoon Area was used as random fill in the South Lagoon Area in place of the Keel material, and the consolidated material and random fill was graded and surveyed.

A soil barrier layer (SBL) was constructed of an 18- to 21-inch-thick earthen cover system composed of clean, approved soil that was placed on top of the sludge and random fill layer. The purpose of the SBL was to reduce infiltration of moisture into the underlying layer of contaminated material. Both onsite and offsite sources were used for the SBL and was tested in accordance with the project specifications.

A biota barrier consisting of recycled, crushed concrete was placed on top of the SBL. The purpose of this layer is to prevent animals from burrowing into the SBL. A 6-inch erosion/vegetation layer was constructed on top of the SBL.

The South Lagoon Area, 23 acres, was revegetated with native species using an approved seed mix. A five-strand barbed-wire fence was installed on the northern boundary of the capped area to separate the North and South Lagoon Areas and to prohibit access to the site.

4.1 Evaluation of Site Conditions

Preliminary site work was completed in 1998 to support the use of sludge consolidation and covering the contaminant area with soil to achieve site closure. Human health and ecological risk assessments were conducted as part of the CMS in order to determine the level at which contaminant and source was required at the site. An ecological survey of the area was also conducted to support the risk assessment.

A field program was conducted during the CMS to characterize the Sewage Lagoon sludge and the native soil directly beneath the lagoons for the future design phase of the corrective action. Fate and transport modeling was performed to support the risk assessment and the evaluation of corrective action alternatives to simulate contaminant migration through the vadose zone. Results of the modeling under the site conditions at the time illustrated that degradation to groundwater, due to contaminants of concern in sludge, was unlikely to occur.

The CMS evaluated three alternatives; no action, sludge dewatering in-place, consolidation, compaction, and cover; and in-site bioremediation through composting. The recommended corrective action was sludge dewatering in-place, consolidation, compaction and cover. The alternative met the CAOs, conformed to the conceptual design criteria, and provided the additional benefit of restoring the north lagoon for stormwater management.

The Phase III Sludge Management, Compliance Evaluation, and Requirements Identification report (E&E, 1998) and the Sewage Lagoons Closure Final Specifications (USACE, 2002) concurred that dewatering, consolidation, and compaction of the contaminated material, followed by placement of a protective cover, was an economical solution to close the lagoons permanently. Construction activities at SWMU 101 were completed from 2003 to 2004 and documented in the Construction Completion Report (TtEC, 2005), and is presented in Section 4.3.

4.2 Pre-Voluntary Corrective Action Site Characterization

In order to characterize the Sewage Lagoon sludge and native soil directly beneath the lagoons before completion of corrective action activities, the CMS included a field investigation designed to collect additional analytical and geotechnical data.

The CMS field investigation was conducted during April 3-7, 2000 in order to characterize the sludge and native soil for the future design phase of the corrective action and included the following steps:

- Mobilization of personnel and equipment
- Construction of access ramps into the lagoons and to each sample location using road base materials
- Collection of sludge and native soil samples at five locations in each lagoon with a hollow-stem auger rid
- Restoration of the site to a state comparable to pre-CMS field activities
- Demobilization of personnel and equipment

Sludge and soil sampling was performed in April 3-7, 2000 in order to characterize the sludge and native soil for the future design phase of the corrective action.

Native soil sampling was conducted with a hollow-stem auger drilling rig. Prior to sampling, ten locations were identified. Five of the locations were located in the north lagoon (SB01 through SB05), and five were located in the south lagoon (SB06 through SB10). Soil samples were collected from each borehole at depth intervals of 0 to 2 ft, 4 to 6 ft, and 8 to 10 ft. One sludge sample was also collected at each sample location and the sludge thicknesses observed in the boreholes ranged from 2 to 10.5 inches. Coordinates and elevations were established for each borehole location using a portable global positioning system unit. Soil and sludge samples were analyzed for RCRA metals, VOCs, pesticides, PCBs, nitrate and total organic carbon (TOC). In addition, sludge samples were analyzed for TCLP Pesticides and Metals.

Very low TCLP concentrations of pesticides and metals were detected in the sludge samples from both the north and south Sewage Lagoons. All of the sludge TCLP concentrations were below the RCRA regulatory limits specified in 40 CFR 261. The sludge was considered to be

nonhazardous and does not require offsite disposal. TCLP results for sludge samples indicated that there was no potential for leachate to exceed regulatory levels.

Low levels of pesticides were detected in the soil in both the north and south lagoons. Various metals were also detected in the soil at concentrations that tend to decrease with depth. The soil was considered nonhazardous and did not require offsite disposal.

Geotechnical results for the soil samples indicated that the soil consisted mostly of clay and some silt with gravel. Fate and transport modeling using the Seasonal Soil Compartment Model (SESOL) simulated contaminant migration through the vadose zone. The modeling showed that degradation to groundwater from sludge migration was unlikely under normal conditions, where infiltration of water into the vadose zone is minimal.

4.3 Voluntary Corrective Action Activities

The Construction Completion Report (TtEC 2005) documents the construction activities conducted for remedial action at SWMU 101. All field activities were performed according to USACE and Cannon AFB requirements and the approved Work Plan (FWEC, 2003). The USACE Albuquerque District personnel provided construction management oversight. Construction activities occurred in 2003 and 2004.

The primary purpose of the Voluntary Corrective Action was to remove sludge from the sewage lagoons in order to close the site.

The Sewage Lagoons cover system was designed to minimize potential threat to human health and the environment by removing the sludge and underlying contaminated soil from the former north lagoon, (North Lagoon Area), consolidating the excavated material into the former south lagoon (South Lagoon Area), grading and compacting the sludge and soil material to prepare the substrate, and constructing a 42-inch-thick engineered earthen cover system.

Construction activities included:

- Grading and drainage
- Demolition and removal of concrete and piping
- Excavation and handling of contaminated material from the North Lagoon Area
- In-place consolidation of excavated material, random fill, and grading in the South Lagoon Area
- Construction of a 20-acre, 42-inch-thick engineered earthen cover (soil barrier layer)
- Installation of the biota barrier and erosion/vegetation layers
- Site revegetation and fencing

4.3.1 Grading and Drainage

Temporary soil erosion control measures were constructed along the southern and southeastern borders of SWMU 101 in order to prevent storm water runoff from leaving the site. Also, temporary soil erosion and sediment control measures were installed at two drop-inlets and one culvert on the east side of the entire unit during construction and post-construction activities.

4.3.2 Demolition and Removal

Roads were constructed into the lagoons and tree limbs were trimmed to prepare the site for demolition activities. Demolition at the site involved removing concrete structures, slabs, steel and polyvinyl chloride piping, and associated components from the North Lagoon Area. These materials were then used as fill in the South Lagoon Area.

Materials from the exposed earthen berms in the North Lagoon Area and earthen berms surrounding the South Lagoon Area, approximately 20,000 cy, were used to construct the SBL of the cover system.

4.3.3 Excavation and Handling of Contaminated Material

According to the work plan (FWEC, 2003), approximately 70,000 cy of contaminated material was to be excavated from the North Lagoon Area and placed in the South Lagoon Area. However, the thickness of the sludge and the layers of underlying contaminated soil were less than anticipated, resulting in approximately 60,200 cy of contaminated material. The variance in depth was attributed to evaporation of the lagoons, beginning in 1999 through the initiation of construction. The sludge contained relatively little moisture and was consolidated without the need for dewatering.

During the excavation of the southern section of the North Lagoon Area, a subgrade "'trench" of sludge trending east-west was discovered below the established limits of the contaminated soil layer. This material, approximately 13,200 cy, was placed in the south Lagoon Area. The over-excavated area was backfilled with stockpiled material left over from former runway work at Cannon AFB. This stockpile is commonly referred to as the Keel material and was located adjacent and west of SWMU 101. TtEC conducted post excavation confirmation soil sampling. Hagar & Associates, P.C. Land Surveyors completed the post excavation topographical and sample location surveys. According to the sludge layer as-built survey, the total amount of fill materials placed in the South Lagoon Area, including concrete rubble, piping, sludge and soil, was 73,400 cy.

4.3.4 Sludge Consolidation and Random Fill

Approximately 60,200 cy of sludge and contaminated soil materials from the North Lagoon Area were excavated and consolidated with the South Lagoon Area material. The 13,200 cy of additional sludge material excavated from the North Lagoon Area was used as random fill in the South Lagoon area in place of the Keel material specified in the Final Work Plan. This resulted in a cost savings to the project. The consolidated material and random fill was graded from 1 to 3 percent and surveyed to document as-built conditions.

4.3.5 Soil Barrier Layer Construction

The SBL/ is approximately 43,500 cy of an 18- to 21-inch-thick earthen cover system composed of clean, approved soil placed on top of the sludge and random fill layer. The purpose of the SBL was to reduce infiltration of moisture into the underlying layer of contaminated material. Both onsite and offsite sources were used for the SBL and were tested in accordance with the project specifications.

4.3.6 Biota Barrier Construction

The biota barrier consisted of 15 to 18 inches of recycled, crushed concrete placed on top of the SBL. The purpose of the layer was to prevent animals from burrowing into the SBL. Several sources were used to provide the material required to construct the biota barrier. Approximately 8,000 cy of material came from the crushed concrete stockpile at SWMU 97, Landfill 25; an additional 8,000 cy consisted of extra, unused Keel material. The biota barrier layer was placed in two lifts because the grain size of the two sources did not meet the requirements of the barrier specification. The first lift consisted of the SWMU 97 and Keel material and the second lift consisted of another 16,000 cy of 3- to 6- inch crushed concrete from an offsite borrow source.

4.3.7 Erosion/Vegetation layer Construction

The 6-inch erosion/vegetation layer was completed in mid-December 2003. Approximately 12,800 cy of material was imported from a borrow area located 8 miles north of the Village of Melrose, New Mexico to construct this layer. The area was re-seeded and the topsoil was crimp-mulched which was part of erosion control measures.

4.3.8 Site Revegetation and Fence Construction

In April 2004, the site was revegetated by seeding with native species using an approved seed mix. Also, a five-strand barbed-wire fence was installed on the northern boundary of the capped area to separate the North and South Lagoon Areas and to prohibit access. This fence was tied in with the existing fencing.

4.3.9 Confirmation Samples

Confirmation sampling was performed at SWMU 101 in the North Lagoon Area after excavation activities were completed. Also, offsite borrow sources were sampled prior to delivery.

Seventeen (17) composite samples plus three (3) field duplicate samples were collected to a depth of 1 ft within the North Lagoon. The last composite sample was collected in the southern portion of the lagoon area that was over-excavated to remove contamination extending deeper than anticipated.

All samples were analyzed for the parameters presented as chemicals of potential concern (COPCs) and included pesticides, PCBs, nitrate, and selected metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver).

Based on the data, the conditions at the North Lagoon do not impose a risk to human health and the environment and were considered free of contamination due to previous activities at the site. Complete results can be found in Appendix A of the Construction Completion Report.

5.0 SITE CONCEPTUAL MODEL

This section presents a summary of the elements of the site conceptual model SWMU 101. Information presented in this section originally was presented in the following reports generated for the different phases of work completed for SWMU 101:

- William Matotan and Associates – 1985
- Woodward Clyde, Remedial Investigation – 1992
- E & E - 1998
- CMS Report, FWEC – 2001

5.1 Soils and Geology

The near-surface stratigraphic units of interest at Cannon AFB are the Late Miocene-Late Pliocene age Ogallala Formation and the Early Triassic Dockum Group.

The Dockum Group consists of three formations. The stratigraphically lowest unit is the Santa Rosa Sandstone. Overlying the Santa Rosa Sandstone are the Chinle and Redonda Formations. The Chinle and Redonda Formations are composed mainly of red shales with lesser interbedded sands and are known locally as "redbeds." The top of the Dockum Group is marked by an erosional unconformity having relief of up to several hundred feet (ft).

Overlying the Dockum Group redbeds is the Ogallala Formation, which extends from eastern New Mexico and Colorado into Texas, Oklahoma, Kansas, Nebraska, and South Dakota. Drillers' logs from Cannon AFB indicate that the Ogallala Formation varies from 360 to 415 ft in thickness. The incised upper surface of Triassic redbeds strongly influences the Ogallala thickness. Stream valleys in the post-Triassic unconformity are deep and trend dominantly east-west. Ogallala thickness may, thus, vary significantly over short north-south distances.

The Ogallala is erosionally truncated to the south along the abandoned Portales Valley, to the west along the Pecos River Valley, and to the north in a series of ephemeral stream valleys. The Ogallala Formation extends more than 125 miles to the east before terminating as an escarpment in Briscoe County, Texas. Springs and seeps are common along the erosional margins of the Ogallala.

The Ogallala dips gently and monoclinally to the southeast in the vicinity of Cannon AFB. As reported in Lee Wan and Associates (1990), data suggest that some Quaternary warping may have occurred; however, most of the structures are well to the northwest and southwest of Cannon AFB. No faults or buried structural lineaments are known to exist in the vicinity of Cannon AFB.

The Ogallala Formation is composed of unconsolidated, poorly sorted gravel, sand, silt, and clay. The base of the Ogallala is generally marked by a gravel, cobble, and boulder deposit. This basal member contains sediment derived from igneous and sedimentary rock transported from the mountains to the west. The Ogallala Formation was laid down by stream and overbank deposits formed within coalescing alluvial fans. These fans form a broad pediment along the eastern flank of the Rocky Mountains. As is typical of alluvial deposits, Ogallala internal stratigraphy varies vertically and horizontally over short distances.

Except where strongly cemented by calcium carbonate (caliche), the sediment of the Ogallala is loose and friable. Authigenic and allogenic clays are found as a trace to abundant matrix mineral (Lee Wan and Associates, 1990). As reported by Lee Wan and Associates (1990), five zones have been distinguished within the Ogallala of east-central New Mexico on the basis of clay minerals. Smectites (montmorillonites) and attapulgite (with sepeotite) are the dominant clays throughout the Ogallala. Illite is a lesser but persistent clay, as is kaolinite. Smectite is a swelling clay, causing deep cracks to form in dry surface soil. Smectite in particular and, to a lesser extent, attapulgite and illite are clays with moderate to high cation exchange capacities (CEC). The formation as a whole should, therefore, have a relatively high CEC, which should inhibit the migration of charged contaminants, especially ionic forms of metals.

Caliche is a major feature of the Ogallala Formation, occurring as nearly continuous to discontinuous layers throughout. Caliche is hard, white to pale tan on fresh surfaces, weathering to gray, and has a chalky appearance. Caliche forms as calcium carbonate leached from overlying sediment, and precipitates in the pore space of the host sediment. Precipitation is caused by the evaporation of downward percolating water. The caliche may, thus, mark the position of ancient vadose zones. Lee Wan and Associates (1990) give radiocarbon dates for the upper climax caliche range from approximately 27,000 years before present (BP) to approximately 42,000 years BP.

Caliche is relatively soluble in acidic water (pH less then 7) or in water containing dissolved carbon dioxide. The top surface of the upper climax caliche in fresh outcrop shows solution etching.

5.2 Groundwater

The lower portion of the Ogallala Formation is the primary regional aquifer for both potable and irrigation water. No deeper aquifers are used in the vicinity of Cannon AFB. The Ogallala aquifer is part of the High Plains Aquifer, which extends continuously from Wyoming and South Dakota into New Mexico and Texas. In east-central New Mexico, the Ogallala aquifer rests on Dockum Group redbeds, which serve as the basal confining layer. The Ogallala is a water table, or unconfined aquifer. The Ogallala aquifer has a southeasterly regional gradient of about 10 to 15 ft per mile (mi) (Woodward-Clyde, 1992). Well yields vary from less than 1 gallon per minute (gpm) in thin silt and sand, and up to 1,600 gpm in thick sand and gravel (Lee Wan and Associates, 1990). Water quality is generally good with dissolved solids ranging from 250 to 500 mg/L (Gutentag et. al., 1984) and fluoride ranging from 2.2 to 2.7 mg/L (William Matotan and Associates, Inc., 1985).

Based on the mid-1960's data, the Ogallala aquifer at Cannon AFB has an average saturated thickness of 120 ft. The local groundwater gradient is southeasterly at 7 to 15 ft per mi (USAF, 1990). Cannon AFB water well tests have yields ranging from 205 gpm to 1,150 gpm. Specific capacities range from 11.4 gallons per ft (gpf) to 27.9 gpf (Lee Wan and Associates, 1990).

Estimates of hydraulic conductivity were made from well pump tests conducted by Cannon AFB using the Theis equation. 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, and should, therefore, be considered as estimates only.

Hydraulic conductivity values ranged from approximately 2.0×10^{-3} centimeters per second (cm/sec) to 2.0×10^{-2} cm/sec. These estimates appear to be low when compared to published

hydraulic conductivity data for sand and gravel (Freeze and Cherry, 1979). As reported in Kearney (1987), a groundwater flow velocity of about 150 ft per year has been estimated. Based on this calculation, the hydraulic conductivity is approximately 1.0×10^{-1} cm/sec.

Recharge to the Ogallala is primarily through precipitation. Kearney (1987) indicated that the recharge rate may be as much as 1.0 in per year. Because of the 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 water 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 ft has been observed in the area around Clovis, New Mexico.

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

5.3 Surface Water

Stream valleys in Curry County tend to be fairly broad and widely spaced. Streams are ephemeral and drainages are poorly developed. No permanent streams exist on or near Cannon AFB (Harza 1997).

Historically, runoff at Cannon AFB has drained into four natural ephemeral playas. The two northern playas were converted into plastic-lined golf course ponds. The southern playa is still intact; however, the surrounding drainage patterns have been altered. The eastern playa, known as the North Playa Lake, was bermed on the north, west, and south sides with topsoil and concrete debris. Drainage ditches at Cannon AFB are concentrated around the developed/landscaped areas of the Base and carry runoff to the playa lakes and golf course ponds. The playa lakes have no surface outlet, and any water they collect is eventually lost to evaporation or infiltration, or is used by plants and animals.

5.4 Nature and Extent of Contamination

Investigations began at the Sewage Lagoons in 1984 when four groundwater monitoring wells were installed (Motaton and Associates, 1985) The Sewage Lagoons were designated a SWMU in 1989, and since that time, many field investigations have been conducted in order to determine the nature and extent of contamination at this SWMU. In 1991, a RI was conducted by Woodward Clyde.

Sludge samples reported acetone, 2-butanone, and bis(2-ethylhexyl)phthalate. However, it is possible that the detections of these compounds are attributable to laboratory contamination since they were detected in many of the method blanks. Metals results of the sludge showed that barium, chromium, copper, selenium, silver, vanadium, and zinc all exceeded the site

background levels for soil. The pesticides 4,4'-DDD, 4,4'-DDE, chlordane, and PCB-1260 were detected in the sludge samples from both the north and south lagoons. However, these pesticides and PCB were uniformly detected at low concentrations throughout the lagoons and are most likely the result of an accumulation of materials from various base activities transferred to the lagoons through the sanitary sewer. Sludge samples were analyzed for TCLP parameters and none of the results exceeded the TCLP criteria.

Groundwater samples collected from the four existing wells reported metals above the reporting limits. Barium and vanadium were found in all four groundwater samples, but concentrations were less than MCLs.

Surface water samples were taken from the south lagoon, north lagoon, and wastewater flow splitting pool. The metals detected included barium, lead, copper, zinc, mercury, silver and vanadium.

In January 1997, E & E collected additional sludge samples to support the preliminary evaluation of corrective action alternatives. Three sludge samples were collected and analyzed for total nitrogen, total solids, volatile solids, metals, and pathogens. One sample each was collected from the north lagoon, the south lagoon, and the discharge point at the south lagoon that leads to the playa lake. Results indicate that the sludge samples did not exceed RCRA limits for hazardous constituents. E & E concluded that additional sludge samples were required to adequately characterize the sludge during the corrective action process of the Sewage Lagoons.

5.5 Contaminant Fate and Transport

Fate and transport modeling simulated contaminant migration through the vadose zone. The fate and transport of contaminants of concern (COCs) that exceeded appropriate screening criteria were modeled based on current, normal site conditions. The COCs modeled were heptachlor, gamma-BHC (lindane), nitrate, and total xylenes. Additional simulations were performed with excessive precipitation to evaluate the transport effects of the COCs with increased infiltration.

The Seasonal Soil Compartment Model (SESOIL) was used for the fate and transport modeling (General Sciences Corporation, 1998). The SESOIL model has been used by many local, state, and federal agencies at several sites across the country to evaluate the effectiveness of waste-contaminant cover systems.

SESOIL is a one-dimensional vertical transport model designed to simultaneously simulate water transport, sediment transport, and contaminant fate for the unsaturated zone. Input data include soil physical parameters, contaminant chemical parameters, and meteorological information. The specific input parameters are presented in Appendix D of the Revised Final CMS Report (FWEC, 2001).

The processes modeled by SESOIL are categorized into three cycles: hydrology, sediment washload, and pollutant transport; each cycle is a separate sub-model within the SESOIL code. SESOIL is a compartmental model that allows the user flexibility to divide the unsaturated zone into separate layers (if appropriate) and model contaminant release and migration within each layer down to the water table. The result is a calculated leachate concentration that will be introduced to groundwater. The model simulates leaching to groundwater and subsequent mixing that ultimately provides a groundwater concentration as a calculated result.

The simulations performed for the CMS applied conservative assumptions for the fate and transport modeling. The greatest concentrations of soil/sludge samples from field-testing were used to calculate loading rates for the COCs. The contaminant sources were modeled as instantaneous releases from the top 10 ft of the model. Groundwater was modeled as 290 ft below ground surface. The first simulation of each COC used climatic data specific for Clovis, New Mexico. Additional simulations were performed within one 24-hour, 100-year storm per year, and six 24-hour, 100-year storms per year, beyond normal precipitation events.

Results of the 50-year simulations for the current, normal conditions at Cannon predicted vertical contaminant migrations of 0.02 ft, 0.04 ft, 225.85 ft, and 53.02 ft for heptachlor, gamma-BHC (lindane), nitrate, and total xylenes, respectively. None of the COCs reached groundwater in the 50-year simulation under normal, current conditions. An extended duration simulation predicted nitrate reaching the groundwater after 65 years under current, normal conditions. The increased infiltration from the addition of one 24-hour, 100-year storm per year had a negligible effect on transport of the heptachlor and gamma-BHC (lindane). Nitrate and total xylenes showed vertical depth increases of approximately 12 to 13 percent. The precipitation equivalent of six 24-hour, 100-year storms per year were required to increase infiltration to the extent that nitrate reached groundwater within 45 years. Once nitrate reached groundwater, the model predicted concentrations above the EPA MCL.

Additional modeling was performed to observe the effects of standing water within the sewage lagoons. The unsaturated flow model VS2DTI was used to determine the infiltration rate of water from the sewage lagoons for a thirty-five year period. Based on predicted soil types and initial soil moisture contents, infiltrating water from the lagoons reached groundwater at 290 ft after approximately 2.7 years, yielding an infiltration rate of 107.4 ft per year.

A calibration was performed on the SESOIL model to imitate the predicted infiltration rate by increasing monthly precipitation. The contaminant surface loading rate for the model was manipulated to match observed groundwater concentrations of approximately 12 mg/L nitrate. Different simulations were performed using average contaminant concentrations from field data and calibrated surface loading to achieve measured groundwater concentrations. The results from the modeling indicated that extreme precipitation events were necessary to match the effects on infiltration of the standing surface water. Also, nitrate concentrations much greater than those measured in the field were necessary to achieve a groundwater concentration equivalent to that measured in the field.

The modeling illustrated that degradation to groundwater from sludge COCs migration is unlikely under current, normal conditions where infiltration of water into the vadose zone is minimal. In summary, the model predicted that under conservative conditions where extreme precipitation occurred or standing water is allowed to accumulate in the open lagoons, the only COC that would reach groundwater is nitrate. An extended discussion of the modeling effort, including output, is presented in Appendix D, Revised Final CMS (FWEC, 2001).

5.6 Human Health Risk Evaluation

As part of the CMS, a HHRA was performed. The HHRA was conducted in accordance with the New Mexico Environment Department (NMED) Position Paper, *Assessing Human Health Risks Posed by Chemicals: Screening-level Risk Assessment* (NMED 2000a), EPA's *Region 6 Human Health Medium-Specific Screening Levels* (EPA 1999), and standard EPA guidance, including *Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation*

Manual (Part A) (EPA 1989) *and Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors* (EPA 1991). The entire HHRA and calculations are found in Appendix C, Revised Final CMS (FWEC, 2001).

5.6.1 Data Usability

The risk assessment was based on data that were collected in April 2000 in support of the CMS. SWMU 101 was divided into four media of concern for evaluation in the HHRA: north lagoon sludge, north lagoon soil, south lagoon sludge, and south lagoon soil. Each lagoon was evaluated separately; soil and sludge from the lagoons were also evaluated separately. The HHRA conservatively considered soil data from the 0 to10 ft interval and all the sludge data collected.

5.6.2 Selection of Chemicals of Potential Concern

Detected chemicals in soils and sludge were screened against site-specific background levels and EPA Region 6 residential human health screening levels (HHSLs).

For background comparisons, the maximum detected value in the site investigative data was compared to the maximum detected value in the site-specific background data presented in *Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico* (Cannon, 1997). In accordance with EPA guidance (1989), those chemicals present on site at naturally occurring levels were eliminated from the quantitative risk assessment. The maximum detected concentrations of inorganics and 4,4'-DDT detected in sludge samples were compared to maximum concentrations detected in surface background soil samples collected from 0 to 1 ft bgs. The maximum detected concentrations of inorganics and 4,4'-DDT in soil samples collected from each lagoon from the 0 to 10 ft below the sludge-native soil interface were compared to maximum detected background soil samples collected from 0 to 40 ft bgs. Barium in north lagoon sludge and selenium in south lagoon soil were both detected below background concentrations and eliminated from further evaluation in the HHRA. No inorganics in the north lagoon soil or south lagoon sludge were detected below background concentrations.

A comparison with EPA Region 6 HHSLs for soil (EPA, 1999) was made as a conservative approach for selecting COPCs and is considered a conservative estimate of potential risk at SWMU 101. The residential HHSLs used in the screening incorporate oral, inhalation, and dermal exposure pathways. Based on NMED guidance (2000a), carcinogenic and non-carcinogenic compounds were compared to HHSLs differently. NMED requires if two or more non-carcinogenic chemicals are present at a site, each chemical must be compared to one-tenth of their respective HHSL to address the potential that two or more non-carcinogenic COPCs may affect the same target organs or systems. Once this initial COPC screening was performed, the critical effects and target organs of the non-carcinogenic compounds that exceeded the adjusted HHSLs were compared separately for soil and sludge in each lagoon and screened against readjusted HHSLs. The HHSLs were readjusted based on the number of chemicals with the same critical effects and/or target organs. The residential HHSL was divided by the number of chemicals with the same critical effects and maximum detected concentrations of the chemicals were all screened against the newly adjusted value.

Chemicals with maximum detections below the unadjusted and adjusted residential HHSLs were eliminated from the quantitative risk assessment. Arsenic was the only chemical detected above the HHSLs in both north and south lagoon soil; all other chemicals detected in soil were

eliminated from further evaluation in the HHRA. Polychlorinated biphenyl (PCB)-1260, dieldrin, heptachlor epoxide, and arsenic in north lagoon sludge were all detected above their respective HHSLs; all other chemicals detected in the north lagoon sludge were detected at concentrations below the HHSLs and were eliminated from further evaluation in the HHRA. Only dieldrin and arsenic were detected above their HHSLs in the south lagoon sludge; all other chemicals detected in south lagoon sludge were eliminated from further evaluation in the HHRA.

Based on the results of screening against background levels and the HHSLs, four COPCs were identified for further evaluation in the HHRA: arsenic, dieldrin, PCB-1260, and heptachlor epoxide. Arsenic is the only COPC found in both north and south lagoon soil. Arsenic and dieldrin are COPCs in sludge in both north and south lagoon; PCB-1260 and heptachlor epoxide are COPCs only in the north lagoon sludge.

5.6.3 Human Health Risk Assessment Results

The Management Action Plan for Cannon AFB indicated that the current land use at SWMU 101 is industrial and is expected to remain industrial in the future. Based on land use information, under both current and future conditions, industrial workers are the only potential receptors who have direct access to SWMU 101 and any related contamination. The pathways that represent potentially complete exposure routes for industrial workers include the following: ingestion and dermal contact with soils during work activities and inhalation of contaminated soil and soil particulates during wind or soil disturbance activities. The HHRA did not evaluate industrial worker exposure to chemicals detected in groundwater below the north and south lagoons because a complete exposure pathway does not exist.

For the industrial worker, the excess lifetime cancer risk (ELCR) or hazard quotient (HQ) value for each analyte and exposure pathway was summed to produce total cancer risk and hazard index (HI). As shown in Table 5-1, risks from COPCs in soil and sludge in the north and south lagoon were below the target HQ of 1.0 (NMED, 2000a). NMED has also established a target total ELCR of $1x10^{-5}$ for the sum of all carcinogens at a site or if only one carcinogen is present (NMED, 2000a). If multiple carcinogens are present the target ELCR for each carcinogen is $1x10^{-6}$ (NMED, 2000a). Arsenic was the only COPC that exceeded the target ELCR of $1x10^{-6}$ for a single chemical in sludge and soil in the north and south lagoons. Based on the results of the risk calculations, there is negligible risk to industrial workers from exposure to sludge and soil at SWMU 101.

5.7 Screening-Level Ecological Risk Assessment

As part of the CMS, a SLERA was performed. The procedures used were consistent with those presented in *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (NMED 2000b), *Risk Assessment Handbook Volume II: Environmental Evaluation* (U.S. Army Corps of Engineers [USACE] 1996), *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1996), and *Guidelines for Ecological Risk Assessment* (EPA 1998). Chemical contamination that is determined to potentially cause ecological risk may require additional evaluation in a more detailed quantitative assessment. The entire Ecological Risk Assessment and calculations are found in Appendix C, Revised Final CMS (FWEC, 2001).

On April 6-7, 2000, a site survey of SWMU 101 was conducted to gather site-specific information to identify relevant and complete contaminant-pathway-receptor relationships.

5.7.1 Data Usability

The SLERA assessment was based on data that were collected in April 2000 in support of the CMS. SWMU 101 was divided into four media of concern for evaluation in the evaluation in the SLERA: north lagoon sludge, north lagoon soil, south lagoon sludge, south lagoon soil. Each lagoon was evaluated separately; soil and sludge from the lagoons were also evaluated separately. The SLERA considered soil data from the 0 to 6 ft interval and all the sludge data collected (0 to 1ft).

5.7.2 Screening-Level Risk Assessment Results

The pathways that represent potentially complete exposure routes for ecological receptors included the following: ingestion of soil and sludge, and ingestion of terrestrial invertebrates, plants, or vertebrate prey. Exposure to groundwater was not evaluated because groundwater does not discharge naturally through seeps and springs in the area; therefore a complete exposure pathway does not exist. The assessment endpoints indentified for the SLERA included decomposer/detritivore, habitat for wildlife, major food source for consumer species, seed disperser, and regulator of prey species. Measurement receptors for guilds were chosen for the following class-specific guilds: herbivorous mammal, herbivorous bird, omnivorous mammal, and carnivorous bird. Measurement receptors for guilds evaluated in the SLERA include deer mouse, mourning dove, least shrew, and red-tailed hawk.

The risk characterization for measurement receptors from potential exposure to chemicals of potential ecological concern (COPECs) in north lagoon sludge, south lagoon soil, and south lagoon sludge found that pesticides produced elevated ecological screening quotients (ESQs) for the deer mouse and least shrew. Results of the risk characterization are summarized in Table 5-2. Concentrations of VOCs did not produce elevated ESQs for any of the measurement receptors at the areas of concern. Concentrations of PCBs produced elevated ESQs for the deer mouse and least shrew in north lagoon sludge. This is the only area of concern in which PCBs were detected. Concentrations of inorganics produced ESQs for all measurement receptors in all four areas of concern. ESQs ranged from 1.1 for terrestrial invertebrates due to lead exposure to 5,300 for plants due to silver exposure. Many of the ESQs may be overestimated due to the presence of naturally high concentrations of inorganics, with most of the site inorganic concentrations only slightly higher than background; therefore risks to potential ecological receptors may exist even at background concentrations.

The SLERA was designed to evaluate potential risk to representative receptors from multiple trophic levels present at the site as well as wildlife temporarily visiting the site. The risk characterization indicated that there might be risk for multiple tropic-level species from COPECs (metals) present in all four areas of concern.

5.8 Post-Voluntary Correction Action Conditions and Associated Risk

A CMS for closure of SWMU 101 identified and evaluated potential corrective actions (FWEC, 2001). Human health and ecological risk assessments as described in the previous sections were conducted as part of the CMS to determine the requirements for contaminant containment and source control. Although no risk to human health was identified from exposure to surface or subsurface soil or sludge at the site, concentrations of inorganic chemicals produced elevated ESQs for potential ecological receptors.

At Cannon AFB the depth of groundwater is approximately 300 ft bgs, not currently used by industrial workers as a potable water source, nor does it discharge naturally through springs or seeps in the area. The groundwater exposure pathway was therefore considered to be incomplete for industrial workers and ecological receptors and was not evaluated in the risk assessments. As part of the CMS however, fate and transport modeling was performed to support the risk assessment and the evaluation of corrective action alternatives to simulate contaminant migration through the vadose zone. The fate and transport of COCs that exceeded risk-based screening criteria were modeled based on the current, normal site conditions. The simulations performed for the CMS applied conservative assumptions for the fate and transport modeling. Results of the 50-year simulations for the current, normal conditions at Cannon predicted vertical pollution migration does not reach groundwater. The modeling illustrated that degradation to groundwater, due to COCs in sludge, was unlikely under current, normal conditions. As a result of the 1992 RI program, recommendations were made for annual groundwater sampling of the four monitoring wells at SWMU 101. The groundwater was sampled yearly from 1998 through 2001 and analyzed for VOCs, metals, nitrate, sulfate and TDS. Iron was the only analyte detected above EPA's SMCL (0.30 mg/L), which indicate contaminants have not impacted the groundwater due to previous operations at the site.

Based on the SLERA, sludge removal from the former north lagoon, in-place consolidation in the former south lagoon, and closure using an engineered cover with a biotic barrier was selected as the corrective action for closing the lagoons. This alternative was considered a conservative design for closure of the lagoons and would prevent ecological receptors, including burrowing organisms, from coming in contact with the sludge. The evaluation and selection of the proposed corrective action alternatives was based on the ability to meet the following criteria: CAOs, conceptual design criteria; long-term reliability and effectiveness; reduction of waste toxicity, mobility, or volume; short-term effectiveness; implementability; safety; and cost.

The Phase III Sludge Management, Compliance Evaluation, and Requirements Identification report (E&E, 1998) and the Sewage Lagoons Closure Final Specifications (USACE, 2002) concurred that dewatering, consolidation, and compaction of the contaminated material, followed by placement of a protective cover, was an economical solution to close the lagoons permanently. The construction activities were documented in a Construction Completion Report (TtEC, 2005); excavation of sludge and soil, in-place consolidation of the material, and construction of an engineered cover were considered a voluntary corrective measure. The cover design assumed that the contaminated media at the site consisted of approximately 2 ft of sludge overlying a 1-ft-thick layer of soil.

5.9 Risk Characterization

Based on an industrial exposure scenario as demonstrated in Section 5.6, there is no risk due to exposure to chemicals in sludge and soils at SWMU 101. With the voluntary corrective measure in place, sludge and affected soil in the south lagoon are covered with debris, topsoil, and vegetation. The covering eliminates exposure to the COPCs; therefore, there is no risk to the industrial worker at the south lagoon. Because all of the sludge and affected soil was removed from the north lagoon, there is also no risk to an industrial worker working at the north lagoon.

Based on the SLERA, the risk characterization indicated that there might be risk for multiple tropic-level species from COPECs (metals) present in all four areas of concern. Because the voluntary corrective measure required all of the affected soil and sludge in the north lagoon to be

consolidated in the south lagoon, risk to ecological receptors in the north lagoon is also eliminated. In the south lagoon, sludge and affected soil were covered with a biotic barrier; which prevents ecological receptors, including burrowing organisms, from coming in contact with the sludge thus also eliminating potential risk.

There is also no potential risk to receptors from groundwater at SWMU 101. Groundwater beneath SWMU 101 is not used by industrial workers, nor does it discharge naturally through seeps or springs in the area to affect ecological receptors. Groundwater monitoring at the SWMU area indicated metals were the only analytes detected and results showed all concentrations were below respective MCLs. Fate and transport modeling was performed in the CMS to support the risk assessment and the evaluation of corrective action alternatives to simulate contaminant migration through the vadose zone. The fate and transport of COCs that exceeded risk-based screening criteria were modeled based on the current, normal site conditions. Results of the 50-year simulations for the current, normal conditions at Cannon predicted vertical pollution migration does not reach groundwater. The modeling illustrated that degradation to groundwater, due to COCs in sludge, was unlikely under current, normal conditions.

6.0 CONCLUSIONS AND RECOMMENDATIONS

A summary of the VCA field activities and previous investigations is presented below to support the recommendation for the future of the Sewage Lagoons, SWMU 101.

- In 1985, a hydrogeologic investigation was conducted and four monitoring wells were installed, prior to the Sewage Lagoons being designated as a SWMU. One well was installed upgradient, and three wells were installed downgradient. The wells were sampled quarterly for only field parameters of pH, temperature and conductivity.
- Results of the 1991 RI indicated that sludge samples from the lagoon areas contained low levels of pesticides and PCBs, but they were most likely as a result of base activities that transferred these contaminants from the lagoons through the sanitary sewer.
- The 1991 RI recommended to continue annual groundwater monitoring of the four wells for volatile organics, metals, pesticides, nitrate, sulfate and TDS. This recommendation was made to support site closure.
- Annual groundwater samples were taken from 1998 to 2001 from wells Well E, Well F, Well G, and Well H at SWMU 101. The groundwater was sampled and analyzed yearly by the USGS and analyzed by USACE's Southwestern Division Laboratory, located in Dallas, Texas. Iron was the only analyte detected above USEPA's SMCL of 0.30 mg/L.
- The results of the 1997 Supplemental Sludge Sampling effort showed that levels of analytes did not exceed RCRA limits for hazardous constituents. Additional sludge samples were recommended to adequately characterize the sludge prior to any corrective action.
- In 2000, a CMS was performed which included sludge and native soil sampling. Sludge results were less than TCLP levels; therefore, it was considered non-hazardous, and it was determined that it would not require off-site disposal during removal.
- In 2000, the CMS reported that concentrations of pesticides decreased with depth. None of the soil was determined to be hazardous and it was determined that it would not require off-site disposal during removal.
- The CMS evaluated three alternatives; no action, sludge dewatering in-place, consolidation, compaction, and cover; and in-site bioremediation through composting. The recommended corrective action was sludge dewatering in-place, consolidation, compaction and cover. The alternative met the CAOs, conformed to the conceptual design criteria, and provided the additional benefit of restoring the north lagoon for stormwater management.
- Fate and transport modeling was performed during the CMS to support the risk assessment and the evaluation of the corrective alternatives. Results of the 50-year simulations predicted that vertical pollution migration does not reach groundwater.
- Risk characterization was evaluated during the CMS and showed negligible risk to industrial workers due to exposure to chemicals in the sludge or soil, but indicated there may be risk to ecological receptors that reside or visit the site.

- A VCA was performed during 2003-2004. Soils and sludge were removed from the former north lagoon and consolidated into the former south lagoon. The material was graded, compacted, and covered with a 20-acre, 42" thick soil barrier layer.
- Confirmation samples taken after excavation activities showed no contamination and no potential for leaching to groundwater.

The results of previous investigations, risk evaluations, and completion of the VCA at the Sewage Lagoons, SWMU 101, support a recommendation of NFA for this SWMU in accordance with NMED NFA Criterion #5:

> The site was characterized/remediated in accordance with applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use.

7.0 REFERENCES

Cannon AFB.
1997. *NaturallyOccurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico.* Final Report. September.

E & E. (Ecology and Environment, Inc)
1998. Phase III Sludge Management Compliance Evaluation and Requirements Identification.

Environmental Protection Agency (EPA).
1989. Risk Assessment Guidance for Superfund, Volume 1: *Human Health Evaluation Manual (Part A) Interim Final.* EPA/540/1-89/002. Office of Research and Development. Office of Emergency and Remedial Response. December.

EPA.
1991. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors.* March 25. OSWER Directive 9285.6-03.

EPA.
1996. *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments.* Environmental Response Team, Edison, NJ.

EPA.
1998. *Guidelines for Ecological Risk Assessment.* Risk Assessment Forum, Washington, DC. EPA/630/R-95/002F. April

EPA.
1999. Region 6. Human Health Medium Specific Screening Levels. June.

Foster Wheeler Environmental Corporation.
2001. Revised Final Corrective Measures Study Report for SWMU 101 – Sewage Lagoons.

Foster Wheeler Environmental Corporation.
2003. Work Plan for the Closure of SWMU 101, Sewage Lagoons.

Freeze R.A. and J.A. Cherry.
1979. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

GSC, General Sciences Corporation.
1998. SESOIL Reference Guide and User's Guide. Version 3.0.

Gutentag, Edwin D., et al.

1984. Geohydrology of the High Plains Aquifer in Part of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas and Wyoming. USGS Professional Paper 1400-B.

Harza (Harza Environmental Services)
1997 Phase II RCRA Facility Investigation Report (Draft). Cannon AFB, New Mexico. August.

Kearney, A.T.
1987. Preliminary Review/VSI Report, RCRA Facility Assessment, CAFB, New Mexico. Radian Corporation, Final Report for Period 9/84 – 4/85, Vol. 1 and Appendices ABM.

Lee Wan and Associates.
1990. RCRA Facility Investigation Work Plan, CAFB, New Mexico. Prepared for 27 CSG/DEC CAFB, New Mexico. Vols. I and II.

Matotan, William and Associates, Inc.
1985. Waste Well Master Plan Survey. Prepared for the Department of the Air Force, Cannon Air Force Base, New Mexico.

New Mexico Environment Department Hazardous and Radioactive Materials Bureau (NMED)
2000a. Position Paper: *Assessing Human Health Risks Posed by Chemicals: Screening-level Risk Assessment.* March.

NMED.
2000b. *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment.* Final. Hazardous and Radioactive Materials Bureau. March.

Tetra Tech EC.
2005. Construction Completion Report for the Remedial Action at SWMU 101, Sewage Lagoons, Cannon AFB. March.

U.S. Army Corps of Engineers (USACE).
1996. *Risk Assessment Handbook Volume II: Environmental Evaluation.*

USAF, (U.S. Air Force)
1990. Final Environmental Impact Statement. Realignment of CAFB, Curry County, New Mexico

Woodward-Clyde Consultants
1992. Remedial Investigation Report for 18 Solid Waste Management Units. Cannon Air Force Base.

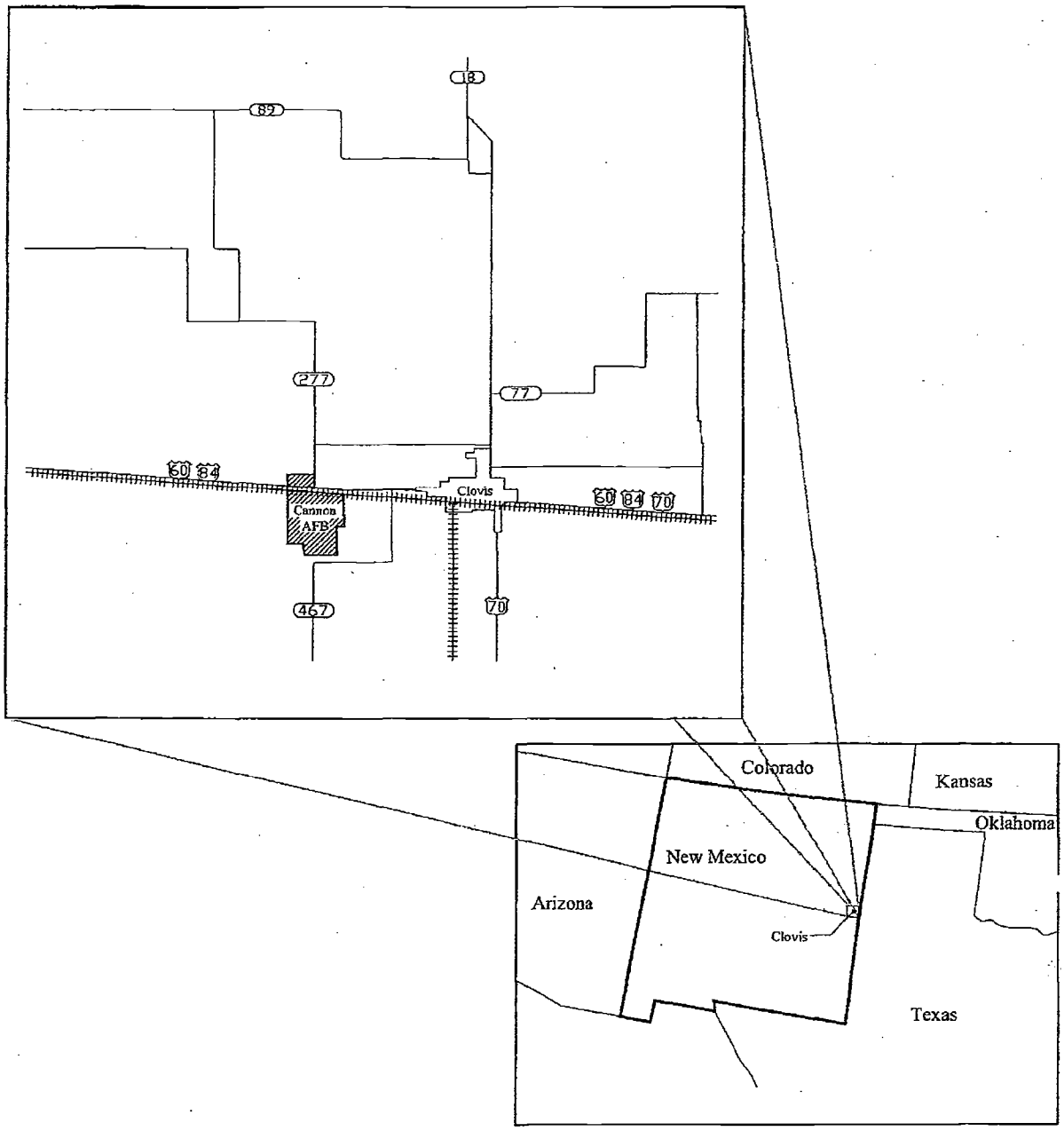
FIGURES

Figure 1-1 Location of Cannon AFB

Figure 1-2 Location of SWMU 101, Sewage Lagoons

FIGURE 1-1

Location of Cannon AFB



0 1000 2000

Not Drawn to Scale

N

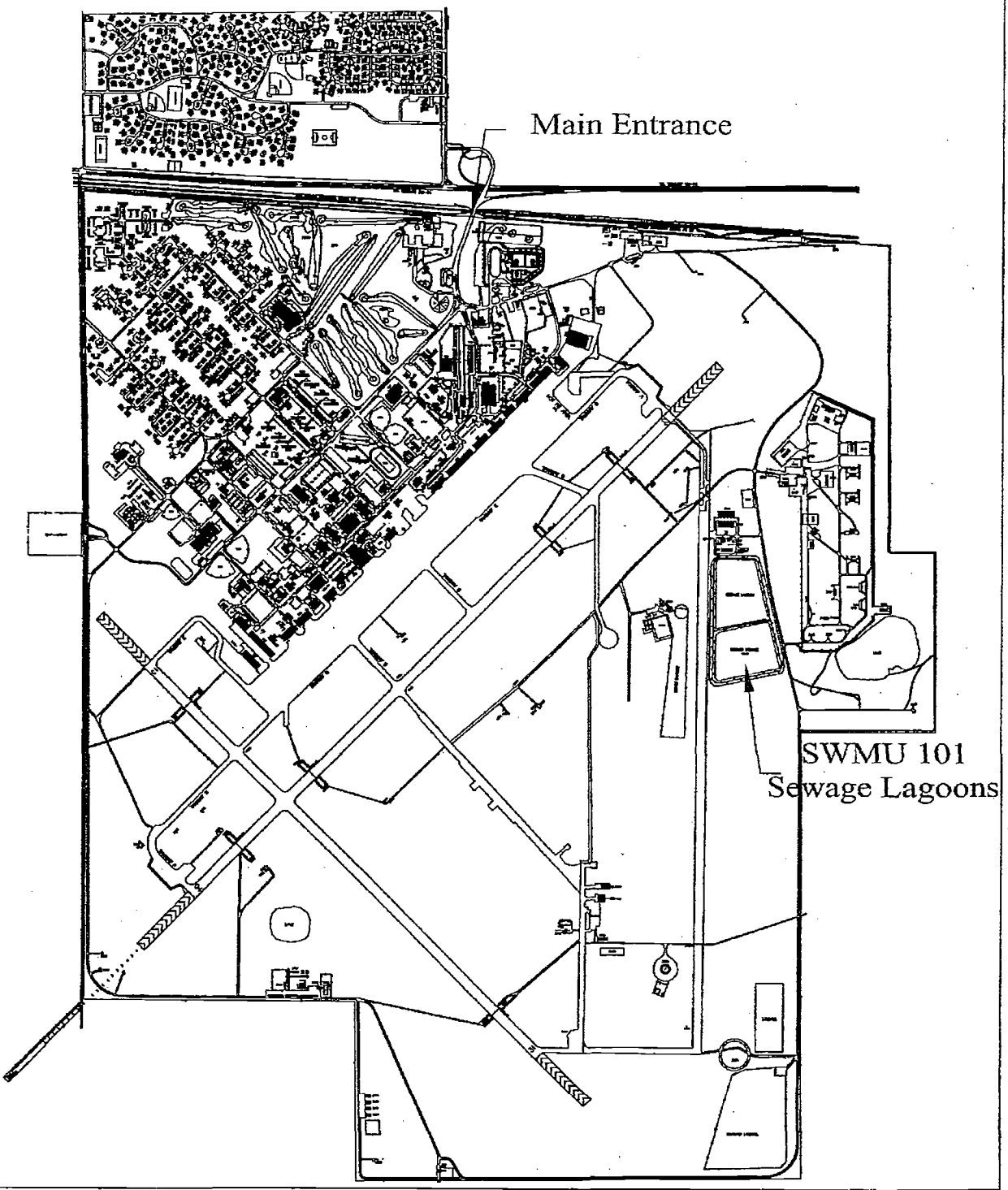
Closure of
SWMU 101 – Sewage Lagoon
Cannon Air Force Base, New Mexico
U.S. Army Corps of Engineers, Omaha District

Base Location Map

Figure 1-1

FIGURE 1-2

Location of SWMU 101, Sewage Lagoons



1000 500 2000 3000
SCALE IN FEET

N

Closure of
SWMU 101 – Sewage Lagoons
Cannon Air Force Base, New Mexico
U.S. Army Corps of Engineers, Omaha District

Sewage Lagoons Site
Location Map

Figure 1-2

TABLES

Table 3-1 Previous Investigation Sampling Programs at SWMU 101

Table 3-2 Groundwater Monitoring Results, Well E, Upgradient Well

Table 3-3 Groundwater Monitoring Results, Well F, Downgradient Well

Table 3-4 Groundwater Monitoring Results, Well G, Downgradient Well

Table 3-5 Groundwater Monitoring Results, Well H, Downgradient Well

Table 5-1 Summary of Risks and Hazards to Potential Human Receptors at the Sewage Lagoons (SWMU 101)

Table 5-2 Summary of Risk to Ecological Receptors at SWMU 101

Table 3-1 Previous Investigation Sampling Programs at SWMU 101

Year/Investigation	Number of Locations/Samples	VOCs	SVOCs	TCLP - Organics & Inorganics	Metals	Pesticides/ PCBs	General Chemistry	Field Parameters
1985, Hydrogeologic Investigation[1]	4 wells							pH, Temp, Conductivity
1988, Supplemental Sludge Sampling[2]	3 sludge				x		Total nitrogen, total solids, volatile solids, pathogens	
1991, Remedial Investigation[3]	8 sludge			x				
	3 surface water	x	x		x	x		
	4 groundwater	x	x		x	x		
1998 to 2001, Groundwater Sampling	4 wells	x			x		nitrate+nitrite, nitrate, sulfate, TDS	
2000, Corrective Measures Study[4]	10 sludge							
	10 locations, 30 soil samples							
2005, Final Construction Completion Report[5]	confirmation samples, borrow source samples				x	x	nitrate	

Notes:
[1] Matotan and Associations, 1985
[2] E &E, 1988
[3] Woodward-Clyde, 1991
[4] FWEC 2000
[5] TtEC, 2005

Table 3-2 Cannon AFB, Sewage Lagoons, SWMU 101

Groundwater Monitoring Results 1998 through 2001

Well E, Upgradient Well

Table 3-2
Cannon AFB, Sewage Lagoons, SWMU 101
Groundwater Monitoring Results, 1998 to 2001
Well E, Upgradient Well

Location:	Well E			Well E			Well E			Well E			Well E		
Sample I.D.:	E/CAFB-E-0498-1			E/CAFB-E			CAFB-E-1			E/CAFB-E			E/CAFB-E		
Collection Date:	4/7/1998			3/2/1999			8/31/1999			3/15/2000			3/22/2001		
	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.
Appendix IX Volatile Organics (ug/L)															
Methylene Chloride	1	2.7		1	ND		1	0.28	JB	1	ND		1	ND	
Tetrachloroethene	1	3.7		1	2.1		1	1.9		1	ND		1	ND	
Trichloroethene	1	ND		1	ND		1	0.11	J	1	0.12	J	1	ND	
Metals, Total (mg/L)															
Aluminum		NA			NA			NA		0.10	.0569	B	0.10	0.107	
Arsenic		NA			NA			NA			NA		0.005	.0031	B
Barium	0.01	0.044		0.01	0.0482			NA		0.01	0.0512		0.01	0.0512	
Calcium	0.20	37.1		0.20	36.9			NA		0.2	39.8		0.2	47.3	
Chromium	0.005	0.0072	M	0.005	0.0051			NA		0.001	0.0115		0.001	0.012	
Iron	0.10	ND	M	0.10	ND			NA		0.1	0.0966	B	0.1	0.084	B
Lead		NA		0.001	0.00047	J		NA		0.001	0.0114		0.001	0.0054	
Magnesium	0.20	33.6		0.20	34.5			NA		0.2	37.2		0.2	43.5	
Manganese	0.01	ND		0.01	ND			NA		0.01	0.004	B	0.01	0.002	B
Potassium	5	6.4		5	6.2			NA		5	6.92		5	6.70	
Selenium	0.005	ND	M	0.005	0.0057			NA		0.005	0.004	B	0.005	0.0052	B
Sodium	5	52.0		5	53.2			NA		5.0	56.4		5.0	60.3	
Vanadium	0.01	0.019		0.01	0.020			NA		0.01	0.0196		0.01	0.0018	
Zinc	0.02	ND		0.02	ND			NA		0.02	0.0123	B	0.02	0.0070	B
General Chemistry (mg/L)															
Nitrate + Nitrite	0.1	2.8		0.1	ND		0.1	ND		0.1	ND		0.1	ND	
Nitrate	0.1	2.8		0.1	ND		0.1	4.4		0.1	1.8		0.1	1.4	
Sulfate	5.0	75.0	M	25.0	60.3	Q	5.0	ND		25.0	64.7	Q	25.0	81.1	Q
Total Dissolved Solids	10.0	401		10.0	414		10.0	ND		10	426		10	503	

µg/L micrograms per liter
mg/L miligrams per liter
ND Not Detected
NA Not Analyzed
M associated matrix spike and matrix spike duplicate results did not meet quality control acceptance criteria
q post-digestion spike recovery fell between 40 and 85 percent due to matrix interference
J result is detected below the reporting limit or is an estimated concentration
RL reporting limit
s sample diluted due to the concentration of target analytes
Q reporting limit is elevated due to high analyte levels
B Analyte detected in associated method blank

Table 3-3 Cannon AFB, Sewage Lagoons, SWMU 101

Groundwater Monitoring Results 1998 through 2001

Well F, Downgradient Well

Table 3-3
Cannon AFB, Sewage Lagoons, SWMU 101
Groundwater Monitoring Results, 1998 to 2001
Well F, Downgradient Well

Location:	Well F			Well F			Well F			Well F			Well F			Well F			Well F		
Sample I.D.:	F/CAFB-F-0498			F/CAFB-T-0498-1 (duplicate)			F/CAFB-F			CAFB-F-1			CAFB-F-1			CAFB-F-1			CAFB-F-1		
Collection Date:	4/8/1998			4/8/1998			3/2/1999			8/31/1999			3/2/2000			3/22/2001*			8/21/2001		
	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.
Volatile Organics (ug/L)																					
Methylene Chloride	1	0.4	J	1	0.43	J	1	ND		1	ND		1	ND			NA		1	ND	
Tetrachloroethene	1	ND		1	ND		1	ND		1	ND		1	ND			NA		1	ND	
Trichloroethene	1	ND		1	ND		1	ND		1	ND		1	.11	J		NA		1	ND	
Metals, Total (mg/L)																					
Aluminum													0.10	.0522	B		NA		0.10	1.89	
Barium	0.01	0.042		0.01	0.042		0.01	ND			NA		0.01	0.0379			NA		0.01	0.055	
Calcium	0.20	57.6		0.20	57.2		0.20	ND			NA		0.2	44.7			NA		0.2	NA	
Chromium	0.005	0.0044	JM	0.005	0.0018	JM	0.005	0.0015			NA		0.001	0.0022			NA		0.001	0.0106	
Iron	0.10	0.053	JM	0.10	0.089	JM	0.10	ND			NA		0.1	0.0278	B		NA		0.1	1.73	
Lead													0.001	0.00067	B		NA		0.001	0.01020	
Magnesium	0.20	53.8		0.20	53.6		0.20	ND			NA		0.2	45			NA		0.2	44	
Manganese	0.01	0.0098 J	J	0.01	0.011		0.01	ND			NA		0.01	ND			NA		0.01	0.0428	
Potassium	5	8.4		5	8.1		5	ND			NA		5	7.55			NA		5	8.38	
Selenium	0.005	0.0054	qM	0.005	0.0052	qM	0.005	0.0058			NA		0.005	0.0088			NA		0.005	0.0071	
Sodium	5	43.5		5	42.8		5	0.643	J		NA		5.0	42.8			NA		5.0	5.0	
Vanadium	0.01	0.018		0.01	0.016		0.01	ND			NA		0.01	0.0185			NA		0.01	0.0233	
Zinc	0.02	0.015	J	0.02	0.019	J	0.02	ND			NA		0.02	0.005	B		NA		0.02	0.0605	
General Chemistry (mg/L)																					
Nitrate + Nitrite	0.1	2.4		0.1	2.2		0.1	ND		0.1	ND		0.1	ND			NA		0.1	ND	
Nitrate	0.1	2.4		0.1	2.2		0.1	ND		0.1	1.2		0.1	1.3			NA		0.1	1.4	
Sulfate	5	163	sM	5	164	sM	25	139	Q	25	ND		25	139	Q		NA		25	131	Q
Total Dissolved Solids	10	535		10	528		10	506		10	ND		10	432			NA		10	538	

µg/L micrograms per liter
mg/L miligrams per liter
ND Not Detected
NA Not Analyzed
M associated matrix spike and matrix spike duplicate results did not meet quality control acceptance criteria
q post-digestion spike recovery fell between 40 and 85 percent due to matrix interference
J result is detected below the reporting limit or is an estimated concentration
RL reporting limit
s sample diluted due to the concentration of target analytes
Q reporting limit is elevated due to high analyte levels
B Analyte detected in associated method blank
* Not sampled on 3/22/01 due to decline in water table. A sample could not be collected nor analyzed.

Table 3-4 Cannon AFB, Sewage Lagoons, SWMU 101

Groundwater Monitoring Results 1998 through 2001

Well G, Downgradient Well

Table 3-4
Cannon AFB, Sewage Lagoons, SWMU 101
Groundwater Monitoring Results, 1998 to 2001
Well G, Downgradient Well

Location:	Well G			Well G			Well G			Well G			Well G		
Sample I.D.:	G/CAFB-G-0498			G/CAFB-G			CAFB-G-1			G/CAFB-G			G/CAFB-G		
Collection Date:	4/8/1998			3/2/1999			3/31/1999			3/2/2000			3/22/2001		
	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.
Appendix IX Volatile Organics (ug/L)															
Methylene Chloride	1	0.2 J		1.0	ND		1	ND		1	ND		1	ND	
Tetrachloroethene	1	ND		1	ND		1	ND		1	ND		1	ND	
Metals, Total (mg/L)															
Aluminum		NA			NA			NA		0.10	.0456	B	0.10	.0826	B
Barium	0.01	0.032		0.01	0.0314			NA		0.01	0.0335		0.01	0.0303	
Calcium	0.20	86.9		0.20	71.9			NA		0.2	69.1		0.2	59.0	
Chromium	0.005	0.0018	JM	0.001	0.0076			NA		0.001	0.0014		0.001	0.0034	
Iron	0.10	ND	M	0.10	ND			NA		0.1	0.0334	B	0.1	0.0867	B
Lead		NA		0.001	0.00088	J		NA		0.001	0.00044	B	0.001	0.00065	B
Magnesium	0.20	83.6		0.20	70.2			NA		0.2	69.8		0.2	56.9	
Manganese	0.01	ND		0.01	ND			NA		0.01	ND		0.01	0.00092	B
Potassium	5	10.0		5	8.69			NA		5	9.06		5	7.61	
Selenium	0.005	0.0045	JM	0.005	0.0042	J		NA		0.005	0.0091		0.005	0.0062	
Sodium	5	63.9		5	60.3			NA		5.0	55.6		5.0	57.2	
Vanadium	0.01	0.015		0.01	0.0158			NA		0.01	0.0173		0.01	0.0171	
Zinc	0.02	0.033		0.02	0.0199	J		NA		0.02	0.0098	B	0.02	0.0159	B
General Chemistry (mg/L)															
Nitrate + Nitrite	0.1	12.1		0.1	ND		0.1	ND		0.1	ND		0.1	ND	
Nitrate	0.1	12.1		0.1	ND		0.1	4.0		0.1	10.6	Q	0.1	5.6	Q
Sulfate	5.0	203	sM	25	182	Q	25.0	ND		25	183	Q	25	169	Q
Total Dissolved Solids	10	856		10	781		10.0	ND		10	696		10	627	

µg/L micrograms per liter
mg/L miligrams per liter
ND Not Detected
NA Not Analyzed
M associated matrix spike and matrix spike duplicate results did not meet quality control acceptance criteria
q post-digestion spike recovery fell between 40 and 85 percent due to matrix interference
J result is detected below the reporting limit or is an estimated concentration
RL reporting limit
s sample diluted due to the concentration of target analytes
Q reporting limit is elevated due to high analyte levels
B Analyte detected in associated method blank

Table 3-5 Cannon AFB, Sewage Lagoons, SWMU 101
Groundwater Monitoring Results 1998 through 2001
Well H, Downgradient Well

Table 3-5
Cannon AFB, Sewage Lagoons, SWMU 101
Groundwater Monitoring Results, 1998 to 2001
Well H, Downgradient Well

Location:	Well H			Well H			Well H			Well H			Well H		
Sample I.D.:	H/CAFB-H-0498-1			H/CAFB-H			CAFB-H-1			CAFB-H-1			H/CAFB-H		
Collection Date:	4/8/1998			3/2/1999			8/31/1999			3/2/2000			3/2/2001		
	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.	RL	Result	Qual.
Appendix IX Volatile Organics (ug/L)															
Methylene Chloride	1	0.5	J	1	ND		1	ND		1	ND		1	ND	
Tetrachloroethene	1	ND		1	ND		1	ND		1	ND		1	ND	
Metals, Total (mg/L)															
Aluminum		NA			NA			NA		0.10	0.0863	B	0.10	0.1110	
Arsenic		NA			NA			NA			NA		0.10	0.0034	B
Barium	0.01	0.031		0.01	0.0336			NA		0.01	0.0303		0.01	0.0303	
Calcium	0.20	44.2		0.20	40.2			NA		0.2	38.5		0.2	43.5	
Chromium	0.005	0.007	qM	0.001	0.0054			NA		0.001	0.0024		0.001	0.0035	
Iron	0.10	0.30	M	0.10	0.284			NA		0.1	0.067	B	0.1	0.0543	B
Lead		NA		0.001	0.0021			NA		0.001	0.00054	B	0.001	0.00038	B
Magnesium	0.20	41.3		0.20	38			NA		0.2	38.0		0.2	40.4	
Manganese	0.01	.0073 J		0.01	ND			NA		0.01	0.0022	B	0.01	0.0011	B
Potassium	5	7.0		5	6.4			NA		5	6.7		5	6.63	
Selenium	0.005	.0073 qM		0.005	0.0072			NA		0.005	0.0066		0.005	0.0067	
Sodium	5	55.0		5	52.5			NA		5.0	53.3		5.0	57.9	
Vanadium	0.01	0.020		0.01	0.0018			NA		0.01	0.0216		0.01	0.0194	
Zinc	0.02	0.120		0.02	0.138			NA		0.02	0.028		0.02	0.0533	
General Chemistry (mg/L)															
Nitrate + Nitrite	0.1	1.3		0.1	ND		0.1	ND		0.1	ND		0.1	ND	
Nitrate	0.1	1.3		0.1	ND		0.1	1.1		0.1	1.2		0.1	1.3	
Sulfate	25	143	sM	25	132	Q	25	ND		25	121	Q	25	126	Q
Total Dissolved Solids	10	459		10	492		10	ND		10	454		10	468	

µg/L micrograms per liter
mg/L miligrams per liter
ND Not Detected
NA Not Analyzed
M associated matrix spike and matrix spike duplicate results did not meet quality control acceptance criteria
q post-digestion spike recovery fell between 40 and 85 percent due to matrix interference
J result is detected below the reporting limit or is an estimated concentration
RL reporting limit
s sample diluted due to the concentration of target analytes
Q reporting limit is elevated due to high analyte levels
B Analyte detected in associated method blank

Table 5-1 Summary of Risks and Hazards to Potential Human Receptors at the Sewage Lagoons (SWMU 101)[1]

Risk or Hazard*	North Lagoon Sludge	North Lagoon Soil	South Lagoon Sludge	South Lagoon Soil
Hazard Index	0.046	0.012	0.033	0.016
Excess Lifetime Cancer Risk (ELCR)	3.1×10^{-6}	1.9×10^{-6}	5.5×10^{-6}	2.5×10^{-6}

*Unacceptable risk is based on a target HQ of 1.0 or a carcinogenic risk level of 1×10^{-5} for the sum of all carcinogens at a site or if only one carcinogen is present. Arsenic was the only chemical of potential concern that exceeded the target ELCR of 1×10^{-6} for a single chemical in sludge and soil in the north and south lagoons. Based on the data, there is negligible risk to industrial workers from exposure to sludge and soil at SWMU 101.

[1](FWEC, 2001)

Table 5-2. Summary of Risk to Ecological Receptors at SWMU 101[1]

COPEC	Terrestrial Invertebrates	Plants	Deer Mouse	Mourning Dove	Least Shrew	Red-Tailed Hawk
North Lagoon Soil Pesticides						
Heptachlor	NA	< 1	< 1	< 1	< 1	< 1
Inorganics						
Arsenic	21	5.3	< 1	< 1	< 1	< 1
Barium	NA	170	97	< 1	220	1.6
Cadmium	< 1	1.5	2.7	< 1	5.9	< 1
Chromium	96	1100	< 1	< 1	< 1	< 1
Lead	< 1	3.0	3.8	4.9	11	21
Nitrate/Nitrite	NA	NA	< 1	NA	< 1	NA
Selenium	< 1	26	< 1	3.5	2.2	< 1
North Lagoon Sludge VOCs						
m-/p-Xylenes	NA	< 1	< 1	NA	< 1	NA
PCBs						
PCB-1260	< 1	< 1	480	< 1	1100	< 1
Pesticides						
alpha-BHC	NA	NA	1	< 1	2.3	< 1
beta-BHC	NA	NA	13	< 1	28	< 1
Gamma-Chlordane	NA	NA	19	< 1	43	< 1
4,4'-DDE	NA	NA	<1	< 1	<1	< 1
4,4'-DDT	NA	NA	<1	< 1	<1	< 1
Dieldrin	NA	NA	810	< 1	1800	< 1
Endrin Aldehyde	NA	NA	11	< 1	25	< 1

COPEC	Terrestrial Invertebrates	Plants	Deer Mouse	Mourning Dove	Least Shrew	Red-Tailed Hawk
Heptachlor Epoxide	NA	<1	7.6	< 1	17	< 1
Inorganics						
Arsenic	21	5.3	<1	< 1	< 1	< 1
Cadmium	<1	25	46	< 1	100	< 1
Chromium	170	1900	<1	< 1	< 1	1.3
Lead	<1	18	23	30	66	130
Mercury	1.6	11	240	7.7	530	23
Nitrate/Nitrite	NA	NA	<1	NA	< 1	NA
Selenium	1.3	200	6.9	< 1	17	< 1
Silver	NA	2700	10	< 1	19	< 1
South Lagoon Soil VOCs						
m-/p-Xylenes	NA	< 1	< 1	NA	< 1	NA
Pesticides						
alpha-BHC	NA	NA	530	< 1	< 1	< 1
gamma-BHC (Lindane)	NA	NA	< 1	< 1	< 1	< 1
Heptachlor	NA	<1	< 1	< 1	1	< 1
Inorganics						
Arsenic	28	7	<1	< 1	<1	< 1
Cadmium	<1	5.4	10	< 1	22	< 1
Chromium	100	1100	<1	< 1	<1	< 1
Lead	<1	2.2	2.8	3.6	8.1	15
Nitrate/Nitrite	NA	NA	<1	NA	<1	NA
South Lagoon Sludge Pesticides						

COPEC	Terrestrial Invertebrates	Plants	Deer Mouse	Mourning Dove	Least Shrew	Red-Tailed Hawk
gamma-BHC (Lindane)	NA	NA	<1	< 1	<1	< 1
alpha-Chlordane	NA	NA	5.2	< 1	12	< 1
gamma-Chlordane	NA	NA	5.5	< 1	12	< 1
4,4'-DDE	NA	NA	<1	< 1	<1	< 1
Dieldrin	NA	NA	570	< 1	1300	< 1
Inorganics						
Arsenic	56	14	<1	<1	<1	<1
Barium	NA	190	110	<1	230	1.7
Cadmium	1.3	64	120	<1	260	<1
Chromium	290	3200	<1	<1	<1	2.2
Lead	1.1	23	29	38	85	160
Mercury	1.3	10	200	6.7	460	5.3
Nitrate/Nitrite	NA	NA	<1	NA	<1	NA
Selenium	4.3	660	23	<1	55	<1
Silver.	NA	5300	19	<1	37	<1

Notes:

BHC – hexachlorocyclohexane

COPEC – chemicals of potential ecological concern

DDE –dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethane

NA – not available; risk was not quantitatively evaluated due to lack of toxicity value.

PCB – polychlorinated biphenyl

VOC – volatile organic chemical

[1](FWEC, 2001)

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE