

Headquarters, Air Combat Command Langley Air Force Base, Virginia

Final Construction Workplan IRP Site FT-31 Former Fire Training Area Bioventing System

Holloman AFB Alamogordo, NM

July 1997



49 CES/CEVR Holloman Air Force Base New Mexico

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FINAL CONSTRUCTION WORKPLAN IRP SITE FT-31, FORMER FIRE TRAINING AREA BIOVENTING SYSTEM HOLLOMAN AIR FORCE BASE, NEW MEXICO

Prepared for:

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and

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U.S. Army Corps of Engineers Omaha District Omaha, Nebraska

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LIST OF ACRONYMS

ac	alternating current
AFB	Air Force Base
AHA	Activity Hazard Analysis
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CAO	Corrective Action Objective
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulation
cfm	Cubic Feet Per Minute
C-O-C	Chain-of-Custody
COC	Contaminant of Concern
CPVC	Chlorinated Polyvinyl Chloride
CQC	Contractor Quality Control
DQCR	Daily Quality Control Report
DRMO	Defense Reutilization and Marketing Office
DOM	Delivery Order Manager
DOT	Department of Transportation
EPA	U. S. Environmental Protection Agency
ERP	Emergency Response Plan
FCR	Field Change Request
FID	Flame Ionization Detector
FSP	Field Sampling Plan
ft	Feet/Foot
FTA	Fire Training Area
GC	Gas Chromatography
GFAA	Graphite Furnace Atomic Absorption
gpm	Gallons Per Minute
HM	Hazardous Materials
HSWA	Hazardous and Solid Waste Amendments
HW	Hazardous Waste
HWMR	Hazardous Waste Management Regulations
IDW	Investigative Derived Waste
IR	Infrared Spectrophotometry
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
kVA	kilovolt-amps
LDR	Land Disposal Restriction
LEL	Lower Explosive Limit
LIMS	Laboratory Information Management System
LNAPL	Light Nonaqueous Phase Liquid
MAP	Management Action Plan
mg/kg	Milligrams Per Kilogram

MIBK	Methyl Isopbutyl Ketone
MRD	Missouri River Division
MS	Mass Spectrometry
NFA	No Further Action
NMED	New Mexico Environment Department
NOI	Notice of Intent
O&M	Operations and Maintenance
OSHA	Occupational Health and Safety Administration
OWS	Oil/Water Separator
PCS	Petroleum-ContaminatedSoils
PHSM	Project Health and Safety Manager
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts Per Million
psig	pounds per square inch gauge
PVC	Polyvinyl Chloride
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RALs	Remedial Action Levels
RBC	Risk-Based Concentrations
RCP	Regulatory Compliance Plan
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RS	Regulatory Specialist
SARA	Superfund Amendments and Reauthorization Act
SCFM	Standard Cubic Feet per Minute
SOP	Standard Operating Procedure
SSHP	Site Safety and Health Plan
SWMR	Solid Waste Management Regulations
SWMU	Solid Waste Management Unit
TC	Toxicity Characteristic
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TERC	Total Environmental Restoration Contract
TPH	Total Petroleum Hydrocarbon
TRPH	Total Recoverable Petroleum Hydrocarbon
TSDF	Treatment, Storage, and Disposal Facility
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
UTS	Universal Treatment Standards
VOC	Volatile Organic Compound
V	Volts

WAD Work Authorization Directive WWTF Wastewater Treatment Facility

1.0 INTRODUCTION

Foster Wheeler Environmental was retained by the United States Army Corps of Engineers (USACE)-Omaha District to furnish design and construction services at the former Fire Training Area (FTA) designated as Installation Restoration Program (IRP) Site FT-31 at Holloman Air Force Base (AFB) in New Mexico. These services involve the design and installation of a bioventing system for the remediation of petroleum-contaminated soils with concentrations above the Base-specific cleanup levels established with the New Mexico Environmental Department (NMED) for basewide activities. The Base-specific Total Recoverable Petroleum Hydrocarbons (TRPH) cleanup levels are concentrations above 1,000 milligrams per kilogram (mg/kg). The FTA contains five Solid Waste Management Units (SWMUs)—39, 127, 135, 170, and 171—as illustrated in Figure 1-1.

Fuel-related contamination was detected during field investigation activities in soils and groundwater in three distinct areas at the FTA. Elevated TRPH levels were detected in soil at SWMU 170 and the oil/water separator (OWS) area identified as SWMUs 39, 127, and 135. Additionally, elevated TRPH concentrations and low levels of chlorinated solvents were detected in the soil near the JP-4 tank located in the southeastern corner of the FTA. The highest concentration of the chlorinated solvents were: 1,1,1-trichloroethane (2000 ppb), 1,1-dichloroethane (57 ppb), 1,1-dichloroethene (12 ppb), and trichloroethene (1.3 ppb). Benzene, toluene, ethylbenzene, and xylene (BTEX) groundwater contamination was detected primarily near the OWS area. Maximum detections were: benzene (6900), toluene (360 ppb), ethylbenzene (2300 ppb), and xylenes (560 ppb). The FTA is scheduled to be added to Holloman's basewide biennial long-term groundwater sampling program. Groundwater samples were analyzed for VOCs using EPA Method 8260. Groundwater data (Foster Wheeler Environmental, Radian 1997) are presented in Table 1-1.

The Phase II Remedial Field Investigation (RFI) (Foster Wheeler Environmental, Radian 1997) quantitative risk assessment concluded that soil and groundwater contamination do not pose a

Honoman AFB FT-31 Site Bioventing System



Table 1-1

Location ID		31W1		31-MW-03		31-MW-04		31-MW-05	
SW8240 (µg/L)	1,1,1-Trichloroethane	ND	(250)	ND	(5)	ND	(5)	ND	(5)
	1,1,2,2-Tetrachloroethane	ND	(250)	ND	(5)	ND	(5)	ND	(5)
	1,1-Dichloroethane	ND	(250)	ND	(5)	ND	(5)	ND	(5)
	1,1-Dichloroethene	ND	(250)	ND	(5)	ND	(5)	ND	(5)
	4-Methyl-2-pentanone (MIBK)	230 J	(500)	ND	(10)	ND	(10)	ND	(10)
	Acetone	450 J	(500)	ND	(10)	ND	(10)	ND	(10)
	Benzene	4,500	(250)	4.7 J	(5)	120	(5)	ND	(5)
	Carbon disulfide	36 J	(250)	ND	(5)	ND	(5)	ND	(5)
	Chloroform	ND	(250)	0.33 J	(5)	ND	(5)	ND	(5)
	Ethylbenzene	1,600	(250)	3.9 J	(5)	29	(5)	ND	(5)
	Methyl ethyl ketone	ND	(500)	ND	(10)	ND	(10)	ND	(10)
	Methylene chloride	120 J	(250)	1.1 JB	(5)	2.3 J	(5)	0.92	JB (5)
	Toluene	360	(250)	7.3	(5)	ND	(5)	ND	(5)
	Total xylenes	560	(250)	7.8	(5)	16	(5)	ND	(5)
	Trichloroethene	ND	(250)	4.7 J	(5)	ND	(5)	ND	(5)
SW8270 (mg/L)	2,4-Dimethylphenol	0.024 J	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	2-Methylnaphthalene	0.071 J	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	2-Methylphenol	0.021 J	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	3-Methylphenol/4-Methylphenol	0.039 J	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Acetophenone	0.10 J	(0.2)	ND	(0.01)	0.001	7 J (0.01)	ND	(0.01)
	Diethylphthalate	ND	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Naphthalene	0.17 J	(0.2)	ND	(0.01)	0.003	6 J (0.01)	ND	(0.01)
	Pentachlorophenol	0.051 J	(1)	ND	(0.05)	ND	(0.05)	ND	(0.05)
	Phenol	0.026 J	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	bis(2-Chloroisopropyl)ether	ND	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	bis(2-Ethylhexyl)phthalate	ND	(0.2)	ND	(0.01)	ND	(0.01)	ND	(0.01)

Analytical Results for the Fire Training Area Groundwater Samples

	Location ID	31-MV	V-06	MV	V-07	MW-	08	MW-0)9
SW8240 (µg/L)	1,1,1-Trichloroethane	ND	(5)	ND	(5)	ND	(250)	ND	(120)
	1,1,2,2-Tetrachloroethane	ND	(5)	ND	(5)	ND	(250)	ND	(120)
	1,1-Dichloroethane	ND	(5)	ND	(5)	ND	(250)	ND	(120)
	1,1-Dichloroethene	ND	(5)	ND	(5)	ND ·	(250)	ND	(120)
	4-Methyl-2-pentanone (MIBK)	ND	(10)	ND	(10)	2,400	(500)	130 J	(250)
	Acetone	ND	(10)	ND	(10)	860	(500)	650	(250)
	Benzene	ND	(5)	ND	(5)	6,900	(250)	2,800	(120)
	Carbon disulfide	ND	(5)	ND	(5)	ND	(250)	ND	(120)
	Chloroform	ND	(5)	ND	(5)	ND	(250)	ND	(120)
	Ethylbenzene	ND	(5)	ND	(5)	2,300	(250)	1,800	(120)
	Methyl ethyl ketone	ND	(10)	ND	(10)	ND	(500)	ND	(250)
	Methylene chloride	0.95 JB	(5)	0.78	JB(5)	60 J	(250)	22 J	(120)
	Toluene	ND	(5)	ND	(5)	ND	(250)	ND	(120)
	Total xylenes	1.2 Jb	(5)	ND	(5)	30 J	(250)	12 J	(120)
	Trichloroethene	ND	(5)	ND	(5)	ND	(250)	NĎ	(120)
SW8270 (mg/L)	2,4-Dimethylphenol	ND	(0.01)	ND	(0.01)	0.028 J	(0.2)	ND	(0.05)
	2-Methylnaphthalene	ND	(0.01)	ND	(0.01)	0.11 J	(0.2)	0.098	(0.05)
	2-Methylphenol	ND	(0.01)	ND	(0.01)	0.034 J	(0.2)	0.015 J	(0.05)
	3-Methylphenol/4-Methylphenol	ND	(0.01)	ND	(0.01)	0.021 J	(0.2)	0.034 J	(0.05)
	Acetophenone	ND	(0.01)	ND	(0.01)	ND	(0.2)	ND	(0.05)
	Diethylphthalate	ND	(0.01)	ND	(0.01)	ND	(0.2)	0.0059 J	(0.05)
	Naphthalene	ND	(0.01)	ND	(0.01)	0.23	(0.2)	0.20	(0.05)
	Pentachlorophenol	ND	(0.05)	ND	(0.05)	0. 09 9 J	(1)	0.025 J	(0.25)
	Phenol	ND	(0.01)	ND	(0.01)	0.022 J	(0.2)	0.010 J	(0.05)
	bis(2-Chloroisopropyl)ether	ND	(0.01)	ND	(0.01)	ND	(0.2)	ND	(0.05)
	bis(2-Ethylhexyl)phthalate	ND	(0.01)	ND	(0.01)	ND	(0.2)	ND	(0.05)

Table 1-1 (continued)

Location ID		31-M	W-10	31-MW-11		7-11 31-MW-12		31-MW-13	
SW8240 (µg/L)	1,1,1-Trichloroethane	ND	(5)	ND	(5)	ND	(5)	4.5 J	(5)
	1,1,2,2-Tetrachloroethane	ND	(5)	ND	(5)	ND	(5)	0.35 J	(5)
	1,1-Dichloroethane	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	1,1-Dichloroethene	ND	(5)	ND	(5)	1 J	(5)	8.7 .	(5)
	4-Methyl-2-pentanone (MIBK)	ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Acetone	ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Benzene	ND	(5)	ND	(5)	ND	(5)	0.54 Jb	(5)
	Carbon disulfide	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Chloroform	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Ethylbenzene	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Methyl ethyl ketone	ND	(10)	ND	(10)	ND	(10)	ND	(10)
	Methylene chloride	2.4 J	(5)	1.9 JB	(5)	0. 8 JB	(5)	1.8 JB	(5)
	Toluene	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Total xylenes	ND	(5)	ND	(5)	ND	(5)	ND	(5)
	Trichloroethene	ND	(5)	ND	(5)	ND	(5)	2.1 J	(5)
SW8270 (mg/L)	2,4-Dimethylphenol	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	2-Methylnaphthalene	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	2-Methylphenol	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	3-Methylphenol/4-Methylphenol	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Acetophenone	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Diethylphthalate	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Naphthalene	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	Pentachlorophenol	ND	(0.05)	ND	(0.05)	ND	(0.05)	ND	(0.05)
	Phenol	ND	(0.01)	ND	(0.01)	ND	(0.01)	ND	(0.01)
	bis(2-Chloroisopropyl)ether	ND	(0.01)	0.0013	J (0.01)	ND	(0.01)	ND	(0.01)
	bis(2-Ethylhexyl)phthalate	ND	(0.01)	ND	(0.01)	ND	(0.01)	0.017	(0.01)

Table 1-1 (continued)

b = Reported analyte concentration cannot be distinguished from field blank concentrations.

B = Reported analyte concentration may be due to analytical background (or noise) from the laboratory.

J = Estimated concentration; analyte measured below the detection limit.

NA = Not applicable.

ND = Not detected. No instrument response for analyte or result less than zero.

() = Detection limit.

risk to human health or the environment. Due to low contamination levels at SWMU 171, No Further Action (NFA) was recommended. The Base planned to conduct a bioventing pilot test at the FT-31 and SD-47 Sites. Implementation of long-term pilot testing was never completed at FT-31 due to the lack of availability of electric power source to operate the system. The nearest electrical power source is approximately 0.6 miles from Site FT-31. Installation of the power drop was completed at the SD-47 site and startup of the long-term pilot test was implemented in April 1995. A more comprehensive remediation effort utilizing either soil vapor extraction or bioventing will be utilized to remediate TRPH-contaminated soils to the Base-specific cleanup levels at SWMU 170, the OWS area, and the JP-4 tank area. The extent of TRPH-contamination above the Base-specific cleanup level is limited to the following three distinct areas: (1) the shallow soils within SWMU 170, extending to the groundwater table south and east of the SWMU; (2) shallow soils near the southern end of the abandoned JP-4 tank, extending to groundwater and vadose zone near the northern end of the tank; and (3) the shallow soils in the OWS area and extending downward to the groundwater. Ten soil borings were drilled during the Phase II RFI in order to delineate the horizontal and vertical extent of contamination. TRPH ranged from not detected to 11,500 mg/kg. This data was in turn used to establish biovent well locations (Appendix D) for this project.

During the design phase of the project a detailed analysis was performed that concluded that a bioventing system was an adequate technology to remediate the three areas. This revised approach provides a substantial reduction in capital equipment requirements construction costs (i.e., liquid-ring vacuum pumps and thermal oxidation unit). The bioventing process will supply air to the vadose zone to stimulate aerobic biodegradation of the contaminants. Bioventing is applicable to any contaminant that is biodegradable aerobically. Pressurized air will be injected through a series of 22 boreholes screened in the vadose zone.

This Workplan is written to meet the requirements stipulated within the Total Environmental Restoration Contract (TERC) No. DACW45-94-D-0003, Delivery Order No. 8, Work Authorization Directive (WAD) 3. This Workplan provides project objectives, descriptions, construction drawings, technical specifications, field procedures, and related plans, addressing all

aspects of the proposed construction activities and waste management at IRP Site FT-31. All field activities will be performed in accordance with the Basewide Health and Safety Plan (Foster Wheeler Environmental 1995b) and Section 6 of this Workplan, the Site Safety and Health Plan (SSHP).

1.1 PROJECT OBJECTIVES

The primary project objective is to install the bioventing system and remediate TRPH-impacted soils. Waste minimization for the project will be accomplished through the use of on-site field screening and analytical testing. Following system startup, operations and maintenance (O&M) of the remediation systems will consist of daily and weekly site visits to inspect the system, gather data, and make minor system adjustments. The objective is to keep the system operational in an efficient manner and produce maximum remediation of the subsurface contamination in a minimum amount of time.

1.2 WORKPLAN OVERVIEW

This Workplan was structured to provide details on the major aspects of the remediation project. Site description information is presented in Section 2. The scope of work, including on-site and off-site activities, is discussed in Section 3. The Project Implementation Plan, which describes all site activities from mobilization through demobilization, is presented in Section 4. Off-site activities, particularly the transportation and disposal of wastes, and Regulatory Compliance issues, including environmental procedures, permitting and approval requirements, and regulatory procedural and training requirements, are presented in Section 5; Site Safety and Health requirements are addressed in Section 6. Field sampling procedures are addressed in Section 7, Field Sampling Plan (FSP). The Contractor Quality Control (CQC) Plan is presented in Section 8 and the Quality Assurance Project Plan (QAPP) in Section 9. The Project Management Plan, including staffing, scheduling, reporting, data management, document control, and meetings, is presented in Section 10. References are provided in Section 11.

2.0 SITE DESCRIPTIONS

Holloman AFB is located in the Tularosa Basin in Otero County in southern New Mexico. It is located immediately southwest of the City of Alamagordo. Holloman AFB. The location of Holloman AFB and Alamogordo are shown on Figure 2-1. Base operations consist of the 49th Fighter Wing with associated Fighter and Training Squadrons under the 49th Operations Group as well as other support organizations. Other tenant organizations exist at Holloman AFB, the largest being the 46th Test Group and the Det 1, 821st Space Group.

2.1 SITE LOCATION AND EXISTING CONDITIONS

The FTA is located northeast of Saber Road and west of the Main Base Landfill as identified on the Vicinity Map, Drawing No. 2, Appendix D of this Workplan. The FTA was used by the Base Fire Department for fire training exercises from 1945 to 1991. From 1945 to 1979, approximately 1,800 to 2,700 gallons of waste fuels, oils, and some solvents were delivered to the FTA each month. Approximately 2,500 gallons of JP-4 were used every 6 weeks in the training exercises from 1979 to 1991. Prior to the training exercises, training areas were soaked with water prior to fuel application and ignition. The flammable liquids were sprayed primarily in two areas, SWMUs 170 and 171, and ignited for these training exercises. A cross-sectional view of the TRPH contamination, developed as part of the RFI investigation, is provided in Figure 2.2.

The FT-31 Site is defined by a circular, gravel-covered area, approximately 400 feet in diameter, that contains the five SWMUs. The topography of the site is relatively flat with the exception of the depression at the location of the abandoned OWS (SWMU 39). SWMU 170 is a circular, gravel-covered burn area, approximately 100 feet in diameter, located near the center of the FTA. The SWMU is surrounded by a 12-inch-high gravel berm. The mock aircraft has been removed. SWMU 171 is a circular, gravel-covered burn area, approximately 60 feet in diameter, and is located in the northeastern portion of the FTA. This area is also surrounded by a 12-inch-high gravel berm; the mock rocket test engines have been removed.



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Figure 2-2 Cross Sectional View of TRPH Contamination



The OWS identified as SWMU 39, the waste oil tank identified as SWMU 127, and the discharge pit identified as SWMU 135 are located approximately 200 feet north of the former mock aircraft area. These SWMUs were installed in 1979 to collect and handle runoff from the burn areas. Wastewater from the two burn areas was directed to the OWS via underground collection lines. Fuels and oils skimmed from the OWS were transferred by gravity flow to a 500-gallon waste oil tank. The wastewater was discharged into an unlined drainage pit. The drainage pit (SWMU 135) is circular with a diameter of approximately 70 feet and a depth of 6 feet.

In 1979, an aboveground storage tank was installed in the southeastern portion of the site to store JP-4, which replaced the waste fuels, solvents, and oils used as the fuel source during the training exercises. Fuel from the JP-4 tank was transferred to SWMU 170 through a valve box, adjacent to the eastern side of the aircraft burn area, via underground pipes. A valve box was also provided for SWMU 171, located adjacent to the southern edge of the burn area.

The FT-31 Site bioventing system will encounter only minimal physical constraints during construction due to its proximity and limited surface features. Electricity is required at the equipment pad location, adjacent to the northeastern area of SWMU 170. The location and depth of the fuel transfer lines is not known. Prior to trench excavation these pipes will be located.

2.2 SITE GEOLOGY AND HYDROGEOLOGY

The stratigraphy of the FTA consists primarily of silty and clayey sands. Drilling logs completed during the Phase II RFI indicate a general sequence of 5 to 10 feet of silty sands overlying clays and clayey sands interbedded with silty sands. The bottom of the clayey unit was not encountered in most of the borings that were drilled to a depth of 20 feet. Groundwater was encountered in clays and sands at approximately 19 feet to 21 feet below ground surface in borings taken at the FTA. Groundwater level measurements taken during the monitoring well sampling indicate that groundwater flows to the south-southeast.

2.3 SOIL CHARACTERISTICS

Site soil characteristics were established during a bioventing initiative conducted at IRP Site FT-31 in April 1995. Soil intrinsic permeabilities ranged from 0.0018 to 2.5 darcy. Site soil conditions are relatively homogeneous (fine silty sand). No impermeable layers are present which would affect air flows across the site. The majority of soil pH measurements ranged from 7.1 to 7.6. Moisture content of the shall soils ranged from 9.0 to 13.7 percent, while the deeper soil measured 36.9 percent. Groundwater temperature averaged 66 degrees Fahrenheit, and is indicative of the soil temperature. This temperature is in the optimal range for microbial activity.

Site-specific data for microbial populations were not taken during the bioventing initiative. However, this data will be measured during biannual sampling at the site beginning in August 1997. For comparison, heterotrophic bacterial counts conducted at Area of Concern-V, the Officer's Club, ranged from 8.8X10⁻⁵ Colony Forming Units (CFU)/gram (gm) to 4.9X10⁻⁶ CFU/gm. Hydrocarbon utilizing bacteria counts ranged from 9.0X10⁻³ CFU/gm to 1.2X10⁻⁵ CFU/gm. These counts were somewhat depressed due to the anaerobic conditions present at AOC-V.

The remediation at IRP Site FT-31 will continue until soil TPH concentrations are below 1000 mg/kg. Based on respirometry testing conducted at the site, bioventing will likely achieve the 1000 mg/kg TPH soil cleanup standard. The current estimate to achieve this level is two to three years. The system has been operational since July 1996 and therefore could continue to operate until July 1999. The current estimate, of fuel degraded at FT-31, based on respirometry testing is 41,000 pounds. As mentioned previously, biannual soil testing will be conducted until the 1000 mg/kg TPH level has been achieved. Upon completion of the remediation at FT-31, a Site Closeout Report will be generated which will document the activities conducted at the site and the supporting data.

2.4 WASTE/CONTAMINANT MATRIX ASSESSMENT

The contamination present at the IRP Site FT-31 consists of primarily of petroleum contaminated soils that include adsorbed-phase petroleum hydrocarbons and dissolved petroleum-hydrocarbons

including BTEX. Maximum concentrations of TRPH have been measured up to 11,500 mg/kg in soil. In addition, very low concentrations of chlorinated solvents were also detected near the JP-4 tank. As the nature of the contaminants has been well documented and a thorough site investigation was performed, results do not indicate the presence of any listed hazardous waste.

3.0 SCOPE OF WORK

This section provides an overview of project activities and objectives. A summary of projectrelated activities that will occur both on site and off site is provided.

3.1 PROJECT OBJECTIVES

It has been determined that in situ remediation is the most cost-effective method of preventing future exposure to the contaminated soil and groundwater for IRP Site FT-31. Site activities are no longer performed and potential sources of continuing contamination, i.e., the JP-4 tank, have been removed. Based on the data collected from the operation of the pilot study initiative, a bioventing system will be constructed to remediate the site. The biovent system, with a radius of influence of 40 feet, will provide sufficient coverage to remediate the areas between the bioventing wells. Twenty-two bioventing wells will be installed and divided into three groups, each group will be serviced with a dedicated air supply pipe, controlled at the equipment pad. A group of six wells will be installed at the north area, including SWMUs 29, 127, and 135, the OWS area. The second group of four wells will be installed in the east area around the JP-4 storage tank. The remaining 12 wells will be installed at the south area, SWMU 170.

It is not known if the underground transfer lines between the JP-4 tank and the burn areas have been removed. As a contingency, if these transfer pipes are encountered during the trench excavation they will be drained and managed as a recovered product, and the pipes will be removed and disposed.

3.2 ON-SITE ACTIVITIES

On-site activities include the following:

- Preconstruction conference
- Mobilization and demobilization
- Construction activities, including waste characterization and disposal
- Field engineering and quality control
- Health and safety
- Site security
- Community relations

3.2.1 Preconstruction Conference

A preconstruction conference will be conducted at the Base prior to mobilization. Attendees at the conference will include the following:

Name	<u>Affiliation</u>	Project Role
Warren Neff	Holloman AFB	Base Project Manager
Rich Macfarlane	USACE-Albuquerque	Resident Engineer
Herman Calvo	Foster Wheeler Environmental	Construction Project
Bill Foley	Foster Wheeler Environmental	CQC System Manager
Dan Holmquist	Foster Wheeler Environmental	Site Manager

Other individuals from the Base, USACE, Foster Wheeler Environmental Corporation, subcontractors, and vendors may attend the meeting, as necessary.

The agenda for this conference will include some or all of the following topics:

- Introductions, roles, and responsibilities
- Review of scope of work
- Construction schedule
- Mobilization logistics
- Review of off-site delivery schedules
- Forecast of progress until next scheduled meeting
- Coordination of schedules
- Review of submittal schedules
- Review of quality/health and safety programs
- Pending changes and substitutions
- Review of proposed changes for effects on construction, completion date, and other aspects of the project
- Other business

The agenda will be formalized prior to the preconstruction conference.

3.2.2 Mobilization/Demobilization

Mobilization activities will include the following:

- Erect temporary facilities
- Deliver equipment, materials, and supplies to the site

- Establish work zones
- Confirm approval of the Base excavation permit and inspect utilities mark outs at each site
- Coordinate with facility points of contact to ensure minimal disturbance to ongoing operations
- Conduct site-specific orientation and health and safety training of workers
- Establish a decontamination facility or facilities as necessary

Demobilization activities will commence after completion of construction activities and will include the following:

- Remove temporary facilities
- Conduct final punch-list inspections
- Remove equipment and materials from the site
- Meet with Base personnel to discuss future site-use concerns
- Restore site to preconstruction conditions
- Decommission decontamination facilities

3.2.3 Construction Activities

The following summarizes the major construction activities that will be performed at the site:

- Prepare site
- Survey and layout well and equipment pad locations
- Extend electric power service to proposed equipment pad location
- Test stored excavated soil for contamination and dispose of appropriately
- Drill and install bioventing wells
- Excavate trenches and install underground bioventing piping
- Install equipment pads
- Install process equipment
- Install fence
- Restore and cleanup site

3.2.4 Field Engineering and Quality Control

Field engineering and quality control (QC) encompass engineering, particularly survey control and QC inspection and testing. Field engineering will be performed under and is one of the primary responsibilities of the Construction Project Manager. A surveyor certified by the state of New Mexico will provide horizontal and vertical control as required. Field change requests (FCRs) and nonconformance notices will be documented when discrepancies occur between constructed elements and associated drawings and specifications. A daily survey log will be maintained at the site. The surveyor will be responsible for providing elevation data that will be incorporated into the record (as-built) drawings.

QC inspections will be performed by the CQC System Manager/Construction Project Manager in accordance the CQC Plan in Section 8. The Construction Project Manager will document daily construction activities on appropriate log forms, which are included in the CQC Plan. Field change requests and nonconformance reports, also included within the CQC Plan, will be issued and maintained by the Construction Project Manager.

Testing will be performed by the Construction Project Manager in accordance with the Field Sampling Plan in Section 7 and the CQC Plan in Section 8 and requirements detailed in the construction drawings and technical specifications. Testing encompasses chemical testing of stockpiled soil and debris. Testing may be conducted both on site and off site.

3.2.5 Health and Safety

Health and safety activities will be conducted in accordance with the Basewide Health and Safety Plan, Foster Wheeler Environmental Corporate Health and Safety Program, EM 385-1.1, and Section 6.0 of this document. All employees and subcontractors will be responsible for complying with these documents. The Site Manager, Site Superintendents, and the Health and Safety Officer will ensure implementation of these programs and procedures.

3.2.6 Site Security

The preconstruction level of security provided by fencing and locked gates shall be maintained throughout all construction activities. All removal of fencing and use of temporary fencing must be coordinated with the Base Project Manager.

3.2.7 Community Relations

Community relations are the responsibility of Holloman AFB. All inquiries regarding the project will be deferred to the Base Project Manager or a delegated representative.

3.3 OFF-SITE ACTIVITIES

All engineering functions will be provided by Foster Wheeler Environmental Corporation home office staff in Denver, Colorado. Project, mechanical, civil, and electrical engineering will be performed at the home office. The Project Engineer in the Foster Wheeler Environmental home office will serve as the point of contact for all field inquiries regarding engineering and will coordinate engineering efforts in compliance with Foster Wheeler Environmental corporate procedures and applicable professional standards.

During the project, home office personnel may be required to visit the site to provide routine inspection and technical assistance. The Foster Wheeler Environmental Project Engineer will coordinate visits and inspections through the Delivery Order Manager (DOM) according to the needs of the project.

Procurement of subcontractors and major work items will be accomplished by home office staff. The Foster Wheeler Environmental Project Engineer will furnish final "Issued for Construction" specifications and drawings to the Procurement Agent, who will be the point of contact for all vendor inquiries.

The following administrative support functions will be furnished by the home office:

- Contract Administration—The Contract Administrator will assist project management with all issues pertaining to contract compliance.
- Regulatory Compliance—Compliance with permits and regulatory requirements will be overseen by designated home office personnel as described in Section 5.0, Regulatory Compliance Plan (RCP).
- Safety Compliance—Home office compliance officers will periodically monitor the site safety program.
- Compliance Inspections—All issues regarding corporate, regulatory, health and safety, and project compliance will be evaluated periodically throughout the project by designated corporate representatives from the home office.

4.0 IMPLEMENTATION OF ON-SITE WORK ACTIVITIES

This section provides the details of the on-site work implementation including mobilization, construction activities, waste management, and demobilization.

4.1 BASE ACCESS AND SITE SECURITY

4.1.1 Transportation Operations

The following summarizes on-site transportation operations:

- Contractor and Subcontractor vehicles will access sites at the Base via the main gate located on State Highway 70.
- All vehicles will travel along improved roads and will not enter secure areas without receiving prior clearance.
- The truck scale nearest to the construction sites is located at 1505 U.S. Highway 70 West.
- The Construction Project Manager, required Foster Wheeler Environmental personnel, subcontractors, and vendors will receive vehicle passes valid for the duration of the project. A valid driver's license, proof of vehicular insurance, and valid vehicle registration will be required to obtain a pass.

4.1.2 Field Communications

The following is the point of contact and the telephone number for this project:

Site	Point of Contact	Telephone Number
IRP Site FT-31	Dan Holmquist Rich Macfarlane (USACE)	(505) 479-2668 (505) 479-6095

A complete listing of project-related telephone numbers is contained in the Basewide Health and Safety Plan.

4.1.3 Site Access and Security

Access to Holloman AFB will be provided through the main gate. Authorization to work outside of the limits of work as indicated on the construction drawings must be obtained in advance in writing from the appropriate Base personnel. All personnel shall keep in their possession a picture ID or valid driver's license. Vehicles allowed on all open and accessible roads at Holloman AFB include standard cars and trucks. Construction vehicles and pieces of construction equipment (either operating under their own power or hauled on a trailer) are restricted to the following routes:

IRP Site FT-31— From the right turn onto Delaware, proceed approximately 2 miles, turn right onto the unpaved road leading to the Main Base Landfill. The FT-31 Site is located on the left before reaching the landfill entrance.

4.2 MOBILIZATION

4.2.1 <u>Temporary Facilities and Utilities</u>

Temporary facilities will be provided as described in this section including the furnishing, installation, operation, and maintenance, and shall be in accordance with Technical Specification - Section 01500 located in Appendix C of this Workplan. After the work is completed, these temporary facilities will removed to the satisfaction of Holloman AFB personnel.

4.2.2 Staging, Storage, and Decontamination Areas

The construction drawings do not indicate specific locations for use as staging and storage areas. Due to the remote location of the site, the Contractor will utilize areas away from known contamination and work areas. These areas will be used for stockpiling of material, storage of equipment and supplies, maintenance operations, decontamination, and sanitary facilities, and general construction administration. Contaminated soil, fencing, and other debris will be stockpiled until sampling and analysis are completed and the results indicate the absence of contaminants. Decontamination fluids will be stored in temporary storage tanks until sampling is completed and the results indicate the absence of contaminants. If the analytical results indicate the absence of hazardous constituents, such materials will be disposed of in accordance with Section 5 of this Workplan.

Equipment and personnel decontamination areas will be established at each site. In general, heavy equipment and well drilling equipment will be decontaminated after contact with contaminated materials, prior to leaving a particular site, or after being used for clean

construction. Personnel decontamination will occur when workers leave an exclusion area as defined in the SSHP presented in Section 6 of this Workplan.

Decontamination facilities will be located in the staging areas identified in the construction drawings. The following minimum requirements and those presented in Standard Operating Procedure (SOP) B2 located in Appendix B of this Workplan, shall be adhered to when constructing and maintaining decontamination areas:

Equipment Decontamination Area

- The equipment decontamination area shall be lined with a minimum of 40-mil polyethylene lining and surrounded by a berm (railroad ties are acceptable) to create an artificial low area for capture of liquids and removed solids. Containers for storage of waste liquids shall be kept within the bermed areas prior to disposal.
- If the liner is damaged or breached during the project, it shall be repaired prior to conducting any equipment and/or debris decontamination.
- Equipment decontamination areas shall be located downwind from other site operations. If this is not possible, the areas shall be located sufficiently upwind to minimize receptor contact with overspray.
- Gross accumulations of contaminated materials on equipment shall be removed manually before steam cleaning operations can be employed. Accumulated solids shall be removed from the decontamination pad and containerized accordingly to prevent their contact with spray washings. Bulk liquid containerization methods may be employed for this project. Smaller, temporary containers may be used for intermittent storage of liquids prior to their transfer to a bulk storage container. Pumps, hoses, and containers shall be inspected prior to the transfer of any liquids to ensure their integrity and suitability for use, thereby minimizing the potential for releases or spills into the environment. Secondary containment shall be provided for all transfer lines exiting the decontamination area. Temporary berms shall be established around container holding areas during liquid transfer operations.

Personnel Decontamination Area

- The personnel decontamination area shall be located outside of the exclusion area and serve as the contamination reduction zone.
- Separate, clearly labeled containers shall be maintained in each decontamination area for disposition of uncontaminated and contaminated waste. Filled containers shall be sealed securely to prevent inadvertent releases of waste into the environment.
- Wastewater from decontamination procedures shall be containerized on a daily basis.

- The personnel decontamination area shall be kept clean; good site safety practices shall be maintained to immediately containerize wastes and store personnel equipment when not in use.
- Personnel decontamination areas shall be lined with a minimum 20-mil polyethylene liner to prevent release of contaminated washing liquids into the environment. Berms (railroad ties are acceptable) shall be placed around the decontamination area to create an artificial low area that will further help contain washwater. Containers with liquid waste shall be stored within the bermed area.

4.2.3 Miscellaneous Site Preparation

Work zones for the project shall be established in accordance with the SSHP, Section 6 of this workplan. Areas designated for this use are identified on sheet 3 of the construction drawings.

4.3 SYSTEM CONSTRUCTION

This section describes the major elements of construction of the bioventing systems. An overview of the project approach is provided for each construction element. Discussions of pertinent equipment, methods, and procedures are included in the Technical Specifications, which are included in Appendix C of this Workplan.

4.3.1 Dust Control

Operations will be conducted at the project site so as to minimize the creation and dispersion of dust. Dust controls will be used throughout the worksite, especially during excavation, handling, and transport of contaminated soil and shall be in accordance with Technical Specification - Section 01562.

Clean water (i.e., water free from salt, oil, and other deleterious material) will be used for on-site dust control. Water-spraying equipment capable of accessing all work areas will be provided. Strict dust control measures will be implemented during active construction periods on site. These control measures will generally consist of water applications that will be applied a minimum of once a day during dry weather to control dust.

4.3.2 Erosion and Sediment Control

During all phases of construction, erosion and sediment control measures will be installed, maintained, and be operated in accordance with Technical Specification - Section 01563. As

required, discharge of turbid or contaminated water shall be limited in accordance with state and local regulations. Diversion of all uncontaminated runoff from rainfall away from the contaminated areas shall be directed to the natural drainage pathways. All runoff or runon that comes into contact with stockpiled contaminated soil will be collected for analysis.

All erosion control measures (e.g., dikes, silt fences, haybales and/or temporary diversion, surface impoundments and protection works) will be constructed and maintained as necessary. Materials and control procedures will conform to the requirements of the New Mexico State Highway and Transportation Department, Section 603—Temporary Erosion & Sediment Control. This standard requires that water be removed from the construction worksites using necessary pumps, piping, and other equipment and that the work environment remain free of water as required for each aspect of the project.

Every effort to minimize erosion from excavation and backfilling operations will be made. Waterproof coverings shall be provided, installed, and maintained for stockpiled soil to prevent infiltration and contaminant transport.

4.3.3 Utility Survey and Clearance

Holloman AFB will perform a subsurface utility survey as part of the Base excavation permit approval process. Locations of subsurface utilities will be clearly demarcated prior to excavation. In addition, overhead power lines will be flagged with safety ribbon to protect against accidental contact. The Construction Project Manager will inspect the site for the presence and continuity of utility markouts. Any concerns or discrepancies with drawings or other available information will be brought to the immediate attention of the Base Project Manager and USACE Resident Engineer. Buried gas, water, power, and sewer service, if located, will remain in service and remain undisturbed by construction activity. Underground utilities, including piping and wiring, will be accurately defined on the record drawings, in both plan and depth.

4.3.4 Site Survey Control

A field survey will be performed to establish horizontal and vertical control and will locate alignment of wells, mechanical units, and piping. The primary goal of field surveying will be to ensure adherence to the construction drawings.

Field personnel will be responsible to complete Daily Log Forms and update the Construction Project Manager of any deviations from the survey controls. These updates will result in the transfer of field-generated information onto the construction drawings. The Construction Project Manager will maintain a set of project drawings for annotation based on field measurements. These annotated drawings and markups will be transferred to the project record drawings.

4.3.5 Bioventing Well Installation

Installation of the bioventing wells shall be in accordance with Technical Specification - Section 02300. The biovent wells are located to provide areal influence for the contaminated areas while minimizing the need to disturb any surface features. The North Area (SWMU 39, 127, and 135) has a 6-feet (ft) deep depression from the former location of the OWS. To avoid the expense of backfilling the pit to provide a level surface for a drill rig to install a well in the middle of the pit, biovent wells were placed at the periphery of the pit and will supply air to the soil beneath the pit. The existing chain link fence in this area will be removed during construction to allow the well and biovent pipe installation. A temporary safety fence shall be installed along the perimeter of the depression. No construction activities are planned within the depression area.

The biovent wells will connect to PVC air distribution pipe as shown on the Construction Drawings (Appendix D).

All drilling equipment and tools must be initially decontaminated upon arrival to the site. Decontamination of all tools and drill rig parts, which may potentially contact soils at the site, shall occur prior to drilling equipment use at the next sample collection interval or mobilization to the next bore hole location. This practice minimizes the potential for cross-contamination between each bore hole location.
All waste materials created during drilling activities will be stored in the designated staging area(s). The staging area location(s) for material stockpling will be determined during construction to minimize the amount of material handling required. This waste material will be sampled for contamination in accordance with the FSP presented in Section 7 of this Workplan. All drill cuttings and decontamination liquids will be disposed in accordance with the waste management requirements presented in Section 5 of this Workplan.

4.3.6 Well Plugging and Abandonment

At the North area location, the existing well IW-02 will be used for monitoring the bioventing system. Well IW-02 was installed as part of a bioventing initiative conducted in 1995. The purpose of the initiative conducted in 1995 was to determine whether bioventing was feasible at HAFB. Monitoring well IW-02 is screened in two intervals: 5 to 11 ft below ground surface (bgs) and 15 to 22 ft bgs. IW-02 was screened at two intervals so that soil gases could be measured at two distinct intervals in order to evaluate potential effects on air movement and biodegradation induced by variations in soil characteristics. However, since no laterally continuous impermeable layers are present at the site, the injection well installed during this project were continuously screened from 6 ft bgs to 21 ft bgs. This information along with data used to estimate radius of influence can be found in Appendix E. Using well IW-02 monitoring is located at a sufficient distance from the biovent injection wells such that it is anticipated that it will not be subjected to positive injection air pressure and not provide a substantive short-circuit for the bioventing system.

Two new polyvinyl chloride (PVC) monitoring wells with metal protective enclosure with hinged lockable cap will be installed within the South Area plume. The metal enclosure will protect the PVC plastic well from degradation from sunlight exposure. One well will be screened from 6 to 11 ft bgs, and the other well will be screened from 16 to 21 ft bgs. Both wells will be located close together (5 ft apart) so that monitoring data will be obtained from essentially the same areal location.

Two new PVC monitoring wells with metal protective enclosures with hinged lockable cap will be installed within the East Area plume. One well will be screened from 6 to 11 ft bgs, and the other well will be screened from 16 to 21 ft bgs. Both wells will be located close together (5 ft apart) so that monitoring data are will be obtained from essentially the same areal location.

Well plugging and abandonment will be completed in accordance with Technical Specification— 02350 and the monitoring wells will be constructed in accordance with Technical Specifications—Section 02300.

4.3.7 Piping Installation

Galvanized Schedule 40 steel pipe will be used at the blower station. For distribution of compressed air to the biovent wells, the steel pipe will transition to on-grade Schedule 40 CPVC pipe, then the CPVC pipe will transition to on-grade Schedule 40 PVC pipe, and finally the on-grade PVC pipe will connect to the PVC biovent wells. CPVC pipe has a higher temperature rating than does PVC pipe, thus CPVC pipe will be used near the blower station to dissipate heat. Details of the piping are shown on the Construction Drawings (Appendix D).

4.3.8 Equipment Pad Construction

The equipment pads will be installed in conformance with the details provided in the technical specifications and construction drawings. The concrete equipment slab will be 6-inch reinforced cast-in-place concrete with thickened edge sections and shall be constructed in accordance with Technical Specification - Section 03300. The concrete slab will be gently sloped to drain and will have a broom finish. The perimeter fence will be a 5-ft-high commercial grade fence with one double gate having a 8-ft-wide opening. The perimeter fence will be grounded in accordance with Technical Specification - Section 02830.

The main air distribution pipe, extending from the blower outlet, will branch into a pipe manifold containing three air distribution pipes for the specific well group. The pipe manifold will provide control and monitoring of well group flow rates, pressure levels, and temperature readings for the three well groups. A butterfly throttling valve will be located at the blower outlet as a means of adjusting the total system flow rate, though it is anticipated that this valve

will be normally fully open. Additional throttling valves will be provided to isolate and control flow rates to the three well groups.

4.3.9 Process Equipment and Controls

The major process equipment to be installed at the FT-31 Site is limited to the bioventing blower. The blower will be capable of being mechanically adjustable, in the field, to achieve a range of operating flow rates utilizing the original blower and single-speed motor. Belt-driven blowers are capable of operating at multiple speeds by replacing the blower and/or motor sheaves. Multiple blower speeds will result in the capacity to achieve multiple performance curves, thereby accommodating a range of operating conditions. A belt-driven positive displacement rotary lobe blower meets the design criteria and shall be constructed in accordance with Technical Specification - Section 15700.

The blower system will include instrumentation and controls capable of monitoring the inlet pressure filter, discharge pressure, and discharge air temperature. These controls will shut the system down when the blower operates beyond normal operating parameters. The blower system will require a manual restart, if it is disengaged, due to pressure monitoring controls. The blower will have a manually adjustable pressure relief valve and tee for a low pressure switch installation on the discharge silencer. These controls will be used to monitor system operating pressure. Process design details are contained in Appendix E, the Design Report. Each bioventing well will be throttled by butterfly valves at the wellheads to allow independent control and system balancing. The proposed FT-31 Site bioventing system layout, well locations, equipment details, and blower station details are shown in the 100 Percent Technical Specifications and Construction Drawings, dated April 5, 1996, and are located in Appendix C and D, respectively, in this Workplan.

The air injection rate at the wellhead for each biovent well will be maintained at approximately 19 standard cubic feet per minute (SCFM). Pressure at the wellhead for each biovent well will be maintained at approximately 3.5–4.5 pounds per square inch gauge (psig). The blower system discharge will be maintained at 500 SCFM and the pressure at the blower outlet will be

maintained at a maximum of 5.1 psig. The estimated "k" air permeability value was previously discussed and evaluated extensively as a part of the *Draft Bioventing Initiative for Sites FT-31 and SD-47* (EBASCO/GTI 1995). The air permeability value, was calculated in Appendix H at a value of 2.5 darcy. The calculated estimate of 2.5 darcy is approximately two orders of magnitude less than the laboratory results for air permeability (0.018 darcy at the 7.5 ft depth and 0.062 darcy at the 18 ft depth). The difference is primarily attributed to highly transmissive lens interbedded in between the two depths sampled for laboratory testing.

The inlet air filter will be provided with a pressure differential switch, which will stop the blower when the filter's differential pressure indicates that the filter is beginning to foul. Pitot tubes or equivalent in-line pressure transmitting devices will be mounted in the inlet air stream across the in-line filter. A temperature switch, located just downstream of the blower discharge, will shut down the blower when a preset high temperature is detected. This is needed to prevent blower air temperatures exceeding 165°F from being injected into the subsurface, which may affect the biological remediation process or sterilize the soil.

The blower motor starter will be fitted with a run time indicator. Run time information will be used to schedule and perform maintenance activities, such as adding or changing inlet air filters, lubricating oil, bearing grease, and drive belts, and to document actual run time. The fence surrounding the blower station will be provided with slats to reduce equipment exposure to blowing sand. The belt and sheaves will be provided with a protective jacket.

4.3.10 Utility Connections

All final utility connections and equipment wiring will be coordinated and sequenced with the mechanical and electrical trades. The electrical power source requirement is 480-volt (V), three-phase, which will require an extension to the FT-31 Site. A step-down transformer will be installed and supply a minimum electrical capacity of 30 kilovolt-amps (kVA). A 480Y/277 drop line will be provided from the power/light pole to be installed next to the blower station on the equipment pad.

A fusible safety switch with lightning arrestor will serve to disconnect incoming 480 V, alternating current (ac) power to the site. A mini-power center and combination NEMA Size 2 motor starter will serve to provide electrical power to the blower motor, a Ground Fault Circuit Interrupting receptacle, and site lighting. The best location for the electrical tie-in on the 13.2 kV line, located south of the FT-31 proposed site, will be determined by the electrical subcontractor as part of the electrical transmission design. This design and installation will be coordinated with the Civil Engineering Commands electrical shop to determine the location best equipped for the electrical tie-in.

Lighting for the site shall be provided by a 250 watt High Pressure Sodium Lamp. The lamp shall be fitted on a 6 foot arm, mounted to the electrical pole contained within the site perimeter. Power and circuit breaker control for the lighting system shall be provided by the mini-power center, with local control being provided by a photoelectrical cell.

4.3.11 Site Restoration

Once the work is completed, the FT-31 Site will be restored to preconstruction conditions. Trenched or excavated areas will be restored and graded to the adjacent and surrounding existing surfaces.

4.3.12 System Startup and Operations

Following equipment procurement, a detailed procedure will be prepared by Foster Wheeler Environmental prior to startup of the equipment that will include procedures and schedules for system performance monitoring and tracking. The startup procedure will be submitted as an addendum to this Workplan. The O&M manual will be provided by the equipment manufacturer to ensure the proper testing and operation of the systems. The performance of the bioventing system will be monitored during operations to verify continuing bioremediation of the subsurface contamination and optimal operating conditions.

Initially pressures and flow rates throughout the well system will be monitored to document adequate well coverage. As airflow is initiated and the wells are sequentially activated, pressures in the remaining wells will be observed and recorded. In addition, after all of the biovent wells are operational, pressures and airflow rates will be observed and recorded in the monitoring wells located throughout the site.

Progress of remediation will be tracked by turning off the air flow to each area on a monthly basis and recording the rate of oxygen consumption (decline). This test will be conducted in accordance with standard bioventing respirometry testing protocols as referenced in the *Test Plan and Technical Protocol for a Field Treatability Test for Bioventing*, by R. Hinchee and S. Ong, Battelle, Columbus, Ohio; R. Miller, U.S. Air Force, Center for Environmental Excellent, Brooks Air Force Base, Texas; D. Downey and R. Frandt Engineering-Sciences, Denver, Colorado. Comparison of the monthly respirometry data will detect any problems and eventual achievement of cleanup goals and document the remedial progress at the site.

If determined to be absolutely necessary, nutrients (primarily nitrogen and phosphorus) may be added to the sites to facilitate bacterial growth. Nutrients may be added via surface liquid application or gaseous subsurface injection using the blower. Specific requirements for nutrient addition and sampling requirements will be addressed in the Start-up, Operations, and Maintenance Manual.

After a year of operation, subsurface soil test samples will be collected from each site to document in-situ remediation progress and assess continued operational requirements. If bioventing continues beyond the first year, sampling will probably be conducted on a quarterly or bi-annual cycle until it can be confirmed that cleanup goals have been achieved.

4.4 DEMOBILIZATION

This section discusses final cleaning, inspection, and other procedures necessary for demobilization. Demobilization consists of decontaminating of all equipment, cleaning the project site, inspecting, and filling out the certification of completion. Final decontamination consists of decontamination and removal of all construction equipment and materials as well as collection and disposal of all contaminated material, including decontamination water and equipment on the site for which decontamination is inappropriate.

Decontamination of heavy equipment will consist of degreasing, if required, followed by highpressure water and/or steam cleaning supplemented by detergents or solvents as appropriate. Special attention will be paid to removal of material on and within the undercarriage and sprockets of crawler equipment, and undercarriage, tires, and axles of trucks and rubber-tiremounted equipment. Tools and items for which decontamination is difficult or impossible to verify (e.g., wire, rope, lumber) will remain on site until completion of the work, at which time they will be packed and disposed of at an approved treatment, storage, and disposal facility (TSDF).

Prior to removal from site, all decontaminated equipment and material will be inspected and accepted by the Construction Project Manager. A copy of each decontamination certificate will be provided to USACE and Holloman AFB, if requested. The original certificate will be maintained in the project file.

Site cleaning work will include repair of any erosion or runoff-related damage, grading and landscaping of all areas used for construction, removal of all debris (e.g., excess construction material, wood, debris, and other foreign material), and removal of all construction equipment.

5.0 <u>REGULATORY COMPLIANCE PLAN</u>

The RCP contains of the following sections. Section 5.1 provides an introduction to the project and regulatory requirements and lists the regulated activities. Section 5.2 provides a description of the wastes expected to be generated during project activities. Section 5.3 addresses waste management activities. Sections 5.4 and 5.5 provide spill-release reporting and training-certification requirements, respectively. Section 5.6 provides policies and procedures for inspection of the project by regulatory agencies and third parties. Section 5.7 details documentation and records retention for project activities. Section 5.8 discusses the procedures for updating the RCP in the event of changes in project activities or applicable regulations.

5.1 INTRODUCTION

This RCP has been specifically developed to identify necessary regulatory requirements applicable to constructing the FT-31 bioventing system at Holloman AFB, New Mexico. The RCP details waste management practices and training requirements that are necessary to store and dispose expected materials that will be generated during the installation of the bioventing system at the FT-31 Site, with regard to drilling, trenching, and well completion activities.

In addition, a secondary goal of the RCP is to minimize, to a practical extent, the volume of waste which will be generated, stored, and removed from the site for disposal. In order to minimize the volume of waste, the following general rules will be applied:

- Do not contaminate materials unnecessarily.
- Plan work ahead, based on the work procedure to be used.
 - Take only the material (i.e., chemicals) needed to perform the work activity.
 - Additional material can be brought to the work location if it is found to be necessary.
 - Materials can be stored in large containers but the smallest reasonable container will be used to transport the material to the location where it is needed.
 - Maintain cleaning and extra sampling supplies outside any potentially contaminated area to keep them clean and to minimize additional waste generation.
 - Maintain or construct prefabricated materials, barriers, support equipment, etc., outside potentially contaminated areas.
 - Perform mixing of detergents or decontamination solutions outside potentially contaminated areas.
 - Do not place media considered hazardous for different reasons together.

- Use drop cloths or other absorbent material to contain small spills or leaks.
- Avoid a bellows effect when double-bagging contaminated materials.
- Use containers to minimize the spread of contamination.
- Do not place contaminated materials with clean materials.
- Cover wooden pallets inside the exclusion zone with plastic.
- Decontaminate and re-use material and equipment when practical.
- Use volume reduction techniques when practicable.
 - Verify that waste containers are solidly packed to minimize the number of containers.
 - Use only the size of container to meet needs (i.e., do not use a drum or garbage can when a small polyethylene bag will do).
 - Use less hazardous substances whenever possible (i.e., bring only the volume of standard solutions needed for testing, use minimal amounts of decontamination water and solvent rinses).

5.1.1 <u>Regulatory Framework</u>

Holloman AFB is actively conducting an environmental restoration program. Remedial activities at Holloman AFB are subject to several environmental regulatory program requirements. Initially, the program was managed under the Air Force's IRP but was later integrated with EPA Resource Conservation and Recovery Act's (RCRA) corrective action program. The IRP was established to investigate past hazardous waste disposal sites at Department of Defense installations. The IRP generally follows the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA).

Under the RCRA permit, Holloman AFB operates an on-site hazardous waste storage facility. Because of the facility's operating permit, the Base is subject to the RCRA corrective action program. The Hazardous and Solid Waste Amendment (HSWA) portions of the RCRA permit require that Holloman AFB investigate SWMUs identified in the 1988 RCRA Facilities Assessment (RFA). The HWSA permit divided the Base's 113 SWMUs into three separate tables on the basis of their perceived risk to human health and the environment. The SWMUs believed to have the highest potential risk were included on Table 1 of the HSWA permit, while SWMUs believed to have reduced risk were placed on Tables 2 and 3. The 113 units listed in Tables 1, 2, and 3 of the permit must comply with the approved schedules for implementing the Base's corrective action program. SWMU's 170 and 171 are listed in the Holloman AFB Management Action Plan (MAP) (revised December 1995) as Table 1 Sites and SWMUs 39, 127, and 135 are listed as Table 2 SWMUs. The FT-31 Site is a designated IRP Site.

The waste management practices described herein are based on the data generated in the Phase II RCRA Facility Investigation (RFI) data (Final RCRA RFI Table 1 Solid Waste Management Units (Vol. 1), Foster Wheeler Environmental/Radian June 1997). According to the RFI, petroleum-contaminated soil (PCS) in excess of applicable Holloman AFB remediation standards has been identified in the Phase II RFI conducted at Holloman AFB. Consequently, the primary regulatory driver for this remedial project is the New Mexico solid waste regulations pertaining to the remediation of PCS (i.e., TPH and benzene). As appropriate, the Base must comply with both the IRP and RCRA corrective action programs. Both are similarly phased and ultimately intended to ensure that contaminated sites such as Site FT-31 that pose a threat to human health or the environment are remediated.

The preamble of U.S. Environmental Protection Agency's (EPA's) proposed RCRA Subpart S regulations encourage coordination between the two independent programs. Because its HSWA permit was issued by the EPA, Holloman AFB has integrated the two programs to reduce duplicative efforts. This approach has been endorsed by both EPA Region VI and the NMED.

5.1.2 <u>Regulated Site Activities</u>

The following actions are addressed in this Workplan and are applicable to all Site FT-31 construction activities. The anticipated regulated activities are as follows:

- Construct and install a soil bioventing system at Site FT-31 site, i.e., drilling and trenching, and well completion activities associated with project (requires that a Holloman AFB drilling/digging permit be obtained prior to start of activities).
- General—Sample decontamination water and soil and perform chemical analysis for characterization, management, and disposal purposes.
- Transportation and Disposal of Wastes Assist Holloman AFB with disposal and transportation of any hazardous or special wastes resulting from Site FT-31 construction-related activities.

5.1.3 <u>Regulatory Requirements</u>

Project activities are potentially expected to generate nonhazardous waste, NMED-regulated special wastes, and hazardous wastes. As such, the following federal and state regulations are applicable and must be complied with during implementation of planned project activities:

- 40 Code of Federal Regulations (CFR) Parts 190-256 EPA regulations for Solid Waste
- 40 CFR Parts 260—299 EPA Regulations for Identification and Management of Hazardous waste
- 49 CFR Parts 100—178 Department of Transportation (DOT) Rules For Hazardous Materials Transport
- New Mexico Solid Waste Management Regulations
- New Mexico Hazardous Waste Management Regulations
- New Mexico Air Quality Control Regulations
- New Mexico Water Quality Control Commission Regulations
- New Mexico Underground Storage Tank Regulations

As previously indicated, the purpose of this project is to achieve site closure objectives, through bioventing of subsurface soils to reduce petroleum-contamination to required levels while minimizing air emissions, in as a timely and cost-effective method as possible. The following information is provided with respect to management and disposal for waste streams generated as part of the construction activities. The volume of regulated soil will be minimized using on-site analytical testing and field screening techniques.

A more detailed discussion of the specific remedial activities to be implemented during the project is presented in Section 4 of this Workplan. The clean up levels have been defined and identified in the Holloman AFB MAP dated December 1995. Table 5-1 summarizes the clean up levels (i.e., risk-based concentration levels for industrial-use sites) for applicable site identified hazardous constituents determined to be present at Site FT-31. Industrial use levels were selected based on current and anticipated land use for this site. These levels are derived from the following two sources:

• Various NMED correspondence to Holloman AFB confirming negotiated remediation standards for Holloman AFB [e.g., total petroleum hydrocarbons (TPH) in soil standard].

• EPA Region III, Risk-Based Concentration Table (EPA 1995 for residential and industrial sites).

These standards are currently being used at Holloman to determine the need for remedial actions. In addition, Holloman AFB has an agreement with NMED regarding the remediation of TRPH contaminated soil. If the contamination, measured as a TRPH concentration in the soil, is less than 1,000 mg/kg, then NMED requires that no further action be taken. The agreed upon clean up levels applicable to PCS and groundwater at Holloman AFB as established by the NMED are as follows:

- For PCS, TRPH < 1,000 milligrams per kilogram (mg/kg) and benzene < 25 mg/kg
- Removal of Light Non-Aqueous Phase Liquid (LNAPL) from groundwater

Excavated soil and drill cuttings with TRPH concentration greater than 1,000 mg/kg will be disposed off-site at an approved New Mexico special waste disposal facility as required under NMED regulatory requirements.

Because of the high total dissolved solids (TDS) concentration in groundwater at the Base, there are no applicable dissolved groundwater standards. However, Holloman AFB has an agreement with NMED that NMED groundwater standards are applicable to any discharge of water to the ground and a Notice of Intent to discharge (NOI) is not required provided that the water discharged meets the NMED groundwater discharge standards.

Table 5-1Site Cleanup Levels Applicable at Holloman AFB

METHOD	PARAMETER	SOIL CONCENTRATION (mg/kg)
Modified EPA 8015/418.1	ТКРН	\geq 1,000 ⁽¹⁾
EPA Method 8240: Volatile Organic Compounds	Benzene	200 ⁽²⁾

(1) NMED USTB Correspondence to Holloman AFB, dated November 2, 1992.

(2) EPA Region III, Risk-Based Concentrations - industrial use (EPA 1995).

5.2 PROJECT WASTE DESCRIPTIONS

The section presents information regarding the types of waste streams that are anticipated to be generated during Site FT-31 remedial activities and a description of each waste stream identified.

5.2.1 Anticipated Waste Streams

The anticipated waste streams associated with FT-31 Biovent System construction activities can be categorized as follows:

- Contaminated and uncontaminated drill and trench cuttings
- Decontamination fluids used to decontaminate field equipment and
- Personal protective equipment (PPE)

In addition to the waste descriptions below, Table 5-2 presents detailed waste management, transportation, and disposal requirements for each waste category.

5.2.2 <u>Waste Descriptions</u>

The following descriptions pertain to contaminated drill/trench excavated soils, decontamination fluids, and disposable PPE.

Contaminated Drill/Trench Material

Contaminated soil will consist of soil generated during drilling and trenching activities. As construction activities are conducted, PCS from drilling and trenching activities will be segregated on the basis of visual and olfactory observations and a combination of photoionization detector (PID) field headspace screening used in conjunction with immunoassay testing. In addition, existing analytical and historical process knowledge and any information that identifies the potential presence of characteristic hazardous constituents will also be used for waste characterization purposes. For field screening purposes, a PID will be used to identify potential PCS with a screening level of 100 ppm. Soil identified as greater than 100 ppm will be segregated and stored as potential PCS. The stockpiled soil will then be sampled and tested for TPH using an immunoassay test kit. Soil identified as potential PCS through immunoassay testing will be sampled for off-site laboratory TRPH analysis using one composite sample per

TRANSPORTATION DISPOSAL WASTE CHARACTERIZATION APPLICABLE ALLOWABLE STORAGE REQUIREMENTS TYPES REQUIREMENTS REGULATIONS CONTAINMENT REOUIREMENTS REOUIREMENTS EIB/HWMR-7 Part II.201 and Part Hazardous waste manifest If a HW, must be disposed at an Soil Need to determine whether Department of Transportation 90 day storage limit if approved off-site RCRA TSDF baving excavated soil is a hazardous waste. III.301 - "Identification & Listing of (DOT) approved 55 gal. determined to be a DOT placarding. Must use an Run total analysis¹ for benzene and EPA permitted transporter. approval to receive CERCLA off-site Hazardous Waste" and "Stds. metal drums (1A1 or 1A2) hazardous waste. lead. Applicable to Generators of waste or DOT approved portable Hazardous Waste." tanks (DOT 51,52,53,56,57 Must also have LDR Need to determine whether excavated soil Must be labeled with a certifications as necessary. PCS special waste can only be and 60). Must be sealed is a New Mexico Environment Department 40 CFR 268.48 - Land Disposal when not being filled/unloaded. completed hazardous 40 CFR 262 Subpart C disposed in an approved off-site solid waste facility authorized for (NMED) special waste, i.e., petroleum Restriction (LDR) - Universal waste label. contaminated soil (PCS). 100 ppm will Treatment STDs (UTS) Can be stored temporarily PCS shipped off-site must be special wastes. be used as a PID screening level. An on-site in a bermed area Maximum on-site accompanied by a NMED Special Waste manifest. **PCSspecial waste containing free** on an impermeable liner. storage for PCS special immunoassay test will be run on PID 40 CFR 262 - Generator STDs. waste is 45 days. Containers must be labeled liquid cannot be sent to a landfill and identified stockniled soil > 100 ppm. then covered or stored in a indicating contents and the must pass the paint filter test EIB/SWMR-4 Part VII "Special manner that will not Immunoassay tested soil greater than 1,000 ppm will be managed as PCS Waste Requirements Sections 701, contaminate environmental Storage clock starts from potential health, safety, and before it can be landfilled. 702, 703, 704, 708, and 712. the date that waste is first environmental hazards requiring confirmatory analytical testing. media, i.e., soil, ground and Regulatory Affairs Advisor (RAA) surface water. put into the container. associated with the waste. must approve TSDF and trans-If generator knowledge used in Individuals involved in overseeing porter prior to shipment of waste. lieu of analysis supporting or shipping hazardous materials documentation must be maintained. must meet HM-181 & HM-126F training requirements. If a HW, must be disposed at an EIB/HWMR-7 Part II.201 and Part Hazardous waste manifest Need to determine whether DOT approved 55 gal. (bunghole-90 day storage limit if Decon approved RCRA TSDF having been Water decontamination water is a III.301 - "Identification & Listing of type) metal drums (1A1 or 1A2) determined to be a DOT placarding. Must use an approved CERCLA off-site waste. hazardous waste. Run a VOC Hazardons Waste" and "Stds. or DOT approved portable hazardous waste. EPA permitted transporter. tanks (DOT 51,52,53,56,57 Must be labeled with a Must also have LDR analysis using EPA Method 8260A. Applicable to Generators of Hazardous Waste." and 60). Must be sealed completed hazardous certifications as necessary. If not a HW, may dispose of into Base's WWTF or to a designated when not being filled/unloaded. waste label. Also need to determine whether wastewater treatment unit, i.e., an OWS water contains free oil, is corrosive or 40 CFR 268.48 - LDRs (UTS) Individuals involved in overseeing approved in advance by HAFB personnel. Storage clock starts from or shipping bazardous materials ignitable, or can generate toxic fumes must meet HM-181 & HM-126F if being discharged to a WWTF. 40 CFR 262 - Generator STDs. the date that waste is first put into the container. training requirements. RAA must approve TSDF and transporter prior to shipment of EIB/SWMR -4 "Solid Waste Management Regulations." waste. Dispose at approved landfill. Disposable Decontaminated PPE will be handled EIB/SWMR -4 "Solid Waste Double plastic bags. Once bagged, keep None Personal as a SW and no analysis required. Management Regulations." separate from other waste. Protective Equipment If not decontaminated then If a HW, must be disposed at an EIB/HWMR-7 Part II.201 and Part DOT approved 55 gal. 90 day storage limit if (PPE) need to determine whether III.301 - "Identification & Listing of metal drums (1A1 or 1A2) determined to be a DOT placarding. Must use an approved CERCLA offsite TSDF. the PPE is a bazardous waste or not. Hazardous Waste" and "Stds. or DOT approved portable hazardous waste. EPA permitted transporter. Applicable to Generators of tanks (DOT 51.52.53.56.57 Must be labeled with a Must also have LDR Can run total analysis¹ or a TCLP. certifications as necessary. RAA must approve TSDF and Hazardous Waste." and 60). Must be sealed completed hazardous when not being filled. waste label. transporter prior to shipment of

Table 5-2. WASTE MANAGEMENT REOUIREMENTS. FT-31 PROJECT

NOTE:

40 CFR 262 - Generator STDs. 1) If a total analysis is chosen and the results indicate that a constituent is more than 20x the appropriate TC level then a TCLP will have to be run.

40 CFR 268.48 - LDRs (UTS)

40 CFR 261.7 - RCRA Empty

container rule.

If a container involved and

is "empty," i.e., < 1 " liquid

then container is not a HW

Storage clock starts from

the date that waste is first

put into the container.

Individuals involved in overseeing

or shipping hazardows materials

must meet HM-181 & HM-126F training requirements.

waste.

each 100 cubic yards of PCS stockpiled. PCS having a confirmed TRPH concentration greater than 1,000 mg/kg will be disposed at an approved off-site special waste landfill.

Soil from construction activities at the site is generally considered usable for grading and backfill purposes, provided that the TRPH concentration is less than 1,000 mg/kg. Consequently, soilthat is not identified and confirmed to be PCS will be placed in the trenches as backfill material and in the case of drill cuttings be put back into borehole if possible or spread evenly around the borehole or a designated area.

Although no generation of RCRA hazardous waste is anticipated, if characterization indicates that the affected soil is a hazardous waste, the waste will be temporarily stored in a roll-off container to be later disposed of at a fully permitted RCRA Subtitle C facility that is in compliance with EPA's CERCLA Off-Site Rule requirements for Subtitle C facilities. The facility must meet land disposal restriction (LDR) requirements and must provide treatment of wastes prior to disposal as required under the LDR. Prior to shipment, a brief review will be conducted by the Regulatory Specialist (RS) to determine disposal facility compliance with the CERCLA Off-Site Rule.

Decontamination Water

Equipment will be decontaminated as described in this Workplan. Decontamination water will be containerized in drums or tanks and will be sampled, analyzed, and characterized prior to disposal. If decontamination water analysis indicates that no hazardous waste is present and the water meets NMED groundwater discharge standards it can be discharged to the ground. If the analysis indicates that constituent levels are above NMED groundwater standards and that the decontamination water is not a hazardous waste it will be discharged to the Base wastewater treatment facility. An alternate disposal method would be to discharge the decontamination water at a designated OWS or to the Holloman AFB wastewater treatment facility. Wastewater that is characterized as a hazardous waste will be disposed of at an approved, fully permitted RCRA Subtitle C TSDF.

<u> PPE</u>

Protective clothing and sampling equipment is typically collected on a daily basis in plastic garbage bags and disposed in a drum or storage container dedicated for this type of waste. Personal protective equipment worn by observers or other site personnel who do not come in any contact with contaminated media can be disposed of as domestic waste. Properly decontaminated PPE, clothing, and/or miscellaneous sampling equipment solid wastes may be considered nonhazardous. If disposable PPE and equipment are used to manage characteristic hazardous waste, the PPE itself should be managed as a solid waste unless extremely contaminated. The proposed classifications will be reviewed and approved by Holloman AFB.

5.3 WASTE MANAGEMENT ACTIVITIES

This section provides a discussion as to how waste generated during remedial activities will be characterized and classified. Also discussed is how identified hazardous waste and New Mexico special waste will be managed, contained, and stored while on-site. Figure 5-1 presents a waste management logic diagram for the management of FT-31 remedial activity waste streams.

5.3.1 Waste Characterization/Classification

All waste streams including but not limited to PCS and decontamination water will be sampled and characterized in accordance with 40 CFR 262.11 and in the case of PCS, New Mexico's Environmental Improvement Board's Solid Waste Management Regulations (EIB/SWMR4-704), which require the generator to determine if a solid waste is a listed or characteristic hazardous waste or a New Mexico special waste. To meet these testing requirements, representative samples will be taken in accordance with federal and New Mexico Hazardous Waste Management Regulations (HWMR) and Solid Waste Management Regulations (SWMR). Waste streams including but not limited to soils and decontamination water destined for off-site disposal will be sampled and/or characterized in accordance with 40 CFR 262.11 and New Mexico's HWMR as indicated in the FSP (Section 7) and QAPP (Section 9).

To determine proper waste management requirements for waste generated during construction activities, hazardous waste characterization is necessary. Wastes are determined to be characteristically hazardous on the basis of their chemical constituents or physical properties.

FIGURE 5.1 DECISION PROCESS DIAGRAM IRP SITE FT-31, FORMER FIRE TRAINING AREA BIOVENTING SYSTEM WASTE MANAGEMENT





Listed wastes are specifically identified in 40 CFR 261 Subpart D. Based on process knowledge and existing-supporting data, as established in the FT-31 RFI, no hazardous constituents have been identified in soil in excess of site screening levels or established background levels with the exception of TRPH and BTEX contamination.

Characteristic hazardous waste are those wastes that exhibit toxicity in excess of the values indicated in 40 CFR 261 Subpart C. An exceedance of a toxicity characteristic is generally determined through the wastes constituent concentration comparisons with listed Toxicity Characteristic Leaching Procedure (TCLP) regulatory levels. In lieu of performing a TCLP test, a total analysis of a waste may instead be performed to indicate that individual analytes are not present at concentrations greater than 20 times the listed toxicity characteristic values for TCLP analytes. The 20 times value above is related to the dilution factor used in the TCLP test. Consequently, TCLP analyses may not have to be performed if the total value is less than 20 times the indicated regulatory level for a particular constituent.

Because the RFI data indicates that the only TCLP analyte of concern present at FT-31 is benzene which is below the regulatory threshold level to be a characteristic hazardous waste, a total analysis for benzene in soil will be used. Although some volatile organic constituents were detected in the Phase II RFI, soil determined to be a PCS will be analyzed for benzene and lead only as indicated in Table 5-3. The analysis is based on NMED's policy regarding Holloman AFB, as identified in NMED correspondence dated May 15, 1995 from Ed Kelly, Director Water and Waste Management Division to Howard Moffit, Deputy Base Civil Engineer on the basis that the RFI data indicates that RCRA hazardous constituents present in the soil are well below the calculated risk-based levels for those constituents. Also, a volatile organic compound (VOC) analysis for EPA Method 8260A constituents will be used to characterize decontamination water to determine whether the water can be discharged on-site or whether it has to go to the wastewater treatment facility (WWTF).

Constituent	RFI Data (Max) mg/kg	TC Regulatory Levels mg/L	EPA Region III Industrial RBC Levels
TRPH	11,500	NA	1,000 (NMED Standard)
Benzene	2.2	0.5	200*

Table 5-3IRP Site FT-31 RFI Soil Data Summary

* There is a 25 mg/kg benaene Standard associated with the 1,000 mg/kg TRPH Standard.

Waste testing necessary to characterize and manage wastes generated during remedial activities has been reduced by using RFI-generated analytical data. Consequently, testing requirements for hazardous waste and special waste classification as presented in the FSP and QAPP have been established to include the following testing protocols:

- TRPH (for PCS)
- Volatile Organic Compounds for decontamination water (all EPA Method 8260A constituents) and soil (benzene only) going off-site (based on applicable organic constituents of concern identified in the RFI)
- Lead for soil going off-site.

Sample analytical results for benzene will be compared against the toxicity characteristic (TC) levels listed in Table 5-3 to establish the presence of characteristic hazardous wastes. Documentation of all proposed waste classifications will be provided to Holloman AFB.

5.3.2 Hazardous Waste Management

New Mexico's HWMR are found in EIB/HWMR-7. RCRA Subtitle C and the New Mexico HWMR govern hazardous wastes from the point of generation, through treatment and storage, to its ultimate disposal. The NMED Hazardous Waste Bureau oversees management of the hazardous waste program in New Mexico.

Hazardous waste must comply with the following requirements:

- Any waste generated during FT-31 construction activities that will be shipped off-site for disposal must be characterized to determine if it is a hazardous waste. Based on RFI data, testing will be limited to a total analysis for both benzene and lead for PCS soil and VOC analysis for decontamination water and for soil benzene and lead.
- Hazardous waste must be managed in accordance with 40 CFR 262 "Standards Applicable to Generators of Hazardous Waste."

- Hazardous waste transported off site must be manifested in accordance with 40 CFR 262 Subpart B "Manifests" and accompanied by LDR certification notices as per 40 CFR 268.7 "Waste Analysis and Recordkeeping."
- Hazardous waste must be stored in accordance with 40 CFR 265 Subpart I "Use and Management of Containers."
- All containers of hazardous waste to be stored or disposed will be clearly marked with a completed hazardous waste label, indicating the starting date of accumulation, EPA identification number, EPA waste code, etc., and DOT markings.
- Hazardous waste may be stored on-site for a maximum of 90 days. The 90 days begin on the date that the waste is first generated and containerized (i.e., the first drop of waste is in a container).
- Hazardous waste must be disposed only at a permitted hazardous waste disposal facility permitted for the disposal of the particular type of hazardous waste generated.

5.3.3 New Mexico Special Waste Management

New Mexico Special Waste Regulations are found in EIB/SWMR-4. Management of special wastes is under the control of the NMED Solid Waste Bureau.

With regard to this project, defined New Mexico Special Wastes, i.e., solid wastes that have unique handling transportation, or disposal requirements to assure protection of the environment and the public's health and safety which for the Site FT-31 project include PCS.

As previously discussed, for Holloman AFB, New Mexico has defined PCS as special waste if the TRPH concentration is greater than 1,000 mg/kg and benzene is greater than 25 mg/kg.

Special wastes must comply with the following requirements:

- Special wastes must either be treated prior to disposal and/or isolated in their disposal to ensure a minimum of exposure to the public.
- All special wastes must be disposed only at solid waste facilities permitted for disposal of special wastes.
- All special wastes must be manifested in accordance with Section 712 of the New Mexico Special Waste Requirements Regulations.
- Storage of special wastes will occur only at an approved special wastes storage area in a bermed area containing an impermeable membrane liner. Special wastes will not be stored longer than 45 days, unless approved in advance by the NMED.
- All containers of special wastes to be stored or disposed will be clearly labeled, indicating the contents and potential health, safety, and environmental hazards associated with the waste.

- The physical and chemical characteristics of all special wastes will be documented prior to storage, transportation, or disposal, by means of the following:
 - Records of the results of analysis performed in accordance with Section 704 as applicable.
 - Detailed descriptions of the generator's knowledge of specific wastes.

Transporters of any type of waste must be registered with the NMED Solid Waste Bureau.

5.3.4 Waste Containerization and Storage

Container selection will be performed by DOT-trained personnel, based on type and quantity of waste to be generated. Containers may include either DOT-specification drums or rolloffs for regulated hazardous material. DOT-specification containers are not required for material that does not meet a DOT hazard class (such as PCS, which may be transported in a dump truck).

Prior to starting remedial activities, the Foster Wheeler Environmental Site Manager will, in conjunction with Holloman AFB personnel, select areas for the temporary staging and storage of non-regulated soil, PCS, decontamination fluids, and hazardous waste.

Based on visual inspection and field screening using a combination PID and immunoassay test kit approach (using a 100 ppm PID and a 1,000 ppm immunoassay stockpile screening value), soil will be segregated into petroleum-contaminated and non-PCS categories. PCS will be stored within a temporary protected (lined) bermed area. Soil identified as potentially being a hazardous waste will be stored in drums or rolloffs. PCS may be stored on site for up to 45 days. Soil determined to be a hazardous waste may be stored for up to 90 days.

Waste material must be classified according to EPA and DOT criteria prior to affixing labels. Upon classification, the RS will direct the application of appropriate hazardous/nonhazardous waste and DOT labels, complete with proper information specific to each waste stream. Each container will be marked and labeled as required by EPA and DOT, if applicable. All DOT functions will be conducted by trained personnel as required by 49 CFR 172 Subpart H. PCS stockpiles will also be labeled as to contents by placing a label on the liner.

At the time of generation, all waste containers will be labeled, using indelible ink, with the following information:

- Source and location
- Contents and quantity of material in the container
- Potential health, safety and environmental hazards
- Accumulation start date (the date the first drop of material was put in the container)
- Date container sampled
- Parameters analyzed for
- "ANALYSIS PENDING POTENTIALLY HAZARDOUS"

Containers determined to contain hazardous waste will immediately be labeled with a completed commercial EPA "HAZARDOUS WASTE" label, which will include the accumulation start date and other requested information.

Excavated soil stockpiles and/or rolloffs containing confirmed PCS shall be labeled using the following format:

"Petroleum-Contaminated Soil" Origin: Drill/Trench Cuttings-Petroleum Hydrocarbons Contaminated Soils-Gasoline, Diesel, Jet Fuel (which ever applies) Concentration: _____ parts per million TRPH

All hazardous waste will be stored on wooden pallets in DOT-approved containers at Holloman AFB's 90-day storage facility or the Defense Reutilization and Marketing Office (DRMO). The area will be secured with a standard Holloman AFB chain link fence, and a sign reading "DANGER-UNAUTHORIZED PERSONNEL KEEP OUT" will be posted at the entrance and on all sides of the enclosure. An inventory of waste containers will be maintained for later submittal to and inspection by the USACE and Holloman AFB.

Containers of hazardous waste will be inspected and logged weekly while the field work is in progress. Inspection will encompass evaluation for proper labeling, secure closure, the condition of each container, number of containers, and condition of the storage area. Any signs of deterioration, leaking, or dents will be noted, and containers will be immediately overpacked, if necessary. Standing water will be removed from the containment area as necessary. Inspection

results will be provided to the USACE and Holloman AFB. The containers will be transferred over to Holloman AFB after waste characterization, as defined in this Section.

Figure 5-2 presents a typical hazardous waste label. All containers will be checked to ensure labels and markings are in good condition. DOT information for hazardous materials, including proper shipping descriptions and hazard class labels, will be added prior to shipping.

Disposal of soils and liquids will be as follows:

Petroleum-impacted soil with TRPH concentrations less than 1,000 mg/kg will be used as backfill in trenches or spread around borehole locations or designated areas. PCS will be transported off site to a special waste landfill for disposal.

As previously indicated, RCRA hazardous wastes will be sent either to the Holloman AFB 90day storage area or the DRMO RCRA storage facility and then to an off-site TSDF, which has been approved by the Base and USACE.

5.4 REPORTING SPILLS AND RELEASES

Precautions shall be taken to prevent oil and hazardous material spills, including daily inspection by the site personnel of equipment, structure(s), and containers. Personnel using hazardous material will inspect the container before and after use. In the event of a spill/release, Warren Neff, Holloman AFB Fire Department, and USACE will be immediately notified. Spill response will be in accordance with federal, state, local, and Holloman AFB regulations.

Emergency Response

Emergency response procedures are specified in the Holloman Air Force Basewide Health and Safety Plan (Dec. 95).

Figure 5-2 HAZARDOUS WASTE LABEL

	ARDUUS
VV	ASIE
FEDERAL LAW PR	ROHIBITS IMPROPER DISPOSAL
IF FOUND, CONTACT T AUTHORITY, OR THE U	HE NEAREST POLICE, OR PUBLIC SAFETY S. ENVIRONMENTAL PROTECTION AGENCY.
GENERATOR INFORMATION:	
NAME	
ADDRESS	PHONE
CITY	STATE ZIP
EPA /MANIFEST 10 NO./ DOCUMENT NO	·/
ACCUMULATION START DATE	EPA
Г	-
L D.O.T. PROPER SHIP	PIN'S NAME AND UN OR NA NO. WITH PREFIX

Client Notification

The following chain of communications should be used in case of a spill:

- Mr. Dan Holmquist has been designated as the Foster Wheeler Environmental Spill and Release Reporting Site Representative. Mr. Holmquist has received training in Foster Wheeler Environmental Corporation's Policy and Procedure RC 6 "Reporting Spills and Releases," presented in Appendix A. In the event of a spill or release Mr. Holmquist shall immediately notify Warren Neff, Holloman AFB (505-475-5395) and Rich Macfarlane, USACE (505-479-0456), the Base Fire Department (ext. 7228 on Base), and the DOM.
- Site personnel must contact the Foster Wheeler Environmental DOM. If the DOM cannot be located, contact the Regulatory Specialist (RS):
 - Foster Wheeler Environmental DOM: Ronald Versaw
 - Phone: (303) 980-3598
 - Fax: (303) 980-3539
 - Foster Wheeler Environmental RS: Lee Snowhite
 - Phone: (303) 980-3579
 - Fax: (303) 980-3539
- The DOM or RS must notify Barbara Walz, Foster Wheeler's Western Region Compliance Manager ([303] 988-2202), of any spills and/or releases.

5.5 TRAINING/CERTIFICATION REQUIREMENTS

This section presents the DOT training and certification requirements for personnel involved in the remediation project. In addition, all employee's will be trained in Foster Wheeler's Environmental Compliance Policies and Procedures to ensure that they are familiar with the program. These Policies and Procedures meet Department of Justice requirements for a sound environmental management program. The Occupational Safety and Health Administration (OSHA) training and certification requirements are contained in Section 6, Health and Safety Requirements in the Baseline Health and Safety Plan.

All personnel who perform or oversee DOT-related activities must be DOT trained. DOT training records will be maintained in project files on site. A copy of the DOT training records should also be sent to the Compliance Officer for the regulatory compliance files.

5.6 INSPECTION PROCEDURES

The following section describes inspection procedures to be followed by field personnel in the event that a regulatory agency or third party conduct an on-site inspection.

5.6.1 Inspections by Regulatory Agencies

Foster Wheeler Environmental Corporation personnel shall respond to inspections by regulatory agencies in accordance with Foster Wheeler Environmental—Environmental Compliance Procedure No. RC 8 for "Environmental Inspection by Regulatory Agencies." Dan Holmquist has been designated as the Foster Wheeler Environmental on-site representative for inspections by regulatory agencies. Mr. Holmquist has received training on this procedure and is familiar with implementation of the procedure. In the event that Holloman AFB is notified of an impending regulatory inspection, Mr. Holmquist will be notified as soon as possible by the Base personnel notified by the regulatory agency. During any inspection, both a Base and USACE representatives should both be present. These procedures require that Mr. Holmquist contact the DOM who must notify the following Foster Wheeler personnel: Patsy Meehan, Director, Regulatory Affairs and Remediation Compliance or Barbara Walz, Western Region Compliance Manager, at ([303] 988-2202).

The DOM or his deputy will notify Warren Neff (505) 475-5395 if contacted by a regulatory agency for site inspection .

5.6.2 Inspections by Third Parties

Any outside party requesting access to inspect the site must be referred to Warren Neff. Foster Wheeler Environmental personnel must not grant access or answer the questions of unauthorized personnel. Individuals requesting access must be directed to contact Holloman AFB's Public Affairs Office (505) 475-5406.

If members of the media pose questions or attempt to access the site, Foster Wheeler personnel should direct those individuals to the Base's Public Affairs Office and then notify the following Foster Wheeler Environmental Corporate personnel: Patsy Meehan, Director, Regulatory Affairs and Remediation Compliance, or Barbara Walz, Western Region Compliance Manager.

5.7 DOCUMENTATION AND RECORDS RETENTION

This section presents project requirements relating to documentation and records and their retention.

5.7.1 Documentation

The information contained in this section applies to all waste managed during environmental data collection activities. Field records will be kept of all disposal activities. The logs and records will include the following information as required for the type of waste generated:

- Description of generating activities
- Location of generation (including depth, if applicable)
- Type of waste
- Date and time of generation
- Date and time of disposal of each type
- Disposal location of each type
- Disposal method
 - Description of any waste sampling, including:
 - Type of test
 - Laboratory where sample is to be sent
 - Sampling method
 - Name of sampler
- Name of person recording information
- Name of field manager at time of generation and at time of disposal
- Test results
- Inspection logs
- Waste documentation, including:
 - Waste profile sheets
 - LDR certification
 - Hazardous waste manifest
 - Trip tickets or bills of lading
 - Copies of any state or local permits or approvals

Transportation

Transportation documentation will comply with DOT regulations (49 CFR 100-177) and will be prepared by personnel trained according to the requirements of HM-181 and HM-126F.

Containers will be marked, labeled, and/or placarded prior to off-site transport. TSDF waste profile sheets, LDR notifications, waste manifests, and shipping documents will be prepared for Holloman AFB officials to review and sign.

All waste transporters used for Holloman AFB projects will be registered with NMED and approved in accordance with Foster Wheeler Environmental procedures for TSDF and transporter approvals.

Hazardous and Special Waste Manifests and LDR Certification

All hazardous waste transported from the site will be accompanied by a Hazardous Waste Manifest. New Mexico does not provide a standard state manifest, so the receiving state manifest must be used unless that state does not have a state manifest, and then a Uniform Hazardous Waste Manifest may be used.

Holloman AFB personnel will be responsible for reviewing and signing all waste documentation, including waste profiles, manifests, and LDR notifications (manifest packages). Prior to signing the manifest, the designated Holloman AFB official will ensure that pre-transport requirements of packaging, labeling, marking, and placarding are met according to 40 CFR 262.30-262.33 and 49 CFR 100-177.

For special waste, a manifest containing the following information will accompany each load of special waste originating from or to be disposed in New Mexico, as specified in Section 702.C:

- Name, address, and phone number of the generator
- Name, address, and phone number of any and all transporters in the order each will be transporting the waste
- Name, site address, phone number, and identification number of the solid waste facility to which the waste is to be delivered
- Type and proper name of waste being shipped
- Total weight or volume of waste prior to shipment from generator
- Total weight or volume of waste received at solid waste facility
- Type and number of containers in shipment
- Any special handling instructions
- Date and location the waste was delivered

• Date of receipt from the generator and total weight or volume of the Special Wastes to be provided by the transporter

If more than one transporter is used, each transporter will provide the date of receipt and total weight or volume of said waste received from the previous transporter, to be provided by the current transporter.

The manifest will be signed by the Holloman AFB personnel, each transporter of the special waste, and the solid waste facility operator. All signatories will be duly authorized agents of their organizations. Significant discrepancies will be reported to the NMED Solid Waste Bureau within 24 hours of discovery.

Holloman AFB will receive one copy of the manifest; the remaining copies will be given to the transporter. The manifest will be returned to the Holloman AFB signatory official to be placed on file.

Copies of all manifests for waste generated at the site will also be kept in a central file. The state copy of the manifest will be sent to the state by Holloman AFB.

A LDR form will accompany the shipment of hazardous waste to the TSDF. The TSDF must be notified prior to sending the waste. The following items must accompany the notification and are included in one of the following facility specific forms:

- EPA and New Mexico Hazardous Waste Generator ID number (provided by Holloman AFB)
- Manifest number, including state disposal application number
- Waste analysis data
- If the waste is also restricted, corresponding concentration-based or technology-based treatment standards or prohibition

5.7.2 <u>RCRA Records Retention</u>

The designated Holloman AFB manifest signatory official will be responsible for ensuring that all RCRA record-keeping requirements are met according to 40 CFR 262.20-262.44, including retention of signed copies of manifests from the designated facility that received the waste. The

copy must be maintained for a period of at least 3 years from the date the waste was accepted by the initial transporter. Additionally, biennial and exception reporting must be submitted, as necessary, according to 40 CFR 262.41 and 262.42, respectively. Additional reporting may be required according to 40 CFR 262.43.

Compliance files will be maintained by the DOM in the project files. The compliance file must contain a completed project questionnaire, this plan, and any updates to this plan or the questionnaire. Filing of project documents shall conform to Foster Wheeler Environmental Regulatory Compliance Program Manual Policy and Procedure RC 7 "Documentation and Records Retention - Environmental Compliance File Index."

5.8 UPDATING THE REGULATORY COMPLIANCE PLAN

The RCP will be updated as changes in site activities or changes in applicable regulations occur.

6.0 SITE SAFETY AND HEALTH REQUIREMENTS

Worker health and safety is governed by the Foster Wheeler Environmental Health and Safety Program as described in the Foster Wheeler Environmental Basewide Health and Safety Plan for Holloman AFB (Foster Wheeler Environmental 1995). This section provides health and safety information for the IRP Site FT-31 bioventing activities not addressed by the Basewide Health and Safety Plan. Worker health and safety requirements addressed in this section include:

- Definition of health and safety responsibilities
- Site history and description
- A project-specific hazard assessment
- Training
- Site control
- Monitoring of personal exposures
- Safety considerations for site operations
- Decontamination procedures
- An emergency response plan (ERP)

This plan shall be used in conjunction with the Holloman Basewide Health and Safety Plan and the Foster Wheeler Environmental Corporate Health and Safety Manuals. Where subjects are addressed in the Basewide Plan, the appropriate section of the Basewide Plan is referenced in this section. Specific health and safety requirements for this WAD not covered adequately by the Basewide Plan are also addressed in this section. Applicable sections of the Basewide Plan and this SSHP shall both be implemented for this project.

6.1 KEY PERSONNEL AND RESPONSIBILITIES

The health and safety related responsibilities for key project personnel are provided in Section 2 of the Basewide Health and Safety Plan.

6.2 PROJECT DESCRIPTION

Section 4 of this Workplan provides a description of the proposed activities.

6.3 HAZARD ASSESSMENT

This section addresses the chemical, physical, and biological hazards that may exist on this project. An activity hazard analysis (AHA), written in accordance with EM 385-1-1, USACE Safety and Health Requirements Manual, is provided in Table 6-1 of this section and in the AHA provided in Attachment A of the Basewide Plan. Activities addressed in the Basewide Plan include drilling, well installation, and sampling. The AHA provided in Table 6-1 addresses all other activities to be conducted during the course of this project. In each case where hazard controls are specified within the AHA, an appropriate section of the Basewide Plan or this SSHP is referenced where implementation requirements for the hazard control are provided.

6.3.1 Chemical Hazards

The following Contaminants of Concern (COCs) are known to exist at the site above detectable levels:

- TRPH
- Acetone
- Benzene
- Ethylbenzene
- Toluene
- Total Xylenes
- 2-Methylnaphthalene
- Methylene Chloride
- Napthalene
- 4-methyl-2-pentanone (MIBK)
- 1,1-Dichloroethene

Hydrogen sulfide gas may also be present at each site as a result of anaerobic breakdown of hydrocarbons by indigenous bacteria. The exposure limits and the chemical and physical properties for all compounds except napthalene, 1,1-dichloroethene, and hydrogen sulfide are listed on Tables 4-1 and 4-2 of the Basewide Health and Safety Plan. The same information for napthalene, 1,1-dichloroethene, and hydrogen sulfide are presented in Table 6-2 and Table 6-3 of this section.

Honoman AFB FT-31 Site Bioventing System

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Task or Phase	Task Steps and/or Components	Hazards	Hazard Controls
Mobilization	Site Mobilization	Vehicle accidents	Driver safety per Section 8.14*
		Slips, trips, and falls	Fall prevention per Section 8.28*
		Heat stress	Heat stress protocols per Section 8.6*
		Cold stress	Cold stress prevention per Section 8.7*
		Improper lifting	Lifting protocols per Section 8.11*
		Hand injuries	Hand protection per Section 8.16*
		Unauthorized traffic	Traffic control per Section 8.18*
		Inadequate illumination	Illumination per Section 8.3*
		Electrical hazards	Electrical safety per Section 8.4*
	Clearing and Grubbing	Hazards listed in site mobilization	Hazard controls listed during site mobilization
		Injuries from heavy equipment	Heavy equipment safety per Section 8.13*
		Striking overhead utilities and obstructions	Overhead utility clearance per Section 8.8*
		Striking underground utilities	Underground utility clearance per Section 8.9
	Survey of Well Locations	Hazards listed for site mobilization	Hazard controls listed for site mobilization
Construction Equipment Pad Insta	Equipment Pad Installation	Fires and injury from welding and cutting	Hot work safety per Section 8.21*
		Vehicle accidents	Driver safety per Section 8.14*
		Slips, trips, and falls	Fall prevention per Section 8.1*
		Heat stress	Heat stress protocols per Section 8.6*
		Cold stress	Cold stress prevention per Section 8.7*
		Improper lifting	Lifting protocols per Section 8.11*
		Hand injuries	Hand protection per Section 8.16*
		Unauthorized traffic	Traffic control per Section 8.18*
		Inadequate illumination	Illumination per Section 8.3*
		Injuries from heavy equipment	Heavy equipment safety per Section 8.13*
		Striking overhead obstructions	Overhead utility clearance per Section 8.8*
		Striking underground utilities	Underground utility clearance per Section 8.9*
		Inclement weather	Weather protocols per Section 8.10*
		Injuries from hand tools	Hand tool safety per Section 8.15*
		Hazardous noise exposure	Hearing conservation per Section 7.8

Table 6-1 Activity Hazard Analysis

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Task or Phase	Task Steps and/or Components	Hazards	Hazard Controls				
	Piping trench excavation, piping	Hazards listed for equipment pad installation	Hazard controls listed for equipment pad installation				
	installation, and valve vault	Exposure to piping adhesives	Hazard communication per Section 4.3*				
	installation	Injuries resulting from excavation hazards	Excavation safety per Section 8.19*				
	Process equipment and utility	Hazards listed for equipment pad installation	Hazard controls listed for equipment pad installation				
	installation	Injuries from unsafe use of cranes, hoisting, or rigging equipment's	Crane operations per Section 8.20*				
		Hazardous exposure and contact with electrical and gas utilities	Lockout/tagout per Section 8.17*				
	Process equipment startup and	Exposure to hazards from electrical and gas utilities	Lockout/tagout per Section 8.18*				
	testing	Vehicle accidents	Driver safety per Section 8.14*				
	-	Slips, trips, and falls	Fall prevention and postings per Section 8.28*				
		Heat stress	Heat stress protocols per Section 8.6*				
		Cold stress	Cold stress prevention per Section 8.7*				
	Improper lifting		Lifting protocols per Section 8.1*				
		Hand injuries	Hand protection per Section 8.6*				
		Inadequate illumination	Illumination per Section 8.3*				
		Inclement weather	Weather protocols per Section 8.10*				
		Injuries from hand tools	Hand tool safety per Section 8.15*				
	Hazard noise exposure		Startup noise level survey, postings, and hearing protection per Section 7.8*				
		Pinch/shear points or other hazards from unguarded or unsafe equipment	Pre-startup health and safety inspection by senior health and staff. Major deficiencies corrected prior to startup.				

Table 6-1 Activity Hazard Analysis

* Items marked with an asterisk are references to sections contained in the Basewide Health and Safety Plan.

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			Exposure Effects			
Contaminant	Irritant	Corrosive	Acute Effects	Chronic Effects		
1,1-Dichloroethene	Yes		Dizziness, headache, nausea, dyspnea, pneumonitis	Cancer in animals, liver and kidney dysfunction		
Hydrogen Sulfide	Yes		CNS depression, pulmonary edema, chemical asphyxiant	Neurotoxin		
Napthalene	Yes		Headache, confusion, excitement, nausea, vomiting, profuse sweating, dermatitis	Jaundice, optical neuritis, hemoglobin-urea, renal shutdown		

Table 6-2 Suipplemental Exposure Information

Table 6-3 Exposure Limits and Properties Of Site Contaminants								Page 1 of 1		
							Flash			
Contaminant	PEL	TLV	STEL	IDLH	Skin Notation	Vapor Pressure	Point (°F)	UEL %	LEL %	IP (eV)
1,1-dichloroethene	1 ppm ⁽¹⁾	5 ppm	20 ppm	N/A	N/A	500 mmHg	-2	15.5	6.5	10.00
Hydrogen sulfide	10 ppm	10 ppm	15 ppm	300 ppm	No	9,346 mmHg	N/A	44	4	10.46
Napthalene	10 ppm	10 ppm	15 ppm	250 ppm	no	0.08	174	5.9	0.9	8.12

⁽¹⁾ Vacated OSHA Standard
Personnel will consult these tables for basic information related to exposure limits and signs and symptoms of overexposure related to the contaminants.

6.3.2 Physical Hazards

The physical hazards associated with this project are typical of construction sites and are addressed in the AHAs provided as Table 6-1 and in Attachment A of the Basewide Plan. Where a control for a particular hazard is specified, it is referenced to the appropriate section of the Basewide Health and Safety Plan or this SSHP.

6.3.3 Biological Hazards

The types of biological hazards that may be encountered include black widow spiders, vipers, cacti, and other hazards that inhabit a desert climate. Personnel shall be made aware of these hazards and how to avoid potential contact with them.

6.4 TRAINING

Training requirements are provided in Section 5 of the Basewide Health and Safety Plan.

6.5 WORK ZONES, PERSONNEL PROTECTION, AND COMMUNICATIONS

6.5.1 Work Zones

Site zones will be established around the perimeter of the work activities to limit access and prevent visitors or casual by-standers from injury or potential exposure. The zone will also provide for decontamination if personnel protective equipment is required.

6.5.2 Personal Protective Equipment

During routine field work, personnel will be required to wear work clothes. Level D modified protection will be used when there is potential for contact with either free product or visibly stained soils. In the event that upgrading to Level C protection for site personnel is necessary, the requirements provided in Section 6.4 of the Basewide Plan shall be implemented. If upgrading to Level B protection is required, all activities will cease and the Project Health and Safety Manager (PHSM) shall be notified to provide additional guidance. Hand and face washing facilities will be provided at all work sites.

For decontamination of heavy equipment, Level D Modified PPE will be used, as will splash goggles and a face shield. Rubber or neoprene coated rain-suits may be used in lieu of coated tyvek during equipment decontamination. Reusable rain-suits will be decontaminated after each use.

6.5.3 Communications, Site Control, and Visitors

Communications, site control, and visitor requirements will be implemented as provided for in Section 6 of the Basewide Plan.

6.6 EXPOSURE MONITORING

6.6.1 Hydrocarbons

Real-time monitoring of airborne exposures to hydrocarbons in the breathing zones of site personnel will be accomplished using a PID equipped with a 10.2 eV probe. Monitoring strategy, calibration, and maintenance will be conducted in accordance with Sections 7.1 and 7.2 of the Basewide Health and Safety Plan. Action levels are provided in Table 6-4. All readings will be documented in the health and safety officers logbook.

6.6.2 Benzene

Colormetric detector tubes will be used for monitoring benzene in accordance with Section 7.3 of the Basewide Health and Safety Plan. Action levels for readings are provided in Table 6-4 of this section.

6.6.3 <u>Hydrogen Sulfide</u>

Monitoring for hydrogen sulfide gas, Lower Explosive Limit (LEL), and oxygen concentrations will be accomplished using a tri-gas monitor such as the MSA, Model 361. Monitoring strategy, calibration, and maintenance will be conducted in accordance with Sections 7.1 and 7.4 of the Basewide Health and Safety Plan. Action levels are provided in Table 6-4 of this section.

6.6.4 Integrated Personal Sampling

Personal sampling will be implemented if necessary in accordance with Section 7.5 of the SSHP.

Table 6-4 Monitoring Action Levels

Page 1	ot L	
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Equipment	Concentration	Action Level
O ₂ Meter	$19\% \le O_2 \le 23.5\%$	Continue work
O ₂ Meter	$19\% > O_2 > 23.5\%$	Stop work
CGI	LEL < 10%	Continue work
CGI	LEL > 10%	Stop work
PID	0–5 ppm (1)	Level D
PID	5 ppm–50 ppm	Level C
	> 50 ppm	Stop work and contact the PHSM
H ₂ S	0-5 ppm	Level D
H_2S	>5 ppm	Stop work and contact the PHSM
_	Visible dust	Dust suppression

¹Upon obtaining a sustained reading of ppm a colormetric for benzene will be used. Action levels for benzene are:

0-1 ppm Level D

1-10 ppm Level C

> 10 ppm Stop work and contact Project Health and Safety Manager (PHSM)

CGI-Combustible Gas Instrument

ppm-parts per million

PID-Photoionization Detector

LEL-Lower Explosive Limit

6.7 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

Safety requirements related to general construction hazards are provided in the AHA provided as Table 6-1 and in Attachment A of the Basewide Health and Safety Plan. Where a hazard control is referenced, the appropriate section of the Basewide Plan describing the implementation of the control is also provided.

6.8 DECONTAMINATION

Decontamination of personnel and equipment will be implemented as described in Section 9 of the Basewide Plan and Section 4.2.2 of this Workplan.

6.9 EMERGENCY RESPONSE PLAN

The emergency response procedures and emergency routes to local hospitals to be used on this project are provided in Section 10 of the Basewide Plan. The project personnel and emergency contacts are provided below:

Program Health and Safety Manager:	Andy Strickland, CIH 303-988-2202
Program Manager:	Sina Seyedian, PE 303-988-2202
Delivery Order Manager:	Ronald Versaw, PE 303-988-2202
Site Health and Safety Officer:	Dan Holmquist/Jeff Thompson 505-479-2668
Site Manager:	Dan Holmquist 505-479-2668
Emergency Coordinator:	Dan Holmquist 505-479-2668
Base Remedial Project Manager	Warren Neff 505-475-5395
USACE Resident Engineer	Rich Macfarlane 505-479-6095

6.10 APPROVALS

This SHSP is approved by the following individuals and will be used for the IRP Site FT-31 Bioventing System at Holloman AFB.

For

Suna Seyely Ronald Versaw, Delivery Order Manager Dan Holmquis Superintendent Dan Holmquist, Site Health and Safety Officer

Andrew Strickland, Program Health and Safety Manager

4-17-97 Date

04-14-97-Date

04-14-57 Date

Date

7.0 FIELD SAMPLING PLAN

The FSP outlines the constituent sampling and analytical procedures/methodologies that will be used during the FT-31 bioventing system installation. The FSP prepared for these sites and is intended to be used in tandem with the QAPP (Section 9) in providing specific rationales, protocols, and methodologies to be employed when performing field analytical screening, field sampling or data collection activities during the project.

The FSP Plan has been developed according to USACE and EPA Region VI requirements. The plan provides an overview of the sampling program, methodologies, objectives, equipment, and procedures.

Sections 7.1 and 7.2 describe field sampling objectives and summarize the sampling and analysis program, respectively. Section 7.3 discusses data collection information. Sections 7.4 and 7.5 outline project sampling procedures and field measurements.

7.1 FIELD SAMPLING OBJECTIVES

Field sampling will be performed to satisfy the need for the characterization of waste materials generated during construction activities to determine appropriate management and disposition. The FSP is designed to meet project objectives associated with the remediation of IRP Site FT-31. Specifically, the FSP will generate analytical and test data to ensure the following:

- Remedial activities are performed in a safe manner
- Material collection, treatment, storage, transport, discharge, and containment activities are in compliance with all federal, state, and local regulatory agency requirements

Samples collected during remedial activities will include contaminated soil, and decontamination water.

7.1.1 Disposal Classification Sampling and Analysis

The following sections discuss classification-related sampling and analysis needs for the various potential waste streams resulting from construction activities. Each waste stream will be sampled as indicated and samples will be analyzed for the indicated parameters. Waste will be classified as either a hazardous, special, or nonhazardous waste. Sampling and analysis will be

performed in accordance with the latest revision of USEPA SW-846, "Test Methods for Evaluating Solid Waste, Chemical Methods," 3rd Edition (1986) and Methods for Chemical Analysis of Water and Wastes, EPA Manual 600/4-79/020.

7.1.1.1 Characterization of Decontamination Water

One sample will be taken of decontamination water from each storage tank for waste characterization purposes. Samples are to be analyzed for volatile organic compounds (VOCs) (EPA Method 8260A). Samples will be collected, labeled, preserved, stored, analyzed, and documented on C-O-C forms following appropriate requirements specified in this section and SW-846.

7.1.1.2 Characterization of Contaminated Soils

Soil cuttings from monitoring well installation activities and from trenching activities will be sampled for waste characterization purposes. PCS will be segregated and stockpiled based on the PID field screening level of 100 ppm. A composite sample will be collected per each 100 cubic yards of PCS stockpiled soil. Samples will be collected, labeled, stored, analyzed, and documented on C-O-C forms following appropriate requirements specified in this section and SW-846. Samples will be analyzed for TRPH (EPA Method 418.1), total benzene (EPA Method 8020A), and total lead (EPA Method 7421).

7.2 SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Table 7-1 summarizes the sampling and analysis program for this project.

Table 7-1 H	Page 1 of 1				
Matrix	Sample No. ^a	VOCs ^b	Benzene	TRPH ^c	Lead
Soil	3	NA ^d	3	3	3
Decon Water	2	2	NA	NA	NA

Notes

a - Includes quality control samples, one field duplicate soil sample and one trip blank for water. Sample quantities are estimated.

b - Volatile Organic Compounds

c - Total Recoverable Petroleum Hydrocarbons

d - Not applicable

7.3 DESIGN OF DATA COLLECTION OPERATIONS

This section addresses project-specific requirements related to the location and frequency of sampling as well as the establishment of nomenclature to designate the various samples that will be acquired in the field.

7.3.1 Sample Locations and Frequency

The SWMUs included in the FT-31 sampling program are 39, 127, 135, and 170. The following protocols will be utilized when sampling the soil and decontamination water.

<u>Soil</u>

Soil generated during well installation and trenching activities will be segregated if considered to be PCS exhibiting a TRPH concentration greater than 1,000 mg/kg. The workplan addresses segregation of soils on the basis of real-time measurements using PID screening followed by sampling of the PCS stockpile and immunoassay confirmation analysis. A PID screening of soil will occur on a continuous basis as trenching and drilling operations proceed. A PID reading of greater than 100 ppm will identify PCS and the soil will be segregated to the PCS stockpile. The 100 ppm screening action level will be verified using immunoassay testing prior to the initiation of field operations. In addition, visual and odor screening will be used during field operations to identify PCS.

One composite sample will be collected for each 100 cubic yards of PCS generated. The composite will contain portions of soil collected from the surface and interior of the stockpile. A minimum of 5 grab samples will be used for homogenizing any individual composite sample. The composite sample will be analyzed on-site using the Ensys Petro Risc immunoassay test kit. A TRPH value of greater than 1,000 mg/kg will require a split of the composite soil sample to be sent to the off-site laboratory for TRPH, benzene, and lead analysis as specified in Table 7-1.

Decontamination Water

One composite sample will be collected for each storage tank of decontamination water generated. The sample shall be analyzed for VOCs as specified in Table 7-1.

7.3.2 Sample Designation

The following sample nomenclature will be used for designating environmental samples:

NNN	XXX	AA	NN
Site	Well/Trench	Sample	Sampling
Number	Number	Matrix	Event

Allowable nomenclature for this project is limited to the following:

NNN:	FT31
XXX:	Well number or trench number
AA:	S (soil), D (decontamination water) and TB (trip blank)
NN:	00, 01, 02, 03, etc.

The following are examples of the sample numbering system:

Example No. 1: A decontamination water sample is to be collected from FT-31 monitoring well No 5.

Sample Number: FT3105D01

Example No. 2: A second waste classification sample is to be collected from the suspected contaminated trench generated from the air supply pipe excavation.

Sample Number: FT3102502

Duplicate samples will be given a unique sampling-event designation. The field logbook will note the sample designated for duplicate analysis.

7.4 SAMPLING EQUIPMENT AND PROCEDURES

The following standard operating procedures (SOPs) contained in Appendix B will be followed to collect samples:

SOP B2	Decontamination Methods
SOP B5	Stockpile Soil Sampling
SOP B6	Tank Sampling

7.5 FIELD MEASUREMENTS

The following SOPs contained in Appendix B of this Workplan shall be referenced when taking field measurements:

SOP B1	Borehole and Well Logging
SOP B4	Photoionization Detectors

8.0 CONTRACTOR QUALITY CONTROL PLAN

This CQC Plan establishes the procedures and methods to be implemented during the installation of the bioventing system IRP Site FT-31. This CQC Plan combines the quality assurance/quality control (QA/QC) requirements from the USACE-Omaha District with the Foster Wheeler Environmental QC system requirements to form a set of common requirements commensurate with the scope and nature of services planned under the southwest TERC.

8.1 PURPOSE

The purpose of this CQC Plan is to establish the procedures and methods to be implemented during construction operations performed under TERC No. DACW45-94-D-0003 with the USACE-Omaha District to complete the installation of the bioventing system at IRP Site FT-31. This CQC Plan provides an effective QC system to ensure the quality of all work performed by describing the specific organization, personnel, procedures, controls, instructions, tests, records, submittals, and forms to be used to ensure that all work products comply with the contract requirements.

8.2 SCOPE

The CQC Plan is applicable to all on-site and off-site construction operations, including inspections and testing activities performed for this project. All work activities will be conducted in accordance with this Workplan and its respective attachments. This CQC Plan will be implemented for the following activities:

- Installation of bioventing wells
- Trenching and pipe installation
- Excavation and compaction of soils
- Equipment pad installation
- Backfill and compaction of soils
- Equipment installation
- Required inspections
- Required testing (other than chemical)

8.3 ORGANIZATION AND RESPONSIBILITIES

8.3.1 Quality Control Organization

This section describes the organization and authority for project personnel performing construction operations, both on site and off site, including subcontractors, vendors, fabricators, suppliers, and purchasing agents. This section documents the organizational structure, functional responsibilities, personnel qualifications, levels of authority, and lines of communication established within the organization to ensure high-quality work. The project organization chart showing the reporting lines of communication for each individual is provided in Section 10 of this Workplan.

The names, qualifications, duties, responsibilities, and authorities for project personnel are described in the following paragraphs.

8.3.2 Delivery Order Manager

The DOM is Mr. Ronald Versaw, P.E. The DOM is responsible for the direction, execution, and successful completion of project tasks and is responsible for the execution of the tasks within overall project goals. Mr. Versaw has responsibility of performing the following activities related to the specific task order:

- Prepare and approve all proposed task-specific work orders.
- Coordinate work activities of subcontractors and Foster Wheeler Environmental personnel and ensure that all personnel adhere to the administrative and technical requirements of the project.
- Monitor and report the progress of work and ensure that project deliverables are completed on time and under budget.
- Ensure adherence to the quality requirements of the contract, specifications of the delivery order and the CQC Plan.
- Direct the Construction Project Manager to undertake and accomplish the required construction
- Ensure that all task activities are conducted in a safe manner in accordance with the SSHP in Section 6 of this Workplan.
- Communicate as the primary contact between USACE and Foster Wheeler Environmental for actions and information related to the delivery order.
- Communicate and interface with the CQC System Manager.

8.3.3 Contractor Quality Control System Manager

The CQC System Manager, Mr. Bill Foley, is responsible for overall management of contractor quality control and reports to the DOM. The CQC System Manager will be on site at all times during construction. In the event of this individual's absence, a qualified individual will be appointed to serve as his/her replacement for periods of time not to exceed 2 weeks at any one time, and not more than 30 workdays during a calendar year. The requirements for the alternate will be the same as for the designated CQC System Manager.

The duties of the CQC System Manager as they apply to this project include the following:

- Provide and maintain an effective QC system for all construction activities
- Monitor QC activities to ensure conformance with authorized policies, procedures, contract specifications, and sound practices.
- Maintain sufficient staff to perform all QC activities to appropriate to all work phases, work shifts, and work crews.
- Inspect the work performed each day for compliance with the plans and specifications and prepare the Daily QC Report (DQCR).
- Ensure that the three phases of inspection (preparatory, initial, and follow-up) are implemented for all definable phases of construction.
- Schedule and manage all submittals, as identified in the submittal register, including those of subcontractors providing monthly updates.
- Ensure that all required tests and inspections are performed and the results reported.
- Attend required meetings, including the site survey visit, submittal review meetings, and field review meetings.
- Review all submittals in detail and verify that they are correct and in strict compliance with contract drawings and specifications.
- Stop work that is not in compliance with the contract.

8.3.4 Construction Project Manager

Mr. Herman Calvo will serve as the Construction Project Manager. The primary responsibility of the Construction Project Manager is the completion of all field activities on time and as directed by the DOM. The duties of the Construction Project Manager as they apply to the project include the following:

- Establish a field base for operations and mobilize subcontractors and Foster Wheeler Environmental personnel.
- Procure equipment for work crews and health and safety personnel.

- Coordinate all personnel involved in task activities, including obtaining support services.
- Direct field leaders, support personnel, and subcontractors.
- Administer site access.
- Maintain work site, vehicles, and equipment.
- Coordinate and maintain logistics of all components of on-site tasks, including all personnel and equipment.
- Prepare weekly status reports and estimate future scheduling needs.
- Coordinate, prepare, and complete all required field reports.
- Evaluate relevant documents and permits for validity and current status.
- Acquire necessary permits, licenses, and rights-of-way.

8.3.5 Subcontractors and Vendors

Subcontractors and vendors will be required to conform with Foster Wheeler Environmental's CQC Plan, and any other approved procedures, technical specifications, or contract provisions.

The subcontractor's QC inspectors are responsible for field inspection of their construction and operating activities. Foster Wheeler Environmental will monitor, oversee, and make on-site observations and inspections of work in progress to determine whether the subcontractor's work is proceeding in accordance with the CQC Plan.

Subcontractor personnel are responsible for maintaining a daily log of the project activities they perform and for providing information needed to complete the DQCR. All inspection records, including inspection reports and deficiency reports and re-inspections of corrective actions, will be documented.

8.4 CONSTRUCTION INSPECTION PLAN

Contractor QC is the means by which Foster Wheeler Environmental ensures that all construction, including that of Subcontractors and suppliers, complies with the requirements of the contract. The Construction Inspection Plan establishes the measures required to verify both the quality of work performed and compliance with specified requirements, including the inspection of materials and workmanship before, during, and after each definable feature of work. Definable features for this project are discussed in Section 3 of this Workplan. The controls defined shall be adequate to cover all construction operations, including on site and off ite fabrication, and are

keyed to the proposed construction sequence. Contractor QC includes implementation of the following three control phases for all aspects of the work specified:

- Preparatory phase
- Initial phase
- Follow-up phase

Inspection requirements specific to this project are discussed throughout this section.

8.4.1 Preparatory Phase Inspections

Preparatory phase inspections will be conducted by the CQC System Manager prior to starting the definable features of work listed in the technical specifications. At a minimum, these inspections will include the following:

- A review of each paragraph of applicable specifications
- A review of the contract plans
- A check to ensure that all materials and/or equipment have been tested, submitted, and approved
- A check to ensure that provisions have been made to provide required control inspection and testing
- An examination of the work area to ensure that all required preliminary work has been completed and is in compliance with the contract
- A physical examination of required materials, equipment, and sample work to ensure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored
- A review of the appropriate activity hazard analysis to ensure that safety requirements are met
- A discussion of procedures for constructing the work, including repetitive deficiencies
- Documentation of construction tolerances and workmanship standards for that phase of work
- A check to ensure that the portion of the CQC Plan for the work to be performed has been accepted by the USACE or Designee

The Base Project Manager and USACE Resident Engineer will be notified at least 48 hours in advance of any preparatory phase activity. This phase will include a meeting conducted by the CQC System Manager that will be attended by other responsible construction personnel as applicable (e.g., the project superintendent, the construction foreman).

The preparatory phase meetings will be documented by item on the Inspection Checklist, as shown on Figure 8-1. Preparatory inspections will be reported on the DQCR with the checklist included as an attachment. An example of the DQCR is included as Figure 8-2. Personnel performing work activities will be directed by the CQC System Manager as to the acceptable level of workmanship involved to cover the feature of work covered by the inspection.

8.4.2 Initial Phase Inspection

An initial inspection will be performed at the beginning of a definable feature of work and will include the following:

- A check of preliminary work to ensure that it is in compliance with contract requirements
- A review of the Inspection Checklist documenting results of the preparatory meeting
- Verification of full contract compliance, including required control inspection and testing
- Establishment of the required level of workmanship and verification that it meets minimum acceptable standard
- Resolution of all differences
- A check of safety requirements to include compliance with and upgrading of the safety plan and activity hazard analysis
- A review of the activity analysis with project personnel

The Base Project Manager and the USACE Resident Engineer will be notified at least 48 hours in advance of any initial phase activity. Initial inspections will be documented by the CQC System Manager for each item using the Inspection Checklist (Figure 8-1). This documentation will be attached to the DQCR. The exact location of the initial phase inspection will be indicated for future reference and comparison with follow-up inspections. An initial phase inspection will be conducted each time a new crew arrives on site or any time acceptable specified quality standards are not being met.

FIGURE 8-1 INSPECTION CHECKLIST

Page 1 of 2

ITEM:				DATE:		
Contract Specifications:						
MATERIAL	QTY	CONDITION	TESTING	COMMENTS		
STORAGE CONDITIONS:						
SUBMITTALS:			······			
-						

FIGURE 8-1 (Continued) INSPECTION CHECKLIST

Page 2 of 2

MATERIAL/EQUIPMENT CERTIFICATIONS:		
PREPARATORY SITE CONDITIONS:		
CONTRACT VARIANCE:		
COMMENTS:		
ATTENDEES:		
	QC REPRESENTATIVE	DATE
······································	OCSM	DATE
		DAIL
	1	

FIGURE 8-2 DAILY QUALITY CONTROL REPORT

Page 1 of 3

Daily Report No.:			Date:	Date:		
Contract No.:		- Baterriterate				
Project Title & Location:						
Weather:	Precipitation:		In.:	Temp.:	Min.:	Max.:

1. Contract/Subcontractors and Area of Responsibility:

NUMBER	TRADE	HOURS	EMPLOYER	LOCATION/DESCRIPTION OF WORK

2. Operating Plant or Equipment (not hand tools):

Plant/Equipment	Date of Arrival/Departure	Date of Safety Check	Hours Used	Hours Idle	Hours Repair

FIGURE 8-2 (Continued) DAILY QUALITY CONTROL REPORT

Page 2 of 3

3. Work Performed Today: (Indicate location and description of work performed by prime and/or subcontractors. When network analysis is used, identify work by NAS activity number).



FIGURE 8-2 (Continued) DAILY QUALITY CONTROL REPORT

Page 3 of 3

7. Submittals Reviewed:

(a) Submittal No.	(b) Spec/Plan Reference	(c) By Whom	(d) Action

8. Off-Site Surveillance Activities, Including Action Taken:

9. Job Safety: List items checked, results, instructions, and corrective actions taken.

10. Remarks: Instructions received or given. Conflict(s) in plans and/or specifications. Delays encountered.

<u>Contractor's Verification</u>: On behalf of the Contractor, I certify this report is complete and correct, and all materials and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as may be noted above.

CQC SYSTEM MANAGER

DATE

8.4.3 Follow-up Phase Inspection

During the completion of a particular work feature, follow-up inspections will be conducted to ensure continued compliance with contract requirements. The frequency of the follow-up inspections will be dependent on the extent of the work being performed on each particular feature. Each follow-up inspection will be documented on the Inspection Checklist (Figure 8-1). This documentation will be attached to the DQCR. A final follow-up check will be conducted on any completed work phase prior to the commencement of a subsequent phase. Any deficiencies will be corrected prior to starting additional phases of work or will be identified on a list of items that do not conform to the specified requirements or are incomplete.

8.4.4 Additional Preparatory and Initial Phases

Additional preparatory and initial inspections may be conducted by the CQC System Manager on the same definable features of work under the following circumstances: if the quality of ongoing work is unacceptable as determined by the Base Project Manager or Designee or the USACE Resident Engineer; if there are changes in the staff, on-site supervision, or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

8.4.5 <u>Completion Inspection</u>

Completion inspections will be performed as summarized in this section.

8.4.5.1 Contractor's Quality Control Completion Inspection

The CQC System Manager or designated Foster Wheeler Environmental QC Inspection personnel will conduct a detailed inspection when all of the work or an increment of work is deemed to be substantially complete. This inspection will be conducted prior to the pre-final inspection. The Base Project Manager and the USACE Resident Engineer may also participate; he/she will be notified in advance of the inspection date. The work will be inspected for conformance to plans, specifications, quality, workmanship, and completeness. The CQC System Manager will prepare an itemized list of work not properly completed, inferior workmanship, or work that does not conform to plans and specifications. The list will also include outstanding administrative items

such as record (as-built) drawings, O&M manuals, and spare parts. The list will be included in the QC documentation and submitted to the Base Project Manager or Designee and the USACE Resident Engineer with an estimated date for correction of each deficiency within 5 working days following the conduct of the inspection. The completion inspection will be documented on the Inspection Checklist, shown in Figure 8-1, and attached to the DQCR.

8.4.5.2 Pre-final Inspection

The pre-final inspection will be conducted by the Base Project Manager; the USACE Resident Engineer, Foster Wheeler Environmental QC inspection personnel, CQC System Manager, or other primary management representative, as applicable, will attend. The pre-final inspection will be scheduled by the Base Project Manager or Designee in response to notification from the CQC System Manager prior to the planned inspection date. The CQC System Manager is required to verify at this time that all specific items previously identified to Foster Wheeler Environmental as being unacceptable, along with all remaining project work, will be complete and acceptable by the date scheduled for the pre-final inspection. At this inspection, the Base Project Manager or Designee will develop a specific list of incomplete and/or unacceptable work performed under the contract and will provide this list to Foster Wheeler Environmental .

8.4.5.3 Final Acceptance Inspection

The final acceptance inspection will be formally scheduled by the Base Project Manager based on notification from the CQC System Manager of readiness and will include the QC inspection personnel, CQC System Manager, or other primary management personnel, the Base Project Manager, and the USACE Resident Engineer. This notification will be provided prior to the planned final acceptance inspection date and must include verification that all specific items previously identified as being unacceptable, along with all remaining work performed under the contract will be complete and acceptable by the date scheduled for the final acceptance inspection.

8.4.6 Inspection Documentation

The CQC System Manager is responsible for the maintenance of the inspection records. Inspection records will be legible and will provide all necessary information clearly to verify that the items or activities inspected conform to the specified requirements or, in the case of nonconforming conditions, provide evidence that the conditions were brought into conformance or otherwise accepted by Foster Wheeler Environmental.

All inspection records will be made available to Holloman AFB and USACE through the Foster Wheeler Environmental DOM.

8.5 TESTING

8.5.1 Testing Procedures (Other Than Chemical Sampling and Analysis)

General requirements for testing procedures to be implemented for this project are included in the Technical Specifications and Construction Drawings, Appendix C and D of this Workplan. The type, number, and frequency of required tests are specified in the Technical Specifications. Information such as test name, specification paragraph containing test requirements, feature of work to be tested, test frequency, and person responsible for each test is included.

The CQC System Manager shall be responsible for the performance of all tests specified or required by the Technical Specifications to verify control measures are adequate to provide a product conforming to contract specifications. These tests include both operational and acceptance testing as appropriate. For all testing activities the CQC System Manager shall:

- Verify testing procedures comply with contract requirements
- Verify that facilities and testing equipment are available and comply with testing standards
- Check test instrument calibration data against certified standards
- Verify that recording forms and test identification control number system have been prepared

8.5.2 Documentation

All test results, both passing and failing, will be recorded on the DQCR for the day taken. Specification paragraph reference, location where tests were taken, and sequential control number identifying the test will be given. The actual test reports may be submitted later to the USACE Resident Engineer. An information copy of tests performed by off-site facilities will be provided directly to the Base Project Manager or Designee, representative.

8.5.3 Laboratory Services

Laboratory services will be provided by an independent testing laboratory, which will be selected and qualified in accordance with recognized industry and applicable project requirements.

8.6 DOCUMENT CONTROL

Preparation, review, approval, and issuance of documents affecting quality will be controlled to the extent necessary to determine the documents meet specified requirements. Project documents to be controlled include the following:

- Submittal Register
- Inspection Documentation
- Daily CQC Report
- Test Results
- Nonconformance Reports
- Project Plans

Discussions of the required DQCR and records to be provided to document conferences are included in this section. The DQCR and required inspection documents are described in this CQC Plan in Section 8.4, Construction Inspection Plan; the Submittal Register is discussed in Section 8.7, Submittals; and the Nonconformance Report is included in Section 8.8, Nonconformances.

8.6.1 Daily QC Report

The CQC System Manager is responsible for maintenance of current records of QC operation, activities, and tests performed, including the work of subcontractors and suppliers. The records will include factual evidence that required QC activities and tests were performed. A DQCR will be completed to document construction activities covered by the CQC Plan and will include the following information:

- Contractor/subcontractor(s) and their area of responsibility
- Operating equipment with hours worked, idle, or down for repair
- Work performed that day, giving location, description, and by whom

- Test and/or control activities performed with results and references to specifications/plan requirements, including the control phase (Preparatory, Initial, Follow-up) and deficiencies (along with corrective action)
- Material received with statement as to its acceptability and storage
- Submittals reviewed, with Contract reference, by whom, and action taken
- Off-site surveillance activities, including actions taken
- Job safety evaluations stating what was checked, results, and instructions or corrective actions
- A list instructions given/received and conflicts in plans and/or specifications
- Contractor's verification statement
- Site visitors/purpose, deviations from plans, difficulties/resolution

The records will indicate a description of trades working on the project, the number of personnel working, weather conditions encountered, and any delays encountered. Both conforming and nonconforming features will be covered with a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original of this report shall be furnished to the USACE Resident Engineer on the first work day following the date covered by the report, except that reports need not be submitted for days on which no work is performed. At a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no-work period. All calendar days shall be accounted for throughout the life of the Contract. The first report following a day of no work will summarize work for that day only. Reports will be signed and dated by the CQC System Manager and other appropriate personnel, including subcontractors responsible for completion of activities. The report from the CQC System Manager will include copies of test reports and copies of reports prepared by all subordinate QC personnel. A sample of the DQCR is included as Figure 8-2.

8.6.2 Conference Notes and Confirmation Notes

In addition to other required documentation, the DOM is responsible for taking notes and preparing the reports of all conferences. Conference notes will be typed and the original report furnished to the USACE within 5 days after the date of the conference for concurrence and subsequent distribution to all attendees. At a minimum, this report will include the following items:

- Date and place the conference was held
- List of attendees, including name, organization, and telephone number
- Written comments presented by attendees attached to each report with the conference action noted: "A" for an approved comment, "D" for a disapproved comment, "W" for a comment that has been withdrawn, and "E" for a comment that has an exception noted
- Comments made during the conference and decisions affecting criteria changes
- Conference notes that augment the written comments

The DOM or his designee is also responsible for providing a record of all discussions, verbal directions, telephone conversations, etc., participated in by Foster Wheeler Environmental personnel or their representatives on matters relating to this contract and work. These records, entitled "Confirmation Notices," will be numbered sequentially and will fully identify participating personnel, subject discussed, and any conclusions reached. The DOM or his designee will forward to the Base Project Manager or Designee and the USACE Resident Engineer within 5 work days a reproducible copy of the confirmation notices.

8.7 SUBMITTALS

Submittals will be scheduled, reviewed, certified, and managed in accordance with procedures defined in this section. Submittals for the FT-31 Site Bioventing System are presented in Technical Specification - Section 01300.

Required submittals may consist of the following types:

- Data—Submittals that provide calculations, descriptions, or documentation of the work
- Drawings—Submittals that graphically show relationship of various components of the work, schematic diagrams of systems, details of fabrication layouts of particular elements, connection, and other relational aspects of the work.
- Instructions—Preprinted material that describe the installation of a product, system or material, including special notices and material safety data sheets concerning impedance's, hazards, and safety precautions.
- Schedules—Tabular lists show the location, features, or other pertinent information regarding products, materials, equipment, or components to be used in the work.
- Statements—A required document the purpose of which is to confirm the quality or orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel, qualifications, or other verifications of quality.

- Reports—Reports of inspection or test, each property identified, and an interpretation of results that includes a description of test methods and all results.
- Certificates—Statement signed by an official authorized to certify on behalf of the manufacturer of a product, system, or material, attesting that the product, system, or material meets specified requirements. The statement must be dated after the award of this Contract, must state the Contractor's name and address, must name the project and location, and must list the specific requirements which are being certified.
- Samples—Samples, including both fabricated and unfabricated physical examples of materials, products, and units of work as complete units or as portions of units of work.
- Records—Documentation to record compliance with technical or administrative requirements.
- O&M Manuals—Data which for a part of an operation and maintenance manual.

8.7.1 Preparation and Maintenance of Submittals

The CQC System Manager is responsible for the preparation and maintenance of the required project submittals. These submittals are listed on the Submittal Register located in Section 01300 of the Technical Specifications. The Submittal Register will be used to log and monitor all submittal activities.

8.7.2 <u>Review of Submittals</u>

Review of submittals to ensure completeness, accuracy, and contract compliance is the responsibility of the Denver Project Engineer. Any submittals requiring modifications or changes will be returned to the originating organization for correction and then resubmitted for review and approval by the Project Engineer prior to acceptance. All submittals will be submitted to USACE at the end of the project. Approval of the submittal by the Project Engineer will be indicated by stamping, signing, or initialing, in addition to dating the submittal form. The Project Engineer and the CQC System Manager will perform a check to ensure that all materials and equipment have been tested, submitted, and approved during the preparatory phase of the QC inspections; no construction activities will be performed prior to required approval of applicable submittals.

8.7.3 Execution

All items listed on the Submittal Register in addition to any requested by the USACE Resident Engineer or the Base Project Manager will be required submittals. The following requirements apply to submittals:

- Units of weights and measures will match those used in the construction drawings.
- Each submittal will be complete and in sufficient detail to allow determination of contract compliance.
- All items will be checked by the Project Engineer and CQC System Manager prior to submittal.
- Each submittal is accompanied by a transmittal form certifying compliance with all contract requirements.
- Proposed deviation from the contract requirements will be clearly identified.
- Submittals will include items such as applicable drawings, descriptive literature, test reports, samples, O&M manuals, certifications, and warranties.

8.7.3.1 Submittal Register

Foster Wheeler Environmental will provide a complete Submittal Register as shown in Technical Specification - Section 01300. Foster Wheeler Environmental will revise the information on the Submittal Register as necessary. The approved Submittal Register will become the scheduling document and will be used to control submittals for the entire project.

8.7.3.2 Scheduling

Submittals of interrelated items or items forming a system are to be scheduled for coordination and submitted concurrently for review and approval. Certifications to be submitted with the pertinent drawings will be scheduled accordingly.

8.7.4 <u>Record Drawings</u>

In addition to the basic requirements for record drawings, all drawings will be developed or modified using Auto-CADD for required submittals. All Auto-CADD drawings will be compatible with the Auto-CADD system used at Holloman AFB. After construction, Foster Wheeler Environmental will provide the Base Project Manager with copy of the Auto-CADD drawing files (on disk) and prints (drawings) which will include the as constructed site conditions.

8.7.5 Final Submittals

Specific requirements pertaining to final submittals are provided in this section. Final submittal will be reproduced and distributed by mail to all reviewers via a carrier service that will provide overnight service.

Partial submittals will not be accepted unless prior approval is given. A cover letter will accompany each final document and indicate the following information: project, project phase, date comments are due, to whom comments are to be submitted, and the date and location of the review conference, as appropriate. The cover letter will not be bound into the document. The tabulation of criteria, data, calculations, etc. that are performed but not included in detail in the report will be assembled as appendices or other support documents.

One unbound copy of each submittal will be provided to USACE and to Holloman AFB when the project is completed. This copy will be in addition to the quantities listed in the submittal register. All final submittals should be error free.

8.8 NONCONFORMANCES

8.8.1 Nonconformance Report

Any work or materials not conforming to the technical specifications or contract requirements will be identified and documented on a Nonconformance Report as indicated in Figure 8-3. The Nonconformance Report will detail the nonconforming condition, recommended corrective action(s), and disposition of the corrective action(s). The Nonconformance Report will remain open until the nonconforming condition has been satisfactorily resolved and verified by QC inspection staff. Upon receipt of notification of detected nonconformances from the USACE

Base Project Manager, Nonconformance Reports for each item will be completed.

Figure 8-3

Nonconformance Report FOSTER WHEELER ENVIRONMENTAL CORPORATION

REPORT NO(1) NONCONFORMANCE REPORT				
CLIENT OR PROJECT (2)			DRAWING NO/SPEC NO. (3)	
SUPPLIER, CONSTRUCTION QC OR CONTRACTOR (4)		P. O. NO. (5)		
DESCRIPTION OF COMPONENT, PART OF	R SYSTEM (6)	1		
1. DESCRIPTION OF NONCONFORMANCE	(7) (Items involved, Specifications, Code or Star	idard to Which Items Do Not Comply, Submit Ske	Ich (lf Applicable)	
NAME AND SIGNATURE OF PERSON REP	ORTING NONCONFORMANCE (8)	TITLE/COMPANY	DATE (9)	
II. RECOMMENDED DISPOSITION (10) (5	Submit Sketch If Applicable)			
<u></u>				
NAME AND SIGNATURE OF PERSON REC	COMMENDING DISPOSITION (11)	TITLE/COMPANY	DATE (12)	
III EVALUATION OF DISPOSITION BY F	OSTER WHEELER ENVIRONMENTAL REA	SON OF DISPOSITION (13)		
••• · · · · · · · · · · · · · · · · · ·				
IV. CORRECTIVE ACTION (14)	Required Not Required		· · · · · · · · · · · · · · · · · · ·	
<u></u>		·		
	QUALITY ASSURANCE		OTHER	
NAME (SIGNATURE)	NAME (SIGNATURE) NAME (SIGNATURE)		NAME (SIGNATURE)	
	DATE	DATE	DATE	
C ACCEPTED	ACCEPTED ACCEPTED	ACCEPTED REJECTED	ACCEPTED ACCEPTED	
COMMENTS	C ACCEPTED WITH COMMENTS	C ACCEPTED WITH COMMENTS	C ACCEPTED WITH COMMENTS	
VL VERIFICATION OF DISPOSITION		0 (16)		
(17) BY	SIGNATURE	TITLE	DATE	

8.8.2 Identification of Nonconforming Items

Items identified as nonconforming will be documented on a Nonconformance Report that will include the following information:

- Description of nonconforming item or activity
- Detailed description of nonconformance
- Referenced criteria
- Recommended disposition and corrective action to prevent recurrence (as applicable)
- Affected organization

8.8.3 Control and Segregation

The nonconforming items will be controlled to prevent inadvertent use. All items identified as nonconforming will be clearly identified and segregated from acceptable items when practical.

8.8.4 Disposition

The disposition of Nonconformance Reports will include the necessary actions required to bring the nonconforming condition to an acceptable condition and may include reworking, replacing, retesting, or reinspecting. Implementation of the disposition may be done in accordance with the original procedural requirements, a specific instruction, or a Field Change Request (FCR) (Figure 8-4.

8.8.5 Corrective Actions

Upon detection of a nonconforming condition the CQC System Manager will immediately take corrective action. In addition to resolving identified nonconforming conditions, corrective action records will also address the initial cause of adverse conditions and establish methods and controls to prevent recurrence of the same or similar types of nonconformances. The CQC System Manager will monitor the corrective actions to verify that they were properly implemented and accepted and that the Nonconformance Report (Figure 8-3) was closed out.

FIGURE 8-4

FOSTER WHEELER ENVIRONMENTAL CORPORATION ENGINEERING PROCEDURES DEVELOPING AND ISSUING ENGINEERING DOCUMENTS

FIELD CHANGE REQUEST

Project	Proj. No.		Field Change No.	
ТО	_DEPT	LOCATION	DATE	
RE: Drawing No Spec No Other	Tit	le		
1. Description (Items involved, submit sl	tetch if applicable)			
2. Reasons for Change (If from disposition	on of nonconformance	report, list report numbe	:r)	
3. Recommended Disposition	Minor Change	Major Chan	ge	
 Resident Engineer (Signature) 	Date	Project Supt. Concurre	ence (Signature)	Date
 Disposition NOT APPROVED (Give Reason) 				
CONSIDERED MINOR CHANG documents will not be normally r	E - Approved per Rec evised; field to mainta	ommended Disposition-I ain as-built records	Design	
CONSIDERED MAJOR CHANG	E - Action will be tak	en as prescribed on DCN	-	Date
(Signature)	Dan	Tiojeet Engineer of De	-signee	Date
Project Engineer signs and returns to LD	E for transmittal to Re	sident Engineer with cop	pies to:	
Project Manager		Others as Required	ann 1, s	
Project Supt.				
Project Files				

8.9 MANAGEMENT INSPECTIONS

In addition to the required QC field inspections, one internal management inspection will be performed and will check for the following:

- Possession and use of approved procedures, standards, and technical specifications
- Conformance with appropriate procedures, standards, and instructions
- Thoroughness of performance
- Identification and completeness of documentation generated during performance.

Section 9.0 (A1) - Quality Assurance Project Plan

Title and Approval Sheet

For

IRP Site FT-31, Fire Training Area **Bioventing System** Quality Assurance Project Plan Holloman AFB Alamogordo, N.M.

Prepared By:

Foster Wheeler Environmental Corporation 143 Union Boulevard, suite 1010 Lakewood, CO. 80228

Foster Wheeler Environmental Corporation Approval

For

Ron Versaw Delivery, Order Manager

Paul R. White Quality Assurance Manager

nus

Pam Moss **Project Chemist**

<u>4-17-97</u> Date

S. Army Corps of Engineers Approval

connealv Chief Chemistry Section

<u>**4**/18/97</u> Date

9.0 QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP)has been prepared to follow the format provided in the General Chemistry Supplement to the Scope of Services for Studies (USACE 1996). The "A" designations following the section heading number correspond to the designation found in the above referenced document.

9.1 (A2) TABLE OF CONTENTS

The Table of Contents (TOC) for the Quality Assurance Project Plan (QAPP) is contained within the TOC for the Workplan.

9.2 (A3) DISTRIBUTION LIST

The distribution list is indicated on the transmittal letter for the submittal of the Draft Final Construction Workplan IRP Site FT-31, Fire Training Area Bioventing System.

9.3 (A4) PROJECT ORGANIZATION AND RESPONSIBILITIES

Ms. Pam Moss will be the Project Chemist for the FT-31 Bioventing System project. In this capacity she will be responsible for the oversight of laboratory performance and for the validation of the analytical data prior to disposition of the waste. Analytical services will be provided by Laucks Testing Laboratories, Inc. (Laucks). Ms. Karen Kotz will be responsible for the overall performance of the laboratory and the implementation of the analytical requirements for the project. Ms. Kotz is also responsible for reporting any problems associated with sample cooler receipt and/or problems with analysis of the samples. Any corrective action implemented in the laboratory that may potentially affect the quality of the analytical data shall be approved by Ms. Moss prior to implementation.

Mr. Bill Foley will be the onsite CQC System Manager responsible for ensuring that sampling is conducted in accordance with prescribed procedures. All corrective actions will be provided to the FWENC Project QA Manager, Mr. Paul White and the Delivery Order Manager, Mr. Ron Versaw for concurrence. Additional information regarding the project organization, including an organization chart is provided in Section 10 of the Workplan.
9.4 (A5) PROBLEM BACKGROUND/DEFINITION

Sampling and analysis is being conducted to determine the disposal options for waste generated during the construction of the FT-31 Biovent System. The waste generated during the construction of this system is anticipated to consist of soil generated during the drilling of the extraction wells and excavation of trenches, and decontamination water. Site contaminants are anticipated to be total petroleum hydrocarbons (TPH) and benzene. A detailed Site Description including the site history and site contamination information is contained in Section 2 of the Work Plan. The known contaminants were identified during the RCRA Phase II RFI. Additional details regarding contaminants are contained in Section 5, Regulatory Compliance Plan and Section 7, Field Sampling Plan of the Workplan.

9.5 (A6) PROJECT DESCRIPTION

This QAPP has been prepared to address the specific chemical QA requirements for sampling and analysis conducted during the installation of the bioventing system at IRP Site FT-31. A description of the project scope is contained within Sections 3 of the Workplan.

The activities covered by this QAPP include sampling and analysis for waste characterization of the soil cuttings generated during drilling for well construction, characterization of soil generated during trenching, and decontamination water generated during remedial activities. QC activities for the construction of the remediation system are discussed in Section 8. The Field Sampling Plan contains detailed information on the number and types of samples to be collected and the sampling procedures to be used.

9.6 (A7) QUALITY OBJECTIVES

9.6.1 Data Quality Objectives (DQOs)

Sampling and analysis will be conducted to determine the proper disposal options for soil generated during drilling and trenching and decontamination water generated during remedial activities.

9.6.2 Analytical Support Levels

The analytical support levels for the FT-31 bioventing system IRP will include screening level and definitive data as determined by the project DQOs. Screening level data will be generated from the on-site screening of soil using the PID and immunoassay test kits for determination of TRPH. Definitive data will be generated by the off-site analytical laboratory for the analysis of the potentially contaminated soil for TRPH, benzene, and lead; and for the VOC analysis of the decontamination water.

9.6.3 Data Quality Indicators

Laboratory precision and accuracy data and reporting limits are provided in Appendix F. Method descriptions for each of the analyses required for the project are provided in Section 9.13.

9.6.4 Level of Field Quality Control Effort

One soil sample will be collected and sent to the off-site laboratory as a field duplicate to assess sampling and analytical precision. Decontamination water samples will be packaged together and shipped to the off-site laboratory with one trip blank to be analyzed for VOCs.

9.7 (A8) PROJECT NARRATIVE

Information required for the Project Narrative is contained throughout the Work Plan.

9.8 (A9) SPECIAL VALIDATION

Laucks is validated by USACE - Missouri River Division to perform the analytical methods required for this project. All contact with Laucks will be made to:

Laucks Testing Laboratories, Inc. 940 S. Harney Street Seattle, Washington 98108 Phone: 206-767-5060 Attn: Ms. Karen Kotz

9.9 (A10) DOCUMENTATION AND RECORDS

Documentation and Records generated during this project and the submittal schedule for each will consist of:

- 1. Field Borelogs and Well Construction Logs Submitted to USACE Project Engineer within one day of completion.
- 2. Daily Quality Control Reports Submitted to USACE Project Engineer by noon of the following day.
- 3. On-site TRPH Screening Logs Submitted to the FWENC Project Chemist for review, and to be included with the project report.
- 4. Level 3 Type Analytical Data Packages Submitted by Laucks to the FWENC Project Chemist within 2 weeks of completion of analysis for validation. Submitted to USACE with the project report.

Additional documentation consisting of the geologist and field sampling logbooks will be made. All logbook pages will be copied and maintained in the field files.

9.10 (B1) SAMPLING DESIGN PROCESS

The Design of Data Collection Operations is presented in Section 7.3 of the Field Sampling Program (FSP). This section of the FSP discusses the project specific requirements related to the type and frequency of sampling, including QC samples, as well as establishment of nomenclature to designate the various samples that will be acquired in the field. Field Procedures to be used during the project are provided in Appendix B.

9.11 (B2) SAMPLING METHOD REQUIREMENTS

Sampling procedures for collection of soil and decontamination fluids are discussed in Section 7, the FSP. These procedures consist of:

SOP B5 Stockpile Soil Sampling

SOP B6 Decontamination Water Sampling

These procedures are provided in Appendix B to this Workplan.

9.12 (B3) SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sample Handling and Custody Requirements are contained in SOP B7. This SOP provides detailed information on the processes used for sample labeling, sample preservation, sample handling and shipping, sample documentation and tracking, and sample chain of custody. Examples of the Sample Tag, Chain of Custody and the Custody Seal are presented as Figures 9-1, 9-2, and 9-3, respectively. Sample containers, preservation requirements and holding times are presented in Table 9-1.

Water and soil samples received at Laucks will be documented and logged into their Laboratory Information Management System (LIMS) for tracking purposes. Each sample will be assigned a unique work order, sample number, and test code. Date and time of sample receipt as well as identifying marks are recorded in the LIMS. A label exhibiting the unique workorder number is attached to each sample container. Samples are tracked under C-O-C from the point of entry into the laboratory system until time of disposal and are checked into and out of secure storage areas by authorized personnel.

9.13 (B4) ANALYTICAL METHODS REQUIREMENTS

The analytical program for this project will consist of on-site TRPH immunoassay testing (Method SW-846 4030 draft) and off-site chemical testing. Analytical methods for chemical analysis are taken from USEPA SW-846 "Test Methods for Evaluating Solid Waste, Third Edition" (EPA 1986), and Methods for Chemical Analysis of Water and Wastes, EPA Manual 600/4-79-020. The off-site chemical analytical procedures to be used for liquid and solid samples are specified in Table 9-2.

9.13.1 Volatile Organic Compounds

VOCs include three classes of halogenated organic, nonhalogenated organic, and aromatic organic compounds. The first two classes include contaminants associated with solvents, the third class includes compounds associated with fuels. Decontamination water will be analyzed for VOCs.

Figure 9-1 Sample Tag Form

ANALYSES REQUESTED	TAG NO:	SITE IDENTIFICATION:
	SITE TYPE:	REMARKS:
	DATE:	
	DEPTH (FT):	
	TECHNIQUE:	FOSTER WHEELER ENVIRONMENTAL 143 Union Blvd. Lakewood, CO 80228
(Signatures)	TIME:	ENVIRONMENTAL PROGRAM

Figr -2

Foster Wheeler Environmental Corporation

Chain-of-Custody Record

Project No. Project Name Sample Date:					nple Date:		Pres	erv	ativ	e								Ana	alys	is I	Req	uir	ed											
Chain-of-Custody No. Samplers:							te/NaOH		e Technique	Containers			enzene	ad																	I ag Number			
Site Type	lde	Site Intificat	ion	Time (Military Standard)	Sample Depth (inches / feet)	FONH	H2SO4	NaOH	ZnAceta		Sample	No. of	VOCs	тярн	Total B	Total Le																	sample	
																								_										
																								+							_	_	 ,	-
			<u>.</u>								_											_		_					-	+	_	_		_
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Relinquished	d by: (Signa	atu <i>re)</i>	Date	e/Time	Received by: (Sig	natu	re)				Da	ate/T	ime										y 0								_		 	_
Relinquished	d by: (Sign	ature)	Date	e/Time	Received by: (Sig	natu	тө)				Da	ite/T	ime		-	Jar			15 / 	hin 6		-gre	atic				<u> </u>	0					 	dí 96.
												-			_	ier	npera	iure	WI				anc	- ni			_0	-					 	-31 4.8
Remarks:															_	Cor	recteo	d Co	ppy /	Atta	che	d												man Fl
													Problems or Discrepancies					Hollo																

Figure 9-3 Custody Seal

FOSTER WHEELER ENVIRONMENTAL CORPORATION 143 Union Boulevard, Suite 1010 Lakewood, CO 80228	Sample Number Signature	Date	en by:	
Place Collected	Print Name and Tille (Scientist, Technician)		Seal brok	Date

ŀ

Table 9-1

				Maximum Ho	olding Times ⁽³⁾
Matrix	Parameter	Container ⁽¹⁾	Preservation ⁽²⁾	Extraction	Analysis
Liquid	VOCs	3 x 40ml ⁽⁴⁾ VOA	HCL to pH<2		14 d ⁽⁵⁾
			Ice to 4°C		
Solid	TRPH	1 x 8 oz. ⁽⁶⁾ G	Ice to 4°C		28 d
Solid	Benzene	2 x 125 ml G	Ice to 4°C		14 d
Solid	Lead	1 x 8 oz G	Ice to 4°C		180 d

Sample Container, Preservation, and Holding Time Requirements

Notes:

¹All containers must have Teflon-lined lids (Teflon-lined septa for VOA vials).

An containers must nave 1 effon-lined lids (Tetlon-lined septa for VOA vials). G = Amber Glass; P = High-Density Polyethylene²Sample preservation will be done in the field immediately upon sample collection. ³When only one holding time is given, it implies total holding time from sampling until analysis. ⁴ml-millimeter ⁵d-day ⁶

⁶oz-ounce

The volatile organic method 8260A employs gas chromatography (GC) for separation of compounds and mass spectrometry (MS) for detection. Benzene in soil samples will be analyzed using method 8020A which employs GC for separation of compounds and a photoionization detector.

9.13.2 Total Recoverable Petroleum Hydrocarbons

Petroleum hydrocarbon analysis is indicated where suspected or known releases or disposal of fuels, waste petroleum, oil, and lubricants have occurred. Soil samples for total recoverable petroleum hydrocarbon analysis will be extracted and analyzed using methods 9071/418.1. This method employs infrared spectrophotometry to measure freon-extractable petroleum hydrocarbons.

9.13.3 Lead

Lead analysis will be performed on the composite soil sample from the PCS stockpile as required by the PCS TSDF for disposal purposes. Lead will be extracted using method 3050 and analyzed using method 7421, graphite furnace atomic absorption spectroscopy.

9.14 (B5) QUALITY CONTROL REQUIREMENTS

Duplicate samples will be collected and analyzed for the same parameters for five percent of soil samples. No field duplicate sample will be collected for decontamination water. Trip blanks will be shipped with each cooler containing water samples for VOC analysis. The analytical laboratory will adhere to the internal QC checks specified in their QA Plan.

Corrective Actions will be conducted in accordance with the process identified in Section 8.8.5 of the Work Plan. The CQC System Manager will be responsible for identifying nonconforming conditions during sampling and shipping. The Laboratory QA Manager will be responsible for identifying nonconforming conditions in the laboratory. All nonconforming conditions and recommended corrective action will be immediately reported to the Project Chemist and the Project Quality Assurance Manager.

Table 9-2

Analytical Procedures for the FT-31 Bioventing System

		Extraction and	Analysis Method
Parameter	Technique	Liquid	Solid
VOCs ⁽¹⁾	GC/MS ⁽²⁾	8260A	NA ⁽³⁾
Benzene	GC/PID ⁽⁴⁾	NA	8020A
TRPH ⁽⁵⁾	IR ⁽⁶⁾	NA	9071/418.1
Lead	GFAA ⁽⁷⁾	NA	3050/7421

Notes:

¹VOCs - Volatile Organic Compounds

²GC/MS - Gas Chromatography/Mass Spectrometry

³NA - Not applicable ⁴GC/PID - Gas Chromatography/Photoionization Detector

⁵TRPH - Total Recoverable Petroleum Hydrocarbon

⁶IR - Infrared Spectrophotometry

⁷GFAA - Graphite Furnace Atomic Absorption

Laucks will perform sample analysis in accordance with their internal QA program. This program includes periodic review and inspection of laboratory procedures, followed by reports to management. These reviews are performed and documented by the laboratory QA manager. The audits are used to ensure proper use of measurement systems, evaluate accuracy of analytical procedures, and to assume the laboratory is adhering to internal policies and procedures are set forth in their QAP and SOPs.

9.15 (B6) INSTRUMENT/EQUIPMENT TESTING AND MAINTENANCE REQUIREMENTS

All field and laboratory instruments will be tested to ensure proper functioning prior to sampling and analysis. Photoionization detectors will be used during sampling for health and safety monitoring and for TRPH screening. Maintenance of PIDs is discussed in Section 7.2 of the Basewide Health and Safety Plan. The laboratory performs maintenance on all instruments as per an established schedule or based on the manufacturer's recommendation. Appendix G contains the instrument maintenance schedule for Laucks.

9.16 (B7) INSTRUMENT CALIBRATION

Instrument Calibration for Health and Safety Monitoring is discussed in Section 7 of the Basewide Health and Safety Plan. Lauck's instrument calibration procedures for GC/MS, GC, GFAA, and UV spectrophotometers are contained in Appendix G.

9.17 (B8) INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES

I-Chem Quality Assured containers will be used for collection of field samples. Certification will be supplied to the site CQC Systems Manager with any shipment of sample containers. Standards supplied for the calibration of the PID will be certified as traceable to a primary standard. These certifications will be attached to the DQCR.

Standard solutions used by Laucks for analytical testing are obtained from reliable sources and prepared with calibrated glassware. Where possible, standards are used which are traceable to the National Institute of Standards and Technology through the stock standard supplier and Lauck's internal system of standards tracking.

9.18 (B9) DATA ACQUISITION REQUIREMENTS

Data used to determine the field sampling and analysis requirements was obtained from the Phase II RFI for FT-31. This data is presented in Section 5.3.1 of the Workplan. Table 5-3 presents the constituents identified in the RFI. The data collected for the RFI has been determined to meet the Data Quality Objectives for the investigation.

9.19 (B10) DATA MANAGEMENT

Definitive data deliverables are required for this project for the off-site laboratory analysis. Hard copies of the data deliverables will be provided to FWENC within two weeks of completion of analysis for validation prior to submittal. Electronic data formats consistent with the Installation Restoration Program Management Information System (IRPIMS) are not required. Information for hardcopy data deliverables includes:

- Sample results forms
- Initial and continuing calibration information
- Method blank summary
- Laboratory control sample summary
- Matrix spike/matrix spike duplicate summary
- Surrogate percent recovery data
- Internal standard area summary
- GC/MS tuning data

9.20 (C) ASSESSMENT/OVERSIGHT

Inspections of sampling of soils and decontamination water will be conducted during the Biovent System installation by the onsite CQC System Manager. All inspections will be documented on the DQCR. In addition, one Management Inspection will be conducted as indicated in Section 8.9. Laboratory oversight will be conducted by the laboratory QA Manager as described in their QA Plan. Any deficiencies noted during inspection activity requiring corrective action will be documented on the corrective action form presented in section 8.0 and provide to the FWENC Project Chemist. All corrective actions must be approved by the Delivery Order Manager and the QA Manager.

9.21 (D) DATA VALIDATION AND USABILITY

Analytical data generated by Laucks will be validated by the Foster Wheeler Environmental Project Chemist prior to disposition of the waste. This validation will be in accordance with PARCC parameters, and will include a review of the COC, holding times, instrument calibration, trip and method blanks, verification of quantitation limits, laboratory corrective actions, analyte quantitation and identification, surrogate system monitoring compounds, MS/MSD analyses, internal standards performance, and data completeness.

10.0 PROJECT MANAGEMENT PLAN

This section will present the project schedule and identify key personnel involved in the construction phase of the project.

10.1 PROJECT SCHEDULE

Figure 10-1 presents the FT-31 Site Bioventing System Construction schedule.

10.2 PROJECT PERSONNEL

Figure 10-2 presents the project organization chart. A brief summary of key Foster Wheeler

Environmental project team members and their responsibilities are as follows:

- SINA SEYEDIAN, P.E.—Mr. Seyedian serves as the Program Manager of the Total Environmental Restoration Contract.
- RONALD VERSAW, P.E.—Mr. Versaw act as DOM for Holloman AFB activities on this project. In this role, he is responsible for the implementation of the work in accordance with performance, cost, and schedule goals.
- DAN HOLMQUIST—Mr. Holmquist will act as Site Manager for this project. In this role, Mr. Holmquist will be responsible for the daily execution of site related project activities.
- RONALD BORREGO, P.E—Mr. Borrego will support Mr. Versaw as the Project Engineer. In this role, Mr. Borrego will be responsible for the daily execution of office-related project activities. In addition, he will lend technical assistance and oversight to the Subcontractors to assure performance of the work in accordance with regulations, professional standards, and client expectations.
- HERMAN CALVO—Construction Project Manager—This individual will be responsible for the daily progress of construction activities, and provide Foster Wheeler Environmental management and oversight to all Foster Wheeler Environmental Subcontractors.
- BILL FOLEY—CQC System Manager—This individual will be responsible for implementing the QC system during the remedial activities.

Figure 10-1



Figure 10-2 FT-31 Project Organization Chart



10.3 PROJECT MEETINGS

Project meetings will be held at the site and the Denver home office and supplemented by weekly

(or more frequent) teleconferences. The agenda for these meetings may include the following:

- Review of work progress
- Field observations, problems, and conflicts
- Problems that affect the construction schedule, and proposed corrective actions
- Review of off-site delivery schedules
- Revisions to construction schedule
- Forecast of progress for following week
- Review of submittal schedule
- Review of quality/health and safety programs
- Pending changes and substitutions
- Review of proposed changes for effects on construction, construction completion date, and other construction activities
- Any other business

10.4 DATA MANAGEMENT

Data management is addressed in detail in Section 8.

10.5 DOCUMENT CONTROL

Document control is addressed in detail in Section 8.6 of this Workplan, CQC Plan.

10.6 REPORTS

Reports and submittals are discussed in detail in Section 8.7 of this Workplan, CQC Plan.

11.0 <u>REFERENCES</u>

- EBASCO/GTI (Ebasco Services Inc./Groundwater Technology Inc.) 1995 Draft Bioventing Initiative, Sites FT-31 and SD-47, Preliminary Pilot Testing Report, Holloman AFB, NM, October.
- EPA (ENVIRONMENTAL PROTECTION AGENCY) 1995 Region III Risk Based Concentration Table.

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1992 Test Plan and Technical Protocol for a Field Treatability Test for Bioventing.

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1995 Correspondence to Mr. Howard E. Moffit, Deputy Base Civil Engineer, May 15.

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1993 Basewide Background Study for Holloman AFB.

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1996 General Chemistry Supplement to the Scope of Services for Studies, January.

APPENDIX A

COMPLIANCE PROCEDURE FOR REPORTING SPILLS AND RELEASES

Foster Wheeler		RC 6
Environmental Regulatory	REPORTING SPILLS AND	Revised: 08/18/95
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1.0 PURPOSE

The purpose of this procedure is to implement Foster Wheeler Environmental Corporation's policy of strict compliance with all reporting requirements. This procedure describes the four categories of spills that Foster Wheeler Environmental employees must report, and identifies the specific reporting process to follow for each category.

Numerous federal, state, and local regulatory requirements govern spill/release reporting and response activities. Depending upon the circumstances, reporting may be necessary under federal (CWA, CERCLA, SARA Title III, RCRA, TSCA), state, and/or local spill reporting programs. Some programs specify minimum quantities, others do not. Some programs apply to virtually any spill, others are very specific.

Spill/release reporting can be complex. Outside contractor employees have been indicted and convicted of criminal violations of federal spill/release reporting requirements. This obligation may hold even though the spill was made by the client and not the contractor. In the absence of such requirements, money damages may still be imposed by a court for failure to disclose knowledge of spills that present a hazard to human health.

2.0 SCOPE

This procedure applies to all Foster Wheeler Environmental employees who learn of the existence of a spill or release during the course of a project. The procedure is to be implemented *immediately* once a Foster Wheeler Environmental employee learns of the existence of a spill or release, regardless of who may have caused the spill or when the spill may have occurred.

As noted in the Project Regulatory Compliance Procedure (RC 1), it is critical that spill reporting procedures be coordinated with the client prior to initiation of the project. If the procedures are modified and a mutually agreeable criteria to responding to spills are developed with the client, the Regulatory Compliance Manager must be advised of and must approve of these modified procedures.

3.0 DEFINITIONS

None.

4.0 RESPONSIBILITIES

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4.1 PROJECT PERSONNEL

The Project Manager shall present these procedures to the client prior to beginning the project. The Project Manager shall assign an On-Site Spill/Release Coordinator to each remediation and waste management project. The On-Site coordinator shall be identified in the project Regulatory Compliance Plan or Waste Management Plan, and shall be trained in these procedures by the assigned Regulatory Affairs Advisor.

4.2 REGULATORY COMPLIANCE PERSONNEL

The Regulatory Affairs Advisors must train the assigned On-Site Coordinators in these procedures and document that training. Any client questions or concerns regarding these procedures shall be referred to the Regulatory Affairs Advisor or the Regulatory Compliance Manager.

5.0 PROCEDURE

The On-Site Coordinator, in conjunction with the assigned Regulatory Affairs Advisor and the Regulatory Compliance Manager, must determine the following:

- Who caused the spill/release;
- Whether it is reportable;
- Who must report;
- *How* to report, if required.

The following steps must be followed to determine the answer to these questions and determine the appropriate reporting requirements.

STEP 1: DETERMINE WHO CAUSED THE SPILL - FOSTER WHEELER ENVIRONMENTAL OR CLIENT

Foster Wheeler Environmental Spill/Release

A spill/release is considered a "Foster Wheeler Environmental spill/release" if the following conditions are met:

• The spill/release is physically caused by, or is suspected to have been caused by, a Foster Wheeler Environmental or Foster Wheeler Environmental subcontractor employee.

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- The spill/release is from, or is suspected to have been from, a facility or equipment that meets one of the following criteria:
 - owned by Foster Wheeler Environmental or a Foster Wheeler Environmental subcontractor
 - operated by Foster Wheeler Environmental or a Foster Wheeler Environmental subcontractor
 - under Foster Wheeler Environmental's direct or indirect control as a construction manager, oversight contractor, or similar capacity.

Client Spill/Release

All other spills/releases are considered "client spills/releases" for purposes of this procedure.

STEP 2: DETERMINE IF THE SPILL OR RELEASE IS REPORTABLE

After responding to the spill as directed in the Foster Wheeler Environmental Health and Safety procedures, the On-Site Coordinator assigned to the project must contact the Regulatory Affairs Advisor to determine if the spill or release is subject to any federal, state, or local reporting requirements. The on-site coordinator must provide an estimate of quantity and concentration of the material spilled or released, and other details of the spill/release. The Regulatory Affairs Advisor will identify what agencies need to be notified and the type of notification (i.e., written or verbal) required.

STEP 3: DETERMINE IF THE SPILL OR RELEASE POSES A THREAT TO HUMAN HEALTH

If *no* reporting requirement is identified in Step 2, the Regulatory Affairs Advisor will contact the Regulatory Compliance Manager. The Regulatory Compliance Manager will determine if the spill or release poses a threat to human health. For purposes of this procedure a spill/release is considered to present a hazard to human health if the following criteria are met:

- The spill or release results, or may result, in downgradient groundwater contamination that has entered, or is about to enter, known drinking water sources (wells or surface water bodies)
- The spill or release has caused, or is about to cause, contamination of surface soils or other materials in areas accessible to the general public

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• The spill or release has caused, or is about to cause, odors/air contamination detectable in areas accessible to the general public.

STEP 4: REPORT THE SPILL OR RELEASE

Spills or releases that are either "reportable" (Step 2) or determined to pose a "hazard" (Step 3) must be reported as specified in Table 1 below. Spills or releases which are *not* "reportable" (Step 2) or determined *not* to pose a "hazard" (Step 3) **need** *not* be reported to an agency, but response information should be provided to the client and retained in the project file. These determinations and how the release was reported, if applicable, must be documented in the project file.

PARTY WHO CAUSED SPILL	REPORTABLE TO AGENCY	NOT REPORTABLE BUT THREAT TO HUMAN HEALTH
Foster Wheeler Environmental	 Immediately report to the client and regulatory agencies. Regulatory Affairs Advisor must provide Regulatory Compliance Manager with verbal and written notification of the spill. 	 The Project Manager and Regulatory Compliance Manager will report to clien Regulatory Compliance Manager and client will determine whether to report to agencies.
Client	 Real-Time Spill Release. If Foster Wheeler Environmental personnel observe the occurrence of the spill or release or learn of it immediately after it happens: Project Manager shall immediately contact the client to give the client a "right of first refusal" to report the spill/release, and notify the Regulatory Compliance Manager. If the client cannot be reached or declines to report, Project Manager shall report to the regulatory agencies as specified in Step 2 above. Historic Spill or Release. If Foster Wheeler Environmental personnel observe or learn of evidence that a spill or release has occurred in the past: Regulatory Affairs Advisor will immediately notify the Regulatory Compliance Manager. The Regulatory Compliance Manager along with Project Manager will notify the client and avaluate whether the roll or place has 	 The Project Manager and Regulatory Compliance Manager will report to clier Regulatory Compliance Manager and client will determine whether to report to agencies.

6.0 TRAINING

All project personnel must be trained in this and other Regulatory Compliance Procedures and Policies. The assigned project Spill/Release Coordinator may contact the Regulatory Affairs Advisor if additional training is required in order to implement this procedure.

7.0 REFERENCES

None.

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----End of Section----

APPENDIX B

STANDARD OPERATING PROCEDURES FOR FIELD INVESTIGATIONS

The Standard Operating Procedures for *Holloman AFB* field investigation activities are included in this appendix. It is understood at all times that the site-specific requirements supersede these generic requirements.

LIST OF STANDARD OPERATING PROCEDURES

- SOP B1 Borehole and Well Logging
- SOP B2 Decontamination Methods
- SOP B3 Residuals Management
- SOP B4 Photoionization Detectors
- SOP B5 Stockpile Soil Sampling
- SOP B6 Tank Sampling
- SOP B7 Sampling Handling and Documentation

SOP B1 BOREHOLE AND WELL LOGGING

Drilling Logs and Documentation

Each boring shall be fully described on a boring log similar or equivalent to that shown in Figure 1 of this procedure. Because detailed well logs exist for the FT-31 site (see Draft Final Phase II RCRA Facility Investigation Report, Table 1 Solid Waste Management Units, Volumes I and II, June 1995. Figure 4.5-1, Fire Training Area - Soil Sample Locations. Appendix B, Boring Logs), the borings shall be primarily logged on the basis of drilling cuttings. The Contractor's Field Representative may request split spoon samples to clarify subsurface conditions, as needed. The Contractor's Field Representative shall log the boring as it is being drilled by recording relevant data, listed below, on either the appropriate boring log or in a bound field notebook. Boring log forms may be transcribed from a field notebook, but must be completed on a daily basis. Data to be included in the logs, when applicable, are:

- Identifying number and location of each boring.
- Depths in feet and tenths of feet.
- A full description of soils based on drill cuttings, including major and minor constituents, Uniform Soil Classification System (USCS) soil type, color, moisture content, and relative density or cohesiveness. Split spoon samples shall be taken at the discretion of the Contractor's field representative, to clarify subsurface conditions.
- The number of blows required for each 6-inch penetration of split-spoon sampler and for each 12-inch penetration of casing; hammer weight and length of fall for split-spoon samplers.
- Field screening results as an indication of soil contamination.
- A general description of the drilling equipment used. This description, including such information as rod size, bit type, pump type, rig manufacturer, and model, may be provided in a general legend.
- Dates and times of start and completion of boring.
- Names of Contractor, driller and Contractor's Field Representative.

Figure 1

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HTW Drilling Log

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Location Name of driller Manufacturer's designation of drill Sizes and types of drilling and sampling equipment Sizes and types of drilling and sampling equipment Hole location Surface elevation Date started Date completed Overburden thickness Depth groundwater encountered Depth drilled into rock Depth to water and elapsed time after drilling completed Total depth of hole Other water level measurements (specify) Geotechnical samples • Disturbed • Undisturbed • Other (specify) • Other (specify) • Other (specify)	Company	/ nameFoster Wheeler	Environmental Corpora	tion Drilling s	ubcontractor					
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Sizes and types of drilling and sampling equipment Hole location Surface elevation Date started Date completed Overburden thickness Depth groundwater encountered Depth drilled into rock Depth to water and elapsed time after drilling completed Total depth of hole Other water level measurements (specify) Geotechnical samples Disposition of hole • Undisturbed Backfilled • Undisturbed Backfilled • Undisturbed Backfilled • Watals Signature of inspector • Other (specify) Signature of ins	Manufactu	urer's designation of dr								
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Depth drilled into rock Depth to water and elapsed time after drilling completed Total depth of hole Other water level measurements (specify) Geotechnical samples . Disturbed • Disturbed	Overburd	len thickness	Depth gro	undwater encountere	d					
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Geotechnical samples	Total dept	th of hole	Other wat	er level measuremer	ts (specify)					
• Undisturbed Disposition of hole • Undisturbed Backfilled • Samples for chemical analysis • Monitoring well • VOCs • Monitoring well • Other (specify) • Other (specify)	Geotect	hnical samples	Tota	I core recovery	%					
Total number of core boxes	• Ui	indisturbed	Disp	osition of hole						
Samples for chemical analysis • Other (specify) • VOCs · · · · · · · · · · · · · · · · · · ·	Total nu	umber of core boxes .		Monitoring well	ıg well					
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HTW Drilling Log

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Projec	t Hollon	nan AFB Site FT-31 Former Fir	e Training	Area	-lole No.	Inspe	ctor	
Elevation	Depth (ft)	Description of Materials	Field Screening Results	Geotech Sample or Core Box No.	Analytical Sample No.	Blow Counts	Remarks	
Elevat	tage 	Description of Materials	Field Screet	Geote Sample Core E No.	Analytics	Count	Remarks	
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As the boring is drilled, the Contractor's Field Representative shall evaluate the drill cuttings and drilling progress to determine appropriate stratigraphic definitions or distinctions within the soil column. Such contacts or breaks between strata shall be determined by the Contractor's field representative and indicated on the boring log. Stratigraphic contacts based on drill cuttings shall be indicated on the log as dashed lines. In general, a stratigraphic unit contains only similar soils which can be classified within the same two-letter USCS classification category symbol. In some cases, significant differences in soil color, grain size distribution, strength, etc., would be sufficient to classify soils having the same two-letter USCS classification category symbol into two or more distinct strata.

Major and Minor Constituents: The name of the soil describes the relative percentage by weight of the soil constituents. Minor constituents are added as modifiers to the major components, and so the major soil component is named last. In addition, the size of sand or gravel grains are always included as a parenthetical addition to these components. Some examples of soil descriptions include: sand (f-med gr); slightly clayey, silty sand (f gr); silt and sand (f-cs gr). The appropriate modifiers for a given weight percent for minor components are presented below:

Defining Range of
Percentages by Weight
0 - 10%
11 - 20%
21 - 35%
36 - 50%

The appropriate grain size modifiers for sand and gravel are:

<u>Particle Name</u>	Grain Size Diameter
Cobbles	> 64 mm
Pebbles	4 - 64 mm
Granules	2 - 4 mm
Very Coarse Sand	1 - 2 mm
Coarse Sand	0.5 - 1 mm
Medium Sand	0.25 - 0.5 mm
Fine Sand	0.125 - 02.5 mm
Very Fine Sand	0.0039 - 0.0625 mm

USCS Classification: Soils shall be classified according to the USCS. This method of classification is detailed in Figure 2. This method of classification identifies soil types on the basis of grain size and liquid limits, and categorizes them by two-letter symbols.

In the USCS system, fine-grained soils, or fines, are classified as those that will pass through a No. 200 U.S. standard sieve (0.074 mm) and are of two types: silt (M) and clay (C). Some classification systems define size ranges for these soil particles, but for field classification purposes, they are identified by their respective behaviors only. Organic material (O) is common component of soil but has no size range, and is recognized by its composition.

Gravely soils are identified by a (G) as the first letter in the two-letter symbol, whereas sandy soils are identified with an (S). The term "rock fragments" shall be used to indicate granular materials resulting from the breakup of rock. These materials are normally angular, indicating little or no transport from their source. When the term "rock fragments" is used it shall be followed by a size designation, such as "1/4" - "1/2" diameter" or "coarse-sand size" either immediately after the entry or in the remarks column. The USCS classification would not be affected by this variation in terms.

The second letter in the two-letter USCS symbol provides information about the grain size distribution of granular soils, or the plasticity characteristics of fine-grained soils. These second-letter modifiers are (P) well sorted, (W) well graded/poorly sorted, (C) clayey, (M) silty, (L) low plasticity, or (H) high plasticity. Note that the term "poorly graded" implies a uniform grain size distribution and is the same as "well sorted."

Color: Soil colors should be described utilizing a single color descriptor preceded, when necessary, by a modifier to denote variations in shade or color mixtures. A soil could therefore be referred to as "gray" or "light gray" or "blue-gray." Since color can be utilized in correlating units between sampling locations, it is important that color descriptions be kept consistent throughout field operations.

Colors must be described while the sample is still moist. Soil samples should be broken or split vertically to describe colors. Soil sampling devices tend to smear the sample surface creating color differences between the sample interior and exterior. Munsell Color Charts or equivalent shall be used.

Figure 2 The Unified Soil Classification System (USCS)



Moisture: Moisture content is estimated in the field according to four categories: dry, moist, wet, and saturated. In dry soil, there appears to be little or no water. Saturated samples obviously have all the water they can hold. Moist and wet classifications are somewhat subjective and often are determined by the individual's judgment.

Relative Density or Cohesiveness: This descriptive term is used to provide a sense of the resistance of the soil to penetration by the drill rig. It is a qualitative evaluation of drilling conditions, meant to distinguish soil variability across the site. Four descriptive terms are used: loose, firm, hard, and very hard. Loose soils are easily penetrated, and are likely to collapse if the drill augers are removed. Firm soils are also easily penetrated, but an auger hole will remain open without support. Hard soils require greater pressure from the drill rig to advance the hole, relative to firm soils, and may result in slower drilling progress. Very hard soils are difficult to drill, and drilling progress is noticeably slower.

Well Logging

The constructed dimensions of each well shall be fully described on a well construction diagram similar or equivalent to that shown in Figure 3. The Contractor's field representative shall log the well as it is being built by recording relevant data, listed below, on either the appropriate well construction diagram or in a bound field notebook. Well construction diagrams may be transcribed from a field notebook, but shall be completed on a daily basis. Data that shall be included in the logs, when applicable, are:

- Project and site names, well number and the total depth of the well.
- Depth of any grouting or sealing, the amount of cement and/or bentonite used, and the total depth of the boring.
- Static water level upon completion of the well.
- Installation date or dates, and name of the driller and the Contractor's field representative. Each well construction diagram shall be prepared and signed by the Contractor's field representative.
- All pertinent construction details of the monitoring wells, such as depth to and description of all backfill materials installed such as manufacturer and type of sand filter pack, bentonite, and grout; length, location, diameter, slot size, material and manufacturer of well screen; and location of any blank pipe installed in the well.
- A description of any difficulties encountered during well installation.

Figure 3

Well Installation Form	143 Union Blvd., Suite Lakewood, Colorado Br
roject Holloman AFB	Weil No.
Ite FT-31 Former Fire Training Area	Installation Date
ield Geologist	QA Checked by
	Drilling Summary
urface completion:	Total depth ft.
Above grade, stickup =	Borehole diameter Inches
	Driller
Π	Rig type
	Method
Ground surface	7 Hollow stem auger
	$\overline{/7}$ Air rotary
	$\sqrt{7}$ Air rotary/driven casing
Cement	/ 7 Other
Well Casing	Well Construction Materials
	Cupetity
π	
Besterile Cool	Filter
	No. buckets
	Sand type
	D- Hoaite
	Belleteize
	No. of buckets
	Туре
n	Depths
	Measured internal well depth (ft.)
	Stick-up (ft.)
n	4" Screen
	Slot size0.040*
	Length
PVC Screen Sand pack	t
tt Cap or plug	
e 🕅	
n <u>[AAAAAAA</u>	Comments
Not to scale	

SOP B2 DECONTAMINATION METHODS

Decontamination methods shall consist of high-pressure steam cleaning, or of an alconox wash followed by a potable water rinse. All equipment coming in contact with the borehole or the well materials shall be decontaminated between holes. All visible dirt, grease, oil, and foreign particles shall be removed during decontamination.

The drilling subcontractor shall construct a temporary decontamination pad at a site location approved by the Contractor's Field Representative. The decontamination pad shall be bermed, and it shall be sloped to a sump for water and sludge collection. The decon pad shall be lined with 40 mil plastic sheeting, without holes. Any holes in the plastic sheeting shall be repaired to water-tight conditions. The plastic sheeting shall be secured to prevent fluttering or blowing away by high winds.

All drilling equipment and tools shall be initially decontaminated upon arrival at the site, and shall be decontaminated prior to departure from the site. All decontaminated equipment shall be stored in a clean condition.

Residuals from decontamination activities shall be managed in accordance with SOP B3, Residuals Management and this Workplan.
SOP B3 RESIDUALS MANAGEMENT

Residuals from drilling operations shall be handled in accordance with this Workplan. Residuals include the following:

- Clean trash including cardboard, plastic, decontaminated PPE, and domestic trash.
- Clean and potentially contaminated soil from drilling operations.
- Clean and potentially contaminated decontamination water and sludge.

Field screening of soil to segregate potentially contaminated materials shall be done by the Contractor's field representative using a photoionization detector (PID). The procedures for using this instrument are presented in SOP B4. Action levels to determine potentially contaminated materials shall be based on Section 5 and 6 of this Workplan. Field screening levels shall be verified by immunoassay kits for specific contaminated soil shall be segregated on plastic sheeting, and transported to a bermed and covered soil stockpile area at the end of the day. Composite samples of soil will be collected and screened on-site using immunoassay test kits to determine if these materials are in fact contaminated, and subject to special handling under Section 5 of this Workplan.

SOP B4 PHOTOIONIZATION DETECTORS

A PID is used to detect the concentration of organic gases in air. During field investigations, this particular instrument serves several functions. First, and most importantly, it is used to protect the health and safety of the field personnel by providing information concerning the presence and concentration of contaminants encountered. Second, the information gained from the instrument is used to screen for potentially contaminated materials. The use of this instrument for health and safety considerations is described in Section 6 of this Workplan and the Basewide Health and Safety Plan.

The PID has some important limitations. The instruments can only monitor certain vapors and gases in air. Many nonvolatile liquids, toxic solids, particulates and other toxic gases and vapors cannot be detected. Because the types of compounds that the PID can potentially detect are only a fraction of the chemicals possibly present at an incident, a zero reading does not necessarily signify the absence of air contaminants.

The instrument is also non-specific, and its response to different compounds are relative to the calibration settings. In addition, the reading shown on the meter represents the total volatile organic concentrations rather than any one compound. The PID cannot detect methane, nor can it be used as an indicator for combustible gases or oxygen deficiency. In the presence of methane, the PID will register lower levels for organic contaminants that are present due to the interference caused by the methane.

The PID shall be used to monitor drill cuttings and worker breathing zones for the presence of contaminants above action levels. In addition, headspace screening of drill cuttings may be performed to determine the presence of contaminants above action levels using procedures described below. Action levels are established in the site specific health and safety plan, and the regulatory compliance plan.

Headspace Screening

When headspace screening is specified, soil samples will be screened for VOCs in the field at the time of sample collection. Field screening will utilize a PID. The ionization potential of the lamp for the PID will be optimum for the contaminants of concern. Field screening shall be performed in accordance with the following procedures:

1. During drilling in an area suspected of containing contamination above waste management action levels, a representative portion of the drill cuttings shall be collected and placed in a clean, contaminant-free jar. The sample may be placed in a new, clean, plastic sandwich bag inside a jar to minimize the number of new jars required. If the plastic bag method is utilized, readings shall be taken inside empty bags to ensure no external contamination is being introduced.

- 2. Seal each jar with at least one continuous sheet of aluminum foil, using the jar lid to secure the foil.
- 3. Vigorously agitate the sample jar for at least 15 seconds and then allow a minimum of ten minutes (or as the environmental conditions dictate) for the sample to adequately volatilize.
- 4. During cold weather the samples shall be warmed to room temperature prior to taking the headspace measurement. Since a temporary shelter (e.g., a vehicle) is generally used to protect the field instruments, especially during inclement weather, warming the samples to room temperature should not be a problem.
- 5. Re-shake the jar and then remove the jar lid. Quickly insert the vapor sampling probe through the aluminum foil and record the maximum meter response (which should be within the first two to five seconds). Erratic responses should be evaluated in terms of high organic vapor concentrations or conditions of elevated headspace moisture.
- 6. Record headspace screening data on the boring log and any other appropriate documentation (e.g., sample transmittals, field notebooks, etc.), as appropriate.
- 7. The screening instrument shall be calibrated according to the appropriate standard span gas and will be calibrated a minimum of twice daily and before use after a long shut-down period (i.e., lunch breaks, equipment breakdowns, weather-related breaks, etc.).

If sample jars are to be re-used in the field, the jars shall be cleaned according to the field decontamination procedures for cleaning of sampling equipment. In addition, headspace readings shall be taken to ensure no residual organic vapors exist in the cleaned sample jars.

SOP B5 SOIL STOCKPILE SAMPLING

Soil stockpile sampling will be performed by the following procedure:

- Wear appropriate PPE as specified in the SSHP. In addition, samplers will don new sampling gloves at each location.
- Use a decontaminated stainless steel scoop/trowel to excavate to a depth of approximately 12 inches below the surface of the stockpile.
- Record appropriate air monitoring results.
- Obtain soil sample at six random locations using a decontaminated stainless steel scoop/trowel and bowl. The number of random sample locations should be proportional to the size of the stockpile i.e. a large stockpile will require more than six random sample locations.
- Empty the contents of the scoop/trowel into the decontaminated stainless steel bowl for homogenizaiton.
- Homogenization of soil samples will be conducted by first removing rocks, twigs, leaves and other debris if they are not considered part of the sample. The soil in the bowl should be thoroughly mixed by scraping it from the sides, corners and bottom of the pan, and rolling it to the middle of the pan. Fill the sample jars with the homogenized soil using a stainless steel spatula or spoon.
- Place analytical samples in a cooler containing ice and chill to 4°C. Samples will be shipped within 24 hours to an appropriate laboratory.
- Decontaminate scoop/trowel and bowl as specified in SOP B2.
- Fill out field logbook, sample log sheet, custody seals, labels, and Chain-of-Custody forms.

SOP B6 TANK SAMPLING

Field sampling procedures for collecting samples of tank contents using a Teflon[®] bailer with a Teflon[®]-coated stainless steel wire cord or an open tube sampler are as follows:

Teflon[®] Bailer

- Gain access (e.g., steps, ladder, man-lift, etc.) to the top of the tank.
- Slowly open release valve (if any) to bring the tank to atmospheric pressure.
- Loosen access port/cover bolts and remove port/cover.
- If no access port/cover is available, unscrew cap of top opening.
- Insert a decontaminated Teflon® bailer into tank slowly to allow stratified content (if any) to fill the bailer.
- Retrieve the bailer and wipe it with a disposable absorbent pad (place the pad in a 55-gallon drum).
- Transfer the sample(s) into appropriate containers.
- Repeat the previous step until enough sample volume is obtained, as required.
- If using bottom valve, place the sample container below the valve and turn the valve slowly and easy to ensure a slow, controlled flow of sampling material.
- Cap the sampler container, place in double plastic bag, attach label, record all pertinent data in the field logbook and complete the Chain-of-Custody form.
- Preserve and/or place sample(s) on ice, if required.
- Prepare sample(s) for delivery to the laboratory within 24 hours of collection.

Open Tube Sampler

- Follow the first four steps as for a Teflon® bailer sampler.
- Insert a decontaminated sampler into tank until it reaches the bottom.

- Place thumb securely over open end of tube and carefully retrieve the sampler.
- Transfer the sample(s) directly into appropriate containers.
- Repeat the previous step until enough sample volume is obtained, as required.
- Cap the sampler container, place in double plastic bag, attach label, record all pertinent data in the field logbook and complete the Chain-of-Custody form.
- Preserve and/or place sample(s) on ice, if required.
- Prepare sample(s) for delivery to the laboratory within 24 hours of collection.

If tanks are found to contain solid materials, the following sampling procedures will be followed using a rust-free carbon steel sample trier:

Sample Trier

- Follow the first four steps as for a Teflon® bailer sampler.
- Insert a decontaminated trier into the tank and into the solid material.
- Rotate the trier once or twice to cut a core of the material.
- Slowly retrieve the trier, making sure that the slot is facing upward.
- Transfer the sample into appropriate container with the aid of a stainless steel spatula.
- Repeat the previous step at two or more different points inside the tank until enough sample volume is obtained, as required.
- Cap the sample container, place in a double plastic bag, attach label, record all pertinent data in the field logbook and complete the Chain-of-Custody form.
- Preserve and/or place sample(s) or ice, if required.
- Prepare sample(s) for delivery to the laboratory within 24 hours of collection.

SOP B7 SAMPLE HANDLING AND DOCUMENTATION

PURPOSE

Sample handling and documentation procedures will be used to ensure the integrity of the sample from sample collection to receipt at the laboratory. Documentation of sample handling will be implemented to ensure the traceability and integrity of the sample.

PROCEDURE

Labeling

All sample containers will be labeled. Labels may be partially completed prior to sample collection. The date, time, and sampler's name should **NOT** be completed until the time of sample collection. Pre-printed, self-adhesive sample labels containing all appropriate sample information including sample identification, field sample number, sample type, and analyses requested will be used. Sample labels will be completed with waterproof ink. Sample labels should be completed and attached prior to sample collection for soil samples collected in jars and all decontamination samples collected in bottles.

At a minimum, each numbered label shall contain the following information:

- Project/Facility
- Sample type (e.g., grab, composite)
- Sampler's company affiliation
- Date and time of sample collection
- Analyses required
- Preservation used
- Sampler's initials
- MRD identified if sample is collected for the USACE laboratory
- Sample identification (see below)
- MRD Laboratory Information Management System (LIMS) number

Sampling Containers

Certified, commercially clean sample containers will be obtained from the contract analytical lab. If appropriate, the bottles will be labeled by the lab to indicate the type of sample to be collected. Surface soil samples will typically be collected wide-mouth sample jars or in stainless steel liners.

Sample Preservation

All samples will be stored on ice in an insulated cooler immediately following sample collection. Soil samples do not require additional preservation. Sample containers for aqueous samples will be sent by the laboratory containing the appropriate preservatives.

Sample Handling And Shipping

Sample containers will be placed in recloseable plastic storage bags and wrapped in protective packing material (if appropriate). Ice (double bagged using plastic trash bags) will be placed on top of the samples in a cooler for shipment to the laboratory. The drain on the cooler will be taped shut. Samples collected in glass containers will be packed in foam liners and bubble packing or styrofoam peanuts to ensure that no breakage occurs during shipment. Samples will be shipped by overnight express carrier for delivery to the analytical laboratory and to the MRD laboratory. The MRD laboratory will be notified prior to the arrival of the first shipment, after the final shipment, and prior to any Saturday delivery.

A completed chain-of-custody form for each cooler will be placed in a ziplock bag and taped to the inside of the cooler lid. Coolers will be wrapped with strapping tape at two locations to secure lids. Signed custody seals will be placed on the outside of each cooler. In addition, "Fragile" labels and "This Side Up" labels will be placed on the outside of each cooler containing glass bottles. Put "This Side Up" labels on all four sides and "Fragile" labels on at least two sides. Note that each cooler cannot exceed the weight limit set by the shipper.

Holding Times and Analyses

The holding time is specified as the maximum allowable time between sample collection and analysis and/or extraction, based on the analyte of interest, stability factors, and preservation methods. Allowable holding times are listed in Table 9-2 of Quality Assurance Project Plan. Samples should be sent by overnight courier service to the laboratory daily after collection.

Chemical constituents which will be analyzed have been identified in the FSP.

Sample Documentation and Tracking

This section describes documentation required in the field notes, Daily Quality Control Reports, and sample COC requirements.

Field Notes: Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded with waterproof ink in a permanently bound weatherproof field book with consecutively numbered pages and, if applicable, on field sampling data sheets.

The information in the field book will include the following as a minimum. Additional information is included in the specific SOPs regarding the appropriate data sheets:

- Project name
- Location of sample
- Sampler's signature
- Date and time of sample collection
- Sample identification numbers
- Description of samples (matrix sampled), composite or grab sample
- Analysis to be performed
- Number and volume of samples
- Description of QA/QC samples
- Sample methods or reference to the appropriate SOP
- Sample handlingas appropriate for samples
- Field observations
- Personnel present

Changes or deletions in the field book should be lined out with a single strike mark, initialed and dated by person making change, and remain legible. Sufficient information should be recorded to allow the sampling event to be reconstructed without relying on the collector's memory.

Each page of the field book will be signed by the person making the entry. Anyone making entries in another person's field book will sign and date those entries.

Daily Quality Control Report: To supplement the information recorded in the field book, DQCRs will also be maintained to document daily field activities and will note any nonconformances and corrective actions taken at every sampling location. DQCRs will be maintained by each field sampling team and cross-checked for completeness at the end of each day by a sampling team member and/or the Field Operations Leader. They will be signed and dated by the individual making entries and initialed by the reviewer upon completion. Copies of the DQCR will be forwarded to the USACE Resident Engineer by noon of the following day. Copies of the DQCR will be forwarded to the FWENC Quality Assurance Officer for review on a weekly basis.

Sample Chain-Of-Custody: During field sampling activities, traceability of the sample must be maintained from the time the samples are collected until laboratory data are issued. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. COCs will include site identification, field sample number, sample type, and analysis requested.

The sample handler will be responsible for completing the COC form. The COC will be signed by the sampler when the sampler relinquishes the samples to anyone else. It is not necessary for Federal Express to sign COC; however, the airbill will be retained by the sample handler for tracking purposes. A COC form will be completed for each set of samples collected daily, and will contain the following information:

- Sampler's signature and affiliation
- Project number
- Date and time of collection
- Sample identification number
- Sample type/matrix
- Grab or composite sample
- Preservative used
- Analyses requested
- Number of containers
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times (laboratory)
- Method of shipment (i.e. Fed-X)

The person responsible for delivery of the samples to the air carrier will sign the COC form, retain the last copy of the three-part COC form, document the method shipment, and send the original and the second copy of the COC form with the sample (taped in a ziplock bag to inner cooler lid). Upon receipt at the laboratory, the person receiving the samples will sign the COC form and return the second copy to the Project manager. Copies of the COC forms and all custody documentation will be received and kept in the central files. The original COC forms will remain with the samples until final disposition of the samples by the laboratory. The analytical laboratory will dispose of the samples in an appropriate manner 60 to 90 days after data reporting. After sample disposal, a copy of the original COC will be sent to the Project Manager by the analytical laboratory to be incorporated into the central files.

APPENDIX C

100 PERCENT TECHNICAL SPECIFICATIONS

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TECHNICAL SPECIFICATIONS FOR CONSTRUCTION SITE FT-31 REMEDIAL ACTION

HOLLOMAN AIR FORCE BASE ALAMOGORDO, NEW MEXICO

DIVISION 1 - GENERAL REQUIREMENTS

- 01005 Definitions, Abbreviations, and Reference Standards
- 01300 Submittals
- 01500 Temporary Facilities and Utilities
- 01562 Dust Control
- 01563 Erosion and Sediment Control
- 01720 Project Record Documents
- 01725 Project Record Drawings

DIVISION 2 - SITE WORK

- 02100 Site Preparation
- 02200 Earthwork
- 02300 Biovent Wells and Monitoring Wells
- 02350 Well Plugging and Abandoning
- 02400 Aggregate Materials
- 02830 Chain Link Fences and Gates

DIVISION 3 - CONCRETE

03300 Cast-in-Place Concrete

DIVISION 4 THRU 12—NOT USED

DIVISION 13 - INSTRUMENTATION AND CONTROLS

- 13100 Pressure Gauges and Flowmeters
- 13200 Blower System Instrumentation and Controls

DIVISION 14 - NOT USED

DIVISION 15 - MECHANICAL

- 15020 Pipes, Valves, and Fittings
- 15700 Positive Displacement Rotary Lobe Blower

DIVISION 16 - ELECTRICAL

16100	Electrical Distribution
1 (0 0 0	

16200 Electrical Equipment

Site FT-31 Technical Specifications

SECTION 01005 DEFINITIONS, ABBREVIATIONS, AND REFERENCE STANDARDS

1.0 GENERAL

1.1 Definitions Used in the Technical Specifications

Contract Documents

- Construction Drawings
- Technical Specifications
- Construction Workplan
- Subcontract Agreements

Base - Holloman AFB

USACE - United States Army Corps of Engineers

Contractor - Foster Wheeler Environmental Corporation (FWENC)

<u>Subcontractor or Vendor</u> - A person, firm, or corporation with whom the Contractor has contracted with to perform the work.

<u>Work</u> - Any and all obligations, duties, and responsibilities necessary to the successful completion of the Project assigned to or undertaken by the Contractor or any Subcontractor under the Contract Documents, including all labor, materials, equipment, permits, inspections, and other incidentals, and the furnishing thereof.

1.2 Abbreviations

ac	alternating current
ACI	American Concrete Institute
ACFM	Actual Cubic Feet per Minute of Air
AFB	Air Force Base
AIC	Ampere Interrupting Capacity
amp	ampere
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG	American Wire Gauge
bhp	brake horsepower
bgs	below ground surface
ĊŠA	Canadian Standard Association
CPVC	Chlorinated Polyvinyl Chloride
dBA	decibels

DPDT	Double Pole Double Throw
FNPT	Female National Pipe Thread
ft	foot or feet
GFCI	Ground Fault Circuit Interrupting
hp	horsepower
hz	hertz
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
in	inch or inches
ISA	Instrumentation Society of America
kVA	kilovolts
MNPT	Male National Pipe Thread
MSL	Mean Sea Level
NEC	National Electrical Code
NECA	National Electrical Contractors Association
NEMA	National Electrical Manufacturer's Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Agency
NMDOT	New Mexico Department of Transportation
OSHA	Occupational Safety and Health Act
oz	ounce
psia	pounds per square inch - absolute
psig	pounds per square inch - gauge
rpm	revolutions per minute
SAE	Society of Automotive Engineers
SCFM	Standard Cubic Feet per Minute of Air at 14.7 psia and 68 °F
SPDT	Single Pole Double Throw
TEFC	Totally Enclosed Fan-Cooled
TFE	Tetra Fluoro Ethylene (Teflon)
THHN	Heat-Resistant Thermoplastic with Nylon Jacket or Equivalent (for dry and
	damp locations)
THW	Mositure and Heat-Resistant Thermoplastic (for dry and wet locations)
THWN	Moisture and Heat-Resistant Thermoplastic with Nylon Jacket or Equivalent (for
	dry and wet locations)
TRPH	Total Recoverable Petroleum Hydrocarbons
UBC	Uniform Building Code
UL	Underwriters Laboratory Inc.
UV	Ultraviolet
V	Volt or Volts
VOC	Volatile Organic Compounds
XHHW	Moisture-Resistant Thermoset (for dry and damp locations)
3PDT	Three Pole Double Throw
°F	degrees Fahrenheit temperature

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1.3 Reference Standards

Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to any Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of execution of the Work, except as otherwise specifically stated. However, no provision of any referenced standard, specification, manual, or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of Owner, Contractor, Subcontractor, Vendor, or any of their Consultants, agents, or employees from those set forth in the Contract Documents.

SECTION 01300 SUBMITTALS

1.0 GENERAL

This section outlines the requirements for submittals to be delivered in accordance with the Contract Documents.

All submittals shall include calculations, shop drawings, material specifications, manufacturer's installation instructions, plans, reports, records, diagrams, and details for review and approval as appropriate.

2.0 EXECUTION

2.1 Submittal Register

The Submittal Register, located in Appendix A at the end of this specification, lists the submittals required from the Contractor throughout the project. This table lists all submittals currently required in the Technical Specifications and Construction Drawings. Additional submittals may required during the course of performing the work.

2.2 Submittal Process

Engineering data covering all equipment, fabricated materials, and all other materials which will become a permanent part of the Work shall be submitted to the Contractor at the following address:

Ronald Borrego, P.E. Foster Wheeler Environmental Corporation 143 Union Blvd., Suite 1010 Lakewood, Colorado 80228

The submittals shall include drawings and descriptive information in sufficient detail to show the kind, size, arrangement, operation, and maintenance of component materials, controls, instrumentation, and other devices; the external connections, anchorage, and supports required; performance characteristics; and dimensions needed for installation and correlation with other materials and equipment. The submittals shall be prepared in standard engineering format drawings indicating each specific equipment component, including all identification tags, symbols, and references points as indicated on the construction drawings. Hand-drawn sketches will not be accepted. Four copies of each submittal shall be provided by the Subcontractor (15) workdays after the contract is awarded.

The four copies shall be distributed by the Contractor as follows:

- Subcontractor or Vendor One copy returned with comments or approval
- Contractor Office
 One copy

- Contractor Field Office One copy
- USACE-Holloman AFB One copy

2.3 Control of Submittals

The Contractor, Subcontractors, and Vendors shall carefully control each of their operations to assure that each individual submittal is made on or before the corresponding date scheduled on the Submittal Register.

2.4 Submittals Review

The Contractor's review of submittals provided by the Subcontractor or Vendor will cover only general conformity to the Construction Drawings and Technical Specifications, external connections, and dimensions which affect the layout. The Contractor's review does not indicate a thorough review of all dimensions, quantities, and details of the material, equipment, device, or item shown. The Contractor's review of submittals does not relieve the Subcontractor or Vendor from responsibility for errors, omissions, or deviations, nor responsibility for compliance with the Construction Drawings and Technical Specifications. Equipment fabrication shall not begin until the shop drawings are reviewed and approved and written authorization has been given by the Contractor to proceed.

The Subcontractor or Vendor shall make all corrections required by the Contractor or his authorized representative and promptly furnish a corrected submittal in the same manner as specified for initial submittals. If the Subcontractor or Vendor considers any correction indicated on the submittals to constitute a change to the contract, notice should promptly be given to the Contractor.

Payment for materials incorporated into the Work will not be made if required submittals have not been furnished to the Contractor.

2.5 Resubmittal of Drawings and Data

The Subcontractor or Vendor shall accept full responsibility for the completeness of each submittal. The Subcontractor shall verify that all corrected data and additional information previously requested by the Contractor are provided on the resubmittal.

When corrected copies are resubmitted, the Subcontractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by the Contractor on previous submittals.

Requirements specified for initial submittals shall also apply to resubmittals. Resubmittals shall bear the number of the first submittals followed by a letter (A, B, etc.) to indicate the sequence of the resubmittal.

If more than one resubmittal is required because of failure of the Subcontractor to provide all previously requested corrected data or additional information, the Subcontractor shall reimburse

the Contractor for the charges for review of the additional resubmittals.

Resubmittals shall be made within (7) workdays of the date of the letter returning the material to be modified or corrected, unless within (3) workdays the Subcontractor or Vendor submits an acceptable request for an extension of the stipulated time period, listing the reasons the resubmittal can not be completed within that time.

Any need for more than one resubmission, or any other delay in obtaining the Contractor's review of submittals, will not entitle the Subcontractor to an extension of the Contract Schedule unless delay of the Work is directly caused by a change in the Work authorized by a Change Order.

2.6 Operation and Maintenance Data and Manuals

Adequate operation and maintenance information shall be supplied for all equipment requiring maintenance or other attention. The equipment Subcontractor or Vendor shall prepare an operation and maintenance manual for each type of equipment indicated in the equipment schedule section. Parts lists and operating and maintenance instructions shall be furnished for other equipment not listed in the equipment schedule.

Operation and maintenance manuals shall include the following:

- Equipment function, normal operating characteristics, and limiting conditions.
- Assembly, installation, alignment, adjustment, and checking instructions.
- Operating instructions for startup, routine and normal operation, regulation and control, shutdown, and emergency conditions.
- Lubrication and maintenance instructions.
- Guide to "troubleshooting."
- Parts lists and predicted life of parts subject to wear.
- Outline, cross-section, and assembly drawings; engineering data; and wiring diagrams.
- Test data and performance curves, where applicable.

The operation and maintenance manuals shall be in addition to any instructions of parts lists packed with or attached to the equipment when delivered, or which may be required by the Subcontractor.

2.7 Submittals Format

Manuals and other data shall be printed on heavy, first quality paper, 8-1/2 by 11 inch size, with standard three-hole punching. Drawings and diagrams shall be reduced to 8-1/2 by 11 inch or 11 by 17 inches. Where reduction is not practicable, larger drawings shall be folded separately and placed in clear plastic envelopes that are bound into the manuals. Each folded drawing shall be folded so that the title block is visible when placed in the clear plastic envelope. Each envelope shall bear suitable identification on the spine and front cover for referencing.

2.8 Certificates of Compliance

Any certificates required for demonstrating proof of compliance of materials with drawing, specification, and project plan requirements shall be executed in four copies. Each certificate shall be signed by an official authorized to certify on behalf of the manufacturing or testing company and shall contain the name and address of the Subcontractor or Vendor, the project name and location, and the quantity and data or dates of shipment or delivery to which the certificates apply. Copies of laboratory test reports submitted with certificates shall contain the name and address of the testing laboratory and the date or dates of the tests to which the report applies. Certification shall not be construed as relieving the Subcontractor or Vendor from furnishing satisfactory material, if, after tests are performed on selected samples, the material is found not to meet the specified requirements.

APPENDIX A

SUBMITTAL REGISTER

SUBMITTAL	SPECIFICATION SECTION	DATE DUE	NO. OF COPIES	COMMENTS
Project Record Documents	01720	Final Acceptance of Project	2	
Preliminary Project Record Drawings	01725	After Final Inspection	2	
Project Record Drawings	01725	60 days after acceptance of preliminary Project Record Drawings	2	
Biovent Well and Monitoring Well Components	02300	2 weeks prior to mobilization	4	
Borehole Drilling Logs and Well Installation Forms	02300	Daily	4	
Well Plugging and Abandoning Materials	02350	2 weeks prior to delivery	4	
Well Plugging and Abandoning (Using Well Installation Form)	02350	Daily	4	
Aggregate Material Laboratory Gradation Tests	02400	2 weeks prior to delivery	4	
Chain Link Fences and Gates	02830	2 weeks prior to delivery	4	
Concrete Mix Design Report and Laboratory Test Results	03300	2 weeks prior to Blower Station Slab Installation	4	
Delivery Tickets for Concrete	03300	Daily	4	
Concrete Field Control Test Results	03300	Within 3 days of when test is completed	4	
Biovent Well Instrumentation	13100	2 weeks prior to delivery	4	
Blower System Information	13200 15700 16200	15 workdays after award of Contract	4 4 4	
Pipes, Valves, and Fittings	15020	2 weeks prior to delivery	4	

CPVC Pipe and Fittings	15020	2 weeks prior to delivery	4	
Electrical Distribution System Design	16100	3 weeks after Subcontract award	4	
Electrical Distribution System Components	16100	2 weeks prior to delievery	4	
Blower System O&M	13200	Date specified in	4	
Manuals	15700	Bid Documents	4	
	16200		4	

SECTION 01500 TEMPORARY FACILITIES AND UTILITIES

1.0 GENERAL

This section discusses the temporary facilities and utilities needed by the Contractor and Subcontractors during the execution of the Work.

2.0 FACILITIES AND UTILITIES

2.1 Office

During the performance of this contract, the Contractor shall use the existing field office as the project office for this Work. This office is staffed with a Contractor representative authorized to receive drawings, instructions, or other communication. Any communication given to the said representative or delivered at this office in his/her absence shall be deemed to have been delivered to the Contractor. Copies of the drawings, specifications, and other contract documents shall be kept at the Contractor's office for use at all times.

Subcontractors shall provide their own office facilities, if needed. Water, power, and sanitary facilities, described below, will be made available to Subcontractors.

2.2 Water

All water required for and in connection with the work to be performed shall be provided for by the Base. The Contractor shall be responsible for coordinating acceptable points of connection, backflow prevention, pipe or hose connections, routing, and temporary storage tank locations, if needed, to the satisfaction of Base personnel. The Contractor shall be responsible for transporting contaminated water for disposal in accordance with the Construction Workplan.

2.3 Power

A permanent power drop shall be installed by the Electrical Subcontractor at the site in time for installing site electrical equipment.

2.4 Sanitary Facilities

The Contractor shall furnish temporary sanitary facilities at the site for the needs of all construction workers and others performing work or furnishing services on the project. Sanitary facilities shall be of reasonable capacity, and properly maintained throughout the construction period. If toilets of the chemically treated type are used, at least one toilet shall be furnished for each 20 men. The Contractor shall enforce the use of such sanitary facilities by all his personnel at the site.

3.0 EXECUTION

3.1 Construction Aids

The Contractor and Subcontractor shall furnish, install, maintain, and operate all construction aids required in the performance of the work. These construction aids may include but are not limited to hoists, cranes, temporary enclosures, scaffolding, and temporary stairs. The Contractor and Subcontractor shall not use any Base equipment unless written permission is provided for in advance by the appropriate Base personnel.

3.2 Maintenance of Traffic

The Contractor and Subcontractor shall conduct all construction operations in a manner to interfere with vehicular or pedestrian Base traffic as little as possible.

3.3 Barricades and Lights

All roads, parking areas or other public thoroughfares that are closed to traffic shall be protected by effective barricades on which shall be placed acceptable warning signs. All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to vehicles and pedestrians. Obstructions such as material piles and equipment shall be provided with similar warning signs and lights. All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and construction operations on or alongside thoroughfares shall cause the minimum obstruction and inconvenience to passing vehicles and pedestrians.

3.4 Fences

All existing fences affected by the work shall be maintained by the Contractor until the completion of work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from Base personnel, and the period the fence may be left relocated or dismantled has been agreed upon.

3.5 Damage to Existing Property

The Contractor shall be held responsible for damage to existing structures, work, material, or equipment because of his operations and shall repair or replace any damaged structures, work, materials, or equipment to the satisfaction of, and at no additional cost to the Base. The Contractor shall be responsible for all damage caused by to streets, roads, curbs, sidewalks, shoulders, ditches, embankments, culverts, or other Base property which may be caused by transporting equipment, materials, or men to or from the work. The Contractor shall make acceptable arrangements with the owner of the property concerning its repair or replacement. All conditions presented in this section also apply to any Subcontractors and damage caused by the Subcontractors.

3.6 Security

The Contractor shall be responsible for protection of the site, all work, materials, equipment, and existing facilities against vandals and other unauthorized persons. No claim shall be made against the Base reason of any act of an employee or trespasser, and the Contractor shall make good all damage of Base property resulting from his failure to provide security measures as specified.

3.7 Removal of Temporary Facilities

After the work is completed, the Contractor shall remove all temporary facilities to the satisfaction of Base personnel.

SECTION 01562 DUST CONTROL

1.0 GENERAL

The Contractor shall conduct operations and maintain the project site so as to minimize the creation and dispersion of dust. The Contractor shall use watering equipment for dust control as necessary. Dust control shall be used throughout the work at the site, especially during contaminated soil excavation, handling and transport, rough grading, and placement of final soil cover.

2.0 MATERIALS AND EQUIPMENT

The Contractor shall have clean water available, free from salt, oil, and other deleterious material to be used for on-site dust control in any area. The Contractor shall supply water spraying equipment capable of accessing all work areas.

3.0 EXECUTION

The Contractor shall implement strict dust control measures during active construction periods on-site. These control measures will generally consist of water applications that shall be applied a minimum of once per day during earthwork operations when windy, dry weather exists or more often as required to prevent dust emissions. These applications shall keep areas damp without creating nuisance conditions such as ponding.

SECTION 01563 EROSION AND SEDIMENT CONTROL

1.0 GENERAL

The Contractor shall design, furnish, install and maintain all temporary erosion control measures as specified in this section. This section provides the technical requirements for the design of erosion and sediment control systems to limit discharge of turbid or contaminated water into streams and waterways from construction operations in accordance with State and local ordinances.

2.0 MATERIALS

Materials shall conform to the requirements of the State of New Mexico Standard Specifications for Highway and Bridge Construction, Section 603. The Contractor shall design, furnish, install and maintain all erosion control measures during the course of construction. Hay bales, silt fencing or mulching shall be utilized by the Contractor, as necessary, to control erosion from construction activities.

3.0 EXECUTION

The Contractor shall make every effort to minimize erosion from earthwork and backfill operations and be responsible for diverting all noncontaminated runoff from rainfall away from the contaminated areas directing it to natural drainage pathways. All runoff or run-on which comes into contact with visibly contaminated material within the site work areas and/or the contaminated material stockpile areas shall be collected and sampled for contamination in accordance with the Construction Workplan.

The Contractor shall construct and maintain all necessary dikes, silt fences, hay bales, and/or temporary diversion, surface impoundments and protection works. He shall furnish all material required and shall furnish, install, maintain and operate all necessary pumps, piping, and other equipment required to minimize interference with the Work. After having served their purpose, all dikes, ditches, or other diversion systems shall be removed, or leveled so as not to interfere in any way with the biovent system operation and other facilities, and in a manner approved by the Base.

SECTION 01720 PROJECT RECORD DOCUMENTS

1.0 GENERAL

This section covers the requirements for maintenance and submittal of Project Record Documents.

1.1 Maintenance of Documents

The Contractor shall maintain at the site one record copy of:

- Construction schedule and progress record
- The Technical Specifications, Construction Drawings, and Construction Workplan
- Addenda and Modifications, including Design Change Notifications
- Change Orders and other Modifications to the Contract
- Field Change Requests and Non-conformance Reports
- Manufacturer's Certificates
- Daily work activity summary reports
- Reports on any emergency response actions
- Test records from all site work
- Quality Control Records
- Completed Borehole Drilling Logs
- Completed Well Installation Forms
- Items specifically listed in the Submittal Register and all other construction documents, reports, or records

1.2 Record Storage

Project Record Documents shall be stored in the Contractor's Field Office apart from documents used for construction. The Contractor shall provide secure storage for Record Documents.

1.3 Record Maintenance

Project Record Documents are to be maintained in a clean, dry and legible condition and not used for construction purposes.

1.4 Inspection

The Contractor shall keep Record Documents and samples available for inspection by USACE and Base personnel.

1.5 Shop Drawings

Shop Drawings shall be legibly marked and each item of actual construction recorded including:

- Field changes of dimension and detail
- Changes made by modifications

1.6 Borehole Drilling Logs and Well Installation Forms

Boreholes Drilling Logs and Well Installation Forms shall be prepared as specified in Section 02300 - Biovent Wells and Monitoring Wells.

1.7 Certifications

The Contractor shall maintain manufacturer's certifications, inspection certifications and field test records required by individual specification sections.

1.8 Submittals

Record documents shall be delivered at Final Acceptance. Two copies of record documents shall be transmitted with cover letter listing the following:

- Date
- Project title and number
- Contractor's name, address, and telephone number
- Number and title of each Record Document
- Signature of Contractor or authorized representative

SECTION 01725 PROJECT RECORD DRAWINGS

1.0 GENERAL

This Section covers the preparation of final Project Record Drawings as a requirement of this Contract.

2.0 EXECUTION

The Contractor shall revise the Construction Drawings and Technical Specifications to reflect the as-constructed conditions. A preliminary set of revised Construction Drawings and revised Technical Specifications shall be submitted after Final Inspection, and a final set shall be submitted within 60 days after preliminary acceptance as provided for in Section 01300 - Submittals. These marked record prints shall be neat, legible, and accurate.

2.1 Construction Drawings

The Contractor shall continuously mark up one set of full-size Construction Drawings to show the as-constructed conditions. These marked record prints shall be kept current and available on the jobsite at all times. All changes from the Construction Drawings which are made in the Work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. The prints shall show the following information, but not be limited thereto:

- Utilities, Appurtenances, and Other Features The measured horizontal and vertical locations and descriptions of any existing utilities, appurtenances, or other features shall be noted and referenced to permanent surface improvements.
- Distribution Pipe. The location and description of the new distribution pipe.
- Blower Station. The location and dimensions of the new blower station slab, equipment, pipe, fence, and gate.
- Site Grading. Correct elevations if changes were made in site grading.
- Drainage. The topography, grades, and invert elevations of all drainage features installed or affected as a part of the project construction.
- Biovent Wells and Air Supply Riser Pipes. The location of all newly installed biovent wells and biovent well air supply riser pipes.
- Power Drop. The location of the newly installed power drop pole and other newly installed transmission poles.
- Changes made by Addenda or Modifications.

• Final Inspection. All changes or modifications which result from the final inspection.

After the construction is complete and all comments and notes are placed on the record drawings, the original CAD files shall be revised to include all comments and notes. Preliminary and final copies of these AutoCad drawing computer files and two sets of the revised Construction Drawings shall be submitted to the USACE as permanent construction records.

2.2 Technical Specifications

The Contractor's set of Technical Specifications shall be legibly marked and each item of actual construction recorded including:

- Manufacturer, trade name, and catalog number of each product actually installed, including optional items and approved substitute items.
- Changes made by Addenda or Modifications.

The information contained in the revised Technical Specifications shall be incorporated in the revised Construction Drawings.

SECTION 02100 SITE PREPARATION

1.0 GENERAL

This Section covers the requirements for site preparation. This Work includes clearing and grading areas for the new blower station.

2.0 MATERIALS

The aggregate materials described in this section shall conform to those materials described in Section 02400 - Aggregate Materials.

3.0 EXECUTION

3.1 Blower Station

The blower station slab area shall be cleared, leveled, and proof-rolled. Six inches of aggregate base course material shall then be placed and compacted.

All excavated materials shall he handled in accordance with the Construction Workplan.

The Contractor shall contact Base personnel to field locate all existing utilities within the work zones and take all precautions to protect them during construction. If active utility lines are encountered, necessary steps shall be taken to assure that any service interruption, if required, is kept to a minimum.

3.2 Dust Control

The Contractor shall maintain all work areas free from excess dust to such reasonable degree as to avoid causing a hazard or nuisance to others. Clearing and grading are to be performed in a manner that minimizes the generation of dust. Dust control shall be performed in accordance with Section 01562 - Dust Control.

3.3 Erosion and Sediment Control

The Contractor shall implement, as necessary, the erosion and sediment control measures in accordance with Section 01563 - Erosion and Sediment Control.

SECTION 02200 EARTHWORK

1.0 GENERAL

This section covers the excavation, placement, and backfill of materials required for installation of the distribution pipe.

2.0 MATERIALS

The bedding material used in this section shall conform to those aggregate materials described in Section 02400 - Aggregate Materials.

Backfill material shall first be obtained from the soil excavated at the site. All excavated material shall be field screened and dispositioned in accordance with the Construction Workplan, Section 5 - Regulatory Compliance Plan, and Section 7 - Field Sampling Plan, prior to being used as backfill.

If additional backfill material is needed, clean, uncontaminated soil, similar to soil at the Base, shall be used. Clean, uncontaminated soil from other stockpile areas at the Base may be used. Additional off-Base material may be used provided a signed statement by an offical authorized to certify on behalf of the supplier attesting that the material meets this specification is provided.

3.0 EXECUTION

3.1 Trench Excavation

The distribution pipe trench and the short lengths of trench from the distribution pipe to the biovent well air supply risers shall be located and excavated as shown on the drawings.

The Contractor shall contact Base personnel to field-locate all existing utilities with the work zones and take all precautions to protect them during excavation activities. If active utility lines are encountered, necessary steps shall be taken to assure that any service interruptions, if required, are kept to a minimum.

Care shall be taken to avoid damaging the new biovent wells, new air supply risers, and existing wells during earthwork operations.

All excavated materials shall be handled in accordance with the Construction Workplan.

3.2 Trench Backfill Requirements

The trenches shall initially be partially filled with bedding material as shown on the drawings. The bedding material shall be compacted, and the piping shall be placed in the trench and in the

bedding material so the bedding material extends to the horizontal centerline of the pipe. The trench shall then be backfilled with backfill material. Compaction of the backfill material by rolling will be permitted, provided that the degree of compaction equal to the surrounding undisturbed area is obtained and that the trench piping is not damaged. Compaction of materials by water inundation will not be permitted. No materials shall be placed or compacted in water.

3.3 Excavation in Contaminated Areas

The Contractor shall perform excavation activities in such a manner to prevent cross-contaminating of aggregate materials and minimize equipment contamination. All contaminated materials excavated shall be stockpiled and handled in accordance with the Construction Workplan.

3.4 Settlement

The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within a period of one year after the project is accepted. The Contractor shall make all repairs or replacements necessary within 30 days after notice from the Base.

SECTION 02300 BIOVENT WELLS AND MONITORING WELLS

1.0 GENERAL

This section outlines the requirements for installation of biovent wells and monitoring wells as shown on the Construction Drawings.

Well drilling and installation shall be performed by a Subcontractor in accordance with the Contract Documents. The Subcontractor's primary source for clarifications of the technical information contained in these documents shall be the Contractor's Field Representative.

2.0 MATERIALS

The following well materials shall be provided by the Subcontractor, and conform to the dimensions shown on the plans. All chlorinated polyvinyl chloride (CPVC) materials for the biovent wells shall be obtained from the same manufacturer, and all polyvinyl chloride (PVC) materials for the monitoring wells shall be obtained from the same manufacturer.

- Chlorinated polyvinyl chloride (CPVC) biovent well materials as indicated by the details on the Construction Drawings.
- Polyvinyl chloride (PVC) monitoring well materials as indicated by the details on the Construction Drawings.
- Schedule 40 galvanized steel pipe and fittings for the biovent wells as indicated by the details on the Construction Drawings.
- Metal well protective enclosures with hinged lockable cap for the monitoring wells as indicated by the details on the Construction Drawings.
- Sand filter pack consisting of siliceous, well-rounded, hard, durable, washed, and screened sand such as Colorado Silica Sand gradation 8-12 or 10-20.
- Bentonite pellets consisting of 1/4-inch diameter or 3/8-inch diameter Wyoming bentonite pellets, rated for immediate hydration.
- Concrete/bentonite mix composed of a mixture dry-mix (Sackrete, Quikrete, or approved equal), 3 percent by weight bentonite powder, and manufacturer's recommended quantity of potable water. The dry-mix concrete shall be proportioned as 3 parts aggregate, 2 parts sand, and 1 part cement.

3.0 EXECUTION

3.1 Permits and Inspection

The Subcontractor shall obtain a digging permit from Holloman AFB. This permit shall indicate the location of all known buried utilities, and the Base personnel to contact in the event unmarked utilities are encountered. The Subcontractor shall assume responsibility for damage to utilities marked in the field or on the digging permit.

Contractor and Base personnel reserve the right to inspect the Subcontractor's equipment and operations for compliance with the Construction Drawings, Technical Specifications, and Construction Workplan.

3.2 Borehole Drilling, Well Installation, and Documentation

Locations

The new biovent wells and new monitoring wells shall be located as shown on the Construction Drawings.

Borehole Drilling Logs and Documentation

Each boring shall be fully described on a Borehole Drilling Log similar or equivalent to that shown in the Construction Workplan. The Contractor's Field Representative shall log the boring in accordance with the procedures contained in the Construction Workplan.

One biovent well or one monitoring well shall be logged in each of the three areas using physical samples collected every 5 ft with a splitspoon or continuous sample barrel using the procedures included in the Construction Workplan. The Contractor's Field Representative shall determine the three wells to be logged using physical samples.

Borehole Drilling and Well Installation

The Subcontractor shall be responsible for drilling the boring and installing the biovent wells and monitoring wells in accordance with the Construction Drawings and Technical Specifications.

Wells that are not installed in accordance with the Construction Drawings and Technical Specifications shall be plugged and abandoned in accordance with Section 02350 - Well Plugging and Abandoning, and replacement wells installed by the Subcontractor at a locations indicated by the Contractor's Field Representative at no additional charge.

All biovent well boreholes shall be drilled by advancing a 10-inch outside diameter (OD) hollow stem augers to total depth. All monitoring well boreholes shall be drilled by advancing a 8-inch outside diameter (OD) hollow stem augers to total depth. The Subcontractor shall take care during drilling to maintain the vertical orientation of the drill string, to avoid a borehole that is out of plumb.
All wells shall be installed using hollow stem augers as temporary casing to the depths indicated on the Construction Drawings. The well screen shall be placed in the borehole in a centralized position so that the sand pack material will uniformly surround the well screen. The interval between the bottom of the borehole and the bottom of the well cap shall be backfilled with sand pack material.

The sand pack material shall be placed through the augers in a steady stream, at a rate which allows the material to settle through the augers and avoid bridging within the augers. A weighted tape shall be used to monitor the top of the sand, which shall be a minimum 1 foot inside the augers as the augers are withdrawn from the borehole. This will assure that the sand pack material is flowing from the augers into the annular space around the well pipe, and that native soil material is prevented from entering the annular space. Sand pack material shall be placed in this manner to the dimensions shown on the Construction Drawings.

When the target top of sand pack is reached, the sand pack material shall be settled by surge blocking. The surge block shall consist of plastic packers at the end of rigid rods. The packers shall be sized to fill the inside diameter (ID) of the well casing without causing undue binding or pressure, but sufficient to force air into and out of the formation. The Contractor's Field Representative shall monitor the surge blocking effort, and reserves the right to request smaller or larger diameter packers to optimize the process. Surge blocking shall be terminated when the sand pack material stops settling, as determined by lowering a weighted tape to the top of the sand pack to the design depth. The Contractor's Field Representative shall stop the use of the surge block procedure if field evidence indicates it is not effective.

A bentonite pellet seal shall be placed above the sand pack to the dimensions shown on the Construction Drawings. The bentonite seal shall be placed in 6-inch lifts, with 1 gallon of potable water added to each lift. The first lift shall be allowed to hydrate for a minimum of 15 minutes. Subsequent lifts shall be placed and hydrated without waiting an additional 15 minutes. The well shall not be cemented above the bentonite seal until a minimum of 30 minutes has elapsed after the last lift of bentonite pellets has been hydrated.

A concrete/bentonite seal shall be placed beginning at the top of the bentonite pellet seal and extending to the ground surface as shown on the Construction Drawings. The top of this seal shall extend outward around the well casing as shown on the Construction Drawings. The surface of the concrete/bentonite seal shall be sloped so that water will flow radially away from the well casing to the ground surface. The surface of the concrete/bentonite seal shall be trowelled smooth. Following placement of concrete/bentonite seal, activities within 15 feet of the well shall be avoided for 48 hours, to allow the seal to set.

The identification number of each biovent well shall be stamped onto the galvanized steel surface casing in two places using hand dies capable of creating characters a minimum of 1/2 inch high. The stamped characters shall be stamped onto the galvanized steel surface casing prior to attaching the casing to the rest of the well casing. In addition, the identification number shall be marked on the side of the galvanized steel surface casing using permanent marking paint in

characters a minimum 2-inch high.

The identification number of each PVC monitoring well shall be stamped onto the metal protective enclosures in two places as described above.

Monitoring Well Metal Protective Enclosures and Locks

Each PVC monitoring well shall be furnished with an installed metal protective enclosure with hinged locking cap. The metal protective enclosures shall have a shop-applied, primed, and painted surface. The padlocks shall be keyed alike or have changeable combinations and rated for outdoor service.

3.4 Residuals Management

Residuals from drilling operations shall be handled in accordance with the Construction Workplan. Residuals include the following:

- Clean trash including cardboard, plastic, decontaminated PPE, and domestic trash.
- Soils from drilling operations.
- Decontamination water.
- Well construction materials if any newly installed wells have to be plugged and abandoned.

4.0 SUBMITTALS

Manufacturer's information for all materials for the CPVC/steel biovent wells and the PVC monitoring wells shall be submitted to the Contractor for review and approval prior to Subcontractor mobilization according to Section 01300 - Submittals.

The submittals shall provide certification that the well materials to be provided by the Subcontractor meet all project specifications. Where the Subcontractor is proposing an equivalent product instead of the product specifically described in the plans or specifications, the material information data sheets shall serve as the basis for Contractor evaluation and approval of equivalence. Unapproved materials shall not be used.

SECTION 02350 WELL PLUGGING AND ABANDONING

1.0 GENERAL

Some existing wells at the site require plugging and abandoning by the Subcontractor as indicated on the drawings. In addition, incorrectly installed biovent wells or monitoring wells shall also require plugging and abandoning.

2.0 MATERIALS

Materials used to plug and abandon wells are portland cement (Type I or Type II) and bentonite powder.

3.0 EXECUTION

The following procedures shall be followed for plugging and abandoning wells:

- All well pipe and screen sections shall be removed by fishing. In the event that any portion of the pipe and screen sections cannot be removed by fishing, over-drilling shall be employed. The entire depth of borehole shall be cleaned out by over-drilling in all cases. The removed pipe, screen, sand pack material, bentonite, grout, and soil shall be handled according to the Construction Workplan.
- The borehole shall be backfilled with a portland cement/bentonite grout mixture proportioned as one 94-lb sack of Type I or II portland cement, 3 percent by weight bentonite powder, and 7 gallons of potable water.
- The cement/bentonite grout mixture shall be pumped into the borehole using a rigid tremie pipe, the bottom outlet initially located 1 ft above the bottom of the boring, and maintained a minimum 3 ft below the top of the cement/grout mixture as the tremie pipe is raised while pumping the cement/bentonite grout. This will ensure that any water in the well will be displaced upwards and will not dilute the cement/grout mixture.
- Any displaced water shall be collected and placed into suitable containers for handling in accordance with the Construction Workplan.

Activities within 15 feet of plugged and abandoned wells shall be avoided for 48 hours to allow the cement/bentonite grout to set. In the event that a biovent well is plugged and abandoned, the replacement well shall not be redrilled until the 48 hour period following grout placement has elapsed.

4.0 SUBMITTALS

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Manufacturer's information for all matertials shall be submitted to the Contractor for review and apporval prior to Subcontractor mobilization according to Section 01300 - Submittals.

SECTION 02400 AGGREGATE MATERIALS

1.0 GENERAL

This section covers the following types of aggregate materials:

- Pipe bedding material placed under the air distribution pipe
- Base course material placed under the blower station slab

These materials shall be installed at the locations and dimensions shown on the Construction Drawings.

2.0 MATERIALS

The source(s) of materials shall be acceptable to the Contractor. The aggregate materials shall conform to the following table.

AGGREGATE MATERIALS

APPLICATIONS	AGGREGATE SPECIFICATION
Aggregate Base Course Layer under Blower Station Slab	Pea Gravel
Pipe Bedding Material	Pea Gravel

PEA GRAVEL GRADATION

Sieve Size	Total Percent Passing by Weight
3/8 inch	100
No. 200	0-5

All materials shall be clean and free of any type of contamination.

3.0 EXECUTION

Aggregate material shall be stockpiled prior to placement in such a manner to prevent particle size segregation and unnecessary material loss. Aggregate material shall be placed according to Section 02200 - Earthwork.

4.0 SUBMITTALS

The aggregate Vendor shall submit a laboratory gradation test report for each proposed source of aggregate material. The gradation test shall be performed per ASTM D-3282 - Standard Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

All off-Base material used at the site shall require a signed statement by an offical authorized to certify on behalf of the supplier attesting that the material meets this specification.

END OF SECTION

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SECTION 02830 CHAIN LINK FENCES AND GATES

1.0 GENERAL

The Work includes supply and installation of chain link gates and fencing to be installed around the new blower station as indicated on the drawings. All fencing materials supplies shall comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fencing". All fencing materials shall be supplied as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings. It is not the intent of this section to specify all details of fabrication and construction. All fencing work shall be performed by individuals that have a minimum of five years of experience installing similar fencing.

Plan dimensions of the fence and the location of the gate are shown on the Construction Drawings.

2.0 MATERIALS

2.1 Coating

All steel fence components shall be galvanically compatible, shall be galvanized, and shall contain not less than 2.0 oz of zinc per square ft of coating.

2.2 Posts and Rails

All posts, rails, gate frames, and post braces shall be Schedule 40 hot-dip galvanized standard steel pipe. The pipe diameters for end, corner, pull, line, and gate posts shall be typical for commercial grade installations.

All posts shall be equipped with pressed steel combination tops. Tops shall be provided with a hole to permit through passage of the top rail. Post tops, extension arms, rail sleeves, and miscellaneous clamps shall be hot-dip galvanized and supplied as required.

2.3 Fence Fabric

Wire for chain link fence fabric shall be No. 9 wire gage zinc coated steel mesh. Ties or clips shall be provided in a strength and spacing typical for commercial grade installations. Finish of ties shall match fabric finish.

2.4 Gates

A galvanized commercial grade double gate shall be installed as indicated on the Construction Drawings. Gate fabric shall be the same type as used in the fence construction. The gate should

be easily opened by one person. The gates shall provide a clear opening of 8 feet when both gates are opened, and shall include locking hardware and outdoor service padlock for locking securely.

2.5 Privacy Slats

Privacy slats shall be installed on the entire surface area of the fence and gates. The privacy slats shall be constructed of suitable materials to resist continuous exposure to the bright sunlight typical of the New Mexico desert.

2.6 Miscellaneous Accessories

Tension bars, terminal post bands, and any other required accessories shall be hot-dip galvanized and typical for commercial grade fencing installations.

2.7 Electrical Grounding

Electrical grounding features and materials are described in Section 16100 - Electrical Distribution and the Construction Drawings.

3.0 EXECUTION

3.1 General

Chain link fence and gates shall be 5 feet in height above ground. Posts shall extend 3 feet under the ground in concrete footings. Line posts shall be spaced equally not more than 10 feet on centers. Rails shall be furnished in random lengths averaging a minimum of 20 feet. All other fence details shall be typical for commercial grade fence installations.

3.2 Electrical Grounding

All chain link fence shall be grounded in accordance with Section 16100 - Electrical Distribution and the Construction Drawings.

4.0 SUBMITTALS

The vendor supplying the materials and labor for fence installation shall submit a layout plan of fence and gates, the name of the fence fabricator, size, type and quality of all fence materials including foundations and hardware, to the Contractor for approval prior to delivery of fencing materials to the site in accordance with the Section 01300 - Submittals.

SECTION 03300 CAST-IN-PLACE CONCRETE

1.0 GENERAL

This section covers all cast-in-place concrete, including reinforcing steel, forms, finishing, curing, and other appurtenant work.

2.0 MATERIALS

2.1 General

All cast-in-place concrete materials shall conform to the standards and specifications presented in the following table.

Cement	ASTM C150, Type I or II.
Fly Ash	ASTM C618, Class F, except loss on ignition shall
	not exceed 4 percent.
Fine Aggregate	Clean natural sand, ASTM C33. Artificial or
	manufactured sand will not be acceptable.
Coarse Aggregate	Crushed rock, washed gravel, or other inert
	granular material conforming to ASTM C33
Water	Clean and free from deleterious substances
Retarder	ASTM C494, Type D, nonair-entraining solution of
	metallic salts of hydroxylated carboxylic acids
Plasticizer	ASTM C494, Type A, nonair-entraining solution of
	metallic salts of hydroxylated carboxylic acids
Air-Entraining Agent	ASTM C260
Reinforcing Steel	ASTM A615, Grade 60, deformed
Welded Wire Fabric	ASTM A185 or A497
Membrane Curing Compound	Fed Spec TT-C-800, Type I, Class 1; min 18
	percent solids; non-yellowing; unit moisture loss

2.2 Mix Design

A mix design approved for use by NMDOT shall be submitted to the Contractor for review. The report for the tentative concrete mix submitted shall contain the following information:

- Slump on which design is Based
- Total gallons of water per cubic yard
- Brand, type, composition, and quantity of cement
- Brand, type, composition, and quantity of fly ash
- Specific gravity and gradation of each aggregate
- Weight (surface dry) of each aggregate per cubic yard
- Brand, type, ASTM designation, active chemical ingredients, and quantity of each admixture
- Air content

- Compressive strength Based on 7-day and 28-day compression tests
- Time of initial set

2.2.1 Limiting Requirements. The concrete mix shall meet the following limiting requirements.

Total Water Content	Shall not exceed 5.7 gallons of water per hundred pounds of cement in the mix, or equivalent cement weight if fly ash is added
Slump	Slump shall not exceed 4 inches
Initial Set	5-1/2 hours plus or minus one hour after the water and cement are added to the aggregates per ASTM C403
Total Air Content	6 percent plus or minus one percent.
Admixtures	A water-reducing admixture shall be included in all concrete

CAST-IN-PLACE CONCRETE LIMITING REQUIREMENTS

The minimum acceptable compressive strengths as determined by ASTM C39 shall be:

CAST-IN-PLACE CONCRETE MINIMUM COMPRESSIVE STRENGTHS

Age (days)	Minimum Strength (psi)
7	2,500
28	3,750

2.3 Membrane Curing Compound

One of the following membrane curing compounds shall be used. Fed Spec TT-C-800, Type 1, Class 1; min 18 percent solids; non-yellowing; unit moisture loss as manufactured by Gifford-Hill "Sealco 800", ProSoCo "Kure and Seal", Protex "Acrychlor", or Sonneborn "Kure-N-Seal".

3.0 EXECUTION

3.1 General

Except as modified herein, hot weather concreting shall comply with ACI 305. At air temperatures of 90°F or above, concrete shall be kept as cool as possible during placement and curing. The temperature of the concrete when placed in the work shall not exceed 90°F. Plastic shrinkage cracking, due to rapid evaporation of moisture, shall be prevented. Concrete shall not be placed when the evaporation rate (actual or anticipated) equals or exceeds 0.2 pound per square foot per hour, as determined by Figure 2.1.5 in ACI 305

3.2 Forms

Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings. Forms shall conform to ACI 347 and the following additional requirements.

Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, such surfaces shall be covered with polyethylene film to protect the concrete from loss of water. Joints in the film shall be lapped at least 4 inches.

3.2.1 Design. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Forms shall be braced or tied to maintain the desired position, shape, and alignment during and after concrete placement. Walers, studs, internal ties, and other form supports shall be sized and spaced so that proper working stresses are not exceeded. Chamfer strips shall be placed in forms to bevel all edges and corners, except edges which are to be buried. Unless otherwise noted, bevels shall be 3/4 inch wide.

Forms shall not be removed or disturbed until the concrete has attained sufficient strength to safely support all dead and live loads. Care shall be taken in form removal to avoid surface gouging, corner or edge breakage, and other damage to the concrete.

3.3 Reinforcements

Reinforcements shall be accurately formed and shall be free from loose rust, scale, and contaminants which reduce bond. Unless otherwise indicated on the drawings or specified herein, the details of fabrication shall conform to ACI 315 and 318. Splices shall conform to the notes included in the construction drawings.

3.4 Batching And Mixing

Concrete shall be furnished by an acceptable ready-mixed concrete supplier and shall conform to ASTM C94. A delivery ticket shall be prepared for each load of ready-mixed concrete. A copy of each ticket shall be handed to the Contractor by the truck operator at the time of delivery. Tickets shall show the mix identification, quantity delivered, the amount of each material in the batch, the outdoor temperature in the shade, the time at which the cement was added, and the numerical sequence of the delivery.

3.5 Field Testing

An independent testing laboratory shall perform the following field control tests.

Test	Test Frequency	Test Standard
Slump	Each 25 cubic yards of concrete	ASTM C143
	or one test per day minimum	
Air Content	One of the first three batches	ASTM C231
	mixed each day	
Compression Tests	Two sets of four concrete	ACI 214 and 318
	compression test cylinders shall	
	be made each day when concrete	
	is placed. Two cylinders of each	
	set shall be tested at an age of 7	
	days and the other cylinders shall	
	be tested at an age of 28 days	

Test reports shall be prepared and distributed in accordance with Section 01300 - Submittals.

3.6 Curing

Concrete shall be protected from loss of moisture for at least seven days after placement by membrane curing. Membrane curing compound shall be sprayed at a coverage of not more than 300 square feet per gallon. If forms are removed before the removed before the end of the specified curing period, curing compound shall be immediately applied to the formed surfaces before they dry out. Film curing will not be allowed.

3.7 Repairing Defective Concrete

Defects in formed concrete surfaces shall be repaired within 24 hours, and defective concrete shall be replaced within 48 hours after the adjacent forms have been removed. All concrete which is honeycombed or otherwise defective shall be cut out and removed to sound concrete, with edges square cut to avoid feathering.

Concrete repair work shall conform to Chapter 9 of ACI 301 and shall be performed in a manner that will not interfere with thorough curing of surrounding concrete. Repair work shall be adequately cured.

4.0 SUBMITTALS

The concrete supplier shall submit the following in accordance with the Section 01300 - Submittals.:

- 1. Concrete mix design reports
- 2. Copies of test reports from concrete placed on project

SECTION 13100 PRESSURE GAUGES AND FLOWMETERS

1.0 GENERAL

This section covers the requirements for the materials and construction of the pressure gauges and flowmeters. Pressure gauges and flowmeters shall be installed in two general locations - the blower station and near the biovent wells. The main blower discharge pipe and the three distribution headers located at the blower station shall each be furnished with a pressure gauge. The three distribution pipes located at the blower station shall each be furnished with a flowmeter. Each biovent well air supply riser pipe shall also be furnished with a pressure gauge and a flowmeter.

The instrumentation will be used to assist in adjusting the flow rate of the air entering the biovent wells and to provide pressure and flow rate data during system operation.

1.1 System Description

The instrumentation shall be capable of measuring pressure and air flow rate at each location as indicated on the Construction Drawings.

1.2 Service Conditions

The instrumentation shall be installed outdoors and will be continuously subjected to weather typical of the New Mexico desert including, but not limited to, bright sunlight and sandstorms, for a minimum of two years. Ambient temperatures range from 0 °F to 120 °F. Relative humidity is typically low (10% to 40%) but can be high during rainfall and snowfall events.

2.0 MATERIALS

2.1 Pressure Gauges

2.1.1 Pressure Gauges at the Blower Station. Pressure gauges shall be mounted on the main blower discharge pipe and on each of the three distribution headers. The gauges shall have a 0-10 psig range, 4.8 inch diameter dial, and be suitable for operating with process fluid temperatures from 0 °F to 190 °F. All pressure gauges shall have the ability to be isolated from the inline flow by an isolation plug valve described in Section 15020 - Pipe, Valves, and Fittings.

Pressure gauges at the blower station shall be back-mounted. Pressure gauges shall have stainless steel casing, fitting, dial with brass movement, adjustable zero setting, a burst pressure rating of 500% full scale, and a proof pressure of 150% of full scale, without a calibration shift. Gauge accuracy shall be $\pm 2.0\%$ of full scale. Gauges shall be equipped with a 1/4" MNPT back-mounted connection, black-on-white dial, and glass cover. The gauges shall be equipped with a 150 micron, sintered stainless steel, changeable filter. Pressure gauges shall also be fitted with a 1/4" brass pulsation dampener to minimize surge effects on the pressure gauges. Manufacturers

of pressure gauges, changeable filter assemblies, and pulsation dampeners shall be 3D Instruments, Ashcroft, or approved equal.

2.1.2 Pressure Gauges at Biovent Well Air Supply Risers. The pressure gauge installed at each biovent well air supply riser shall be as described in Subsection 2.1.1 above, except that a pulsation dampener shall not be used.

2.2 Flowmeters

2.2.1 Air Flowmeters at the Blower Station Pipe Manifold. Air flowmeters shall be installed on each of the three air distribution headers. Two flowmeters shall be rated for 20-200 SCFM and one flowmeter for 40-400 SCFM.

The flowmeters shall be vane style and designed to measure inline compressed air service. The flowmeters shall be read from the top and the flow into and out of the flowmeters shall be in a horizontal direction. The flowmeters shall be installed so that there is a nominal distance, equivalent to 10 pipe diameters, of clear, unobstructed pipe upstream of the orifice plate and a nominal distance equivalent to 5 pipe diameters downstream of the orifice plate, or as specified by the flowmeter manufacturer.

Flowmeters shall be constructed of aluminum, brass, or stainless steel, with a tempered glass window, carbon steel shunt, and a stainless steel vane. "O" ring seals shall be Buna-n, Viton, or Teflon. All three flowmeters shall have 4-inch, 150 lb, ANSI, flanged fittings, be capable of operating at temperatures from 0°F to 190°F, and operate at pressures from a minimum of 3 psig to a maximum of 10 psig. The accuracy of the flowmeters shall be $\pm 2\%$ of full scale.

The head loss due to friction through the two 20-200 SCFM flowmeters shall not exceed the following values at the indicated service flow rates:

Service Flow Rate (SCFM)	Maximum Allowable Pressure Drop at Indicated Service Flow Rate (psig)
77	0.15
116	0.20

The head loss due to friction through the 40-400 SCFM flowmeter shall not exceed the following values at the indicated service flow rates:

Service Flow	Maximum Allowable Pressure
Rate (SCFM)	Drop at Indicated Service Flow
	Rate (psig)
232	0.30

Flowmeters shall be manufactured by ERDCO Engineering or approved equal.

2.2.2 Air Flowmeters at the Biovent Well Air Supply Risers. The air flowmeters shall be float type flowmeters capable of directly indicating air flow rate at a maximum of ± 5 percent

Site FT-31 Technical Specifications accuracy of full scale. The flowmeters shall be capable of measuring air flow at the following limiting conditions:

- Minimum Pressure = 3 psig
- Maximum pressure = 10 psig
- Minimum Air Flow Rate = 3 SCFM
- Maximum Air Flow Rate = 25 SCFM

The flowmeters shall be mounted in a vertical orientation with flow entering the bottom and exiting the top. The bottom connection shall be a 1-inch FNPT connection, and the top connection shall be a 1-inch FNPT connection. The body of the flow meter shall be constructed of corrosion-resistant metal. The measuring tube shall be constructed of glass. The flowmeter and all components shall be made of materials capable of withstanding flowing air temperatures of from 0 °F to 200 °F. A metal float element shall be provided.

The head loss due to friction through the flowmeters shall not exceed the following values at the indicated service flow rates:

Service Flow Rate (SCFM)	Maximum Allowable Pressure Drop at Indicated Service Flow Rate (psig)
20	0.40

Air flowmeters installed on the biovent well air supply risers shall be Kobold Model SV-5110-LB or approved equal.

3.0 EXECUTION

The equipment shall be installed according to manufacturer's installation requirements and at the locations shown on the Construction Drawings. Installation shall provide for leak-free service.

4.0 SUBMITTALS

Manufacturer's information and installation instructions and operating manuals for all components shall be furnished as described in Section 01300 - Submittals.

SECTION 13200

BLOWER SYSTEM INSTRUMENTATION AND CONTROLS

1.0 GENERAL

This section covers the requirements for the design, installation, materials, construction, and testing of the instrumentation and controls to be installed at the FT-31 Site.

The Blower System Vendor shall supply and provide all design, materials, drawings, installation details, and testing specified in this section and on the Construction Drawings.

1.1 System Description

Instrumentation and controls consist of the process monitoring devices which monitor the inline conditions of the air injection system, monitor specific parameters, and controls that regulate the blower motor, based on existing conditions. Blower system controls shall electrically control the status of the blower motor and shall stop the motor when an alarm condition is experienced. The instrumentation and controls are illustrated in the Construction Drawings on the Piping & Instrumentation Diagram.

Instrumentation and control power, shall be supplied by the control transformer in the NEMA size 2 combination starter panel, described in Section 16200 - Electrical Equipment.

Blower instrumentation and controls include a differential pressure switch, low pressure switch, run time indicator, run beacon, and a high temperature switch with inline sensing element. Blower system controls shall be installed and/or a connection provided to access the motor starter circuit by the Blower System Vendor.

1.2 Service Conditions

All instrumentation and control equipment shall be installed outdoors and shall be selected to withstand environmental extremes typical of the New Mexico desert including, but not limited to, exposure to bright sunlight and windblown sand, for a minimum of two years. Ambient temperatures at the site range from 0 to 120°F. The relative humidity typically ranges between 10 and 40 percent with higher values occurring during rainstorm and snowfall events.

1.3 System Requirements

All equipment used in the construction shall be standard products of manufacturers regularly engaged in the production of the specified equipment.

Instrumentation and control equipment shall be properly tagged to include, but not limited to the particular devices: Project Tag Number; manufacturers model number; type of service; process fluid with for which the device is calibrated; pressure, flow and/or temperature operating ranges and limitations; and device sensitivity. Submittal information is described in Section 01300 -

Submittals, and shall include information on the instrumentation and control device service conditions, operating limits, construction details, as well as installation, operations, and maintenance information.

1.4 Differential Pressure Switch

A differential pressure switch shall monitor the differential pressure across the inlet filter and stop the blower motor when the filter begins to foul. The differential pressure gauge shall have an adjustable range appropriate with the inlet pressure drop experienced by the oversized filter, as described in Section 15700 - Positive Displacement Rotary Lobe Blower.

1.5 Low Pressure Switch

A low pressure switch shall be mounted in conjunction with a pressure relief valve on the discharge silencer of the blower. The low pressure switch shall stop the blower motor when low pressure, indicative of a broken blower belt or broken downstream pipe, is encountered.

1.6 Temperature Gauge and Switch

The temperature gauge/switch shall be installed to monitor inline blower discharge air temperature and stop the blower motor when the discharge temperature exceeds a preset temperature value. A local mount temperature gauge/switch with local terminal box with gauge or capillary tube shall be installed with remote, panel mounted gauge and switch. The temperature gauge/switch shall be adjustable to accommodate a change in the allowable maximum discharge temperature. The temperature gauge/switch shall have a 32° F to 210° F adjustable range. The temperature gauge and connection to the electrical control system shall be provided by the Blower System Vendor, but shall be installed by the Contractor, in a 1/2 inch FNPT drilled and tapped steel coupler, following the blower discharge as shown on the Construction Drawings. A 2.5 inch thermobulb temperature sensing element, with 1/2 inch MNPT fitting, shall be threaded into place in the steel coupler.

1.7 Run Time Indicator

A run time indicator shall be installed as part of the blower system package to maintain the number of hours that the blower has operated and to aid in planning regular maintenance. The indicator shall be mounted on the combination motor starter panel and shall be CSA certified and UL listed. The run time indicator shall be an ac hour meter with 7 digit numeral, non-resettable readout. The indicator shall be rated for 120 V ac, 2 Watts. The indicator shall be wired to count only while the blower motor is in operation.

1.8 Relay Logic Control

The control logic for the blower system shall be provided by several different relays, including: a multifunction, digital time delay relay/counter; a multifunction time delay relay; and a general purpose relay. The multifunction, digital time delay relay/counter shall be activated when the high temperature switch reaches its upper limit and shall provide an adjustable period before initiating an automatic restart of the blower system. The time delay relay shall provide a short period, 5 -

15 seconds, in which the low pressure switch on the blower outlet is bypassed, allowing the automatic restart of the system. A general purpose relay shall be used as a "seal-in" relay for all the field mounted controls.

1.9 Run Beacon

A "RUN" beacon shall be installed on the control enclosure and frame to alert personnel to the operational status of the system. The beacon shall be rated as detailed on the Construction Drawings. The beacon shall extend 2 ft above the top of the blower station fence.

1.10 Tubing

Copper tubing or equivalent material shall be used to transmit inline pressure to the bourdon tube style pressure and differential pressure switches contained in the blower controls. Tubing materials shall be 3/8" in diameter and be in accordance with ASTM B-75.

Tube fittings shall be compression style fittings consisting of four machined pieces: body, ferrule, back ferrule, and nut. The sealing and gripping power of the fitting shall be such that a compensating action between ferrules will overcome variations in tubing wall thickness, hardness, diameter, and installer skill.

2.0 MATERIALS

Design and installation of the instrumentation equipment shall conform with applicable ASTM and ISA standards.

2.1 Differential Pressure Switch

The differential pressure switch shall be equipped with a 120 V ac, 10 amp minimum electrical contact rating with 3 screw type wiring connections. The switch shall be single-pole-double-throw (SPDT) snap type. In addition, the pressure differential switch shall be equipped with a gauge and inline pitot tubes, or equivalent pressure sensing element, capable of withstanding particulate-laden air streams. The initial set-point for the differential pressure switch shall be specified by the blower manufacturer, dependent upon the specific inline air filter selected. Allowable differential pressure switch manufacturers include Mid-West Instruments, Dwyer, or approved equal.

2.2 Low Pressure Switch

The low pressure switch shall be brass with an adjustable deadband of 100% and an operating range of 1/8-20 psig or equivalent for the specified pressures of the system. The low pressure switch shall be equipped with a 150 micron, sintered stainless steel, changeable filter. The low pressure switch shall be a Bourdon tube style switch with a minimum 120 V ac, 4 amp rated, SPDT snap-switch. The start-up setpoint for the low pressure switch shall be 1 psi and shall be adjusted, in the field, as necessary. Allowable low pressure switch manufacturers include 3D Instruments or approved equal.

2.3 Temperature Gauge and Switch

The temperature gauge/switch shall have an aluminum alloy case, cover, and terminal box. The gauge/switch shall have a glass disk, bronze settings and wire outlet with a aluminum or P-Bronze scale plate and pointer. The temperature gauge/switch shall have two DPDT, 120 V ac, 5 amp rated contacts. The temperature setpoint for the initial blower start-up shall be 180°F and shall be adjusted as appropriate. The temperature gauge/switch shall be attached to the thermobulb temperature sensing element, installed in the air distribution header. Allowable temperature gauge/switch manufacturers include 3D Instruments, Dwyer, or approved equal.

2.4 Run Time Indicator

The run time indicator shall be an ac hour meter with 7 digit numeral, non-resettable readout. The indicator shall be rated for 120 V ac, 2 Watts. The indicator shall be wired to count only while the motor to the blower is in operation. Allowable run time indicator manufactures include Redington, Veeder-Root, or approved equal.

2.5 Time Delay Relay

A time delay relay shall be configured into the electrical control system with the temperature switch. The time delay relay shall be a DIN mounted multifunction, digital time delay relay/counter, with an adjustable range from 0.1 seconds to 10 hours. The time delay shall be rated for a minimum 1/3 horsepower at 120 V ac and have a 2 form C DPDT relay arrangement. The time delay relay shall have an initial setpoint of 3 hours, which shall be adjusted, in the field, as necessary. Allowable time delay relay manufacturers include Potter & Brumfield, IDEC, Allen-Bradley, or approved equal.

2.6 Timing Relay

A timing relay shall be configured into the electrical control system to provide a bypass for the low pressure switch which is mounted on the blower discharge silencer. The timing relay shall be a multifunction time delay relay with programmable timing modes include a interval on or input controlled timing function. The timing relay shall be rated for a minimum 1/3 horsepower at 120 V ac and have a 2 form C DPDT relay arrangement. An initial setpoint of 15 seconds shall be set, which shall be field adjustable. The timing relay shall have an overall adjustable timing range from 0.1 seconds to 100 minutes. Allowable relay manufacturers include Potter & Brumfield, IDEC, Allen-Bradley, or approved equal.

2.7 General Purpose Relays

A general purpose relay shall be configured into the electrical control system to provide control to the field mounted instrumentation. The general purpose relay shall be an octal plug type with 3 form C, 3PDT, relay arrangement. The contacts shall be rated for a minimum 1/3 horsepower at 120 V ac. Allowable general purpose relay manufacturers include Potter & Brumfield, IDEC, Allen-Bradley, or approved equal.

2.8 Tubing

Tubing for the instrumentation and controls which require such, shall be copper, hard drawn, seamless copper No. 122, per ASTM B75. The hard drawn tubing shall be obtained in 20-ft straight lengths.

Tube fittings shall be made of brass. The tube fitting shall provide for a leak-proof seal for pressure or vacuum service.

2.9 Supports

Instrumentation and controls shall be supported by the carbon steel piping to which it is attached. This piping shall bear the instruments weighted load to timber supports, to located on either side of the instrument, as necessary.

3.0 EXECUTION

The Instrumentation and Controls shall be installed in accordance with the requirements of the construction drawings, technical specifications and the manufacturer's instructions and recommendations.

3.1 Testing and Inspection

All materials shall be installed after field verification of distances and requirements in the field.

Fittings and tubing shall undergo pressure testing in the field. All instrumentation and controls items shall be tested, calibrated, and certified by the manufacturer.

4.0 SUBMITTALS

The Blower System Vendor shall submit shop drawings and information showing outline and overall dimensions, as well as component limits, connections, and orientation, for all materials furnished under this section. As-built drawings including the required orientation, supplied model numbers, and equipment types with options shall be submitted for approval. Submittals shall be in accordance with Section 01300 - Submittals.

SECTION 15020 PIPES, VALVES, AND FITTINGS

(Design Change Notification No. 1)

1.0 GENERAL

The Contractor shall supply and provide all materials and installation as specified in this section and shown on the Construction Drawings.

This section covers the requirements for the materials, installation, and testing of the items described herein. The materials are located beginning at the blower and continuing along the pipe manifold at the blower station, the distribution pipe placed on top of the ground, and to the general proximity of the biovent wells. Note that the materials comprising the biovent wells and monitoring wells are described in Section 02300 - Biovent Wells and Monitoring Wells.

Pipes and fittings shall be supplied for the following services and locations:

Pipe Type	Service	Location
Welded	Low	On top of blower station slab.
galvanized	pressure air	
carbon steel	flow	
CPVC	Low	From end of steel pipe at the blower station to PVC pipe
ſ	pressure air	transition point along each air distribution pipe branch.
	flow	Pipe located on top of ground.
PVC	Low	From end of CPVC distribution pipe branch (described
	pressure air	above) to biovent wells. Pipe generally located on top of
	flow	ground.

Pipe types, sizes, lengths, and dimensions shall be taken from the Construction Drawings.

2.0 MATERIALS

2.1 Steel Pipe and Fittings

All steel pipe and steel fittings shall be schedule 40, welded, galvanized, carbon steel pipe manufactured according to ASTM A-53. Threaded ends shall be FNPT or MNPT, as appropriate. Steel pipe shall transition to CPVC pipe with a 150-lb ANSI bolted flanged end connection of differing materials (steel and CPVC) as shown on the Construction Drawings.

2.2 CPVC Pipe and CPVC Fittings

All chlorinated polyvinyl chloride (CPVC) pipe and fittings shall conform to the following ASTM standards:

- ASTM D-1784, "Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) Compound," Class 23447-B for CPVC.
- ASTM D-2846, "Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hotand Cold-Water Distribution Systems."
- ASTM F-439, "Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40."

Slip joint fittings shall be used. Solvents and glue as specified by the CPVC pipe manufacturer shall be used according to the CPVC pipe manufacturer's instructions.

The CPVC pipe shall begin (in the direction of air flow) at the edge of the blower station by transitioning from steel pipe using a 150-lb ANSI bolted flanged end connection of differing materials (steel and CPVC) as shown on the Construction Drawings.

The CPVC pipe shall end (in the direction of air flow) at the locations shown on the Construction Drawings. The transition from PVC pipe to CPVC pipe by shall be made by using a 150-lb ANSI bolted flanged end connection of differing materials (CPVC and PVC) as shown on the Construction Drawings.

2.3 PVC Pipe and PVC Fittings

All polyvinyl chloride (PVC) pipe and fittings shall conform to the following ASTM standards:

- ASTM D-1784, "Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) Compound," Class 12454-B for PVC.
- ASTM D-1785, "Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120."
- ASTM D-2466, "Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40."

Slip joint fittings shall be used. Solvents and glue as specified by the PVC pipe manufacturer shall be used according to the PVC pipe manufacturer's instructions.

The PVC pipes shall begin (in the direction of air flow) at the termination of CPVC pipe at the locations shown on the Construction Drawings. The transition from CPVC pipe to PVC pipe by shall be made by transitioning from CPVC pipe using a 150-lb ANSI bolted flanged end connection of differing materials (CPVC and PVC) as shown on the Construction Drawings.

2.4 Plug Valves

Plug valves shall be used to isolate the pressure gauges from the air distribution pipe located at the blower station. Plug valves shall have a brass body and TFE-coated Viton O-rings for the packing materials. Plug valves shall be lever operated. The end connections shall be 1/4" FNPT. Plug valves shall be NUPRO N-791 or approved equal.

2.5 Butterfly Valves

Butterfly valves shall be 125 psi, bronze body, stainless steel disc and stem, resilient replaceable seats, and infinitely variable lever-operated with continuous motion. The valve disc position shall have components to securely lock the set disc position in place using hands or small hand tools. The lock shall be designed to hold the valve disc in any intermediate position between fully open and fully closed without creeping or fluttering. Butterfly valve locations, sizes, and end connection types are shown on the Construction Drawings.

2.6 Ball Valves

Ball valves shall be 125 psi, PVC body, PVC ball and trim, and thermo plastic elastomer seats and stuffing box rings. Ball valve locations, sizes, and end connection types are shown on the Construction Drawings.

2.7 Globe Valves

The globe valves shall be used to throttle air flow. All globe valves shall have a documented valve flow coefficient, C_v , with a value of 13 minimum to 20 maximum at the fully open position, expressed in units of gallons per minute of 60 °F water with 1.0 psi pressure drop across the valve. Globe valves shall be 125 psi, bronze body, stainless steel ball and trim, rising stem, and lockable hand wheel. Globe valves shall be Model 10-M manufactured by Dragon Valves, Inc., Norwalk, California, or approved equal. Globe valve locations, sizes, and end connection types are shown on the Construction Drawings.

3.0 EXECUTION

3.1 Installation

All materials shall be properly and securely installed such that undue stresses are not exerted on equipment or connections. Bolts for flange connections shall be tightened using proper bolt torques as recommended by the manufacturer. The bolts shall be tightened alternatively and evenly. Threaded connections shall be cleaned and made up with the correct torque. All threaded connections shall be wrapped with Teflon tape before making up the connection. All PVC slip joints and all CPVC slip joints shall be cleaned before connecting and connected using joining materials and procedures according to the manufacturer's instructions.

3.2 Cleaning

The inside of all pipe, valves, and fittings shall be smooth, clean, and free from blisters, loose mill scale, sand, dirt, and other foreign matter when installed.

3.3 Low-Pressure and Leakage Testing

Pressure testing shall be performed by the Contractor on the air distribution piping in sections or for the entire system at once. The biovent wells shall not be subject to this test requirement. Testing shall be performed using low pressure air.

A portable low-pressure air compressor or blower shall be used to perform the testing. The air compressor or blower shall be furnished with a pressure regulator and a pressure relief valve at its discharge to limit the test pressure. The maximum test pressure shall not exceed 6.0 psig. The biovent system blower shall not be used to perform the testing.

The procedure for testing shall generally comply with ASTM C-828, "Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines." Testing includes the following steps:

- 1. Determine the test time for the section of line to be tested. For 4-inch pipe, the test time is 0.3 minutes per 100 ft of pipe length.
- 2. Plug all openings in the test section.
- 3. Add air until the internal pressure of the line is raised to approximately 6.0 psig. After this pressure is reached, allow the pressure to stabilize. The pressure will normally drop as the air temperature stabilizes. This usually takes 2 to 5 minutes, depending on the pipe size.
- 4. The pressure shall be reduced to 5.5 psig before starting the test.
- 5. Start the test when the pressure is at 5.5 psig. If a 1.0 psig pressure drop does not occur within the test time, the line has passed the test. If the pressure drop is more than 1.0 psig during the test time, the line has failed the test.
- 6. Leaks shall be located by testing short sections of pipe as described above. Leaks shall be repaired and tested.

4.0 SUBMITTALS

Manufacturer's information, performance data, and installation instructions for all materials shall be furnished as described in Section 01300 - Submittals.

SECTION 15700 POSITIVE DISPLACEMENT ROTARY LOBE BLOWER

1.0 GENERAL

This section covers the skid mounted, positive displacement, rotary lobe blower system. This blower system shall be used for providing pressurized air to the bioventing system. The blower system shall be provided by the Blower System Vendor.

1.1 Operating Conditions

The blower system will operate outdoors at 4,100 feet above mean sea level. The blower system shall have the capacity to provide a minimum flow rate of 330 SCFM and maximum flow rate of 425 SCFM. The anticipated discharge pressure can range from 4.0 psig to 6.0 psig. The blower shall be V-belt driven and be capable of adjusting the flow rate by replacing the blower shaft sheave and/or the electric motor shaft sheave.

The blower system shall be able to withstand ambient air temperature from 0 $^{\circ}$ F to 120 $^{\circ}$ F, in the presence of airborne particles such as sand, and bright direct sunlight, typical of conditions in the New Mexico desert. Humidity typically ranges from a low of 10% to 40% with higher values during rainstorm and snowfall events.

The blower design point shall be no more than 75% of the manufacturer's published design capacity and shall operate at speeds no more than 80% of maximum. The blower shall operate at no more than 2500 rpm and have a gear tip speed of less than 3500 rpm. The blower system motor shall be designed to operate at 60% to 80% of its rated maximum capacity.

All electrical equipment and instrumentation associated with control of the blower shall be provided by the Blower System Vendor as provided in Section 16200 - Electrical Equipment, and Section 13200 - Blower System Instrumentation and Controls. The Vendor package shall include electrical equipment for supplying power to the blower system, site lighting, auxiliary outlets, and instrumentation and controls.

2.0 MATERIALS

The blower system shall include a painted skid with attached supports for power panels, blower, and electric motor. The electrical motor and blower housing shall be mounted on a common baseplate. The blower shall have a protective housing for the belt drive system to protect personnel and to protect the belts and sheaves from exposure to blowing sand. The blower system instrumentation and controls, air inlet filter housing, inlet silencer, discharge silencer, vibration isolation coupling, and all necessary accessories and appurtenances required shall be furnished for a complete operating system. The blower system shall be fabricated and pre-tested as a complete unit before shipment to the site.

A skid frame shall be fabricated of painted carbon steel, complete with lifting lugs used for lifting, and attachment points, for bolting the skid to a reinforced concrete slab using 3/4" anchor bolts.

Site FT-31 Technical Specifications Paint shall be adequate to prevent rust formation on the skid frame materials. The skid frame shall also be provided with supports for two power panels as indicated on the Construction Drawings. The blower system shall have a rigid base/discharge silencer that is comprised of a welded piece designed to minimize vibration.

The positive displacement rotary lobe blower shall be manufactured by Roots, Sutorbilt, or approved equal. The blower shall be designed, constructed, and guaranteed to provide compressed air at the specified operating conditions. The blower belt drive guard shall meet OSHA standards. The vendor shall document and provide the performance characteristics of the blower system for all recommended combinations of sheaves used to operate the blower through the entire range of operating conditions. The blower shall be mounted on vibration isolation pads made of sandwich cork and rubber or approved equal.

The inlet filter for the blower system shall be oversized by 25% and shall have a maximum 10 micron screen size, replaceable filter, constructed of pleated paper or synthetic material. The filter shall be canister type and have the capacity to be cleaned several times prior to being replaced. Inlet filters shall have weatherhood protection and be design for low head losses.

The blower shall be provided with a manually adjustable pressure relief valve.

Silencers shall be provided and mounted on both the inlet and discharge of the blower. During normal operation the maximum noise level measured one meter from the blower system shall not exceed 90 dBA. Each silencer shall be of the straight through, annular absorption type with fiberglass packing suitable for continuous operation. Each silencer shall be of all-welded steel construction with prime painted exterior surfaces and flanged connections. Silencers shall attach to connection piping without reducers.

The final discharge point for the Vendor-supplied blower system shall be the 4-inch galvanized steel coupling that houses the temperature element. The Contractor shall be responsible for connecting the remainder of the biovent system piping to the Vendor-supplied coupling.

The blower system shall be constructed for transport to the site as an integral unit and be ready for installation. No field splicing, fabrication, or assembly shall be performed on the blower system with the exception of easily installed items that would be subject to theft or damage during complete blower package shipment.

The blower motor shall have an enclosure suitable for direct exposure to precipitation and airborne particulate. The power supply to the blower motor shall be a maximum 25 hp motor rated for 480 Volt, 3 phase power. The blower system motor shall be designed to operate at 60% to 80% of its rated maximum capacity. Detailed information on the electrical requirements are provided in Section 16200 - Electrical Equipment.

Instrumentation and controls for the blower unit shall be contained in a local, weatherproof housings or shall have indicators located on the main control panel. Specifications on blower system instrumentation and controls are provided in Section 13200 - Blower System Instrumentation and Controls.

3.0 EXECUTION

The blower skid shall be prepackaged by the manufacture or vendor and shipped as an entire unit.

3.1 Fabrication and Inspection and Testing

Design and construction of the blower package system shall conform with all ASME, NEC, NEMA, NESC, OSHA, and all other applicable standards. Mechanical and electrical equipment shall have nameplates with operating limits and power requirements listed. The blower system shall be tested to confirm the actual blower capacity. A 1-psi ASME PTC-9 slip test shall be conducted by the manufacturer or Blower System Vendor and all variables measured precisely and documented. All equipment shall be thoroughly cleaned and painted before shipment.

3.2 Installation

The equipment shall be installed in conformance with the manufacturer's installation instructions. The Vendor shall provide all necessary plates, shims, anchor bolts, fasteners, piping, connections, or other miscellaneous accessories. The Contractor shall align the blower system with the other process piping, so that binding, twisting, or stressing of connections is avoided.

4.0 SUBMITTALS

The Blower System Vendor shall provide complete assembly and installation drawings, together with detailed specifications and manufacturer's literature on all materials. The Blower System Vendor shall demonstrate the ability to provide the specified equipment by providing a list contained at least five (5) similar installations completed within the last 3 years. The Blower System Vendor shall also supply a complete parts list and recommended maintenance information for all equipment contained in the packaged system.

Blower performance curves based on the site conditions for the complete range of specified operating conditions shall be submitted. The curves shall show discharge pressure in psig, brake horsepower, and efficiency, all plotted as a function of discharge flow rate in SCFM for the complete range of specified operating conditions.

Documentation of the ASME PTC-9 slip test shall be submitted.

Inlet filter sizing documentation shall be submitted for review, in order to ensure that the filter meets the specified technical requirements for an oversize inlet filter.

Electrical schematics and instrumentation and control schematics shall be furnished to provide a basis for confirming electrical requirements and applicability with other system controls and power.

Submittal schedule and quantities shall conform to the requirements listed in Section 01300 - Submittals.

SECTION 16100 ELECTRICAL DISTRIBUTION

1.0 GENERAL

This section covers the requirements for the design, performance, materials, construction, testing, and handling of the electrical distribution system.

1.1 Holloman Air Force Base Coordination

The Electrical Subcontractor shall supply and provide all Holloman Air Force Base coordination, engineering design, technical specifications, drawings, materials, installation details, permits, and testing to meet the performance requirements specified by the Base, this section, and as specifically identified on the Construction Drawings.

The Electrical Subcontractor shall coordinate the design and installation of the transmission line with the Civil Engineering Command Electrical Department. The contact at the Base is:

Mr. Phillip Trujillo Phone: (505) 475-3781

1.2 System Description

For the purpose of this specification, the electrical distribution system is comprised of raceway, wiring and cable, outlet and pull boxes, lightning and surge arresting equipment, and a grounding system.

An overhead electrical transmission system shall be designed and installed by the Electrical Subcontractor, starting from the 13.2 kVA transmission lines and continuing on to the site, located approximately 350 feet north of the transmission line. The design shall include, but is not limited to, producing engineering design, drawings, details, and specifications necessary to provide 480Y/277 power to the site. This design and installation shall be coordinated with the Holloman Air Force Base Civil Engineering Command Electrical Department to determine the location best equipped for the electrical tie-in and other details of the transmission design. Services required of the Base for the design and installation of the electrical transmission design shall be specified by the Electrical Subcontractor during his design.

The Electrical Subcontractor shall also be tasked with installing: 1) the light/power pole, inside the site perimeter; 2) a minimum 30 kVA step-down transformer prior to crossing the site perimeter and connecting to the site lighting pole; 3) the lighting fixture and photoelectric control; 4) 480Y/277 volt service drop line; 5) a utility meter (if required by the Base); 6) a 100 amp safety switch; 7) the grounding system for the site; and 8) all conduit and wiring required to connect the blower skid and overhead lighting. Electrical equipment to be installed by the Electrical Subcontractor, not specified in this section, includes the lighting fixture, photoelectric control, and safety switch, specified in Section 16200 - Electrical Equipment

1.3 Service Conditions

All electrical distribution equipment shall be installed outdoors and shall be selected to withstand environmental extremes typical of the New Mexico desert including, but not limited to, exposure to bright sunlight and windblown sand, for a minimum of two years. Ambient temperatures at the site range from 0 to 120°F. The relative humidity experience at the site is typically between 10 and 40 percent with higher percentages occurring during precipitation events.

1.4 System Requirements

The electrical distribution system shall be designed to effectively and safely conduct power to the electrical loads of the system. All equipment used in the construction shall be standard products of manufacturers regularly engaged in the production of this type of equipment.

1.5 Conduit and Cable

Conduit and fittings shall be UL approved rigid hot dipped galvanized steel (ANSI C80.1-90). Liquid-tight flexible conduit (UL 360) and fittings shall be utilized between the motor terminal box or other equipment subject to vibration and mechanical adjustment. Conduit systems shall be sized and supported in accordance with the NEC.

Cable conductors shall be constructed of copper. Instrumentation and controls wiring shall be stranded copper or as specified in Section 13200 - Blower System Instrumentation and Controls. Cable insulation type and temperature rating shall be as specified in the Construction Drawings. Cable splicing and termination shall adhere to the NEC and UL approved materials and tools listing. The wiring system shall be identified as follows:

- Three phase 480Y/277 wiring shall be labeled by phase and color coded as follows: phase A, brown; phase B, orange; phase C, yellow; neutral, white; and ground, green.
- Single phase 240/120 wiring shall be color coded as follows: phase A, black; phase B, red; neutral, white; and ground, green.

1.6 Lightning and Surge Arresters

Lightning and surge arresting equipment shall be install on the primary and secondary sides of the step-down transformers. All arresting equipment shall meet all applicable ANSI, NEMA, IEEE, and OSHA standards. The arresting equipment shall be UL listed under lightning protective devices and shall be in accordance with NFPA 70, 1996.

1.7 Grounding

Ground cable connections below grade shall be thermic welded. Mechanical connections made as part of the grounding system shall be made with compression type connectors, permitted for exposed installation. The grounding system shall have less than 25 ohms, and tested in accordance with IEEE 81. Grounding for the electrical transmission system and electrical equipment shall be in accordance with NFPA 70, 1996.

2.0 MATERIALS

Design and installation of the electrical equipment comprising the distribution system shall conform with all ANSI and ASTM standards as well as the NEC.

2.1 Conduit and Cable

Rigid conduit shall be, schedule 40, heavy wall, hot-dipped galvanized steel. Rigid conduit shall comply with ANSI C80.1 and shall be UL 6 listed. Flexible conduit shall be liquid-tight, galvanized steel flexible tubing with UV-resistant synthetic jacket extruded over the tubing. The flexible conduit shall be UL 360 listed. Acceptable conduit manufactures include Allied Tube & Conduit, Triangle Wire & Cable, or approved equal.

- Wire and cable shall be copper conductors and meet the following material specifications:
- Wire size and construction shall be as follows: #2 through #8 AWG wire, shall be 7 stranded copper conductor; #10 AWG and smaller, for feeding lights and receptacles shall have a solid conductor; #10 AWG and smaller, for motor loads and control wiring shall be stranded.
- Insulation for conduction shall be rated for 600 volts, 90 degrees Celsius, type THW/XHHW for conductors large than size #10 AWG, and type THHN/THWN for size #10 AWG conductors and smaller.
- Multiple conductor cables shall contain phase identification and conform to the color coding described above.

Acceptable wire manufactures include ALPHA, General Electric, Okonite, or approved equal.

2.2 Outlets and Boxes

Receptacles shall be Ground Fault Circuit Interrupting type with a NEMA configuration 5-20R. Boxes shall have a weather proof cast type with "weather-proof while in use" type cover. Pull boxes shall be NEMA 4 rated, fabricated from 16 or 14 gauge steel, with external screw clamps on three sides of the cover with one continuously hinged side. The pull box shall have minimum of three access locations.

2.3 Lightning and Surge Arresters

The primary lightning arrester-cutout equipment shall be 8.3/14.4 kV cutouts with a 9/10 kV type "Q" arresters. Mountings and mechanical equipment required to mount the primary arrestercutouts shall be determined by the electrical subcontractor based upon the detail of the electrical transmission design. Acceptable arrester-cutout combination package manufacturers are Joslyn or approved equal. The secondary surge arrester unit shall be in a WYE, 4-wire, grounded neutral configuration. The unit shall be rated for a maximum 650 volts line-to-line. Both secondary surge arrester units shall be constructed of aluminum, with silicon carbide valve blocks, the ability to maintain low sparkover, and have #10 AWG, 19 strand, 18 inch, tinned copper lead wires. Acceptable secondary surge arrester manufacturers are Joslyn or approved equal.

2.4 Grounding

The grounding system shall provide no less than 25 ohms resistance for the four, 3/4 inch ground rods, driven to 10 feet. Ground rods shall be copper-welded and be connected together with wire-tinned, #1/0 AWG, copper wire. The ground rods shall be connected to the #1/0 AWG wire bus with a thermic weld type connection. The #1/0 AWG cable shall be connected to the fence grounding systems with cable-to-cable type connectors. The fence shall be grounded by a #2 AWG, tinned copper wire, using cable-to-cable, non-thermo, compression Servit type connectors, to connect the wire to the fence. Metallic enclosures and equipment shall be grounded using cable to flat bar type compression fittings, with copper body, single tightening bolt, nut and locking washer. Gates shall be connected by a grounding jumper to the adjacent fence and then connect to the fence grounding bus system, as indicated on the construction drawings. Lighting fixtures and convenience outlets shall be grounded through the conduit system.

3.0 EXECUTION

The equipment shall be installed in accordance with the requirements of the Technical Specifications, Construction Drawings, and manufacturer's instructions and recommendations. All equipment shall be properly and securely installed such that undue stresses are not exerted on equipment and connections.

Base Coordination, engineering design, and installation of the site transmission line shall be conducted by an Electrical Subcontractor. The site transmission line shall be run from the 13.2 kVA transmission lines, located approximately 350 feet south of the proposed treatment system location. The pole line shall be installed in accordance with NESC, 1993. Connection to the 13.2 kVA line shall be coordinated with the Base Civil Engineering Command Electrical Department.

3.1 Testing and Inspection

All materials shall be installed after the location of incoming power, orientation of the reinforced concrete blower pad, and blower are finalized. Conduit shall be square cut and threaded with approved tools and the conduit interior cleaned and burrs removed prior to installation. Wire shall be pulled following the installation of mechanical equipment and care shall be taken while pulling wire point to point so that conductor installation is not damaged. Wire shall be pulled using lubrication and methods recommended by the wire manufacture.

The grounding system shall be visually inspected at all below-grade grounding sites, prior to being backfilled. Ground loop resistance shall be measured to ensure that the resistance is less than 25 ohms with 4 ground rods. If the resistance of the grounding system is exceeded additional

grounding rods shall be installed as required. All equipment grounding and compression connectors shall also be inspected.

The power distribution system shall also be inspected to verify that all conduit routing, termination and supports are properly sized and installed per the Construction Drawings and the NEC. All wiring shall be inspected by the Base to verify adherence to base standards, Electrical Subcontractor's specifications and drawings, NEC, and any other regulations that apply. Proper wire phasing and termination shall also be checked and a functional test of the entire electrical system performed.

4.0 SUBMITTALS

All submittals shall be in accordance with the procedures, format, and schedule specified in Section 01300 - Submittals.

The Electrical Subcontractor shall prepare and submit calculations, drawings, and material descriptions to the Contractor for initial review. These shall include outlines and overall dimensions for all materials furnished under this section and include conduit, receptacle wiring, and power supply schematics. The Electrical Subcontractor shall also be responsible for providing details on the connection to the Base electrical system, pole locations and spacing, transformer locations, and system one-line diagrams. The Electrical Subcontractor shall revise the design, drawings, and materials based on Contractor review comments. The revised product shall receive a final review by the Contractor prior to submission by the Electrical Subcontractor to the Base. The extent of the Contractor's review is stated in Section 01300 - Submittals, Subsection 2.4.

After the Contractor has finished reviewing the Electrical Subcontractor's design, drawings, and materials, the Electrical Subcontractor shall then submit the drawings and material descriptions to the Base for approval and subsequent revision, if necessary.

The Electrical Subcontractor shall prepare Project Record Drawings upon conclusion and acceptance of work by the Base.

SECTION 16200 ELECTRICAL EQUIPMENT

1.0 GENERAL

This section covers the requirements for the design, installation, materials, construction, and testing of the electrical equipment not described in Section 16100 - Electrical Distribution. The Electrical Subcontractor shall supply and provide all design, materials, drawings, installation details, and testing specified in this section and on the Construction Drawings.

1.1 System Description

The electrical equipment for the FT-31 Site includes all the electrical equipment following the 30 kVA, 13.2 kV to 480Y/277 V, step-down transformer to be located and installed by the Electrical Subcontractor. This section does not include instrumentation and controls contained in Section 13200 - Blower System Instrumentation & Controls.

The electrical equipment shall include but is not limited to the following: a heavy duty, fusible safety switch for disconnecting the incoming 480 V power; combination motor starter for blower motor control; a mini-power center with transformer and circuit breaker panel board; site lighting and photoelectric control equipment; and a Ground Fault Circuit Interrupting (GFCI) receptacle.

As specified in Section 15700 - Positive Displacement Rotary Lobe Blower, all electrical equipment, with exception of the safety switch, utility meter (if required), site lighting, and field instrumentation, shall be provided for by the Blower System Vendor.

1.2 Service Conditions

All electrical equipment shall be installed outdoors and shall be selected to withstand environmental extremes typical of the New Mexico desert including, but not limited to, exposure to bright sunlight and windblown sand, for a minimum of two years. Ambient temperatures at the site shall range from 0 to 120°F. The relative humidity experience at the site is typically between 10 and 40 percent with higher percentages occurring during precipitation events.

1.3 System Requirements

All electrical equipment shall be selected to withstand environmental exposure for a minimum of two years. All equipment used in the construction shall be standard products of manufacturers regularly engaged in the production of the specified equipment.

Electrical control and distribution panels shall be installed on supports attached to the blower skid by the Blower System Vendor. Care shall be taken to locate these units so as to minimize the effects of vibration on panel mounted electrical equipment.

1.4 Safety Switches

Safety switches shall meet applicable requirements set forth by the NFPA, NEMA, and shall be UL listed. Safety switches shall be a 4-wire, solid neutral, with a ground bus system, rated for 100 amps and shall be mounted to the power pole located within the blower station fence.

1.5 Comination Motor Starter

Combination starters shall contain a NEMA size 2 full-voltage nonreversible motor starter, rated for a maximum 600 V ac, 3-phase power, with a 50 amp motor-circuit protector disconnect. The combination starter shall have a 250 VA control transformer with 5 amp fused secondary. The starter shall meet all applicable NEMA and UL standards.

1.6 Mini-Power Center

A mini-power center shall be installed to provide power for site lighting, a GFCI receptacle, and a spare 120 V ac, 20 amp power line. The mini-power center shall be listed with UL and meet applicable NEMA standards. The mini-power center shall be rated for 5 kVA and equipped with a 480-120/240 V transformer.

1.7 Site Lighting

Site lighting shall be provided as detailed on the construction drawings and shall meet IES requirements and be listed and classified by UL. Lighting shall be rated for a 120 V ac supply power with a 250 Watt High Pressure Sodium luminaire. A luminaire shall have integral, photoelectric control and shall be affixed on a 6-foot arm. Wood power poles shall be grounded as indicated on the construction drawings and shall be buried to a minimum 5 foot depth and grouted.

2.0 MATERIALS

Design and installation of the electrical equipment shall conform with applicable ANSI, NEMA, IEEE, and NECA standards. All electrical components shall be suitable for extreme weather conditions and shall have NEMA 4 enclosures.

2.1 Safety Switches

Safety switches shall be heavy duty, 4-wire, 3 blade type with solid neutral assembly. The switch shall be single throw fusible type, rated for 600 V ac, 100 amps. The three fuseholders shall have class R fuse kit, with a 60 amp rating. The safety switch shall be housed in NEMA 4 enclosure with a rubber handled hand switch. Acceptable safety switch manufactures include Cutler Hammer/ Westinghouse, Allen Bradley, Square D, or approved equal.

2.2 Combination Starter

A combination starter with a NEMA size 2, full-voltage, nonreversible type motor starter. The components of the combination starter shall be installed in a NEMA 4 enclosure. The motor starter shall be rated for 480 V ac, 3 phase, 60 hz, and shall be appropriate for controlling a 25 horsepower (460 V ac) motor. The combination starter shall have an adjustable instantaneous trip circuit breaker with magnetic trip elements in each pole and adjustable trip point settings on the front of the unit. A combination starter shall have a 120 V, 250 V amp control transformer, with a 5 amp fused secondary. The control transformer shall provide 120 V ac power to system instrumentation and controls.

The combination starter shall be contained in a NEMA 4 enclosure with mounted push-button controls and indication lights. The system shall be operated using "STOP" and "RUN" oil tight, momentary push-buttons. Transformer type indicating lights shall also be panel mounted, a green for "BLOWER RUN" and red for "BLOWER STOP". Indicating lights and push-button controls shall be mounted to the external portion of the cabinet and legend plates shall be furnished for both the push-buttons and indicator lights. A 120 V ac, 0.35 amp, "RUN" beacon, with weatherproof housing shall be installed in parallel with the "BLOWER RUN" light, and mounted on top of the combination starter. A ten point terminal block for instrumentation and control termination shall also be installed within the combination starter enclosure. Acceptable manufactures of combination starters include General Electric, Square D, Cutler Hammer/Westinghouse, or approved equal.

2.3 Mini-Power Center

The mini-power center shall have a transformer rated for 5 kVA, 480-120/240 V ac, single phase power. The mini-power center panelboard shall be rated for 120/240 V ac, single phase, 3 wire, and 4 circuits. A minimum of three circuit breakers, each rated for 20 amps shall be furnished. The panelboard shall have one 2-pole circuit breaker rated for 20 amps and two 1-pole circuit breakers, each rated for 20 amps. The panelboard shall have an interrupting rating of 10,000 AIC. The mini-power center shall be contained in a minimum NEMA 4 enclosure or approved equal. All energized parts of the mini-power center shall be contained and all cores positively grounded. A ground bar shall be supplied for the grounding of secondary circuits, the neutral bar shall be grounded to the case, and a grounding terminal provided for grounding the entire mini-power center. Acceptable manufactures of mini-power centers include General Electric, Cutler Hammer/Westinghouse, or approved equal.

2.4 Site Lighting

Site lighting fixtures shall be mounted on a 30 foot, Class 3, pressure treated, Southern Yellow Pine pole. Lighting fixtures shall be grounded along with other equipment as indicated on the drawings. The luminaire shall be outdoor roadway type, IES type 3 for light distribution, with one 250 watt High Pressure Sodium Lamp, with an integral high power factor 120 V ac, 60 hz ballast, and integral photo cell. The high pressure sodium lamp shall have a slipfitter mount and 6 foot arm suitable for wood pole mounting. Acceptable manufactures of luminaires include General Electric, Holophane, or approved equal.

2.5 Power Outlet

A GFCI, duplex, receptacle with 2-pole, 3 wire configuration shall be installed as described on the construction drawings, for additional site power. The GFCI receptacle shall have a NEMA 5-20R configuration and be rated for 120 V ac, 20 amp power.

2.6 Equipment Support

Electrical equipment supports shall be shop or field fabricated supports or manufactured supports, assembled from U-channel. Steel brackets shall be fabricated from angles, channels, and other standard structural support shapes. All support connections shall be welded and machine bolted to form a rigid frame support. All supports shall be painted for outdoor service to prevent rust.

3.0 EXECUTION

The equipment shall be installed in accordance with the requirements of the Technical Specifications, Design Drawings, and manufacturers' instructions and recommendations.

3.1 Testing and Inspection

All materials shall be installed after field verification of distances and requirements in the field. Electrical equipment connections shall be checked and properly secured. Coil voltages, thermal elements, phasing for motor loads, and grounding shall be checked prior to energizing motors or other loads to ensure proper operation.

4.0 SUBMITTALS

The Electrical Subcontractor shall submit shop drawings showing outline and overall dimensions for all materials furnished under this section for approval. As-built drawings including the orientation, model numbers, and equipment types shall be submitted. Submittals shall be in accordance with Section 01300 - Submittals.
APPENDIX D

100 PERCENT CONSTRUCTION DRAWINGS



U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS OMAHA, NEBRASKA

Soil Bioventing System IRP Site FT-31 - Former Fire Training Area 100% Design Submittal

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Holloman Air Force Base Alamogordo, New Mexico

CONTRACT: DACW45-94D-0003 DELIVERY ORDER NO. 8, WORK AUTHORIZATION DIRECTIVE NÓ. 3

THIS DRAWING HAS BEEN REDUCED FROM THE ORIGINAL 40" x 28" SIZE



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DRAWING INDEX

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NOTES

1. WRAP ALL THREADS WITH TEFLON TAPE BEFORE CONNECTING PIPE, VALVES, FITTINGS, GAUGES, AND FLOW METERS.

2. BGS - BELOW GROUND SURFACE.

THE DRAWING LINE DEEN DEDUCED



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TAG	FLOW RATE	PRESSURE	COMMENTS
1	0-425 SCFM MAX.	6.0 PSIG MAX.	AIR INJECTION
2	0-116 SCFN MAX.	5.5 PSIG MAX.	AIR INJECTION
28	0-19 SCFW WAX.	4.5 PSIG MAX.	AIR INJECTION
3	0-232 SCFN MAX.	5.5 PSIG MAX.	AIR INJECTION
JA	0-19 SOFW MAX.	4.5 PSIG MAX.	AIR INJECTION
4	0-77 SCFM MAX.	5.5 PSIG MAX.	AIR INJECTION
4A	D-19 SOFW MAX.	4.5 PSIG MAX.	AIR INJECTION









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SCHEDULE OF PIPE, VALVES, AND FITTINGS

APPENDIX E

DESIGN REPORT

Design Report

Holloman Air Force Base, New Mexico IRP Site FT-31 Bioventing System

This document provides information about the design features for the Soil Bioventing System to be installed at the FT-31 Site at Holloman Air Force Base, New Mexico.

Project Description: Holloman Air Force Base (HAFB) is located just northwest of Alamogordo, New Mexico. Site FT-31 is a former fire training area. Based on previous field investigations and studies, the soil contains total recoverable petroleum hydrocarbons (TRPH) in excess of the basewide cleanup standard of 1,000 mg/kg. The contaminated soil is located in three distinct areas of the site. The design effort refers to the three areas as North Area, South Area, and East Area, according to their respective locations. These designated areas are shown on the Construction Drawings.

Remediation of the hydrocarbon contamination will be accomplished by designing, procuring, installing, and operating a soil bioventing system.

<u>Site Contamination</u>: Contaminated soil is present from a depth of approximately 0 to 20 ft below grade. Maximum concentrations of TRPH have been measured up to 11,500 mg/kg in soil. No light non-aqueous phase liquids (LNAPLs) have been identified at the site. The average depth to the water table beneath the site is approximately 20 ft below ground surface (bgs). The water table fluctuates from approximately 19 ft to 21 ft below grade.

<u>Remediation Approach</u>: A combined soil vapor extraction and soil bioventing system was initially presented in the Request for Proposal. However, process design calculations indicated the site could be remediated, in approximately the same duration, exclusively through bioventing without incurring the capital, operation, and maintenance costs of soil vapor extraction equipment.

<u>Site Survey</u>: A topographic site survey was performed by Southwest Engineering Inc., on January 10, 1996. The survey information was used in the preparation of a base map for the Construction Drawings.

General Design Criteria: The following list presents general criteria, applied to the design and constructed elements of the project.

- 1. Location Holloman Air Force Base, located northwest of the City of Alamogordo, New Mexico. Site FT-31 is an abandoned remote site with no roads or traffic.
- 2. Ground Elevation approximately 4,100 ft MSL.
- 3. Minimum Extreme Temperature: 20 degrees Fahrenheit (°F).
- 4. Minimum Winter Daily Normal Temperature: 25 °F.

- 5. Maximum Summer Daily Normal Temperature: 95 °F.
- 6. Maximum Extreme Temperature 120 °F.
- 7. Design Life Approximately 2 years.
- 8. Chemical Resistance Petroleum, oil, and lubricants with maximum measured concentration of TRPH = 11,500 mg/kg. (Other chemicals and concentrations for Site FT-31 are included in the June 1995 Draft Final RFI Report).
- 9. Ultraviolet Resistance All exposed above-grade materials and equipment due to the predominantly sunny location. (However, materials selection will include consideration of the relatively short design life).
- 10. Equipment slab will be sloped to drain (rainfall will not be captured).
- 11. Reinforced concrete design per American Concrete Institute Code 318.
- 12. UBC Seismic Zone = 1.
- 13. UBC Wind Speed = 70 mph.
- 14. Electrical design per National Electrical Code, National Electrical Manufacturer's Association Standards, and National Electrical Safety Code.
- 15. The blower discharge temperature will be limited to 165°F to prevent damaging the subsurface microorganisms outside of the near-wellbore region of the biovent wells during the hot seasons.

Radius of Influence and Air Permeability: A pressure vs. distance test was performed at Well IW-01 under the Bioventing Initiative. The test data and semilog plot of pressure vs. distance are provided at the end of this appendix. The analysis of the test data resulted in a computed air permeability of 2.5 darcy for the 14-20 ft interval. Laboratory results for air permeability were 0.018 darcy at the 7.5 ft depth, and 0.062 darcy at the 18 ft depth. The order of magnitude difference between the computed and laboratory air permeability may be the result of method differences and stratigraphic variation in air permeability. Inspection of the semilog plot of pressure vs. distance indicates a radius of influence from 20 to 60 ft.

Process Design Criteria: There will be a total of 22 biovent wells, each screened from 6 ft below ground surface (bgs) to 21 ft bgs. Each biovent well is anticipated to have a 20 ft to 60 ft radius of influence based on data presented in the Draft Bioventing Initiative Report. A 40 ft radius of influence was used to develop the well spacings and locations. The North Area will have 6 biovent wells, the South Area will have 12 biovent wells, and the East Area will have 4 biovent wells. Air flow to each of the three areas will be independence controlled. The air injection rate at the well head for each biovent well will be approximately 15 SCFM to 19 SCFM. Pressure at the well head for each biovent well will be maintained between 3.5 psig and 4.5 psig. The compressed air flow rate at the blower system discharge will be approximately 330 to 424 SCFM at discharge pressures ranging from approximately 4.0 psig to 6.0 psig.

Blower: The blower will be capable of being mechanically adjustable, in the field, within the limitations of the originally installed equipment, to achieve any discharge rate within the specified operating range using the original blower and single-speed motor. The blower discharge rate can be reduced at a later time if any of the areas are finished being bioremediated. Belt-driven blowers are capable of operating at multiple speeds by replacing the blower and/or

motor sheaves. Multiple blower speeds will result in the capacity to achieve multiple performance curves, thereby accommodating a range of operating conditions. A positive displacement blower results in a known flow rate that is not strongly affected by discharge pressure. Therefore, a belt-driven positive displacement rotary lobe blower meets the design criteria and is a common and dependable component of many bioventing systems.

Centrifugal blowers (also called regenerative blowers) were ruled out because they are used primarily with close-coupled motors. To operate within a range of operating conditions, the motor would have to be a variable speed motor with ancillary instrumentation and controls. A belt drive could be installed in place of a variable speed motor to achieve multiple operating conditions (or blower performance curves), however, centrifugal blowers are not typically designed for belt drives. In addition, the discharge rate is strongly influenced by the discharge pressure. A constant known discharge rate could not be assured using a centrifugal blower.

A belt-driven positive displacement rotary lobe blower with sheave change-outs in the field (as operating conditions dictate) is more cost effective than a centrifugal blower with a close-coupled variable speed motor with instrumentation and controls.

The inlet air filter will be oversized to minimize blower downtime associated with a changing fouled filters. The filter will be sized appropriately for operating in heavy particulate laden air, for the appropriate humidity, and rainy conditions. The blower will be stopped when the in-line differential pressure gauge experiences the prescribed pressure drop across the filter.

Blower Station Slab and Fencing: The slab will be 6-inch reinforced cast-in-place concrete with thickened slab edge beams. The slab will be gently sloped to drain and will have a broom finish. There will be no liquids handled on the slab, therefore, there will be no curbs. The perimeter fence will be a 5-ft high commercial grade fence with one double-gate having a 8-ft wide opening. The fence and gates will be completely covered with privacy slats to minimize the impingement of blowing sand on the blower station equipment. The perimeter fence will be grounded as prescribed by the electrical specifications.

Blower Discharge Temperature Limitation: The blower discharge temperature will be limited to 165°F to prevent damage to the microorganisms beyond the near-wellbore region of the biovent wells. The near-wellbore region of the biovent wells will be provided with air at optimal temperatures (90 to 100°F) during the cool seasons, thereby providing for bioremediation of the soil at the near-wellbore regions.

<u>Air Distribution Pipe</u>: The air distribution pipe will consist of three materials. These are, in order of use from the blower station to the biovent wells: 1) Schedule 40 welded galvanized carbon steel pipe, 2) Schedule 40 CPVC pipe, and 3) Schedule 40 PVC pipe. The maximum service air pressure will be approximately 6 psig, therefore the use of plastic CPVC and PVC pipe on grade was considered appropriate, and thus more cost-effective than burying the plastic pipe.

Steel pipe will be used at the blower station to provide for cost-effective and efficient joining of metal blower discharge pipe, valves, fittings, flowmeters, and pressure gauges.

Plastic pipe will be used for the majority of the distribution pipe length due to its lower unit cost. CPVC has a maximum rated temperature of 210 °F, and PVC pipe has a maximum rated temperature of 140 °F.

The steel pipe will transition to CPVC pipe just outside of the blower station fence. CPVC pipe will be used for the distance of pipe necessary to dissipate the flowing air temperature from 165 °F maximum to 140 °F. From that point, PVC pipe will be used to convey air to the biovent wells.

Biovent Wells: Biovent wells were located to provide areal influence for the contaminated areas. The North Area has a pit in the middle of the area. The sides slope downward to a maximum depth of approximately 6 feet. To avoid the expense of backfilling the pit to provide a level surface for a drill rig to install a well in the middle of the pit, biovent wells were placed at the periphery of the pit and will supply air to the soil beneath the pit.

The biovent wells can be operated simultaneously with equal flow rates, simultaneously with unequal flow rates, or selectively operated to induce varying subsurface air flow patterns.

Each biovent well will be screened from 9 ft bgs to 21 ft bgs. The biovent wells will be constructed of 4-inch diameter, schedule 40 CPVC pipe and screen placed inside a 10-inch diameter borehole. The filter pack material will have a 8-12 or 10-20 gradation. The wells will be sealed with a minimum 6 ft length of bentonite pellets to prevent short-circuiting (escape) of the injected air via the well annulus. The well will be secured with 2-foot length of concrete/bentonite mixture at the top.

A number of existing wells at the North Area will be plugged and abandoned because they are within the zone of influence of the new biovent wells and they may allow for short-circuiting of the pressurized subsurface air via the annulus. The wells to be abandoned are not suitable to function as air injection wells and they are not located to optimize the area of influence.

Air Flow Rate Adjustment: The air flow rate to each biovent well will be adjusted in the field. The first point of air flow adjustment will be at the blower. The total system air flow rate and pressure will be adjusted by changing the blower and/or electric motor sheaves. The maximum discharge pressure will be set by manually adjusting the pressure relief valve located at the discharge of the blower. A butterfly valve will be located at the blower discharge as a means of inducing friction loss, if needed, though it is anticipated that this valve will be normally fully open.

The second point of air flow adjustment will be at the pipe manifold. The air flow rate for each main distribution pipe (North Area, South Area, and East Area) will be set by adjusting the butterfly valve on each main distribution pipe to achieve the proportionate flow rate to each area. One air flowmeter and pressure gauge will be installed on each of the three main distribution pipes at the pipe manifold at the blower station.

The third point of air flow adjustment will be at the individual biovent wells. A vane type flowmeter and a pressure gauge will be installed on each biovent well. The globe valve on each well head will be adjusted to achieve the desired air flow rate and back pressure.

Electrical Power: The anticipated life of the project will be two years. Based on a two year life, it is more cost effective to install a power drop than to purchase or lease, operate and maintain a diesel electric generator.

The power requirements will be met by running a transmission line from the 13.2 kV line that exists in proximity to the site. A step-down transformer will be installed and supply a minimum electrical capacity of 30 kVA. A 480Y/277 drop line will be provided from the power/light pole to be installed next to the blower station.

A fusible safety switch with lightning arrestor will serve to disconnect incoming 480 V ac power to the site. A utility meter will be installed, prior to the safety switch, if requested by the client. A mini-power center and combination NEMA size 2 motor starter will serve to provide electrical power to the blower motor, a Ground Fault Circuit Interrupting receptacle, and site lighting.

Instrumentation and Controls: The blower system will have controls that monitor the inlet filter differential pressure, blower discharge pressure, and blower discharge air temperature. The blower system will require a manual restart, if it is disengaged by a high-inlet filter differential pressure or a low discharge pressure. The blower system will restart automatically (after a preset time delay) if it is disengaged by a high-discharge temperature.

The blower will have a "BLOWER RUN" and "BLOWER STOP" indicator lights and a "RUN" beacon for visual indication of the blower's operating status.

The side of the discharge silencer will be tapped and connected to a nipple with a tee fitting. A manually adjustable pressure relief valve will be installed at one end of the tee fitting. It will

open when the preset pressure is reached. A manually adjustable low pressure switch will be installed at the other side of the tee fitting. It will disengage the blower when a preset low discharge pressure is sensed.

The inlet air filter will have a pressure differential switch which will stop the blower when the filter's high differential pressure indicates that the filter is beginning to foul. Pitot tubes or equivalent in-line pressure transmitting devices will be mounted in the inlet air stream across the in-line filter.

A temperature switch, located just downstream of the blower discharge, will stop the blower when a preset high temperature is sensed. This is needed to prevent injecting air with temperatures greater than 165 °F into the subsurface. A manually adjustable time delay will restart the blower.

The blower motor will be fitted with a run time indicator. Run time information will be used to schedule and perform maintenance activities such as adding or changing inlet air filters, lubricating oil, bearing grease, and drive belts, and to document actual run time.

Monitoring Wells: At the North area, existing well IW-02 will be used for monitoring. The well is located far enough away from the biovent wells such that it is anticipated that it will not be subjected to high positive injection air pressure and not provide a substantive short-circuit for the injected air. Well IW-02 is screened in two intervals: 5 to 11 ft bgs and 15 to 22 bgs. The well schematic indicates that the two screened intervals are isolated from each other.

Two new PVC monitoring wells with metal protective enclosures with hinged lockable cap will be installed within the South Area plume. The metal enclosure will protect the PVC plastic well from degradation from sunlight exposure. One well will be screened from 6 to 11 ft bgs and the other well will be screened from 16 to 21 ft bgs. Both wells will be located close together (5 ft apart) so that monitoring data will be obtained from essentially the same areal location.

Two new PVC monitoring wells with metal protective enclosures with hinged lockable cap will be installed within the East Area plume. One well will be screened from 6 to 11 ft bgs and the other well will be screened from 16 to 21 ft bgs. Both wells will be located close together (5 ft apart) so that monitoring data will be obtained from essentially the same areal location.

Bioremediation System Performance Monitoring: The performance of the bioventing system will be monitored during operations to verify continuing bioremediation of the subsurface contamination and optimal operating conditions. An operation manual will be developed for the project prior to start-up of the equipment that will include detailed procedures and schedules for system performance monitoring and tracking.

Initially pressures and flow rates throughout the biovent well system will be monitored to document adequate well coverage. As air flow is initiated and the biovent wells are sequentially activated, pressures in the remaining biovent wells will be observed and recorded. In addition,

after all of the biovent wells are operational, pressures and airflow rates will be observed and recorded for each biovent well.

Progress of remediation will be tracked by turning off the air flow to each area on a monthly basis and recording the rate of oxygen consumption (decline). This test will be conducted in accordance with standard bioventing respirometry testing protocols. Comparison of the monthly respirometry data will detect any problems, eventual achievement of cleanup goals, and document the remedial progress at each sites.

If determined to be absolutely necessary, nutrients (primarily nitrogen and phosphorus) may be added to the sites to facilitate bacterial growth. Nutrients may be added via surface liquid application or gaseous subsurface injection using the blower.

After a year of operation, subsurface soil test samples will be collected from each site to document in-situ remediation progress and assess continued operational requirements. If bioventing continues beyond the first year, sampling will probably be conducted on a quarterly or six month cycle until it can be confirmed that cleanup goals have been achieved.



4-5 Air Permeability Test for FT31-IW01-D Pressure vs Distance Graph



4-6 Air Permeability Test for FT31-IWO1-D Estimation of ROI

APPENDIX F

QUALITY ASSURANCE OBJECTIVES

					Soil/	Soli	Soil/
		Water	Water	Water	sediment	sediment	sediment
Test Method	Analyte	MDL	RL	Units	MDL	RL	Units
365.3 (Total Phosphorus)	Phosphorus	0.01	0.01	mg/L			
376.1 (Sulfide)	Sulfide		0.2	mg/L			
376.2 (Sulfide)	Sulfide	0.04	0.04	mg/L			
405.1 (Biochemical Oxygen Demand (BOD))	Biochemical Oxygen Demand		5	mg/L			
410.4 (Chemical Oxygen Demand, manual colorimetric)	Chemical Oxygen Demand		10	mg/L			
413.1 (Total Recoverable Oil & Grease, gravimetric)	Oil and Grease		5	mg/L			
413.2 (Total Recoverable Oil & Grease, infrared)	Oil and Grease	0.8	1	mg/L		20	mg/kg DB
415.2 (Total Organic Carbon, UV, persulfate oxidation)	Total Organic Carbon	0.3	1	mg/L			
418.1 (Total Recoverable Petroleum Hydrocarbons)	TPH-418.1	0.2	0.5	mg/L	5	20	mg/kg DB
420.1 (Phenolics, total recoverable, automated 4AAP)	Phenolics, Total Recoverable	0.001	0.005	mg/L			
425.1 (Methylene Blue Active Substances (MBAS))	Methylene Blue Active Substances		0.02	mg/L			
504 (EDB & DBCP by Microextraction and GC)	1,2-Dibromo-3-chloropropane	0.01	0.05	ug/L			
504 (EDB & DBCP by Microextraction and GC)	1,2-Dibromoethane	0.01	0.05	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	4,4'-DDD	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	4,4'-DDE	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	4,4'-DDT	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Alachlor	0.004	0.02	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Aldrin	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	alpha-Chiordane	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Atrazine	0.046	0.23	ug/L_			
508 (Chlorinated Pesticides by GC with ECD)	Dieldrin	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Endrin	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	gamma-BHC (Lindane)	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	gamma-Chlordane	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Heptachlor	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Heptachlor Epoxide	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Hexachlorobenzene	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Hexachlorocyclopentadiene	0.001	0.005	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Methoxychlor	0.002	0.01	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Propachlor	0.02	0.1	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Simazine	0.12	0.62	ug/L			
508 (Chlorinated Pesticides by GC with ECD)	Trifluralin	0.002	0.01	ug/L			
524.2 (Volatile Organics by GC/MS, rev. 4.0, 8/92)	1,1,1,2-Tetrachloroethane	0.17	0.17	ug/L	ļ		
524.2 (Volatile Organics by GC/MS, rev. 4.0, 8/92)	1,1,1-Trichloroethane	0.08	0.08	ug/L			1

					Soil/	Soll	Soil/
		Water	Water	Water	sediment	sediment	sediment
Test Method	Analyte	MDL	RL	Units	MDL	RL	Units
7090 (Beryllium by flame atomic absorption)	Beryllium		2	ug/L		2	mg/kg DB
7130 (Cadmium by flame atomic absorption)	Cadmium		2	ug/L		2	mg/kg DB
7140 (Calcium by flame atomic absorption)	Calcium		1000	ug/L		100	mg/kg DB
7190 (Chromium by flame atomic absorption)	Chromium		5	ug/L		5	mg/kg DB
7195 (Hexavalent Chromium by Coprecipitation)	Chromium (hexavalent)			ug/L			mg/kg DB
7196A (Hexavalent Chromium, Colorimetric)	Chromium			ug/L		0.1	mg/kg DB
7196A (Hexavalent Chromium, Colorimetric)	Chromium (hexavalent)		5	ug/L			mg/kg DB
7197 (Hexavalent Chromium by Chelation Extraction)	Chromium (hexavalent)			ug/L		0.1	mg/kg DB
7200 (Cobalt by flame atomic absorption)	Cobalt		10	ug/L		10	mg/kg DB
7210 (Copper by flame atomic absorption)	Copper		2	ug/L		2	mg/kg DB
7380 (Iron by flame atomic absorption)	Iron		10	ug/L		50	mg/kg DB
7420 (Lead by flame atomic absorption)	Lead		10	ug/L		10	mg/kg DB
7421 (Lead by graphite furnace atomic absorption)	Lead	0.74	0.74	ug/L	0.8	4	mg/kg DB
7450 (Magnesium by flame atomic absorption)	Magnesium		100	ug/L		10	mg/kg DB
7460 (Manganese by flame atomic absorption)	Manganese		2	ug/L		2	mg/kg DB
7470A (Mercury in liquids)	Mercury	0.1	0.2	ug/L			
7471A (Mercury in solids and semisolids)	Mercury				0.02	0.1	mg/kg DB
7480 (Molybdenum by flame atomic absorption)	Molybdenum		10	ug/L		10	mg/kg DB
7520 (Nickel by flame atomic absorption)	Nickel		10	ug/L		10	mg/kg DB
7610 (Potassium by flame atomic absorption)	Potassium		100	ug/L		10	mg/kg DB
7740 (Selenium by graphite furnace atomic absorption)	Selenium	1.6	5	ug/L	0.2	1	mg/kg DB
7741A (Selenium by gaseous hydride atomic absorption)	Selenium	1.8	5	ug/L	0.28	0.5	mg/kg DB
7760A (Silver by flame atomic absorption)	Silver		2	ug/L		2	mg/kg DB
7761 (Silver by graphite furnace atomic absorption)	Silver			ug/L			mg/kg DB
7770 (Sodium by flame atomic absorption)	Sodium		1000	ug/L		100	mg/kg DB
7841 (Thallium by graphite furnace atomic absorption)	Thallium	1.1	5.5	ug/L	0.14	0.7	mg/kg DB
7870 (Tin by flame atomic absorption)	Tin	0.08	0.4	ug/L		10	mg/kg DB
7910 (Vanadium by flame atomic absorption)	Vanadium	190	200	ug/L		100	mg/kg DB
7950 (Zinc by flame atomic absorption)	Zinc		2	ug/L		2	mg/kg DB
8010B (Halogenated Volatile Organics by GC)	1,1,1,2-Tetrachloroethane	0.07	0.35	ug/L	0.14	0.7	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,1,1-Trichloroethane	0.08	0.4	ug/L	0.16	0.8	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,1,2,2-Tetrachloroethane	0.19	0,95	ug/L	0.38	1.9	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,1,2-Trichloroethane	0.05	0.25	ug/L	0.1	0.5	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,1-Dichloroethane	0.04	0.2	ug/L	0.08	0.4	ug/kg DB

					Soil/	Soll	Soil/
		Water	Water	Water	sediment	sediment	sediment
Test Method	Analyte	MDL	RL	Units	MDL	RL	Units
8010B (Halogenated Volatile Organics by GC)	1,1-Dichloroethene	0.08	0.4	ug/L	0.16	0.8	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,2,3-Trichloropropane	0.22	1.1	ug/L	0.44	2.2	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,2-Dichlorobenzene	0.12	0.6	ug/L	0.24	1.2	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,2-Dichloroethane	0.09	0.45	ug/L	0.18	0.9	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,2-Dichloropropane	0.05	0.25	ug/L	0.1	0.5	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,3-Dichlorobenzene	0.08	0.4	ug/L	0.16	0.8	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	1,4-Dichlorobenzene	0.06	0.3	ug/L	0.14	0.7	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	2-Chloroethyl vinyl ether	1.4	14	ug/L	2.8	14	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Benzyl chloride	0.2	1	ug/L	0.4	2	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Bromobenzene	0.35	1.7	ug/L	0.7	3.5	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Bromodichloromethane	0.03	0.15	ug/L	0.06	0.3	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Bromoform	0.08	0.4	ug/L	0.16	0.8	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Bromomethane	0.06	0.3	ug/L	0.12	0.6	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Carbon tetrachloride	0.06	0.3	ug/L	0.12	0.6	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Chlorobenzene	0.1	0.5	ug/L	0.22	1.1	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Chloroethane	0.07	0.35	ug/L	0.14	0.7	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Chloroform	0.19	0.95	ug/L	0.38	1.9	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Chloromethane	0.07	0.35	ug/L	0.14	0.7	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	cis-1,2-Dichloroethene	0.06	0.3	ug/L	0.12	0.6	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	cis-1,3-Dichloropropene	0.03	0.15	ug/L	0.06	0.3	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Dibromochloromethane	0.08	0.4	ug/L	0.16	0.8	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Dibromomethane	0.03	0.15	ug/L	0.06	0.3	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Dichlorodifluoromethane	0.09	0.45	ug/L	0.18	0.9	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Dichloromethane	4.2	4.2	ug/L	8.4	8.4	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Tetrachloroethene	0.1	0.5	ug/L	0.2	1	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	trans-1,2-Dichloroethene	0.07	0.35	ug/L	0.14	0.7	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	trans-1,3-Dichloropropene	0.03	0.15	ug/L	0.06	0.3	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Trichloroethene	0.12	0.6	ug/L	0.1	0.5	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Trichlorofluoromethane	0.09	0.45	ug/L	0.18	0.9	ug/kg DB
8010B (Halogenated Volatile Organics by GC)	Vinyl chloride	0.08	0.4	ug/L	0.16	0.8	ug/kg DB
8020A (Aromatic Volatile Organics by GC)	1,2-Dichlorobenzene	0.18	0.9	ug/L	0.36	1.8	ug/kg DB
8020A (Aromatic Volatile Organics by GC)	1,3-Dichlorobenzene	0.12	0.6	ug/L	0.24	1.2	ug/kg DB
8020A (Aromatic Volatile Organics by GC)	1,4-Dichlorobenzene	0.12	0.6	ug/L_	0.24	1.2	ug/kg DB
8020A (Aromatic Volatile Organics by GC)	Benzene	0.09	0.45	ug/L	0.18	0.9	ug/kg DB

					Soil/	Soil	Soil/
		Water	Water	Water	sediment	sediment	sediment
Test Method	Analyte	MDL	RL	Units	MDL	RL	Units
8240A (Volatile Organics by GC/MS)	Vinyl chloride	0.5	3	ug/L	1	3	ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1,1,2-Tetrachloroethane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1,1-Trichloroethane	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1,2,2-Tetrachloroethane	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1,2-Trichloroethane	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1-Dichloroethane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1-Dichloroethene	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,1-Dichloropropene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2,3-Trichlorobenzene	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2,3-Trichloropropane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2,4-Trichlorobenzene	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2,4-Trimethylbenzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2-Dibromo-3-chloropropane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2-Dibromoethane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2-Dichlorobenzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2-Dichloroethane	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,2-Dichloropropane	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,3,5-Trimethylbenzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,3-Dichlorobenzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,3-Dichloropropane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	1,4-Dichlorobenzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	2,2-Dichloropropane	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	2-Butanone	1.2	1.2	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	2-Chloroethyl vinyl ether	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	2-Chlorotoluene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	2-Hexanone	0.8	1	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	4-Chlorotoluene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	4-Methyl-2-pentanone	0.6	1	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	Acetone	1.7	1.7	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	Allyl chloride	0.2	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	Benzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	Bromobenzene	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	Bromochloromethane	0.1	0.5	ug/L			ug/kg DB
8260A (Volatile Organics by GC/MS)	Bromodichloromethane	0.1	0.5	ug/L			ug/kg DB

					RPD
Matrix	Method number	Test	LCL	UCL	Limit
SOIL	8010	trans-1,3-Dichloropropene	70	130	50
SOIL	8010	Trichloroethene	70	130	50
SOIL	8010	Trichlorofluoromethane	70	130	50
SOIL	8010	Vinyl Chloride	70	130	50
WATER	8015	Acetonitrile	57	126	20
WATER	8015	Isobutyl Alcohol	63	130	18
WATER	8015	Propionitrile	73	124	13
SOIL	8020	Benzene	42	25	132
SOIL	8020	Ethylbenzene	38	20	120
SOIL	8020	m+p-Xylene	50	20	131
SOIL	8020	o-Xylene	33	21	121
SOIL	8020	Toluene	33	20	136
WATER	8020	1,2-Dichlorobenzene	76	115	10
WATER	8020	1,3-Dichlorobenzene	77	111	10
WATER	8020	1,4-Dichlorobenzene	72	113	10
WATER	8020	Benzene	79	110	10
WATER	8020	Chlorobenzene	83	110	10
WATER	8020	Ethylbenzene	78	109	10
WATER	8020	m+p-Xylene	76	109	10
WATER	8020	o-Xylene	77	111	10
WATER	8020	Toluene	73	111	10
OIL	8080	Aroclor 1242	73	147	50
OIL	8080	Aroclor 1254	20	160	50
OIL	8080	Aroclor 1260	61	141	17
SOIL	8080	4,4'-DDT	20	160	50
SOIL	8080	Aldrin	20	138	39
SOIL	8080	Aroclor 1242	20	160	50
SOIL	8080	Aroclor 1248	20	160	50
SOIL	8080	Aroclor 1254	20	160	50
SOIL	8080	Aroclor 1260	20	160	50
SOIL	8080	Chlorpyrifos	20	160	50
SOIL	8080	Dieldrin	32	146	44
SOIL	8080	Endrin	27	155	40

Matrix Method number Test LCL UCL Limit WATER 8150 Dicamba 20 160 50 WATER 8150 Dicoseb 20 160 50 WATER 8150 MCPA 20 160 50 WATER 8150 MCPA 20 160 50 WATER 8150 MCPP 20 160 50 SOIL 8260 1,1-Dichlorophenol 26 160 50 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Trichloroethene 70 130 20 WATER 8260<						RPD
WATER 8150 Dicamba 20 160 50 WATER 8150 Dinoseb 20 160 50 WATER 8150 MCPA 20 160 50 WATER 8150 MCPP 20 160 50 WATER 8150 Pentachlorophenol 26 160 50 SOIL 8260 1,1-Dichloroethene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Trichloroethene 70 130 20 WATER 8260 Trichlorobenzene 40 121 30 20 S0IL	Matrix	Method number	Test	LCL	UCL	Limit
WATER B150 Dinoseb 20 160 50 WATER B150 MCPA 20 160 50 WATER B150 MCPA 20 160 50 WATER B150 Pentachlorophenol 26 160 50 SOIL 8260 1,1-Dichloroethene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Toluene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Toluoneenzene 70 130 20 SOIL 8270 1	WATER	8150	Dicamba	20	160	50
WATER 8150 MCPA 20 160 50 WATER 8150 MCPP 20 160 50 WATER 8150 Pentachlorophenol 26 160 50 SOIL 8260 1,1-Dichlorophenol 26 160 50 SOIL 8260 Benzene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 34 107 36 SOIL	WATER	8150	Dinoseb	20	160	50
WATER 8150 MCPP 20 160 50 WATER 8150 Pentachlorophenol 26 160 50 SOIL 8260 1,1-Dichloroethene 70 130 20 SOIL 8260 Benzene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Thichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Toluene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL	WATER	8150	MCPA	20	160	50
WATER 8150 Pentachlorophenol 26 160 50 SOIL 8260 1,1-Dichloroethene 70 130 20 SOIL 8260 Benzene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichlorobenzene 70 130 20 WATER 8260 Trichlorobenzene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30	WATER	8150	MCPP	20	160	50
SOIL 8260 1,1-Dichloroethene 70 130 20 SOIL 8260 Benzene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL	WATER	8150	Pentachlorophenol	26	160	50
SOIL 8260 Benzene 70 130 20 SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 4-Chloro-3-methylphenol 55 120 22	SOIL	8260	1,1-Dichloroethene	70	130	20
SOIL 8260 Chlorobenzene 70 130 20 SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichlorobenzene 40 121 30 20 SOIL 8270 1,2,4-Trichlorobenzene 34 107 36 SOIL 8270 2,4-Dinitrotolene 32 127 25 SOIL 8270 4-Chloro-3-methylphenol 55 120 22	SOIL	8260	Benzene	70	130	20
SOIL 8260 Toluene 70 130 20 SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Trichloroethene 70 130 20 WATER 8260 Trichloroethene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Nitrophenol 23 143 37 <t< td=""><td>SOIL</td><td>8260</td><td>Chlorobenzene</td><td>70</td><td>130</td><td>20</td></t<>	SOIL	8260	Chlorobenzene	70	130	20
SOIL 8260 Trichloroethene 70 130 20 WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichlorobenzene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 4-Chloro-3-methylphenol 40 106 30 SOIL 8270 Acenaphthene 41 122 42	SOIL	8260	Toluene	70	130	20
WATER 8260 1,1-Dichloroethene 70 130 20 WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichlorobenzene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 Acenaphthene 41 122 42 <td>SOIL</td> <td>8260</td> <td>Trichloroethene</td> <td>70</td> <td>130</td> <td>20</td>	SOIL	8260	Trichloroethene	70	130	20
WATER 8260 Benzene 70 130 20 WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43	WATER	8260	1,1-Dichloroethene	70	130	20
WATER 8260 Chlorobenzene 70 130 20 WATER 8260 Toluene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 <	WATER	8260	Benzene	70	130	20
WATER 8260 Toluene 70 130 20 WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 1,4-Dichlorobenzene 34 107 36 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pyrene 25 141 50	WATER	8260	Chlorobenzene	70	130	20
WATER 8260 Trichloroethene 70 130 20 SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 1,4-Dichlorobenzene 34 107 36 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Phenol 41 109 28 SOIL 8270 1,2,4-Trichlorobenzene 45 105 20 </td <td>WATER</td> <td>8260</td> <td>Toluene</td> <td>70</td> <td>130</td> <td>20</td>	WATER	8260	Toluene	70	130	20
SOIL 8270 1,2,4-Trichlorobenzene 40 121 30 SOIL 8270 1,4-Dichlorobenzene 34 107 36 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14	WATER	8260	Trichloroethene	70	130	20
SOIL 8270 1,4-Dichlorobenzene 34 107 36 SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14<	SOIL	8270	1,2,4-Trichlorobenzene	40	121	30
SOIL 8270 2,4-Dinitrotoluene 32 127 25 SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14	SOIL	8270	1,4-Dichlorobenzene	34	107	36
SOIL 8270 2-Chlorophenol 40 106 30 SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23 <	SOIL	8270	2,4-Dinitrotoluene	32	127	25
SOIL 8270 4-Chloro-3-methylphenol 55 120 22 SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2,Chlorophenol 45 108 23	SOIL	8270	2-Chlorophenol	40	106	30
SOIL 8270 4-Nitrophenol 23 143 37 SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	4-Chloro-3-methylphenol	55	120	22
SOIL 8270 Acenaphthene 41 122 42 SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	4-Nitrophenol	23	143	37
SOIL 8270 N-Nitroso-di-n-propylamine 48 118 28 SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	Acenaphthene	41	122	42
SOIL 8270 Pentachlorophenol 20 159 43 SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	N-Nitroso-di-n-propylamine	48	118	28
SOIL 8270 Phenol 41 109 28 SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	Pentachlorophenol	20	159	43
SOIL 8270 Pyrene 25 141 50 WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	Phenol	41	109	28
WATER 8270 1,2,4-Trichlorobenzene 45 105 20 WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	SOIL	8270	Pyrene	25	141	50
WATER 8270 1,4-Dichlorobenzene 43 101 26 WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	WATER	8270	1,2,4-Trichlorobenzene	45	105	20
WATER 8270 2,4-Dinitrotoluene 62 115 14 WATER 8270 2-Chlorophenol 45 108 23	WATER	8270	1,4-Dichlorobenzene	43	101	26
WATER 8270 2-Chlorophenol 45 108 23	WATER	8270	2,4-Dinitrotoluene	62	115	14
	WATER	8270	2-Chlorophenol	45	108	23
WATER 8270 4-Chloro-3-methylphenol 54 111 20	WATER	8270	4-Chloro-3-methylphenol	54	111	20
WATER 8270 4-Nitrophenol 20 144 21	WATER	8270	4-Nitrophenol	20	144	21
WATER 8270 Acenaphthene 50 108 17	WATER	8270	Acenaphthene	50	108	17

					RPD
Matrix	Method number	Test	LCL	UCL	Limit
SOIL	210.1/7090	Beryllium	50	150	30
WATER	210.1/7090	Beryllium	74	118	17
SOIL	213.1/7130	Cadmium	60	117	22
WATER	213.1/7130	Cadmium	72	117	10
SOIL	218.2/7191	Chromium	50	142	24
WATER	218.2/7191	Chromium	65	118	16
SOIL	219.1/7200	Cobalt	50	150	30
WATER	219.1/7200	Cobalt	72	119	11
SOIL	220.1/7210	Copper	52	129	30
WATER	220.1/7210	Copper	61	121	22
SOIL	236.1/7380	Iron	50	150	30
WATER	236.1/7380	Iron	50	138	30
SOIL	239.1/7420	Lead	56	107	27
WATER	239.1/7420	Lead	74	116	10
SOIL	239.2/7421	Lead	56	107	27
WATER	239.2/7421	Lead	74	129	11
SOIL	243.1/7460	Manganese	50	150	30
WATER	243.1/7460	Manganese	65	120	28
WATER	245.1/7470	Mercury	85	118	11
SOIL	249.1/7520	Nickel	58	124	18
WATER	249.1/7520	Nickel	66	117	10
SOIL	270.2/7740	Selenium	50	150	30
WATER	270.2/7740	Selenium	55	147	19
SOIL	270.3/7741	Selenium	50	148	30
WATER	270.3/7741	Selenium	69	129	19
SOIL	272.1/7760	Silver	50	150	30
WATER	272.1/7760	Silver	70	109	12
SOIL	279.2/7841	Thallium	50	113	26
WATER	279.2/7841	Thallium	50	128	24
SOIL	286.1/7910	Vanadium	50	150	30
WATER	286.1/7910	Vanadium	50	150	30
SOIL	289.1/7950	Zinc	50	150	30
WATER	289.1/7950	Zinc	60	121	26

					RPD
Matrix	Method number	Test	LCL	UCL	Limit
WATER	CLP-PEST	Gamma-BHC (Lindane)	56	123	15
WATER	CLP-PEST	Heptachlor	40	131	20
WATER	FREE FATTY ACIDS/SOP	Acetic Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Butyric Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Caproic Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Formic Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Heptanoic Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Iso-Butyric Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	iso-Valeric Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Propionic Acid	20	160	50
WATER	FREE FATTY ACIDS/SOP	Valeric Acid	20	160	50
SOIL	ORGANOTINS	Dibutyltin dichloride	20	160	50
SOIL	ORGANOTINS	Monobutyitin trichloride	20	160	50
SOIL	ORGANOTINS	Tetrabutyltin	20	160	50
SOIL	ORGANOTINS	Tributyltin chloride	20	160	50
WATER	ORGANOTINS	Dibutyitin dichloride	20	160	50
WATER	ORGANOTINS	Monobutyltin trichloride	20	160	50
WATER	ORGANOTINS	Tetrabutyltin	20	160	50
WATER	ORGANOTINS	Tributyltin chloride	20	160	50
SOIL	PSEP_S2	Sulfide	50	150	30
WATER	SM 4500-CI G	Chlorine (SM 4500-CI G)	50	150	30
SOIL	TPH-413.1	TPH Oil and Grease (grav.)	51	122	26
WATER	TPH-413.1	TPH Oil and Grease (grav.)	71	119	15
SOIL	TPH-418.1	TPH Oil and Grease (IR)	51	122	26
WATER	TPH-418.1	TPH Oil and Grease (IR)	71	119	15

Appendix TECH-C-6 Data Quality Objectives Blank spike control limits

Matrix	Method	Analyte	LCL	UCL
WATER	8010	Chioroform	78	119
WATER	8010	Chloromethane	81	118
WATER	8010	cis-1,2-Dichloroethene	70	130
WATER	8010	cis-1,3-Dichloropropene	78	119
WATER	8010	Ethyi benzene	76	118
WATER	8010	m,p-xylene	76	127
WATER	8010	Methylene Chloride	52	139
WATER	8010	o-xylene	77	118
WATER	8010	Tetrachloroethene	91	111
WATER	8010	Toluene	76	125
WATER	8010	trans-1,2-Dichloroethene	84	119
WATER	8010	trans-1,3-Dichloropropene	83	115
WATER	8010	Trichloroethene	71	120
WATER	8010	Trichlorofluoromethane	74	143
WATER	8010	Vinyl Chloride	78	126
SOIL	8015	Cyclohexanone	20	160
SOIL	8015	EGMPE	20	160
SOIL	8020	1,2-Dichlorobenzene	70	130
SOIL	8020	1,3-Dichlorobenzene	70	130
SOIL	8020	1,4-Dichlorobenzene	70	130
SOIL	8020	Benzene	59	116
SOIL	8020	Benzene	75	125
SOIL	8020	Chlorobenzene	70	130
SOIL	8020	Ethylbenzene	35	144
SOIL	8020	Ethylbenzene	75	125
SOIL	8020	m+p-Xylene	37	128
SOIL	8020	o-Xylene	48	124
SOIL	8020	Toluene	54	122
SOIL	8020	Toluene	75	125
SOIL	8020	Total Xylenes	75	125
MATERIAL	8080	Aroclor 1242	20	160
MATERIAL	8080	Aroclor 1254	20	160
MATERIAL	8080	Aroclor 1260	20	160
OIL	8080	Aroclor 1242	73	147
OIL	8080	Aroclor 1254	20	160
OIL	8080	Aroclor 1260	61	141
SOIL	8080	4,4'-DDT	20	160
SOIL	8080	Aldrin	20	138
SOIL	8080	Aroclor 1242	20	160
SOIL	8080	Aroclor 1248	20	160
SOIL	8080	Aroclor 1254	20	160
SOIL	8080	Arocior 1260	20	160
SOIL	8080	Chlorpyrifos	20	160
SOIL	8080	Dieldrin	32	146
SOIL	8080	Endrin	27	155
SOIL	8080	Gamma-BHC (Lindane)	20	128
SOIL	8080	Heptachlor	20	131
SOIL	8080	Technical Chlordane	20	160

Appendix TECH-C-6 Data Quality Objectives Blank spike control limits

Matrix	Method	Analyte	LCL	UCL
SOIL	200.8/6020	Cadmium	60	138
SOIL	200.8/6020	Calcium	50	150
SOIL	200.8/6020	Chromium	60	134
SOIL	200.8/6020	Cobalt	85	113
SOIL	200.8/6020	Copper	50	150
SOIL	200.8/6020	Gold	50	150
SOIL	200.8/6020	Iron	50	150
SOIL	200.8/6020	Lead	50	148
SOIL	200.8/6020	Magnesium	50	150
SOIL	200.8/6020	Manganese	50	150
SOIL	200.8/6020	Mercury	56	110
SOIL	200.8/6020	Molybdenum	50	150
SOIL	200.8/6020	Nickel	69	124
SOIL	200.8/6020	Phosphorus	50	150
SOIL	200.8/6020	Platinum	50	150
SOIL	200.8/6020	Potassium	50	150
SOIL	200.8/6020	Selenium	67	129
SOIL	200.8/6020	Silicon	50	150
SOIL	200.8/6020	Silver	58	132
SOIL	200.8/6020	Sodium	50	150
SOIL	200.8/6020	Strontium	50	150
SOIL	200.8/6020	Thallium	68	116
SOIL	200.8/6020	Tin	50	150
SOIL	200.8/6020	Titanium	50	150
SOIL	200.8/6020	Tungsten	50	150
SOIL	200.8/6020	Vanadium	68	125
SOIL	200.8/6020	Zinc	50	150
SOIL	202.1/7020	Aluminum	50	150
SOIL	204.2/7041	Antimony	50	120
SOIL	206.2/7060	Arsenic	59	142
SOIL	206.3/7061	Arsenic	6 0	128
SOIL	208.1/7080	Barium	50	150
SOIL	210.1/7090	Beryllium	50	150
SOIL	213.1/7130	Cadmium	6 0	117
SOIL	213.2/7131	Cadmium	60	117
SOIL	218.1/7190	Chromium	50	142
SOIL	218.2/7191	Chromium	50	142
SOIL	219.1/7200	Cobalt	50	150
SOIL	220.1/7210	Copper	52	129
SOIL	236.1/7380	Iron	50	150
SOIL	239.1/7420	Lead	56	107
SOIL	239.2/7421	Lead	56	107
SOIL	243.1/7460	Manganese	50	150
SOIL	249.1/7520	Nickel	58	124
SOIL	270.2/7740	Selenium	50	150
SOIL	270.3/7741	Selenium	50	148
SOIL	272.1/7760	Silver	50	150
SOIL	279.2/7841	Thallium	50	113

Appendix TECH-C-6 Data Quality Objectives Blank spike control limits

Matrix	Method	Analyte	LCL	UCL
SOIL	ORD-NAVY SOP	1,3-Dinitrobenzene	43	150
SOIL	ORD-NAVY SOP	1,3-Dinitrobenzene	43	150
SOIL	ORD-NAVY SOP	2,4,6-Trinitrotoluene	20	143
SOIL	ORD-NAVY SOP	2,4,6-Trinitrotoluene	20	143
SOIL	ORD-NAVY SOP	2,4-Dinitrotoluene	43	147
SOIL	ORD-NAVY SOP	2,4-Dinitrotoluene	43	147
SOIL	ORD-NAVY SOP	2,6-Dinitrotoluene	53	147
SOIL	ORD-NAVY SOP	2,6-Dinitrotoluene	53	147
SOIL	ORD-NAVY SOP	Nitrobenzene	35	144
SOIL	ORD-NAVY SOP	Nitrobenzene	35	144
SOIL	ORD-NAVY SOP	Nitroglycerine	20	160
SOIL	ORD-NAVY SOP	Otto Fuel	20	152
SOIL	ORD-NAVY SOP	Otto Fuel	20	152
SOIL	ORD-NAVY SOP	RDX	20	160
SOIL	ORD-NAVY SOP	RDX	20	160
SOIL	ORD-NAVY SOP	Tetryl	20	160
SOIL	ORD-NAVY SOP	Tetryi	20	160
SOIL	ORGANOTINS	Dibutyltin dichloride	20	160
SOIL	ORGANOTINS	Monobutyltin trichloride	20	160
SOIL	ORGANOTINS	Tetrabutyltin	20	160
SOIL	ORGANOTINS	Tributyltin chloride	20	160
SOIL	PSEP_S2	Sulfide	50	150
SOIL	TPH-418.1	TPH Oil and Grease	51	122

APPENDIX G

LAUCK'S LABORATORY INSTRUMENTATION MAINTENANCE AND CALIBRATION PROCEDURES

LAUCKS Testing Laboratories, Inc.

4. INSTRUMENTATION AND EQUIPMENT Revision 6

4.1. MAINTENANCE LOGS

- 4.1.1. All instruments have maintenance logs. These logbooks cover routine maintenance items which the operators perform on the schedules established in the manual or recommended by the manufacturer.
- 4.1.2. Maintenance intervals are daily, weekly, monthly, quarterly, semi-annually, or annually depending on the vendor's specifications, method recommendations, or laboratory requirements based on experience and instrument performance. Maintenance schedules which are routine must be documented in the maintenance logbook itself. Many maintenance tasks are undertaken based on instrument performance. These types of maintenance do not follow a strict schedule and are more likely to be affected by the types and quantity of samples which were analyzed on that particular instrument. Maintenance items which are routine are as follows:

Organics Instrumentation:

GC/MS - Semivolatiles	change injection port liner & septum	daily or as needed
	clip 5 - 10 cm from front of column	11
	ramp GC oven twice to 300°C	"
	vacuum computer's air filters	approximately annually
	clean source	as needed
GC/MS Volatiles	change pump oil	yearly
	clean and rinse transfer lines	as needed
	trim front end of column	n
	rinse 6-port valve	
	clean sample lines	"
	replace trap	"
	replace column	
	clean source	"

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	replace fittings	19
	change sample block on autosampler	"
	replace filaments	10
GC ECD	swab EC detectors for radioactivity	annually
	change O ₂ traps on gas lines	approx. semi-annually
	clean autosampler syringe	approximately monthly
	change injection port liner & septum	approx. every 100 injections
	bake system, flush injection port, clip guard column, change analytical column, etc.	as needed
	change carrier hydrocarbon trap	as needed
GC FID	replace septum, injection port liner, check / replace o-ring in injection port, cut pre-column and column as necessary, clean / check syringe, leak-check gas lines	after approximately 100 injections
	check / clean detector assembly	after ~200 injections
	replace pre-column and/or column	as necessary for acceptable response
	change carrier and make-up gas filters	as needed
GC/VOA	clean and rinse sample transfer lines	as needed
	trim front end of column	н
	rinse 6-port valve	11
	replace trap	"
	replace column	11
	clean or replace PID lamps	

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	replace fittings	н
	replace reaction vessels	11
	replace nickel tubes	**
	replace roughing and finishing resins	17
	replace electrolyte or bring to volume	n
	check for leaks	11
	check all gas flows	18
	clean cell	11
	replace electrolyte pump	18
	clean or replace transfer line from reaction vessel to cell	u
+PLC	change filter frit in mixer	as needed (when pressure builds)
	change column pre-filter	as needed (~2-3 months)
	rinse water pump with methanol	~ weekly
	change pump seals	as needed
Gel Permeation Chromatograph (GPC)	backflush	as needed (approximately semiannually)
	reverse or replace sample vial o- rings	as needed (approximately quarterly)
	lubricate pump	as needed (approximately semiannually)

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Inorganics Instrumentation:

TOC Analyzer	change pump tubing	each run
	change other tubing	as needed
	change furnace tubes	as needed (~2-3 months)
	change LiOH tube	as needed (~2-3 months)
	change tin trap	as needed (~monthly)
	change IR filter screen	check monthly; replace as needed (~annually)
	adjust optical balance	as needed (~3-6 months)
	change gas tubing	check monthly; replace as needed (~annually)
	change septum	as needed
	change permeation dryer tubing	as needed (~ semiannually)
TOX Analyzer	burette pumps	clean as needed
	pyrolysis tube	replace when devitrified
	agar bridge	replace as needed (~quarterly)
	disassemble & clean all electrodes & cell body	check each run; perform as needed
Dionex Ion Chromatograph	Replace pump seals	annually
	lubricate analytical pump motor	every 2 weeks
	check chromatography module and all gas lines for leaks	every run
	clean conductivity detector cell electrodes and check cell calibration	monthly
	Replace bed supports	as needed

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	clean columns	as needed
	clean AMMS (membrane suppresser)	as needed
	replace autosampler pipet tip	as needed
Lachat QuickChem AE Ion Analyzer	lubricate pump	semi-annually
	replace pump tubing	as needed (~1-2 months)
	change Cd column (NO ₃ /NO ₂)	as needed
Technicon AA1 autoanalyzer	replace pump tubing	as needed (~4-5 months)
PE 1600 FTIR	change desiccant	semiannually
Horiba OCMA 220	align optics	as needed
Enviro 36 ICP	Service Intercooler	annually
	Rinse & clean nebulizer cap and spray chamber	monthly or as needed
	clean torch, optimize instrument	bimonthly
	vacuum filters	bimonthly
	examine autosampler tubing & replace as needed	daily
	empty rinse container, fill rinse water reservoir	as needed
PE Lamda 4A UV/Visible Spectrophotometer	clean sample compartment and entrance windows	semiannually
	check wavelength calibration	annually
PE 5000 AA Spectrophotometer	clean burner head	monthly
	clean mixing chamber	monthly
	clean nebulizer	monthly
	clean entrance windows	monthly
	drain water trap	weekly

Quality Assurance Plan

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PE 3030 and 5100 Zeeman Graphite furnace AAs	replace capillary	annually
	change cones	as needed
	clean entrance windows	as needed
PE Elan 5000 ICP/MS	change pump oil	semiannually
	change air filters	semiannually
	change cones	as needed
	check sensitivity	daily
	check mass calibration	every 2 weeks
	clean torch	as needed
	replace injector	as needed
	replace nebulizer tips	as needed
	replace pump tubing	as needed
HACH 2100 Turbidimeter	clean and align optics	annually
YSI Model 32 Conductivity meter	clean conductivity cell	annually

4.1.3. The operator performing a specific maintenance task will detail any problems and corrective actions and initial/date the entry.

4.2. SERVICE ENGINEER CALLS

4.2.1. The telephone number to the appropriate service engineer will be readily available to the analysts. This number will be called as required to have service-related questions answered. If it has been determined that a visit by a service engineer is required, this should be approved by the Division Manager before the call is placed. All visits by service engineers, and actions taken, **must** be recorded in the maintenance manual, preferably enhanced by keeping a copy of the signed service order.

10. INSTRUMENT CALIBRATION PROCEDURES Revision 5

10.1. INTRODUCTION AND SCOPE

The purpose of the Quality Assurance/Quality Control (QA/QC) procedures outlined here is the definition of procedures for the evaluation and documentation of laboratory analytical work. The objective is to provide a uniform basis for the entire analytical process so that the data reported can be of known quality.

10.2. INSTRUMENT CALIBRATION

General Laboratory Instruments - The following section covers the calibration of general laboratory instruments.

10.2.1. Balances

- 10.2.1.1. Balances will be of a type appropriate for the accuracy of the weighing performed. Balances available include triple beam, double pan analytical, single pan analytical, and single pan top-loading.
- 10.2.1.2. The analytical balances will be used on a heavy table and the level checked and adjusted as necessary each time the balance is used.
- 10.2.1.3. Analytical balance calibration is checked daily with a secondary standard by the first person using the balance that day.
- 10.2.1.4. It is also checked weekly with class "S" weights spanning the range of the balance and/or the range of weights for which the balance is typically used.
- 10.2.1.5. Balances will be serviced annually by a qualified service engineer. The results of these checks are all recorded in the maintenance manual and with a certificate supplied by the service person.
- 10.2.2. pH/Selective Ion Meters
 - 10.2.2.1. The pH meter will be standardized daily at two pH levels (generally pH 4 and pH 7 or pH 7 and 10). This will be recorded in the maintenance manual. The buffers selected will bracket the values of any associated samples unless those values are less than pH 4 or greater than pH 10. Other buffers may be used as appropriate for

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the pH range of the samples being measured but this is not routine practice. The buffers used should be within 3 pH units of the samples.

- 10.2.2.2. pH meters at Laucks are generally equipped with a temperature correction probe. When using meters not so equipped, the temperature of samples must be allowed to come to that of the buffer solutions for accurate measurement.
- 10.2.2.3. The pH electrode will be inspected weekly and cleaned as required. See part 31 of ASTM for a complete cleaning procedure. Records of all inspections and cleaning will be maintained. The electrode(s) will be filled with the proper electrolyte solution when the level is inadequate. Such filling should be noted in the maintenance manual.
- 10.2.2.4. Specific ion electrodes will be inspected and cleaned as needed. Records of all inspections and cleaning will be maintained in the maintenance manual.
- 10.2.3. Turbidimeter
 - 10.2.3.1. The meter will be standardized with 1 reference solution per range.
 - 10.2.3.2. The samples will be diluted to be read within the working range.
 - 10.2.3.3. The reference solution cuvettes will be protected from scratches.
 - 10.2.3.4. Calibrating solutions will be checked against standards from an alternate source on a weekly basis in order to determine if standard deterioration is occurring. Disagreement between calibrating and reference solutions of 10% or more require initiation of corrective action. Due to the short holding time, analysis may not be able to be discontinued. If such occurs, differences of 20% or greater require remedial action of reanalyzing all samples analyzed under the out-of-control condition after the problem has been corrected. Final results should be reported after consultation with the QC Officer, Technical Director, or Division Manager.

10.2.4. Conductivity Meter

- 10.2.4.1. The meter will be standardized each day that it is used with ranges of KCI standard solution appropriate to the levels of the samples analyzed and the results of the standardization recorded in the maintenance manual. It is **critical** that the samples be at the same temperature as the KCI solution or the conductivity measurement will not be accurate.
- 10.2.4.2. The cell will be examined before each use to ensure that:
 - the platinized coating is intact;
 - plates are not coated with suspended matter;
 - plates are not bent; and
 - lead wires not frayed or shorting.
- 10.2.4.3. Records will be maintained of these checks and notation made of any corrections.
- 10.2.5. UV/Visible Spectrophotometers
 - 10.2.5.1. The Perkin Elmer Lambda 4A automatically aligns itself to an internal deuterium wavelength of 656.1 nm during an initialization process each time the power is turned on, at least once per day of use.
 - 10.2.5.2. At least once per calendar quarter, a graphic printout is made of the wavelength calibration and is dated and kept in a binder. When normalized, the energy output at that wavelength is the maximum of the y-axis. This value, along with the date of calibration is recorded in the maintenance manual and monitored for significant change.
 - 10.2.5.3. All absorption cells must be kept clean, free of scratches, fingerprints, smudges, and evaporated film residues.
- 10.2.6. Technicon I Autoanalyzer
 - 10.2.6.1. At least six calibration standards (including a zero standard) are analyzed at the beginning of each analytical run. The highest standard may be just out of the linear range of the instrument. If this is the case, this point may not be used as part of the calibration

curve, but rather to estimate high level samples for re-analysis at an appropriate dilution.

- 10.2.6.2. A reference material is analyzed as a calibration check. The reference material must be within the tabulated acceptance limits.
- 10.2.6.3. The reference material or a mid-range standard is analyzed after every ten samples.
- 10.2.6.4. A standard at the MDL is analyzed for all analytes. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.6.5. Documentation All strip chart recordings will be kept as a part of the permanent sample analysis record.
- 10.2.7. Lachat Quickchem AE Ion Analyzer
 - 10.2.7.1. At least six calibration standards (including a zero standard) are analyzed at the beginning of each analytical run.
 - 10.2.7.2. A reference material is analyzed as a calibration check. The reference material must be within the tabulated acceptance limits.
 - 10.2.7.3. The reference material or a mid-range standard is analyzed after every ten samples.
 - 10.2.7.4. A standard at the MDL is analyzed for all analytes. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
 - 10.2.7.5. All appropriate calibration printouts will be kept as a part of the permanent sample analysis record.
- 10.2.8. TOX Analyzer
 - 10.2.8.1. The manufacturers manual will be consulted for complete operating instructions.
 - 10.2.8.2. For water samples the Mitsubishi TOX 10 analyzer is used. 2,4,6-Trichlorophenol is employed as the calibration material. This

instrument will detect organic compounds containing bromine, chlorine, and iodine. It does not detect fluorine. The instrument requires no initial calibration since it is recalibrated each day of operation.

- 10.2.8.3. Linear Range Determination A linear range determination should be performed every six months and a summary retained by the QC Officer. A series of five standards (not including a blank) will be analyzed to determine the linear range. The lowest standard must be five to ten times the Instrument Detection Limit (IDL) and the highest at the expected maximum of the linear range or lower. The highest level standard must come within 10% of the true value for that level to be considered within the linear range. The correlation coefficient for the curve should be .995 or higher. No values are reported which are greater than a successful linear range standard.
- 10.2.8.4. The daily calibration of the TOX analyzer consists of a single point calibration standard. This standard is analyzed after every 10 samples and must be within 15% of true value.
- 10.2.8.5. A standard at the MDL is analyzed. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.8.6. Documentation The printer tapes are retained as a part of the data file.
- 10.2.9. TOC Analyzer
 - 10.2.9.1. The manufacturers manual will be consulted for complete operating instructions.
 - 10.2.9.2. The Dohrman TOC analyzer is used. This instrument employs acid potassium phthalate as the calibration material. The operator's manual for this instrument calls out injection volumes and standard concentrations for calibration. These guidelines are to be followed. The instrument is recalibrated each day of operation.
 - 10.2.9.3. Linear Range Determination A linear range determination should be performed every six months and a summary retained by the QC Officer. A series of five standards (not including a blank) will be analyzed to determine the linear range. The lowest standard must

be five to ten times the Instrument Detection Limit (IDL) and the highest at the expected maximum of the linear range or lower. The highest level standard must come within 10% of the true value for that level to be considered within the linear range. The correlation coefficient for the curve should be .995 or higher. No values are reported which are greater than a successful linear range standard.

10.2.9.4. To calibrate for the purgeable (volatile) organic carbon (POC) fraction a known solution of benzene in tetraglyme is analyzed using the POC analysis cycle. A factor is derived as follows:

POC factor =
$$\frac{C_{iheoretical}}{C_{measured}}$$

This factor is used to adjust all measured POC values to a "true" value.

- 10.2.9.5. Ongoing calibration A single standard is analyzed at the beginning of each analytical run.
- 10.2.9.6. A reference material is analyzed as a calibration check. If the result is outside the control limits provided, corrective action must be taken.
- 10.2.9.7. Non-purgeable organic carbon standards are analyzed after every 10 samples and must be within 15% of the true value.
- 10.2.9.8. A standard at the MDL is analyzed. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.9.9. Documentation The printer tapes are retained as a part of the data file.
- 10.2.10. Dionex 2000I Ion Chromatograph
 - 10.2.10.1. Specific operating procedures for the Dionex 2000I are presented in the Laucks SOP, LTL-0030. The manufacturers manual will be consulted for complete operating instructions.

- 10.2.10.2. Initial calibration of the Ion Chromatograph consists of the analysis of at least 3 standards plus a blank for every 24 hour period of operation. The correlation coefficient should not be less than 0.995.
- 10.2.10.3. A calibration check solution is analyzed following the standard curve and must meet the established acceptance criteria.
- 10.2.10.4. A standard at the MDL is analyzed. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.10.5. Continuing Calibration The mid-range standard is analyzed after every 10 samples and at the end of the analytical run. The response factor (RF) for any given analyte must be within 20% of the calibration curve and the concentration must be within 15% of the true value. A continuing calibration blank must also be analyzed at the same frequency and demonstrate no more than twice the detection limits for the analytes of concern.
- 10.2.10.6. Documentation All chromatograms, work sheets, and printouts are filed with the individual data package along with a copy of the run log and a QC review form.
- 10.2.11. Flame Atomic Absorption, PE 5000 AA
 - 10.2.11.1. The manufacturer's manual will be consulted for complete operating instructions. Sections 2 and 3 of this manual cover gases and other services.
 - 10.2.11.2. Hollow cathode and EDL lamps will be dated when received and when first put into service.
 - 10.2.11.3. A 3 point calibration plus a blank are analyzed at the beginning of an 8 hour QC period.
 - 10.2.11.4. Immediately following calibration a Lab Control Standard (LCS) is analyzed. The concentration values for the LCS must be either within the tabulated acceptance window or be within 15% of the stated true value, if no acceptance windows have been tabulated.
 - 10.2.11.5. During analysis the mid-range calibration standard is analyzed after every 10th sample. If the measured concentration differs from the

expected value by more than 10%, the instrument is recalibrated. The mid-point calibration standard is also analyzed at the end of the analytical run and must meet the same criteria or else the previous 10 samples are to be reanalyzed.

- 10.2.11.6. A standard at the MDL is analyzed for all analytes. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.11.7. Documentation All work sheets and printouts are required. Report forms summarizing calibration, calibration verification, and analysis of Laboratory Control Samples (LCSs) are to be provided upon request.
- 10.2.12. ICP Analysis
 - 10.2.12.1. The manufacturer's manual will be consulted for complete operating instructions. Sections 2 and 3 of this manual cover gases and other services. Greater detail of operating instructions and quality control are provided in the individual SOPs for SW 846 (6010), CLP, method 200.7, etc.
 - 10.2.12.2. Linear Range Determination On a quarterly basis, for all ICP metals, a linear range check standard is analyzed. The standard must be analyzed during a routine analytical run. The standard is of a concentration at the upper limit of the linear range and the measured concentration must be within 5% of the true value. All reported concentrations for sample target metals must be based on digestate concentrations within the determined linear range. Sample results cannot be reported where the concentrations in the digestates or their dilutions are above this high standard.
 - 10.2.12.3. Different protocols may be used for ICP calibration, depending upon the methods to be used. SW 846 criteria, for instance, call for a multi-point calibration in which measured concentration for the high level standard must be within 5% of the true value, while CLP protocols call for a single point calibration with a demonstrated linear range which exceeds that standard. In general, Laucks follows the methodology agreed upon at the time work is initiated. Since the CLP criteria are more specific in their requirements than is SW 846, Laucks often chooses to apply the CLP model where other methods

either do not address a specific topic or where they do not provide detailed requirements that contradict the CLP methodology.

10.2.12.4. The Calibration Model:

- Initial Calibration At the beginning of each 8 hour QC period the instrument will be calibrated using a zero standard (Initial Calibration Blank, ICB) and a single standard which is within the linear range. Typically this standard is 1 mg/L per analyte for environmental analyses. The absolute value of the ICB must be no greater than the reporting limit (the Contract Required Detection Limit, CRDL, for samples actually being analyzed under CLP guidelines) for any analyte. Otherwise, corrective action must be taken and the instrument recalibrated.
- An Initial Calibration Verification standard (ICV) is also analyzed at the beginning of the analytical run. The results of the ICV analysis must either fall within the tabulated acceptance windows supplied by the vendor of that material, or if these are not available, within 10% of the true value.
- If samples are being analyzed under SW 846 protocols, the ICV is replaced with the high standard. The high standard must be within 5% of the true value for the analysis to be in control.

If both of these conditions are met, the instrument is deemed to be in calibration and samples can be analyzed.

- For ICP calibrations the Interference Check Sample must be analyzed to verify that the analytical lines chosen are free from spectral interference and that background correction is being correctly performed. The ICP interference check standard is analyzed at the beginning and at the end of the analytical run.
- A standard at the MDL is analyzed for all analytes. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- A Continuing Calibration Verification standard (CCV) and a zero standard (Continuing Calibration Blank, CCB) are analyzed at a frequency of 10%. The absolute value of the CCB must be no greater than the reporting limit of any sample in that analytical run. If the requirement is for CLP calibration, the CCB must not

exceed the CLP Contract Required Detection Limit (CRDL). All sample results not bracketed by acceptable CCBs are reanalyzed.

- The continuing calibration verification standard (CCV) must be within 10% of the true value or fall within any project specific control limits. Otherwise, corrective action must be taken and the instrument recalibrated. Only analytical results which have been determined between acceptable calibration verification standards and blanks are considered reportable. All sample results not bracketed by acceptable CCVs are reanalyzed.
- 10.2.12.5. Documentation All computer printouts and raw data sheets are required to be filed in the client data file.

10.2.13. ICP/MS Analysis

- 10.2.13.1. The manufacturer's manual will be consulted for complete operating instructions. Sections 2 and 3 of this manual cover gases and other services. Greater detail of operating instructions and quality control are provided in the individual SOPs for SW 846 (6020), method 200.8, etc.
- 10.2.13.2. Mass Calibration/Mass Resolution

Mass calibration and resolution checks are conducted in the mass regions of interest. The mass calibration and resolution parameters are required criteria which must be met prior to any sample being analyzed. They are performed every two weeks or whenever system integrity is compromised. The monitored masses of Mg, Rh, and Pb must meet the following criteria:

Element	Mass, amu	Resolution @ 10 % peak height, amu
Mg	23.90-24.10	<1.0
Rh	102.80-103.00	<1.0
Pb	207.90-208.10	<1.0

10.2.13.3. The Calibration Model:

• Initial calibration data is evaluated using the correlation coefficient of a linear regression analysis. The correlation coefficient must

be 0.995 or greater. All CCVs and sample extract concentrations must be computed using the regression equation.

- An Initial Calibration Verification standard (ICV) is also analyzed at the beginning of the analytical run. The results of the ICV analysis must either fall within the tabulated acceptance windows supplied by the vendor of that material, or if these are not available, within 10% of the true value.
- After the analysis of the ICV standard an instrument blank (ICB) is analyzed. The levels of target analytes in the ICB should not exceed the method detection limit. SW 846 6020 states that the control for ICB is three times the IDL.
- A Continuing Calibration Verification standard (CCV) and a zero standard (Continuing Calibration Blank, CCB) are analyzed at a frequency of 10%. The absolute value of the CCB must be no greater than the reporting limit of any sample in that analytical run. All sample results not bracketed by acceptable CCBs are reanalyzed.
- The continuing calibration verification standard (CCV) must be within 10% of the true value or fall within any project specific control limits. Otherwise, corrective action must be taken and the instrument recalibrated. Only analytical results which have been determined between acceptable calibration verification standards and blanks are considered reportable. All sample results not bracketed by acceptable CCVs are reanalyzed.
- 10.2.13.4. Documentation All computer printouts and raw data sheets are required to be filed in the client data file.

10.2.14. Gaseous Hydride

- 10.2.14.1. The manufacturer's manual will be consulted for complete operating instructions. Section 2 and 3 of this manual cover gases and other services.
- 10.2.14.2. Initial Calibration For each analytical run, a 4 point calibration (including a blank) is made at the beginning of the analytical run. Each standard is analyzed in duplicate. If the peak heights differ by more than 20% for replicate standards a third standard at the same concentration is analyzed. All standards are used for the calibration

curve and must demonstrate a MINIMUM correlation coefficient of 0.995.

- 10.2.14.3. Immediately following calibration an ICV solution is analyzed. The concentration values for the ICV must be either within the tabulated acceptance window or be within 15% of the stated true value, if acceptance windows have not been tabulated.
- 10.2.14.4. A standard at the MDL is analyzed for all analytes. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.14.5. During analysis the mid-range calibration standard (CCV) is analyzed after every 10th sample. If the measured concentration differs from the expected value by more than 15%, the instrument is recalibrated as previously described and all samples analyzed since the last correct calibration are reanalyzed. The mid-point calibration standard is also analyzed at the end of the analytical run and must meet the same criteria.
- 10.2.14.6. Immediately following each CCV, a blank solution (CCB) is analyzed. When calculated from the original standard curve, it must not be detectable at a level above the reporting limit or else the samples analyzed since the last satisfactory CCB are to be reanalyzed.
- 10.2.14.7. Documentation All work sheets, strip chart recordings and printouts are to be filed in the client data file.
- 10.2.15. Graphite Furnace Atomic Absorption (GFAA)
 - 10.2.15.1. The manufacturer's manual will be consulted for complete operating instructions. Section 2 and 3 of this manual cover gases and other services.
 - 10.2.15.2. A daily calibration is performed for this analysis. A 4 point calibration (including a blank) is made at the beginning of the analytical run. Each standard is analyzed in duplicate. All standards are used for the calibration curve and the correlation coefficient for that curve must be .995 or greater.

- 10.2.15.3. Immediately following calibration an initial calibration verification (ICV) solution is analyzed. The concentration values for the ICV must be either within the tabulated acceptance window or be within 10% of the stated true value, if acceptance windows have not been tabulated.
- 10.2.15.4. A standard at the MDL is analyzed for all analytes. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.15.5. During an analytical sequence, the mid-range calibration standard (CCV) is analyzed after every 10th sample. If the measured concentration differs from the expected value by more than 10%, the instrument is recalibrated as previously described and all samples analyzed since the last satisfactory calibration check are reanalyzed. The mid-point calibration standard is also analyzed at the end of the analytical run and must meet the same criteria or else the samples analyzed since the last satisfactory calibration check are to be reanalyzed.
- 10.2.15.6. Immediately following each CCV, a blank solution (CCB) is analyzed. When calculated from the original standard curve, it must not be detectable at a level above the reporting limit or else the samples analyzed since the last satisfactory CCB are to be reanalyzed.
- 10.2.15.7. Documentation All work sheets, strip chart recordings and printouts are to be filed in the client data file.
- 10.2.16. Cold Vapor Mercury (CVAA)
 - 10.2.16.1. The manufacturer's manual will be consulted for complete operating instructions. Section 2 and 3 of this manual cover gases and other services. This calibration procedure is designed to be used whether analysis is by traditional CVAA or using the Perkin Elmer FIMS instrument.
 - 10.2.16.2. Daily Calibration
 - A 5 point calibration, including a blank, is made at the beginning of the analytical run. All standards are used for the calibration curve which fall within the linear range (those producing a

correlation coefficient of at least 0.995). Occasionally a single standard may produce an absorbance not conforming with the others. This may be judged to be due to contamination, as all standards are digested the same way as samples.

- Immediately following calibration an ICV solution is analyzed. The concentration values for the ICV must be either within the tabulated acceptance window or be within 15% of the stated true value.
- During analysis a mid-range calibration standard is analyzed after every 10th sample and at the end of the analytical run. The measured concentration must be within 80% - 120% of the expected value or the instrument is either recalibrated as previously described and all samples analyzed since the last satisfactory calibration check are reanalyzed or, if all samples are undetected and the sensitivity is judged by the QC Officer to be sufficient to justify reporting undetected values, the data may be reported. No values with quantifiable levels of mercury will be reported from data where the calibration has drifted out-of-control.
- Immediately following each CCV, a blank solution (CCB) is analyzed. When calculated from the original standard curve, it must not be detectable at a level above the reporting limit or else the samples analyzed since the last satisfactory CCB are to be reanalyzed.
- A standard at the MDL is analyzed. The minimum requirement for the MDL standard is that it be detectable, an observable instrument response which is above that of the background.
- 10.2.16.3. Documentation All work sheets, strip chart recordings and printouts are to be filed in the client data file.
- 10.2.17. Volatile Compounds By GC/MS
 - 10.2.17.1. The manufacturer's manual will be consulted for complete operating instructions. Section 2 and 3 of this manual cover gases and other services.
 - 10.2.17.2. Tuning and GC/MS Calibration
 - 10.2.17.3. Prior to the analysis of any standards or sample extracts the GC/MS system(s) used must demonstrate the ability to meet standard mass

spectral abundance criteria. The tuning compound for volatiles is p-Bromofluorobenzene (BFB).

10.2.17.4. Each GC/MS system used for the analysis of volatile compounds must meet the tuning criteria for an injection of 50 ng BFB; 50 ng BFB may be added to 5 ml of reagent water and purged onto the GC column to meet these criteria. These criteria are outlined in Table 1 except when EPA CLP analysis is to be performed under the 3/90 Statement of Work (SOW) in which case the criteria from Table 2 are used or when Method 524.2 is being used when the criteria in Table 3 apply. The BFB can be analyzed separately or as part of the 12hour calibration standard. Background subtracting or spectrum averaging may be used in order to eliminate column bleed or background ions, but software manipulation of the BFB spectra solely to meet tuning requirements is unacceptable. Instrument conditions must be consistent with those used during sample analysis.

TABLE 1. BFB KEY IONS AND ABUNDANCE CRITERIA, SW846 Methods 8240 and 8260

<u>Mass</u>	<u>Ion Abundance Criteria</u>
50	15.0 - 40.0 percent of mass 95
75	30.0 - 60.0 percent of mass 95
95	base peak, 100 percent relative abundance
96	5 to 9% of mass 95
173	less than 1.00 percent of mass 174
174	greater than 50.0 percent of mass 95
175	5.0 - 9.0 percent of mass 174
176	greater than 95.0 percent but less than 101.0 percent of mass 174
177	5.0 - 9.0 percent of mass 176

Method 8260 does allow alternate tuning criteria (CLP, method 524.2 or manufacturers' instructions) as long as method performance is not compromised. Laucks routine practice is to use the above criteria unless otherwise specified in the project QA plan.

TABLE 2. BFB KEY IONS AND ABUNDANCE CRITERIA, 3/90 EPA SOW

Mass	Ion Abundance Criteria
50	8.0 - 40.0 percent of mass 95
75	30.0 - 66.0 percent of mass 95
95	base peak, 100 percent relative abundance
96	5.0 - 9.0 of mass 95
173	less than 2.0 percent of mass 174
174	50.0 - 120.0 percent of mass 95
175	4.0 - 9.0 percent of mass 174
176	93.0 - 101.0 of mass 174
177	5.0 - 9.0 percent of mass 176

TABLE 3. BFB KEY IONS AND ABUNDANCE CRITERIA, EPA METHOD 524.2

Mass	Ion Abundance Criteria
50	15 - 40 percent of mass 95
75	30 - 80 percent of mass 95
95	base peak, 100 percent relative abundance
96	5 - 9 of mass 95
173	less than 2. percent of mass 174
174	>50 percent of mass 95
175	5 9. percent of mass 174
176	>95 but <101.0 percent of mass 174
177	5 - 9 percent of mass 176

Note: Any laboratory action taken which may affect tuning for BFB (e.g., ion source cleaning) requires that the tune be verified irrespective of the 12-hour tuning requirement.

- 10.2.17.5. The 12-hour time period for GC/MS tuning and standards calibration (either initial or continuing) begins at the moment of the injection of the BFB. The time period ends after 12 hours have elapsed according to the system clock.
- 10.2.17.6. Initial Calibration Initial calibration of volatile compounds is performed with a minimum of a 3 point (typically a 5 point) curve. Surrogate and internal standards are added to all calibration standards.

- 10.2.17.7. The Relative Response Factor (RRF) for all compounds at each concentration level are calculated using the internal standard method. The mean response factor for each compound is also calculated. The percent relative standard deviation (%RSD) of the RRF for the specific method criteria will be met.
- 10.2.17.8. Any method specific minimum RRFs will be met before samples can be analyzed.
- 10.2.17.9. Continuing Calibration Every 12 hours of instrument operation a mixed standard is analyzed which contains all target compounds at a mid-range level. The standard also contains all surrogate compounds and internal standards, including Bromofluorobenzene (BFB).
- 10.2.17.10.Any method specific minimum RRFs for the continuing calibration standard will be met before samples can be analyzed.
- 10.2.17.11.Any method specific percent differences (%D) of the RRFs must also be met before samples can be analyzed.
- 10.2.17.12.If the Continuing Calibration verifies the Initial Calibration then it is satisfactory to recalibrate using the current standard.
- 10.2.17.13.Documentation After the initial calibration has been validated the mean RRF and percent RSD are calculated for all compounds. A report form is completed detailing the results of the initial calibration. The results of the tune(s) performed during initial calibration must also be generated. All Reconstructed Ion Chromatograms (RICs) and data system printouts are filed in the calibration file.
- 10.2.17.14.Each day a report is required for each GC/MS for each 12 hour time period in which samples are analyzed. This report will consist of the standard quantitation report generated by the data system software. It will document that RRF deviation criteria from the initial multipoint calibration curve and any other method specific calibration criteria have been met. All RICs and sample specific data system printouts must be filed in the client data file. Copies of the daily laboratory standard, along with continuing calibration reports are kept in files specific to each instrument.

10.2.18. Semivolatile Compounds By GC/MS

- 10.2.18.1. The manufacturer's manual will be consulted for complete operating instructions. Section 2 and 3 of the QC manual cover gases and other services.
- 10.2.18.2. Tuning and GC/MS Calibration
- 10.2.18.3. Prior to the analysis of any standards or sample extracts the GC/MS system(s) used must demonstrate the ability to meet standard mass spectral abundance criteria. The tuning compound for semi-volatiles is decafluorotriphenylphosphine (DFTPP).
- 10.2.18.4. Each GC/MS system used for the analysis of semi-volatile or pesticide compounds must meet the tuning criteria for an injection of 50 ng DFTPP; DFTPP must be injected to meet these criteria. These criteria are outlined in Table 4 except when EPA CLP analysis is to be performed under the 3/90 Statement of Work (SOW) in which case the criteria from Table 5 are used. The DFTPP can be injected separately or as part of the 12-hour calibration standard. Background subtracting or spectrum averaging may be used in order to eliminate column bleed or background ions, but software manipulation of the DFTPP spectra solely to meet tuning requirements is unacceptable. Instrument conditions must be consistent with those used during sample analysis.

TABLE 4. DF	TPP KEY IONS	AND ION ABUNDANCE	CRITERIA	SW846-8270
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Mass	lon Abundance Criteria
51	30.0 - 60.0 percent of mass 198
68	less than 2.0 percent of mass 69
70	less than 2.0 percent of mass 69
127	40.0 - 60.0 percent of mass 198
197	less than 1.0 percent of mass 198
198	base peak, 100 percent relative abundance
199	5.0 - 9.0 percent of mass 198
275	10.0 - 30.0 percent of mass 198
365	greater than 1.00 percent of mass 198
441	present but less than mass 443
442	greater than 40.0 percent of mass 198
443	17.0 - 23.0 percent of mass 442

TABLE 5. DFTPP KEY IONS AND ION ABUNDANCE CRITERIA, 3/90 EPA SOW

	Mass	Ion Abundance Criteria
	51	30.0 - 80.0 percent of mass 198
	68	less than 2.0 percent of mass 69
	69	present
	70	less than 2.0 percent of mass 69
	127	25.0 - 75.0 percent of mass 198
	197	less than 1.0 percent of mass 198
	198	base peak, 100 percent relative abundance
	199	5.0 - 9.0 percent of mass 198
	275	10.0 - 30.0 percent of mass 198
	365	greater than .75 percent of mass 198
	441	present but less than mass 443
	442	40.0 - 110.0 percent of mass 198
-	443	15.0 - 24.0 percent of mass 442

Note: Any laboratory action taken which may affect tuning for DFTPP (e.g., ion source cleaning) requires that the tune be verified irrespective of the 12-hour tuning requirement.

- 10.2.18.5. The 12-hour time period for GC/MS tuning and standards calibration (either initial or continuing) begins at the moment of the injection of the DFTPP. The time period ends after 12 hours have elapsed according to the system clock.
- 10.2.18.6. Initial Calibration Initial calibration of semivolatile compounds is performed with a minimum of a 3 point (typically a 5 point) curve. Surrogate and internal standards are added to all calibration standards.
- 10.2.18.7. The Relative Response Factor (RRF) for all compounds at each concentration level are calculated using the internal standard method. The mean response factor for each compound is also calculated. The percent relative standard deviation (%RSD) of the RRF for the specific method criteria will be met.
- 10.2.18.8. Continuing Calibration Every 12 hours of instrument operation a mixed standard is analyzed which contains all target compounds at a mid-range level. The standard also contains all surrogate compounds and internal standards, and DFTPP.

- 10.2.18.9. Any method specific minimum RRFs for the continuing calibration standard will be met before samples can be analyzed.
- 10.2.18.10.Any method specific percent differences (%D) of the RRFs must also be met before samples can be analyzed.
- 10.2.18.11.If the Continuing Calibration validates the Initial Calibration then it is satisfactory to recalibrate using the current standard.
- 10.2.18.12.Documentation After the initial calibration has been validated the mean RRF and percent RSD are calculated for all compounds. A report form is completed detailing the results of the initial calibration. The results of the tune(s) performed during initial calibration must also be generated. All Reconstructed Ion Chromatograms (RICs) and data system printouts are filed in the calibration file.
- 10.2.18.13.Each day a report is required for each GC/MS for each 12 hour time period in which samples are analyzed. This report will consist of the standard quantitation report generated by the data system software. It will document that RRF deviation criteria from the initial multipoint calibration curve and any other method specific calibration criteria have been met. All RICs and sample specific data system printouts must be filed in the client data file. Copies of the daily laboratory standard, along with continuing calibration reports are kept in files specific to each instrument.

10.2.19. GC Analyses

- 10.2.19.1. The manufacturer's manual will be consulted for complete operating instructions. Section 2 and 3 of this manual cover gases and other services. Analytical criteria outlined in this section are general. Individual methods vary in both scope and detail and will not be outlined here. For method specific criteria, the individual methods must be consulted.
- 10.2.19.2. Retention time windows are established when any significant change is made to an instrument or its configuration or whenever specified in a method, whichever is shorter. A MINIMUM of three standards are analyzed over the course of a method specific QC period (72 hours). These should include the beginning and end of the sequence with at least one in the middle and should be analyzed throughout the

course of a typical analysis, to include samples so as to simulate real analytical conditions.

- 10.2.19.3. The mean and standard deviation of the retention times (RT) of ALL standards for all compounds in the analytical run are determined. The retention time windows are defined as the window half-width ± the MAXIMUM of 3 times the standard deviation OR 0.3% of the relative retention time (RRT) for narrow bore capillary columns OR 1.0% of the RRT for megabore columns. These are calculated to the nearest 0.001 minutes. The RT windows for a QC period are set at the above determined width from the midpoint of the RT window. The midpoint is either the average RT of the DAILY multipoint standards or of a midpoint standard. Greater detail on the establishment of retention time windows is provided in Laucks SOP LTL-8000RTW
- 10.2.19.4. Initial Calibration At the beginning of a method specific QC period, a multipoint calibration curve is constructed from the number of standards specified by the method, generally 3 or 5. More standards may be added for any reason, such as to determine the instrument linearity, but no fewer may be analyzed if sample results are to be reported. Calibration factors are determined for each analyte and standard using the formula:

$$CF = \frac{Response}{ng \text{ on column}}$$

- 10.2.19.5. Any of four methods may be used as defined in the specific method to determine the calibration. Either the linear regression coefficient OR the %RSD is used to evaluate the calibration curve.
 - A linear regression analysis is performed using the raw instrument responses. The correlation coefficient for the curve must be greater than or equal to the r_{test} value for the number of points in the curve for a 99% confidence interval (see r_{test} in glossary and in Appendix F). The number of points and the corresponding r_{test} values for a limited number of points are listed in the table below:

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# of points	minimum r value
3	1.000
4	.990
5	.959
6	.917
7	.875
8	.834
9	.798
10	.765

Sample values may be determined by using the equation y = mx + b, where:

m = slope, x = sample response, and b = intercept of the line from the linear regression calculation.

OR

 The percent relative standard deviation (%RSD) for the calibration factors for the various analytes are calculated. Acceptable values are specified in the individual method, usually 20% to 35% RSD. Sample extract concentrations are calculated using EITHER the average calibration factor, which is the preferred and most used option OR the mid-point calibration factor, if specified in the method or the project QA plan. In any event, the calibration must have either an acceptable correlation coefficient (r value) or an acceptable %RSD.

OR

- If data systems are used which are capable of non-linear calibrations, this option may be used. The specific methodologies for this type of calibration are not available at this time but will be in accordance with the manufacturer's instructions.
- 10.2.19.6. Continuing Calibration During any time period in which samples are analyzed, a mid-range standard is analyzed at a minimum of the method-specific frequency, usually 24 hours, and at the end of the QC period. The value obtained is compared to the true value and a percent difference (%D) calculated. The %D must be less than the method specific limit, usually about 25%. For these purposes, a

sample is defined as an analytical sample, a reagent blank, a sample spike, or a sample duplicate.

10.2.19.7. Documentation - A tabular presentation of compound calibration factors (CFs) for all standard levels is required as well as retention times (RTs), and the standard deviation of the RTs for each compound. The results of the analyses of all mid-range standards analyzed during the QC period are reported as well as the %D for the CFs of all compounds. All chromatograms and data system printouts are also required.

10.3. DETECTION LIMITS

Most instrumental and method detection limits are determined using statistical methods described in Laucks SOP LTL-0027, Determination of Detection Limits. General descriptions of the techniques used are discussed below. Some specific methods have their own ways of determining detection limits which are followed as closely as possible.

10.3.1. Determination of Instrument Detection Limit

Laucks SOP on the Determination of Detection Limits (see Appendix E), gives specifics for determining most detection limits. For most analytes, a standard at a concentration of about 3 to 5 times the expected detection limit is analyzed at least 7 times throughout the course of at least one typical analytical run. The standard deviation and t-statistic of the results of these analyses are calculated. If the absolute value of the t-statistic is less than the appropriate value from the Student's t-table for the 99% confidence interval, the IDL is calculated as 3 times the standard deviation. Otherwise, a higher or lower estimate must be made and the IDL analysis redetermined. EPA CLP and specific other methods often have their own prescribed ways to determine appropriate limits. These methods are followed when appropriate.

- 10.3.2. Determination of Method Detection Limit
 - 10.3.2.1. Laucks establishes <u>Method Detection Limits (MDLs) according to the Code of Federal Regulations. 40 CFR Part 136, Appendix B</u>. In this method, 7 replicates of a "standard" matrix, usually deionized water or clean sand, are spiked with target analyte(s) at a level near the anticipated MDL. This artificial sample is then processed and analyzed in exactly the same manner as a sample of that matrix. The standard deviation of the analytical values of these replicates is

calculated and then multiplied by the single sided Student's *t* value at the 99% confidence level for that number of replicates (3.143 for 7 replicates). The resulting number is called the MDL and is based solely on the precision of that analysis for that target analyte at a relatively low level under "typical" conditions, but on a matrix which is generally free of any interfering agents.

- 10.3.2.2. In some cases, the resulting statistically determined MDL is a value that is less than the concentration which is truly achievable in routine determinations, whether due to the inability to actually "see" a peak at that level, to recognize a characteristic chromatographic pattern, to confirm the presence of the analyte through mass spectral identification, or by other means. Actual detection in these instances and at the MDL level is questionable and quantification is highly unreliable.
- 10.3.2.3. Laucks has taken the approach of determining a value using professional judgment, by observation of the signal/noise ratio or whatever other factors might be involved, which, in the opinion of the experienced senior chemists, could be reliably reported on a continuing basis. Whereas the empirically determined MDL may change regularly, the reporting limit values, which also represent what are often called the <u>Practical Quantitation Limits</u> (PQLs), will remain relatively constant unless significant changes in instrumentation or technique occur which allow for improved sensitivity and precision.
- 10.3.2.4. We have chosen to call this limit the <u>Reporting Limit</u> (RL). Subsequent MDL determinations will be used to confirm that the Reporting Limit is still valid. We will typically only report down to the Reporting Limit. If requested, we will report "J" flagged values between the most recent MDL and this reporting limit. These values, however, are estimated and may be unreliable. A skilled analyst will make a judgment in each such case as to the presence of a target analyte at a concentration less than the Reporting Limit.