ENTERED

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

MAY 18 2012

Colonel David C. Piech
Commander
110 E Sextant Avenue Suite 1098
Cannon AFB NM 88103

Ms. Lane Andress
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East Bldg 1
Santa Fe NM 87505-6063

Dear Ms. Andress

Attached is the *Work Plan Addendum Facility-Wide Long-Term Monitoring, Maintenance, and Inspections at Multiple Sites, Cannon AFB, New Mexico.* If you have any questions regarding this submittal, please contact Mr. Ronald Lancaster, Chief, Asset Management Flight at (575) 784-1146 or Mr. Matthew Higginbotham, Restoration Program Manager at (575) 784-6031.

Sincerely

DAVID C. PIECH, Colonel, USAF

Attachment:
Work Plan Addendum Facility-Wide Long-Term Monitoring, Maintenance, and Inspections at Multiple Sites, Cannon AFB, New Mexico

cc:
Environmental Protection Agency, Region VI, Ms. Wendy Jacques w/o Attachment

FINAL

WORK PLAN ADDENDUM
FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES
CANNON AIR FORCE BASE, NEW MEXICO

Prepared for:

27 SOCES/CEAN
Cannon Air Force Base, New Mexico

Prepared by:

1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205

And

1002 N. Eglin Parkway
Shalimar, Florida 32579

Contract No. FA8903-10-D-8594
Delivery Order Number: 0034

Bhate Project No.: 9110129

April 2012

FINAL

WORK PLAN ADDENDUM

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

Prepared for:

27 SOCES/CEAN
Cannon Air Force Base, New Mexico

Under Contract To:

Air Force Center for Engineering and the Environment
772 ESS/PKS, Building 171
Lackland AFB Base, TX 78236

Prepared by:

Bhate Environmental Associates, Inc.
1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205

Bhate Project No. 9110129

and

Trinity Analysis & Development Corp.
1002 North Eglin Parkway
Shalimar, Florida 32579

Contract No. FA8903-10-D-8594
Delivery Order Number: 0034

April 2012

This page intentionally left blank.

FINAL

WORK PLAN ADDENDUM

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

DISTRIBUTION LIST

	Number of Draft Copies	Number of Final Copies
Eliud Burgos AFCEE COR 2261 Hughes Ave., Suite 155 Lackland AFB, Texas 78236 210-395-8626 Eliud.burgos@us.af.mil	1 Hard	1 Hard
Matthew Higginbotham Restoration Program Manager Cannon Air Force Base 506 N. DL Ingram Blvd. Cannon AFB, New Mexico 88103-5003 575-784-1092 (office) Matthew.higginbotham@cannon.af.mil	3 Hard, 3 CD	3 Hard
TOTALS	4 Hard, 3 CD	4 Hard

This page intentionally left blank.

FINAL

WORK PLAN ADDENDUM

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

		4-17-12
Richard Burdine, P.G. Sr. Vice President Trinity Analysis & Development Corp.	Sign	Date
		4-17-12
Tracy L. Walker, P.G. Sr. Project Manager Bhate Environmental Associates, Inc.	Sign	Date

This page intentionally left blank.

FINAL

WORK PLAN ADDENDUM

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

Acronyms and Abbreviations iii

1 Introduction 1-1
- 1.1 Scope of Work 1-2

2 Field Sampling Plan 2-1
- 2.1 Water Level Measurement 2-1
- 2.2 Monitoring Well Inspection 2-2
- 2.3 Groundwater Sampling 2-2
  - 2.3.1 Sampling Locations 2-2
  - 2.3.2 Site Specific Requirements 2-3
  - 2.3.3 Sample Collection 2-3
  - 2.3.4 Field and Laboratory Analysis 2-4
  - 2.3.5 Sample Containers and Preservation Techniques 2-7
- 2.4 Sample Packaging and Shipping Requirements 2-7
- 2.5 Decontamination Procedures 2-8

3 Field Operations Documentation 3-1
- 3.1 Field Logbook and/or Sample Field Sheets 3-1
- 3.2 Photographic Records 3-1
- 3.3 Sample Numbering System 3-2
- 3.4 Chain-of-Custody Records 3-2

4 Investigation-Derived Waste 4-1

5 Site Inspections and Maintenance 5-1
- 5.1 Frequency 5-1
- 5.2 Procedures 5-1
  - 5.2.1 Inspections 5-1

5.2.2 Maintenance 5-1
5.2.3 Repair 5-2
5.2.4 Landfill-03 (LF-03/SWMU 105) and Landfill-04 (LF-04/WMU 104) 5-2
5.2.4.1 Inspection and Maintenance Activities 5-2
5.2.4.2 Repair Activities 5-3
5.2.5 Landfill 25 (LF-25/SWMU 97) 5-3
5.2.5.1 Inspection and Maintenance Activities 5-3
5.2.5.2 Repair Activities 5-4
5.2.6 Sewage Lagoons (SWMU 101) 5-4
5.2.6.1 Inspection and Maintenance Activities 5-4
5.2.6.2 Repair Activities 5-5

6 References 6-1

Figures

Figure 2-1 Plan View
Figure 5-1 2009 Aerial Photograph – LF-03/LF-04
Figure 5-2 2009 Aerial Photograph – LF-25
Figure 5-3 2009 Aerial Photograph – SWMU 101

Tables

Table 2-1 Cannon AFB Facility-Wide LTM Well Network
Table 2-2 Cannon AFB Site Specific Well Network
Table 2-3 Well Construction Details
Table 2-4 Laboratory Analysis and Method Requirements
Table 2-5 Sample Containers, Preservation, and Holding Times
Table 3-1 Sample QA/QC Extensions
Table 4-1 TCLP Regulatory Limits
Table 5-1 Summary of Inspection and Maintenance Activities – LF-03/SWMU 105 and LF-04/SWMU 104
Table 5-2 Summary of Inspection and Maintenance Activities – LF-25/SWMU 97
Table 5-3 Summary of Inspection and Maintenance Activities – Sewage Lagoons (SWMU 101)

Attachment

Attachment 1 Supporting Documents
Part 1 – Quality Assurance Project Plan
Part 2 – Site Safety and Health Plan

Appendices

Appendix A Forms
Appendix B Field Methods
Appendix C Landfill Cover System Inspection Report

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AFCEE	Air Force Center for Engineering and the Environment
Bhate	Bhate Environmental Associates Inc.
bTOC	Below top of casing
°C	Degrees Celsius
COC	Chain-of-custody
CFR	Code of Federal Regulations
DO	Dissolved Oxygen
ECOS09	Environmental, Construction, Operations and Services 2009
ft	Feet
FSP	Field Sampling Plan
GCAL	Gulf Coast Analytical Laboratories, Inc.
GPS	Global Positioning System
IATA	International Air Transport Association
IDW	Investigation-derived waste
LF	Landfill
LTM	Long-Term Monitoring
mg/L	Milligrams per liter
mL	Milliliter
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NMED	New Mexico Environment Department
NTU	Nephelometric turbidity unit
No.	Number
OSHA	Occupational Safety and Health Administration
P.G.	Professional Geologist
PPE	Personal protective equipment
PVC	Polyvinyl chloride
QA	Quality assurance
QC	Quality control
RCRA	Resource Conservation and Recovery Act

QAPP	Quality Assurance Project Plan
SpC	Specific Conductance
SDG	Sample Delivery Group
SM	Standard Method
SSHP	Site Safety and Health Plan
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total organic carbon
TRINITY	Trinity Analysis & Development Corp.
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compound

1 INTRODUCTION

Bhate Environmental Associates, Inc., (Bhate) has been retained by the Air Force Center for Engineering and the Environment (AFCEE) to perform Long-Term Monitoring, Maintenance, and Inspections at Multiple Sites at Cannon Air Force Base (AFB), New Mexico. The work was awarded under Environmental, Construction, Operations, and Services 2009 (ECOS09) AFCEE contract FA8903-10-D-8594, Delivery Order No. 0034.

Bhate is being supported on this Delivery Order by Trinity Analysis and Development Corp. (TRINITY), which has extensive institutional knowledge of the Long-Term Monitoring (LTM) program at Cannon AFB.

This Work Plan Addendum is a supplement to the *January 2011 Facility-Wide Long-Term Ground Water Monitoring Plan, Cannon AFB* (AECOM, 2011) and is meant to address specific field procedures and quality control (QC) requirements for the continuation of the LTM activities including biennial groundwater monitoring and vegetative cover inspections and maintenance at the following landfills (LFs) and solid waste management units (SWMUs): LF-03/SWMU 105, LF-04/SWMU 104, LF-25/SWMU 97, and SWMU 101 (Sewage Lagoons) at Cannon AFB.

Previous reports and plans have provided detailed summaries of site history, previous investigations, and the overall technical approach implemented at each site. As such, reiteration of that information is not included in this Work Plan Addendum.

The primary components of this Work Plan Addendum include the Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and Site Safety and Health Plan (SSHP). The focus of this document is to provide specific field procedures and quality control (QC) requirements for the continuation of the LTM activities, including groundwater monitoring and vegetative cover inspections at Cannon AFB. The FSP and QAPP, are intended as a supplement to the *January 2011 Facility-Wide Long Term Ground Water Monitoring Plan, Cannon AFB* (AECOM, 2011). The FSP provides details of the planned field effort to the extent necessary, without repeating information already provided in the *January 2011 Facility-Wide Long Term Ground Water Monitoring Plan, Cannon AFB* (AECOM, 2011). The original Work Plan (AECOM, 2011) is referenced wherever possible and will be used along with this FSP during the performance of fieldwork.

The SSHP has been prepared to address all field procedures anticipated under this Delivery Order. The plan was prepared in accordance with Air Force, Occupational Safety and Health Administration (OSHA), U.S. Environmental Protection Agency (USEPA), State, and local health and safety regulations.

Due to contractual requirements with the AFCEE and the safety of field sampling personnel, it is necessary to include the QAPP and SSHP as part of this Work Plan Addendum (Attachment 1,

Part 1 and Part 2, respectively). *We understand that the New Mexico Environment Department (NMED) will not review the QAPP and the SSHP.*

1.1 Scope of Work

The LTM field activities for this Delivery Order include the following:

- Site Preparation/Mobilization/Demobilization
- Biennial groundwater sampling at Sites LF-03, LF-04, LF-05, LF-25, and SWMU-101
- Annual water level measurements of monitoring wells
- Annual inspection and maintenance of the covers at Sites LF-03,LF-04, and LF-25 and SWMU 101
- Annual site inspections of institutional controls at LF-02, FT-06, SD-12, SD-15, SD-17, SD-20, SWMU-2, SWMU-4, SWMU-6, SWMU-31, and SWMU-102

2 FIELD SAMPLING PLAN

This Long-Term Groundwater Monitoring FSP is a supplement to the *January 2011 Facility-Wide Long-Term Ground Water Monitoring Plan, Cannon AFB* (AECOM, 2011) and is meant to address specific field procedures and QC requirements for the continuation of the LTM activities including groundwater monitoring, vegetative cover inspections and maintenance at the following LFs and SWMUs: LF-03/SWMU 105, LF-04/SWMU 104, LF-25/SWMU 97, and SWMU 101 (Sewage Lagoons); and institutional controls inspections at sites LF-02, FT06, SD-12, SD-15, SD-17, SD-20, SWMU 2, SWMU 4, SWMU 6, SWMU 31, and SWMU 102, at Cannon AFB.

2.1 Water Level Measurement

Prior to groundwater sampling activities, a full round of water levels will be collected from all 18 monitoring wells associated with this LTM investigation using an electronic water level indicator. A complete table of monitoring wells included in this investigation is provided as Table 2-1.

Table 2-1. Cannon AFB Facility-Wide LTM Well Network

LTM Monitoring Wells	
MW-A	MW-O/Oa
MW-B	MW-P/Pa
MW-C	MW-Ra
MW-D	MW-S
MW-E	MW-T
MW-F	MW-U
MW-G	MW-V
MW-H	MW-W
MW-N/Na	MW-X

Water levels will be measured in the shortest time practical to minimize the effects of water table fluctuations, ideally within a 24-hour period. Water level measurements will be documented on a Water Level Data Summary form (Appendix A) and in a bound, numbered, site-specific field logbook. The depth to groundwater will be measured from the top of well casing (i.e. below top of casing [bTOC]) to the nearest 0.01 foot and always from the same reference point or survey mark on the well casing. If there is no reference mark, the measurement will be from the highest point of the well casing where possible, and from the northern side of the casing if not possible to determine the highest point on the well casing. In either case, notes must be made on the summary form and in the logbook to foster standardization of the measuring point for future sampling events.

The total depth of the well will be measured in the same manner as above and recorded on the Water Level Data Sheet and applicable logbook. Field procedures for water level measurements were developed in general accordance with guidance provided by the NMED (NMED, year unknown). These procedures are detailed in Field Method Number (No.) 1 (included in Appendix B of this Work Plan Addendum).

2.2 Monitoring Well Inspection

During each sampling event, monitoring well inspections will be conducted to assess the overall condition of the wells located at Cannon AFB. Inspections will be documented using the Well Inspection Form included in Appendix A of this Work Plan Addendum. The following items will be noted on the inspection forms and in the logbook:

- Verify the identification of the monitoring well by examining markings, sign plates, placards, or other designations.
- Remove the exterior well cover and remove all standing water around the top of the well casing before opening the well cap, if applicable.
- Inspect pad, bollards, and exterior protective casing (if present and/or applicable) of the monitoring well or supply well for damage and document the results of the inspection if there is a problem.
- Inspect the well lock and determine whether the cap fits tightly. Replace the cap and/or lock if necessary.

2.3 Groundwater Sampling

2.3.1 Sampling Locations

Groundwater samples will be collected on a biennial basis from monitoring wells at four landfills (LF-03/SWMU 105, LF-04/SWMU 104, LF-05/SWMU 113, LF-25/SWMU 97), the former Sewage Lagoons (SWMU 101), and four perimeter wells. A complete table of site specific monitoring wells is provided as Table 2-2.

Table 2-2. Cannon AFB Site Specific Well Network

Site/SWMU	Monitoring Well IDs
LF-03/SWMU 105	Oa
LF-04/SWMU 104	Na
LF-05/SWMU 113	A, B, C, D, S, U
LF-25/SWMU 97	Pa, Ra
Sewage Lagoons/SWMU 101	E, F, G, H
Perimeter	T, V, W, X

2.3.2 Site Specific Requirements

The presence of metals (inorganics) in groundwater samples collected from monitoring wells can be natural, anthropogenic in origin, or both. Metals are common, naturally occurring, ubiquitous elements in sediments such as the Ogallala, and in some instances may naturally exceed applicable standards. Elevated metals in groundwater samples may be an artifact of the well installation process. For example, formation damage incurred during drilling may not be sufficiently repaired and/or the well may not be completely developed, which could result in elevated turbidity during well sampling. Additionally and sometimes unavoidably, the targeting of less desirable strata, i.e. placing the screen intake opposite clayey sediment, can also result in the introduction of colloidal clay into samples, which may also produce high metals results.

Sampling protocol can have significant effect on measured concentrations. It is TRINITY's experience that when groundwater is collected from wells installed in clastic aquifers, such as the Ogallala Aquifer, large discrepancies between total and dissolved metal results are suggestive of 'artificial' influence from the well, when comparing total and dissolved metal results. When similar concentrations for total and dissolved metals are reported during a single sampling event, the total result is likely an accurate reflection of the metal concentration in groundwater moving through the aquifer, and would suggest that the reported concentrations are ambient in origin, waste related, or both. To date, insufficient data has been collected to accurately determine a relationship between turbidity and elevated metals concentrations in total and dissolved groundwater samples.

Previous sampling events conducted at Cannon AFB have included dissolved (filtered) metal results. In the majority of sampling conducted prior to January 2010, only dissolved metal results appear to have been reported. NMED has previously accepted the use of dissolved metals data at Cannon AFB to support the argument that increased turbidity may result in increased metal concentrations. To date, insufficient data has been collected to accurately determine if any trends in metal concentrations in groundwater are evident. Depending on the data, a reasonable estimation of total and dissolved metal trends may be established after four sampling events. Therefore, TRINITY recommends continuing collection of total and dissolved metals at least for the next four years until accurate trends can be determined.

2.3.3 Sample Collection

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation. Every attempt must be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria. Based on the low yield of wells at Cannon AFB "low-flow" sampling methodologies are necessary. Therefore a low-flow electronic submersible or bladder pump will be used to minimize drawdown in the wells. It should be noted that a minimum column of water (i.e. hydrostatic

pressure) is necessary for proper equipment function. As water levels decline, adjustments to sampling protocol and equipment use may be required.

Field procedures for groundwater sampling were developed in general accordance with guidance provided by NMED (NMED, year unknown) and are detailed in Field Method No. 2 (included in Appendix B of this Work Plan Addendum). Requisite well details, sampling protocol, and groundwater parameters will be documented using the Ground Water Sampling Log included in Appendix A of this Work Plan Addendum. Well construction details are summarized in Table 2-3.

A flow-through cell attached to the pump discharge will be used to measure stabilization parameters. Purging will continue until all field parameters have stabilized for three consecutive readings according to the following criteria:

- Turbidity: ≤ 10 NTUs or ± 10% where > 10 NTUs
- pH: ± 0.1 units
- Specific Conductance (SpC): ± 10% of reading
- Dissolved Oxygen (DO): ± 0.3 milligrams per liter (mg/L) of reading
- Temperature: ± 10% of reading

Note: NTU: nephelometric turbidity unit

The current groundwater monitoring program is summarized below and the well locations are depicted on Figure 2-1. On the basis of the discussion in Section 2.3.2, both total and dissolved metals will be analyzed. In addition to a total metals sample, a groundwater sample will be collected for each well and immediately filtered with a 0.45 micron filter.

2.3.4 Field and Laboratory Analysis

The current groundwater monitoring program provides for biennial testing at 18 wells associated with the facility-wide LTM program at Cannon AFB (Table 2-4).

Table 2-3. Monitoring Well Construction Details

Site/SWMU	Monitoring Well ID	Land Surface Elevation (ft above NAVD88)	Latitude (NAD83)	Longitude (NAD83)	Top of Casing Elevation (ft above NAVD88)	Well Depth (ft bTOC)	Casing Material	Screen Length (ft)	Top of Screen Elevation (ft above NAVD88)	Bottom of Screen Elevation (ft above NAVD88)
LF-03/SWMU 105	Oa	4270.11	34.383425	103.297389	4271.07	365	PVC	60	3970.11	3910.11
LF-04/SWMU 104	Na	4266.00	34.388364	103.296278	4268.4	358	PVC	60	3972.88	3912.88
LF-05/SWMU 113	A	4263.83	34.221891	103.183144	4265.8	343	PVC	15	3935.83	3920.83
	B	4262.10	34.220267	103.181036	4265.41	362	PVC	15	3914.80	3899.80
	C	4263.72	34.215668	103.181650	4267.9	362	PVC	15	3916.72	3901.72
	D	4261.94	34.215713	103.182444	4265.9	357	PVC	15	3920.19	3905.19
	S	4260.70	34.215701	103.181070	4263.83	365	PVC	40	3976.72	3936.72
	U	4262.27	34.220481	103.180993	4265.26	365	PVC	40	3978.27	3938.27
LF-25/SWMU 97	Ra	4272.31	34.232350	103.180823	4275.32	311	PVC	30	3991.75	3961.75
	Pa	4270.85	34.386125	103.302297	4271.82	360	PVC	60	3875.85	3815.85
Sewage Lagoons/ SWMU101	E	4279.70	34.232651	103.182623	4281.12	373	PVC	15	3924.70	3909.70
	F	4274.93	34.231290	103.181432	4278.5	375	PVC	15	3919.93	3904.93
	G	4276.46	34.231286	103.181207	4279.99	372	PVC	15	3919.46	3904.46
	H	4275.98	34.230722	103.181743	4276.15	375	PVC	15	3920.98	3905.98
Perimeter	T	4260.82	34.220007	103.180947	4263.69	365	PVC	40	3976.82	3936.82
	V	4324.82	34.405000	103.336839	-	370	PVC	60	4019.82	3959.82
	X	4296.95	34.396844	103.396844	-	365	PVC	60	3996.95	3936.95
	W	7264.76	34.372822	103.328650	-	336	PVC	40	3973.76	3933.76

Notes: bTOC: below top of casing; ft: feet; NAVD88: North American Vertical Datum of 1988; NAD83: North American Datum of 1983; PVC: polyvinyl chloride

Table 2-4. Laboratory Analysis and Methods Requirements

Site/SWMU	Monitoring Well ID	Analytical Suite/Method[1]									
		VOCs[2]	TAL Metals (incl. Mercury)	Chromium (VI)	Perchlorate	Chloride	Nitrate/ Nitrite	Sulfate	Ammonia	TOC	Field Parameters[3]
		8260	6010/7470	7196	6860	300.1	300.1	300.1	SM4500	SM5310	-
LF-03/SWMU 105	Oa	X	X	X	X	X	X	X	X	X	X
LF-04/SWMU 104	Na	X	X	X	X	X	X	X	X	X	X
LF-05/SWMU 113	A	X	X	X	X	X	X	X	X	X	X
	B	X	X	X	X	X	X	X	X	X	X
	C	X	X	X	X	X	X	X	X	X	X
	D	X	X	X	X	X	X	X	X	X	X
	S	X	X	X	X	X	X	X	X	X	X
	U	X	X	X	X	X	X	X	X	X	X
LF-25/SWMU 97	Ra	X	X	X	X	X	X	X	X	X	X
	Pa	X	X	X	X	X	X	X	X	X	X
Sewage Lagoons/ SWMU 101	E	X	X	X	X	X	X	X	X	X	X
	F	X	X	X	X	X	X	X	X	X	X
	G	X	X	X	X	X	X	X	X	X	X
	H	X	X	X	X	X	X	X	X	X	X
Perimeter	T	X	X	X	X	X	X	X	X	X	X
	V	X	X	X	X	X	X	X	X	X	X
	W	X	X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X	X	X	X

Notes: SM: Standard Method; TAL: Target Analyte List; TOC: total organic carbon; VOC: volatile organic compound
[1] Methods: 6010, 6860, 7196, 7470, 8260 – adapted from the USEPA SW846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods; Method 300.1 – adapted from EPA Drinking Water Methods; Methods SM4500, SM5310 – adapted from Standard Methods Committee
[2] VOCs: Target Compound List
[3] Field Parameters: pH, dissolved oxygen (DO), specific conductance (SpC), Turbidity, Temperature

2.3.5 Sample Containers and Preservation Techniques

The primary contract laboratory, Gulf Coast Analytical Laboratories, Inc. (GCAL) of Baton Rouge, Louisiana will provide new, certified clean sample bottles for analyses according to previously specified requirements. Sample containers will contain preservatives where applicable in the appropriate sample containers, placed there by the laboratory. Sample container requirements for the analyses anticipated and preservation requirements to be required for this project are summarized in Table 2-5 below.

Table 2-5. Sample Containers and Preservation

Groundwater				
Analytical Parameter	**Method**	**Container**	**Preservation**	**Maximum Holding Time**
Ammonia	SM4500	500-mL HDPE	H2SO4 to pH < 2, Cool 4°C	28 days
Anions	300.1	500-mL HDPE	Cool 4°C	Nitrite/Nitrate 48 hours; Others 28 days
Chromium (VI)	7196A	500-mL HDPE	Cool 4°C	24 hours
Mercury	7470A	500-mL HDPE	Cool 4°C, HNO_3 to pH < 2	28 days
Metals (Total & Dissolved)	6010B	500-mL HDPE	Cool 4°C, HNO_3 to pH < 2	180 days
Perchlorate	6860	125-mL HDPE	Cool 4°C	28 days
TOC	SM5310	Two 40-mL Amber vials	Cool 4°C, HCl to pH < 2	28 days
VOCs	8260B	Three 40-mL Amber vials	Cool 4°C, HCl to pH < 2	14 days
Notes: SM:Standard Method; mL: milliliter; °C: degrees Celsius; HNO_3: Nitric Acid; HCl: Hydrochloric Acid; H2SO4: Sulfuric Acid; HDPE – high density polyethylene; Anions: chloride, sulfate, nitrite and nitrate; TOC: total organic carbon; VOC: volatile organic compound				

2.4 Sample Packaging and Shipping Requirements

Samples for chemical analyses will be packed on wet ice in sealed coolers for transport to ensure a temperature of 4 ±2 degrees Celsius (°C) upon receipt by the contract laboratory.

Samples will be shipped by overnight commercial courier to the laboratory. The laboratory will be notified prior to sample shipments. The packaging of each cooler will follow these steps:

1. Ensure sample lids are tight.
2. Individually seal the sample containers and associated quality assurance/quality control (QA/QC) samples in Ziploc™ or other water tight plastic bags prior to packing them in the cooler with bubble wrap to prevent breakage during shipment.

3. Wet ice is to be doubled bagged in Ziploc™ or other plastic bags (to inhibit cross contamination of samples by melted water) and placed with the samples in the cooler to maintain the samples at a temperature of 4°C during shipping.
4. Fill cooler with enough packing material to prevent breakage of glass bottles.
5. Make sure the sample cooler has a temperature blank and trip blank (for shipment of VOC samples), and are properly packed.
6. Place associated chain-of-custodies (COCs) (as described in Section 3.4 of this Work Plan Addendum) in a waterproof plastic bag, and tape it to the inside lid of the cooler.
7. Following packing, seal the cooler lid with strapping tape. Affix two custody seals (signed and dated) about two corners of the cooler, across the seal of the lid, and cover with clear tape.
8. Ship all samples in accordance with International Air Transport Association (IATA) and U.S. Department of Transportation (USDOT) regulations.

2.5 Decontamination Procedures

All reusable equipment that comes into contact with potentially contaminated water or other material will be decontaminated prior to use at each sampling location. All equipment will be thoroughly decontaminated before use and between sampling locations. Standard operating procedures for equipment and personnel decontamination were developed in general accordance with guidance provided by NMED (NMED, year unknown) and are detailed in Field Method No. 3 (included in Appendix B of this Work Plan Addendum).

3 FIELD OPERATIONS DOCUMENTATION

3.1 Field Logbook and/or Sample Field Sheets

During field work, records will be maintained in the field, with digital copies maintained by the Field Site Manager. Records will include daily summary sheets and related field and daily logs (included in Appendix A of this Work Plan Addendum).

Field logbooks will be maintained to record site activities and field data in a neat, legible manner. Logbooks will be bound and pages consecutively numbered. Personnel will make logbook entries in indelible ink. The following information, at minimum, will be entered during the course of the project activities;

- Date and location
- Weather
- Personnel onsite (including subcontractors) and work performed
- Equipment and instrument checks
- Injuries and/or illnesses
- Changes to work instructions
- Work stoppage
- Visitors
- Other relevant events

Personnel will supplement logbooks and records by the use of preprinted forms (that is, safety inspection forms and tailgate safety briefings). These forms help to ensure uniformity of activities being conducted, inspected, and reviewed. Project forms are located in Appendix A of this Work Plan Addendum. All handwritten records and logbook entries will be scanned into an acceptable digital form and submitted to Cannon AFB and the AFCEE as part of the digital data package.

3.2 Photographic Records

A Photographic Log will be maintained by the Field Site Manager. The field logbook, described in Section 3.1, will be used to record all photographs taken at the site. Photographic information will include the following details:

- Date and time taken;
- Unique identifying number(s) relating to the Photographic Logbook;
- Location photograph was taken including Global Positioning System (GPS) coordinates; and
- Brief description of the subject matter.

3.3 Sample Numbering System

Sample containers will be labeled using existing well IDs. The sample identification number will be logged in the field logbook and on the COC form.

QA/QC samples are denoted by adding an extension at the end of the sample identification number. The extensions are as follows:

Table 3-1. Sample QA/QC Extensions

Extension	Description
-a	Field duplicate
-c	Trip blank
-d	Equipment blank
-MS	Matrix spike
-MSD	Matrix spike duplicate

3.4 Chain-of-Custody Records

The purpose of the COC is to provide continuous possession of samples from their origin to completion of analysis and archiving/disposal in the laboratory. This uninterrupted possession is required to maintain integrity of samples. The COC record is the documentation of this uninterrupted possession of the samples. The following method is prescribed for documenting COC.

- To simplify the COC record and eliminate potential litigation problems, as few people as possible should handle the sample or physical evidence.
- The field investigator is responsible for the proper handling and custody of the samples collected until they are properly and formally transferred to another person or facility.
- Sample labels shall be completed for each sample using water-proof, non-erasable ink.
- All samples shall be sealed immediately upon collection utilizing the custody seal. This requirement shall be waived if the field investigator keeps the samples in his/her continuous custody from the time of collection until they are delivered to the laboratory analyzing the samples.
- All samples must be documented in bound field log books.
- A COC record will be completed for all samples or materials collected. A separate COC record will be used for each final destination or laboratory used during the sampling event.
- All samples shall be accompanied by the COC record. The original COC record will be placed in a plastic bag inside the secured shipping container if samples are shipped. One

copy of the record will be retained by the field investigator or project leader. The original record will be transmitted to the field investigator or project leader after samples are accepted by the laboratory. This copy will become a part of the project file.

To complete the COC and to maintain an accurate record of sample collection, transport, analysis, and disposal, the following process will be used:

1. Samples will be accompanied by a COC at all times.
2. For ease of reporting, all samples collected during a single sampling event will be assigned the same Sample Delivery Group (SDG) number, when and where possible. It will be necessary to check with the laboratory to confirm the SDG number prior to shipment.
3. The COC record will be used by personnel responsible for ensuring the integrity of samples from the time of collection until shipment to the laboratory.
4. The COC record will be signed by each individual who has the samples in his or her possession.
5. The COC record will be initialed in the field by the person collecting the sample for every sample, or the COC may be initiated electronically prior to field activities. Every sample will be assigned a unique identification number, to be entered on the COC record. Any number of COC records and related samples can be shipped together.
6. The record will be completed in the field to indicate project, sampling team, etc.
7. The person responsible for samples must sign the "Relinquished by" in the "Custody Transfers Prior to Receipt by the Laboratory" section of the COC prior to releasing to overnight delivery service (FedEx, UPS, or similar services) or hand delivery to the laboratory.
8. If the samples are transported directly to the laboratory, the COC will be kept in the possession of the person delivering the samples.
9. If the samples are shipped to the laboratory by commercial carrier, the COC will be sealed in a watertight container and taped on the inside lid, and the shipping container sealed prior to being given to the carrier.
    - For samples shipped by commercial carrier, the waybill will serve as an extension of the COC record between the final field custodian and receipt in the laboratory. The sender's copy of the waybill must be stapled to the sender's copy of the COC and filed with the original. The waybill tracking number must be entered into the logbook and on the COC.
    - Upon receipt in the laboratory, the sample custodian will open the shipping containers, compare the contents with the COC record, ensure that document control information is accurate and complete, and sign and date the record. Any discrepancies will be documented on the COC form or on an internal laboratory

"condition upon receipt" form or equivalent.

- In the event of any discrepancies, the samples in question will be segregated from normal sample storage, and the Project Chemist will be immediately notified.
- The original COC will accompany the hardcopy analytical report and will be completed upon receipt by the analytical service laboratory.

4 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW) generated during groundwater sampling activities will include monitoring well purge water, decontamination water, and personal protective equipment (PPE). All wastewater generated during well purging and equipment decontamination will be placed in bulk liquid storage tanks located adjacent to each monitoring well. Each container will be clearly labeled to identify the contents, date of generation, generation location, media, contact information, container number, restrictions for adding or removing contents, and the statement "Waste Classification Pending Analytical Results".

Monitoring well analytical results from the associated samples will be used to characterize the IDW by applying the "20 Times Rule" (40 Code of Federal Regulations [CFR] §261.24). If analytical results are greater than or equal to 20 times any of the Toxicity Characteristic Leaching Procedure (TCLP) regulatory limits (40 CFR §261.24), then a waste characterization sample will be collected and analyzed for TCLP. TCLP regulatory limits are summarized in Table 4-1. The results from these analyses will be compared directly to TCLP regulatory limits. IDW that is characterized as hazardous waste will be sent to Eco-Logical of Amarillo, Texas or an equivalent waste management service for disposal.

If monitoring well analytical results are less than 20 times any of the TCLP regulatory limits, then groundwater screening criteria will be used to characterize IDW. If analytical results are less than the screening values, then IDW will be discharged to the ground surface from where the aqueous IDW was generated. If analytical results for any site-related contaminants are greater than the screening values, then the IDW will be handled as non-hazardous Resource Conservation and Recovery Act (RCRA) solid waste and disposed offsite at a subtitle D facility.

PPE, decontamination plastic, and similar waste material will be consolidated into contractor trash bags and placed in a solid waste dumpster designated by Cannon AFB personnel.

Table 4-1. TCLP Regulatory Limits

Contaminant	Regulatory Level (mg/L)	Contaminant	Regulatory Level (mg/L)
Metals		**VOCs**	
Arsenic	5.0	Benzene	0.5
Barium	100.0	Carbon tetrachloride	0.5
Cadmium	1.0	Chlorobenzene	100.0
Chromium	5.0	Chloroform	6.0
Lead	5.0	1,2-Dichloroethane	0.5
Mercury	0.2	1,1-Dichloroethylene	0.7
Selenium	1.0	Methyl ethyl ketone	200.0
Silver	5.0	Tetrachloroethylene	0.7
		Trichloroethylene	0.5
		Vinyl chloride	0.2

Notes: TCLP: Toxicity Characteristic Leaching Procedure; mg/L: milligram per liter; VOC: volatile organic compound

This page intentionally left blank.

5 SITE INSPECTIONS AND MAINTENANCE

5.1 Frequency

The vegetative cover inspections and maintenance will be conducted on an annual basis at LF-03, LF-04, LF-25, and the south area of the Sewage Lagoon site (SWMU-101). Institutional controls inspections will be conducted on an annual basis at LF-02, FT06, SD-12, SD-15, SD-17, SD-20, SWMU 2, SWMU 4, SWMU 6, SWMU 31, and SWMU 102. The annual institutional controls inspections will be documented in an annual report to be submitted to Cannon AFB and NMED. The annual landfill cover inspections and maintenance will be documented in the biennial long-term groundwater monitoring report to be submitted to Cannon AFB and NMED.

5.2 Procedures

The LTM contractor will be responsible for performing and documenting the site inspections, routine maintenance, and repairs at each of the sites. The inspection, maintenance, and repair activities are described in this section.

5.2.1 Inspections

Inspections shall consist of a review of the condition of the cover system, including vegetation and any associated drainage and erosion control features, to determine whether all components are functioning as designed. The perimeter fence, gates, and signage will be included in the inspection, if present at the site.

All site inspections will be recorded on the Landfill Cover System Inspection Report provided in Appendix C of this Work Plan Addendum. Two inspection report forms were developed, one for LF-03 and LF-04, and one for LF-25 and the Sewage Lagoon site (SWMU-101). A copy of the site map will accompany the Inspection Report and be manually updated as necessary during the inspection to reflect any changes to the site condition, maintenance activities performed, and areas requiring repairs. A complete photographic record will be taken during inspections to document site conditions.

5.2.2 Maintenance

The contractor will perform maintenance as required to ensure all erosion control features and other protection measures are in effective operating condition. Sediment or debris accumulations in areas that threaten proper function of an erosion control feature will be removed. Areas impacted by erosion will be filled in and contoured to maintain proper grade. Similarly, low graded areas designed to control storm water runoff will be recontoured to maintain proper function. Perimeter fence signage and locks will be replaced as necessary. Maintenance activities and description of areas or features requiring repair will be noted on the Inspection Report.

Tumbleweeds and other uprooted vegetation will be removed from areas within the landfill where they accumulate, such as along perimeter fence lines. The uprooted vegetation will be loaded on trucks for disposal as clean construction debris at a local municipal landfill or other approved facility. No material or debris will be disposed of within the limits of LF-03, LF-04, LF-25, or the Sewage Lagoon site (SWMU-101).

5.2.3 Repair

As needed, the contractor will perform minor repairs within two weeks of inspection unless otherwise directed by Cannon AFB. Minor repairs are those performed to restore original site conditions, such as backfilling gullies, rebuilding berms, and replacing signage. Repair activities may be scheduled jointly at the four sites to increase efficiency and limit the number of required mobilizations. Repair activities will be documented by photographs taken prior to and after completion of necessary repairs. An Inspection and Maintenance Report will be submitted to Cannon AFB and NMED documenting details of repair actions, including a site map showing the locations of all completed repairs.

Any repairs that require modification to the existing design, or re-engineering and generation of record drawings, are considered major repairs and are not included under this plan.

5.2.4 Landfill-03 (LF-03/SWMU 105) and Landfill-04 (LF-04/WMU 104)

5.2.4.1 Inspection and Maintenance Activities

LF-03 and LF-04 are very similar and are addressed in this plan together. Site locations and plan view outlines of the sites are depicted on Figure 5-1. A vegetative cover (open field) is present over both landfill sites. The surface of each landfill is relatively flat and no defined drainage pathways have formed on the cover surface or away from the former landfill sites. The inspection and maintenance requirements for the vegetative covers at LF-03 and LF-04 are summarized in Table 5-1.

Table 5-1. Summary of Inspection and Maintenance Activities–LF-03/SWMU 105 & LF-04/SWMU 104

Feature	Location	Inspection	Routine Maintenance
Cover surface	Over entire cover	- Integrity of cover - Exposure of buried waste - Maintain surface contours in low areas/depressions graded to prevent storm water runoff form discharging offsite - Building up of excessive debris that diverts intended storm water flow - Surface erosion; gully formation - Tumbleweed/uprooted vegetation	- Fill in gullies as necessary to restore grade - Maintain original contours of cover surface to prevent storm water runoff from leaving the site - Clean out excess debris - Remove uprooted vegetation
Vegetation	Over entire cover	- Extent of vegetation cover - Type of vegetation - General condition	- Document condition of vegetation - Site photographs

5.2.4.2 Repair Activities

The basic categories of potential repairs at LF-03 and LF-04 include:

- Grade and fill to repair erosion of surface cover.
- Grade surface to conform with original contours to prevent storm water flows from discharging offsite.
- Remove excessive silt and debris that diverts intended direction of storm water flows.
- Reseed localized areas where vegetation is sparse or where repairs have been performed.

5.2.5 Landfill 25 (LF-25/SWMU 97)

5.2.5.1 Inspection and Maintenance Activities

The current conditions of LF-25 including the general topography and existing drainage patterns at the site, and unique drainage and erosion control features requiring inspection and maintenance are shown on Figure 5-2. The inspection and maintenance requirements for the vegetative cover at LF-25 are summarized in Table 5-2.

Table 5-2. Summary of Inspection and Maintenance Activities – LF-25/SWMU 97

Feature	Location	Inspection	Routine Maintenance
Cover surface, especially steeper slopes	Over entire cover	- Integrity of cover - Exposure of buried waste - Maintain surface contours in low areas/depressions graded to prevent storm water runoff from discharging offsite - Building up of excessive debris that diverts intended storm water flow - Surface erosion; gully formation - Tumbleweed/uprooted vegetation	- Fill in gullies as necessary to restore grade - Maintain original contours of cover surface to prevent storm water runoff from leaving the site - Clean out excess debris - Remove uprooted vegetation
Berm	Landfill's southern and eastern edges	- Erosion along and adjacent to berm - Ponding and leakage through berm	- Restore berm to original contours to prevent runoff from the landfill - Minor grading
Perimeter fence and gates	Fence line	- Structural integrity - Tumbleweed and debris accumulation - Locks on gates	- Remove tumbleweed and debris - Replace damaged or missing locks
Signage on perimeter fence	Various	- Inspect signage for damage - Note missing signage	- Replace damaged or missing signage
Vegetation	Over entire cover	- Extent of vegetation cover - Type of vegetation - General condition	- Document condition of vegetation - Site photographs

5.2.5.2 Repair Activities

The basic categories of potential repairs at LF-25 include at a minimum:

- Grade and fill to repair erosion of cover surface.
- Restore grade at low areas/depressions to maintain original contours designed to prevent storm water runoff from discharging offsite.
- Grade and fill low areas along and adjacent to berm to prevent ponding and leakage through the berms.
- Remove excessive silt and debris that diverts intended direction of runon/runoff flows.
- Restore structural integrity of affected sections of the perimeter fence and gates.
- Replace faulty or missing locks on gates.
- Replace or repair damaged or missing perimeter fence signage as necessary.
- Remove tumbleweeds or other uprooted vegetation from fence line.
- Reseed localized areas where vegetation is sparse or where repairs have been performed.

5.2.6 Sewage Lagoons (SWMU 101)

5.2.6.1 Inspection and Maintenance Activities

The current condition of the south area of the Sewage Lagoon site including the general topography and existing drainage patterns at the site, and the unique drainage and erosion control features requiring inspection and maintenance are shown on Figure 5-3. The inspection and maintenance requirements for the vegetative cover system at the south lagoon are summarized in Table 5-3. No contaminated media remains in the north lagoon area and inspection and maintenance is not required.

Table 5-3. Summary of Inspection and Maintenance Activities – Sewage Lagoons (SWMU 101)

Feature	Location	Inspection	Routine Maintenance
Cover surface	Over entire cover	- Surface erosion, gully formation - Buildup of excessive silt and debris - Accumulation of weeds - Exposure of crushed concrete in eroded areas - Blockage	- Fill in gullies to restore grade - Clean out excess debris, silt, and weeds - Restore all areas of cover to original contours
Drainage Ditches	Perimeter of cover	- Erosion - Crushed concrete displacement - Excessive silt buildup - Tumbleweed accumulation	- Replace soil - Remove excess silt, debris, and tumbleweeds
Perimeter fence and gates	Fence line	- Structural integrity - Tumbleweed and debris accumulation - Locks on gates	- Remove tumbleweed and debris - Replace damaged or missing locks
Signage on perimeter fence	Various	- Inspect signage for damage - Note missing signage	- Replace damaged or missing signage
Vegetation	Over entire cover	- Extent of vegetation cover - Type of vegetation - General condition	- Document condition of vegetation - Site photographs

5.2.6.2 Repair Activities

The basic categories of potential repairs at the south lagoon include:

- Grade and fill to repair erosion of the engineered cover.
- Grade and fill low spots to original configuration.
- Remove silt or debris and accumulated tumbleweeds from drainage channels and fill in eroded areas to original configuration.
- Repair erosion along or adjacent to the drainage channels to direct storm water into channels.
- Replace crushed concrete displaced by storm water flows.
- Remove any excessive silt and debris that diverts intended direction of runon/runoff flows.
- Replace faulty or missing locks on gates.
- Replace damaged or missing perimeter fence signage as necessary.
- Reseed localized areas where vegetation is sparse or where repairs have been performed.

This page intentionally left blank.

6 REFERENCES

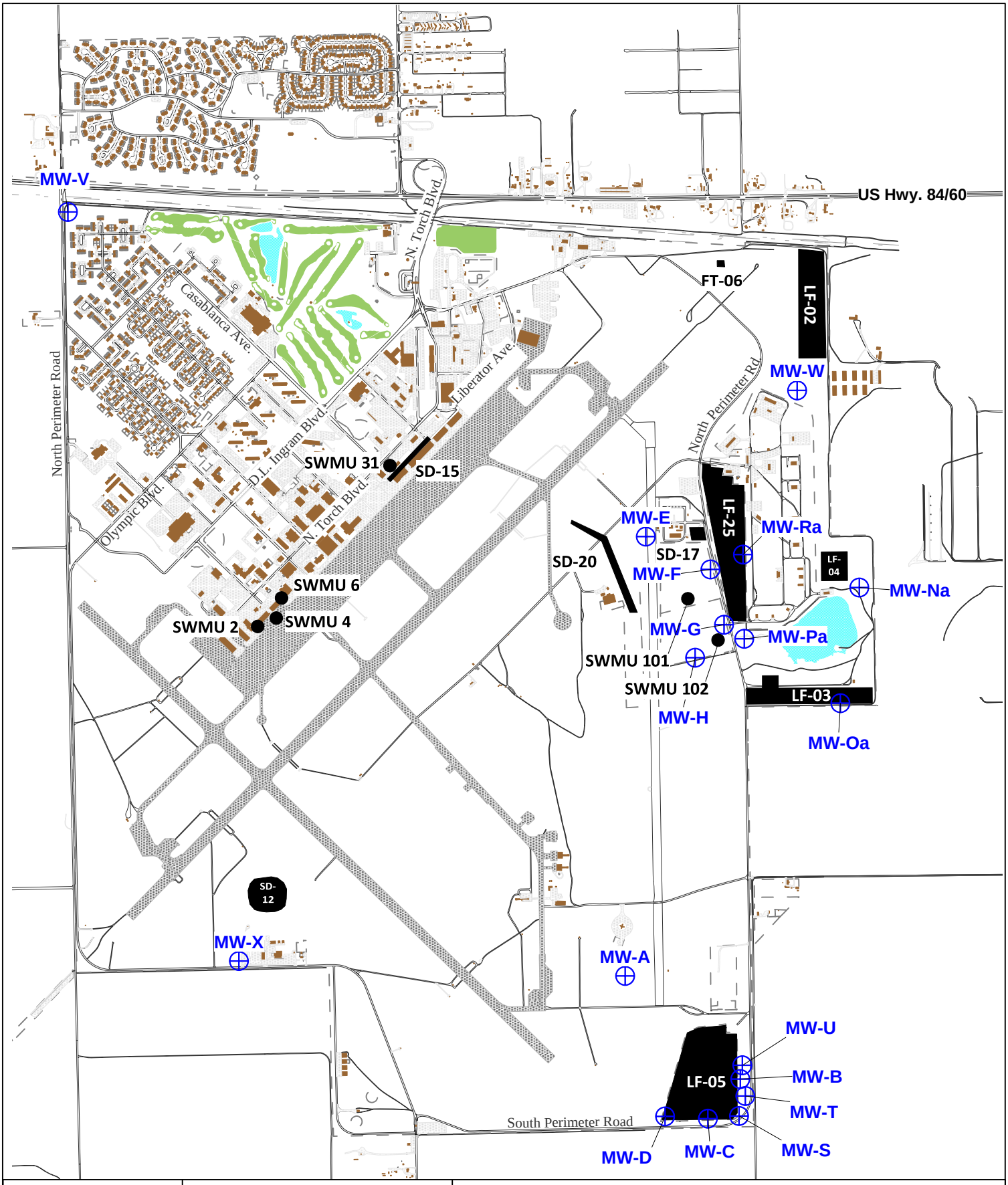
AECOM. (2011). *January 2011 Facility-Wide Long Term Ground Water Monitoring Plan.*

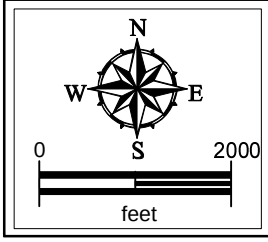
Department of Defense. (2009). *Department of Defense Quality System Manual Manual for Environmental Laboratories, Version 4.1, Based on NELAC Voted Revision, 6-5-2003.*

New Mexico Environment Department. (2008). *Ground Water Discharge Permit, Monitoring Well Construction, and Abandonment Guidelines, Revision 1.0, July 2008.*

NMED. (year unknown). *How to Sample A Monitoring Well.*

FIGURES



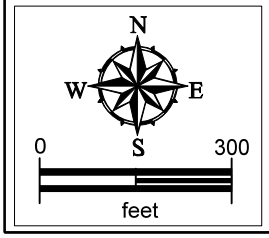


NOTES

Digital data files provided by GeoBase/CAFB
Projection: UTM Zone 13N, NAD 83

FIGURE 2-1
PLAN VIEW
LONG TERM MONITORING, MAINTENANCE & INSPECTIONS
Cannon Air Force Base
Curry County, New Mexico

Trinity Analysis & Development Corp.

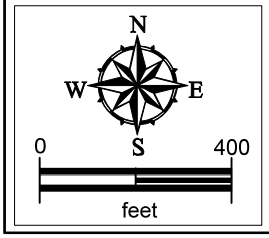


NOTES

Digital data files provided by GeoBase/CAFB
Projection: UTM Zone 13N, NAD 83

FIGURE 5-1
2009 AERIAL PHOTOGRAPH - LF-03/LF-04
LONG TERM MONITORING, MAINTENANCE & INSPECTIONS
Cannon Air Force Base
Curry County, New Mexico

Trinity Analysis & Development Corp.

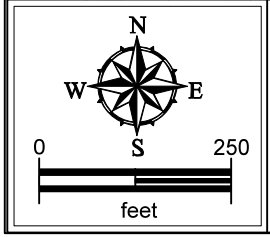


NOTES

Digital data files provided by GeoBase/CAFB
Projection: UTM Zone 13N, NAD 83

FIGURE 5-2
2009 AERIAL PHOTOGRAPH - LF-25
LONG TERM MONITORING, MAINTENANCE & INSPECTIONS
Cannon Air Force Base
Curry County, New Mexico

Trinity Analysis & Development Corp.



NOTES

Digital data files provided by GeoBase/CAFB
Projection: UTM Zone 13N, NAD 83

FIGURE 5-3
2009 AERIAL PHOTOGRAPH - SWMU 101
LONG TERM MONITORING, MAINTENANCE & INSPECTIONS
Cannon Air Force Base
Curry County, New Mexico

ATTACHMENTS

ATTACHMENT 1

SUPPORTING DOCUMENTS

PART 1

QUALITY ASSURANCE PROJECT PLAN

FINAL

QUALITY ASSURANCE PROJECT PLAN

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

Prepared for:

27 SOCES/CEAN
Cannon Air Force Base, New Mexico

Contract No.: FA8903-10-D-8594
Delivery Order No.: 0034

Under Contract To:

Air Force Center for Engineering and the Environment
772 ESS/PKS, building 171
Lackland AFB Base, TX 78236

Prepared by:

Bhate Environmental Associates, Inc.
1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205
Bhate Project No.: 9110129

April 2012

This page intentionally left blank.

QUALITY ASSURANCE PROJECT PLAN

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS QUALITY ASSURANCE PROJECT PLAN		
		4-17-12
Project Manager Tracy Walker, P.G.	Signature	Date
		4-17-12
Project Chemist David Badio, Jr.	Signature	Date

This page intentionally left blank.

QUALITY ASSURANCE PROJECT PLAN

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

List of Acronyms iii

1 Organization and Responsibilities 1

1.1 Project Laboratory Organization and Responsibilities 1
1.2 Data Assessment Organization and Responsibilities 1

2 Data Quality Objectives 3

2.1 Data Use Background 3
2.2 Measurement Quality Objectives for Chemical Data Measurement 3
2.2.1 Precision 3
2.2.2 Accuracy 4
2.2.3 Representativeness 4
2.2.4 Comparability 4
2.2.5 Completeness 4
2.2.6 Sensitivity 4

3 Sample Receipt, Handling, Custody, and Holding Time 5

3.1 Verification/Documentation of Cooler Receipt Condition 5
3.2 Corrective Action for Incoming Samples 6

4 Analytical Procedures 7

4.1 Preventive Maintenance 7
4.2 Calibration Procedures and Frequency 8
4.3 Laboratory QC Procedures 9
4.3.1 Analytical Sequence QC 9
4.3.2 Batch/Matrix-Specific/Performance-Based QC 9
4.4 Performance and System Audits 10
4.5 Nonconformance/Corrective Actions 11

5 Data Reduction/Calculation of Data Quality Indicators 13

5.1 Precision 14
5.2 Accuracy 14
5.3 Sample Reporting Limits 15

5.4 Completeness 15

6 Laboratory Operations Documentation 17

6.1 Sample Management Records 17
6.2 Data Reporting Procedures 17
6.2.1 Data Package Format and Contents 17
6.2.2 Electronic Deliverables 18
6.3 Data Management Procedures 19
6.3.1 Laboratory Turnaround Time 19
6.3.2 Data Archival/Retention Requirements 19

7 Data Assessment Procedures 21

7.1 Data Verification 21
7.2 Data QC Review 21
7.3 Data Validation 21
7.4 DQO Reconciliation 22
7.5 Project Completeness Assessment 22

8 References 23

Tables

2-1 Summary of Laboratory QC Limits
2-2 Summary of Field QC Samples
3-1 Summary of Sample Containers and Holding Times

Attachments

1 GCAL Organizational Chart
2 Bhate Chain of Custody Form
3 Laboratory QC Summary
4 DQO Attainment Verification Worksheet

LIST OF ACRONYMS

ADR	Automated Data Review
AFB	Air Force Base
APHA	American Public Health Association
AWWA	American Water Works Association
Bhate	Bhate Environmental Associates, Inc.
CAF	Corrective Action Form
CCV	Continuing Calibration Verification
CLP	Contract Laboratory Program
CoC	Chain-of-custody
csv	Comma separated values
DoD	Department of Defense
DHL	DHL Analytical, Inc.
DQI	Data Quality Indicator
DQO	Data Quality Objective
ECA	External Certificate Authority
EDD	Electronic data deliverables
ELAP	Environmental Laboratory Accreditation Program
ERPIMS	Environmental Restoration Program Information Management System
GCAL	Gulf Coast Analytical Laboratories, Inc.
GC/MS	Gas chromatography/mass spectroscopy
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LF	Landfill
LIMS	Laboratory Information Management System
LTM	Long-Term Monitoring
MDL	Method Detection Limit
MQO	Measurement Quality Objective
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
PARCCS	Precision, accuracy, representativeness, comparability, completeness, sensitivity
PT	Performance test
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCSR	Quality Control Summary Report
%R	Percent Recovery
RF	Response factors
RL	Reporting Limit

RPD	Relative Percent Difference
SDG	Sample delivery group
SEDD	Staged electronic data deliverable
SOP	Standard Operating Procedure
SWMU	Solid Waste Management Unit
SW-846	*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*
TOC	Total organic carbon
TRINITY	Trinity Analysis and Development Corp.
txt	Text
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile organic compounds
WEF	Water Environment Federation

1 ORGANIZATION AND RESPONSIBILITIES

1.1 Project Laboratory Organization and Responsibilities

The primary laboratory for this project will be Gulf Coast Analytical Laboratories, Inc. (GCAL) of Baton Rouge, Louisiana. They will perform all of the analysis except for perchlorate. The perchlorate analysis will be performed by DHL Analytical, Inc. of Round Rock, Texas, as a subcontractor to GCAL.

Gulf Coast Analytical Laboratories, Inc.
7979 GSRI Avenue
Baton Rouge, Louisiana 70820-7402
Phone: (225) 769-4900
Fax: (225) 767-5717

The GCAL primary laboratory contact is Ms. Dana Merrill, Project Manager. The GCAL project manager will be responsible for all communications with DHL Analytical. The GCAL organizational chart is presented in Attachment 1. GCAL will also be responsible for all data deliverables from DHL Analytical.

DHL Analytical
2300 Double Creek Drive
Round Rock, Texas 78664
Phone: (512) 388-8222
Fax: (512) 388-8229

1.2 Data Assessment Organization and Responsibilities

This section of the Quality Assurance Project Plan (QAPP) identifies personnel or organizations that will be performing data assessment activities. All definitive level data will be verified and reviewed and validated by the Bhate Environmental Associates, Inc. (Bhate) Project Chemist. Data assessment procedures are discussed in Section 7 of this QAPP.

The Bhate Project Chemist, Mr. David Badio, will report directly to the Bhate Project Manager, Mr. Tracy Walker, P.G. The Bhate Project Chemist will also be the primary point of contact between Bhate and the subcontractor laboratory for routine communications and problem resolution.

This page intentionally left blank.

2 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) specify the data type, quality, quantity, and uses needed to make decisions and are the basis for designing data collection activities. The following sections define the intended use of the data, and any specific conditions, criteria, or limits to be applied to the data based upon this use.

2.1 Data Use Background

The primary focus of the project is the continuation of the Long-Term Monitoring (LTM) activities including groundwater monitoring and vegetative cover inspections and maintenance at the following landfills (LFs) and solid waste management units (SWMUs): LF-03/SWMU 105, LF-04/SWMU 104, LF-25/SWMU 97, and SWMU 101 (Sewage Lagoons) at Cannon Air Force Base (AFB).

Bhate is being supported on this Delivery Order by Trinity Analysis and Development Corp. (TRINITY), which has extensive institutional knowledge of the LTM program at Cannon AFB.

Samples will be collected and analyzed using standardized U.S. Environmental Protection Agency (USEPA) methods and Standard Methods for the Analysis of Water and Wastewater. The analytical methods and target analytes are presented in Table 2-1.

2.2 Measurement Quality Objectives for Chemical Data Measurement

To ensure that quality data are continuously produced during analysis and allow the eventual compliance review, systematic Quality Control (QC) checks are incorporated into the sampling and analyses to show that procedures and test results remain reproducible and that the analytical method is actually measuring the quantity of target analytes without unacceptable bias. Systematic QC checks include the scheduled analyses of field and laboratory replicates, standards, surrogates, spiked samples, and blanks. Measurement quality objectives (acceptance criteria or ranges) or MQOs will be expressed as data quality indicators (DQIs). DQIs (formerly known as PARCCS [precision, accuracy, representativeness, comparability, completeness, and sensitivity]) are further discussed below.

2.2.1 Precision

Both field and laboratory precision will be assessed as part of the data validation procedure. The field precision will be evaluated through the use of Field Duplicates, while the laboratory precision will be evaluated through the use of spike duplicates (either matrix or laboratory). In both cases the precision will be determined by calculating the relative percent differences (RPDs) between the original and duplicate samples. The laboratory RPD QC limits are presented in Table 2-1 and field QC samples are presented in Table 2-2.

2.2.2 Accuracy

Accuracy objectives will be assessed as part of the data validation procedure. The accuracy will be evaluated through the use of laboratory control samples (LCS), matrix spikes (MSs), and surrogates. In each case, the accuracy will be determined by calculating the percent recovery (%R) for each analyte. The laboratory %R QC limits for LCS, MS, and surrogates are presented in Table 2-1.

2.2.3 Representativeness

Representativeness is also a qualitative term that is related to the sample collection procedures. Representativeness is a parameter that is concerned primarily with the proper design of the sampling program or subsampling of a given sample. Samples that are improperly preserved or collected, or are analyzed beyond the method holding time, would not provide data that represented the sampling site. In addition, if the laboratory subsampling criteria were not met, i.e. proper premixing and homogenizing, the resulting data would not be representative of the initial sample collected.

2.2.4 Comparability

Comparability is a qualitative term of which the objective is to ensure that the data set collected during the sampling event is comparable or agrees with the data set collected during the most recent sampling event. In order to ensure that the data sets are comparable, the same methods used to analyze the parameters in the most recent sampling event will be used during the sampling event.

2.2.5 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for each site. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an “R” (data rejected) flag. The completeness goal is 90 percent for groundwater samples.

2.2.6 Sensitivity

Sensitivity will be measured based on the laboratory method detection limits (MDLs) and the method reporting limits (RLs). The laboratory must be able to measure the contaminants of concern at or below the regulatory limits, which for this project are the site specific clean-up levels. The laboratory established MDLs and RLs are presented in Table 2-1.

3 SAMPLE RECEIPT, HANDLING, CUSTODY, AND HOLDING TIME

This section identifies the requirements for sample receipt condition verification, sample storage and/or handling requirements, any intra-laboratory custody requirements, and analytical parameter holding times. In addition, all notifications, customer correspondence, and corrective actions for incoming samples must be thoroughly documented and available for review. See Table 3-1 for a summary of the sample containers, preservation, methods, and holding times for this project.

A chain-of-custody (CoC) record will be initiated at the sampling stage and will accompany the sample throughout the analysis and reporting stages of the process. See Attachment 2 of this QAPP for an example CoC form. Sample reports will be easily traceable to CoC records. In addition, GCAL uses a laboratory information management system (LIMS) that tracks samples and the associated data throughout the laboratory. All documentation pertaining to sample receipt or analysis will be included in the laboratory's data report.

Once samples are received by GCAL or DHL, labels that include bar codes are placed on each sample. Each sample is scanned every time the custody of the container is changed and the information is stored in the LIMS. The LIMS stores a complete record of the sample custody from receipt to disposal. The sample information stored by the LIMS would also include the location of the sample, the date and time of each custody transfer, unique initials of each person assuming custody, and the reason for sample transfer.

3.1 Verification/Documentation of Cooler Receipt Condition

Upon arrival at the laboratory, the log-in personnel will inspect the coolers and samples. The integrity of each sample will be determined by comparing sample labels with the CoC and by visual check of the container for possible damage. The following procedures will be performed at the time of sample receipt:

- Verify that the custody seal on the cooler is intact and that the samples have not been tampered with.
- Verify complete documentation of all samples (sample ID, time, date, analyses requested, etc.) are included on the CoC.
- Verify that the appropriate type and number of containers for the indicated analyses have been received by the laboratory.
- Use the proper laboratory documentation to note missing or damaged sample containers.
- Measure the temperature of the samples for those analyses that will require thermal preservation (using the temperature blank included in the cooler).

All findings will be documented by the laboratory on a cooler receipt form or similar document, and become part of the final data package.

3.2 Corrective Action for Incoming Samples

Any deviations found during the sample log-in procedure will be documented on the cooler receipt form, which will be submitted to the Bhate Project Chemist electronically. The Bhate Project Chemist will also notify the Bhate Project Manager of any deviation and ensuing correction action as soon as possible. The laboratory will not proceed with the processing and analysis of any problem samples without approval by the Bhate Project Chemist. If holding times have been exceeded, the laboratory must notify the Bhate Project Chemist within 48 hours of the occurrence. If the Bhate Project Chemist determines that the issues may impact the quality or usability of the data, he will notify the Bhate Project Manager to determine if further action such as re-collecting the sample is required.

4 ANALYTICAL PROCEDURES

This section of the QAPP identifies the appropriate analytical test methods to be used for each environmental sample. All analyses will be performed using standard USEPA laboratory methods as presented in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Final Update IV* (USEPA, January 2008); *Environmental Monitoring Systems Laboratory, Office of Research and Development, USEPA, Cincinnati, OH* (August 1993); and *Standard Methods for the Examination of Water and Wastewater,* published by the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF), November 2010.

The analytical method that will be used to analyze for volatile organic compounds (VOCs) will be SW8260B. The analytical method that will be used to analyze for perchlorate will be SW6860. The analytical methods that will be used to analyze for metals will be SW6010B and SW7470A. The analytical method that will be used to analyze for total organic carbon (TOC) will be SW9060A. Method SW9060A is equivalent to method SM5310. The analytical method that will be used to analyze for the anions (chloride, nitrite, nitrate, and sulfate) will be SW9056A. Method SW9056A is equivalent to method EPA 300.1. The analytical method that will be used to analyze for ammonia will be SM4500 NH3 E. The target analytes and their associated MDLs and RLs are presented in Table 2-1.

4.1 Preventive Maintenance

This section of the QAPP discusses the laboratory's preventive maintenance plan that will be implemented to minimize downtime of laboratory instruments. The laboratory follows a well defined program to prevent the failure of laboratory equipment or instrumentation during use. The program of preventative maintenance helps avoid delays due to instrument failure. GCAL and DHL Analytical adheres to the procedures presented below.

All routine maintenance is performed as recommended by the instrument manufacturer. Maintenance contracts are purchased for most instruments. This ensures periodic preventive maintenance visits by factory authorized service representatives and immediate service for corrective actions if required.

When a piece of equipment is deemed defective, it is taken out of service and identified with an "OUT OF SERVICE" label. For support equipment such as balances, ovens, coolers, and pipettes, the Quality Assurance (QA)/QC Department is notified so that proper servicing and repair can be scheduled. The analysts perform routine and preventative maintenance for major instrumentation. If outside service is necessary, the Department Supervisor schedules the service call, with approval from the Laboratory Manager. Satisfactory instrument performance must be verified prior to returning to service any repaired equipment.

A maintenance log is issued for each piece of equipment. It shall be maintained by the analyst to describe problems, the maintenance performed on the instrument and outcome. This includes routine service checks by laboratory personnel (unless described in the Standard Operating Procedure [SOP]) as well as factory service calls. This log also provides a written source for future use in preventative maintenance. The logs are periodically reviewed by QA personnel.

4.2 Calibration Procedures and Frequency

This section of the QAPP discusses the calibration procedures that are to be used by the subcontractor laboratories. Analytical instruments shall be calibrated in accordance with the analytical methods. All analytes reported shall be present in the initial and continuing calibrations, and these calibrations shall meet the acceptance criteria specified by the method. All results reported shall be within the calibration range. Results outside the calibration range are unsuitable for quantitative work and will only give an estimate of the true concentration. Records of standard preparation and instrument calibration shall be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantitation of sample results. Calibration standards shall be traceable to standard materials.

Instrument calibration shall be checked using all of the analytes listed in Table 2-1 of this QAPP for each of the methods. All calibration criteria shall satisfy the method requirements at a minimum. The initial calibration shall be checked at the frequency specified in the method using materials prepared independently of the calibration standards. Multipoint calibrations shall contain the minimum number of calibration points specified in the method with all points used for the calibration being contiguous. If more than the minimum number of standards is analyzed for the initial calibration, all of the standards analyzed shall be included in the initial calibration. The only exception to this rule is a standard that has been statistically determined as being an outlier can be dropped from the calibration, providing the requirement for the minimum number of standards is met. Acceptance criteria for the calibration check will be as required in the method.

Analyte concentrations are determined with either calibration curves or response factors (RFs). For the gas chromatography/mass spectroscopy (GC/MS) method, when using RFs to determine analyte concentrations, the average RF from the initial five point calibration shall be used. The continuing calibration shall not be used to update the RFs from the initial five point calibration. The continuing calibration verification (CCV) cannot be used as the LCS. In addition, the concentration used for the calibration verification sample shall be at or below the middle of the calibration curve. Finally, the lowest standard used must be at or below the RL for each analyte in the method.

4.3 Laboratory QC Procedures

This section of the QAPP identifies the specific internal QC measures to be used by the laboratory when performing the analytical tests. Laboratory overall method performance shall be monitored by the inclusion of various internal QC checks that allow an evaluation of method control (batch QC), and the effect of the sample matrix on the data being generated (matrix-specific QC). Batch QC is based on the analysis of a laboratory control sample to generate accuracy (precision and bias) data and method blank data to assess the potential for cross contamination. Matrix-specific QC shall be based on the use of an actual environmental sample for precision and bias determinations from the analysis of MSs, MS duplicates (MSDs), and surrogate spikes, etc. The overall quality objectives are to implement procedures for laboratory analysis and reporting of data that are indicative of the degree of quality consistent with their intended use. A summary of laboratory QC requirements for each parameter is presented in Attachment 3.

4.3.1 Analytical Sequence QC

The analysis sequence shall be defined as samples that are analyzed together within the same time period or in continuous time periods on one instrument under the control of one continuing calibration verification. Analysis sequences are bracketed by the appropriate continuing calibration verification standards and other QC samples as defined by the analytical method. Each analysis sequence shall contain the requisite number and type of calibration solutions, QC samples, and regular analytical samples as defined by the analytical method.

Analytical sequence QC shall include calibration blanks, continuing calibration verifications, and any other special analytical sequence QC required by the method.

4.3.2 Batch/Matrix-Specific/Performance-Based QC

Internal QC methods require performance on a sample batch basis and include analyses of method blanks, laboratory control samples, and actual environmental samples as duplicates, matrix spikes, and matrix spike duplicates. The basic unit for application of laboratory QC is the batch. Samples shall be prepared, analyzed, and reported in batches and be traceable to their respective batches. Batch sizes are normally limited to 20 field samples of a similar matrix but can exceed this by incorporating additional QC samples. Field QC samples, i.e., trip blanks, rinsates, etc., shall not knowingly be used for batch QC purposes.

Batch QC samples shall include method blanks, surrogates, LCSs, MSs, and MSDs, and any other special batch QC samples required by the method.

4.4 Performance and System Audits

This section of the QAPP describes the performance and system audits that will be performed onsite and at the contractor's laboratory. The laboratory audits are typically conducted internally by the laboratory QA staff, as well as by external agencies.

GCAL participates in at least two Water Pollution, two Underground Storage Tank (UST), and two Hazardous Waste performance tests (PTs) annually. The QA/QC Department orders the necessary PT at approximately six-month intervals from an Environmental Laboratory Accreditation Program (ELAP) approved vendor. When samples are received, they are logged into the LIMS as a work order. All PT samples are analyzed as client samples with the normal batch QC performed. It is the policy of GCAL that PT samples are handled as client samples throughout the analytical process. It is inappropriate to analyze multiple duplicates or dilutions unless this procedure is described in the approved analytical SOP, as the required analytical method for all samples. Any problems with the PT samples shall be immediately communicated to the QA/QC Department.

All audit findings, any corrective actions, root cause determination, etc., shall be fully documented in QA reports to management. The QA officer shall document that all corrective actions necessary are verified complete within a reasonable time frame.

Before any samples are analyzed by the laboratory in support of this project the laboratory will have undergone a Department of Defense (DoD) ELAP audit and received a current certification for all methods used for analysis of samples from this project. External audits and assessments are scheduled through the QA/QC Director with regulators and clients. It is the policy of GCAL that all information pertaining to that client or scope of accreditation be available for review by the auditor(s). Client confidentiality must be maintained throughout the audit process. The QA/QC Director is responsible for monitoring the audit, reviewing all findings, issuing a corrective action plan in a timely manner, and follow-up to ensure agreed changes are implemented. All documentation pertaining to the audit is kept on file. External audits may be performed before or during the project by either the AFCEE or Bhate at their discretion.

Both GCAL and DHL are currently certified ELAP laboratories and are certified for the analytical methods that they will be performing in support of this project.

GCAL system audits are performed to determine if all aspects of the QA program are operational. Through the use of a checklist (published National Environmental Laboratory Accreditation Conference [NELAC] checklist), the QA/QC Director reviews all information pertaining to QA systems, summarizes the situation and notes any deficiencies. A report is prepared based on the audit and is distributed to management in a timely manner. The report is also reviewed with laboratory personnel, so that a concerted effort can be made to correct any deficiencies, as well as provide positive feedback. The QA/QC Director reviews the following elements of the program:

- Sample handling, including custody and storage procedures
- Sample analysis
- Records
- Preventative maintenance
- PT programs
- Training
- Project Management
- Report Generation

4.5 Nonconformance/Corrective Actions

This section of the QAPP addresses corrective actions that must be implemented if MQOs are not met. When errors, deficiencies, or out-of-control situations exist, corrective action is taken. The following corrective actions used by GCAL are described below:

Internal corrective actions are documented on the Corrective Action Form (CAF). Initiation of corrective action shall be by any GCAL staff that identifies a problem. All forms must return to the QA/QC Director or Technical Director for review and approval. The QA/QC Director or Technical Director shall investigate to verify resolution. The QA/QC Director shall close the CAF or plan for follow-up if determined necessary before CAF is considered closed. If the corrective action was unsuccessful, the above procedure is to be repeated. This form is completed for any corrective action initiated in-house. When a situation results in a change in data reported, a corrected report shall be prepared and submitted to the client. The corrected report file copy shall then be attached to the top of the original report file copy so that sample analytical data is complete and accurate. The CAF is tracked by a controlled logbook. Originals are collected and filed in the QA department.

If the result of a corrective action or audit cast doubt on the validity of a sample result, the Bhate Project Chemist must be notified. Client notification and further instructions must be documented.

This page intentionally left blank.

5 DATA REDUCTION/CALCULATION OF DATA QUALITY INDICATORS

This section of the QAPP discusses how data are reduced by the laboratory and define how the precision, accuracy, sensitivity parameters (detection, quantitation, and reporting limits), and completeness goals are to be calculated from the project data. Data reduction procedures, whether performed by the instrument or manually, shall follow methodologies outlined within the laboratory SOP or analytical method.

All analytical data generated by the laboratory shall be extensively reviewed prior to report release to assure the validity of the reported data. This internal data evaluation process shall cover the areas of data generation, reduction, and a minimum of three levels of documented review. For each level, the review process shall be documented using an appropriate checklist that is signed and dated by the reviewer. The analyst who generates the analytical data has the prime responsibility for the correctness and completeness of the data. Each step of this review process involves evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the data evaluation is essential in ensuring that data of known quality are generated consistently. All data generated and reduced shall follow well-documented in-house protocols.

Each analyst reviews the quality of his/her work based on an established set of guidelines. The review criteria as established in each method or within the laboratory shall be used. This review includes, but is not limited to, verifying that MQOs meet protocol criteria, calibration criteria are met, appropriate detection limits were used, data was reduced correctly and that any non-conformance or corrective action was documented properly. The analyst will perform a primary review of 100% of the data generated.

The secondary review shall be performed by department supervisor or designee, who has documentation that supports demonstration of performance for all areas for which he/she provides review. The function of this review is to provide an independent, complete peer review of the analytical batch data package. This review shall also be conducted according to an established set of guidelines and will include calibration criteria, QC, compound identification, reporting limits, and level of documentation.

The final reviews are performed by the technical director or designee at the laboratory. This review shall provide a total overview of the data package, including sample receipt, to ensure its consistency and compliance with project-specific requirements. All errors noted shall be corrected and documented.

A laboratory QA review will be performed on approximately 5-10% of all laboratory projects by the laboratory QA officer. This review will cover technical completeness and accuracy.

5.1 Precision

Precision refers to the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed conditions. Precision reflects the random error and may be affected by systematic error. Precision also characterizes the natural variation of the matrix and how the contamination exists or varies within that matrix.

The precision of the data is quantified by the RPD between two results obtained for the same sample. The samples may be either internal laboratory QC samples (*i.e.*, LCSs) or field samples. A high RPD in an LCS/LCS Duplicate (LCSD) pair is an indication of overall method failure, and may result in the rejection of an entire data set. Laboratory matrix duplicates and MSDs are also assessed by their RPD values. High RPD values for matrix duplicates indicate a lack of reproducibility, and such data may be qualified or rejected. Any such results should be noted in the assessment of data quality. RPD is calculated as follows.

$$RPD = \frac{(X_1 - X_2)}{(X_1 + X_2)/2} \times 100$$

X_1 = original sample analyte concentration
X_2 = duplicate sample analyte concentration

5.2 Accuracy

Accuracy refers to the systematic or persistent distortion of a measurement process that causes errors in one direction (above or below the true value or mean). Accuracy may be affected by errors made in field or laboratory handling procedures. For example, procedural deviations in sample acquisition, incomplete homogenization prior to sub-sampling or incomplete extraction of contaminants from the matrix intensifies accuracy.

Analytical accuracy is measured by comparing the percent recovery of analytes spiked into an LCS, to a control limit. For organic compounds, surrogate compound recoveries are also used to assess accuracy and method performance for each sample analyzed. Accuracy will be reported as part of the data evaluation process, but the results reported by the laboratory will not be adjusted in any way based on this information. In support of this project, accuracy will be assessed by the use of surrogate compounds, LCSs, and MSs. %R is calculated as follows.

$$\%R = \frac{X_{measured}}{X_{true}} \times 100$$

X = analyte concentration

5.3 Sample Reporting Limits

The reporting limits to be used for this project are presented in Table 2-1. Reporting limits will be adjusted by the laboratory for sample-specific factors such as aliquot size, dilution factors, and moisture content.

5.4 Completeness

Completeness is calculated for the aggregation of data for each analyte measured for any particular sampling event or other defined set of samples (e.g. by site). Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. For completeness requirements, valid results are all results not qualified with an "R" flag (rejected) during the data validation process. The target for analytical data completeness on this project is 90 percent for groundwater samples. For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of possible results minus the number of possible results not reported.

$$\%\ \text{completeness} = \frac{\text{number of valid (i.e., non-R flagged) result}}{\text{number of possible results}}$$

This page intentionally left blank.

6 LABORATORY OPERATIONS DOCUMENTATION

This section of the QAPP discusses the data reporting procedures for the project. The reporting package format, contents, reporting schedule, data archival, and records retention requirements. Electronic data deliverables format and technical content are identified here also.

6.1 Sample Management Records

These types of records include the documentation accompanying the samples (i.e., original chain-of-custody record, shipping documents, laboratory notification sheets), records generated by the laboratory that detail the condition of the samples upon receipt at the laboratory (i.e., sample cooler receipt forms, any telephone conversation records, etc.), and any records generated to document sample custody, transfer, analysis, and disposal.

6.2 Data Reporting Procedures

The analytical data packages will contain enough information to demonstrate that the project data quality objectives have been fulfilled. In general, this will allow a reviewer to determine the precision, accuracy, representativeness, comparability, completeness, and sensitivity of the data from information contained in the data package. The amount of information required to demonstrate attainment of DQOs depends upon the acceptable level of uncertainty for the intended data use. In general, the type of data package required for this project will fall into the general category of definitive data.

6.2.1 Data Package Format and Contents

The definitive data package format allows for the review of the data by an independent organization. However, this data package does not allow for complete independent reconstruction of the analytical data. Definitive data are produced using rigorous analytical methods, such as USEPA standard reference methods (e.g., SW-846, Contract Laboratory Program [CLP]). Analyte presence and quantitation are confirmed through extensive QC procedures at the laboratory, which may be onsite or offsite. Definitive hardcopy data packages should be received from the laboratory no later than seven days following sample analysis. Verbal results should be received from the laboratory within 48 to 72 hours of sample receipt.

At a minimum, all definitive data packages will include the following information:

- Cover Sheet. Including name and location of laboratory or laboratories, client name and address, site name and location, laboratory project number, statement of data authenticity, and official signature and title of person authorizing report release.

- Table of Contents. In a format that allows for easy identification and retrieval of information.
- Case Narrative. Including listing of samples included in the data package, the correlation between field sample identification and laboratory sample identification, and any deviation from analytical methods, holding times, associated QC limits, or any other information that could affect the sample results.
- Analytical Results. Including sample identification, matrix, collection date and time, extraction data and time, analysis date and time, method, preparation batch number, analytical batch number, analyte or parameter, and analytical result.
- Laboratory Reporting Limits. Including both the laboratory reporting limit and method detection limit.
- Sample management records. Including chain of custodies, shipping documents, laboratory sample receipt forms and any records generated to document sample custody, transfer, analysis, and disposal.
- QA/QC Information. Including the calibration, calibration verification, and internal laboratory QA/QC data with their respective acceptance criteria.

6.2.2 Electronic Deliverables

Laboratory deliverables will include electronic copies of the entire analytical data package in computer readable files (such as Acrobat Adobe's portable document file - pdf). One pdf file will be submitted for each sample delivery group (SDG).

Electronic data deliverables (EDDs) will be supplied in addition to the computer files in a format compatible with Bhate's in-house database, in order to facilitate use and interpretation of results, generation of tables, and archiving of laboratory data. These EDDs contain the same information as described for the hard copy deliverables. The EDDs use a common syntax for terms used to describe diverse laboratory activities and report analytical data. The EDDs should also provide sufficient input parameters to allow users to link analytical data to underlying laboratory activities, full traceability for data, and a means for reporting complex analytical relationships.

EDDs will be provided by the laboratory in the most recent version of Automated Data Review (ADR), in addition to the pdf files. Acceptable ADR file formats include text (txt), comma separated values (csv), or staged electronic data deliverable (SEDD 2A). An errorlog text file will also be submitted by the laboratory for each SDG. The ADR EDD will not be considered complete until the EDDs are run by Bhate's Project Chemist through the ADR Compliance Screener and the results compared to the errorlog file submitted by the laboratory.

In addition, the laboratory should provide EDDs in the most current version of the Environmental Restoration Program Information Management System (ERPIMS). The

laboratory will need to obtain an External Certificate Authority (ECA) in order to be able to use the latest version of ERPIMS, i.e. ERPToolsX. Bhate will upload the ERPIMS files to the appropriate ERPIMS website.

6.3 Data Management Procedures

Electronic data management systems shall be verified by the laboratory to ensure accurate data transfer, reduction, and reporting. All aspects of the data management system shall be fully documented by the laboratory.

6.3.1 Laboratory Turnaround Time

Definitive hardcopy data packages should be received from the laboratory no later than 15 business days following laboratory sample receipt. This turnaround time will end upon receipt (and completeness check) of all data deliverables by Bhate.

6.3.2 Data Archival/Retention Requirements

All reported data packages will be retained by the laboratory for a minimum of five years. In the event of laboratory closure, all applicable documents must be transferred to Bhate for continued archiving.

This page intentionally left blank.

7 DATA ASSESSMENT PROCEDURES

This section of the QAPP discusses the data review, verification, or validation process that is required to assure the validity of the data. It also discusses the DQO reconciliation process and the effect that it has on the final assessment of project completeness. Any time chemical data are generated, their quality must be assessed prior to use. The type and degree of assessment required depends upon the project DQOs. Several different levels of data assessment exist, including data review, data verification, and data validation.

7.1 Data Verification

Data verification is the most basic assessment of data. Data verification is a process for evaluating the completeness, correctness, consistency, and compliance of a data package against a standard or contract. In this context, "completeness" means all required electronic deliverables (including computer files and EDDs) are present, complete and usable, when compared to the samples received by the laboratory based on the CoC. Data verification will be performed by the Bhate Project Chemist or their designee for definitive laboratory deliverables, and will be conducted on 100% of the data.

7.2 Data QC Review

Data review is the next step in the data assessment hierarchy. Data review includes an assessment of summary QC data provided by the laboratory. Data review may include examination of laboratory data and the internal QC and QA sample results to ascertain the effects on the primary laboratory's data. Data qualifiers will be applied by the Bhate Project Chemist as appropriate, to alert the data user of deficiencies in the data. The results of the review will be documented in a Quality Control Summary Report (QCSR). Data review will be performed by the Bhate Project Chemist or their designee under the supervision of the Bhate Project Chemist on 100% of the definitive laboratory deliverables.

7.3 Data Validation

Validation is a process of data assessment in accordance with USEPA regional or National Functional Guidelines, or project-specific guidelines. Data validation may include an assessment of the whole raw data package from the laboratory. Data validation will be performed on all definitive data generated in support of this project. Validation will be a process of data assessment in accordance with current USEPA National Functional Guidelines for organic analyses. The ADR Software will be used for data validation and preparation of data summary tables. Manual data validation to address those QC requirements not covered by ADR will also be performed. Additional data validation qualifiers may be applied, in addition to those applied by ADR, as appropriate following manual data validation to alert the data user of

deficiencies in the data. The results of the validation process will be documented in a formal data validation report.

7.4 DQO Reconciliation

After the completion of field activities and the review and validation of the final analytical reports from the laboratory, the following will be reviewed to determine if the project met the specified DQOs. Verifying the attainment of the DQO statements should be done as follows:

- Verification should generally be done by the data user perspective(s) that will be using the data;
- Verification of DQO attainment must be completed before the data are used by the data users;
- All data quality requirements of a DQO statement should be verified; and
- Verification of DQO attainment is typically required to ensure contract compliance.

The DQO Attainment Verification worksheet provided in Attachment 4 will be used by Bhate for verifying DQO attainment.

7.5 Project Completeness Assessment

Following completion of all field work and laboratory analyses, the data completeness for the entire project will be assessed. Completeness goals, as defined for individual sampling and analytical protocols, are combined to assess the expectations of the project as a whole. Completeness is the percentage of measurements that are judged to be usable (i.e., which meet project-specific requirements) compared to the total number of measurements planned. The target for project completeness for the biennial sampling event is 90 percent.

8 REFERENCES

APHA, AWWA, WEF. November 2010. *Standard Methods for the Examination of Water and Wastewater.*

USEPA. August 1993. *Environmental Monitoring Systems Laboratory, Office of Research and Development, Cincinnati, OH.*

USEPA. July 2000. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis*, EPA QA/G-9.

USEPA. January 2008. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Final Update IV.

USEPA. June 2008. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-99-008 (PB99-963506).

USEPA. January 2010. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.*

This page intentionally left blank.

TABLES

Table 2-1
Summary of Laboratory QC Limits
Cannon Air Force Base, New Mexico

Parameter	CAS No.	Method Detection Limits	Reporting Limits	LCS		Matrix Spike Water		
		Water	Water	Water		MS Recovery		MSD
		MDL	RL	LCL	UCL	LCL	UCL	RPD
VOCs per EPA Method 8260B		µg/L	µg/L[1]	%	%	%	%	%
Acetone	67-64-1	0.32	25	40	135	40	135	20
Benzene	71-43-2	0.05	5	81	122	81	122	20
Bromobenzene	108-86-1	0.09	5	76	124	76	124	20
Bromochloromethane	74-97-5	0.24	5	65	129	65	129	20
Bromodichloromethane	75-27-4	0.07	5	76	121	76	121	20
Bromoform	75-25-2	0.28	5	69	128	69	128	20
n-Butylbenzene	104-51-8	0.07	5	69	137	69	137	20
sec-Butylbenzene	135-98-8	0.09	5	72	127	72	127	20
tert-Butylbenzene	98-06-6	0.06	5	70	129	70	129	20
Chlorobenzene	108-90-7	0.05	5	81	122	81	122	20
Chloroethane	75-00-3	0.28	5	58	133	58	133	20
Chloroform	67-66-3	0.06	5	69	128	69	128	20
2-Chlorotoluene	95-49-8	0.09	5	73	126	73	126	20
4-Chlorotoluene	106-43-4	0.04	5	74	128	74	128	20
Carbon disulfide	75-15-0	0.19	5	35	160	35	160	20
Carbon tetrachloride	56-23-5	0.05	5	66	138	66	138	20
1,1-Dichloroethane	75-34-3	0.06	5	69	133	69	133	20
1,1-Dichloroethene	75-35-4	0.18	5	68	130	68	130	20
1,1-Dichloropropene	563-58-6	0.07	5	73	132	73	132	20
1,2-Dibromo-3-chloropropane	96-12-8	0.08	5	50	132	50	132	20
1,2-Dibromoethane	106-93-4	0.17	5	80	121	80	121	20
1,2-Dichloroethane	107-06-2	0.12	5	69	132	69	132	20
1,2-Dichloroethene (Total)	540-59-0	0.17	2	60	140	60	140	20
1,2-Dichloropropane	78-87-5	0.11	5	75	125	75	125	20
1,3-Dichloropropane	142-28-9	0.11	5	73	126	73	126	20
2,2-Dichloropropane	594-20-7	0.11	5	69	137	69	137	20
Dibromochloromethane	124-48-1	0.13	5	66	133	66	133	20
Dichlorodifluoromethane	75-71-8	0.09	5	30	153	30	153	20
cis-1,2-Dichloroethene	156-59-2	0.1	5	72	126	72	126	20
cis-1,3-Dichloropropene	10061-01-5	0.1	5	69	131	69	131	20
1,3-Dichlorobenzene	541-73-1	0.08	5	75	124	75	124	20
1,2-Dichlorobenzene	95-50-1	0.08	5	71	122	71	122	20
1,4-Dichlorobenzene	106-46-7	0.06	5	74	123	74	123	20
trans-1,2-Dichloroethene	156-60-5	0.09	5	63	137	63	137	20
trans-1,3-Dichloropropene	10061-02-6	0.07	5	59	135	59	135	20
Ethylbenzene	100-41-4	0.18	5	73	127	73	127	20
2-Hexanone	591-78-6	0.3	5	58	134	58	134	20
Hexachlorobutadiene	87-68-3	0.35	5	67	131	67	131	20
Isopropylbenzene	98-82-8	0.06	5	75	127	75	127	20
4-Isopropyltoluene	99-87-6	0.17	5	73	130	73	130	20
4-Methyl-2-pentanone	108-10-1	0.14	5	58	134	58	134	20
Bromomethane	74-83-9	0.28	5	30	141	30	141	20
Chloromethane	74-87-3	0.07	5	56	131	56	131	20
Methyl iodide	74-88-4	0.097	5	43	157	43	157	20
Dibromomethane	74-95-3	0.2	2	76	125	76	125	20
Methylene chloride	75-09-2	0.1	5	67	137	67	137	20
2-Butanone	78-93-3	0.23	5	49	136	49	136	20
Methyl Tert Butyl Ether	1634-04-4	0.08	1	65	123	65	123	20
Naphthalene	91-20-3	0.17	5	54	138	54	138	20
n-Propylbenzene	103-65-1	0.07	1	72	129	72	129	20
Styrene	100-42-5	0.06	1	65	134	65	134	20
1,1,1,2-Tetrachloroethane	630-20-6	0.15	1	89	121	89	121	20
1,1,1-Trichloroethane	71-55-6	0.08	1	67	132	67	132	20
1,1,2,2-Tetrachloroethane	79-34-5	0.11	1	63	128	63	128	20
1,1,2-Trichloroethane	79-00-5	0.18	1	75	125	75	125	20
1,2,3-Trichlorobenzene	87-61-6	0.11	1	55	140	55	140	20
1,2,3-Trichloropropane	98-18-4	0.06	2	73	124	73	124	20
1,2,4-Trichlorobenzene	120-82-1	0.14	1	66	134	66	134	20
1,2,4-Trimethylbenzene	95-63-6	0.08	2	74	132	74	132	20
1,3,5-Trimethylbenzene	108-67-8	0.05	2	74	131	74	131	20
Tetrachloroethene	127-18-4	0.14	1	66	128	66	128	20

Table 2-1
Summary of Laboratory QC Limits
Cannon Air Force Base, New Mexico

Parameter	CAS No.	Method Detection Limits	Reporting Limits	LCS		Matrix Spike Water		
		Water	Water	Water		MS Recovery		MSD
		MDL	RL	LCL	UCL	LCL	UCL	RPD
VOCs per EPA Method 8260B		µg/L	µg/L[1]	%	%	%	%	%
Toluene	108-88-3	0.08	1	77	122	77	122	20
Trichloroethene	79-01-6	0.09	1	70	127	70	127	20
Trichlorofluoromethane	75-69-4	0.09	2	57	129	57	129	20
Vinyl chloride	75-01-4	0.1	1	50	145	50	145	20
Vinyl Acetate	108-05-4	0.2	5	66	145	66	145	20
m,p-Xylene	136777-61-2	0.1	2	76	128	76	128	20
o-Xylene	95-47-6	0.08	1	80	121	80	121	20
Xylene (Total)	1330-20-7	0.12	3	75	130	75	130	20
Isopropyl Ether	108-20-3	0.1	5	75	125	75	125	20
Dibromofluoromethane (surr)	1868-53-7		--	85	115	--	--	--
Toluene-D8 (surr)	2037-26-5		--	85	120	--	--	--
4-Bromofluorobenzene (surr)	460-00-4		--	75	120	--	--	--
1,2-Dichloroethane-D4 (surr)	17060-07-0		--	70	120	--	--	--
TAL Metals per SW6010B/7470A		mg/L	mg/L	%	%	%	%	%
Aluminum	7429-90-5	0.024	0.2	80	120	80	120	20
Antimony	7440-36-0	0.004	0.06	80	120	80	120	20
Arsenic	7440-38-2	0.0035	0.01	80	120	80	120	20
Barium	7440-39-2	0.0016	0.01	80	120	80	120	20
Beryllium	7440-41-7	0.00008	0.005	80	120	80	120	20
Cadmium	7440-43-9	0.0001	0.005	80	120	80	120	20
Calcium	7440-70-2	0.0243	0.1	80	120	80	120	20
Chromium	7440-47-3	0.00034	0.01	80	120	80	120	20
Cobalt	7440-48-4	0.00052	0.01	80	120	80	120	20
Copper	7440-50-8	0.00017	0.01	80	120	80	120	20
Iron	7439-89-6	0.0267	0.1	80	120	80	120	20
Lead	7439-92-1	0.0028	0.015	80	120	80	120	20
Magnesium	7439-95-4	0.0122	0.1	80	120	80	120	20
Manganese	7439-96-5	0.00083	0.015	80	120	80	120	20
Nickel	7440-02-0	0.00084	0.04	80	120	80	120	20
Potassium	7440-09-7	0.0407	0.5	80	120	80	120	20
Selenium	7782-49-2	0.00379	0.04	80	120	80	120	20
Silver	7440-22-4	0.00064	0.01	80	120	80	120	20
Thallium	7440-28-0	0.0026	0.02	80	120	80	120	20
Vanadium	7440-62-2	0.0012	0.02	80	120	80	120	20
Zinc	7440-66-6	0.0059	0.02	80	120	80	120	20
Mercury by SW7470A	7439-97-6	0.000075	0.0002	80	120	80	120	20
Chromium VI by SW7196A	18540-29-9	0.0033	0.01	80	120	80	120	20
Perchlorate by SW6860	14797-73-0	0.0001	0.0003	85	115	85	115	20
Anions by EPA SW9056A								
Chloride	16887-00-6	21	100	80	120	80	120	20
Sulfate	14808-79-8	79	200	80	120	80	120	20
Nitrite	14797-65-0	59	500	80	120	80	120	20
Nitrate	14797-55-8	78	500	80	120	80	120	20
Total Organic Carbon by SW9060A	NA	254	1,000	80	120	80	120	25
Nitrogen, Ammonia by SM 4500NH3 E [1]	7664-41-7	0.242	1	80	120	80	120	25

Notes:

µg/L = Micrograms per liter
mg/L - milligrams per liter
EPA = U.S. Environmental Protection Agency
LCL = Lower Control Limit
LCS = Laboratory Control Sample
CAS No. = Chemical Abstract Services Number
[1]MDL/RL for ammonia in mg/L units, others in µg/L units.
% = Percent

MS = Matrix Spike
MSD = Matrix Spike Duplicate
RL = Reporting Limit
RPD = Relative Percent Difference
UCL = Upper Control Limit
VOCs = Volatile Organic Compounds
MDL - Method Detection Limit

Table 2-2
Summary of Field QC Samples

Matrix	Analysis	Number of Field Samples	Equipment Blanks	Trip Blanks[1]	Field Duplicates	MS/MSD	Total
Groundwater Samples	VOCs per EPA Method 5035/8260B	18	2	3	2	2	27
	Perchlorate (SW6860)	18	2	NR	2	2	24
	Target Analyte List Metals (SW6010B/7470A)	18	2	NR	2	2	24
	Chromium VI (SW7196A)	18	2	NR	2	2	24
	Anions: Chloride, Sulfate, Nitrite, Nitrate (SW9056A)	18	2	NR	2	2	24
	Nitrogen Ammonia by SM 4500NH3 E	18	2	NR	2	2	24
	Total Organic Carbon (SW9060A)		2	NR	2	2	24

Notes:

[1]Estimated, one trip blank will accompany every shipment of volatile samples

EPA = Environmental Protection Agency

VOCs = Volatile Organic Compounds

MS/MSD = Matrix spike/matrix spike duplicate

NR - not required

Table 3-1
Summary of Sample Containers and Holding Times

Matrix	Analysis	Method	Container	Preservatives	Hold Time
Groundwater	VOCs	SW 8260B	3-40-mL Amber vials	HCl, pH<2, Cool 4°C	14 days
	Perchlorate	SW 6860	(1) 125-mL HDPE	Cool 4°C	28 days
	TAL Metals	SW 6010B/7470A	(1) 500-mL HDPE	Cool 4°C, HNO_3 to pH < 2	180 days (mercury 28 days)
	Chromium VI	SW7196A	(1) 500-mL HDPE	Cool 4°C	24 hours
	Anions	300.1	(1) 500-mL HDPE	Cool 4°C	Nitrite/Nitrate 48 hours; Others 28 days
	Total Organic Carbon	SM5310	(2) 40-mL Amber Vials	HCl, pH<2, Cool 4°C	28 days
	Nitrogen Ammonia	SM 4500NH3 E	(1) 500-mL HDPE	$H2SO_4$ to pH < 2, Cool 4°C	28 days

Notes:
EPA = Environmental Protection Agency
SM - Standard Methods for the Examination of Water and Wastewater
SW - SW 846
VOCs = Volatile Organic Compounds
TAL Metals - Contract Laboratory Program (CLP) Target Analyte List of metals (23). To include total and dissolved metals.
mL = milliliters, oz = ounce
VOA vial= Volatile Organic Analysis vial usually clear or amber glass with PTFE septa screw top, no headspace
HCl = Hydrochloric Acid, H2SO4 = Sulfuric acid, HNO3 = Nitric acid
^{o}C = Degrees Celsius
HDPE - high density polyethylene
Anions - chloride, sulfate, nitrite, and nitrate

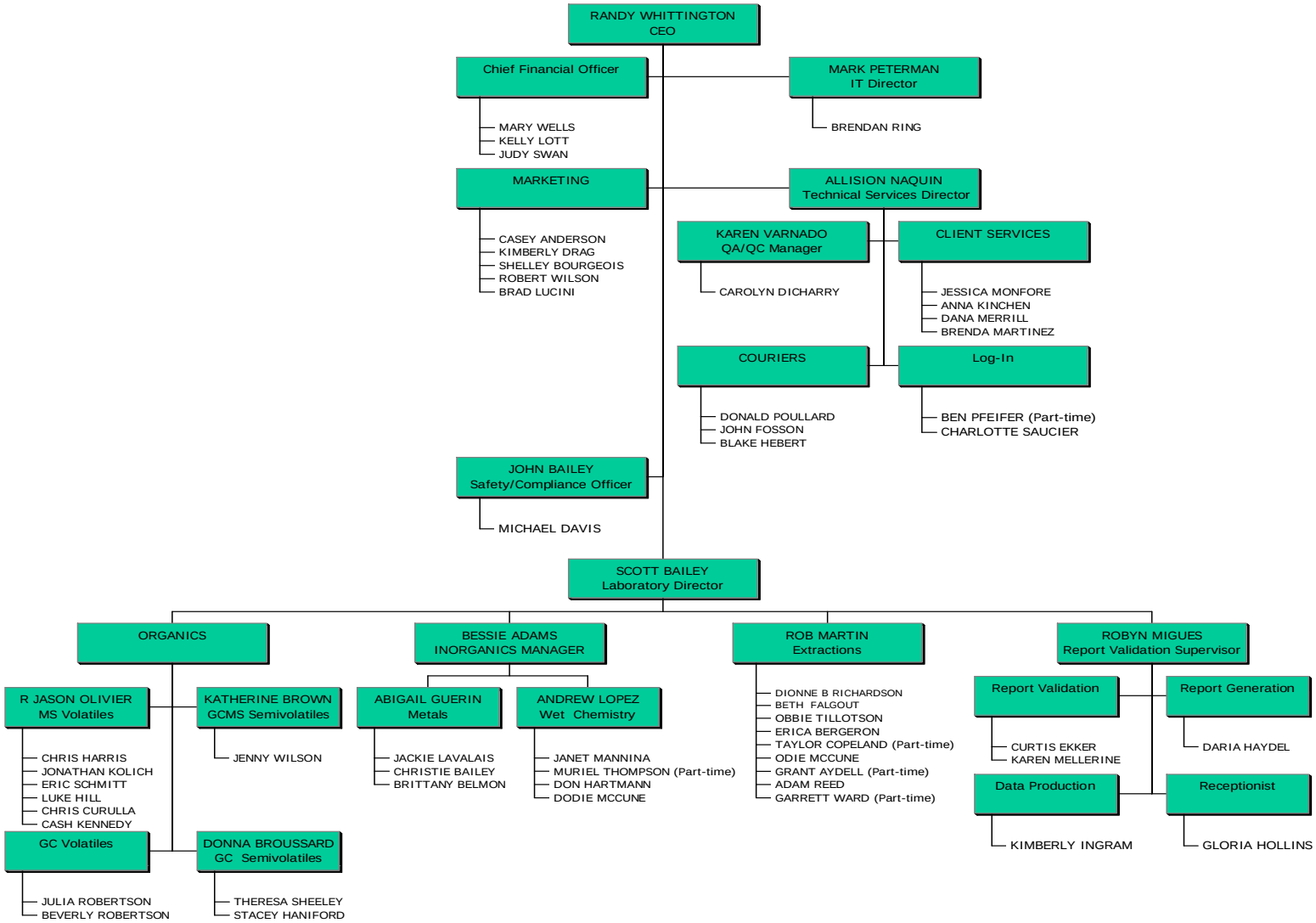
ATTACHMENTS

ATTACHMENT 1

GCAL ORGANIZATIONAL CHART

GCAL
GULF COAST ANALYTICAL LABORATORIES, INC

ORGANIZATIONAL CHART



3/9/2012

ATTACHMENT 2
CHAIN OF CUSTODY FORM

TRINITY ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

Chain of Custody and Analytical Request

Page 1 of

Project Number:

Chain of Custody Number (1):

Facility:

Project Name / Site Name:

Client Name: Trinity (850) 613-6800

Project Manager:

Collected by:

Field Sample ID (30 Characters Max)	ERPIMS LOCID (15 Characters Max)	Date Collected (dd-mmm-yyyy)	Time Collected (Military) (hhmm)	Sample Depth (beginning - ending)	SA Code (2)	Sample Number (3)	Sample Matrix (4)	Sample Analysis Requested (5): Number of containers										Quality Assurance Samples (6): Ambient Blank Lot Control Number	Equipment Blank Lot Control Number	Trip Blank Lot Control Number	Cooler ID

Comments

Custody Transfers Prior to Receipt by Laboratory

Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1.			1.		
2.			2.		
3.			3.		

Sample Delivery Details / Laboratory Receipt

Delivered Directly to Lab: _____ Shipped: No.: 1

Method of Shipment: _____ Airbill Number: _____

Analytical Lab: _____ Delivery Location: _____

Lab Recipient: _____ Delivery Date/Time: _____

1.) Chain of Custody Number = date collected + custody number (e.g. 09-02-2011-01)

2.) Sample Type (SA) Codes: N = Normal Sample, TB = Trip Blank (-c) Sample, FD = Field Duplicate (-a) Samples, FR = Field Replicate (-b) Samples, EB = Equipment Blank (-d) Samples, MS = Matrix Spike, SD = Matrix Spike Duplicate, AB = Ambient Blank (-e)

3.) Sample Number: Unique sample number collected from a particular location per day. (e.g. Groundwater sample collected from MW-1 on 10/10/11 = 01, if sampled again on 10/10/11 = 02, etc.)

4.) Matrix Codes: GS = Soil Gas, WG = Ground Water , WS = Surface Water SO = Soil, SE = Sediment, SL = Sludge, SS= Suface Soil Samples, WQ = Aqueous Blank Samples (trip, equipment, ambient, etc.), SQ= Soil Blanks

5.) Sample Analysis Requested: Analytical method requested and number of containers provided for each.

6.) Quality assurance samples are assigned by date (ddmmyy) and the number of the associated QC sample (01, 02, etc). (E.g., The first equipment blank, trip blank, or ambient blank collected on May 10, 2011 in association with samples on the COC will be designated 10051101 in the Blank Lot Control Number field).

7.) Trip Blanks shall correspond to the first well sampled, for example: ST069-MW-08S-c

ATTACHMENT 3
LABORATORY QC SUMMARY

VOCs by 8260B - GCMS QC Summary

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in GCAL SOP QA-014	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.		This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in GCAL SOP QA-014. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
LOD determination and verification	Immediately following MDL Study and Quarterly	Meets method defined compound qualitative identification or 3X signal to noise if method does not define	Repeat LOD at higher concentration		
LOQ establishment and verification	Quarterly	Meets reference method criteria if defined, GCAL SOP criteria when available, or LCS criteria	Repeat LOQ at higher concentration		
Tune	Prior to ICAL and at the beginning of each 12-hour period	Reference Method criteria	Retune instrument and verify. Rerun affected samples.		Problem must be corrected. No samples may be accepted without a valid tune.
Minimum five-point initial calibration (ICAL) for all analytes	ICAL prior to sample analysis.	1. Average response factor (RF) for SPCCs: VOCs ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachlorolethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane. SVOCs ≥ 0.050. 2. RSD for RFs for CCCs: VOCs and SVOCs ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15%; Option 2: linear least squares regression r^2 ≥	Correct problem then repeat ICAL.		Problem must be corrected. No samples may be run until ICAL has passed. Contact client if holding time is an issue.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
		0.990; Option 3:non-linear regression–coefficient of determination (COD) r2 ≥ 0.99 (6 points shall be used for second order.			
Second source calibration verification (ICV)	Immediately following ICAL.	All project analytes within established retention time windows. All project analytes within ± 20% of expected value from the ICAL.	Correct problem, rerun ICV. If that fails, repeat ICAL.		Problem must be corrected. No samples may be run until calibration has been verified. Contact client if holding time is an issue.
Retention time window position establishment for each analyte and surrogate	Once per ICAL and at the beginning of the analytical shift.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the CCV is used.			
Evaluation of relative retention times (RRT)	With each sample.	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL.		Samples are compared to daily CCV. CCV are compared to ICAL. If the RRT has changed by more than ±0.06 RRT units since the last update, this indicates a significant change in system performance and the laboratory must take appropriate corrective actions as required by the method and rerun the ICAL to reestablish the retention times.
Continuing calibration verification (CCV)	Prior to sample analysis, every 12 hours of analysis time.	All project analytes within established retention time windows. All project analytes within ± 20% of expected value from the	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
		ICAL; if response has increased and there are no detects in the associated sample, the data may be reported with a narrative.		to all results for the specific analyte(s) in all samples.	cases where the samples cannot be reanalyzed.
Internal standards (IS) verification	Every field sample, standard, and QC sample.	Retention time ± 30 seconds from retention time of the midpoint standard in the ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	If corrective action fails in field samples, apply Q-flag to analytes associated with the non-compliant IS. Flagging criteria are not appropriate for failed standards.	Sample results are not acceptable without a valid IS verification.
Method blank	One per preparatory batch	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Laboratory control sample (LCS) containing all analytes to be reported, including surrogates	One per analytical batch.	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits. If high recovery and there are no detects in the associated sample, the data may be reported with a narrative.	Correct problem, then reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS	One per preparatory batch.	For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix spike duplicate (MSD) or sample duplicate	One per preparatory batch.	MSD: For matrix evaluation, use LCS acceptance criteria specified by DoD, if available. Otherwise, use in-house LCS control limits. MSD or sample duplicate: RPD ≤ 30% (between MS and MSD or sample and sample duplicate).	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		The data shall be evaluated to determine the source of difference.
Surrogate spike	All field and QC samples.	QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits.	For QC and field samples, correct problem then reanalyze all failed samples for failed surrogates in the associated batch. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary. If surrogate recovery is high and there are no detects in the sample report with a case narrative.		
Results reported between DL and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ.	

TOC by 9060A - QC Summary

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in GCAL SOP QA-014	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in GCAL SOP QA-014. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
LOD determination and verification	Immediately following MDL Study and Quarterly	Meets method defined compound qualitative identification or 3X signal to noise if method does not define	Repeat LOD at higher concentration	NA	
LOQ establishment and verification	Quarterly	Meets reference method criteria if defined, GCAL SOP criteria when available, or LCS criteria	Repeat LOQ at higher concentration	NA	
Minimum three-point initial calibration (ICAL) and blank	ICAL prior to sample analysis.	R ≥ 0.995	Correct problem then repeat ICAL.		Problem must be corrected. No samples may be run until ICAL has passed. Contact client if holding time is an issue.
Second source calibration verification (ICV)	Immediately following ICAL.	Recovery within 90-110%	Correct problem, rerun ICV. If that fails, repeat ICAL.		Problem must be corrected. No samples may be run until calibration has been verified. Contact client if holding time is an issue.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	Prior to sample analysis, every 10 samples, and at the end of the analysis sequence.	Recovery within 90-110%; if response has increased and there are no detects in the associated sample, the data may be reported with a narrative.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Continuing calibration blank (CCB)	Prior to sample analysis, every 10 samples, and at the end of the analysis sequence.	No analytes detected greater than the RL	Correct problem, then rerun calibration blank.		If reanalysis cannot be performed evaluate for impact on the data. Report with a case narrative.
Method blank	One per batch of 20, the CCB may be used for the MB	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem. If required, reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Laboratory control sample (LCS)	One per batch of 20, the CCV may be used for the LCS.	QC acceptance criteria specified in Worksheet #15. If high recovery and there are no detects in the associated sample, the data may be reported with a narrative.	Correct problem, reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix spike (MS)	One per batch.	For matrix evaluation, use LCS acceptance criteria.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per batch.	Use LCS acceptance criteria. MSD or sample duplicate: RPD ≤ 25% (between MS and MSD or sample and sample duplicate).	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		The data shall be evaluated to determine the source of difference.
Results reported between DL and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ.	

Anions (Chloride, Sulfate, Nitrite, Nitrate) QC Summary (SW9056A)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in GCAL SOP QA-014	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in GCAL SOP QA-014. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
LOD determination and verification	Immediately following MDL Study and Quarterly	Meets method defined compound qualitative identification or 3X signal to noise if method does not define	Repeat LOD at higher concentration	NA	
LOQ establishment and verification	Quarterly	Meets reference method criteria if defined, GCAL SOP criteria when available, or LCS criteria	Repeat LOQ at higher concentration	NA	
Minimum three-point initial calibration (ICAL) and blank	ICAL prior to sample analysis.	R ≥ 0.995	Correct problem then repeat ICAL.		Problem must be corrected. No samples may be run until ICAL has passed. Contact client if holding time is an issue.
Second source calibration verification (ICV)	Immediately following ICAL.	Recovery within 90-110% within RT window	Correct problem, rerun ICV. If that fails, repeat ICAL.		Problem must be corrected. No samples may be run until calibration has been verified. Contact client if holding time is an issue.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Retention time window position establishment	Once per ICAL and at the beginning of the analytical shift.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.			
Continuing calibration verification (CCV)	Prior to sample analysis, every 10 samples, and at the end of the analysis sequence.	Recovery within 90-110%; if response has increased and there are no detects in the associated sample, the data may be reported with a narrative. Within RT window	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Continuing calibration blank (CCB)	Prior to sample analysis, every 10 samples, and at the end of the analysis sequence.	No analytes detected greater than ½ the RL	Correct problem, then rerun calibration blank.		If reanalysis cannot be performed evaluate for impact on the data. Report with a case narrative.
Method blank	One per batch of 20, the CCB may be used for the MB	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem. If required, reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory control sample (LCS)	One per batch of 20, the CCV may be used for the LCS.	QC acceptance criteria specified in Table 2-1 If high recovery and there are no detects in the associated sample, the data may be reported with a narrative.	Correct problem, reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS)	One per batch.	For matrix evaluation, use LCS acceptance criteria.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per batch.	Use LCS acceptance criteria. MSD or sample duplicate: RPD ≤ 25% (between MS and MSD or sample and sample duplicate).	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		The data shall be evaluated to determine the source of difference.
Results reported between DL and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ.	

Metals QC Summary (SW6010B/7470A)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in GCAL SOP QA-014	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in GCAL SOP QA-014. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
LOD determination and verification	Immediately following MDL Study and Quarterly	Meets method defined compound qualitative identification or 3X signal to noise if method does not define	Repeat LOD at higher concentration	NA	
LOQ establishment and verification	Quarterly	Meets reference method criteria if defined, GCAL SOP criteria when available, or LCS criteria	Repeat LOQ at higher concentration	NA	
Linear dynamic range (ICP only)	Every 6 months	Within ± 10% of true value	NA	NA	
(ICAL) for all analytes ICP: one point and blank CVAA: minimum 5-point and blank	ICAL daily prior to sample analysis.	CVAA: $r \geq 0.995$;	Correct problem then repeat ICAL.		Problem must be corrected. No samples may be run until ICAL has passed. Contact client if holding time is an issue.
Second source calibration verification (ICV)	Immediately following ICAL.	All project analytes within established retention time windows. All project analytes within ± 10% of expected value from the ICAL.	Correct problem, rerun ICV. If that fails, repeat ICAL.		Problem must be corrected. No samples may be run until calibration has been verified. Contact client if holding time is an issue.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	After every 10 field samples and at the end of the analytical batch	All project analytes within ± 10% of expected value for ICP, ± 20% for CVAA from the ICAL; if response has increased and there are no detects in the associated sample, the data may be reported with a narrative.	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results for the specific analyte(s) in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Low level calibration check sample (ICP only)	Daily after 1 point ICAL	Within ± 20% of true value for target analytes	Correct problem and reanalyze	NA	Problem must be corrected. Check sample must be equal to or less than reporting limit
Method blank	One per batch	No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater).	Correct problem. If required, reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Calibration Blank (CCB)	Before beginning sample analysis, every 10 samples and at the end of the analytical batch	No target > LOD	Correct problem and reanalyze CCB. Reanalyze all samples since last passing CCB	Apply B flag to all analytes associated with failed blank.	
Interference Check Solutions (ICP only)	Before sample analysis	ICS-A: Absolute value of concentration for all non-spiked compounds < LOD (unless they are a verified trace impurity from ICS-A standard). ICS-B: Within ± 20% of true value.	Do not proceed with analysis until passing ICS; correct problem and rerun.	Q flag analyte in associated samples	

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Laboratory control sample (LCS) containing all analytes to be reported, including surrogates	One per batch.	QC acceptance criteria specified in DOD. If high recovery and there are no detects in the associated sample, the data may be reported with a narrative.	Correct problem, reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS)	One per batch.	For matrix evaluation, use LCS acceptance criteria.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Matrix spike duplicate (MSD) or sample duplicate	One per batch.	Use LCS acceptance criteria. MSD or sample duplicate: RPD ≤ 20% (between MS and MSD or sample and sample duplicate).	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		The data shall be evaluated to determine the source of difference.
Dilution Test (ICP only)	One per prep batch	Five-fold dilution must agree within ± 10% of original measurement	Perform post digestion spike (PDS)		Only applies to samples/analytes with detects > 50X LOQ
Post Digestion Spike (ICP only)	When dilution test fails or when analyte concentration in all samples < 50 X LOD	Recovery within 75-125%	Include case narrative		MSA may be performed to confirm matrix interference
Results reported between DL and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ.	

Hexavalent Chromium QC Summary (SW7196A)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in GCAL SOP QA-014	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in GCAL SOP QA-014. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
LOD determination and verification	Immediately following MDL Study and Quarterly	Meets method defined compound qualitative identification or 3X signal to noise if method does not define	Repeat LOD at higher concentration	NA	
LOQ establishment and verification	Quarterly	Meets reference method criteria if defined, GCAL SOP criteria when available, or LCS criteria	Repeat LOQ at higher concentration	NA	
Reference Blank	Before beginning standards or sample analysis	NA	NA	NA	Used for blank subtraction of standards, field and QC samples.
ICAL (minimum of three standards and calibration blank)	Perform a new calibration when standard expires, major maintenance is performed, a CCV fails, or at least annually.	$r \geq 0.995$;	Correct problem then repeat ICAL.		Problem must be corrected. No samples may be run until ICAL has passed. Contact client if holding time is an issue.
Second source calibration verification (ICV)	Immediately following ICAL.	Within ± 10% of expected value from the ICAL;	Correct problem, rerun ICV. If that fails, repeat ICAL.		Problem must be corrected. No samples may be run until calibration has been verified. Contact client if holding time is an issue.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Continuing calibration verification (CCV)	At the beginning of a batch, after every 10 field samples and at the end of the analytical batch	Within ± 10% of expected value	Correct problem, then rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Method blank	One per batch of 10 or fewer samples	No analytes detected > ½ RL and > 1/20 the amount measured in any sample (whichever is greater).	Correct problem. If required, reanalyze method blank and all samples processed with the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for in all samples in the batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Laboratory control sample (LCS)	One per batch of 10.	80-120% Recovery	Correct problem, reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Matrix spike (MS)	One per batch of 10.	For matrix evaluation, 85-115%.	A low recovery indicates a matrix interference, requiring a dilution and reanalysis.		For matrix evaluation only. If MS results are low, a reducing condition of the sample is indicated. Contact client.
Matrix spike duplicate (MSD) or sample duplicate	One per batch of 10.	Use LCS acceptance criteria. MSD or sample duplicate: RPD ≤ 25% (between MS and MSD or sample and sample duplicate).	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		The data shall be evaluated to determine the source of difference.
Results reported between DL and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ.	

Perchlorate QC Summary (SW6860)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in WetChem-ICMS-02	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in WetChem-ICMS-02. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
LOD determination and verification	Immediately following MDL Study and Quarterly	Meets method defined compound qualitative identification or 3X signal to noise if method does not define	Repeat LOD at higher concentration	Flagging criteria are not appropriate	
Initial Calibration (ICAL)	Minimum of 5 calibration standards to establish linearity at method set-up, after major maintenance, and after a change in column.	$r \geq 0.995$ or RSD ≤ 20%. The concentration corresponding to the absolute value of the calibration curve's Y-intercept must be ≤ LOD.	Correct Problem, then repeat ICAL	NA	Problem must be corrected. No sample may be run until ICAL passed. The calibration is linear and shall not be forced through the origin.
Initial Calibration Verification (ICV)	Once after each ICAL, analysis of a second source standard at the mid-point of the calibration.	Within ± 15% of true value.	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.	Flagging criteria are not appropriate.	Problem must be corrected. No samples may be run until calibration is verified.
Continuing Calibration Verification (CCV)	Analysis of mid-level standard after every 10 field samples. All samples must be bracketed by the analysis of a standard demonstrating that the system was capable of accurately detecting and quantifying perchlorate.	Within ± 15% of true value.	Correct problem, rerun calibration verification. If that fails, then repeat ICAL. Reanalyze all samples since the last successful calibration verification.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results in all samples since the last acceptable calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Limit of detection verification (LODV)	Prior to sample analysis and at the end of the analysis sequence. It can be analyzed after every 10 samples in order to reduce the reanalysis rate.	Within ± 30% of true value.	Correct problem, and rerun all samples that have or ND or estimated (J) detect.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all results in all samples since the last acceptable LODV.	Problem must be corrected. Results may not be reported without a valid CCV. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Perchlorate spike concentration is approximately 2 times LOD.
Isotope Ratio $^{35}Cl/^{37}Cl$	Every sample, batch QC sample, and standard.	Monitor for either the parent ion at masses 99/101 or the daughter ion at masses 83/85 depending on which ions are quantitated. Must fall within 2.3-3.8 (theoretical 3.06).	If criteria are not met, the sample must be rerun. If the sample was not pretreated, the sample should be reextracted using cleanup procedures. If, after cleanup, the ratio still fails, use alternative techniques to confirm presence of perchlorate (i.e., a post spike sample, dilution to reduce any interference, etc.).	Apply J flag if criteria are not met.	Document failure in case narrative.
Internal Standard (IS)	Addition of ^{18}O-labeled perchlorate to every sample, batch QC sample, standard, instrument blank, and method blank.	Measured ^{18}O IS area within ± 50% of the value from the average of the IS area counts of the ICAL. RRT of the perchlorate ion must be 1.0 ± 2% (0.98 – 1.02).	Rerun the sample at increasing dilutions until the ± 50% acceptance criteria are met. If criteria cannot be met with dilution, the interference are suspected and the sample must be reprepped using additional pretreatment steps.	Apply Q flag	If peak is not within retention time window, presence is not confirmed. Use for quantitation and to ensure identification. Failing internal standard should be documented in the case narrative.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Interference Check Sample (ICS)	One ICS is prepared with every batch of 20 samples and must undergo the same preparation and pretreatment steps as the samples in the batch. It verifies the method performance at the matrix conductivity threshold (MCT). At least one ICS must be analyzed daily.	Within ± 30% of true value.	Correct problem and then reanalyze all samples in that batch. If poor recovery from the cleanup filters is suspected, a different lot of filters must be used to reextract all samples in the batch. If column degradation is suspected, a new column must be calibrated before the samples can be reanalyzed.	NA	Analysis of a standard containing perchlorate at the RL and interfering anions at the concentration determined by the interference threshold study. Monitor recovery of perchlorate and retention time. No samples may be reported that are associated with a failing ICS.
Laboratory Reagent Blank	Prior to calibration, after samples with overrange concentration of perchlorate, and at the end of the analytical sequence.	No target > ½ RL.	Reanalyze reagent blank (until no carryover is observed) and all samples processed since the contaminated blank.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated batch.	Problem must be corrected. Results may not be reported without a valid reagent blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Tuning	Prior to ICAL and after any mass calibration or maintenance is performed.	Mass calibration within ±0.3m/z for ions 99, 101, and 107	Retune instrument. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone.	NA	Problem must be corrected. Sample analysis shall not proceed without acceptable tuning.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Mass Calibration	Instrument must have a valid mass calibration prior to any sample analysis. The mass calibration is updated on an as-needed basis (e.g., QC failures, ion masses show large deviations from known masses, major instrument maintenance is performed, or the instrument is moved).	Mass calibration range must bracket the ion masses of interest without greatly exceeding the range. The most recent mass calibration must be used for an analytical run, and the same mass calibration must be used for all data files in an analytical run. Mass calibration must be verified by acquiring a full scan continuum mass spectrum of a perchlorate stock standard. Perchlorate ions should be within ± 0.3 *m/z* of mass 99, 101, and 107 or their respective daughter ion masses (83, 85, and 89), depending on which ions are quantitated.	If the mass calibration fails, recalibrate. If it still fails, consult manufacturer instructions on corrective maintenance.	NA	Problem must be corrected. No samples may be analyzed under a failing mass calibration.
Interference Threshold Study	At initial setup and when major changes occur in the method's operating procedures (e.g., addition of cleanup procedures, column changes, mobile phase changes).	Measure the threshold of common suppressors (chloride, sulfate, carbonate, bicarbonate) that can be present in the system without affecting the quantitation of perchlorate. The threshold is the concentration of the common suppressors where perchlorate recovery falls outside an 85-115% window.	NA	NA	This study and site history will determine the concentration at which the ICS suppressors should be set.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Method Blank (MB)	One per prep batch.	No perchlorate detected > ½ RL and greater than 1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). Blank result must not otherwise affect sample results.	If blank fails, reprep and reanalyze blank and all associated samples.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed. Method blank must undergo the same preparation and pretreatment steps as the samples in the batch.
Laboratory Control Sample (LCS)	One per prep batch. LCS is spiked at the RL.	80-120%	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed. LCS must undergo the same preparation and pretreatment steps as the samples in the batch.
Matrix Spike (MS)	One per prep batch. MS is spiked at the RL.	80-120%	Include case narrative.	Apply J flag if acceptance criteria are not met.	For matrix evaluation only. If MS results are outside the limits, the data must be evaluated to determine the source of the difference and to determine if there is a matrix effect or analytical error. MS must undergo the same preparation and pretreatment steps as the samples in the batch.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike Duplicate or Lab Duplicate	One per prep batch. MSD is spiked at the RL.	80-120%, RPD < 15%	Include case narrative.	Apply J flag if acceptance criteria are not met.	Evaluate data to determine source of the difference.
Results reported between DL and LOQ	NA	NA	NA	Apply J-flag to all results between DL and LOQ.	

Ammonia QC Summary (SM 4500NH3 E)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Demonstrate acceptable analytical capability	Prior to using any test method and at any time there is a significant change in instrument type, personnel, test method, or sample matrix.	As specified in GCAL SOP QA-014	Recalculate results; locate and fix problem, then rerun demonstration for those analytes that did not meet criteria.	Not Applicable (NA).	This is a demonstration of analytical ability to generate acceptable precision and bias per the procedure in GCAL SOP QA-014. No analysis shall be allowed by analyst until successful demonstration of capability is complete.
Calibration	The titrator is calibrated using pH buffers 4.00, 7.00, and 10.00 before each day of use	Slope between -52 and -65	Use fresh buffers, perform instrument maintenance	NA	Do not proceed with analysis until acceptable calibration is achieved.
Method Blank	One per prep batch of 20	Blank < RL	Find source of contamination and reprep blank and associated samples.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	Problem must be corrected. Results may not be reported without a valid method blank. Flagging is only appropriate in cases where the samples cannot be reanalyzed.
Laboratory control sample (LCS)	One per prep batch of 20.	80-120%	Correct problem, reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient sample material is available.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to specific analyte(s) in all samples in the associated batch.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action	Flagging Criteria	Comments
Matrix Spike (MS)	One per prep batch of 20.	80-120%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		For matrix evaluation only. If MS results are outside the LCS limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.
Sample duplicate	One per batch.	RPD ≤ 25%	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		The data shall be evaluated to determine the source of difference.

ATTACHMENT 4

DQO ATTAINMENT VERIFICATION WORKSHEET

DQO ATTAINMENT VERIFICATION WORKSHEET

Page ____ of _____

Site:
Project:
DQO Statement Number:

DQO Element Number	DQO Element Description	Site-Specific DQO Statement	Attained?	Required Corrective Action?
Intended Data Use(s):				
1	Project Objective(s) Satisfied			
Data Need Requirements:				
2	Data User Perspective(s			
3	Contaminant or Characteristic of Interest			
4	Media of Interest			
5	Required Sampling Locations or Areas and Depths			
6	Number of Samples Required			
7	Reference Concentration of Interest or Other Performance Criteria			
Appropriate Sampling and Analysis Methods:				
8	Sampling Method			
9	Analytical Method			

PART 2

SITE SAFETY AND HEALTH PLAN

FINAL

SITE SAFETY AND HEALTH PLAN

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

Prepared for:

27 SOCES/CEAN
Cannon Air Force Base, New Mexico

Contract No: FA8903-10-D-8594
Delivery Order No. 0034

Under Contract To:

Air Force Center for Engineering and the Environment
772 ESS/PKS, building 171
Lackland AFB Base, TX 78236

Prepared by:

Bhate Environmental Associates, Inc.
1608 13th Avenue South, Suite 300
Birmingham, Alabama 35205
Bhate Project No. 9100129

April 2012

This page intentionally left blank.

FINAL

SITE SAFETY AND HEALTH PLAN

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

TABLE OF CONTENTS

REVIEW SHEET v

Acronyms vii

1 Background Information 1

1.1 Contract Information 1
1.2 Background Information 1
1.3 Task Description 1
1.4 Site Safety and Health 1
1.5 Contractor Accident Experience 2
1.6 Phases of Work Requiring Activity Hazard Analysis 2

2 Statement of Health and Safety Policy 3

3 Responsibilities and Lines of Authority 5

3.1 Corporate Personnel 5
3.2 Health and Safety Manager 6
3.3 Site Safety and Health Officer 6
3.4 Project Manager 7
3.5 Subcontractors and Suppliers 7

4 Training 9

4.1 Safety Indoctrination 9
4.2 Training Requirements 9
4.3 Emergency Response Training 9

5 Safety and Health Inspections 11

5.1 Internal Safety and Health Inspections 11
5.2 External Safety and Health Inspections 11

6 Safety and Health Expectations, Incentive Programs, and Compliance 13

7 Accident Reporting 15
7.1 Exposure Data 15
7.2 Accident Investigations, Reports, and Logs 15
7.3 Notification of Major Accidents 15
8 Medical Support 17
9 Personal Protective Equipment 19
9.1 Written PPE Program 19
9.2 Minimum PPE 19
9.3 Upgrades/Downgrades in Personal Protective Equipment 19
10 Plans Required by the Safety Program 21
10.1 Layout Plans 21
10.2 Emergency Response Plans 21
10.2.1 Directions to Hospital 21
10.2.2 Procedures for Evacuation of the Work Area 22
10.3 Hazard Communication Program 23
10.4 Respiratory Protection Plan 23
10.5 Health Hazard Control Program 23
10.6 Lead Abatement Plan 23
10.7 Asbestos Abatement Plan 24
10.8 Abrasive Blasting 24
10.9 Confined Space 24
10.10 Hazardous Energy Control Plan 24
10.11 Critical Lift Procedures 24
10.12 Contingency Plan for Severe Weather 24
10.13 Access and Haul Road Plan 24
10.14 Demolition Plan 24
10.15 Emergency Rescue 25
10.16 Underground Construction Fire Prevention and Protection Plan 25
10.17 Compressed Air Plan 25
10.18 Formwork and Shoring Erection and Removal Plans 25
10.19 Jacking Plan 25
10.20 Blasting Plan 25
10.21 Diving Plan 25
10.22 Alcohol and Drug Abuse Plan 25
10.23 Fall Protection Plan 29
10.24 Steel Erection Plan 29
10.25 Night Operations Lighting Plan 29
10.26 Site Sanitation Plan 29
10.27 Fire Prevention Plan 29

11 Contractor Information 31
11.1 Site Rules/Prohibitions 31
11.2 Excavations 31
11.3 Medical First Aid Requirements 32
11.4 Sanitation 32
11.4.1 Personnel Decontamination 32
11.4.2 Equipment Decontamination 32
11.5 PPE 33
11.6 Fire Prevention 33
11.7 Machinery and Mechanized Equipment 33
11.8 Electrical Safety 33
11.9 Public Safety Requirements 33
11.10 Chemical, Physical, and Biological Exposure Prevention 34
12 Site-Specific Hazards and Controls 35
12.1 Safety and Physical Hazards 35
12.2 Task Identification and Hazard/Risk Analysis 35
12.3 Chemical Hazards 35
12.4 Biological Hazards 35
12.5 Exposure Monitoring/Air Sampling Program 36
12.5.1 Direct Reading Monitoring Instruments 36
12.5.2 Work Stoppage Due to Health and Safety Concerns 36
12.6 Heat Stress 36
12.7 Cold Stress 38
13 Emergency Contacts 41
14 References 43

Tables

4-1 Required Worker Training and Site-Specific Training 11
10-1 Evacuation Procedures 24
10-2 Potential Emergency Situations 24
12-1 Schedule for Monitoring Heat Related Stress 39

Attachments

A Activity Hazard Analyses and Properties of the Primary Contaminants of Concern
B* Written Safety Procedures and Programs
C Bhate Health and Safety Field Forms
D Hospital Map and Directions

*Note: Attachment B includes applicable sections photocopied from Bhate's Corporate Health and Safety Plan. Therefore the section numbers are not in chronological order.

This page intentionally left blank.

FINAL

SITE SAFETY AND HEALTH PLAN

FACILITY-WIDE LONG-TERM MONITORING, MAINTENANCE, AND INSPECTIONS AT MULTIPLE SITES

CANNON AIR FORCE BASE, NEW MEXICO

REVIEW SHEET

COMMITMENT TO IMPLEMENT THIS SITE SAFETY AND HEALTH PLAN		
Health and Safety Manager: Sally S. Smith, CIH, CSP, CHMM, CPEA 205-918-4032 205-983-4150 (Cell)	Sally S. Smith Signature	4-17-12 Date
Project Manager: Tracy Walker, P.G. 205-918-4027 205-213-4027 (Cell)	Tracy R. Walker Signature	4-17-12 Date
Site Safety and Health Officer: Jonathan Kramer 850-613-6800 850-803-0009 (Cell)	_____ Signature	_____ Date

This page intentionally left blank.

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienist
AFCEE	Air Force Center for Engineering and the Environment
AHA	Activity Hazard Analysis
AFB	Air Force Base
ALARA	As low as is reasonably achievable
ANSI	American National Standards Institute
APP	Accident Prevention Plan
APR	Air Purifying Respirators
Bhate	Bhate Environmental Associates, Inc.
°C	Degrees Celsius
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CHMM	Certified Hazardous Materials Manager
CPR	Cardiopulmonary resuscitation
CRZ	Contaminant Reduction Zone
CSP	Certified Safety Professional
dBA	Decibels A weighted
1,1-DCA	1,1-Dichloroethane
1,2-DCE	1,2-Dichloroethene
DOT	Department of Transportation
EMR	Experience Modification Rate
EZ	Exclusion Zone
°F	Degrees Fahrenheit
GCAL	Gulf Coast Analytical Laboratories, Inc.
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HSM	Health and Safety Manager

IDW	Investigation derived waste
IRP	Installation Restoration Program
LTM	Long Term Monitoring
mL	Milliliters
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
P.G.	Professional Geologist
PID	Photoionization detector
PM	Project Manager
PPE	Personal protective equipment
SPF	Sun Protection Factor
SSHP	Site Safety and Health Plan
SSHO	Site Safety and Health Officer
SWMU	Solid Waste Management Units
SZ	Support Zone
TCE	Trichloroehtylene
TRINITY	Trinity Analysis and Development Corp.
UST	Underground Storage Tank
VOC	Volatile Organic Compound

1 BACKGROUND INFORMATION

1.1 Contract Information

Bhate Environmental Associates, Inc., (Bhate) has been retained by the Air Force Center for Engineering and the Environment (AFCEE) under Contract No. FA8903-10-D-8594, Delivery Order Number 0034, to perform Long Term Monitoring (LTM), Maintenance, and Inspections at multiple sites at Cannon Air Force Base (AFB), New Mexico. Specifically, Bhate will perform LTM and/or inspection activities at Sites LF-02, LF-03, LF-04, LF-05, LF-25, FT-06, SD-12, SD-17, SD-20, SWMU-2, SWMU-4, SWMU-6, SWMU-31, SWMU-101, and SWMU-102.

This Site Safety and Health Plan (SSHP) outlines the health and safety policies and procedures that will be used during execution of the awarded Scope of Work.

1.2 Background Information

Previous reports and plans have provided detailed summaries of site history, previous investigations, and the overall technical approach implemented at each site. As such, reiteration of that information is not included in this SSHP.

1.3 Task Description

The LTM field activities for this Delivery Order include the following:

- Site Preparation/Mobilization/Demobilization
- Biennial groundwater sampling at Sites LF-03, LF-04, LF-05, LF-25, and SWMU-101
- Annual water level measurements of monitoring wells
- Annual inspection and maintenance of the covers at Landfills 3, 4, and 25 and SWMU 101
- Annual site inspections of institutional controls at LF-02, FT-06, SD-12, SD-15, SD-17, SD-20, SWMU-2, SWMU-4, SWMU-6, SWMU-31, and SWMU-102

1.4 Site Safety and Health

This document defines the health and safety requirements for field activities to be conducted at the site. Bhate and appropriate subcontractors will provide field activities on behalf of the Cannon AFB. This document is required by corporate policy and Occupational Safety and Health Administration (OSHA). This document incorporates the applicable requirements of OSHA 29 Code of Federal Regulations (CFR) Parts 1910 and 1926, and the *Bhate Corporate Health and Safety Plan* (HASP). All Bhate personnel and subcontractor personnel working at the site will be briefed on the information contained in this SSHP and will follow the procedures established within this SSHP.

The Bhate Project Manager (PM) will not allow fieldwork to begin at the site until this SSHP has been accepted by Cannon AFB and provided to all field personnel. Before work area entry, all Bhate personnel will attend a site-specific briefing session, to be conducted by the Site Safety and Health Officer (SSHO), on the potential site hazards and specific requirements of this SSHP.

1.5 Contractor Accident Experience

Bhate has maintained a Total Recordable Case Frequency Rate of approximately 0.87 over the past 5 years. Over the last 3 years, Bhate's Experience Modification Rate (EMR) has not exceeded 0.80, below our industry average.

1.6 Phases of Work Requiring Activity Hazard Analysis

The Activity Hazard Analysis (AHA) identifies potential safety, health, and environmental hazards, and provides for the protection of personnel, the community, and the environment. Because conditions may be constantly changing during the course of a remedial action project, supervisors must be aware of conditions that may harm site personnel, the community, or the environment. The PM, Site Supervisor, and SSHO must monitor these changing conditions and discuss them with the Corporate Health and Safety Manager (HSM). If needed, the HSM will write or approve addenda to modify the AHAs.

The AHAs are included in Attachment A of this SSHP.

2 STATEMENT OF HEALTH AND SAFETY POLICY

Bhate is committed to achieving unparalleled health and safety results while maintaining the highest standards for production and quality. Bhate believes in protecting the health and safety of our employees, clients, and community members who may be impacted by our work. Further, Bhate believes that no job is so important and no task is so urgent that we cannot take time for proper planning, tasking, and execution of the work at hand.

In order to achieve our goals of zero incidents and providing quality services, our work activities are guided by the following:

- The Bhate Principals have accepted the responsibility of providing a safe workplace and providing their employees with safe work methods and adequate technical resources.
- Health and safety must be an integral part of Bhate's business operations; therefore, it must be given equal priority in every business decision and operation.
- Every job can and will be done safely or it will not be done until it is made safe.
- The safety of the employee will never be endangered to meet the requirements of production, service, or quality.
- All employees have a responsibility to comply with the Bhate health and safety policies, procedures, and work practices, which may constitute a condition of employment.
- Every Bhate employee is accountable for their actions and is responsible for fulfilling their duties in a safe manner.

This page intentionally left blank.

3 RESPONSIBILITIES AND LINES OF AUTHORITY

The following summarizes the health and safety responsibilities of key corporate and project personnel and their lines of authority. Project team members are identified in Section 13 of this SSHP.

3.1 Corporate Personnel

Bhate Corporate Management (Principals, Program Managers, the Technical Director, and Project Managers) ensure that all company activities are executed in accordance with the Bhate Corporate Health and Safety Plan, procedures, and applicable regulations. Site Managers (or the senior company representative at each project site), have the responsibility to integrate loss control principles into all operations and to ensure that:

- All projects are implemented in compliance with all applicable health and safety laws, regulations, and program requirements.
- Site Safety and Health Plans are developed, approved, and implemented in accordance with Bhate requirements. For projects that do not require a SSHP or an Accident Prevention Plan (APP), the requirements of the Bhate Corporate Health and Safety Plan shall be enforced.
- Bhate personnel and subcontractors (as applicable) understand the requirements of the project SSHP and each individual understands his/her responsibility for plan implementation.
- Personnel have all required training and are capable of performing all assigned tasks.
- Facilities and equipment meet Bhate expectations and government regulations.
- Work rules are enforced.
- Inspections and incident investigations are conducted per program requirements.
- Effective corrective actions are implemented in a timely manner following inspections, audits, incident investigations, etc.
- Clients are notified using Bhate incident reporting procedures.
- Appropriate disciplinary action is implemented when necessary.
- Promptly address safety problems or issues that employees bring to their attention and involve technical resource personnel as necessary.
- Provide positive feedback (either verbal or written) to employees who exhibit safe behaviors.

When unsafe behaviors are noticed, managers should:

- Stop work immediately.

- Discuss the behavior with the employee(s), including the possible consequences of such unsafe behavior.
- Document the observations and results of the discussion with the employee for inclusion in the project and/or personnel files.
- Should a behavior result in an incident, report the incident and investigate the root cause in accordance with the Incident Reporting and Investigation Procedure (see Attachment B of this SSHP; and see Attachment C of this SSHP for Incident Report forms).
- Instruct employees on appropriate safe behaviors.
- When necessary, schedule retraining for employees who appear unfamiliar with safety procedures. Training may be conducted by the manager, qualified peer employees, or other resources as necessary.

3.2 Health and Safety Manager

The HSM, a Certified Industrial Hygienist (CIH), will assist with the development, implementation, and oversight of this SSHP. This SSHP will be signed and dated by the HSM prior to initiation of field activities.

The HSM maintains records of personnel training and certifications and is the first point of contact with Bhate Corporate Management in the event of an accident or incident at the site.

3.3 Site Safety and Health Officer

The SSHO has delegated authority from the HSM and respective corporate management to enforce this SSHP. The SSHO (field team leader) will also functionally report to the PM, in addition to safety reporting responsibilities to the Bhate HSM.

The SSHO is responsible for all aspects of site health and safety. He has the authority and responsibility for stopping site work should activities jeopardize the health and safety of workers or the public (if practical, the PM and HSM should be consulted before any operation is interrupted). Additional responsibilities of the SSHO include:

- Provide site orientation safety training for all personnel actively involved in project field work.
- Conduct daily safety briefings.
- Inspect health and safety equipment daily.
- Select protective equipment and clothing in accordance with this SSHP.
- Confirm worker's suitability for performance of activities.
- Coordinate the project safety and health program with the Project Manager.
- Monitor workers for adverse effects of hazardous contaminants.

- Inspect the work areas to ensure compliance with the safety and health requirements for the tasks to be completed and identify hazards.
- Coordinate medical care, as needed.
- Maintain daily exposure data (i.e., man-hours worked, documentation of incidents/injuries).
- Enforce the requirements of this SSHP.

The SSHO will take the following action(s), as appropriate, and in accordance with this SSHP:

- Report all safety and/or health related incidents to the HSM and the Bhate PM.
- Order the immediate shut-down of field activities in case of medical emergency or unsafe practice.
- Restrict visitors from areas of potential exposure to harmful substances or hazardous conditions.

The SSHO will maintain a log to document all activities related to safety and health. This log will include daily safety meeting topics, training given, inspection results, first aid administered, visits of outside personnel, environmental monitoring, and documentation of all activities or incidents of a health and safety nature.

3.4 Project Manager

The PM is the senior Bhate representative for the project. The PM reports directly to Bhate corporate management, and site contacts. The PM is committed to overall success of the project, including performance of all site work in accordance with this SSHP. The PM is responsible for the preparation, organization, and review of the SSHP and is responsible for the selection, assignment, and conduct of site personnel. The PM coordinates field activities with appropriate site contacts, serves as liaison with, and coordinates preparation of the project deliverables. The PM has overall responsibility for the health and safety of Bhate personnel and Bhate subcontractors working on site. If the PM is not available, the Program Manager will assume the Project Manager responsibilities.

3.5 Subcontractors and Suppliers

For any subcontractors used for field activities, Bhate will be responsible for overall health and safety of both contractor and subcontractor(s) employees. Bhate will enforce the requirements of this SSHP for project personnel. Bhate's subcontractor(s) will be required to comply with the requirements of this SSHP and the OSHA standards contained in Title 29 of CFR Parts 1910 and 1926. The subcontractor(s) will also be responsible for site safety related to, or affected by, their operations and actions.

Each subcontractor employee is responsible for his own safety as well as the safety of those around him. The employee will use all equipment provided in a safe and responsible manner as directed by the SSHO.

The selection of qualified subcontractors will be in accordance with the Bhate procurement procedures. The primary subcontractor services anticipated are

- Gulf Coast Analytical Laboratories, Inc. (GCAL) for laboratory services. GCAL will be responsible for performing all its laboratory work under an approved safety plan.
- Trinity Analysis and Development Corp. (TRINITY), Inc. to assist with the following field activities:
  - Monitoring well sampling
  - Institutional controls and landfill cover inspections

An individual with each respective subcontractor will serve to manage each task. They will have the responsibility for planning, supervision, conducting, and delivering work in a safe manner for the assigned tasks.

4 TRAINING

4.1 Safety Indoctrination

Site-specific training concerning site hazards, general health and safety procedures, and the contents of this SSHP will be performed by the SSHO for all Bhate onsite project personnel and subcontractors before field work can commence. This will consist of a review of the specific hazards of concern, risks, symptoms of exposure, and an overview of this SSHP to include safety procedures, and emergency contacts.

4.2 Training Requirements

All personnel performing on-site work activities, wherein they may be exposed to hazards resulting from field activities, will have completed applicable training in compliance with 29 CFR Part 1910/29 and CFR Part 1926. Table 4-1 provides a summary of the minimum training requirements for site project personnel.

Table 4-1. Required Worker Training and Site-Specific Training

Required worker training	Site-specific training requirements
√ 40-hour General Site Worker √ 8-hour Supervisor (SSHO) √ 3-Day On-the-Job √ 8-hour Annual Refresher √ First Aid-Cardiopulmonary Resuscitation (CPR) training (SSHO)	All personnel working on site shall attend site-specific orientation/training prior to starting on site project work. This training will be facilitated and documented by the SSHO.

At a minimum, the SSHO, or designated alternate, will be certified in First Aid and CPR and will be continuously present during site operations.

4.3 Emergency Response Training

Bhate personnel are trained only to OSHA HAZWOPER Emergency Response Awareness Level and will not be performing emergency response activities beyond recognizing and reporting the emergency. For this scope of work, the SSHO shall verify the means to summon emergency rescue, fire fighting, and medical services in advance of arriving on site.

This page intentionally left blank.

5 SAFETY AND HEALTH INSPECTIONS

5.1 Internal Safety and Health Inspections

The SSHO will conduct daily informal safety and health inspections of their active field work areas. The inspection shall cover workplace conditions, physical area safety, and employee work practices. The SSHO shall document any deficiencies and corrective actions in a field logbook. Additionally, a formal weekly inspection shall also be conducted by the SSHO using the Bhate Health and Safety Inspection form.

5.2 External Safety and Health Inspections

For this scope of work, no external safety and health inspections are required.

This page intentionally left blank.

6 SAFETY AND HEALTH EXPECTATIONS, INCENTIVE PROGRAMS, AND COMPLIANCE

As stated in Bhate's Corporate Health and Policy Statement, "Bhate is committed to achieving unparalleled health and safety results while maintaining the highest standards for production and quality. Bhate believes in protecting the health and safety of our employees, clients, and community members who may be impacted by our work. Further, Bhate believes that no job is so important and no task is so urgent that we cannot take time for proper planning, tasking, and execution of the work at hand."

For this project, as well as any project Bhate conducts, the goal is zero incidents. By achieving zero incidents, Bhate ensures that there will be no work related injury or illnesses, spills resulting in deleterious effects to the environment, or cases of property damage. Zero incidents are achieved through proper work planning, personnel tasking, and proper execution of the work. A safety incentive program will not be implemented for this project. It is expected that each Bhate employee will be accountable for their actions and responsible for fulfilling their duties in a safe manner. Bhate will refer to their *Disciplinary Action for Personnel Safety Violations* procedure to enforce non-compliance with safety directions, as needed. A copy of the *Disciplinary Action for Personnel Safety Violations* procedure is included in Attachment B of this SSHP.

This page intentionally left blank.

7 ACCIDENT REPORTING

7.1 Exposure Data

The SSHO will maintain a field logbook sufficient to document the implementation and compliance with the requirements of the SSHP. Daily log entries shall include the following:

- Date
- Area(s) or site(s) worked
- List of employees by area
- Man-hours worked
- Personal protective equipment (PPE) used by employees
- Daily safety inspection results
- Environmental monitoring results
- Description of special or unusual events or incidents, including all first-aid treatments not otherwise reportable

All man-hours worked, by Bhate and subcontractors, will be submitted to the PM.

Attachment C of this SSHP contains Bhate Health and Safety Field Forms that should be completed, as needed, throughout the duration of the project.

7.2 Accident Investigations, Reports, and Logs

The SSHO shall be responsible for compiling any incident reports and incident investigations as necessary and submitting them to the HSM within 24 hours of the occurrence. The SSHO shall use the *Bhate Incident Reporting and Investigation* procedure included in Attachment B of this SSHP. The SSHO shall utilize the *Bhate Incident Reporting Form* and *Incident Investigation Form* included in Attachment C of this SSHP.

7.3 Notification of Major Accidents

In the event of a major accident or injury, immediate notification shall be made by the SSHO to the Cannon AFB Emergency Services to initiate incident response. The SSHO shall make additional notification to Bhate management in accordance with the Bhate Incident Reporting and Investigation procedures. Notifications to the Cannon AFB will be made by the Bhate PM or their designee.

Immediate reporting is required by OSHA (29 CFR Part 1904) for fatalities or a catastrophe (3 or more people sent to hospital).

All other personal injury requiring first aid or resulting in lost time must be recorded on OSHA Form 300. OSHA does not require this to be sent in, but the contractor is required to keep a record for the purpose of inspections by OSHA.

8 MEDICAL SUPPORT

The SSHO for the project will be certified in First Aid and CPR. A person certified in First Aid and CPR will be continuously present during site operations to provide those services as required for Bhate and subcontractor employees. The SSHO shall possess a basic first aid kit suitable for use by the work crew that meets the minimum fill requirements of American National Standards Institute (ANSI) Z308.1-2003. The SSHO shall also maintain a cellular telephone to summon emergency services.

For any medical emergency occurring onsite, dial 911 for Cannon AFB Security and Emergency Services. Prior to arrival onsite, the SSHO shall verify with Cannon AFB the availability of the medical services. In the event of a medical emergency, use of ambulance services and medical facilities shall be determined by the Cannon AFB Emergency Services.

Plains Regional Medical Center located at 2100 N. Dr. Martin Luther King Jr. Blvd in Clovis, New Mexico is the nearest hospital. Plains Regional Medical Center is approximately 6 miles away and can be reached by calling (575) 769-2141.

In the event of a non-serious injury, treatment should be sought as necessary at the Same Day Access Medical Clinic (also called Medical Office Building) located at 2200 West 21st Street in Clovis, New Mexico 88101 and can be reached by calling (575) 769-7577.

The map to the hospital with directions is included in Attachment D and will be located in a common area for reference by all field personnel.

This page intentionally left blank.

9 PERSONAL PROTECTIVE EQUIPMENT

9.1 Written PPE Program

The Bhate Corporate PPE program is included in Attachment B of this SSHP. PPE for this project will be selected in accordance with this program and the anticipated hazards.

9.2 Minimum PPE

While conducting work onsite, the SSHO shall be responsible for ensuring the PPE used is appropriate for the hazard. The proper use of PPE as described in the following sections will prevent employee exposure to these potential site hazards. At a minimum, PPE will consist of:

- Long pants
- Shirt with sleeves a minimum of 4 inches long
- Hard hat (for overhead hazards)
- Safety boots (steel toe)
- Safety glasses with rigid side shields (for potential eye hazards)
- Work gloves (to protect from sharp edges)

Additionally, the following PPE will be maintained throughout the duration of site work for use during activities that may result in contact with contaminated materials or to upgrade PPE as directed by the SSHO based on monitoring results or observed conditions. All items will be available to Bhate personnel.

- Tyvek Coveralls
- Nitrile gloves
- Respiratory protection
- Ear plugs or ear muffs

9.3 Upgrades/Downgrades in Personal Protective Equipment

An upgrade in the designated level of protection may be instituted if conditions change. The SSHO shall make this determination with assistance from the HSM and then implement the upgrade as appropriate. Documentation of the upgrade shall be completed by the SSHO in the field log book.

This page intentionally left blank.

10 PLANS REQUIRED BY THE SAFETY PROGRAM

10.1 Layout Plans

The Bhate SSHO will control access to the work area. Bhate will demarcate the area using a combination of traffic cones, caution tape, construction fencing, and signage as needed. In order to maintain a safe work area Bhate will establish a support zone (SZ) the purposes of staging equipment and supplies. As needed, an exclusion zone (EZ) and contamination reduction zone (CRZ) will be established in and adjacent the immediate work area to limit access to the work area and provide a controlled area for personnel and equipment decontamination. Where necessary, Bhate will employ spotters to guide equipment operators and vehicles transporting materials in tight work areas.

10.2 Emergency Response Plans

The SSHO shall, prior to arrival onsite, verify the means to summon emergency rescue, fire fighting, and medical services if needed.

An emergency situation requiring response is considered to exist if:

- Any member of the field crew is injured in an accident or experiences or exhibits any adverse effects or symptoms of chemical exposure, or heat or cold stress.
- Safety monitoring indicates site conditions are more hazardous than anticipated and cannot be controlled or that an immediate danger to life or health exists.

The SSHO will administer appropriate first-aid treatment, including CPR, in emergency situations as needed. The following general emergency procedures will be carried out in the event of an injury:

1. Notify the SSHO of the incident.
2. If the victim can be moved safely, remove him from the work area to a safe location.
3. Administer first-aid.
4. Transport the victim to the nearest hospital or emergency medical center or call for ambulance transport, as appropriate.
5. Notify the HSM of the incident and describe the emergency response actions taken.

10.2.1 Directions to Hospital

For any medical emergency occurring onsite, the emergency services of the Cannon AFB Fire & Emergency Services will be the primary responder. Prior to arrival onsite, the SSHO shall verify with the Cannon AFB Fire & Emergency Services the availability of the medical services. In the event of a medical emergency, the Plains Regional Medical Center located at 2100 N. Dr. Martin

Luther King Jr. Blvd in Clovis, New Mexico is the nearest hospital. Plains Regional Medical Center is approximately 6 miles away and can be reached by calling (575) 769-2141.

In the event of a non-serious injury, treatment should be sought as necessary at the Same Day Access Medical Clinic (also called Medical Office Building) located at 2200 West 21st Street in Clovis, New Mexico 88101 and can be reached by calling (575) 769-7577.

A map to the hospital with directions is included as Attachment D, Figure 1 and will be located in a common area for reference by all field personnel.

10.2.2 Procedures for Evacuation of the Work Area

In the event that a member of the field crew is injured or experiences any adverse effects or symptoms of possible exposure (chemical or physical) while on site, the entire field crew will immediately halt work and act according to the instructions provided by the SSHO. The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated will result in the evacuation of the field team and reevaluation of the hazard and the level of protection required. If an emergency situation develops which requires evacuation of the work area, the evacuation procedures in Table 10-1 shall be followed.

Table 10-1. Evacuation Procedures

Evacuation Step	Methods and Comments
Notify affected workers	Use of site communication methods as applicable
Evacuate to safe location	Assemble at the SSHO designated-rally point
Assemble and account for workers	SSHO shall account for personnel using the Daily Safety Meeting Log
Notify Fire and Emergency Services	Notification as needed
Complete incident report	Follow the Incident Reporting and Investigation Procedure

Table 10-2 summarizes potential emergency situations and response actions that are applicable for the project.

Table 10-2. Potential Emergency Situations

In Case of	Response Actions
Injury or illness	Treat injury with applicable First Aid. All work related injuries beyond first aid will result in notification of Emergency Services and notification of the employee supervisor. Any employee requiring advanced medical treatment will be accompanied by a knowledgeable company employee that can answer potential questions on job duties and hazards. Make notifications in accordance with the Incident Reporting and Investigation Procedure.
Chemical exposure	First Aid shall be provided such as but not limited to: move victim to fresh air, remove contaminated clothing, flush affected skin with water for 15 minutes, and seek medical attention.
Fire or explosion	Notify emergency services immediately. All personnel shall evacuate the

In Case of	Response Actions
	immediate area of the fire and move to an upwind location. Personnel shall not engage in fire fighting activities (use of fire extinguisher) unless trained to do so and only in the incipient stages of fire.
Adverse weather	Tornados, lightning, or other threatening weather conditions will result in an immediate shut down of operations and evacuation of personnel. When lightning is observed, the SSHO will shut the operations down for a minimum of 30 minutes between strikes. At a minimum, operations will be shut down for the period of the storm passing plus an additional 30 minutes.
Material spill or release	Vehicles and equipment will be maintained and inspected so as to prevent fluid leaks. Should any vehicle fluid leaks occur, the equipment will be taken out of service to make necessary repairs and any contaminated material will be cleaned up and disposed of properly. Spill kits will be available to facilitate prompt containment and clean-up of spills. Notification will be made in accordance with the Incident Reporting and Investigation Procedure.

10.3 Hazard Communication Program

Hazardous materials anticipated to be brought on site include minimal quantities (~5 milliliters [mL]) of sample preservatives (typically hydrochloric acid) found in the sample vials. Material Safety Data Sheets (MSDSs) will be provided as requested and a copy of the Bhate Hazard Communication Program is included as Attachment B of this SSHP.

10.4 Respiratory Protection Plan

The use of respiratory protection is not anticipated. However, a copy of the Bhate Respiratory Protection Program is included in Attachment B of this SSHP.

10.5 Health Hazard Control Program

Details of the Health Hazard Control Program are located in this SSHP (see Attachment B – Environmental Monitoring). Exposure through inhalation, ingestion, skin absorption, or physical contact, to any chemical, biological, or physical agent in excess of the acceptable regulatory limits specified in the most recently published American Conference of Governmental Industrial Hygienist (ACGIH) "*Threshold Limit Values and Biological Exposure Indices*" or by OSHA, whichever is more stringent, shall be prohibited. Every effort will be made by Bhate and it's subcontractors to reduce contaminant concentration levels as low as is reasonably achievable (ALARA). Personnel will minimize exposure potential by wearing the appropriate PPE at all times while inside the work area.

10.6 Lead Abatement Plan

Not applicable for this scope of work.

10.7 Asbestos Abatement Plan

Not applicable for this scope of work.

10.8 Abrasive Blasting

Not applicable for this scope of work.

10.9 Confined Space

Not applicable for this scope of work.

10.10 Hazardous Energy Control Plan

If electricity is supplied from outside the work areas and/or temporary electrical is used they will be equipped with a ground fault circuit interrupt system. Details outlining control measures are listed in the AHA and in Bhate's Corporate Health and Safety Plan.

All equipment will be equipped with manufacturer's guards. Employees will be briefed on potential pinch points and hazards associated with moving parts and other sources of kinetic energy. Under no circumstances shall a guard be removed without rendering that piece of equipment in a zero energy state and applying lockout/tagout.

10.11 Critical Lift Procedures

Not applicable for this scope of work.

10.12 Contingency Plan for Severe Weather

The SSHO shall, upon arrival on site, review the contingency plan for severe weather maintained by Cannon AFB and use that plan as necessary while conducting work on site. Tornados, lightning, or other threatening weather conditions will result in an immediate shut down of operations and evacuation of personnel. When lightning is observed, the SSHO will shut the operations down for a minimum of 30 minutes between strikes. Operations will be shut down for the period of the storm passing plus an additional 20 minutes. Also see Table 10-1 in Section 10 of this SSHP for evacuation guidelines.

10.13 Access and Haul Road Plan

Not applicable for this scope of work.

10.14 Demolition Plan

Not applicable for this scope of work.

10.15 Emergency Rescue

For this scope of work, the SSHO shall verify the means to summon emergency rescue, fire fighting, and medical services in advance of arriving on site. Bhate personnel will not be performing emergency response activities beyond the Awareness-level of recognizing and reporting the emergency.

10.16 Underground Construction Fire Prevention and Protection Plan

Not applicable for this scope of work.

10.17 Compressed Air Plan

Not applicable for this scope of work.

10.18 Formwork and Shoring Erection and Removal Plans

Not applicable for this scope of work.

10.19 Jacking Plan

Not applicable for this scope of work.

10.20 Blasting Plan

Not applicable for this scope of work.

10.21 Diving Plan

Not applicable for this scope of work.

10.22 Alcohol and Drug Abuse Plan

The Bhate Substance Abuse Program is maintained in the Bhate Employee Manual under the direction of the Human Resources Manager and is as follows:

> **"3.17.1Substance Abuse**
>
> The company is committed to the highest standards of integrity and professionalism in its work, and to the safety of its employees. For this reason, the company does not condone abuse of alcoholic or use of illegal drugs by employees. Illegal drugs includes but are not limited to LSD, cocaine, crack,

heroin and other opiates, marijuana, and all other substances for which a physician must provide a prescription. The term does not include proper use of a prescribed medication. The use or possession of illegal drugs, on or off duty, is inconsistent with law-abiding behavior and a potential threat to the safety of others and work efficiency. Further, possession or consumption of alcoholic beverages on company premises or while working, or being under the influence of alcohol while at work, is also a threat to employee safety and work efficiency.

All employees by signing receipt of this manual are also agreeing to this Substance Abuse Policy as a requirement for their continued employment with Bhate.

Employees may be subject to discharge, even for a first offense, if the company concludes that they are guilty of the following:

1. The use or possession of alcohol on premises;

2. The on premises use (except for the proper use of prescribed drugs), manufacture, distribution, dispensing, possession, sale, soliciting, or purchase of any illegal drug or other controlled substance on company premises or while working;

3. Testing positive for the presence of illegal drugs in the body;

4. Testing 0.08 or higher as to the presence of alcohol in the body or otherwise exhibiting conduct, even though testing revealed a lower concentration, indicating impairment from being under the influence of alcohol while at work or performing Company business;

5. Failing to properly notify Bhate as to taking a legal drug the employee has reason to believe may create a safety risk to the employee or others;

6. The failure to report to the company within five days any conviction (including guilty or nolo contendere plea) for a criminal drug offense in the workplace;

7. The conviction (including guilty or nolo contendere plea) of any criminal drug offense in the workplace;

8. The failure or refusal to participate fully and cooperatively in an applicable treatment program if so directed;

9. The failure or refusal to consent to drug or alcohol testing, including, but not limited to, execution of appropriate authorizations to test , if so directed;

10. The attempt to alter, falsify, or interfere with a drug or alcohol test;

11. Failure to cooperate with a search for illegal drugs or alcohol;

Knowledge of employees using, transferring, purchasing, or in possession of illegal drugs or prescriptions while on the job shall immediately be called to the

attention of company management. Failure to do so may result in discipline, including discharge.

Employees will not be disciplined for the proper use of a prescribed medication. However, any employee who has reason to believe that use of a prescribed drug or even an over-the-counter drug may present a safety risk to himself/herself or others must report such drug use to their supervisor in writing in advance of beginning work so that Bhate can determine work-related consequences. The employee may be removed from working a job when in the judgment of the supervisor the employee's performance while taking the medication presents a direct threat to the health or safety of the employee or others.

Bhate may conduct searches for illegal drugs or alcohol on company property, on work sites, and/or company vehicles when management, at its sole discretion, determines there is reasonable suspicion to believe that illegal drugs or alcohol are present. At management's discretion, they may contact local law enforcement agencies to ask them to assist in the search. Those searches may include an employee's personal property, including, but not limited to the employee's vehicle, clothing, lunch box, cooler, purse, parcels, and similar items.

Employees who believe they may have a substance abuse problem are encouraged to seek assistance. An employee's decision to seek assistance will not be used as the basis for disciplinary action. However, it is the responsibility of the employee to seek assistance before alcohol or drug use leads to conduct that results in disciplinary action. An employee's request to seek treatment will not be a defense to discipline imposed for prior misconduct. Bhate may require an employee who is participating in a treatment program to undergo periodic testing at its discretion. Moreover, an employee seeking voluntary assistance, like any other employee, still must comply with all company policies, and still may be disciplined or terminated for any noncompliance. Testing is not a necessary prerequisite to discipline or discharge if it is otherwise determined that this policy was violated.

This policy is intended to create and maintain a workplace free of drug and alcohol abuse. Bhate is committed to providing a drug-free, safe and secure work environment for its employees. Use, consumption, being under the influence of, or possession of, alcoholic beverages, and use, consumption, testing positive for, or possession of, illegal drugs while on company premises are prohibited. Bhate requires every employee to report to work on time and in inappropriate mental and physical condition for work.

Over-the-counter drugs and drugs prescribed by a physician for an employee's personal use in quantities not exceeding reasonable or specified dosage requirements are not subject to this policy. Employees using medications prescribed by a physician or using over-the-counter drugs are responsible for

being aware of any potential effect such drugs may have on their reactions, judgment, or ability to perform their duties, and if impairment is possible, to report use to their managers prior to reporting to work.

Bhate recognizes that drug and alcohol abuses are medical problems with identifiable symptoms and effective treatments. This policy is designed to detect the signs of drug and alcohol abuse as early as possible and offer employees the chance to undergo treatment at their expense. Each applicant for employment will be required as a condition of employment to undergo a urine drug screen. Further, it is the policy of Bhate that each employee, as a condition of continued employment, is subject to medical or physical examinations or tests, including urine drug screen, at the determination of the HR Manager.

3.17.1 Pre-Employment Testing

As a condition of employment, all potential employees must submit to and successfully pass a urine drug screen.

3.17.2 Work Related Accident- To Your Person, Others or a Vehicle

Workers who are injured at the workplace or in the course of employment may be tested for drugs and alcohol, and if impaired, may not be paid benefits.

3.17.3 Suspected Abuse

Employees will be tested for drugs and/or alcohol if a supervisor finds reasonable suspicion for suspecting a violation of any aspect of the company's policy. Reasonable suspicion may be based on observation of behavior or performance. Bhate may conduct searches for illegal drugs or alcohol on company property, on work sites, and/or company vehicles when management, at its sole discretion, determines there is reasonable suspicion to believe that illegal drugs or alcohol are present. At management's discretion, they may contact local law enforcement agencies to ask them to assist in the search. Those searches may include an employee's personal property, including, but not limited to the employee's vehicle, clothing, lunch box, cooler, purse, parcels, and similar items.

3.17.4 Random

All employees will be tested at random and will be subject to scheduled periodic testing. All employees are entered into a list by the last digit of their respective Social Security Number. On the last business day of each month, the HR Manager, using a random number generator that returns a number from 1 through 31, selects the date that all employees will be subject to a random screening. If the month has less than the generated number or the generated number falls on a non-business day, the selected day will be adjusted to the last business day of the month for the former or the closest business day for the latter. The day before the selected date, the HR Manager, with another

individual observing, using a random number generator will generate a number between 0 and 9. The generated number will correspond to the last digit of the employee's SSN. The following day all employees with the selected number will be notified to submit a urine sample. If the employee is not available, they will submit a sample on the day of their return to the office." [End of policy.]

10.23 Fall Protection Plan

Not applicable for this scope of work.

10.24 Steel Erection Plan

Not applicable for this scope of work.

10.25 Night Operations Lighting Plan

Not applicable for this scope of work.

10.26 Site Sanitation Plan

For this scope of work, the sanitation facilities maintained by Cannon AFB will be used. Bhate will ensure any waste (common trash) generated during the performance of work activities will be collected and disposed of properly.

Personnel will remove PPE and perform appropriate decontamination prior to entering any occupied facility at Cannon AFB to include comfort facilities. Please refer to Section 11 of the SSHP for additional information regarding personal decontamination.

Investigation derived waste (IDW) will be managed in a manner that is protective of human health and the environment. Subsequent to characterization results, the IDW will be properly profiled, and manifested with appropriate signature from a designated Cannon AFB representative. Given the waste stream, it is assumed that the IDW can be properly disposed of as non-hazardous waste. Hazardous waste handling, transportation, and disposal are not anticipated for this project.

10.27 Fire Prevention Plan

The scope of work does not require the use of any open flame. Anticipated fire ignition sources would include matches or lighters for personal smoking use. Smoking is discouraged and shall only be conducted in locations outside the work area designated by the SSHO on personal break time.

This page intentionally left blank.

11 CONTRACTOR INFORMATION

All site personnel must follow the following general operating procedures. These precautionary measures are designed to reduce the risks of inadvertent or accidental chemical exposure or injury during on-site operations.

11.1 Site Rules/Prohibitions

- Be familiar with standard operating procedures and adhere to all instructions and requirements in the SSHP.
- Ensure buddy system awareness and good housekeeping practices.
- Eating, drinking, or smoking will be allowed only in designated areas.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any contaminated or potentially contaminated area.
- Hands and face must be thoroughly washed upon leaving the work area. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.
- No facial hair, which interferes with a satisfactory respirator fit of the mask-to-face seal, is allowed on personnel required to wear respirators.
- Respirators are assigned for an individual's use. Do not share respirators.
- Avoid contact with contaminated or suspected contaminated surfaces. Whenever possible, avoid walking through puddles, pools, and mud. Avoid kneeling or sitting on the ground, equipment, or steel drums.
- Personal articles will be prohibited in any contaminated or potentially contaminated area.
- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. While field operations are in effect, alcoholic beverage intake should be minimized or avoided during off-work hours. Prescribed drugs should not be taken by personnel during on site operations where the potential for absorption, inhalation, or ingestion of toxic substance exists unless specifically approved by a qualified physician. However, any discontinuation of prescription medicine should be with prior approval by a physician. Do not work when ill.
- Persons with open wounds are not permitted to enter any work area that may have airborne contaminants.

11.2 Excavations

No excavation activity will be performed in this scope of work.

11.3 Medical First Aid Requirements

The SSHO for the project (or alternate) will be certified in First Aid and CPR and be continuously present during site operations to provide those services as required for Bhate and subcontractor employees. The SSHO shall possess a basic first aid kit suitable for use by the work crew that meets the minimum fill requirements of ANSI Z308.1-2003. The SSHO shall also maintain a cellular telephone to summon emergency services.

For any medical emergency occurring onsite, the emergency services of Cannon AFB Fire & Emergency Services will be the primary responder.

11.4 Sanitation

For this scope of work, the sanitation facilities maintained by Cannon AFB will be used. Bhate will ensure any waste (common trash) generated during the performance of their work activities will be collected and disposed of properly.

Personnel will remove PPE and perform appropriate decontamination prior to entering any occupied facility at Cannon AFB to include comfort facilities.

11.4.1 Personnel Decontamination

Personnel will be required to thoroughly wash hands and face prior to leaving the work area. Hands and face washing must be performed prior to eating, drinking, or smoking and prior to leaving the site. Disposable PPE will be collected in approved containers for proper disposal. Additional decontamination procedures will be developed by the SSHO, as needed.

11.4.2 Equipment Decontamination

Work efforts will be made to minimize equipment contact with contaminated materials. All equipment must be decontaminated prior to exiting the work area. Equipment will be decontaminated using wet methods with phosphate free laboratory detergent (Liqui-Nox® soap or equivalent) and water, as necessary. Decontamination solutions will be handled appropriately. An equipment/PPE decontamination zone will be established between the work area and the personnel decontamination zone. Tools/equipment/re-usable PPE will be decontaminated in the equipment decontamination zone during cleaning operations. A personnel decontamination zone will be established between the equipment decontamination zone and the exit. Personnel are required to wash hands and face in the personnel decontamination zone prior to exiting the work area.

All equipment and solutions used for decontamination shall be handled and disposed of as IDW. IDW will be managed in a manner that is protective of human health and the environment.

All IDW water and waste PPE will also be contained in Department of Transportation (DOT) approved containers and labeled. The labeling will be weatherproof and fade-proof for a minimum of 1-year.

Hazardous waste handling, transportation, and disposal are not anticipated for this project.

11.5 PPE

The selection, maintenance, and use of PPE for this project are outlined in Attachment B and in Section 9 of this SSHP. It is anticipated that only Level D personal protective equipment will be used for this project.

11.6 Fire Prevention

The scope of work does not require the use of any open flame. Anticipated fire ignition sources would include matches or lighters for personal smoking use. Smoking is discouraged and shall only be conducted in locations designated by the SSHO on personal break time.

11.7 Machinery and Mechanized Equipment

All equipment which is needed shall conform to the requirements of 29 CFR Part 1926 Subpart O and Subpart W and shall meet the following requirements:

- Onsite equipment shall meet the requirements of all relevant OSHA standards.
- Eating, drinking, smoking, and using cellular telephones (including the use of a hands-free feature in conjunction with a cellular phone) is prohibited in the exclusion zone.
- The operation of vehicles on Cannon AFB roadways shall conform to the posted regulations.

Personnel in areas in which heavy equipment is being operated shall wear high visibility traffic safety vests and make eye contact with the operator before approaching.

11.8 Electrical Safety

Electrical equipment is not expected to be utilized for this project. In the event electricity is needed, and to protect workers from the possibility of an electrical accident, only ground fault circuit interrupter (GFCI) outlets will be used. Only ANSI-approved extension cords in conjunction with GFCI will be used.

11.9 Public Safety Requirements

The work site shall be cordoned off with the use of fencing, cones, barricades, or similar devices to prevent the general public from entering the work area.

11.10 Chemical, Physical, and Biological Exposure Prevention

The recognition, evaluation, and control of chemical, physical, and biological agents are outlined in Section 12, Site-Specific Hazards and Controls, of this SSHP.

12 SITE-SPECIFIC HAZARDS AND CONTROLS

12.1 Safety and Physical Hazards

The site contains a variety of physical safety hazards associated with slips, trips, and falls. Care should be taken to secure footing and avoid or be aware of debris and slippery surfaces. Prior to initiating a project activity, the work area will be surveyed to identify any physical safety concerns.

Hearing protection with a noise reduction rating of at least 26 will be worn as needed to protect against high noise levels.

Based on the information available, radiological hazards are not expected to be encountered during the field activities at the site.

12.2 Task Identification and Hazard/Risk Analysis

An AHA identifies potential safety, health, and environmental hazards, and provides for the protection of personnel, the community, and the environment. Because conditions may be constantly changing during the course of a project, the SSHO must be able to evaluate the conditions and apply the appropriate level of hazard control. If conditions are such that the SSHO cannot adequately apply appropriate hazard controls, the HSM will be consulted and will facilitate any necessary modifications to the SSHP or the AHAs. The AHAs are included in Attachment A of this SSHP.

12.3 Chemical Hazards

Site history indicates the potential of exposure of site personnel to petroleum hydrocarbons, benzene, toluene, vinyl chloride, various solvents (1,1-dichlorethane [1,1-DCA], 1,2-dichorethene [1,2-DCE], and trichloroethylene [TCE]), metals, and perchlorate. The chemicals of concern and associated risks are provided in Table A-1 in Attachment A.

Table A-1 provides brief descriptions of the properties of Primary Contaminants of Concern. The majority of the information contained in Table A-1 was referenced from the *National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards* (U.S. Department of Human Health, 2005), and the *Threshold Limit Values for Chemical Substances and Physical Agents* (ACGIH, 2007). Care should be taken to avoid all unprotected contact with site soils and/or groundwater.

12.4 Biological Hazards

Site personnel may also be exposed to poisonous plants, animals, and insects but has a low probability of occurrence. The work area will be visually assessed by the SSHO for the presence

of these dangers. Personnel with admitted sensitivities will not be permitted to work in an area identified as containing the above-mentioned hazards. In the event of an extremely hazardous episode (e.g., snake, spider, or animal bite), the victim will be immobilized and emergency transport will be summoned.

12.5 Exposure Monitoring/Air Sampling Program

The potential for exposure to air-borne contaminants at the site is minimal; therefore no air monitoring will be required. However, onsite personal will be aware of the contaminants of concern and will be prepared to upgrade to air monitoring and subsequently Level C with air purifying respirators (APR) if needed.

The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine the level of worker protection needed. Initial screening for identification is often qualitative, i.e., the contaminant, or the class to which it belongs, is demonstrated to be present but the determination of its concentration (quantification) must await subsequent testing. The use of direct-reading instrumentation will be the primary approach, as necessary, for identifying and/or quantifying airborne contaminants.

12.5.1 Direct Reading Monitoring Instruments

A Photoionization detector (PID) or multi-gas monitor will be used to provide real-time data regarding Volatile Organic Compound (VOC) concentrations when they are anticipated to be present.

Monitoring, calibrating, and maintaining instruments are the responsibility of the SSHO.

12.5.2 Work Stoppage Due to Health and Safety Concerns

If work is stopped due to any health and safety concern, immediate attention should be given by health and safety personnel working in cooperation with the Project Manager to identify and correct the cause of concern as quickly as possible. Any such incident should be fully documented by the SSHO in a report to the HSM and PM. In the event of a work stoppage, the Project Manager must be notified as soon as possible and kept apprised of progress in resolving the incident until normal operations are resumed.

12.6 Heat Stress

Ambient temperature and physiological monitoring will begin when the ambient temperature is above 70 degrees Fahrenheit (°F) and impermeable clothing is in use. When the body temperature rises, the body seeks to dissipate the excess heat. The major disorders due to heat stress are heat cramps, heat exhaustion, and heat stroke. The symptoms and recommended prevention for each are listed below.

Heat cramps are painful spasms, which may occur in the muscles of workers who have perspired profusely in the heat. If this occurs, work should be stopped and the worker supplied with fluids. Heat exhaustion is characterized by extreme weakness or fatigue, dizziness, nausea, and headache. In serious cases, a worker may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and the body temperature can be normal or slightly higher than normal. Treatment consists of rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover quickly with this treatment. Severe cases may require care for several days. There are no permanent effects.

Heat stroke is caused by the breakdown of the body's heat regulating mechanism. The skin is very dry and hot with a red or bluish appearance. Unconsciousness, mental confusion, or convulsions may occur. Without quick and adequate treatment, the result can be permanent brain damage or death. Medical assistance should be given quickly. The person should be moved to a cool place. Body heat should be reduced artificially by soaking the person's clothes with water.

The following steps can be taken to reduce the potential for heat stress:

- Drink plenty of fluids with balanced salts (to reduce loss through sweating); e.g.; Gatorade™, mineral water, Powerade™.
- Wear cotton undergarments to act as a wick to absorb moisture.
- Specifically train workers to recognize the early signs and symptoms of heat stress and heat stroke.
- Specifically train workers on procedures to follow if they detect symptoms of heat stress/stroke.
- Make adequate shelter available for taking rest breaks to cool off.

For extremely warm weather, follow these additional recommendations:

- Shift working hours to early morning and early evening, avoiding the hottest time of the day.
- Rotate crews wearing protective clothing.
- Work with the "Buddy System".
- Allow crews to become acclimated.

Additional considerations will be made depending on the specific activities being performed. Table 12-1 below provides suggested times for monitoring breaks.

Table 12-1. Schedule for Monitoring Heat Related Stress

Adjusted Temperature	Normal Work Clothing	Impermeable Clothing
90^0 F or above	After each 45 minutes of work	After each 15 minutes of work
$87.5^0 – 90^0$ F	After each 60 minutes of work	After each 30 minutes of work
$82.5^0 – 87.5^0$ F	After each 90 minutes of work	After each 60 minutes of work
$77.5^0 – 82.5^0$ F	After each 120 minutes of work	After each 90 minutes of work
$70^0 – 77.5^0$ F	After each 150 minutes of work	After each 120 minutes of work

Adjusted temperature (ta adj) is calculated by using the following equation: ta adj = ta °F + (13 x % sunshine). Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. The ta °F is the air temperature measured using a standard mercury thermometer with the bulb shielded from radiant heat.

12.7 Cold Stress

Personnel working outdoors in temperatures at or below freezing or in warmer temperatures but with damp or wet conditions are susceptible to cold related injury. Cold related injuries vary in severity with potential results of permanent tissue damage and/or death.

Extreme cold for a short time may cause injury to the surface of the body or result in profound generalized cooling. Areas of the body that have a high surface-area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. For exposed skin, continuous exposure should not be permitted when the air speed and temperature results in an equivalent chill temperature of -32 degrees Celsius (°C) (-25.6°F). Superficial or deep local tissue freezing will occur only at temperatures below -1°C (30.2°F) regardless of wind speed. It is imperative that workers who become immersed in water or whose clothing becomes wet be immediately provided a change of clothing and treated for hypothermia, when air temperatures are 2°C (35.6°F) or less.

Localized injuries resulting from cold are included in the generic term "frostbite." Several degrees of damage are possible. Frostbite of the extremities can be placed into the following categories:

- Frost nip or incipient frostbite - characterized by initial reddening of the skin, then changing to white. No freezing of tissue occurs.
- Superficial frostbite - characterized by skin that presents a waxy or white appearance that is firm, yet resilient to the touch. This condition affects the skin and the tissue just beneath the skin. The skin turns purple and may tingle and burn during warming.
- Deep frostbite - characterized by cold, pale, and solid tissue. This condition indicates an extremely serious injury and can result in permanent tissue loss.

First aid for frostbite includes the following:

- Move the person into a warm area.
- Warm the affected area with body heat or warm (not hot) water.
- Do not rub or massage the affected area.
- Seek medical attention.

Since prolonged exposure to cold air or immersion in cold water at temperatures well above freezing can lead to dangerous hypothermia, whole body protection must be provided. Adequate insulating dry clothing to maintain core temperatures above 36°C (96.8°F) must be provided to workers if work is performed in air temperatures below 4°C (40°F). Wind chill

cooling rate and the cooling power of air are critical factors. (Wind chill cooling rate is defined as heat loss from a body expressed in watts per meter squared which is a function of the air temperature and wind velocity upon the exposed body.) The higher the wind speed and the lower the temperature in the work area, the greater the insulation value for the protective clothing required.

To prevent the onset of hypothermia, workers should be protected from exposure to cold so that the deep core temperature does not fall below 36°C (96.8°F). Lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision-making, or loss of consciousness with the threat of fatal consequences. Symptoms of systemic hypothermia (by exposure to freezing or rapidly dropping temperature) normally progress through five stages:

1. Shivering;
2. Apathy, listlessness, sleepiness, and sometimes rapid cooling of the body to less than 95°F;
3. Unconsciousness, glassy stare, slow pulse, and slow respiratory rate;
4. Freezing of the extremities; and
5. Death.

First aid for hypothermia includes the following:

- Move the person into a warm area.
- Remove any wet clothing and begin to warm the center of the body (torso) with electric blanket if available or body heat under dry blankets, clothing, towels, or sheets.
- Warm, nonalcoholic liquids may be given to a conscious person.
- Seek medical attention.

If work is performed continuously in the cold at an equivalent chill temperature below -7°C (19.4°F), heated warming shelters should be made available nearby. Workers should be encouraged and allowed to utilize the shelters at regular intervals throughout the work period depending on the severity of the climatic conditions. Inside the heated shelter, the employees' outer layer of clothing should be removed and inner layers loosened to promote the evaporation of perspiration or the worker should change into dry clothing before returning to work.

Work in cold environments does not diminish the need for proper hydration. Warm sweet drinks and soups should be provided in addition to water to facilitate warming and maintain proper hydration. The intake of caffeinated drinks should be limited due to the potential diuretic and circulatory effects.

This page intentionally left blank.

13 EMERGENCY CONTACTS

In the event of an emergency, local sources of assistance will be utilized. Prior to the commencement of the work, the SSHO will familiarize the field team with the location of the closest hospital. Phone numbers and facilities for emergency use are provided for the work site and will be posted.

Ambulance …… 911

Fire …… 911

Police …… 911

Facility Security Police……. (575) 784-4111

Closest Hospital:

Plains Regional Medical Center…… …….. (575) 769-2141
2100 N. Dr. Martin Luther King Jr. Blvd
Clovis, New Mexico 88101
Hospital Directions: See Figure 1 for directions and map in Attachment D
(Figure 1 will also be posted at the site during field activities.)

Non-Emergency Facility:

Same Day Access Medical Clinic …….. (575) 769-7577
(also called Medical Office Building)……..
2200 West 21st Street
Clovis, New Mexico 88101

After primary contacts have been made, the following secondary contacts may be made as appropriate:

Tracy Walker ……. (205) 918-2047
Bhate Team Project Manager ……cell (205) 213-4027

Sally S. Smith, CIH…… (205) 918-4032
Bhate Health and Safety Manager cell (205) 983-4150

Matthew Higginbotham …… (575) 784-1092
Cannon AFB Point of Contact

Jonathan Kramer (Trinity) …….. (850) 613-6800
Site Safety and Health Officer

NOTE: For ambulance, fire, or police contacts, give the name of the road and the nearest intersection. Notify the PM and HSM after emergency contacts have been made.

This page intentionally left blank.

14 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*.

Bhate Environmental Associates, *Bhate Corporate Health and Safety Plan*.

Bhate Environmental Associates, *Bhate Corporate Employee Manual*.

U.S. Department of Labor, Title 29 Code of Federal Regulations Part 1910.

U.S. Department of Labor, Title 29 Code of Federal Regulations Part 1926.

U.S. Department of Health and Human Services, National Institute of Occupational Safety and Health (NIOSH), *Pocket Guide to Chemical Hazards*.

This page intentionally left blank.

ATTACHMENT A

ACTIVITY HAZARD ANALYSIS
AND
PROPERTIES OF PRIMARY CONTAMINANTS OF CONCERN

This page intentionally left blank.

Activity Hazard Analysis – 01

Task: General Site Activities; Site Mobilization and Demobilization	**Project:** Cannon AFB LTM at Multiple Sites	**AHA Reviewed by:** Sally S. Smith, CIH, CSP, CHMM, CPEA
Minimum Personal Protective Equipment (PPE): Level D PPE (Hard Hat, Safety Glasses with rigid side shields, steel toe work boots, leather gloves)	**Location:** Cannon AFB, New Mexico	**AHA Reviewed date:** March 2012

Activity	Potential Hazard(s)	Control Measures
General site activities, site preparation, mobilization, and demobilization The hazards and control measures presented in AHA 01 are applicable to all phases of the project	Slips, trips, or falls on walking and working surfaces	• Be alert for uneven terrain and steep slopes • Keep work area free of dirt, grease, slippery materials, debris, and tools; practice good housekeeping • Provide adequate lighting in all work areas • Keep all stairways and walkways clear of debris/tools to prevent trips
	Site traffic	• Be aware of potential vehicle traffic while on site • Follow posted warnings and rules for travel around site • All onsite personnel must wear highly reflective orange or yellow safety vests in traffic areas and/or when working around heavy equipment
	Eye injury	• Use approved safety glasses with rigid side shields
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1 in any construction areas, and areas with overhead hazards
	Dropped objects	• Steel toe boots meeting ANSI Standard Z41 shall be worn
	Back injury from lifting heavy loads	• Site personnel will be instructed on proper lifting techniques – bend with the knees and not with the back; avoid twisting at the waist, use your feet to turn • Mechanical devices should be used to reduce manual handling of materials • Team lifting should be utilized if mechanical devices are not available

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General site activities, site preparation, mobilization, and demobilization (Continued) The hazards and control measures presented in AHA 01 are applicable to all phases of the project	Inclement weather (Thunderstorms and tornadoes)	• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows • If outdoors, stay close to the ground • Listen to radio or television announcements for pending weather information • Do not try to outrun a tornado on foot or in a vehicle
	Biological hazards (spiders, snakes, etc.)	• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas • Look in direction of travel for biological hazards to avoid • Wear insect repellant as needed
	Thermal Stressors and other hazards (i.e. heat stress, cold stress)	• Employees will have appropriate clothing for variable weather • Wear long sleeves and long pants and sunscreen with a high sun protection factor (SPF) on exposed skin • Employees will take breaks and drink plenty of fluids, as necessary, to prevent heat stress alternating between water and Gatorade-type drinks • Take periodic warming breaks and drink warm sweet liquids when working in cold weather • Protect skin from becoming wet in cold weather; replace clothing that becomes wet as soon as possible • Wear insect repellant as needed • Refer to the Bhate Corporate HASP for detailed information on heat and cold stress

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General site activities, site preparation mobilization, and demobilization (continued) The hazards and control measures presented in AHA 01 are applicable to all phases of the project	Spills/Fire	• Fuel cans will be National Fire Protection Association (NFPA) approved and equipped with pouring spout or funnel • Spill and absorbent materials will be readily available • Smoking and open flames are not permitted in fueling/greasing areas or in the work area • All heavy equipment will be equipped with a ABC type fire extinguishers which will be inspected weekly and documented • Provide fire extinguishers near all welding, soldering, or other sources of ignition • Keep fire extinguishers easy to see and reach in case of an emergency • Store gasoline and other flammable liquids in a safety can with flame arrestor outdoors or in an approved flammable cabinet • Ensure that leaks or spills of flammable or combustible materials are cleaned up promptly • Oily or solvent soaked rags must be disposed of in a metal self closing safety can and must be emptied and properly disposed of on a daily basis

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General site activities, site preparation mobilization, and demobilization (continued) The hazards and control measures presented in AHA 01 are applicable to all phases of the project	Sharp objects, if encountered	• All exposed rebar and other sharp objects that could cut or impale someone must be protected (i.e. rebar caps - mushroom type is not acceptable for impalement protection) • All exposed nails must be bent over or removed; all loose nails must be kept off the ground • Wear leather or Kevlar gloves while handling sharp objects to prevent lacerations
	Electrical, when used	• Ensure GFCI are used in all outdoor environments, in any areas subject to moisture, and for all temporary power • Ensure all cords and electrical tools are in good repair. Do not attempt to repair a cord with tape; discard damaged cords immediately. Ensure ground prong is in place and insulation is not damaged on all extension cords/equipment. • Ensure breaker boxes, electrical boxes, junction boxes, outlets, have covers in place. Ensure there are no openings where someone can come in contact with live electricals; all knockout holes are covered with proper plugs. • Keep cords and electrical tools out of traffic areas where they may be damaged • Inspect all tools; take damaged tools out of service and tag “damaged – do not use”
	Ergonomics	• Avoid awkward postures • Avoid repetitive motions; switch hands and take rest breaks to give your affected body parts time to rest • Avoid excessive contact stress; provide padding if contact with a fixed object is prolonged such as the floor or a wall

AHA – 01 (continued)

Activity	Potential Hazard(s)	Control Measures
General site activities, site preparation mobilization, and demobilization (continued) The hazards and control measures presented in AHA 01 are applicable to all phases of the project	Vehicular traffic in work area and heavy equipment operation	• Wear reflective traffic vest and cordon off work area • Maintain awareness of vehicle movement in work area and exercise caution when approaching heavy equipment exercise caution when approaching heavy equipment • Equipment will be equipped with functioning back-up alarms, signal lamps, lights, and alerting horns • Operators are required to use seat belts at all times • Only qualified / licensed operators will operate mobile equipment • All equipment must be inspected using the appropriate forms prior to use on each day of use
Equipment Used	**Inspection Requirements**	**Training Requirements**
Level D PPE Fire Extinguishers First Aid Kits Eyewash	Employees inspect their own PPE. Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits and eyewash. Informal daily inspections are to be conducted by the SSHO. Formal weekly safety inspections are to be conducted and documented on field inspection form by the SSHO.	Personnel have read and understand this SSHP, hospital route map, MSDSs, and AHAs. At least one designated individual onsite will have current CPR and First Aid training.

Activity Hazard Analysis – 02

Task: Groundwater Sampling	**Project:** Cannon AFB LTM at Multiple Sites	**AHA Reviewed by:** Sally S. Smith, CIH, CSP, CHMM, CPEA
Minimum Personal Protective Equipment (PPE): Level D PPE (Hard Hat, Safety Glasses with rigid side shields, steel toe work boots, leather gloves)	**Location:** Cannon AFB, New Mexico	**AHA Reviewed date:** March 2012

Activity	Potential Hazard(s)	Control Measures
Purging and sampling monitoring wells The hazards and control measures presented in AHA 01 are applicable tothis phase of the project as well	Cross contamination/ Contact with contaminants	• Position body upwind of the monitoring well prior to opening cap • Wear appropriate protective clothing and equipment to safeguard against potential contamination (Nitrile gloves, boot covers, coveralls, etc.) • Conduct work activities in a manner that minimizes potential contact with groundwater • Only essential personnel will be in the work area • All personnel will follow good hygiene practices by washing hands and face prior to eating, drinking, or smoking • SSHO shall conduct breathing zone monitoring for VOCs with a PID in accordance with requirements for site monitoring
	Contact with laboratory preservatives (HCl, H_2SO_4, and HNO_3)	• Wear appropriate protective clothing and equipment to safeguard against potential contact with acids (Nitrile gloves, boot covers, coveralls, etc.) • Inspect sample coolers and sample containers prior to use • Safely discard any broken or leaking containers
	Open water	• Use appropriate equipment and tools to collect water to minimize fall risk • Maintain a safe distance from any open water

AHA – 02 (continued)

Equipment Used	Inspection Requirements	Training Requirements
Level D PPE Fire Extinguishers First Aid Kits Eyewash	Employees inspect their own PPE. Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits and eyewash. Informal daily inspections are to be conducted by the SSHO. Formal weekly safety inspections are to be conducted and documented on field inspection form by the SSHO.	Personnel have read and understand the SSHP, hospital route map, MSDSs, and AHAs At least one designated individual onsite will have current CPR and First Aid training

Activity Hazard Analysis – 03

Task: Annual inspections of landfills and SMWU	**Project:** Cannon AFB LTM at Multiple Sites	**AHA Reviewed by:** Sally S. Smith, CIH, CSP, CHMM, CPEA
Minimum Personal Protective Equipment (PPE): Level D PPE (Hard Hat, Safety Glasses with rigid side shields, steel toe work boots, leather gloves)	**Location:** Cannon AFB, New Mexico	**AHA Reviewed date:** March 2012

Activity	Potential Hazard(s)	Control Measures
• Annual inspection and maintenance of the covers at Landfills 3, 4, and 25 and SWMU 101 • Annual site inspections of institutional controls at LF-02, FT-06, SD-12, SD-15, SD-17, SD-20, SWMU-2, SWMU-4, SWMU-6, SWMU-31, and SWMU-102 The hazards and control measures presented in AHA 01 are applicable to this phase of the project as well	Slip, trip and fall hazards while inspecting	• Be alert for uneven terrain and steep slopes • Keep work area free of dirt, grease, slippery materials, debris, and tools; practice good housekeeping • Provide adequate lighting in all work areas • Keep all stairways and walkways clear of debris/tools to prevent trips
	Inclement weather (Thunderstorms and tornadoes)	• Halt activities immediately and take cover during thunderstorm or tornado warnings, shelter in a building if possible, stay away from windows • If outdoors, stay close to the ground • Listen to radio or television announcements for pending weather information • Do not try to outrun a tornado on foot or in a vehicle
	Biological hazards (spiders, snakes, etc.)	• Workers will inspect the work area carefully and avoid placing hands and feet into concealed areas • Look in direction of travel for biological hazards to avoid • Wear insect repellant as needed
	Vehicular traffic in work area	• Wear reflective traffic vest and cordon off work area • Maintain awareness of vehicle movement in work area and exercise caution when approaching heavy equipment exercise caution when approaching heavy equipment

AHA – 03 (continued)

Equipment Used	Inspection Requirements	Training Requirements
Level D PPE First Aid Kits with Eyewash (in vehicle) Fire extinguisher (in vehicle)	Employees inspect their own PPE. Weekly inspections will be performed on fire extinguishers. Weekly inspections will be performed on first aid kits and eyewash. Informal daily inspections are to be conducted by the SSHO.	Personnel have read and understand the SSHP, hospital route map, MSDSs, and AHAs At least one designated individual onsite will have current CPR and First Aid training

This page intentionally left blank.

Attachment A - Table A-1 Properties of the Primary Contaminants of Concern

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure		Target Organs	IP (eV)	Specific Gravity (g/mL)	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
				Acute	Chronic							
Benzene	1 ppm ST = 5 ppm	0.5 ppm STEL = 2.5 ppm	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose, and throat, headache, dizziness, nausea, staggered gait, fatigue	Cancer (leukemia), adverse reproductive effects (female fertility, birth defects)	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	9.24	0.88	75	12	1.2	7.8
Toluene	200 ppm	20 ppm	Inhalation Ingestion Contact Absorption	Irritation of eyes, skin, nose, drowsiness, fatigue, weakness, confusion, headache, nausea, dilated pupils	Liver and kidney damage	Eyes, skin, respiratory system, Central nervous system, liver, kidneys	8.82	0.87	21	40	1.1	7.1
Vinyl Chloride	5 ppm	1 ppm	Contact Ingestion Inhalation	Blisters, eye irritation, nausea, difficulty breathing, and headaches	Cancer, blood disorders, liver and kidney damage	Eyes, skin, bone marrow, kidneys, central nervous system	NA	0.91	2515.6	-108	3.6	33
TCE	10 ppm	25 ppm	Contact Ingestion Inhalation	Nausea, vomiting, stomach pain, headache, difficulty breathing, drowsiness, and dizziness	Lung, kidney and liver organ damage, brain damage, and cancer.	Eyes, skin, respiratory system, central nervous system, liver, kidneys	NA	1.46	58	NA	8	10.5
1,1-DCA	None	5 ppm	Inhalation Skin absorption Ingestion Skin and/or eye contact	Irritation of eyes, skin, and throat; dizziness; headache; nausea; dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis [potential occupational carcinogen]	Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the kidneys and liver.	Eyes, skin, respiratory system, central nervous system, liver, kidneys	10	1.21	500	-2.0	6.5	15.5

Contaminant	PEL	TLV	Route(s) of Exposure	Signs and Symptoms of Exposure – Acute	Signs and Symptoms of Exposure - Chronic	Target Organs	IP (eV)	Specific Gravity (g/mL)	VP (mm Hg)	Flash Point (°F)	LEL %	UEL %
1,2-DCE	1 ppm	10 ppm	Inhalation Skin absorption Ingestion Skin and/or eye contact	Irritation of eyes, skin, and throat; dizziness; headache; nausea; dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis [potential occupational carcinogen]	Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the kidneys and liver.	Eyes, skin, respiratory system, central nervous system, liver, kidneys	NA	1.235	61	55.4	6.2	15.6
Arsenic	0.01 mg/m^3	0.01 mg/m^3 (TWA)	Inhalation, Ingestion, dermal and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea	Cancer, adverse reproductive effects (female fertility, birth defects)	Kidneys, lungs, central nervous system, mucous membranes	NA	5.72	NA	NA	NA	NA
Chromium	1 mg/m^3	0.5 mg/m^3	Inhalation, Ingestion, Contact, Absorption	Caustic to skin and mucous membranes	Cancer	Lung, kidney, and liver	NA	2.7	NA	NA	NA	NA
Lead	0.05 mg/m^3	0.05 mg/m^3	Inhalation, Ingestion, Contact	Eye irritation	Weakness, anorexia, tremors, neuropathy, Hypo-tension	GI tract, CNS, kidneys, blood, gingival tissue	N/A	11.34	0	N/A	N/A	N/A
Perchlorate (as potassium perchlorate)	None – 15 mg/m^3 (total nuisance dust)	Not established	Skin contact/absorption Inhalation of aerosol, Ingestion	Irritation of the eyes, skin, and respiratory tract	May have affects on the blood, when converts to nitrites resulting in formation of methemoglobin	Red Blood Cells, liver, kidneys	NA	Density 2.52 g/cm^3	NA	NA	NA	NA

Notes:

PEL = Permissible Exposure Limit
TLV = Threshold Limit Value
°F = Degrees Fahrenheit
IP = Ionization Potential
eV = Electron volt
VP = Vapor Pressure
mm Hg = Millimeters of mercury
ACGIH = American Conference of Governmental Industrial Hygienists
STEL (and ST) = Short term exposure limit

LEL = Lower Explosive Limit
UEL = Upper Explosive Limit
% = Percent
ppm = Parts per million
mg/m^3 = Milligrams per cubic meter of air
CNS = Central Nervous System
NA = Not Applicable
g/mL = Grams per milliliter
GI = Gastrointestinal

ATTACHMENT B

WRITTEN SAFETY PROCEDURES AND PROGRAMS

5 INCIDENT REPORTING AND INVESTIGATION

5.1 Purpose

The purpose of this program is to specify the types of incidents to be reported and investigated, to define internal incident notification requirements, to ensure proper management and follow-up of each incident, and to meet regulatory notification and investigation requirements.

5.2 Scope

Incident reporting requirements apply to all Bhate operations, including subcontractor activities.

5.3 Definitions

5.3.1 Incident

For the purposes of this program, an incident is:

A work-related injury or illness;

An exposure to a hazardous substance above the allowable exposure limit;

Property/vehicle/equipment damage;

An unplanned fire or explosion;

An unplanned spill or release (including air releases) to the environment;

A permit or permit equivalent exceedance;

Any unexpected contact with or damage to aboveground or belowground utilities;

Discovery of an unknown and potentially hazardous material;

A "near miss" or an unplanned event or workplace condition that has a reasonable probability of resulting in one of the outcomes described above had the circumstances been different, and for which modifications to management programs will reduce the probability of occurrence or the severity of the outcome.

5.3.2 "Serious" Incident

A "serious" incident includes the following:

Imminent danger safety conditions;

Any incident (including near miss) involving the general public or visitors;

Work-related injury or illness requiring more than First Aid;

Spills or release of hazardous material or contaminated media in excess of 1 gallon, the Reportable Quantity*, or any spill or release to surface water;

Any unexpected contact with or damage to aboveground or belowground utilities; or

Other unusual incidents of a serious nature that could result in an injury or regulatory violation.

*Note: The Reportable Quantity for various hazardous substances is defined by 40 CFR 302.4. If you are uncertain of the Reportable Quantity, report the spill first, and then seek assistance in determining the Reportable Quantity.

5.4 Discussion

5.4.1 Responsibilities

All Bhate Employees

All personnel have the responsibility to immediately report any incident to their supervisor. The report can be verbal or in writing.

5.4.2 Project Management Personnel

Project Managers and/or Site Managers are responsible for identifying a SSHO for each project, for implementation of this program, and for making all client notifications as pertaining to incidents.

Project Managers and/or Site Managers are responsible for:

Implementing the appropriate internal notifications as required by this program as soon as an incident becomes known;

Completing the Incident Report and Investigation Form, as required;

Ensuring that a copy of the report is forwarded to the HSM; and

Ensuring that effective follow-up activities are conducted.

5.4.3 Site Safety and Health Officer

The designated SSHO where the incident occurred has the responsibility to:

Ensure that all notifications are made promptly;

Ensure that all reports are fully completed;

Ensure that all insurance and workers compensation forms are completed and submitted as necessary;

Participate in incident investigations of all Occupational Safety and Health Administration (OSHA) recordable injuries/illnesses, spills, releases, and other investigations as requested;

Maintain a file of all incident reports and investigations within their area of responsibility;

Communicate information about the incident to all site and/or office employees; and

Transmit a copy of the incident report and investigation, and workers compensation forms to the HSM.

5.4.4 Health and Safety Manager

The HSM or his/her designee has responsibility to provide site specific training to the designated SSHO regarding implementation of this procedure onsite. Other responsibilities of the HSM include:

Assisting with notifications to OSHA of any injuries or illnesses as required;

Reviewing/maintaining a log of all investigations which may include basic causes, immediate causes, and management control issues;

Distributing summaries of incidents with periodic management reports;

Communicating significant incidents to key personnel within Bhate;

Assisting with statistical and root cause analyses of Bhate incidents; and,

Recommending Health and Safety Plan modifications, as necessary.

5.5 Incident Reporting and Internal Notification

5.5.1 Reporting Incidents to Supervision

Bhate employees are required to notify the Project Manager and/or their supervisor as soon as possible after an incident has occurred. The notification may be verbal or in writing, but it should be done as soon as reasonably possible.

5.5.2 Completion of the Incident Report

The Incident Report is to be completed by the end of the day of the incident if possible, but no later than 24 hours after the incident was reported by the Project Manager and employee(s) involved in the incident.

Completion of the form is self-explanatory. If the Project Manager or the employee has any questions regarding completion of the report, the SSHO should be contacted for assistance.

Both the employee(s) and the employee's Project Manager must sign the Incident Report.

5.5.3 Transmittal and Filing of the Incident Report

A copy of the Incident Report should be sent within 24 hours to the Project Manager and the HSM.

The SSHO shall maintain a copy of each Incident Report in the project or office files and, for OSHA recordable injuries/illnesses with the OSHA 300 log for each office or project. Do not include the investigation portion of the form with the OSHA log.

5.6 Incident Investigations

Unless otherwise indicated by the HSM, incident investigations are to be initiated and completed as soon as possible, but no later than 72 hours after the incident has been reported.

The Project Manager for the project where the incident occurred has the prime responsibility for coordinating and conducting the incident investigation. At a minimum, the SSHO will participate in investigations of OSHA recordable injuries or illnesses, spills, releases, and permit exceedance.

Copies of the completed Investigation Report should be sent within 72 hours to the Project Manager and the HSM for review and signature. The Project Manager shall ensure that all corrective actions identified on the Investigation Report are completed and closure is properly documented.

Investigations which fall within the scope of the OSHA Process Safety Management Standard must meet the requirements of 29 CFR 1910.119(m).

5.7 External Notifications

5.7.1 OSHA Notification

Notification to OSHA is required within 8 hours if the incident resulted in one or more fatalities and/or three or more hospitalized individuals. The 8-hour notification to OSHA is also required if a fatality or hospitalization of three individuals occurs within 30 days after the incident.

A Bhate Principal or his designee in consultation with the HSM has the responsibility for making the OSHA notification. The local OSHA area office number can be found in the phone book. Most offices have 24-hour message machines.

The Project Manager is responsible for notifying the client of any required OSHA notifications.

5.7.2 Agency Notifications for Environmental Spills, Releases, and Permit Exceedance

Prior to initiation of project field activities, the Project Manager and the client shall establish regulatory agency notification responsibilities and procedures as part of the project Communications Plan. If a Communications Plan is not developed, the Project Manager shall document the agreements made with the client concerning regulatory agency notification responsibilities and procedures. It is Bhate's policy that if a spill, release, or permit exceedance is determined to be reportable, Bhate or the client shall perform the reporting in a timely fashion as defined by federal, state, or local laws and regulations.

The Project Manager must determine if a spill, release, or permit exceedance is reportable to a regulatory agency under federal, state, and/or local laws and regulations or permit conditions. This determination must be made quickly since many laws and regulations have short time frames for requiring notifications (e.g. immediately upon knowledge, but no later than 24 hours).

If a spill or release is determined <u>not</u> to be reportable, the Project Manager, shall evaluate whether the spill or release poses a threat to human health (e.g., has or may release into known drinking water sources, has or may cause contamination of surface soils/materials/air accessible to the public, etc.). If determined to pose a threat to human health, the Project Manager shall consult with the client to determine whether the spill or release should be reported to a regulatory agency.

The client shall be notified regarding the spill, release, or permit exceedance and Bhate's notification determination. Notifications shall be made per the contract or the project Communications Plan.

The Project Manager should allow a Bhate Principal or his designee to review any written notification prior to submittal to the agency.

5.7.3 Documentation of Agency and Client Notifications

All agency and client notifications shall be documented on the Incident Report and Investigation Form and maintained in the project files. Other documentation generated regarding verbal or written agency notifications (if required), including agency response to such notification, shall be maintained in the project file.

In instances where the client conducts the reporting, documentation shall be obtained from the client indicating that the agency was notified in accordance with federal, state, or local regulations and maintained in the project files. In instances where the client verbally notifies Bhate that the notification was made, the Project Manager shall document the conversation with the client indicating that the agency notification was made.

Copies of the Incident Report and Investigation Form and other documentation regarding agency notification shall be maintained in the project files.

If the spill, release, or permit exceedance is determined to not be reportable, the Report and Investigation Form shall include the rationale for not reporting the spill, release, or permit exceedance to a regulatory agency.

5.8 Training

Conducting a thorough incident investigation requires training in loss control principles and incident investigation techniques. The HSM has the responsibility for ensuring that site and supervisory personnel have the appropriate training to conduct incident investigations.

This page intentionally blank.

6 DISCIPLINARY ACTION FOR PERSONNEL SAFETY VIOLATIONS

6.1 Purpose

The purpose of the Disciplinary Action for Personnel Safety Violations procedure is to provide a mechanism for holding personnel accountable for their actions resulting in safety violations occurring on projects managed by Bhate or acting as a representative of Bhate.

6.2 Scope

The Disciplinary Action for Personnel Safety Violations procedure applies to all Bhate personnel.

6.3 Definitions

6.3.1 Safety Violation

Any deviation from 29 CFR 1910, 29 CFR 1926, Bhate Corporate Health and Safety Plan, SSHP, client safety requirements, or accepted industry practice with regards to health and safety.

6.3.2 Imminent Danger

Where conditions or practices exist which could reasonably be expected to cause death or serious physical harm.

6.4 Discussion

All Bhate personnel are required to comply with designated health and safety procedures as defined in the Corporate Health and Safety Plan, procedures, and/or specific project requirements.

Disciplinary action for safety violations will follow a three-step process:

Initial violation – a verbal warning is issued indicating the infraction, explanation of the possible outcomes of the infraction, and steps to prevent recurrence.

Second violation – a written reprimand is issued and entered into the employee's personnel file.

Third violation – employee is terminated and documentation of the infraction and reason for termination is included in the personnel file.

During each step of the process, the employee will be informed of the successive step in the disciplinary action procedure. Additionally, at each step of the procedure the employee will receive retraining at their supervisor's discretion.

Some discretion is permitted in the procedure. In some instances, infractions can be different violations with similar principles. For example, failure to wear proper personal protective equipment on one day and failure to use a seatbelt in a vehicle another day. Both of these infractions can be characterized as a failure to follow procedure.

If disputes arise in the administration of a disciplinary action for a safety violation, a Bhate Principal will render a final decision.

Some situations, due to the severity of the violation may warrant immediate suspension and/or termination, including but not limited to:

- Willful violation of the Corporate Health and Safety Plan, procedures, and/or specific project requirements permitting an imminent danger situation.
- Withholding chemical information regarding a project and allowing personnel to work in such scenarios.
- Working continuously under suspended loads.
- Failure to use appropriate fall protection when required.
- Working in confined spaces without following the appropriate entry procedures.
- Failure to follow lockout procedures where required.

As noted previously, discretion is permitted in implementing this procedure.

All disciplinary action is to be instituted upon witnessing and/or being informed of the infraction. The employee is to be reviewed and held accountable relative to bonuses, raises, and/or promotions during their annual review. The employee will be evaluated for improvement during the employee's subsequent annual review at which time written reprimands will be removed from the personnel file.

12 ENVIRONMENTAL MONITORING

12.1 General

Site monitoring shall be performed as necessary for site remediation and clean construction work. This section covers general site monitoring for employee exposure to physical and chemical hazards including air contaminants (dust, metals, volatile organic compounds (VOCs), and other specific compounds).

Minimum site monitoring requirements are determined during the project design stage, and are specified in the SSHP for each project. Site monitoring shall be performed by, or under the direction of a SSHO.

12.2 Required Site Monitoring

Site monitoring is required under the following conditions:

When required by the contract, or SSHP

When required by specific OSHA standards (e.g., 29 CFR 1910.120, hearing conservation, asbestos, benzene, cadmium, inorganic arsenic, lead, formaldehyde, vinyl chloride, etc.)

When worker exposure is reasonably anticipated to be greater than 50% of the OSHA Permissible Exposure Limit (PEL), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV), or other recognized occupational exposure limit

When necessary to verify the adequacy of hazard control measures and/or PPE, including respiratory protection

When necessary to assess and evaluate worker exposure, or to resolve worker complaints or concerns

With the concurrence of the HSM, site monitoring may be discontinued after representative initial monitoring is conducted and worker exposures are shown to be adequately controlled through the use of engineering, work practice, or PPE control measures. If work activities change so that the initial monitoring is no longer representative of worker exposure, monitoring must be reinitiated.

12.3 Monitoring Strategy

Where site monitoring is required, the SSHP will detail a site monitoring program that considers the factors that may affect worker exposure and the following elements:

Monitoring requirements, contaminants, and monitoring equipment limitations

Specific work locations, work activities, work practices, personnel, and equipment to be used onsite

Any additional site specific hazard information gathered during development of the SSHP

Health and safety program requirements for site monitoring

The monitoring strategy and approach shall be documented in the SSHP. Documentation shall include a discussion of rationale used to determine the site monitoring requirements that sufficiently justifies the approach. Background information, such as exposure modeling calculations and previous (or similar) exposure monitoring data, shall be included as necessary. The approach shall include the type of monitoring (direct reading, personal, perimeter, or area monitoring), activities or locations to be monitored, contaminants, monitoring instrumentation, monitoring methods, and frequency of monitoring as appropriate.

12.4 Typical Site Monitoring

12.4.1 Direct Reading Exposure Monitoring

Direct reading instruments for exposure monitoring are extremely useful on construction and hazardous waste sites. The primary advantages include ease of use, ability to monitor constantly changing conditions, and the rapid detection of flammable atmospheres, oxygen deficiency, certain gases and vapors, and physical hazards including noise and radiation.

The following are some of the instruments that may be used for exposure monitoring:

Photoionization detector (PID)

Flame ionization detector (FID)

Combustible gas indicator (CGI)

Specific gas monitors (e.g., oxygen, carbon monoxide, hydrogen sulfide)

Real-time aerosol monitor

Radiation detection instruments

Colorimetric indicating tubes (e.g., Draeger tubes)

Mercury vapor analyzer

Specialized air monitors

Noise dosimeter

Sound level meter (SLM)

Routine direct reading monitoring results (date/time, calibration information, results, and activities monitored) shall be recorded on the Air Monitoring Data Sheet (Real-Time Air Monitoring) or an equivalent form if approved by the Health and Safety Manager. Monitoring results shall be recorded initially and periodically throughout the monitoring period (e.g., every 15 minutes, when results are above background levels, when site operations or locations change, or when unexpected site conditions arise). When direct reading air monitoring results at the work location equal or exceed the action levels specified in the SSHP for the project, the SSHO shall conduct exclusion zone perimeter air monitoring. If the air concentrations at the perimeter of the exclusion zone equal or exceed the action level(s), the boundaries of the exclusion zone

shall be expanded as necessary to maintain exclusion zone air contaminant concentrations below the action level(s).

12.5 Integrated Personal Air Monitoring

Integrated personal air monitoring refers to the continuous collection of a sample over a period of time for subsequent analysis, usually by a laboratory. This monitoring typically involves the use of portable sampling pumps and an appropriate collection media such as filters, impingers, or adsorption tubes. Integrated monitoring can also be performed using organic vapor monitors and other passive sampling devices.

Personal sampling and analysis will be performed in accordance with the OSHA Industrial Hygiene Technical Manual, the National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods, or other acceptable industrial hygiene practices. Only analytical laboratories accredited by the American Industrial Hygiene Association (AIHA) shall perform sample analysis. The laboratory analysis will include field blanks, as required by the individual method or laboratory. The laboratory shall also be a successful participant in the NIOSH Proficiency Analytical Testing program for the appropriate analytical category. Prior to sampling, the specific sampling and analytical method should be discussed with the receiving laboratory to determine any special requirements or variations to established methods necessary to collect an acceptable sample.

Sampling and analytical information for personal sampling shall be recorded on the Air Monitoring Data Sheet (Integrated Air Monitoring). To ensure timely reporting of analytical results, personal air sampling media shall be sent to the laboratory within 5 working days of the date collected or as specified by the laboratory analysis method and analyzed with normal laboratory turnaround time.

12.6 Training

Persons conducting site monitoring shall have adequate training and/or experience commensurate with the type and complexity of the monitoring program. They should be able to understand the limitations of the equipment they use, proper methods of calibration, proper methods of sealing and shipping samples, and the importance of chain-of-custody.

12.7 Calibration

All instruments shall be calibrated (or checked for proper function if appropriate) before use for each shift. Instrument calibration shall be documented on sample data sheets or in logbooks. Calibration checks may be necessary during the day and at the end of use to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response. Air sampling pumps will be calibrated with primary standards (e.g., dry calibrator or bubble-tube method).

12.8 Operation and Maintenance

All instruments shall be operated and maintained in accordance with the manufacturer's specifications. The manufacturer's operation and maintenance manual will be kept at the site work location for each type of instrument that is being used.

12.9 Sample Shipment

Samples sent to a laboratory for analysis shall be packaged to prevent damage, spillage, or leaks. An air or bulk sample data sheet with chain-of-custody information must accompany any sample shipped.

Filter Cassettes – Filter cassettes should be mailed in a cardboard box and packed with paper. Avoid using packaging peanuts or other static producing material because the static charge will draw material away and off the filter surface. This is especially true for asbestos fiber samples. Filter cassettes shall be taped over the top and bottom to keep the plugs on the end of the cassette and to prevent sample tampering prior to analysis.

Charcoal Tubes – Charcoal tubes should be mailed in a cardboard box and adequately packaged to prevent breakage during shipment. Charcoal tubes must never be shipped in the same package as bulk samples.

Bulk Samples – Bulk samples shall be packaged in labeled containers compatible with the sample and tightly sealed to prevent leaks and spills. Remember that some bulk samples may be considered hazardous materials by the Department of Transportation and have special requirements for packaging, labeling, and method of shipment. Bulk samples must never be shipped in the same package as charcoal tubes.

12.10 Data Review

The designated SSHO or other qualified person will assess and interpret monitoring data and results based on standard industry practices and his/her professional judgment. All calculations performed on raw data (e.g., time-weighted-average calculations) shall be documented and reviewed by another qualified person.

12.11 Recordkeeping and Posting

The SSHO is responsible for maintaining adequate records of site monitoring activities, communicating or posting exposure information, and informing employees of monitoring results as may be required. All integrated personal air sampling results shall be communicated in writing to affected employees within 5 days of receiving laboratory results. All employee exposure records are to be kept by the employer and made available in accordance with 29 CFR 1910.1020.

12.12 Additional Site Monitoring Considerations

12.12.1 Monitoring Frequency

Monitoring or sampling frequency will be influenced by a number of factors including the following:

Frequency of contaminant release (i.e., continuously, intermittently, one-time release)

Frequency of operation

Number of samples required

Number of different work groups requiring assessment

Number of work shifts requiring monitoring

Each of these factors should be considered to determine the monitoring frequency.

12.12.2 Monitoring Duration

When monitoring a worker's exposure for comparison to a published exposure limit value such as the OSHA PELs or ACGIH TLVs, monitoring may need to be conducted over a full 8-hour (or longer) work shift or a 10- to 15-minute period of time. In some cases, monitoring may need to be continuous if there is the potential for buildup of a dangerous atmosphere. Monitoring duration can also be affected by the duration of the operation being monitored (i.e., it may only operate 1 hour a day) or by the length of time a worker performs an operation. Duration can also be affected by the contaminant concentration in air. Often, higher concentrations of air contaminants will require the collection of shorter-term samples to avoid overloading the sample collection device being used.

12.12.3 Monitoring Location

The monitoring location will be influenced by the purpose for monitoring. When monitoring for compliance with employee exposure limit values such as PELs or TLVs, monitoring close to the person's breathing zone will normally be required. Ambient or area monitoring is often used to determine air concentrations in a general area that may then be used to estimate worker exposures when they are working in the area.

The location of monitoring will also be influenced by where the contaminant or hazard source originates and/or the dispersion pattern, which may be influenced by atmospheric conditions.

12.12.4 Number of Samples

The number of samples that need to be collected and analyzed will be influenced by the purpose for the monitoring and the degree of confidence necessary. If the purpose of the monitoring is to collect subjective data to determine the magnitude of the airborne contamination, then only a few samples will be necessary. However, if the purpose is to determine and document compliance with a regulation, then a "statistically" significant number of samples will be necessary. In this

case it may be necessary to consult with a statistician who can help develop a monitoring strategy to achieve sufficient statistical power. In many cases, three or more samples may be necessary to draw any preliminary conclusions.

12.12.5 Observation of Monitoring

Observation of monitoring refers to two different aspects. First, all air monitoring needs to be checked throughout the day by the person performing the monitoring. All air monitoring devices are subject to breakdown and tampering and thus they need to be checked periodically. Never set up a device and leave it unattended until the end of the monitoring period. If the monitoring period is only 10 to 30 minutes long, then it should be observed the entire time.

The other aspect to observation of monitoring is the right of employees or their representative to observe the monitoring. Employees have a right to observe monitoring (that affects them) and this right should be explained to them.

13 HAZARD COMMUNICATION

13.1 Purpose

The purpose of this program is to ensure that employees understand the potential hazards of chemicals used in the workplace in accordance with the Hazard Communication (HAZCOM) Regulation, 29 CFR 1910.1200.

13.2 Scope

This program applies to all Bhate operations where employees have potential exposure to hazardous chemicals as a result of their normal job duties or a foreseeable emergency. This program does not apply to hazardous wastes. However, Bhate will provide employees with information on the potential hazards of wastes in accordance with 29 CFR 1910.120(e) and (i).

13.3 Definitions

13.4 Chemical Manufacturer

A workplace where chemicals(s) are produced for use or distribution.

13.5 Exposed Worker

Any worker subjected to a hazardous chemical in the workplace through any route of entry (inhalation, ingestion, skin contact, absorption, etc.).

13.6 Foreseeable Emergency

Any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that could result in an uncontrolled release of a hazardous chemical into the workplace.

13.7 Hazardous Chemical

Any chemical that constitutes a physical or health hazard. Chemicals with a label containing the words CAUTION, WARNING, or DANGER indicate the chemical is hazardous. Consumer products are not considered hazardous where it can be demonstrated that the products are used in the workplace in the same manner as for normal consumer use.

13.8 Material Safety Data Sheet

Written or printed material describing characteristics, hazards, and controls associated with a specific or combination of chemicals.

13.9 Work Area

A room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

13.10 Discussion

13.10.1 Responsibilities

13.10.1.1 Health and Safety Manager

The HSM shall ensure that:

A list(s) of hazardous chemicals is developed for each work site or office;

A current MSDS is maintained on file;

MSDSs are available to employees; and

Employees understand how to read an MSDS, know the location of the MSDSs, and understand the potential hazards of the chemicals with which they are working.

13.10.1.2 Purchasing Requestors

Personnel purchasing affected chemical products are responsible for ensuring that:

An MSDS is received with all new shipments of hazardous chemicals;

The supplier is contacted when an MSDS is not received; and

A copy of the MSDS is forwarded to the HSM.

13.11 General Guidelines

The HAZCOM regulation sets requirements for information and training on hazardous chemicals used in the workplace. Federal law requires that all states comply with hazard communication regulations, and many states and local governments have adopted their own "equally or more stringent" hazard communication standards. Therefore, applicable state and local requirements must be consulted when conducting projects in states that have their own standards. The following are guidelines for complying with federal requirements.

13.12 Labeling

The HAZCOM regulation requires that the employer ensure the following:

Each container of hazardous chemical in the workplace is labeled, tagged, or marked with the following information:

Identity of the hazardous chemical(s)

Appropriate hazard warnings

Name and address of the chemical manufacturer, importer, or other responsible party

HAZCOM also requires that:

Existing labels on incoming containers of hazardous chemicals are not removed or defaced, unless the container is immediately marked with the required information

Labels or other forms of warning are legible, are in English, and are prominently displayed on the container, or readily available in the work area throughout each work shift

13.13 Label Warning System

The types of common warning systems are:

The National Fire Protection Association (NFPA) Standard defines five degrees of hazard in each of the following three categories: emergency health hazard, fire hazard, and instability or reactivity hazard. NFPA warning labels are an acceptable means of labeling hazardous chemicals provided that employees are trained on the NFPA labeling system.

The Consumer Product Safety Commission requires precautionary labeling on every hazardous chemical intended for household use. Basic precautionary information and labeling terms have been identified by the Manufacturing Chemists Association including the following:

Toxic
Highly toxic
Flammable
Extremely flammable
Corrosive
Irritant
Poison

DOT requires shipping containers of hazardous chemicals to be labeled in accordance with the appropriate hazard class. DOT has established nine hazard classes:

Class 1 -Explosives
Class 2 -Gases
Class 3 -Flammable liquids
Class 4 -Flammable solids
Class 5 Oxidizers/organic peroxide
Class 6 -Poisons/infectious substances
Class 7 -Radioactive materials
Class 8 -Corrosives
Class 9 -Miscellaneous hazardous materials

All Bhate projects shall use the name of the hazardous chemical and the NFPA system for labeling portable and stationary containers that are not appropriately labeled. This includes containers that are for general use (e.g., gasoline cans) and containers that have materials transferred to them from original containers.

"Prop 65" rules in California require special warnings when personnel may be exposed to substances "Known to the State" to be carcinogens or reproductive hazards. If materials which

are subject to "Prop 65" are used at a California site, review the warnings referenced below during the HAZCOM portion of the site specific training. In addition, the SSHPs will identify contaminants of concern that fall under "Prop 65".

For exposure to a chemical known to the State of California to cause cancer:

"WARNING: This product contains a chemical known to the Sate of California to cause cancer."

For exposure to a chemical known to the state to cause reproductive toxicity:

"WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm."

13.14 Personal Responsibilities

Personnel using or handling any chemical shall complete the following steps when handling chemicals:

Read the label on the container. If special instructions are provided, they will usually be part of the label.

Look for information concerning special precautions for personal protection.

Note appropriate first aid in case of an exposure.

Become familiar with the various types of labels and their warnings.

Consult the MSDS for further warnings or requirements.

13.15 Specific Labeling Requirements

Hazardous substances that have specific labeling requirements under other standards include the following:

Carcinogens

Lead

Asbestos

Hydrogen, oxygen, and anhydrous ammonia

Cotton dust

Formaldehyde

13.16 Material Safety Data Sheet

13.16.1 General Information

The MSDS is used to relay chemical hazard information from the manufacturer/importer to the employer and employee. The HAZCOM regulation requires an MSDS for each hazardous

material product an employee packages, handles, or transfers. The HAZCOM regulation does not require an MSDS sheet for hazardous wastes. Only those hazardous chemicals brought onto the job site by the contractor are required to have an MSDS sheet. The SSHPs will contain similar information on the known or potential site contaminants.

13.16.2 MSDS Content

MSDSs that are received with incoming shipments of hazardous chemicals shall be maintained in an onsite file or office file by the HSM and shall be made available to all site or office employees. Each MSDS shall include the following information:

Trade name of the chemical (if appropriate)

Name, address, and telephone number for hazard and emergency information

Date of MSDS preparation

Chemical and common name of all ingredients

OSHA PELs, ACGIH TLVs, and other applicable limits

Physical and chemical characteristics

Physical hazards

Primary route(s) of entry into the body, such as inhalation, ingestion, or skin absorption

Acute and chronic health hazards, including signs and symptoms of exposure and medical conditions aggravated by exposure

Carcinogenic hazards

Emergency and first aid procedures

Precautions for safe handling and use

Engineering/exposure control measures and personal protective equipment

Upon receipt of an MSDS (with a shipment of chemicals or otherwise) the following steps shall be performed:

The MSDS shall be given to the HSM who inspects it for completeness. If incomplete, the MSDS is returned to the manufacturer with a written request for a complete MSDS. After sending the request, the supplier or manufacturer should be contacted by phone.

If the MSDS is complete, the HSM places a copy of the complete MSDS into the site project or office file.

If a revised version of an MSDS is received, the old version of the MSDS is stapled to the revised MSDS and placed in the site project or office file.

If no MSDS is received with a shipment of chemicals, a written request shall be used to request an MSDS from the supplier or the manufacturer. After sending the request, the supplier or manufacturer should be contacted by phone.

Copies of all correspondence, phone contacts, and MSDSs shall be maintained in the project or office files.

MSDSs are a good source of information for those seeking quick hazardous material references. In the case of emergencies, however, not all of the pertinent information is provided and at times the information may be more damaging than helpful. Response to any emergency requires quick judgment calls. If there is any question of which first aid procedures to follow, it is best to call the emergency number provided on each MSDS specific to the material in question.

13.17 Non-Routine Activities

All Bhate employees and subcontractors must be informed of the hazards associated with chemicals involved in non-routine activities. For the purpose of this guideline, non-routine activities include, but are not limited to, line breaking/pipe opening, confined space entry, tank cleaning, and other maintenance of process equipment.

Hazards of non-routine tasks are addressed in SSHPs and Activity Hazard Analyses (AHAs) and are reviewed with the work crew during preparatory meetings of daily briefings.

13.18 Employee Information and Training

Employee information and training shall be provided as part of the employee's EHS training. This documentation includes the initial hazardous waste training certification and the site specific or office training documentation.

The following are required elements of the information and training program:

An overview of HAZCOM;

A review of any operations in their work areas that may involve hazardous materials;

The location and availability of the written Hazard Communication Program, including the list(s) of hazardous chemicals and MSDSs;

Methods and observations that may be used for detecting the presence or release of hazardous chemicals;

An understanding of the physical and health hazards of hazardous chemicals in the work area;

How to understand the information in MSDSs;

How to read the warnings on container labels including the NFPA system;

When and how to report leaks and spills;

How to recognize the symptoms of overexposure and how to protect against it; and

How to implement exposure control methods including work practices, engineering controls, administrative controls, personal protective equipment, and emergency procedures.

Hazard communication training is provided during initial training, site specific and office orientation, supervisor training, and 8-hour refresher training.

In the event that a new chemical hazard or new task is introduced in the workplace, the HSM or designee shall conduct additional training that includes the following:

Objectives of the task, if applicable;

Physical and health hazards associated with the new chemical hazard or task;

Methods to detect the presence or release of the hazardous chemicals;

Procedures and practices recommended to protect themselves from the hazards;

Emergency procedures in the event of a hazardous situation or exposure; and

Location and availability of the written program, lists of chemicals, and MSDS.

13.19 Subcontractors

Subcontractors working for Bhate shall be required to meet the EHS requirements outlined in their contracts. To help meet these requirements, subcontractors are informed of Bhate procedures by the HSM or designee and instructed where to find information on hazardous chemicals being used on the project.

This page intentionally blank.

14 PERSONAL PROTECTIVE EQUIPMENT

14.1 Purpose

The purpose of this program is to ensure that PPE is selected in accordance with 29 CFR 1910.132, properly used and maintained, and that Bhate personnel are properly trained in the inspection, use, and maintenance of PPE.

14.2 Scope

This program applies to all Bhate operations including the activities of contractors on Bhate-managed projects.

14.3 Definition

14.3.1 Personal Protective Equipment

Items which are worn and are designed to protect the health and safety of an employee. This includes, but it is not limited to, chemical resistant shoes, boots, gloves, chemical protective clothing, hard hats, safety glasses, hearing protection, cooling/heating vests, life-lines and harnesses, and respirators. Additional program requirements for respirators are provided in the Respiratory Protection Program.

14.4 Discussion

14.4.1 Responsibilities

14.4.1.1 All Bhate Personnel

All personnel required to use PPE are responsible for wearing the appropriate PPE when required, inspecting the PPE prior to use, properly wearing the PPE, and as necessary, properly maintaining the PPE.

14.4.1.2 Project Management Personnel

Site Managers are responsible for understanding the specific PPE requirements for each project task and ensuring that PPE is provided and worn when required and in the intended manner.

14.4.1.3 Health and Safety Manager

The HSM is responsible for:

Ensuring that PPE is selected in accordance with the hazard assessment requirements of 29 CFR 1910.132(d)

Approving changes to PPE requirements through plan modifications or by incorporating criteria into the SSHP which enable the SSHO to authorize changes to the PPE requirements

14.4.1.4 Site Safety and Health Officer

The SSHO is responsible for:

Monitoring PPE usage;

Recommending modifications to PPE requirements to project management and the HSM, as necessary;

Ensuring that project personnel have the proper training on the PPE which they are required to use, and performing training and retraining, as necessary; and

Providing notifications to laundries which clean Bhate work clothing, as required.

14.5 Intended Use

PPE is intended for use when engineering controls, administrative procedures, and/or work practices are not feasible, when control measures are shown to be ineffective for exposure minimization, when uncertainty exists regarding the nature and level of potential exposure, and as a precautionary measure to prevent exposure due to accidental releases of hazardous materials.

14.6 Hazard Assessment and Selection

Hazard assessments shall be performed during the preparation of all SSHPs. The hazard assessment shall include consideration for:

Potential chemical, physical, and biological hazards present

Work operations to be performed

Potential routes of exposure

Concentrations of contaminants present

Characteristics, capabilities, and limitations of PPE, and any hazards that the PPE presents or magnifies such as heat stress

The SSHP shall be used as the written documentation of the hazard assessment to comply with 29 CFR 1910.132(d)(2), and shall include the identification of the workplace evaluated, the person certifying that the evaluation has been performed, and the date(s) of the hazard assessment.

14.7 PPE Requirements

All PPE shall be of safe design and construction for the work to be performed and shall meet applicable American National Standards Institute (ANSI) standards and/or OSHA regulations.

PPE used exclusively for site work shall be provided at no cost to Bhate personnel. Field personnel will be provided $75.00 biennially for purchasing appropriate leather safety shoes. Prescription safety glasses are not provided to personnel by Bhate. [from NV JV III HASP-""]PPE used exclusively for site work shall be provided at no cost to Nationview-Bhate personnel. Field personnel will be provided $75.00 per year for purchasing appropriate leather

steel toe safety shoes. Prescription safety glasses are provided to personnel by Nationview-Bhate at a cost not to exceed $150 per year.

Personnel responsible for the issuance of PPE shall ensure that PPE properly fits each affected. Respirator fit will be evaluated in accordance the Respiratory Protection Program.

Eye and/or face protection shall be provided when hazards exist from flying particles, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation. Regarding eye and/or face protection:

Side shields shall be used whenever site plans require the use of safety glasses. Employees who wear prescription lenses must use ANSI approved industrial prescription safety glasses with fixed side shields and/or prescription inserts for full face respirators as necessary to meet project requirements. The cost of eye examinations is the responsibility of the employee.

Filter lenses for operations which involve hazardous light radiation shall be in accordance with 29 CFR 1910.133(a)(5).

A full-face respirator is required whenever operations involve corrosive liquids and the operation requires the use of a respirator to provide for maximum eye protection; if the operation does not require a respirator, then splash goggles at a minimum shall be worn. Face shields are not a substitute for splash goggles.

Hard hats shall be provided whenever hazards from falling objects, overhead hazards, low clearance hazards exist, or required by a SSHP.

14.8 Field Work Clothing

PPE is designed and prescribed to protect employees from the risk of injury by creating a barrier against workplace hazards. PPE is not a substitute for good engineering, administrative controls, or good work practices, but should be used in conjunction with these controls to ensure the safety and health of employees. PPE will be provided, used, and maintained by the employee when it has been determined that its use is required and that such use will lessen the likelihood of incurring an occupational injury and/or illness.

The use of PPE can itself create significant worker hazards such as heat stress, physical and psychological stress, impaired vision, reduced mobility, and difficulties with communication. For any given situation, PPE must be selected to provide the appropriate level of protection without creating unnecessary risk to the wearer.

The following is a list of minimum required clothing and PPE for Bhate projects:

Shirts with at least a 4-inch sleeve (tank tops, sleeveless shirts, and/or unbuttoned shirts are not acceptable);

Long pants (loose-fitting pants are not permitted);

Leather or similar material steel-toed work boots;

Hard hats;

Safety glasses with rigid side-shields; and

Leather or similar material work gloves.

Additional equipment to be utilized will be selected on the basis of potential hazards of each project. The actual equipment to be utilized will be chosen on the basis of potential hazards of each project and specified in the SSHP and may include but is not limited to any of the following:

Hearing protective devices (plugs or muffs)

Faceshields and/or chemical resistant splash goggles

Welding helmets or goggles

Chemical resistant gloves

Chemical resistant boots and/or boot covers

Tyvek® or other impermeable coveralls

Respiratory protection

14.9 Inspection

Each employee is responsible for inspecting his/her PPE before and after each use. Any damaged or defective PPE is to be taken out of service immediately and repaired or replaced.

14.10 Cleaning, Maintenance, and Disposal

Used, disposable PPE items are placed in containers at job sites for disposal. The Project Manager or Site Manager in consultation with the HSM shall determine the proper method of disposal.

Non-disposable items such as hard hats and rubber boots are to be decontaminated at the job site. Personnel are responsible for cleaning their own PPE after each work shift unless other arrangements are made for the project. Site specific cleaning procedures are listed in the SSHP for each job site.

14.11 Medical Evaluation

Medical surveillance examinations for personnel required to wear PPE will include an evaluation of the person's ability to tolerate the physical stresses posed by protective equipment.

14.12 Training

14.12.1 Initial Training

Training in PPE inspection, use, and maintenance is conducted as part of the initial hazardous waste 40-hour training. This training provides personnel with an understanding of the

inspection, use (including donning, doffing, adjusting, and wearing), limitations, care, and maintenance of PPE.

14.12.2 Site Specific Orientation

Site specific orientations shall be used to communicate selection decisions to site personnel to meet the requirements of 29 CFR 1910.132(d)(1)(ii). The site specific orientation shall ensure that site personnel:

Understand when PPE is necessary, what PPE is necessary, the limitations of the PPE, and the proper disposal of the PPE;

Understand how to use the specific PPE required by the project; and

Has retained the basic PPE knowledge from the initial training.

14.12.3 Retraining

Retraining shall be performed:

Whenever Bhate personnel have reason to believe that a person does not have the requisite understanding and skill to properly and safely use PPE;

When changes in the workplace or work plans require modifications to the types of selected PPE; and

As necessary, to inform Bhate personnel of changes to the requirements of this program.

14.13 Documentation

PPE training shall be documented through a written certification that contains the name of each person trained, the date(s) of the training, and the identification of the subject of the certification. Training certification may be accomplished as follows:

For initial, supervisor, and refresher training, Bhate shall maintain a copy of the course certificate.

For site specific orientation, site specific training and required retraining, the training sign-in sheet shall contain the required information identified above.

This page intentionally blank.

15 RESPIRATORY PROTECTION

15.1 Purpose

The purpose of this program is to establish minimum requirements for the proper selection, use, and care of respiratory protection equipment by workers at Bhate project sites and to ensure compliance with 29 CFR 1910.134.

15.2 Scope

This program applies to all Bhate respiratory protective equipment users.

15.3 Definitions

15.3.1 Hazardous Atmosphere

Any atmosphere containing a potentially toxic gas, vapor, dust, fume, mist, or pesticide, or any oxygen-deficient atmosphere.

15.3.2 Oxygen-Deficient Atmosphere

An atmosphere containing less than 19.5 percent oxygen by volume at sea level.

15.3.3 Discussion

15.4 Responsibilities

15.4.1 Project Management Personnel

Site Managers are responsible for ensuring that the proper respiratory protective equipment (RPE) is used when required in accordance with the SSHP in the intended manner.

The HSM is responsible for assisting the Site Managers with annual training and fit testing for the use of RPE.

The Site Managers and HSM are responsible for selection and specification of RPE in accordance with the requirements of this program and applicable regulations.

The Site Manager is responsible for:

Ensuring that personnel have the necessary training and fit testing for the use of each type of respirator and ensuring that proper documentation is available;

Monitoring the use of RPE; and

Ensuring that RPE is maintained and inspected in accordance with the SSHP and program requirements.

15.4.2 Health and Safety Manager

The HSM is responsible for evaluating the effectiveness of the respiratory protection program on each site; and recommending changes to the types of RPE being used, as necessary.

15.5 Selection of Respiratory Protective Equipment

All respiratory equipment utilized on Bhate projects shall be certified by the NIOSH and the Mine Safety and Health Administration (MSHA). The type of respiratory protection selected is based upon potential hazards at a specific site. Selection of appropriate respiratory protection is documented in the SSHP and approved by the HSM.

There are three general classes of respiratory protection available:

Self-contained breathing apparatus (SCBA);

Air-supplied devices; and

Air-purifying devices.

To select which type of respiratory protection is appropriate for a given project, the following questions must be answered:

1. Is there a possibility of an oxygen-deficient atmosphere?
2. Are the contaminants and concentrations in the worker breathing zones known or unknown?
3. What are the allowable concentration limits (permissible exposure limits or threshold limit values) for the contaminants? What are their physical properties?
4. What are the maximum expected concentrations of known contaminants? Are the concentrations Immediately Dangerous to Life or Health (IDLH)?
5. What is the expected duration of personnel exposure?
6. What are the warning properties and symptoms of the contaminants?
7. Can the contaminant be absorbed through the skin and/or eyes?
8. Are the contaminants flammable?
9. Is there any other information concerning the contaminants that may be pertinent to selecting appropriate respiratory protection?

Atmosphere-supplying respirators (i.e., pressure demand SCBAs or airline systems) shall be used when one of the following occurs:

1. The hazardous substance has been identified and requires the highest level of protection based on the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates;

2. Site operations involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates; or

3. Operations are being conducted in confined, poorly ventilated areas that could contain hazardous concentrations of atmospheric vapors, gases, or particulates and/or reduced oxygen concentrations less than 19.5 percent.

Escape packs are used with all airline systems. Employees shall not be permitted to enter atmospheres that are immediately dangerous to life or health without the approval of the HSM, or without documentation of specific hazardous atmosphere rescue training.

Negative pressure air purifying respirators, equipped with appropriate filter cartridges for the expected contaminants, may be used only when the atmospheric contaminants have been identified, and expected concentrations are within limits that can be effectively removed by the respirator cartridges. For air purifying respirators used for protection against gases or vapors, a cartridge change schedule shall be included in the SSHP along with a description of the information or data relied upon to develop the schedule. In most cases this will consist of recommendations by the manufacturers when they become available.

15.6 Fit Testing

A qualitative fit test shall be conducted for each employee during the initial 40-hour health and safety training course and/or at site specific training and annually thereafter. Fit testing may also be performed when a condition that may affect the face fit of the respirator has occurred, such as weight gain or loss, dental work, facial surgery, or deformity. Employees shall be clean shaven during fit testing.

Qualitative fit tests shall be administered using irritant smoke or Bitrex in accordance with the OSHA Respiratory Protection Standard in 29 CFR 1910.134.

Qualitative fit testing will be limited to situations where a negative pressure respirator is used and a protection factor of 10 or less is needed. If a protection factor of greater than 10 is needed, the SSHP will require either a positive pressure/pressure demand respirator or quantitative fit-testing of the negative pressure respirator.

All positive pressure/pressure demand respirators with tight-fitting facepieces will be fit-tested qualitatively or quantitatively in the negative pressure mode.

A record of the fit test shall be maintained utilizing the qualitative respirator fit test record form. Records of employee respiratory protection training shall be maintained by the Bhate Corporate office.

15.7 Respirator Use

All Bhate personnel are required to:

Use RPE when required and in the proper manner;

Inspect RPE prior to each use and obtain replacement equipment when found to be defective;

Perform a user seal check each time they put on a tight-fitting respirator;

Take proper care of the RPE;

Be clean shaven where the seal of the respirator contacts the face whenever using RPE; and

Leave the respirator use areas whenever necessary to wash their face or respirator to avoid skin irritation; if they detect contaminant breakthrough, a change in breathing resistance, or leakage of the facepiece; or to change filters or cylinders.

Low temperatures may fog the lenses of the respirator and use of anti-fog spray and a nose cup may be beneficial. Nose cups are part of the NIOSH approval for air supplied respirators at ambient temperatures of 32°F and below. Minimum temperatures recommended by the manufacturer for operation of a SCBA shall be consulted prior to use in low temperatures.

Under no circumstances are employees permitted to use escape provisions of atmosphere-supplying respirators for routine entry and non-emergency egress of work areas.

Wearing any respirator in conjunction with other types of protective equipment will impose some physiological stress on the wearer. Use of respirators in conjunction with protective clothing can greatly affect human response and endurance, especially in hot environments.

15.8 Cleaning and Storage

Each person has the responsibility to clean, disinfect, and care for their respirator in accordance with the training they have received. The following procedures shall be followed for cleaning and storage of respiratory protection equipment:

Personal respirators shall be cleaned and disinfected after each day's use, or more frequently, if necessary.

Respirators for emergency use and all SCBAs shall be cleaned and inspected after each use, and inspected on a monthly basis. Monthly inspections shall be documented, including serial number, date, findings, and remedial action and signature of the inspector.

Routine cleaning shall be completed as follows:

Remove the filters and dispose of per the SSHP requirements, if applicable.
Wash respirator in disinfecting solution.
Rinse respirator in clean water.
Allow respirator adequate time to air dry.

Routine inspection shall be completed as follows:

Check all connections for gaskets and "O" rings and proper tightness.

Check the condition of the facepiece and its parts for tears, cracks, abrasions, or brittleness.
Check the condition of the connecting air hose, regulator, and harness, if applicable.
Check the condition of the headband for tears, cracks, abrasions, or brittleness.
Inspect all rubber or elastic parts for pliability and signs of deterioration.
Check alarms, if applicable.
Report any worn, missing, or broken parts to health and safety personnel onsite.

Clean and dry respirators shall be stored in zippered plastic bags. These bags shall be placed in a clean, dry place out of direct heat and sunlight.

Repairs and parts replacements will only be made by individuals trained to do so using only the manufacturer's NIOSH approved parts. Only manufacturers or technicians trained by the manufacturer can repair\replace reducing and admission valves, regulators, and alarms.

15.9 Air Monitoring of Work Areas

To determine if the selected respiratory protection is appropriate, the work area shall be monitored for contaminant concentrations at the beginning of each phase of work activity as required by the site safety plan. Sampling should be in the breathing zone of the exposed employee. Periodic sampling throughout the project will be conducted per the SSHP to ensure that the selected respirator protection is appropriate.

15.10 Evaluation of the Program

Site Managers and the HSM shall monitor the project implementation of the respiratory program during routine and informal inspections. The HSM will perform evaluations of project implementation of the program during site inspections. The inspections shall include consultation with affected employees required to use respirators. The HSM will evaluate overall program implementation through a review of inspection reports, incident reports and investigations, and audit reports.

15.11 Medical Surveillance

Site personnel shall meet the medical surveillance requirements of 29 CFR 1910.134, 1926.103 and 1910.120, for respirator use prior to engaging in any field work requiring or potentially requiring the use of a respirator. Personnel with medical conditions which prevent or limit their ability to wear a respirator shall be notified in writing by the LMP.

15.12 IDLH Atmospheres

Bhate personnel shall immediately evacuate areas where an IDLH atmosphere develops. Bhate personnel shall not enter IDLH atmospheres except for rescue or when authorized by the HSM. If necessary, at least one standby person equipped with proper rescue equipment and a pressure demand SCBA should be present. Communication between the field team and the standby person should be maintained at all times. If the IDLH atmosphere exists in a confined space, the entry shall be conducted in accordance with the Confined Space Entry Program requirements.

15.13 Training

Personnel required to use respiratory protection shall be trained in the selection, use, and maintenance of the equipment. Respiratory protection training is included as part of the initial health and safety training, the 8-hour refresher course, and/or the site specific training. The training shall be conducted annually. Site specific respiratory protection training includes the following:

Hazard identification to include symptoms of exposure;

Use of engineering controls to minimize exposure and an explanation of why engineering controls are not feasible;

A description of the type of respiratory protection chosen and the protection provided to the employee;

Assurance that the employee understands the protection capabilities and limitations of the method of respiratory protection utilized;

Recognition of medical signs and symptoms that may limit or prevent effective use of respirators;

A thorough demonstration of the selected method of respiratory protection to include how to put it on, how to check the seals, use, troubleshooting, and maintenance followed by hands-on training by the employee;

How to use the respirator in an emergency, including situations in which the respirator malfunctions; and

A description of the on site storage and maintenance facilities for maintaining respiratory protection equipment.

ATTACHMENT C

BHATE HEALTH AND SAFETY FIELD FORMS

ATMOSPHERIC MONITORING LOG

Page No.: _____ of _____

Date: _____

Circle: Sun Mon Tue Wed Thu Fri Sat

Site: _____ Project Number: _____

Site Safety & Health Officer: _____

Action Levels: D ☐ → C ☐ → B ☐ → (Stop work, call in for instructions)

Task/Equipment: _____

Weather: _____

TIME	OVA PPM	HNU PPM	O_2 %	LEL %	H_2S PPM	COMMENTS: DURATION OF READINGS, UPGRADES, LOCATION, ETC.

Additional Comments: _____

Signature: _____ Title: _____

NOTE: Place in project files.

DAILY SITE SAFETY MEETING

Project: _____ **Date:** _____

Project/Phase Number: _____ **Time:** _____

Meeting Conducted By: _____ _____

Print Name ***Signature***

1. AWARENESS (e.g., special EHS concerns, pollution prevention, recent incidents, etc.):

2. OTHER ISSUES (HASP changes, new AHAs, attendee comments, etc.):

3. DISCUSSION OF DAILY ACTIVITIES/TASKS AND SAFETY MEASURES TO BE USED:

4. ATTENDEES (Print Name):

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.
13.	14.
15.	16.
17.	18.
19.	20.
21.	22.
23.	24.
25.	26.
27.	28.
29.	30.

This Site Safety Meeting Log documents the safety briefing conducted in accordance with 29 CFR 1910.120 *Hazardous Waste Operations and Emergency Response* as well as other applicable regulatory requirements. Personnel who perform work operations onsite are required to attend each safety briefing and acknowledge receipt of such briefings daily.

DAILY SIGN-IN/SIGN-OUT LOG

PROJECT: _____ PAGE NO. _____

PROJECT LOCATION: _____ DATE: _____

PROJECT NUMBER: _____

SITE SAFETY & HEALTH OFFICER: _____

TIME IN	TIME OUT	NAME	FIRM	PURPOSE ON SITE

Note: This form is to be completed on a daily basis by all personnel working on the site.

FIELD SSHP REVIEW SHEET

I have been trained in the contents of the Site Specific Safety and Health Plan (SSHP) and have been advised of the locations of copies available for review. I will comply with the provisions contained therein.

Name:	Date:

HEALTH & SAFETY FIELD MODIFICATION FORM

Project: _____

Project Location: _____

Project Number: _____

Site Safety & Health Officer: _____

Field Modification to SSHP: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Prepared by: _____
Site Safety & Health Officer Date

Accepted by: _____
Bhate Field Manager Date

Prepared by: _____
Contract Representative (if applicable) Date

Prepared by: _____
Bhate Health & Safety Manager
or Alternate SSHP Reviewer Date

NOTE: Field Modifications to SSHPs must be discussed with the Bhate Health & Safety Manager with subsequent written approval. Secure approval through fax.

bhate ENVIRONMENTAL CONSTRUCTION ENERGY

Hazardous Chemical Inventory List

Facility Location (Address, City, State, Site Description):	Date Inventory Prepared:

Individual Preparing List:	Phone Number:	Page ____of____

Name of Chemical/Product	Manufacturer	Location

INCIDENT INVESTIGATION

Bhate Report No: _____

1. GENERAL INFORMATION

COMPANY: **DATE OF INCIDENT:** **DATE OF INVESTIGATION REPORT:**

INCIDENT COST: ESTIMATED: $ ACTUAL: $

OSHA RECORDABLE: ❒ YES ❒ NO # RESTRICTED DAYS: # DAYS AWAY FROM WORK:

WAS THE ACTIVITY ADDRESSED IN AN AHA?: ❒ YES (Attach a copy) ❒ NO

2. CAUSE ANALYSIS

IMMEDIATE CAUSES – WHAT ACTIONS AND CONDITIONS CONTRIBUTED TO THIS EVENT? (SEE EXAMPLES NEXT PAGE)

BASIC CAUSES - WHAT SPECIFIC PERSONAL OR JOB FACTORS CONTRIBUTED TO THIS EVENT? (SEE EXAMPLES NEXT PAGE)

3. ACTION PLAN

REMEDIAL ACTIONS - WHAT HAS BEEN AND/OR SHOULD BE DONE TO CONTROL THE CAUSES LISTED? INCLUDE MANAGEMENT PROGRAMS (SEE ATTACHED LIST) FOR CONTROL OF INCIDENTS IF APPLICABLE.

ACTION	PERSON RESPONSIBLE	TARGET DATE	DATE COMPLETE	VERIFIED BY

4. PERSONNEL PERFORMING INVESTIGATION

NAME: (PRINT) SIGN: DATE:

NAME: (PRINT) SIGN: DATE:

NAME: (PRINT) SIGN: DATE:

5. MANAGEMENT REVIEW

Project Manager (PRINT) SIGN: DATE:

COMMENTS:

Bhate Health and Safety Manager (PRINT) SIGN: DATE:

COMMENTS:

NOTE: Attach additional information as necessary. Site Manager to forward copy of Investigation Report to the Bhate Health and Safety Manager as soon as possible, but no later than 72 hours after the incident.

INCIDENT INVESTIGATION (Continued)

EXAMPLES OF IMMEDIATE CAUSES

SUBSTANDARD ACTIONS

1. Operating Equipment without Authority
2. Failure to Warn
3. Failure to Secure
4. Operating at Improper Speed
5. Making Safety Devices Inoperable
6. Using Defective Equipment
7. Failure to Use PPE Properly
8. Improper Loading
9. Improper Placement
10. Improper Lifting
11. Improper Position for Task
12. Servicing Equipment in Operation
13. Horseplay
14. Under Influence of Alcohol/Drugs
15. Using Equipment Improperly
16. Failure to Follow Procedure

SUBSTANDARD CONDITIONS

1. Inadequate Guards or Barriers
2. Inadequate or Improper Protective Equipment
3. Defective Tools, Equipment, or Materials
4. Congestion or Restricted Action
5. Inadequate Warning System
6. Fire and Explosion Hazards
7. Poor Housekeeping/Disorder
8. Noise Exposure
9. Exposure to Radiation/Hazardous Materials
10. Exposure to Temperature Extremes
11. Inadequate Illumination
12. Inadequate Ventilation
13. Hazardous Environmental Conditions

EXAMPLES OF BASIC CAUSES

PERSONAL FACTORS

1. Inadequate Physical/Physiological Capability
2. Inadequate Mental/Psychological Capability Knowledge
3. Physical or Psychological Stress
4. Mental or Psychological Stress
5. Lack of Knowledge
6. Lack of Skill
7. Improper Motivation

JOB FACTORS

1. Inadequate Leadership/Supervision
2. Inadequate Engineering
3. Inadequate Purchasing
4. Inadequate Maintenance
5. Inadequate Tools/Equipment
6. Inadequate Work Standards
7. Excessive Wear and Tear
8. Abuse or Misuse

MANAGEMENT PROGRAMS FOR CONTROL OF INCIDENTS

1. Leadership and Administration
2. Management Training
3. Planned Inspections and Maintenance
4. Task Analysis and Procedures
5. Task Observation
6. Emergency Preparedness
7. Rules and Work Permits
8. Accident/Incident Analysis
9. Personal Protective Equipment
10. Health Control
11. Program Audits
12. Engineering and Change Management
13. Personal Communications
14. Group Communications
15. General Promotion/Awareness
16. Hiring and Placement
17. Purchasing Controls
18. Off-the-Job Safety

NOTIFICATION REMINDER

Fatalities or hospitalization (admittance) of three or more individuals requires notification to OSHA within 8 hours. Contact the Bhate Operations Manager to make the notification. If unavailable, the senior operations person on site should make the notification.

INCIDENT INVESTIGATION INSTRUCTIONS

Report No.: This is the same as the incident report number assigned by the Bhate Health and Safety Manager

Date of Investigation Report: This date should be within 72 hours of the incident. In cases where the investigation is not completed until a later date, submit the incomplete report within the 72 hours, and a revised report should be submitted when the missing information is obtained.

Incident Cost: For all vehicle/equipment or property damage cases, an estimated or actual loss value must be entered. If an estimated value is entered, the report must be revised when the actual costs are known.

OSHA Recordable: This section should be completed in consultation with the Health and Safety Manager.

No. of Restricted Days: This relates to days of restricted work activity, not restrictions on motion or physical capability. If the employee is capable of doing his normal job the day after the injury and thereafter, there are no restricted days, even if the physician indicates a physical restriction. It does not include the day of the injury.

No. of Days Away from Work: The number of days after the day of the injury that the employee was scheduled to work but could not due to an occupational injury. If the treating physician releases an employee to return to work, but the employee chooses not to come to work, do not count those days. In this case the Health and Safety Manager should be consulted.

Cause Analysis

Immediate Causes: Determine the immediate causes, using the examples on page 2 of the Incident Investigation form. If one or more of the examples fits the circumstance, use those words in the cause description. However, do not confine your cause determination to the guide words.

Basic Causes: Like the Immediate Causes, use the guide words in the attachment whenever appropriate and explain. For example, improper motivation may be because the correct way takes more time or effort; short cutting standard procedure is tolerated or positively reinforced; or the person thinks there is no personal benefit to always doing the job correctly.

Remedial Actions: Include all actions taken or those that should be taken to prevent recurrence. Be sure that actions address the causes. For example, training (safety meetings) may be a necessary response for lack of knowledge, but may be inadequate for improper motivation. If completion dates are not verified prior to submitting the report, a revised report must be submitted or verification of closeout noted on the original report.

Personnel Performing Investigation: The primary investigator is the Supervisor in charge of the work where the incident occurred. Others participating in the investigation should also sign the report.

Management Review: The Bhate Project Manager and the Bhate Health and Safety Manager must sign the report indicating their satisfaction with the thoroughness of the investigation and the report, and their concurrence that the action items address the identified causes.

INCIDENT REPORT

Date of Report: _____ **Bhate Report No:** _____
(To be assigned by the HSM)

TYPE OF INCIDENT (check all that apply)

❒ INJURY/ILLNESS ❒ VEHICLE DAMAGE ❒ HIGH LOSS POTENTIAL (NEAR MISS) ❒ FIRE
❒ SPILL/RELEASE ❒ PROPERTY LOSS/DAMAGE ❒ PERMIT OR EQUIV. EXCEEDANCE ❒ OTHER

GENERAL INFORMATION

PROJECT: TASK:

COMPANY OR SUBCONTRACTOR NAME(S):

DATE OF INCIDENT: DAY OF WEEK: MILITARY TIME:

SUPERVISOR ON DUTY: PHONE: SUPV ON SCENE? ❒ YES ❒ NO

LOCATION OF INCIDENT:

WEATHER/LIGHTING CONDITIONS:

DESCRIBE WHAT HAPPENED (step by step, use additional pages if necessary)

1. What was the employee doing, or what was happening, just before the incident occurred? Describe the activity, as well as the equipment, tools, or materials in use. *Be specific, e.g. "climbing a ladder while carrying tools" or "driving westbound on Main St."*

2. What happened? What was the contact or event and how did it occur? e.g. "When the ladder slipped on the wet floor, employee fell 20 feet" or "was distracted by bee, swerved off right side of road and struck the stop sign"

IMMEDIATE CORRECTIVE ACTIONS (use additional pages if necessary)

AFFECTED EMPLOYEE INFORMATION (Include injured person or employees whose activities resulted in incident) ❒ N/A

NAME: ❒ MALE ❒ FEMALE COMPANY:

HOME ADDRESS:

SOCIAL SECURITY OR EMPLOYEE #: HOME PHONE #:

JOB CLASSIFICATION: YEARS IN JOB CLASSIFICATION:

TIME EMPLOYEE BEGAN WORK: DATE OF HIRE: AGE:

DID INCIDENT RELATE TO ROUTINE TASK FOR JOB CLASSIFICATION?: ❒ YES ❒ NO

INJURY/ILLNESS INFORMATION ❒ N/A

NATURE OF INJURY OR ILLNESS (Body part affected and how it was affected, e.g. strained back):

OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:

FIRST AID PROVIDED: ❒ YES ❒ NO IF YES, WHERE: ❒ ON SITE ❒ OFF SITE

IF YES, WHO PROVIDED FIRST AID?:

WILL THE INJURY/ILLNESS RESULT IN: ❒ RESTRICTED DUTY ❒ LOST TIME ❒ UNKNOWN

INCIDENT REPORT (Continued)

TREATMENT OR EVALUATION INFORMATION (Attach Provider's Report/Statement) ❒ N/A

WAS TREATMENT OR EVALUATION PROVIDED? ❒ YES ❒ NO ❒ FIRST AID ❒ EVALUATION ❒ MEDICAL TREATMENT

IF YES, WHERE? ❒ ON SITE ❒ DR'S OFFICE ❒ HOSPITAL ❒ OTHER:

NAME OF PERSON(S) PROVIDING TREATMENT OR EVALUATION:

ADDRESS WHERE TREATMENT OR EVALUATION WAS PROVIDED:

TYPE OF TREATMENT OR EVALUATION:

PROPERTY LOSS OR DAMAGE INFORMATION ❒ N/A

PROPERTY OR VEHICLE INVOLVED:

DESCRIPTION OF LOSS OR DAMAGE: ESTIMATED $ LOST:

SPILL OR RELEASE INFORMATION ❒ N/A

SUBSTANCE SPILLED OR RELEASED: FROM WHERE: TO WHERE:

ESTIMATED QUANTITY/DURATION:

REPORTABLE QUANTITY (RQ): RQ EXCEEDED? ❒ YES ❒ NO

RELEASED TO WATERS OF STATE? ❒ YES ❒ NO CERCLA HAZARDOUS SUBSTANCE? ❒ YES ❒ NO

RESPONSE ACTIONS TAKEN:

PERMIT OR EQUIVALENT EXCEEDANCE ❒ N/A

TYPE OF PERMIT: PERMIT #:

DATE OF EXCEEDANCE: DATE FIRST KNOWLEDGE OF EXCEEDANCE:

PERMITTED LEVEL OR CRITERIA (e.g., Water quality, Air Quality):

EXCEEDANCE LEVEL OR CRITERIA: EXCEEDANCE DURATION:

RESPONSE ACTIONS TAKEN:

PERSONS PREPARING REPORT (Employee and Supervisor to Complete Report)

EMPLOYEE'S NAME (PRINT): SIGN: DATE:

EMPLOYEE'S NAME (PRINT): SIGN: DATE:

SUPERVISOR'S NAME (PRINT): SIGN: DATE:

PERSONNEL NOTIFIED (check all that apply)

ORGANIZATION	NAME(S)	DATE/TIME
❒ Bhate Site Safety and Health Officer		
❒ Bhate Site Manager		
❒ Site Emergency Services		
❒ Other Organizations Notified		

RECEIVED BY Bhate Health and Safety Manager Date:

INCIDENT REPORT INSTRUCTIONS

General: The incident report (2 pages) must be completed within 24 hours of the incident. If any information is unknown, it can be provided later as the information is available. Complete all applicable sections of the form. If a section does not apply, indicate this by using "N/A". Names, dates, and signatures should be complete.

Type of Incident: Check all that apply. A Near Miss (High Loss Potential) incident is one that does not result in loss, but under slightly different circumstances, could have resulted in an OSHA Recordable injury, spill, release, permit exceedance, fire, or vehicle/property damage in excess of $500. All Near Miss (High Loss Potential) incidents are to be investigated.

General Information

Project/Task: Give the Project Name and task being performed.

Supervisor on Duty: The Supervisor on Duty responsible for the work effort involving the incident.

Location of Incident: The specific location on the project (a street address or facility building numbers)

Weather/Lighting Conditions: Temperature, precipitation, approximate wind speed and direction, lighting conditions, cloud cover, relative humidity. This information may be included in the description section, and must be given in detail whenever it is a factor in the cause or impact, e.g., spill, release, heat stress, windblown material.

Describe What Happened: This section must be completed in sufficient detail to describe the events and conditions leading up to and resulting from the incident. Try to answer the questions who, what, where, when, and how. This information is then used to determine why (cause). Provide details such as work objective, procedure being used, body position, and PPE. Include diagrams or sketches for all incidents involving vehicles/equipment and other incidents where they aid in providing detail or perspective. Consider attaching photographs.

Immediate Corrective Actions

List what corrective actions were taken immediately as a result of the incident such as containing spills, first aid, temporary barriers, work stoppage, and similar actions.

Affected Employee Information

Employee: Direct hire, whether professional, administrative, or craft; full-time or part-time; permanent or temporary and/or Subcontractor employee.

Hours Worked on Shift Prior to the Incident: Only include the amount of time the employee worked that shift or day prior to the incident.

Years with the Company: Give the number of years employed with the current company in years and/or months.

Injury/Illness Information

Nature of Injury or Illness: Give a brief description of the body part affected and type of injury or illness, as applicable.

First Aid Provided: First Aid is any treatment that does not have to be provided by a health care professional. A clinic may provide first aid depending on the severity of the injury.

Will the Injury Result In: Do not delay the report if this information is unknown.

Medical Treatment Information

Was Medical Treatment Provided? Medical treatment is that treatment that must be provided by a licensed medical practitioner.

Type of Treatment: This information is important in determining OSHA recordability. Attach a copy of the treating professional's statement/work release.

Property Loss or Damage Information

Property or Vehicle Involved: For vehicles, indicate VIN and vehicle ownership.

Description of Loss or Damage: Be specific as to the identity of damaged part, location, and extent.

Estimated $ Lost: Estimate the monetary amount of loss or damage.

Spill or Release Information

Substance Spilled or Released: For pure substances, list materials by common name/chemical. For wastes, indicate waste code. For mixtures or contaminated media, provide contaminant name, CAS No., concentration.

RQ Exceeded? Specify the Reportable Quantity for the material.

Response Action Taken: Describe the mitigation efforts, as well as any reports made, beyond initial notification.

Permit or Equivalent Exceedance

Type of Permit: List name of permit or equivalent including the agency name where applicable (e.g., NPDES, NESHAP, etc.).

Date of Exceedance: Specify date exceedance occurred (e.g., date discharge in excess of permit limits occurred).

Date First Knowledge of Exceedance: Specify date when first knew there was an exceedance (i.e., date analytical received). This date may be different from the date of the exceedance listed above.

Permitted Level or Criteria: List discharge or emission limit or narrative criteria specified in the permit.

Exceedance Level or Criteria: Specify an actual discharge/emission limit or narrative criterion which was exceeded.

Exceedance Duration: Specify time frame by date and hours (using military time) during which exceedance occurred.

See "**Spill or Release Information**" (above) for description of remaining questions.

Persons Preparing Report

Employee's Name: The affected employee described on page 1 should review the report and sign here, as well as any other employees witnessing or involved in the incident.

Supervisor's Name: The Supervisor must review and sign the report indicating agreement. The Supervisor should be involved in conducting the investigation.

bhate ENVIRONMENTAL CONSTRUCTION ENERGY

Site Health and Safety Inspection Form

Project Location (Address, City, State, Site Description):	Date:	Project Number:

Type of Inspection: ☐ **Weekly** ☐ **Monthly**

Tasks or Activities Observed:

Personnel Participating in Inspection:

Name	Organization	Name	Organization

General Workplace Conditions:

Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Walking/Working Surfaces		
Aisles and Passageways		
Platforms/Scaffolding		
Ladders		
Stairs		
Exits/Egress		
Roadways		
Excavations/Trenches		
Ventilation		
Lighting		
Noise Exposure		
Ergonomics		
Potable Water		
Sanitation Facilities		
Temperature Extremes		

Hazardous Materials Use & Storage:

Category	Observations (N/A if Not Applicable)	Action required - Yes or No
MSDSs Available		
Material Labeling		
Storage Conditions		
Storage Containers Condition		
Chemical Storage Compatibility		
Compressed Gas Storage & Use		
Waste Storage/Disposal		

Motor Vehicles & Power Equipment:

Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Seatbelts & Back-up Alarms		
Dozer Equipment		
Scraper Equipment		
Road Grader Equipment		
Water Trucks		
Front End Loader/Backhoe Equipment		
Cranes/ Hoists & Rigging		
Forklifts		
Other Heavy Equipment		
Loads Secure on Vehicles		
Wheels Chocked		

Hazard Controls:

Category	Observations (N/A if Not Applicable)	Action required - Yes or No
General Site Controls		
Work Zone Delineation		
Lockout/Tagout Systems		
Accident Prevention Signs and Tags		
Barricades		
Hole Covers		
Electrical Grounding & GFCI Use		

Emergency Systems:

Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Emergency Instructions/Postings		
Fire Protection		
Eye Wash and Showers		
First Aid Kits/Stations		
Emergency Rescue Equipment		

Personal Protective Equipment:

Category	Observations (N/A if Not Applicable)	Action required - Yes or No
Eye Protection		
Ear Protection		
Respiratory Protection		
Head Protection		
Hand Protection		
Foot Protection		
Body Protection		
Fall Protection		

Hand/Power Tools and Power Systems:		
Category	**Observations (N/A if Not Applicable)**	**Action required - Yes or No**
Hand Tools Condition		
Portable Power Tools Condition		
Welding/Burning Equipment		
Power Tools Guarding		
Electrical Power Generator		
Pneumatic Power Generator		

Remediation Waste Management:		
Category	**Observations (N/A if Not Applicable)**	**Action required - Yes or No**
Waste Properly Categorized		
Cross Contamination Minimized		
Storage Containers in Good Condition		
Waste Storage Location		
Staging/Stockpiling of Soil/Debris		
Decontamination Water		

Environmental Controls:		
Category	**Observations (N/A if Not Applicable)**	**Action required - Yes or No**
Dust Control		
Odor Control		
Oil and Spill Prevention		
Stormwater/Erosion Control Activities		

Other Health and Safety Related Conditions or Work Practices		

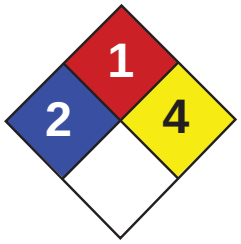
Project Location (Address, City, State, Site Description):	Date:	Project Number:

Type of Inspection: ☐ **Weekly** ☐ **Monthly**

Summary and Recommendations

Hazard Classification*	Findings and Recommended Corrective Action	Date Corrected	Corrected or Verified by

*Classify as Major or Minor – Major findings indicate that a potential or imminent hazard to people, property, or the environment exists



Health	2
Fire	1
Reactivity	4
Personal Protection	E

Material Safety Data Sheet
Ammonium perchlorate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ammonium perchlorate

Catalog Codes: SLA2725

CAS#: 7790-98-9

RTECS: SC7520000

TSCA: TSCA 8(b) inventory: Ammonium perchlorate

CI#: Not available.

Synonym:

Chemical Formula: NH4ClO4

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ammonium perchlorate	7790-98-9	100

Toxicological Data on Ingredients: Ammonium perchlorate LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, kidneys. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Flammable in presence of shocks, of heat, of reducing materials, of combustible materials, of organic materials.

Explosion Hazards in Presence of Various Substances:
Extremely explosive in presence of open flames and sparks, of shocks, of heat, of reducing materials, of organic materials. Slightly explosive in presence of acids.

Fire Fighting Media and Instructions:
Oxidizing material. Do not use water jet. Use flooding quantities of water. Avoid contact with organic materials.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Oxidizing material. Stop leak if without risk. Avoid contact with a combustible material (wood, paper, oil, clothing...). Keep substance damp using water spray. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Keep away from combustible material.. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Take precautionary measures against electrostatic discharges. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, organic materials, acids.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystals solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 117.49 g/mole

Color: Colorless.

pH (1% soln/water): Not available.

Boiling Point: Not available.

Melting Point: Decomposes.

Critical Temperature: Not available.

Specific Gravity: 1.95 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, acetone.

Solubility:
Soluble in cold water, methanol. Partially soluble in acetone. Insoluble in diethyl ether.

Section 10: Stability and Reactivity Data

Stability: Unstable.

Instability Temperature: Not available.

Conditions of Instability: No additional remark.

Incompatibility with various substances:
Extremely reactive or incompatible with reducing agents, combustible materials, organic materials. Reactive with acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Causes damage to the following organs: blood, kidneys.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation: Possibly hazardous short/long term degradation products are to be expected.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 5.1: Oxidizing material.

Identification: : Ammonium Perchlorate UNNA: UN1442 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Ammonium perchlorate Massachusetts RTK: Ammonium perchlorate TSCA 8(b) inventory: Ammonium perchlorate

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS C: Oxidizing material.

DSCL (EEC):
R8- Contact with combustible material may cause fire. R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 4

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 4

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 03:57 PM

Last Updated: 11/01/2010 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.

Perchlorate and Perchlorate Salts

1007

Perchlorate (ClO_4^-) and Perchlorate Salts: 02/18/2005

CASRN 7790-98-9 Ammonium perchlorate
CASRN 7791-03-9 Lithium perchlorate
CASRN 7778-74-7 Potassium perchlorate
CASRN 7601-89-0 Sodium perchlorate

This U.S. EPA IRIS Summary is based on the U.S. Government-sponsored technical review of the "Health Implications of Perchlorate Ingestion EXIT Disclaimer" by the National Research Council of the National Academies (NRC, 2005). The NRC perchlorate committee took into consideration presentations at the committee's public meetings, submitted public comments, and the comments made by technical experts on the draft NRC perchlorate report. The conclusions, recommendations and final content of the NRC (2005) report rest entirely with the committee and the National Research Council. The NRC review follows two external draft toxicological reviews of perchlorate prepared by EPA (1998, 2002) that were also subject to public comment and independent external peer review. The IRIS Summary has undergone review by EPA health scientists from several program offices, regional offices, and the Office of Research and Development. Sections I (Chronic Health Hazard Assessments for Noncarcinogenic Effects) and II (Carcinogenicity Assessment for Lifetime Exposure) present the positions that were reached during the review process. Supporting information and explanations of the methods used to derive the values given in IRIS are provided in the guidance documents located on the IRIS website at http://www.epa.gov/iris/backgrd.html.

STATUS OF DATA FOR Perchlorate and Perchlorate Salts

File First On-Line 02/18/2005

Category (section)	Status	Last Revised
Oral RfD Assessment (I.A.)	on-line	02/18/2005
Inhalation RfC Assessment (I.B.)	discussion	02/18/2005
Carcinogenicity Assessment (II.)	on-line	02/18/2005

_I. Chronic Health Hazard Assessments for Noncarcinogenic Effects

_I.A. Reference Dose for Chronic Oral Exposure (RfD)

Substance Name — Perchlorate and Perchlorate Salts
CASRN 7790-98-9 Ammonium perchlorate
CASRN 7791-03-9 Lithium perchlorate
CASRN 7778-74-7 Potassium perchlorate
CASRN 7601-89-0 Sodium perchlorate

Section I.A. Last Revised —02/18/2005

In general, the oral RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfD is based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis and is expressed in units of mg/kg-day. Please refer to the background document for an elaboration of these concepts. Since RfDs can be derived for the noncarcinogenic health effects of substances that are also carcinogens, it is essential to refer to other sources of information concerning the carcinogenicity of this chemical substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

__I.A.1. Oral RfD Summary

Critical Effect	Experimental Doses*	UF	RfD
		10	0.0007mg/kg/day
Radioactive iodide uptake inhibition (RAIU) in the thyroid	NOEL: 0.007 mg/kg/day LOEL: 0.02 mg/kg/day		
Adult human volunteers			
Greer et al. (2002)			

* Conversion Factors and Assumptions - Iodide uptake inhibition is a key biochemical event that precedes all potential thyroid-mediated effects of perchlorate exposure. Because iodide uptake inhibition is not an adverse effect but a biochemical change, this is a No Observed Effect Level (NOEL). The use of a NOEL differs from the traditional approach to deriving an RfD, which bases the critical effect on an adverse outcome. Using a nonadverse effect that is upstream of the adverse effect is a more conservative and health-protective approach to perchlorate hazard assessment. The point of departure is based on a non-statistically significant mean 1.8% (standard error of the mean 8.3%) decline in RAIU in healthy adults following two weeks exposure to a daily perchlorate dose of 0.007 mg/kg/day. An intraspecies uncertainty factor of 10 is applied to protect the most sensitive population, the fetuses of pregnant women who might have hypothyroidism or iodide deficiency. Dose is given as perchlorate anion.

__I.A.2. Principal and Supporting Studies (Oral RfD)

Greer, M.A., Goodman, G., Pleus, R.C., Greer, S.E. 2002. Health effect assessment for environmental perchlorate contamination: The dose response for inhibition of thyroidal radioiodide uptake in humans. Environ. Health Perspect. 110:927-937.

Greer et al. (2002) studied 21 healthy women and 16 healthy men (mean age 38 years, range 18-57 years) who were given potassium perchlorate in doses of 0.007, 0.02, 0.1 and 0.5 mg perchlorate/kg body weight per day for 14 days. The dose was administered in 400 ml of water with instructions that 100 ml be consumed four times each day. Thyroid uptake of radioiodide was measured at 8 and 24 hours after radioiodide administration: at baseline, on days 2 and 14 of perchlorate administration, and 15 days after cessation of dosing. The human subjects research ethics of the study were approved by the Oregon Health & Science University Institutional Review

Board (IRB). On day 14 of administration, the mean 24-hour radioiodide uptake was 98.2% of the baseline value in the seven subjects given 0.007 mg/kg/day, a non-statistically significant decrease of 1.8% (standard error of the mean 8.3%). The day-14 24-hour radioiodide uptake value was 83.6% of the baseline value (16.4% decrease; n=10) in the subjects given 0.02 mg/kg/day, 55.3% of the baseline value (44.7% decrease; n=10) in those given 0.1 mg/kg/day, and 32.9% of the baseline value (67.1% decrease; n=10) in those given 0.5 mg/kg/day.

The effects of perchlorate in these healthy adult humans did not change over time, as indicated by very similar results for thyroid radioiodide uptake measurements on day 2 of perchlorate administration compared to day 14 in the three higher dose groups (uptake was not measured on day 2 in the lowest dose group). The 8-hour thyroid radioiodide uptake values 15 days after exposure were very similar to the baseline values, indicating rapid disappearance of inhibition on cessation of dosing. The results were similar in the women and men. The statistical no observed effect level (NOEL) for perchlorate-induced inhibition of thyroid iodide uptake was 0.007 mg/kg/day.

There were no changes in serum thyroxine (T4), triiodothyronine (T3) and thyroid stimulating hormone (TSH, thyrotropin) concentrations in the Greer et al. (2002) study, except for a very small decrease in serum TSH concentrations in the subjects given 0.5 mg/kg/day (not an increase, as would be expected if thyroid secretion decreased, and probably explicable on the basis of multiple measurements of TSH concentrations over the course of each day). One woman had a slightly high serum TSH concentration at baseline (18 mU/L), and it was slightly lower (15 mU/L) on day 14 of perchlorate administration at 0.007 mg/kg/day.

The NRC (2005) reviewed a number of benchmark dose models for the radioiodide uptake inhibition point of departure, as developed by the U.S. EPA (2003), California Environmental Protection Agency (CalEPA 2004) and Crump and Goodman (2003). The NRC (2005) concluded that these analyses used different models, approaches, parameters, response levels, and input data, making the comparison of results difficult. Although the NRC Committee recognized that BMD modeling can be an improvement over the use of the NOAEL or LOAEL as a point of departure, there appeared to be no consensus on the criteria for choosing one BMD approach over another. Because no clear justifications were provided with the individual analyses of the Greer et al. (2002) data that allowed selection of one set of results over another, the NRC Committee concluded that using the NOEL (0.007 mg/kg/day) for iodide inhibition from Greer et al. (2002) as the point of departure provided a reasonable and transparent approach to perchlorate risk assessment.

Four additional intentional dosing human studies were cited by the NRC (2005) Committee in their review of perchlorate health effects. Brabant et al. (1992) administered 200 micrograms of iodide daily to five healthy men for 4 weeks, and then 900 mg of potassium perchlorate daily (~9 mg/kg/day, assuming a 70 kg person) for 4 weeks. There were no differences in serum T4, T3 or thyroid volume at the end of each four week period. The mean 24-hour serum TSH, serum free T4, and total thyroid iodide content were slightly lower at the end of the perchlorate period than at the end of the iodide period. Lawrence et al. (2000) administered 10 mg potassium perchlorate (~0.1 mg/kg/day) in water to nine healthy men, ages 22 - 30 years old. There were no changes in serum T4, T3 or TSH concentrations during the 14 day ingestion period. 24-hour radioiodide uptake was decreased 41% at day 14 of perchlorate administration. Lawrence et al. (2001) administered 3 mg potassium perchlorate (~0.03 mg/kg/day) to eight healthy men for 14 days, leading to small, non-statistically significant reductions in mean 24-hour RAIU level (10.3%), and no changes in T4, T3 or TSH. Braverman et al. (2004; abstract) conducted a study of potassium perchlorate administration to 13 healthy subjects over 6 months: four were given placebo, five were given 0.5 mg daily (~0.007 mg/kg/day), and four were given 3 mg daily (~0.04 mg/kg/day). There were no changes in thyroid RAIU or T3, T4 or TSH, compared to baseline, at any time in either placebo or perchlorate groups.

The data from epidemiological studies of the general population provide some information on possible effects of perchlorate exposure, although these studies are inherently limited with respect to establishing causality and cannot serve as the basis for quantitative risk assessment.

Acknowledging that ecologic epidemiological data alone are not sufficient to demonstrate whether or not an association is causal, the NRC (2005) committee found that these studies can provide evidence bearing on possible associations. Noting the limitations of specific studies, the NRC (2005; chapter 3) committee concluded that the available epidemiological evidence is not consistent with a causal association between perchlorate and congenital hypothyroidism, changes in thyroid function in normal-birthweight, full-term newborns, or hypothyroidism or other thyroid disorders in adults. The committee considered the evidence to be inadequate to determine whether or not there is a causal association between perchlorate exposure and adverse neurodevelopmental outcomes in children. The committee noted that no studies have investigated the relationship between perchlorate exposure and adverse outcomes among especially vulnerable groups, such as the offspring of mothers who had low dietary iodide intake, or low-birthweight or preterm infants.

__I.A.3. Uncertainty and Modifying Factors (Oral RfD)

UF = 10

Intraspecies Factor = 10. The intraspecies uncertainty factor accounts for variability in responses among humans, and is intended to protect populations that are more sensitive than the population tested. Because the critical study (Greer et al., 2002) for perchlorate was based on healthy adult men and women, an uncertainty factor of 10 is applied to protect the most sensitive population, the fetuses of pregnant women who might have hypothyroidism or iodide deficiency. In pregnant women who have undiagnosed hypothyroidism, perchlorate exposure could exacerbate the hypothyroidism by inhibiting iodide uptake by the thyroid. In the NHANES III cohort, daily iodide intake was less than 50 microgram in 15% of women of childbearing age, and 7% of pregnant women. However, serum thyroid hormone and TSH concentrations were similar for those who had a daily iodide intake of less than 50 micrograms compared to people with higher daily intakes. Thus, the NRC (2005) concluded that the data indicate that iodide deficiency in the U.S. population is mild, if it exists. An uncertainty factor of 10 was viewed by the NRC (2005) committee as conservative and health-protective, especially given that the point of departure is based on a non-adverse effect that precedes the adverse effect in the continuum of possible effects of perchlorate exposure. They note that inhibition of thyroid iodide uptake is the only effect that has been consistently documented in humans exposed to perchlorate.

Interspecies Factor - Not applicable, as the NOEL is based on human data.

LOAEL - NOAEL Extrapolation - Not applicable, as the point of departure is based on a statistical no observed effect level. Because this NOEL is for a nonadverse effect, this is considered to be a more conservative and health-protective approach than traditional hazard assessments.

Subchronic to Chronic Extrapolation UF = 1: The point of departure is based on the lack of inhibition of radioiodide uptake in the thyroid gland following a 14-day exposure to perchlorate. Chronic exposure will have no greater effect than that resulting from short term exposure, because if the precursor event of inhibition of iodide uptake does not occur, then there will be no changes in thyroid function in the short or long term. Prolonged exposure may actually have less effect because of the capacity of the pituitary-thyroid system to compensate for iodide deficiency by increasing iodide uptake. If some inhibition of iodide uptake by the thyroid did occur at the minimal dose at the point of departure, data from humans indicate that longer exposures are not likely to result in a greater or more severe response. Perchlorate also does not accumulate in the body but is rapidly cleared via excretion in the urine, even during chronic exposure.

Database Adequacy UF =1: The adequacy of the database is typically described in terms of a specific set of animal toxicological studies. For example, chronic toxicity, reproductive toxicity, developmental toxicity, and carcinogenicity studies are typically required to have the highest confidence in a database of studies. However, mode-of-action studies and relevant human studies can eliminate the need for various animal studies. For perchlorate, the selection of the point of departure is designed to prevent the first step in the mode of action continuum, and studies on

downstream events are not necessary. Therefore, an uncertainty factor for database adequacy is not considered necessary for perchlorate because of the consistency of the human data across multiple studies and the reliance on a precursor, non-adverse, biochemical event as the point of departure. In addition to the five intentional dosing human clinical studies in healthy adults noted above, the studies of long-term treatment of hyperthyroidism with perchlorate and the studies of occupational and environmental exposure add confidence to the overall database. The absence of a long-term study is covered under the subchronic-chronic discussion.

__I.A.4. Additional Studies/Comments (Oral RfD)

The fundamental mechanisms involved in the function and regulation of the pituitary-hypothalamus-thyroid system in rats are qualitatively similar to those in humans. However, differences in binding proteins, binding affinities of the proteins for the hormones, turnover rates of hormones, and thyroid stimulation by placental hormones lead to important quantitative differences between the two species. The biochemical and physiologic differences between rats and humans related to the thyroid affect their responses to goitrogens, such as perchlorate. Therefore, although studies in rats provide useful qualitative information on potential adverse effects of perchlorate exposure, they are limited in their utility for quantitatively assessing human health risk associated with perchlorate exposure. For instance, regarding the initial step of radioiodide uptake inhibition, Yu et al. (2002) evaluated thyroid impacts in rats exposed to perchlorate in drinking water at 0, 1.0, 3.0, and 10.0 mg/kg/day for 1, 5, and 14 days. After one day of perchlorate, inhibition of iodide uptake was about 15%, 55% and 65% for the respective doses. By 14 days, the inhibition of iodide uptake was observed only in the high dose group. The data show that the initial inhibition of radioiodide uptake by perchlorate in rats is similar to that in humans. However, rats compensate for the inhibition within 5 days of perchlorate administration. A similar response was not observed in the 14-day Greer et al. (2002) study, suggesting that compensation occurs more quickly in rats because rats have a smaller reserve capacity of thyroid hormones than humans.

Among a number of rodent studies conducted on perchlorate toxicity, the Argus (2001) report provides a comprehensive evaluation of perchlorate impacts on rat development. In this study, female rats (dams) were exposed to perchlorate through gestation and lactation. Ammonium perchlorate was administered in drinking water at concentrations that provided doses of 0, 0.01, 0.1, 1.0 and 30 mg/kg/day. Administration began 2 weeks before mating and extended through postnatal day 22. The offspring were exposed to perchlorate in utero, through their mother's milk, and through any consumption of the perchlorate contaminated water provided to their mothers. There were dose-related increases in serum TSH and dose-related decreases in serum total T4 and T3 in the dams, fetuses, and pups. Serum T4 was decreased significantly in dams at all doses during gestation. A downward trend was observed in serum T3 in the dams, albeit not statistically significant during gestation until the highest dose group. Serum TSH was substantially increased in the pregnant dams at all doses. Statistically significant changes in thyroid hormones and TSH were noted in the fetuses and pups, although the changes tended to be more modest than those in the dams.

Argus (2001) also conducted histological evaluations of the thyroid gland at the same time as the thyroid hormone and TSH measures. In dams, histological examination revealed colloid depletion, follicular-cell hypertrophy, and follicular-cell hyperplasia. These effects were mainly restricted to the highest dose group (30 mg/kg/day), although colloid depletion and follicular-cell hyperplasia were increased at 1.0 mg/kg/day on postnatal days 10 and 22, respectively. In rat fetuses and pups, colloid depletion of the thyroid was the most consistent histological finding, observed consistently in the highest-dose animals and, to a smaller extent, in the 1.0 mg/kg/day group. The thyroid morphology of the two lower-dose groups of animals (0.01 and 0.1 mg/kg/day) was similar to that of controls.

The effects of maternal perchlorate exposure on offspring brain development in Sprague-Dawley rats were also examined by Argus Laboratories (Argus, 1998, 2001). Dams were exposed to the above noted perchlorate doses (Argus, 2001). Pups were sacrificed at several post-natal ages and

their brains fixed and sectioned for histological evaluation. The thickness of various brain regions was measured (morphometry). Statistical analyses revealed a number of significant effects, most notably an increase in the thickness of the posterior corpus callosum. However, questions and concerns about the studies have been raised, including apparent systematic differences in the plane of section among treatment groups, lack of clear and consistent dose-response relationships, doubts about the biologic plausibility of the changes observed, and concerns that the measures used were relatively insensitive and would be unlikely to pick up subtle differences in neurodevelopment. On the basis of its review of the data, the NRC (2005) committee concluded that the evidence in Argus (1998, 2001) was inadequate to determine whether or not a causal relationship exists between maternal perchlorate exposure and pup neurodevelopmental abnormalities.

The NRC (2005) committee also noted that perchlorate could theoretically produce several types of adverse immunological reactions, possibly mediated by a direct effect on the cells involved or by modulation of thyroid hormone-immune system homeostasis. The potential for perchlorate to cause any of these adverse immunological reactions has been studied in animals, the results of which are summarized in the NRC (2005) report. Based on their evaluation, the NRC committee concluded that the evidence favors rejection of a causal relationship between ingestion of perchlorate and an immunotoxic effect in animals.

__I.A.5. Confidence in the Oral RfD

Study — Medium-High: The study was well conducted and provides a clear dose-response curve for radioiodide uptake inhibition in adult humans, although it is limited by small numbers of subjects (n=7) in the lowest dose group. The principal study is supported by four other human clinical studies of similar methodology that provide consistent results.

Database — Medium: The database consists of a number of human clinical studies of precursor events (radioiodide uptake inhibition), supported by other clinical studies, occupational and environmental epidemiologic studies, and studies of long-term perchlorate administration to patients with hyperthyroidism. The available epidemiological studies do not assess the possibility of adverse outcomes among vulnerable groups, such as the offspring of mothers who were exposed to perchlorate and had a low dietary iodide intake. The animal data consist of a number of studies to assess perchlorate impacts, albeit limited in certain situations by concerns about the veracity of some endpoints and the applicability of rodent studies of thyroid function to humans. Concerns have also been expressed about the absence of a long-term study, although the majority of the NRC (2005) committee concluded that, by preventing the precursor, non-adverse, event of iodide uptake inhibition, chronic exposure will have no greater effect than that resulting from short-term exposure.

RfD — High: The overall confidence in this RfD assessment is high because it is based on a no-effect level for a well-characterized biochemical precursor effect (iodide uptake inhibition), accompanied by a 10 fold uncertainty factor for susceptible populations. The RfD should protect the health of even the most sensitive populations, because a dose that does not inhibit thyroid iodide uptake will not affect thyroid function, even in subjects with an abnormal thyroid gland or a very low iodide intake.

__I.A.6. EPA Documentation and Review of the Oral RfD

Source Document — National Research Council. 2005. Health Implications of Perchlorate Ingestion. The National Academies Press. Washington, D.C.

This source document was prepared by the National Research Council of the National Academies on behalf of the United States Government InterAgency Working Group on Perchlorate. The NRC report followed draft Perchlorate Toxicological Reviews prepared by the U.S. EPA, which had also been subject to public comment and peer review.

Other EPA Documentation — Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization. External Review Draft, NCEA-1-0503, January 16, 2002.

Agency Completion Date -- 02/18/2005

__I.A.7. EPA Contacts (Oral RfD)

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202) 566-1676 (phone), (202) 566-1749 (fax), or hotline.iris@epa.gov (email address).

_I.B. Reference Concentration for Chronic Inhalation Exposure (RfC)

Substance Name — Perchlorate and Perchlorate Salts
CASRN 7790-98-9 Ammonium perchlorate
CASRN 7791-03-9 Lithium perchlorate
CASRN 7778-74-7 Potassium perchlorate
CASRN 7601-89-0 Sodium perchlorate

Section I.B. Last Revised — 02/18/2005

The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The RfC considers toxic effects for both the respiratory system (portal-of-entry) and for effects peripheral to the respiratory system (extrarespiratory effects). The inhalation RfC (generally expressed in units of mg/m3) is analogous to the oral RfD and is likewise based on the assumption that thresholds exist for certain toxic effects such as cellular necrosis. Inhalation RfCs are derived according to *Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry* (U.S. EPA, 1994). Since RfCs can also be derived for the noncarcinogenic health effects of substances that are carcinogens, it is essential to refer to other sources of information concerning the carcinogenicity of this chemical substance. If the U.S. EPA has evaluated this substance for potential human carcinogenicity, a summary of that evaluation will be contained in Section II of this file.

__I.B.1. Inhalation RfC Summary

An inhalation reference concentration has not been derived because the available inhalation data are insufficient to characterize dose-response relationships or portal-of-entry modulation of internal dose. Perchlorate is not likely to come out of solution given its low vapor pressure. Droplet size during showering would likely preclude significant inhalation of perchlorate-contaminated water as an aerosol. Particulate inhalation exposures to perchlorate dust have been investigated in two published studies of ammonium perchlorate production workers (Gibbs et al., 1998; Lamm et al., 1999). Exposures were estimated through personal breathing zone and area sampling, adjusted by dose estimation assumptions (Gibbs et al., 1998) or particle size measures accompanied by urinary perchlorate excretion (Lamm et al., 1999). Both studies had small numbers of exposed workers. The cross-sectional epidemiological design means the studies were subject to possible selection bias of affected workers who left employment before the study. Neither study reports any significant relation of estimated perchlorate exposure to changes in thyroid hormone or TSH measures, except for an increase in TSH with duration of shift (Gibbs et al., 1998): the postshift mean serum TSH concentration was higher than the preshift concentration and exceeded it by more after a 12-hour shift than after an 8-hr shift, a difference expected because there is a circadian increase in serum TSH concentrations (NRC, 2005).

__I.B.2. Principal and Supporting Studies (Inhalation RfC)

Not applicable.

__I.B.3. Uncertainty and Modifying Factors (Inhalation RfC)

Not applicable.

__I.B.4. Additional Studies/Comments (Inhalation RfC)

Not applicable.

__I.B.5. Confidence in the Inhalation RfC

Not applicable.

__I.B.6. EPA Documentation and Review of the Inhalation RfC

Not applicable.

__I.B.7. EPA Contacts (Inhalation RfC)

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202) 566-1676 (phone), (202) 566-1749 (fax), or hotline.iris@epa.gov (email address).

_II. Carcinogenicity Assessment for Lifetime Exposure

Substance Name — Perchlorate and Perchlorate Salts
CASRN 7790-98-9 Ammonium perchlorate
CASRN 7791-03-9 Lithium perchlorate
CASRN 7778-74-7 Potassium perchlorate
CASRN 7601-89-0 Sodium perchlorate

Section II Last Revised — 02/18/2005

This section provides information on three aspects of the carcinogenic assessment for the substance in question: the weight-of-evidence judgment of the likelihood that the substance is a human carcinogen, and quantitative estimates of risk from oral and inhalation exposure. Users are referred to Section I of this file for information on long-term toxic effects other than carcinogenicity.

The rationale and methods used to develop the carcinogenicity information in IRIS are described in the *Draft Revised Guidelines for Carcinogen Risk Assessment* (U.S. EPA, 1999). The quantitative risk estimates are derived from the application of a low-dose extrapolation procedure, and are presented in two ways to better facilitate their use. First, route-specific risk values are presented. The "oral slope factor" is an upper bound on the estimate of risk per mg/kg-day of oral exposure. Similarly, a "unit risk" is an upper bound on the estimate of risk per unit of concentration, either per µg/L drinking water (see Section II.B.1.) or per µg/m^3 air breathed (see Section II.C.1.). Second, the estimated concentration of the chemical substance in drinking water or air when associated with cancer risks of 1 in 10,000, 1 in 100,000, or 1 in 1,000,000 is also provided.

_II.A. Evidence for Human Carcinogenicity

__II.A.1. Weight-of-Evidence Characterization

Under U.S. EPA's 1999 Draft Revised Guidelines for Carcinogen Risk Assessment, perchlorate is not likely to pose a risk of thyroid cancer in humans, at least at doses below those necessary to alter

thyroid hormone homeostasis, based on the hormonally-mediated mode of action in rodent studies and species differences in thyroid function. The epidemiological evidence is insufficient to determine whether or not there is a causal association between exposure to perchlorate and thyroid cancer. Sufficient evidence is available from rodent studies to indicate that goitrogenic doses of perchlorate cause follicular cell tumors of the thyroid, both following prolonged ingestion and from a two-generation study where a low incidence of early onset adenomas was reported. Perchlorate is non-mutagenic under standard tests. Extensive data indicate that thyroid-pituitary disruption is the sole mode of action for the observed thyroid tumors caused by perchlorate in rodents.

__II.A.2. Human Carcinogenicity Data

Two ecological epidemiological studies have been conducted to determine whether there is an association between perchlorate exposure and thyroid cancer. Li et al. (2001) analyzed Nevada Medicaid data for a two year period (1997, 1998) to compare the prevalence of specific thyroid diseases, including malignant thyroid cancer, by county of residence as characterized by the presence or absence of perchlorate in the drinking water (only one county had perchlorate detected in the drinking water in this time period). The prevalence ratio (exposed/non-exposed county) was 0.75 (95% confidence interval 0.35 - 1.59), although the number of thyroid cancer cases was too small to a have reasonable chance of detecting an association if one existed. Morgan and Cassady (2002) compared the observed and expected incident cases of cancer among residents of 13 contiguous census tracts in Redlands, California, whose drinking water wells had been tested over various years for both trichloroethylene and perchlorate contamination. No excess of thyroid cancer was observed in the residents (SIR 1.0, 99% confidence interval 0.63-1.47). Limitations of this study include the mixed exposure to trichloroethylene and perchlorate and derivation of expected numbers from a region that includes the exposed community. In both studies it was impossible to adjust for potential confounding variables. As a result, the epidemiological evidence is considered insufficient to determine whether or not there is an association between perchlorate exposure and thyroid cancer.

__II.A.3. Animal Carcinogenicity Data

Few long term cancer bioassays of perchlorate exposure have been conducted. The existing studies have reported that high doses of perchlorate in rodents cause statistically significant increases in follicular cell nodules (Fernandez Rodriguez et al. 1991), adenomas (Kessler and Kruskemper 1966), and carcinomas (Pajer and Kalisnik 1991). Other studies have demonstrated the ability of perchlorate to promote thyroid tumors initiated by other chemical or irradiation means (Hiasa et al. 1987, Fernandez-Santos et al. 2004; Pajer and Kalisnik 1991). Fernandez Rodriguez et al. (1991) administered 1% potassium perchlorate in drinking water to female Wistar rats for 1 - 12 months, reporting that after 6 months of treatment multiple (often bilateral) follicular cell nodules of complex morphology appeared in the diffusely enlarged thyroid glands. Kessler and Kruskemper (1966) administered potassium perchlorate to male Wistar rats in drinking water at 0 or 1% (~1,339 mg/kg/day). Four of the 11 treated rats developed benign tumors of the thyroid gland. Pajer and Kalisnik (1991) administered 0 or 1.2% (~2,147 mg/kg/day) sodium perchlorate in drinking water to female BALB/c mice for up to 46 weeks. There were three groups of controls and three groups of mice treated with perchlorate, some of which were also administered varying levels of whole body irradiation. Thyroid follicular cell carcinomas were observed in five of the six non-irradiated perchlorate treated mice, and in all 14 irradiated perchlorate treated mice.

In a two-generation study (Argus 1999), there were follicular cell adenomas in one control male rat in the initial parent (P1) generation and two high-dose (30 mg/kg/day) males in the first offspring (F1) generation at 19 weeks of age. Bayesian analysis of the early onset thyroid adenomas concluded that they were statistically increased relative to the entirety of the National Toxicology Program database (Dunson, 2001). The NRC (2005) concluded that the thyroid tumors in the offspring were most likely treatment related, but that they would be expected in high dose male rats in the presence of a markedly goitrogenic dosing regimen, as existed under the conditions of the study.

__II.A.4. Supporting Data for Carcinogenicity

Perchlorate has been evaluated in standard *in vitro* and *in vivo* assays to assess genotoxicity. The results of these assays are negative. Ammonium perchlorate was not mutagenic in the Ames assay (with or without S9 activation)(ManTech Environmental Technology, Inc., 1998; Zeiger, 1999a). Negative results were also found in the mouse lymphoma gene mutation assay with and without S9 activation (ManTech Environmental Technology, Inc., 1998; BioReliance, 1999). Ammonium perchlorate did not induce chromosomal anomalies when evaluated for micronuclei induction in the bone marrow of mice when administered via drinking water gavage or ip injection (ManTech Environmental Technology, Inc., 1998; Zeiger et al., 1999b). No increases in micronuclei were found in Sprague-Dawley rats when evaluated from the 90-day study at the highest dose, which produced both thyroid hormone perturbations and follicular cell hyperplasia (Springborn Laboratories, Inc., 1998). Because perchlorate does not have the potential to be mutagenic or clastogenic, mutagenicity is not considered a possible mode of carcinogenic action for this chemical.

Mode of Action

Perchlorate is a negatively charged ion (ClO_4^-) that can affect thyroid function through competitive inhibition of the transport of iodine into the thyroid. Iodine is an important component of thyroid hormones T4 and T3, and the transfer of iodine from the circulation into the thyroid is an essential step in the synthesis of these two hormones. Iodine transport into the thyroid is mediated by a protein molecule known as the sodium(Na+)-iodide(I-) symporter (NIS). NIS molecules bind iodide with very high affinity, but they also bind other ions that have a similar shape and electric charge, such as perchlorate. The binding of these other ions to the NIS inhibits iodide transport into the thyroid, which can result in intrathyroidal iodide deficiency and consequently decreased synthesis of T4 and T3. There is remarkable compensation for iodide deficiency, however, where the body maintains the serum concentrations of thyroid hormones within narrow limits through feedback control mechanisms. This feedback includes increased secretion of thyroid stimulating hormone (TSH) from the pituitary gland, which has among its effects the increased production of T4 and T3. Sustained changes in thyroid hormone and TSH secretion can result in thyroid hypertrophy and hyperplasia, possibly followed by hypothyroidism in people unable to compensate with an increase in thyroid iodide uptake.

The pituitary-thyroid system of rats is similar to that of humans, i.e., decreases in thyroid hormone production result in increased secretion of TSH, which then increases thyroid production and release of T4 and T3. However, there are differences in binding proteins, binding affinities of the proteins for the hormones, turnover rates of the hormones, and thyroid stimulation by placental hormones that lead to important differences between the two species. These differences mean that rats are sensitive to the development of thyroid tumors because their thyroid function is easily disrupted. The NRC (2005) concluded that humans are much less susceptible than rats to disruption of thyroid function and, therefore, are not likely to develop thyroid tumors as a result of perchlorate exposure.

As noted by the International Agency for Research on Cancer (IARC, 2001), "Agents that lead to the development of thyroid neoplasia through an adaptive physiological mechanism belong to a different category from those that lead to neoplasia through genotoxic mechanisms or through mechanisms involving pathological responses with necrosis and repair. Agents that induce thyroid follicular cell tumors in rodents by interfering with thyroid hormone homeostasis, can with some exceptions, notably the sulfonamides, also interfere with thyroid hormone homeostasis in humans if given at a sufficient dose for a sufficient time. These agents can be assumed not to be carcinogenic in humans at concentrations that do not lead to alterations in thyroid hormone homeostasis."

EPA (1998) reached similar findings regarding the relevance of rodent thyroid follicular cell tumors to humans. In this document, EPA provides a cancer mode-of-action framework for determining whether a chemical is acting via disruption of the thyroid-pituitary axis. Perchlorate satisfies these areas of inquiry regarding data demonstrating 1) increases in thyroid growth, 2) changes in thyroid

and pituitary hormones, 3) site of antithyroid action, 4) dose correlations, 5) reversibility of effects during the early stages, 6) lesion progression, 7) structure-activity analysis, and 8) multiple other studies supporting this mode of action, particularly data regarding perchlorate's inhibition of the sodium-iodide symporter and the lack of evidence for mutagenicity. EPA thus concludes that perchlorate is not likely to be carcinogenic to humans, at least at doses below those necessary to alter thyroid hormone homeostasis. In this situation where thyroid-pituitary disruptive effects have not been used as the critical effect in deriving the RfD, it is inappropriate to calculate a margin-of-exposure based on the RfD or the biochemical precursor event of iodide uptake inhibition. This conclusion is strengthened by the determination of the NRC (2005) that it is unlikely that perchlorate poses a risk of thyroid cancer in humans.

_II.B. Quantitative Estimate of Carcinogenic Risk from Oral Exposure

Not applicable.

__II.B.1. Summary of Risk Estimates

____II.B.1.1.

Not applicable (see text)

____II.B.1.2.

Not applicable (see text)

____II.B.1.3.

Not applicable (see text)

__II.B.2. Dose-Response Data (Carcinogenicity, Oral Exposure)

Dose-response data to derive the RfD for perchlorate are presented in Section 1.A.2.

__II.B.3. Additional Comments (Carcinogenicity, Oral Exposure)

__II.B.4. Discussion of Confidence (Carcinogenicity, Oral Exposure)

The overall confidence is high that perchlorate is not likely to be carcinogenic to humans, at least at doses below those necessary to alter thyroid hormone homeostasis. This is based on extensive mechanistic data on the mode-of-action of perchlorate, commencing with the inhibition of iodide uptake at the sodium-iodide symporter, and the conclusion that thyroid-pituitary disruption is the sole mode of action for the observed thyroid tumors caused by perchlorate in rodents.

_II.C. Quantitative Estimate of Carcinogenic Risk from Inhalation Exposure

Not applicable.

__II.C.1. Summary of Risk Estimates

Not applicable.

__II.C.2. Dose-Response Data for Carcinogenicity, Inhalation Exposure

Not applicable.

__II.C.3. Additional Comments (Carcinogenicity, Inhalation Exposure)

Not applicable.

__II.C.4. Discussion of Confidence (Carcinogenicity, Inhalation Exposure

Not applicable.

_II.D. EPA Documentation, Review, and Contacts (Carcinogenicity Assessment)

__II.D.1. EPA Documentation

Source Document — National Research Council. 2005. Health Implications of Perchlorate Ingestion. The National Academies Press. Washington, D.C.

This source document was prepared by the National Research Council of the National Academies on behalf of the United States Government InterAgency Working Group on Perchlorate. The NRC report followed draft Perchlorate Toxicological Reviews prepared by the U.S. EPA, which had also been subject to public comment and peer review.

Other EPA Documentation — Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization. External Review Draft, NCEA-1-0503, January 16, 2002.

__II.D.2. EPA Review (Carcinogenicity Assessment)

Agency Consensus Date - 02/18/2005

__II.D.3. EPA Contacts (Carcinogenicity Assessment

Please contact the IRIS Hotline for all questions concerning this assessment or IRIS, in general, at (202) 566-1676 (phone), (202) 566-1749 (fax), or hotline.iris@epa.gov (email address).

_III. [reserved]
_IV. [reserved]
_V. [reserved]

_VI. Bibliography

Substance Name — Perchlorate and Perchlorate Salts
CASRN 7790-98-9 Ammonium perchlorate
CASRN 7791-03-9 Lithium perchlorate
CASRN 7778-74-7 Potassium perchlorate
CASRN 7601-89-0 Sodium perchlorate

Section VI. Last Revised — 02/18/2005

_VI.A. Oral RfD References

Argus Research Laboratories, Inc. 1998. A neurobehavioral developmental study of ammonium perchlorate administered orally in drinking water to rats [report amendment: July 27]. Horsham, PA: Argus Research Laboratories, Inc.; protocol no. 1613-002.

Argus Research Laboratories, Inc. 2001. Hormone, thyroid and neurohistological effects of oral (drinking water) exposure to ammonium perchlorate in pregnant and lactating rats and in fetuses and nursing pups exposed to ammonium perchlorate during gestation or via maternal milk. Horsham, PA: Protocol no. ARGUS 1416-003.

Brabant, G.P., Bergmann, P., Kirsch, C.M., Kohrle, J., Hesch, R.D., von zur Muhlen, A. 1992. Early adaptation of thyrotropin and thyroglobulin secretion to experimentally decreased iodide supply in man. Metabolism 41(10):1093-1096.

Braverman, L.E., He, X., Pino, S., Magnani, B., Firek, A. 2004. Effects of low dose perchlorate on thyroid function in normal volunteers [abstract]. Thyroid 14(9):691.

CalEPA (California Environmental Protection Agency). 2004. Public Health Goal for Chemicals in Drinking Water, Perchlorate. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency.

Crump, K. and Goodman, G. 2003. Benchmark analysis for the perchlorate inhibition of thyroidal radioiodine uptake utilizing a model for the observed dependence of uptake and inhibition on iodine excretion. Prepared for J. Gibbs, Kerr-McGee Corporation. January 24, 2003 (presentation at the Fifth Meeting on Assess the Health Implications of Perchlorate Ingestion, July 29-30, 2004, Washington, D.C.)

Greer, M.A., Goodman, G., Pleus, R.C., Greer, S.E. 2002. Health effect assessment for environmental perchlorate contamination: The dose response for inhibition of thyroidal radioiodide uptake in humans. Environ. Health Perspect. 110:927-937.

Lawrence, J.E., Lamm, S.H., Pino, S., Richman, K., Braverman, L.E. 2000. The effect of short-term low-dose perchlorate on various aspects of thyroid function. Thyroid 10(8):659-663.

Lawrence, J., Lamm, S., Braverman, L.E. 2001. Low dose perchlorate (3 mg daily) and thyroid function. Thyroid 11(3):295.

NRC. 2005. Health Implications of Perchlorate Ingestion. National Research Council of the National Academies. National Academies Press, Washington, D.C.

U.S. EPA. 2003. Disposition of Comments and Recommendations for Revision to "Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization" (External Review Draft, January 16, 2002). EPA/600/R-03/031 October 2003.

Yu K.O., Narayanan, L., Mattie, D.R., Godfrey, R.J., Todd, P.N., Sterner, T.R., Mahle, D.A., Lumpkin, M.H., Fisher, J.W. 2002. The pharmacokinetics of perchlorate and its effect on the hypothalamus-pituitary-thyroid axis in the male rat. Toxicol Appl Pharmacol. 182(2):148-59.

_VI.B. Inhalation RfC References

Gibbs, J.P., Ahmad, R., Crump, K.S., Houck, D.P., Leveille, T.S., Findley, J.E., Francis, M. 1998. Evaluation of a population with occupational exposure to airborne ammonium perchlorate for possible acute or chronic effects on thyroid function. J. Occup. Environ. Med. 40(12):1072-1082.

Lamm, S.H., Braverman, L.E., Li, F.X., Richman, K., Pino, S., Howearth, G. 1999. Thyroid health status of ammonium perchlorate workers: A cross-sectional occupational health study. J. Occup. Environ. Med. 41(4):248-260.

_VI.C. Carcinogenicity Assessment References

Argus Research Laboratories, Inc. 1999. Oral (drinking water) two-generation (one litter per generation) reproduction study of ammonium perchlorate in rats. Horsham, PA: Argus Research Laboratories, Inc.; protocol no. 1416-001.

BioReliance. 1999. In vitro mammalian cell gene mutation test (L5178Y/TK+/-mouse lymphoma assay). Final report. Rockville, MD: laboratory study number G98BA06.702.

Dunson, D.B. 2001. Statistical analysis of the tumors observed in male F1 rats (second parental generation, P2) at week 19 in the Argus (1999) two-generation reproduction study of ammonium perchlorate [memorandum to Annie Jarabek]. Research Triangle Park, NC: National Institute of Environmental Health Sciences, Biostatistics Branch; November 1.

Fernandez Rodriguez, A., Galera Davidson, H., Salguero Villadiego, M., Moreno Fernandez, A., Martin Lacave, I., Fernandez Sanz, J. 1991. Induction of thyroid proliferative changes in rats treated with antithyroid compound. Anat. Histol. Embryol. 20(4):289-298.

Fernandez-Santos, J.M., De-Miguel, M., Gonzalez-Campora, R., Salguero-Villadiego, M., Cabrera, J.J., Galera-Davidson, H. 2004. Ki-ras mutational analysis in rat follicular-cell proliferative lesions of the thyroid gland induced by radioactive iodine and potassium perchlorate. J. Endocrinol. Invest. 27 (1):12-17.

Hiasa, Y., Kitahori, Y., Kato, Y., Ohshima, M., Konishi, N., Shimoyama, T., Sakaguchi, Y., Hashimoto, H., Minami, S., Murata, Y. 1987. Potassium perchlorate, potassium iodide, and propylthiouracil: Promoting effect on the development of thyroid tumors in rats treated with N-bis(2-hydroxypropyl)nitrosamine. Jpn. J. Cancer Res. 78(12):1335-1340.

IARC (International Agency for Research on Cancer). 2001. Some thyrotropic agents, IARC Monographs on the Evaluation of Carcinogenic Risk to Humans, Vol. 79. Lyon, France: International Agency for Research on Cancer.

Kessler, M.E., and Kruskemper, H.L. 1966. Experimental thyroid tumors caused by long-term potassium perchlorate administration. [in German]. Klin Wochenschr. 44(19):1154-1156.

Li, F.X., Squartsoff, L., Lamm, S.H. 2001. Prevalence of thyroid diseases in Nevada counties with respect to perchlorate in drinking water. J. Occup. Environ. Med. 42(2):200-205.

ManTech Environmental Technology, Inc. 1998. Genotoxicity assays for ammonium perchlorate. I. Salmonella/microsome mutagenesis. II. Mouse lymphoma cell mutagenesis. III. In vivo mouse bone marrow micronucleus test. Final report. Cincinnati, OH: Toxicology Excellence for Risk Assessment, Perchlorate Study Group; study no. 6100-001.

Morgan, J.W., and Cassady, R.E. 2002. Community cancer assessment in response to long-time exposure to perchlorate and trichloroethylene in drinking water. J. Occup. Environ. Med. 44(7):616-

621.

NRC. 2005. Health Implications of Perchlorate Ingestion. National Research Council of the National Academies. National Academies Press, Washington, D.C.

Pajer, Z., and Kalisnik, M. 1991. The effect of sodium perchlorate and ionizing radiation on the thyroid parenchymal and pituitary thyrotropin cells. Oncology 48(4):317-320.

Springborn Laboratories, Inc. 1998. A 90-day drinking water toxicity study in rats with ammonium perchlorate: amended final report [amended study completion date: June 3]. Spencerville, OH: Springborn Laboratories, Inc.; study no. 3455.1. U.S.EPA. 1998. Assessment of thyroid follicular cell tumors. EPA/630/R-97/002, March 1998.

U.S. EPA. 1999. Revised Guidelines for Carcinogen Risk Assessment (External Review Draft, July 1999). NCEA-F-0644.

Zeiger, E. 1998a. Salmonella mutagenicity testing of ammonium perchlorate [memorandum with attachment to Annie Jarabek]. Research Triangle Park, NC: U.S. Department of Health and Human Services, National Institute of Environmental Health Sciences; September 29.

Zeiger, E. 1998b. Ammonium perchlorate MN test results [memorandum to Annie Jarabek]. Research Triangle Park, NC: U.S. Department of Health and Human Services, National Institute of Environmental Health Sciences; December 23.

_VII. Revision History

Substance Name — Perchlorate and Perchlorate Salts
CASRN 7790-98-9 Ammonium perchlorate
CASRN 7791-03-9 Lithium perchlorate
CASRN 7778-74-7 Potassium perchlorate
CASRN 7601-89-0 Sodium perchlorate

File First On-Line 02/18/2005

Date	Section	Description
02/18/2005	All	IRIS Summary first posted

_VIII. Synonyms

Substance Name — Perchlorate and Perchlorate Salts
CASRN — 7790-98-9
CASRN — 7791-03-9
CASRN — 7778-74-7
CASRN — 7601-89-0
Last Revised — 02/18/2005

- 7790-98-9
- 7791-03-9
- 7778-74-7
- 7601-89-0
- Sodium perchlorate

- Lithium perchlorate
- Potassium perchlorate
- Sodium perchlorate

IRIS Home

Chronic Health Hazards for Non-Carcinogenic Effects

Reference Dose for Chronic Oral Exposure (RfD)

- Oral RfD Summary
- Principal and Supporting Studies
- Uncertainty and Modifying Factors
- Additional Studies/Comments
- Confidence in the Oral RfD
- EPA Documentation and Review

Reference Concentration for Chronic Inhalation Exposure (RfC)

- Inhalation RfC Summary
- Principal and Supporting Studies
- Uncertainty and Modifying Factors
- Additional Studies/Comments
- Confidence in the Inhalation RfC
- EPA Documentation and Review

Carcinogenicity Assessment for Lifetime Exposure

Evidence for Human Carcinogenicity

- Weight-of-Evidence Characterization
- Human Carcinogenicity Data
- Animal Carcinogenicity Data
- Supporting Data for Carcinogenicity

Quantitative Estimate of

Carcinogenic Risk from Oral Exposure

- Summary of Risk Estimates
- Dose-Response Data
- Additional Comments
- Discussion of Confidence

Quantitative Estimate of Carcinogenic Risk from Inhalation Exposure

- Summary of Risk Estimates
- Dose-Response Data
- Additional Comments
- Discussion of Confidence
- EPA Documentation, Review and, Contacts

Bibliography

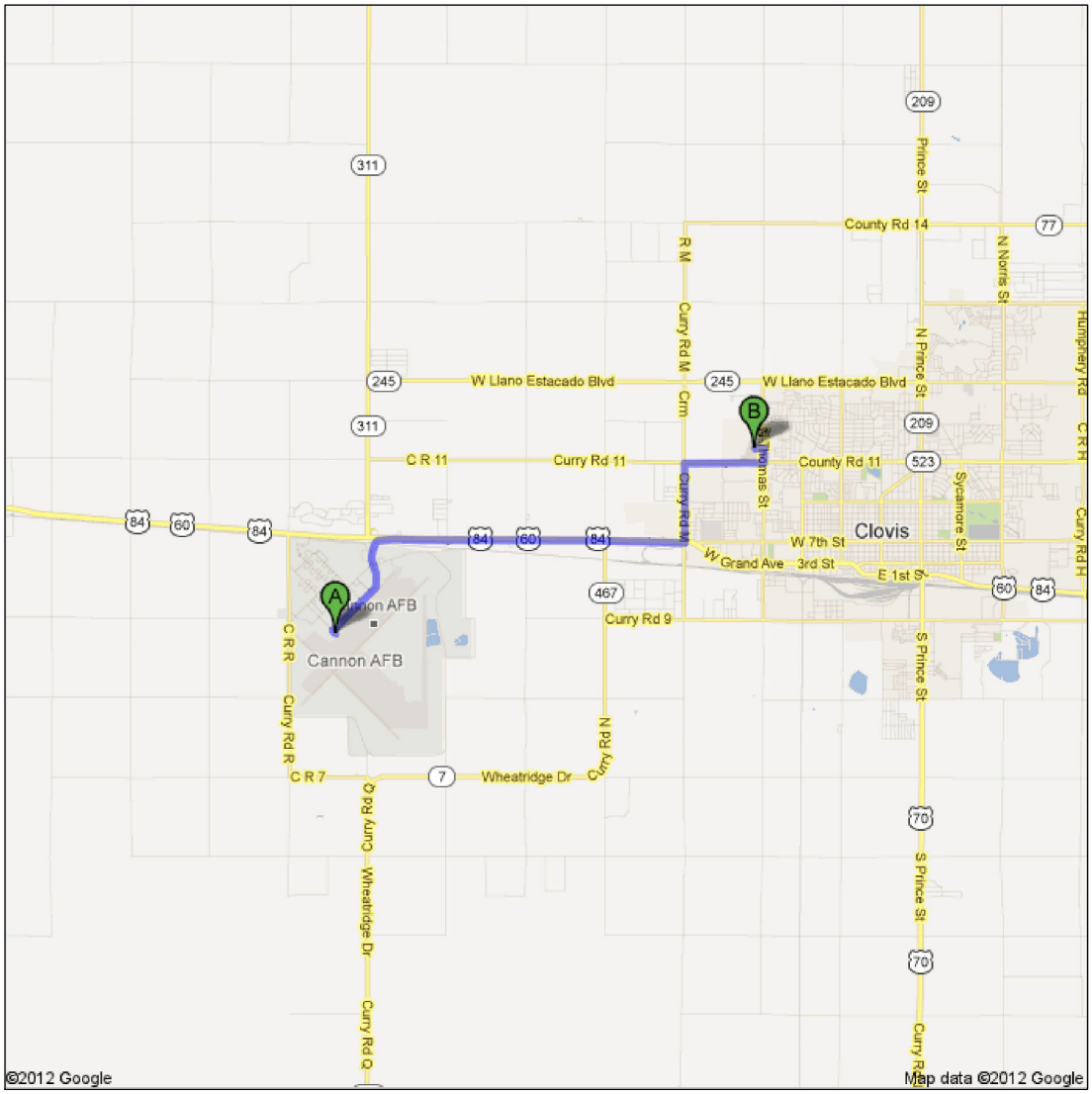
Revision History

Synonyms

ATTACHMENT D
HOSPITAL MAPS AND DIRECTIONS

Overview Directions

Directions to Plains Regional Medical Center
Clovis, New Mexico - (575) 769-2141
7.6 mi – about **16 mins**



Hospital Route Directions

1. Head northwest on E Octagon Ave toward S Torch Blvd	256 ft
2. Take the 1st right onto S Torch Blvd	1.4 mi
3. Take the ramp onto US-60 E/US-84 E	3.9 mi
4. Turn left onto Curry Rd M/N Wheaton St	1.0 mi
5. Turn right onto W 21st St/County Rd 11	1.0 mi
6. Turn left onto N Dr Martin Luther King Blvd/N Dr Martin Luther King Jr Blvd/N Thomas St	0.2 mi
7. Turn left onto Dillon Rd	0.1 mi

bhate ENVIRONMENTAL CONSTRUCTION ENERGY

HOSPITAL ROUTE MAP

Source: Google Maps

PROJECT NO:	SCALE:	DATE:	DRAWN BY:
9110129	NTS	2/22/12	MRM
			DRAWING NO: 9110129-01

Long Term Monitoring at Multiple Sites
Cannon Air Force Base
Cannon AFB, New Mexico

Figure 1

MAPQUEST.

Trip to Plains Regional Medical Center

2100 N Dr M L King Jr Blvd, Clovis, NM 88101 - (575) 769-2141
6.14 miles - about 10 minutes

Notes

Directions form Cannon AFB to
Plains Regional Medical Center
2100 N. Dr. martin Luther King Jr. Blvd.
Clovis, New Mexico 88101
(575) 786-2141

Emergency #911

Cannon Air Force Base - (575) 784-1110
N Torch Blvd, Cannon Afb, NM 88103

START	1. Start out going **north** on **N Torch Blvd** toward **Forest Dr**.	go 0.2 mi
EAST 60	2. Merge onto **US-60 E / US-84 S**.	go 4.1 mi
	3. Turn **left** onto **W 7th St**.	go 0.9 mi
	4. Turn **left** onto **N Martin Luther King Jr Blvd**.	go 1.0 mi
END	5. **2100 N DR M L KING JR BLVD**.	go 0.0 mi

Plains Regional Medical Center - (575) 769-2141
2100 N Dr M L King Jr Blvd, Clovis, NM 88101

Total Travel Estimate : 6.14 miles - about 10 minutes

Route Map Hide

APPENDIX A

FORMS

TRINITY
ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

WATER-LEVEL DATA SUMMARY

Project Name/Number	**Date**
	Field Personnel #1
Site	**Field Personnel #2**
Client	**Field Personnel #3**
Survey Datum (NGVD)	**Weather (previous 24 hours)**
Measuring Device	

Well Number	Time (hhmm)	Measuring Point		Depth to Water (ft, TOC)	Elevation of Water (ft, NGVD)	Security	Condition
		Description	Elevation (ft, NGVD)				

Notes: NGVD = National Geodetic Vertical Datum
TOC = Top of Well Casing

Comments/Observations

TRINITY
ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

GROUND WATER SAMPLING LOG

SITE NAME:	SITE LOCATION:	
WELL NO:	SAMPLE ID:	DATE:

PURGING DATA

WELL DIAMETER (inches):	TUBING DIAMETER (inches):	WELL SCREEN INTERVAL DEPTH: feet to feet	STATIC DEPTH TO WATER (feet):	PURGE PUMP TYPE OR BAILER:

WELL VOLUME PURGE: 1 WELL VOLUME = (TOTAL WELL DEPTH – STATIC DEPTH TO WATER) X WELL CAPACITY
(only fill out if applicable)
= (feet – feet) X gallons/foot = gallons

EQUIPMENT VOLUME PURGE: 1 EQUIPMENT VOL. = PUMP VOLUME + (TUBING CAPACITY X TUBING LENGTH) + FLOW CELL VOLUME
(only fill out if applicable)
= gallons + (gallons/foot X feet) + gallons = gallons

INITIAL PUMP OR TUBING DEPTH IN WELL (feet):	FINAL PUMP OR TUBING DEPTH IN WELL (feet):	PURGING INITIATED AT:	PURGING ENDED AT:	TOTAL VOLUME PURGED (gallons):

TIME	VOLUME PURGED (gallons)	CUMUL. VOLUME PURGED (gallons)	PURGE RATE (gpm)	DEPTH TO WATER (feet)	pH (standard units)	TEMP. (°C)	COND. (circle units) µmhos/cm or µS/cm	DISSOLVED OXYGEN (circle units) mg/L or % saturation	TURBIDITY (NTUs)	COLOR/ ODOR (describe)	ORP (mV)

WELL CAPACITY (Gallons Per Foot): **0.75"** = 0.02; **1"** = 0.04; **1.25"** = 0.06; **2"** = 0.16; **3"** = 0.37; **4"** = 0.65; **5"** = 1.02; **6"** = 1.47; **12"** = 5.88
TUBING INSIDE DIA. CAPACITY (Gal./Ft.): **1/8"** = 0.0006; **3/16"** = 0.0014; **1/4"** = 0.0026; **5/16"** = 0.004; **3/8"** = 0.006; **1/2"** = 0.010; **5/8"** = 0.016

PURGING EQUIPMENT CODES: **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **PP =** Peristaltic Pump; **O** = Other (Specify)

SAMPLING DATA

SAMPLED BY (PRINT) / AFFILIATION:	SAMPLER(S) SIGNATURE(S):	SAMPLING INITIATED AT:	SAMPLING ENDED AT:
PUMP OR TUBING DEPTH IN WELL (feet):	TUBING MATERIAL CODE:	FIELD-FILTERED: Y N Filtration Equipment Type:	FILTER SIZE: _____ µm
FIELD DECONTAMINATION: PUMP Y N	TUBING Y N (replaced)	DUPLICATE: Y N	

SAMPLE CONTAINER SPECIFICATION				SAMPLE PRESERVATION			INTENDED ANALYSIS AND/OR METHOD	SAMPLING EQUIPMENT CODE	SAMPLE PUMP FLOW RATE (mL per minute)
SAMPLE ID CODE	# CONTAINERS	MATERIAL CODE	VOLUME	PRESERVATIVE USED	TOTAL VOL ADDED IN FIELD (mL)	FINAL pH			

REMARKS:

MATERIAL CODES: **AG** = Amber Glass; **CG** = Clear Glass; **PE** = Polyethylene; **PP** = Polypropylene; **S** = Silicone; **T** = Teflon; **O** = Other (Specify)

SAMPLING EQUIPMENT CODES: **APP** = After Peristaltic Pump; **B** = Bailer; **BP** = Bladder Pump; **ESP** = Electric Submersible Pump; **RFPP** = Reverse Flow Peristaltic Pump; **SM** = Straw Method (Tubing Gravity Drain); **O** = Other (Specify)

NOTES: 1. **The above do not constitute all of the information required by Chapter 62-160, F.A.C.**
2. STABILIZATION CRITERIA FOR RANGE OF VARIATION OF LAST THREE CONSECUTIVE READINGS (SEE FS 2212, SECTION 3)

pH: ± 0.2 units **Temperature:** ± 0.2 °C **Specific Conductance:** ± 5% **Dissolved Oxygen:** all readings ≤ 20% saturation (see Table FS 2200-2); optionally, ± 0.2 mg/L or ± 10% (whichever is greater) **Turbidity:** all readings ≤ 20 NTU; optionally ± 5 NTU or ± 10% (whichever is greater)

☐ FD collected _____ ☐ well needs repair_____ ☐ needs well tag _____ ☐ other comment: _____

TRINITY
ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

WELL INSPECTION FORM

DATE:_____ TIME:_____

SITE LOCATION:_____ PROJECT NUMBER:_____

WELL ID:_____COMPLETED BY:_____

Well properly labeled? ID tag present?_____

Type of well completion:_____

Number of bollards and condition:_____

Type of protective casing and condition:_____

Painted? If so, condition of paint:_____

Condition of well pad:_____

Pad locked and secure? If so, condition of lock:_____

Well cap type and condition (J-plug, slip cap):_____

Is well cap vented?_____

Additional Comments:

Project Number:

Chain of Custody Number (1):

TRINITY ANALYSIS & DEVELOPMENT CORP.
Environmental & Engineering Services

Chain of Custody and Analytical Request

Facility:

Project Name / Site Name:

Client Name: Trinity (850) 613-6800

Project Manager:

Collected by:

Field Sample ID (30 Characters Max)	ERPIMS LOCID (15 Characters Max)	Date Collected (dd-mmm-yyyy)	Time Collected (Military) (hhmm)	Sample Depth (beginning - ending)	SA Code (2)	Sample Number (3)	Sample Matrix (4)	Sample Analysis Requested (5)										Quality Assurance Samples (6)			
								Number of containers										Ambient Blank Lot Control Number	Equipment Blank Lot Control Number	Trip Blank Lot Control Number	Cooler ID

Comments

Custody Transfers Prior to Receipt by Laboratory

Relinquished By (Signed)	Date	Time	Received by (signed)	Date	Time
1.			1.		
2.			2.		
3.			3.		

Sample Delivery Details / Laboratory Receipt

Delivered Directly to Lab: _____ Shipped: No.: 1

Method of Shipment: _____ Airbill Number: _____

Analytical Lab: _____ Delivery Location: _____

Lab Recipient: _____ Delivery Date/Time: _____

1.) Chain of Custody Number = date collected + custody number (e.g. 09-02-2011-01)

2.) Sample Type (SA) Codes: N = Normal Sample, TB = Trip Blank (-c) Sample, FD = Field Duplicate (-a) Samples, FR = Field Replicate (-b) Samples, EB = Equipment Blank (-d) Samples, MS = Matrix Spike, SD = Matrix Spike Duplicate, AB = Ambient Blank (-e)

3.) Sample Number: Unique sample number collected from a particular location per day. (e.g. Groundwater sample collected from MW-1 on 10/10/11 = 01, if sampled again on 10/10/11 = 02, etc.)

4.) Matrix Codes: GS = Soil Gas, WG = Ground Water , WS = Surface Water SO = Soil, SE = Sediment, SL = Sludge, SS= Suface Soil Samples, WQ = Aqueous Blank Samples (trip, equipment, ambient, etc.), SQ= Soil Blanks

5.) Sample Analysis Requested: Analytical method requested and number of containers provided for each.

6.) Quality assurance samples are assigned by date (ddmmyy) and the number of the associated QC sample (01, 02, etc). (E.g., The first equipment blank, trip blank, or ambient blank collected on May 10, 2011 in association with samples on the COC will be designated 10051101 in the Blank Lot Control Number field).

7.) Trip Blanks shall correspond to the first well sampled, for example: ST069-MW-08S-c

APPENDIX B

FIELD METHODS

FIELD METHOD NUMBER 1

WATER LEVEL MEASUREMENT

1.1. Objective

This section presents procedures and guidelines for measuring ground water in monitoring wells at Cannon AFB. Consistent repeatable data should be obtained.

1.2. Procedure

Water level measurements used to define a single potentiometric surface should be collected within the shortest time period at Cannon AFB as possible.

Water level measurement equipment will be constructed of materials that are chemically inert and which are not prone to sorption or desorption. When collecting water levels, measurements should be collected from wells in order of potentially least contaminated to potentially most contaminated.

An electronic water level indicator will be used to measure fluid levels at Cannon AFB. The device will consist of an electrode suspended by a pair of insulated wires. An ammeter, indicator light, or audible signal will be used to indicate when the electrode touches the water surface.

The procedures for this method are as follows:

- Check batteries before going to the field and carry an ample supply of spares;
- Turn power switch "ON;"
- Decontaminate tape and probe upon arrival to a site and between measurement in different wells or piezometers, as outlined in Field Method No. 3;
- Lower probe into the well until a sharp deflection is noted on the meter, the indicator light is illuminated, or the audible tone is activated;
- Verify that the electrode is functioning properly and is indicating the water surface with the same depth each time by moving the probe up and down several times;
- Hold the probe cable at the measuring point location on the well pipe at the exact depth where the probe indicates the water surface to be. Record the reading to the nearest 0.01 foot;
- If there is no reference mark, the measurement will be from the highest point of the well casing where possible, and from the northern side of the casing if not possible to determine the highest point on the well casing;
- The total depth of the well will be measured in the same manner ; and
- Remove the probe from the well.

1.3. Reporting

All water level field data are to be entered in field logbooks, or on an appropriate Water Level Data Sheet or Ground Water Sample Collection Field Sheet and will include the following information:

- Date (at top of page);
- Time recording is made;

- Station location (monitoring well or piezometer identification);
- General comments about condition; and
- Measuring point, usually.

FIELD METHOD NUMBER 2

GROUND WATER SAMPLING

1.1. Objective

The objective of this section is to provide procedures for the sampling of ground water monitoring wells at Cannon AFB. These procedures were designed so that the ground water samples will be of verifiable and legally defensible quality. To ensure that this goal is achieved, sampling protocols must be strictly followed and sample collection and handling must be properly documented in field log books, ground water sampling logs, chain-of-custody (COC) forms, and project files. This procedure applies to all personnel who are responsible, both directly and indirectly, for ground water sampling and the evaluation of analytical results from ground water samples collected at Cannon AFB.

1.2. Procedure

The following guidelines and procedures will be used for sampling monitoring wells at Cannon AFB. This Field Method just provides general procedures for low-flow and non low-flow methods of monitoring well sampling. Please refer to project-specific work plans for any deviations from the procedures outlined in this Field Method.

1.3. General Pre-Sampling Requirements

- Monitoring wells will be sampled in order of increasing contamination unless the wells are equipped with dedicated systems.
- Samples will not be collected within 2 weeks of well development.
- Samples to be analyzed for volatile and gaseous constituents will not be withdrawn with pumps that exert a vacuum on the sample (e.g., centrifugal).
- Wear appropriate personal protective equipment (PPE) as outlined in the Basewide Health and Safety Plan (BWHSP) (Appendix F of the BWP) and the Site Safety and Health Plan (SSHP). In addition, samplers will don new sampling gloves at each individual well prior to sampling.
- Visually examine the exterior of the monitoring well for signs of damage or tampering and record in the field logbook.
- All purging and sampling equipment will be decontaminated as specified in Field Method No. 3 and will be protected from contamination until ready for use. If a centrifugal or submersible pump is used, discard pump suction line after each well. If the sampling equipment is dedicated to a specified well, the previous step may be eliminated. Portions of the pumps that contact the sample must be made of stainless steel and/or Teflon®.
- Unlock well cap or outer steel casing lid.
- Take photoionization detector (PID), lower explosive limit, and oxygen readings, with the appropriate meter(s), at the well head immediately upon opening the cap and record in field log book. If high concentrations are detected, take the appropriate measures as outlined in the BWHSP and the SSHP.
- Measure the static water level in the well with an electronic water level indicator as described in Field Method No. 1 and record in the field logbook and Ground Water Sample Collection Field Sheet. Measure the total depth of the well to verify original construction details and determine if any appreciable fines have entered the well which may cause problems during sampling and/or potential problems with the analytical data. The water level indicator will be rinsed with deionized water in

between individual wells to prevent cross-contamination.

- Calculate the volume of water in the well in gallons according to the Ground Water Sample Collection Field Sheet. The information required for the calculation includes well depth (measured from top of casing to bottom of well), well casing diameter, static water level (measured from top of casing) and the borehole diameter.

1.4. Monitoring Well Purge Procedures

1.4.1 Non Low-Flow Well Purging Procedure

- Purge three to five well volumes of water from the well using one of the methods described below:
  - Pump with a submersible pump equipped with a check valve to avoid backflush and polyethylene tubing. For a non-dedicated system, set intake at the surface level of the ground water and start pump; continue to lower the intake line through the well to just above screen depth ensuring that all standing water in the well has been purged. If the system is dedicated, it is not necessary to move the intake from its set position.
  - Pump with a centrifugal pump and polyethylene tubing. For a non-dedicated system, set intake at the surface level of the ground water and start pump; continue to lower the intake line through the well to just above screen depth ensuring that all standing water in the well has been purged. If the system is dedicated, it is not necessary to move the intake from its set position. Discard the suction line after each well unless the tubing is dedicated.
  - Bail well with a stainless steel or Teflon® bailer and Teflon®-coated stainless steel wire. Hand bailing the monitoring well is not a highly recommended purge method and should only be utilized as a last resort.
- Measure and record temperature, pH, specific conductance, turbidity, dissolved oxygen and oxygen reduction potential (ORP) as each volume of ground water is purged.
- After purging, allow the static water level to recover to approximately 80% of its static level or for 16 hours after purge completion, whichever comes first.
- When a well is pumped dry before three to five well volumes have been purged, the sample will be collected as soon as a sufficient amount of water has re-entered the well.
- Obtain the sample from the well after the required volume of ground water has been purged and the temperature, pH, specific conductance, dissolved oxygen, ORP, and turbidity have stabilized according to the stabilization requirements. If the parameters do not stabilize within 3 to 5 well volumes the client should be notified and the well should be considered for additional purging or redevelopment.

1.4.2 Low-Flow Purging with Dedicated Submersible Pumps

- The pump intake shall be set at the bottom of the screened interval of each well where the depth to water (DTW) is within the screened interval. Where the DTW is above the screened interval, pump intakes shall be set at the top of the screened interval.
- Begin purging at a rate of approximately one liter per minute or as slow as the conditions and dedicated system allow (if greater than one liter per minute).
- Continuously monitor the water level and potential subsequent drawdown with an electric water level indicator. If the static water level prior to purging is within the screened interval, the drawdown shall not exceed a distance of 25% of the length of the saturated screened interval. If the water level falls

below the 25% drawdown level, the pumping rate should be decreased to stabilize the water level to prevent cascading and potential loss of volatiles, excessive turbidity and entrapment of air in the filter pack. If the static water level is above the screened interval, acceptable drawdown is defined as the lowering of the water level to the top of the screened interval. If continued drawdown occurs below the top of the screened interval, the pump rate will be decreased to stabilize the water level to prevent atmospheric contact with the filter pack and formation, which could alter redox chemistry of the well.

  - Note: In wells with slow recharge rates, it may be necessary to stop the pump and allow the well to recharge in order to remain at or above the drawdown limit. If this is necessary, be certain not to allow any water in the tubing to backflush into the well and when purging recommences start at a slower rate to avoid increasing turbidity.

- Purging will be considered complete when a minimum of one saturated screen volume, calculated according to the formula presented on the Ground Water Sample Collection Field Sheet, has been removed and the ground water quality parameters have stabilized according to the stabilization requirements.
- In the event the pump seizes and locks up during purging or sampling activities and it is necessary to jiggle or move the pump within the well, the purging will be re-initiated beginning with the first step of this procedure.

1.4.3 Low-Flow Purging with Non-Dedicated Submersible Piston Pumps

- Prior to deploying the pump, it shall be decontaminated in accordance with procedures specified in Field Method No. 3, Equipment Decontamination. If sample collection tubing is non- dedicated, it shall also be decontaminated prior to deployment.
- Collect an equipment blank as described in the Field Sampling Plan.
- Measure the static water level in the well.
- If the DTW is within the screened interval set the pump intake at the bottom of the screened interval.
- If the DTW is above the screened interval the pump intake shall be set at the top of the screened interval.
- Begin purging at a rate of approximately one liter per minute or as slow as the conditions and dedicated system allow (if greater than one liter per minute).
- Continuously monitor the water level and potential subsequent drawdown with an electric water level indicator. If the static water level prior to purging is within the screened interval, the drawdown shall not exceed a distance of 25 percent of the length of the saturated screened interval. If the water level falls below the 25 percent drawdown level, the pumping rate should be decreased to stabilize the water level to prevent cascading and potential loss of volatiles, excessive turbidity and entrapment of air in the filter pack. If the static water level is above the screened interval, acceptable drawdown is defined as the lowering of the water level to the top of the screened interval. If continued drawdown occurs below the top of the screened interval, the pump rate will be decreased to stabilize the water level to prevent atmospheric contact with the filter pack and formation, which could alter redox chemistry of the well.

  - Note: In wells with slow recharge rates, it may be necessary to stop the pump and allow the well to recharge in order to remain at or above the drawdown limit. If this is necessary, be certain not to allow any water in the tubing to backflush into the well and when purging recommences start at a slower rate to avoid increasing turbidity. See section on Low-Flow Purging of Wells with Low Recharge.

- Purging will be considered complete when a minimum of one saturated screen volume, calculated according to the formula presented on the Ground Water Sample Collection Field Sheet, has been removed and the ground water quality parameters have stabilized according to the stabilization requirements (Table 2-1).
- In the event the pump seizes and locks up during purging or sampling activities and it is necessary to jiggle or move the pump within the well, the purging will be re-initiated beginning with the first step of this procedure.

1.4.4 Low-Flow Purging with Non-Dedicated Submersible Piston Pumps in Wells with Low Recharge Rates

- The pump intake shall be set approximately two feet above the bottom of the well.
- Measure the static water level in the well.
- Begin purging at a rate of approximately one liter per minute or as slow as the conditions
- and dedicated system allow (if greater than one liter per minute) until a minimum of one well casing volume is removed or the water level reaches the pump intake, whichever occurs first.
- Allow static water level to recover to approximately 80 percent of its static level or for 16 hours after purge completion, whichever occurs first.
- When sufficient time has passed, measure the water level to confirm 80 percent recharge.
- In the event that the pump is withdrawn from the well decontaminate the exterior of the pump and submerged portion of the tubing bundle with an Alconox® wash and deionized water rinse. Collect an equipment blank prior to redeployment of the pump system.
- Set the intake of the pump at the bottom of the screened interval, pump at a low flow rate and collect ground water quality parameters for temperature, pH, specific conductance, turbidity, dissolved oxygen and ORP at 0.25 gallon intervals. Monitoring will continue until the ground water quality parameters have stabilized according to the stabilization requirements presented on the Ground Water Sample Collection Field Sheet.
    - Note: The drawdown shall be monitored continuously during purging and shall not exceed a level less than one foot above the pump intake.
- Prior to collecting samples, the volume of sample and the volume of the tubing bundle shall be calculates. If the volume of the tubing bundle exceeds the volume of the samples to be collected by more than one gallon the pump may be lowered to a minimum of two feet above the bottom of the well.
- Once readings have stabilized and the pump has been lowered (if the criteria for lowering is satisfied) commence sample collection. Continue to monitor drawdown during sample collection. In the event that the water level reaches a depth of 1 foot above the intake, pumping shall cease until the well has recharged to a level adequate to fill more sample bottles completely.

1.4.5 Sample Collection

- Sample collection will be with a low-flow submersible pump. Flow rates for sampling with low-flow pumps shall be maintained at 1 liter per minute or less.
- Sample containers shall be labeled prior to sample collection.
- Samples for volatile organic analysis shall be collected first. The samples shall be carefully filled to

avoid overflow and potential loss of preservative and tapped so entrapment of air is minimized and no head space exists. If bubbles appear, the vial will be refilled.

- Samples for non-volatile organic analysis shall be collected following the volatile organic sample collection. If field filtration is not performed the sample container must be clearly marked to state "laboratory filtration required".
- Place analytical samples in a cooler and chill to 4°C. Samples will be shipped to the appropriate laboratory within 24 hours. The sample cooler shall be shaded from direct sunlight immediately after collection.

Post-Sample Collection Requirements

- Re-lock well cap.
- Fill out field logbook, sample log sheet, custody seals and COC forms.
- Example copies of these forms are included in Appendix A of the FSP.
- Decontaminate purging and sampling equipment according to the procedures specified in Field Method No. 3.

FIELD METHOD NUMBER 3

EQUIPMENT DECONTAMINATION

1.1. Objective

The objective of field decontamination is to remove contaminants of concerns from sampling, drilling and other field equipment to concentrations that will **not** impact study objectives. This Field Method was developed for use by field personnel who are responsible for cleaning sampling or other equipment in the field.

1.2 Specification for Decontamination Materials

- Use a standard brand of phosphate-free laboratory detergent, either liquid or powder, preferably Liquinox® or Alconox®.
- Use tap water from any municipal water treatment system or use bottled drinking water. Soap and tap water will remove the gross contamination from the sampling equipment.

1.3 Handling and Containers for Cleaning Solutions

Improperly handled cleaning solutions may easily become contaminated, thereby jeopardizing the validity of the sample data. Containers should be constructed of the proper materials to ensure their integrity. The following containers should be used for storing the specified cleaning materials:

- Soap—Store in clean containers until use. It should be poured directly from the container into the wash bucket or tub.
- Tap water—Keep in clean tanks, hand-pressure sprayers, or squeeze bottles, or apply directly from a hose.
- Deionized water—Store in clean containers that can be closed when not in use. It may be applied from squeeze bottles.

1.4 Decontamination of Large Equipment

The following procedure will be used to decontaminate large pieces of equipment, such as casings, auger flights, pipe and rods, and those portions of the drill rig that may stand directly over a boring or well location or that come into contact with casing, auger flights, pipe, or rods. This procedure shall also be employed for the decontamination of heavy machinery such as backhoes, excavators, etc.

- Wash the external surfaces of equipment with high-pressure hot water and Liquinox® or Alconox® or equivalent non-phosphate, laboratory-grade detergent. If necessary, scrub until all visible dirt, grime, grease, oil, loose paint, rust flakes, etc., have been removed. The inside surfaces of equipment which come in direct contact the media being sampled will also be washed as described above. Specific decontamination instructions will be included in the project-specific addenda.
- Rinse with potable water.
- This decontamination procedure will be performed before equipment is used and between each well or other sampling locations.

1.5 Decontamination of Sampling Equipment

The following procedure will be used to decontaminate devices such as split-spoons, bailers, sample trays,

spatulas, spoons and augers that come in direct contact with the sample media:

- Wash and scrub equipment using tap water and laboratory detergent. Wire or plastic bristle brushes can be used.
- Rinse with tap water, removing all visible dirt and soap residue.
- Rinse with deionized water.
- Place onto clean plastic sheeting and allow to completely air dry.
- If not used immediately, wrap in aluminum foil.

Decontamination of sampling equipment will be kept to a minimum in the field and, whenever possible, dedicated sampling equipment will be used. Decontamination fluids will be disposed as required by the project specific addenda to the Waste Management Plan (WMP). Personnel directly involved in equipment decontamination will wear appropriate personal protective equipment as specified in the Basewide Health and Safety Plan (BWHSP) and the Site Safety and Health Plan (SSHP).

Whenever possible, decontamination pads provided by Cannon AFB should be used to clean large equipment. In other instances, a decontamination pad may need to be constructed at the investigation site.

1.6 Construction of a Decontamination Pad

Decontamination pads constructed in the field should meet the minimum specifications described below:

- The pad should be constructed in an area known or believed to be free of surface contamination. A temporary pad should be lined with a water impermeable material with no seams within the pad. The material should be either easily replaced (disposable) or repairable.
- The location of the pad should be out of the work zone and situated not to interfere with other work in progress.
- The pad should not leak excessively. Any sump or pit should be lined.
- Sawhorses or racks constructed to hold equipment while being cleaned should be high enough above the ground surface to prevent equipment for being splashed and re- contaminated.
- Water collected on the pad will be containerized and disposed of as per the investigation-derived waste (IDW) Disposal Plan. Small amounts of water will be left to evaporate.

1.7 Personal Protective Equipment

Personnel directly involved in equipment decontamination shall wear appropriate personal protective equipment (PPE) as specified in the BWHSP and the SSHP. The appropriate PPE is selected based on the level of contamination present or suspected at the site. Care should be taken so the selected PPE protects decontamination workers from unnecessary contact with soils or decontamination fluids. The following is a list of the minimum PPE required to perform decontamination activities:

- Safety glasses with splash shields or goggles and latex gloves will be worn during all cleaning operations. For decontamination activities involving large amounts of water, rain suits or aprons and rubber over-boots should also be worn.

No eating, smoking, drinking, chewing, or any hand-to-mouth contact should be permitted during cleaning operations.

APPENDIX C

LANDFILL COVER SYSTEM INSPECTION REPORT

Cover System Inspection Report Landfill-25 and Sewage Lagoon (South Area) Cannon Air Force Base, Curry County, New Mexico

Inspector Name and Title: _____ Date:
Days since last rain fall:_____ Amount of rainfall:
(Contact Base Weather Service)

Inspection Type	Check as Appropriate
Annual	
Other (Identify)	

	LF-25		Sewage Lagoon	
1. Fences and Gates:	Yes	No	Yes	No
• Structural integrity?				
• Gates locks in place?				
• Signage in place?				
• Tumbleweeds and silt built up?				
Problems observed with the fences/gates/signage:				
Maintenance or repairs required:				
Maintenance to be performed by (Subcontractor name and date):				

	LF-25		Sewage Lagoons	
2. Cover:	Yes	No	Yes	No
• Overall structural integrity maintained?				
• Surface erosion present?				
• Gullies/washouts present?				
• Exposed buried waste?				
• As-constructed contours (topographic highs) intact?				
• As-constructed contours (depressions) intact?				
• Stormwater runoff contained within boundaries of site?				
• Evidence of drainage pathways/diverted runoff?				
• Tumbleweeds or silt built up?				
Problems observed with the cover:				
Maintenance or repair required:				

Maintenance to be performed by (Subcontractor name and date):				
	LF-25		Sewage Lagoons	
3. Berms (Indicate NA if not present)	Yes	No	Yes	No
• Is any erosion present?				
• Is any ponding present?				
• Stormwater runoff contained onsite?				
Describe location and condition:				
Problems observed with berms:				
Maintenance or repairs required:				
Maintenance to be performed by (Subcontractor name and date):				

	LF-25		Sewage Lagoons	
4. Drainage Ditches/Channels (Indicate NA if no channels are present)	Yes	No	Yes	No
• Is any erosion present?				
• Is buildup of sediment/silt debris present?				
• Is displaced crushed concrete present?				
• Is stormwater runoff contained onsite?				
• Excess accumulation of tumbleweeds present?				
Describe location and condition:				
Problems observed with channels:				
Maintenance or repair required:				
Maintenance to be performed by (Subcontractor name and date):				

	LF-25		Sewage Lagoons	
5. Vegetation	Yes	No	Yes	No
• Vegetation native perennial?				
• Vegetation in good condition?				
• Bare/sparse areas?				

Describe overall condition:
Estimate extent and type of vegetative cover:
Maintenance or repairs required:
Maintenance to be performed by (Subcontractor name and date):

	LF-25		Sewage Lagoon	
6. Monitoring Wells	Yes	No	Yes	No
Evidence of tampering?				
Damage?				

Problems observed with the wells.
11. Changes required to the Monitoring and Maintenance Plan?

_____

Inspector's Name

_____

Inspector's Signature

_____

Date

Cover System Inspection Report
Landfill-03 and Landfill-04
Cannon Air Force Base, Curry County, New Mexico

Inspector Name and Title: _____ Date:
Days since last rain fall:_____ Amount of rainfall:
(Contact Base Weather Service)

Inspection Type	Check as Appropriate
Annual	
Other (identify)	

	LF-03		LF-04	
1. Cover:	Yes	No	Yes	No
• Overall structural integrity maintained?				
• Surface erosion present?				
• Gullies/washouts present?				
• Exposed buried waste?				
• As-constructed contours (topographic highs) intact?				
• As-constructed contours (depressions) intact?				
• Stormwater runoff contained within boundaries of site?				
• Evidence of drainage pathways/diverted runoff?				
• Tumbleweeds or silt built up?				
Describe overall condition:				
Problems observed with the cover:				
Maintenance or repairs required:				
Maintenance to be performed by (Subcontractor name and date):				

	LF-03		LF-04	
2. Vegetation:	Yes	No	Yes	No
• Vegetation native perennial?				
• Vegetation in good condition?				
• Bare/sparse areas?				
Describe overall condition:				
Estimate extent and type of vegetative cover:				

Maintenance or repairs required:
Maintenance to be performed by (Subcontractor name and date):

	LF-03		LF-04	
3. Berms (Indicate NA if no berms are present)	Yes	No	Yes	No
• Is any erosion present?				
• Is any ponding present?				
• Stormwater runoff contained onsite?				

Describe location and condition:
Problems observed with berms:
Maintenance or repairs required:
Maintenance to be performed by (Subcontractor name and date):

	LF-3		LF-4	
4. Drainage Ditches/Channels (Indicate NA if no channels are present)	Yes	No	Yes	No
• Is any erosion present?				
• Is buildup of sediment/silt debris present?				
• Stormwater runoff contained onsite?				
• Excess accumulation of tumbleweeds present?				

Describe location and condition:
Problems observed with channels:
Maintenance or repair required:
Maintenance to be performed by (Subcontractor name and date):

	LF-3		LF-4	
5. Monitoring Wells	Yes	No	Yes	No
• Evidence of tampering?				
• Damage?				
Problems observed with wells:				

	LF-3		LF-4	
6. Fences/Gates/Signage (Indicate NA if not present)	Yes	No	Yes	No
• Structural integrity?				
• Gate locks in place?				
• Signage in place?				
• Tumbleweeds or silt built up?				
Problems observed with fencing/gates/signage:				
Maintenance or repair required:				
Maintenance to be performed by (Subcontractor name and date):				
11. Changes required to the Monitoring and Maintenance Plan?				

_____
Inspector's Name

_____
Inspector's Signature

_____
Date