DEPARTMENT OF THE AIR FORCE
27TH SPECIAL OPERATIONS CIVIL ENGINEER SQUADRON (AFSOC)
CANNON AIR FORCE BASE NEW MEXICO

ENTERED

JAN 2010

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Mr. Ronald A. Lancaster
Chief, Asset Management Flight
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506 N DL Ingram Blvd
Cannon AFB NM 88103-5003

Ms. Patricia Stewart
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East – Building 1
Santa Fe NM 87505-6063

Dear Ms. Stewart

Cannon Air Force Base, NM is forwarding two hardbound and two electronic copies of the Final Work Plan, Annual Groundwater Monitoring, Melrose Air Force Range, New Mexico, January 2010 for your use and consideration.

If you have any questions, please contact Mr. Hugh G. Hanson, Natural Resources Management Element, at 575- 784-6391.

Sincerely

RONALD A. LANCASTER, YC-03

cc:
NMED (D. Cobrain) w/o documents
EPA Region 6 (Bob Sturdivant) w/o documents

**Response to Comments contained in the February 11, 2010,
Notice of Disapproval (NOD)**
Draft Work Plan, Groundwater Monitoring, Melrose Air Force Range, New Mexico, October 2009

Comment 1. Section 1.0, General Work Plan, Page 1-1:

Areas of Concern (AOCs) 1, 2, 3 and 4 should no longer be identified as AOCs. The Permittee is referred to NMED's Annual Unit Audit dated June 30, 2005, and subsequent assessments. In Table B attached to Invoice # HWB-MELR-AUA-2004, the former AOCs 1, 2, 3 and 4 are identified as Corrective Action Units 130, 131, 132, and 133, respectively. The Permittee must identify these sites as Solid Waste Management Units (SWMUs) 130, 131, 132 and 133, respectively, in future documents and publications. The Permittee may add the qualifier 'former AOC-n' if it is necessary to avoid confusion.

The Permittee states that monitoring wells are associated with three SWMUs and four AOCs, and then identifies only two SWMUs and three AOCs. The itemized list is correct. There are no monitoring wells associated with SWMU 115 or the AOC 4 (SWMU 133). The Permittee must revise the statement to correct the discrepancy.

Response

AOCs 1, 2, 3 and 4 will now be referred to as SWMUs 130, 131, 132 and 133, respectively, in the *Final Work Plan, Annual Groundwater Monitoring, Melrose Air Force Range, February 2010*. The reference to "three SWMUs and four AOCs" will be corrected to the five SWMUs to be sampled since there are no wells associated with SWMU 115 or SWMU 133.

Comment 2. Purpose and Scope, Page 1-1:

The Permittee proposes semi-annual sampling of groundwater monitoring wells associated with SWMUs 114 and 117 and AOCs 1, 2 and 3, and annual sampling of groundwater in wells in the water quality monitoring network. However, among the program recommendations described in the Permittee's *Initial Baseline Groundwater Monitoring, Melrose Air Force Range, June 2009*, the Permittee proposed annual sampling of monitoring wells and the water quality well network. NMED concurs with the proposed frequency of sampling described in the Draft Work Plan. The Permittee must conduct sampling of groundwater monitoring wells semi-annually.

Response

The groundwater monitoring wells associated with the SWMUs at Melrose Air Force Range will be sampled semi-annually, and the water quality well network will be sampled annually.

Comment 3. Section 2.1.2, Decision Statement, Pages 2-1 and 2-2 and Tables 3-7, 3-8, 3-9, and 3-10:

Where groundwater screening levels are not listed in Water Quality Control Commission (WQCC) regulations at 20.6.2.3 103 NMAC, the Permittee has listed screening levels for tapwater published in the U.S. Environmental Protection Agency *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (RSLs). The WQCC groundwater standards, including any approved alternative abatement standards (20.6.2.7.WW and 20.6.2.3103 NMAC), and the drinking water maximum contaminant levels (MCLs) adopted by EPA under the federal Safe Drinking Water Act (42 U.S.C. §§ 300f to 300j-26), are cleanup levels for groundwater. If both a WQCC standard and an MCL have been established for an individual substance, then the lower of the two levels must be used as the cleanup level for that substance. If no WQCC groundwater standard or MCL has been established for a substance, then a screening level for tapwater published in the NMED *Technical Background Document for Development of Soil Screening Levels, Revision 5.0* (NMED SSLs) is the appropriate value. A RSL value is appropriate when no WQCC, MCL, or NMED SSL value for tapwater is available. For carcinogens, the Permittee must multiply RSL values by a factor of 10 to obtain a screening value based on an excess cancer risk of 10^{-5}. The Permittee must revise the guideline hierarchy in Section 2.1.2 and Tables 3-7, 3-8, 3-9 and 3-10 to reflect appropriate screening levels.

Response

The hierarchy described in Section 2.1.2 will be revised, and Tables 3-7, 3-8, 3-9, and 3-10 of the work plan will be reviewed and updated to prioritize the source of screening levels: 1) WQCC/MCL (whichever is lower) 2) NMED *Technical Background Document for Development of Soil Screening Levels, Rev. 5.0* tapwater value (NMED SSL) 3) RSL value (carcinogens multiplied by a factor of 10). This protocol will be applied to all analytes in the analytical suite.

Comment 4. Section 1.2, Purpose and Scope, Page 1-1 and Section 2.0, Field Sampling Plan, Pages 2-1 and 2-2 and Section 2.1.5, Decision Rule, Page 2-2:

The Permittee indicates that analytical results of groundwater sampling will be used to determine if any of the sites being investigated can be selected for Corrective Action Complete (CAC) status, or if further investigation or monitoring is required. The Permittee is referred to the Department of the Air Force's letter dated May 9, 2007 requesting deferral of a RCRA Facility Investigation (RFI) Work Plan prepared for Melrose Air Force Range (MAFR) because the entire facility is an active range. The Department of the Air Force stated that Cannon Air Force Base (CAFB) will maintain and monitor all areas of SWMUs and AOCs at the range in accordance with range's Hazardous Waste Permit. NMED's letter dated June 19, 2007 approved deferment for the submittal of a revised RFI Work Plan. The Permittee must modify the purpose and scope of the Work Plan to indicate that, as an interim measure until the SWMUs are fully investigated, groundwater will continue to be monitored for the presence of potential contaminants.

Response

The purpose and scope of the work plan will be modified in Section 1.2, Section 2.0, and Section 2.1.5 to indicate that groundwater will continue to be monitored at Melrose Air Force Range for the presence of potential contaminants (semi-annually for groundwater monitoring wells and annually for the water quality well network) as an interim measure until the SWMUs are fully investigated.

Comment 5. Tables 2-1 and 2-2, Quality Well Network and SWMU Monitoring Wells Proposed Sampling Locations and Parameters and Section 3.22, Laboratory Analytical Methods, Page 3-14 and 3-15:

The Permittee listed wells to be included in the Groundwater Quality Well Network and SWMU groundwater monitoring wells. The Permittee is referred to Comments 5, 6 and 7 in NMED's letter dated October 27, 2009 regarding NMED's review of *Initial Baseline Groundwater Monitoring, Melrose Air Force Range, June 2009.* Those comments provide instructions on well abandonment, well installations, as well as inclusion and exclusion of wells in the monitoring well network.

The Permittee proposed analytical suites for the ground water samples. NMED concurs with the proposed chemical analytical methods with the following modifications. The Permittee must analyze both total and dissolved RCRA metals and replace EPA Method 6010B with the updated 6010C for metals analyses. The Permittee must include total and dissolved target analyte list (TAL) metals (aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc and cyanide) in the year 2010 and every sixth year thereafter (i.e., 2016, 2022 and so on). The Permittee must add perchlorate by EPA Method 6850 or 6860 and nitrate plus nitrite by EPA Method 9056 to the analytical suite for the samples to be collected annually.

Response

Comment 5 in NMED's October 27, 2009 letter agreed with abandonment of the four wells associated with SWMU 117, one well associated with SWMU 131, one well associated with SWMU 132, and MWQ-9; as well as approving the installation of a background monitoring well upgradient of the SWMUs. The current Scope of Services for the contractor does not include well abandonment or installation. An attempt will be made to samples these wells during this round of groundwater sampling. It is currently anticipated these wells will be abandoned in late summer/early fall of 2010, during the next round of sampling (semi-annual).

Comment 6 in NMED's October 27, 2009 letter addressed in part the analytical comments included in Comment 5 of the Work Plan. Comment 6 also indicated sampling of MWQ-19 was required. Total and dissolved RCRA metals will be analyzed by Method 6010C, and will also include TAL metals aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc and cyanide in the next round of sampling, and every 6^{th} year thereafter

(2016, 2022, etc.). Perchlorate will be added to the analyte suite and analyzed by EPA Method 6850 or 6860 as well as nitrate and nitrite by EPA Method 9056. MWQ-19 will be included in the list of wells for sampling.

Comment 7 in NMED's October 27, 2009 letter addressed wells to be included in the Groundwater Quality Well Network, recommended not sampling well MWQ-4 if its depth cannot be determined, and required a replacement monitoring well upgradient of the impact area and then discontinue monitoring and sampling well MWQ-10. Wells listed by NMED in Comment 7 of the October 27, 2009 letter will be included in the Groundwater Quality Well Network. The sampling team in the field will confirm whether or not the depth of well MWQ-4 can be determined; therefore, it will remain in the sampling network for this round of sampling. The contractor's current Scope of Services does not include well installation. It is currently anticipated the requested well will be installed during the next round of sampling (semi-annual).

As indicated in the response above to Comment 6 of NMED's October 27, 2009 letter, total and dissolved RCRA metals will be analyzed by Method 6010C, and will also include TAL metals aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc and cyanide in the next round of sampling, and every 6th year thereafter (2016, 2022, etc.). Perchlorate will be added to the analyte suite and analyzed by EPA Method 6850 or 6860 as well as nitrate and nitrite by EPA Method 9056.

Comment 6:

NMED notes that the Draft Work Plan was used by the Permittee to conduct sampling in 2009 that was reported in *Initial Baseline Groundwater Monitoring, June 2009.* An approved Work Plan must be used for all groundwater sampling events.

Response

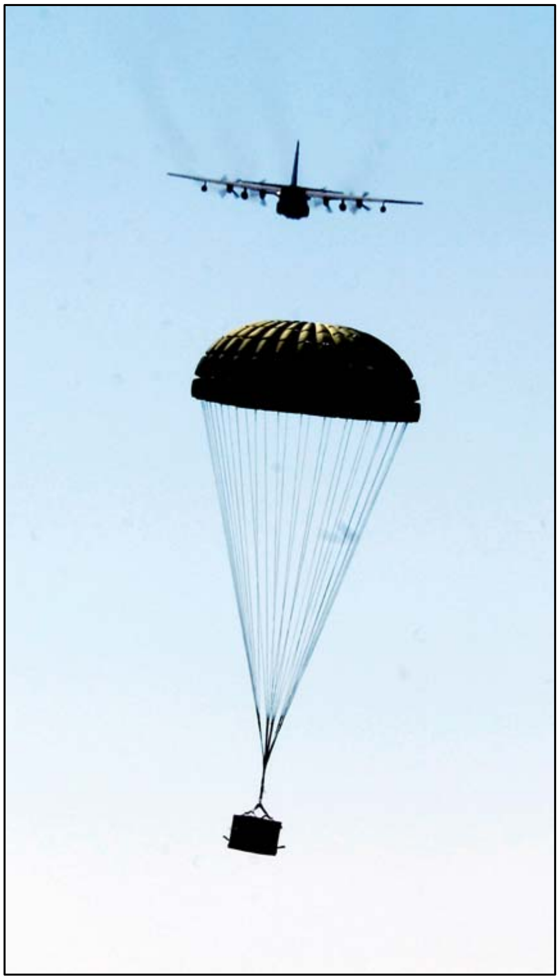
The *Draft Work Plan, Groundwater Monitoring, Melrose Air Force Range, New Mexico, October 2009* was prepared by a different contractor, subsequent to the sampling that was reported in the *Initial Baseline Groundwater Monitoring, June 2009.* Therefore, the October 2009 draft work plan was not used to perform the sampling summarized in the June 2009 report.

F I N A L W O R K P L A N

ANNUAL
GROUNDWATER MONITORING

MELROSE AIR FORCE RANGE
NEW MEXICO

January 2014



Prepared for:

Air Force Special Operations Command

27th Special Operations Wing

Under contract to:

U.S. Army Corps of Engineers
Omaha District

TIDEWATER INC

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Columbia, Maryland 20146

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

List of Tables

The following Tables and Figures can be found at the end of each section.

TABLE OF CONTENTS

List of Figures

TABLE OF CONTENTS

List of Appendices

TABLE OF CONTENTS

List of Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
ADR	automated data review
AFB	Air Force Base
AFR	Air Force Range
AFRIMS	Air Force Restoration Information Management System
AHA	Activity Hazard Analysis
bgs	below ground surface
btoc	below top of casing
CENWO	Corps of Engineers, Northwestern Division Omaha District
CFR	Code of Federal Regulations
CH	Characterization Sample (sample identification modifier)
CHMM	Certified Hazardous Materials Manager
CIH	Certified Industrial Hygentist
cm	centimeter
cm/yr	centimeter/year
COA	certificate of analysis
CoC	chain of custody
COC	Chemical of Concern
COPC	chemicals of potential concern
COPEC	chemical of potential ecological concern
CPR	cardiopulmonary resuscitation
CRZ	Contamination Reduction Zone
CSP	certified safety professional
CVAA	cold vapor atomic absorption
CX	Center of Expertise
DO	dissolved oxygen
DoD	Department of Defense

DoD QSM	Department of Defense Quality Systems Manual
DQCR	Daily Quality Control Report
DQO	data quality objective
EM	Engineering Manual
EOD	Explosives Ordnance Disposal
ERPIMS	Environmental Resources Program Information Management System
ERS	Environmental Remediation Services
ESI	Electrospray ionization
EZ	exclusion zone
FD	Fire Department
FSP	Field Sampling Plan
ft/mi	feet per mile
ft/yr	feet per year
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
GFCI	ground fault circuit interrupter
GIS	geographic information system
gpm	gallon per minute
GPS	global positioning system
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operation and Emergency Response
HCl	hydrochloric acid
HDPE	high density polyethylene
HPLC	High performance liquid chromatography
HTRW	Hazardous, Toxic, and Radioactive
IC	Ion chromatography
ICP	inductively coupled plasma
ID	identification
IDW	investigation-derived waste
in/yr	inches per year
IRP	Installation Restoration Program

J	estimated
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
m^3/m	cubic meter per meter
m/yr	meter per year
MCL	maximum contaminant level
MDL	method detection limit
MEC	munitions and explosives of concern
mg/L	milligram per liter
mL/min	milliliter per minute
MS	Mass spectroscopy
MS/MSD	matrix spike/matrix spike duplicate
MSDS	material safety data sheet
msl	mean sea level
N/A	not applicable
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environmental Department
No.	number
NPD	nitrogen-phosphorous detector
OBZ	operator breathing zone
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PAHs	polynuclear aromatic hydrocarbons
PARCCS	Precision, accuracy, representativeness, completeness, comparability and sensitivity
PCB	polychlorinated biphenyl

pH	hydrogen ion exponent
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppb	parts per billion
ppm	parts per million
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
%R	percent recovery
R	rejected
RCRA	Resource Conservation and Recovery Act
RCO	Range Control Officer
RE	re-analysis (sample identification modifier)
RFI	RCRA Facility Investigation
RFP	request for proposal
RL	reporting limit
RPD	relative percent difference
RPM	Restoration Program Manager
RSL	Regional Screening Level
SATOC	Single Award Task Order Contract
SCFS	sample collection field sheet
SHSO	Site Health and Safety Officer
SLERA	screening-level ecological risk assessment
SOP	standard operating procedure
SOW	statement of work
SSR	Subcontractors Safety Representative
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TAL	target analyte list

TB	trip blank (sample identification modifier)
TBD	to be determined
TCE	trichloroethene
TCLP	toxicity characterization leaching procedure
Test America	Test America, Inc.
Tidewater	Tidewater, Inc.
TOC	total organic carbon
TRPH	total recoverable petroleum hydrocarbon
U	nondetect
UJ	estimated nondetect
U.S.	United States
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	ultraviolet
UXO	unexploded ordnance
VOA	volatile organic analysis
VOC	volatile organic compound
WP	Work Plan
WQCC	Water Quality Control Commission

SECTIONONE General Work Plan

This document presents the Groundwater Monitoring Work Plan (WP) for groundwater monitoring efforts at Melrose Air Force Range (AFR), which is associated with Cannon Air Force Base (AFB). The location of Melrose AFR is shown on **Figure 1-1**. The monitoring effort will include the Melrose AFR groundwater quality well network as well as the environmental monitoring wells associated with five Solid Waste Management Units (SWMUs) at Melrose AFR. The five SWMUs are:

- SWMU 114 – Expended Ordnance and Industrial Waste Burial Site (Motor Pool Trenches)
- SWMU 117 – Domestic Waste Burial Site (Southeast of Main Building)
- SWMU 130 – World War II Cantonment Disposal Site
- SWMU 131 – Domestic Waste Burial Site (East of Fire Station)
- SWMU 132 – Disposal/Burn Site (North Helicopter Pad)

Wells associated with SWMUs 117 and 132 were recommended for abandonment in the initial baseline groundwater monitoring report (URS, 2009). The New Mexico Environmental Department (NMED) agrees with the assessment (NMED, 2009b) to abandon these wells, with abandonment anticipated during the subsequent round of sampling (semi-annual) during the late summer/early fall of 2010. An attempt will be made to collect samples from these wells during this sampling round. The locations of the monitoring wells within the Melrose AFR groundwater quality well network and the monitoring wells associated with the SWMUs are shown on **Figure 1-2**. This figure presents an installation overview of the well locations that exist at Melrose AFR. Data used to create this figure was compiled from Melrose AFR, United States Geological Survey (USGS), and historical reports.

1.1 AUTHORITY

Tidewater, Inc. (Tidewater) has been contracted by the United States Army Corps of Engineers (USACE), Omaha District under Contract Number W9128F-09-D-0005, Delivery Order 0002, to complete groundwater monitoring activities at Melrose AFR. This Groundwater Monitoring WP has been prepared as part of these activities.

1.2 PURPOSE AND SCOPE

The purpose of this Melrose AFR groundwater monitoring project is to monitor and evaluate groundwater conditions at SWMUs 114, 117, 130, 131, and 132 with regard to potential contaminants of concern. The groundwater conditions within Melrose's groundwater well network will also be monitored. Analytical results from this round of sampling will be used to evaluate groundwater conditions at the wells sampled, and as an interim measure until the SWMUs are fully investigated, groundwater will continue to be monitored for the presence of potential contaminants.

This WP outlines specific activities and procedures necessary for groundwater monitoring activities at Melrose AFR. Groundwater monitoring activities for as many as 15 monitoring wells located at SWMUs 114, 117, 130, 131, and 132 will be conducted on a semi-annual basis. The Melrose AFR groundwater quality well network, consisting of as many as 15 monitoring wells, will be sampled on an annual basis.

All field activities presented in this document will be completed in accordance with the procedures described in the Field Sampling Plan (FSP) (**Section 2**), criteria presented in the Quality Assurance Project Plan (QAPP) (**Section 3**), and safety guidelines and requirements in the Health and Safety Plan (HASP) (**Section 4**).

The results of this groundwater sampling event will be presented in an annual groundwater monitoring report for calendar year 2010. Subsequent groundwater sampling results will be presented in additional annual groundwater monitoring reports. Any changes to the groundwater monitoring program at Melrose AFR will be described in supplemental WP addendums, as necessary.

1.3 MELROSE AIR FORCE RANGE DESCRIPTION

The following site information has been adapted from the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Report Addendum (FW, 2003) and the RFI Work Plan (Ebasco, 1995).

1.3.1 Facility Description and History

Melrose AFR is an active United States (U.S.) Air Force bombing and air-to-ground gunnery range located in Roosevelt and Curry counties, approximately 8 miles southwest of Melrose, New Mexico, and 25 miles southwest of Cannon AFB. A facility location map is included as **Figure 1-1**. The U.S. Army Air Corps used the area for training during World War II. In 1952, the U.S. Air Force leased 7,771 acres of grassland for use as a bombing and air-to-ground gunnery range to support Clovis AFB (Kearney, 1987). Clovis AFB was renamed Cannon AFB in 1957 in honor the the late General John K. Cannon, former commander of the Tactical Air Command. Melrose AFR was expanded between 1968 and 1972 with the purchase of both the leased land and an additional 14,369 acres (Kearney, 1987). According to geographic information system (GIS) data provided by Melrose AFR in September 2008, the total area of the range is 59,928 acres. Melrose AFR has been a composite day and night simulated special and conventional weapons delivery range since approximately 1969. Currently, practice ordnance is used at the range. Although designated practice, the ordnance can contain small explosive or pyrotechnic spotting charges. Melrose AFR may potentially implement the use of high explosive ordnance in the future.

1.3.2 Melrose AFR Setting – Physical Geography

Melrose AFR is situated in the Southern High Plains Physiographic Province in the Llano Estacado subprovince. The Llano Estacado is a nearly flat plain sloping gently (10 to 15 feet per mile) to the east and southeast. Elevations in the eastern New Mexico portion of the Llano Estacado exceed 4,000 feet above mean sea level (msl). In the vicinity of Melrose AFR, elevations range from 4,200 feet to 4,600 feet above msl.

The most prominent geomorphic features in the vicinity of Melrose AFR are spurs of an escarpment known as “the Mesa”, which rises about 200 feet above the average elevation of the range surface. The northern spur ends in a small butte near the center, overlooking much of the range. Other geomorphic features in the region include relict sand dunes and minor playas located along the south side of U.S. Highway 84 north of the range. Relict sand dunes are not found on Melrose AFR.

Playas are broad, shallow depressions that may form as a result of soil leaching and wind erosion (blowouts) or from collapse of the surface due to differential erosion of underlying rock. During periods of rainfall, these depressions commonly collect surface runoff from small-to moderate-sized drainage areas to form ephemeral playa lakes. Playas have no external surface drainage. Water is lost by infiltration to the soil and evaporation; without recharge, playa lakes persist for only a few days or weeks. Only minor playa areas are present at the north end of Melrose AFR, but larger playas (greater than 0.3 square mile in area) are present within 1 to 2 miles north of the range.

Stream valleys in this region of New Mexico tend to be fairly broad and widely spaced; streams are ephemeral and drainages are poorly developed. No perennial streams exist on or near Melrose AFR. The nearest named drainages are Chapman Draw, approximately 2 miles west of the range, and Cañada del Tule, about 2 miles southeast of the range. Chapman Draw drains to the north, while Cañada del Tule drains to the east. Neither is a perennial stream. The surface topography of Melrose AFR slopes to the northeast, and overland flow and ephemeral drainage from the site is toward the northeast and not toward either drainage (FW, 2003) (see **Figure 1-1**).

1.3.3 Demographics and Land Use Near Melrose AFR

Melrose AFR is located approximately 8 miles southwest of Melrose, New Mexico and 25 miles southwest of Cannon AFB. The majority of the land in the area is productive, irrigated farmland or grassland. The major crops are wheat, sorghum, sugar beets, corn, cotton, alfalfa, barley, and peanuts. According to the 2000 U.S. Census data, there were 736 people living in the Village of Melrose, New Mexico.

1.3.4 Climate

The climate of east-central New Mexico is classified as tropical semi-arid, with summer temperature and precipitation maxima. Average monthly temperatures range from a January low of 12 degrees Celsius (°C) (39 degrees Fahrenheit [°F]) to a July high of 26°C (78°F). Extreme daily temperatures range from -24°C (-11°F) to 41°C (106°F) (Lee Wan, 1990). Average monthly precipitation ranges from 1 centimeter (cm) (0.4 inch) in winter to 6.9 cm (2.7 inches) in July. The maximum-recorded 24-hour rainfall was 12.2 cm (4.7 inches), which occurred in the month of August. Rainfall occurs on eight or more days per month during the summer precipitation maximum. Mean annual precipitation is approximately 41 cm (14 inches) at Melrose and the mean annual evapotranspiration rate is 175.3 centimeters per year (cm/yr) (69 inches per year [in/yr]) (Lee Wan, 1990). Prevailing winds are from the west at an average of 8 miles per hour (USAF, 1990).

The atmosphere around the area of Melrose AFR is generally well mixed. The seasonal and annual average mixing heights can vary from 400 meters in the morning to 4,000 meters in the afternoon. The afternoon mixing heights are typically greater during the spring and fall seasons. The morning mixing heights are usually low due to nighttime heat loss from the ground, producing surface-based temperature inversions. After sunrise, these inversions break up, and solar heating of the earth's surface causes vertical mixing in the atmosphere.

Dust is frequently entrained into the atmosphere in this region of the country because of gusty winds and the semi-arid climate. The Texas Panhandle-eastern New Mexico area is considered the worst area in the United States for windblown dust. Occasionally, this windblown dust is of sufficient quantity to restrict visibility. Most of the seasonal dust storms occur in March and April, when the wind speeds are typically high.

1.3.5 Geology

Melrose AFR is located in the Southern High Plains physiographic region and lies atop a large plateau known as the Llano Estacado that slopes gently to the east-southeast from eastern New Mexico into west Texas. Melrose AFR topography (excluding the Mesa) is open and mostly flat and gently slopes to the northeast. The Mesa dominates the southwest part of Melrose AFR, is a topographic high, and is part of the Western Caprock Escarpment that defines the western boundary of the Southern High Plains aquifer. The Mesa has a plateau area of about 7,775 acres ranging in altitude from 4,600 to 4,700 feet and forms the surface basin boundary between the Pecos River Basin to the west and the Portales Valley to the east. No surface-water bodies are located within Melrose AFR except minor ephemeral channels including the Chapman Draw and the Cañada del Tule, which originate at the Mesa. Melrose AFR is located in the Plains-Mesa Grassland vegetation unit, and vegetation consists of grasses and shrubs (Langman, Gebhardt, and Falk, 2004).

The geologic structure of the Southern High Plains aquifer at Melrose AFR includes the Chinle, Ogallala, and Blackwater Draw Formations. The Chinle Formation of Triassic age forms the base of the unconfined Southern High Plains aquifer at Melrose AFR, consists mostly of clay with some intermixed sand and silt, and ranges in thickness from 0 to 400 feet for eastern New Mexico. The Ogallala Formation of Tertiary age is the uppermost formation for the central and southern parts of Melrose AFR and lies unconformably atop the upper unit of the eastward-dipping Chinle Formation. The Ogallala Formation consists of eolian sand and silt and fluvial and lacustrine sand, silt, clay, and gravel, and can range in thickness from 30 to 600 feet in eastern New Mexico and west Texas (Langman, Gebhardt, and Falk, 2004).

The Blackwater Draw Formation of Quarternary age overlies the Ogallala Formation in the northern part of Melrose AFR, consists mostly of eolian sand deposits, and can range in thickness from 0 to 80 feet for eastern New Mexico. A caliche layer is typically present in the unsaturated zone of the Blackwater or Ogallala Formations in New Mexico, but its characteristics at Melrose AFR are unknown. The caliche forming the Western Caprock Escarpment was pedogenic carbonate that accumulated locally during the Tertiary and Quarternary Periods and that other buried caliche layers in the Ogallala Formation are not well known. Drilling at Melrose AFR and Cannon AFB has indicated that caliche is discontinuous, of variable thickness, and typically found within 30 feet of the surface (Langman, Gebhardt, and Falk, 2004).

The surface deposits of Melrose AFR consist of sand and gravel facies and playa deposits of the Blackwater Draw, Ogallala, and Chinle Formations. Eolian deposits of thin sand with interbeds of caliche of the Blackwater Draw Formation compose the Mesa surface. The northern part of Melrose AFR occupies the upper reach of the Portales Valley, and is composed of reworked material from the Blackwater Draw and Ogallala Formations. Eolian deposits of the Blackwater Draw Formation are present in the northern part of Melrose AFR as sand deposits and dunes, and the Chinle Formation is exposed in the southwestern portion of Melrose AFR near the Mesa (Langman, Gebhardt, and Falk, 2004).

1.3.6 Hydrogeology

The lower portion of the Ogallala Formation is the primary regional aquifer for both potable and irrigation water. No deeper aquifers are utilized in the vicinity of Melrose AFR. The saturated Ogallala Formation deposits at Melrose AFR are within the western boundary of the Southern High Plains aquifer. In New Mexico, the Southern High Plains aquifer is part of a larger aquifer system extending from South Dakota to Texas and is commonly referred to as the Ogallala aquifer. The part of the Southern High Plains aquifer in New Mexico is composed of hydraulically connected geologic units of late Tertiary or Quaternary age and is underlain by rocks of Triassic, Jurassic, and Cretaceous age. The unconfined Southern High Plains aquifer is composed primarily of the Ogallala Formation (Langman, Gebhardt, and Falk, 2004). The Ogallala aquifer has a southeasterly regional gradient of about 17 feet per mile (ft/mi) (0.0032 meters per meter). Well yields vary from less than 1 gallon per minute (gpm) in thin silts and sands and up to 1,600 gpm in thick sands and gravels (Lee Wan, 1990).

Because of substantial annual pumpage from the aquifer (approximately 17 million gallons in 1995), water levels have been declining in the High Plains aquifer since development first began. In New Mexico, water levels in the Southern High Plains aquifer have declined less than the substantial declines recorded in other States (greater than 150 feet in parts of west Texas), but in New Mexico, the saturated thickness of the Southern High Plains aquifer is generally less than 100 feet (Langman, Gebhardt, and Falk, 2004).

Using 1978 water-level data, it was estimated the depth to water to be about 100 feet below ground surface (bgs) throughout Melrose AFR. In 1987 and 1992, the USGS measured depth to water ranging from about 40 to 125 feet across Melrose AFR. In 2000, water levels measured in the center of Melrose AFR ranged from 50 to 150 feet bgs (Langman, Gebhardt, and Falk, 2004).

During installation of USGS wells (MWQ 1 and 2), drill cuttings indicated a thin soil layer underlain by a thin caliche layer followed by various layers of sand and silt. A saturated gravel layer was encountered between 125 and 130 feet bgs and is underlain by a thin layer of sand, likely the base of the Ogallala Formation. The altitude of the gravel layer is consistent with the altitude of total depths in most windmills, stock wells, and monitoring wells that were installed in and around Melrose AFR to pump water from the unconfined aquifer. Underlying the gravel and thin sand layer is a clay layer about 50 feet thick, which grades into clay with various percentages of sand and silt with some sand stringers. A 2-foot-thick water-yielding zone was present in the clay, sand, and silt deposits of the Chinle Formation at about 235 feet bgs (Langman, Gebhardt, and Falk, 2004).

Drilling logs on file with the New Mexico Office of the State Engineer indicate a similar lithology in other areas of Melrose AFR not dominated by the Mesa. The top of the unconfined aquifer is typically between 80 and 150 feet bgs, aquifer thickness ranges from 5 to 40 feet, and the aquifer is typically underlain by a clay layer. Drilling at most sites did not proceed into this clay layer. This clay layer defines the base of the Ogallala Formation at Melrose AFR, which represents the base of the unconfined aquifer (Langman, Gebhardt, and Falk, 2004).

Within New Mexico, groundwater in the Southern High Plains aquifer generally flows eastward, which is considered the overall direction of regional flow in the unconfined aquifer. Water-level contours for the unconfined aquifer indicate groundwater flowing predominantly northeast from the Mesa (located in the southwestern part of Melrose AFR) to the Portales Valley (located in the northeastern part of Melrose AFR) in the Southern High Plains aquifer. The change in flow direction in the unconfined aquifer in the Portales Valley indicates two flow systems—local and regional. The local flow system is the groundwater in the southwest part of Melrose AFR that flows northeast from the Mesa, and the regional flow system is in the Portales Valley where groundwater flows east to southeast across the northern part of Melrose AFR. Direction of groundwater flow is a reflection of the contact between the Ogallala and Chinle Formations. This contact determines groundwater gradient and saturated thickness of the unconfined aquifer in the Ogallala Formation. The local flow-system gradient is about 1.3 percent, and the regional flow-system gradient is about 0.1 percent. Saturated thickness of the aquifer increases as the local flow system merges with the regional flow system (Langman, Gebhardt, and Falk, 2004).

Based on USGS data, the median specific conductance and concentrations of dissolved solids in groundwater at Melrose AFR varied widely and can be separated into three distinct groups. The first group includes wells in the regional flow system (MWQ 3–7), which yielded groundwater with the smallest median specific-conductance values, ranging from 564 to 792 microsiemens per centimeter (µS/cm), and the smallest median concentrations of dissolved solids, ranging from 370 to 525 milligrams per liter (mg/L). Water from well MWQ 10, located atop the Mesa, had a median specific conductance of 635 µS/cm and a median concentration of dissolved solids of 380 mg/L, which is similar to the regional flow system (MWQ 3-7). In the second group, samples collected from wells MWQ 9 and 11 near the Mesa and from wells MWQ 12 and 13 near ephemeral streams in the southern part of Melrose AFR had larger specific-conductance values (1,100 to 1,436 µS/cm) and larger concentrations of dissolved solids (548 to 860 mg/L). Samples from a third group of wells with similar water quality included wells near and in the

Impact Area (MWQ 14-17) and a well located west of the Impact Area (MWQ 8). Water from this group of wells had the largest median specific-conductance values, ranging from 2,575 to 10,665 µS/cm, and the largest median concentrations of dissolved solids, ranging from 1,700 to 6,200 mg/L (Langman, Gebhardt, and Falk, 2004).

Based on USGS data, the median concentration of dissolved solids (6,300 mg/L) in water from the Chinle Formation (MWQ 2) was comparable to the median concentrations in water from wells in the unconfined aquifer in the Impact Area, particularly well MWQ 16. Concentrations of dissolved solids varied substantially during the study period in water from wells MWQ 2 (5,260 to 7,700 mg/L) and MWQ 16 (1,870 to 7,400 mg/L) (Langman, Gebhardt, and Falk, 2004).

Based on USGS data, water in the confined aquifer (MWQ 2) was the warmest (27.2 ºC) followed by water in well MWQ 16 in the unconfined aquifer (22.7 ºC). Water temperatures in wells near and in the Impact Area generally were higher than water temperatures in wells near the Mesa and in the regional flow system (Langman, Gebhardt, and Falk, 2004).

Recharge to the Ogallala aquifer is primarily through precipitation. Diffuse areal recharge to the Southern High Plains aquifer has been estimated to range from 0.01 to 1.71 inches per year with most estimates less than 1 inch per year. Groundwater in the New Mexico part of the Southern High Plains aquifer is generally suitable for domestic, municipal, and irrigation uses. The water typically contains large concentrations of calcium, magnesium, and bicarbonate and potentially objectionable concentrations of chloride and fluoride for domestic use. Water from older formations, such as the Chinle, is known to be of poorer quality (Langman, Gebhardt, and Falk, 2004).

Discharge from the Ogallala aquifer occurs through well pumping and springs along the eroded margins of the formation. The dominant uses of groundwater in the Cannon AFB and Melrose AFR areas are as potable and irrigation water. Numerous wells are found in the area, most of which provide only irrigation water.

The Ogallala aquifer will continue to be used as the primary source of potable and irrigation water for eastern New Mexico. Melrose AFR is within the Fort Sumner Groundwater Basin, as designated by the New Mexico State Engineer.

1.3.7 Soils

This section presents a summary of the most common near surface soil types at Melrose AFR. This summary is based on the United States Department of Agriculture Natural Resources Conservation Service Soil Survey for Roosevelt County, New Mexico (USDA, 2007).

The most common soil type on Melrose AFR is Springer loamy fine sand (map symbol Sf on **Figure 1-3**). The Springer series consists of very deep, well drained, moderately rapidly permeable soils that formed in eolian sediments and alluvium. The Springer loamy fine sand is present on nearly level to hummocky soils on interdunes and dunes of sand sheets on stream terrace alluvial plains.

Clovis loam, 0- to 1-percent slope phase (map symbol Cf on **Figure 1-3**), account for about 10 percent of the area at Melrose AFR. The Clovis series consists of very deep, well drained, moderately permeable soils that formed in medium and moderately fine textured sediments from quartzite, gneiss, schist, sandstone, and limestone. In the Clovis soils, the depth to the calcic horizon ranges from 18 to 36 inches. Clovis soils are found on fan terraces, piedmont slopes, and plains.

Stegall loam, 0- to 1-percent slope phase (map symbol St on **Figure 1-3**), account for about 10 percent of the area at Melrose AFR. The Stegall series consists of soils that are moderately deep to a petrocalcic horizon. Soils are well drained and moderately slowly permeable above a very slowly permeable petrocalcic horizon. They were formed in loamy eolian sediments over a layer of indurated caliche, which is underlain by loamy calcareous material derived from the Blackwater Draw Formation of the Pleistocene age. The depth to the petorcalcic horizon is from 20 to 36 inches. Stegall loams are found on broad, smooth, nearly level to very gently sloping plains.

Mansker loam, 1- to 3-percent slope phase (map symbol Md on **Figure 1-3**), also account for about 10 percent of the area at Melrose AFR. The Mansker series consists of very deep, well drained, moderately permeable soils that formed in loamy, calcareous eolian sediments derived mainly from the Blackwater Draw Formation of the Pleistocene age. In Mansker soils, the depth to the calcic horizon ranges from 6 to 20 inches. Mansker loams are found on nearly level to moderately sloping plains.

1.4 SITE DESCRIPTIONS AND HISTORY

1.4.1 Groundwater Quality Well Network

The groundwater quality well network consists of as many as 25 monitoring wells (see **Figure 1-2**) located throughout the facility used to evaluate groundwater quality, groundwater elevations, and aquifer sustainability. These monitoring wells are screened in three aquifers:

- **Triassic Dockum Group (or Chinle Formation):** MWQ2, MWQ20, and MWQ22
- **Neogene Ogallala Formation:** MWQ3, MWQ4, MWQ5, MWQ6, MWQ7, MWQ8, MWQ10, MWQ14, MWQ15, MWQ16, MWQ18, MWQ19, MWQ21, and MWL6
- **Ogallala Formation:** MWL1, MWL2, MWL3, MWL4, MWL5, MWL7, MWL8, MWL9, and MWL10

The USGS New Mexico Water Science Center has worked in cooperation with United States Air Force to perform groundwater sampling and analysis at Melrose AFR. The objective of this program was to evaluate groundwater quality and groundwater elevations at Melrose AFR.

Sixteen monitoring wells within the Melrose AFR groundwater quality well network were sampled in 2007 and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), trace and major elements, dissolved solids, organic carbon, alkalinity, phosphorus, ammonia, nitrate plus nitrite, and perchlorate (USGS, 2007).

According to USGS, groundwater quality results from the 2007 sampling event were consistent with previous monitoring. Groundwater in the impact area of the range had a different composition than groundwater from the same formation in other areas of the range. Compositional differences included higher concentrations of dissolved solids and major ions in monitoring wells MWQ14, MWQ15, and MWQ16. Groundwater from the Dockum Group wells had compositional similarities with groundwater from the wells in the Ogallala Formation. This suggests an interaction between the aquifers. Groundwater elevation data indicated that an upward flow from the Dockum Group to the Ogallala Formation is possible (USGS, 2007).

1.4.2 SWMU 114 – Expended Ordnance and Industrial Waste Burial Site

SWMU 114 is located in the southeast quarter of the southwest quarter of Section 15 and the northeast quarter of the northwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 1-2**). SWMU 114 is sparsely vegetated and the surrounding area is flat with mixed desert scrub that consists of prairie grass and cactus. A Melrose production well is located approximately 0.5 mile from SWMU 114, where the depth to groundwater was approximately 150 feet bgs in May 2000.

The SWMU consists of eight unlined burial trenches that were cleared of ordnance and have since been backfilled and closed. The approximate dimensions of these trenches were 20 to 40 feet wide, 100 to 200 feet long, and up to 50 feet deep. These trenches were used to dispose of a variety of military and industrial waste from Melrose AFR and Cannon AFB. The exact dates of operation and types of waste disposed of at SWMU 114 were not clearly defined. From approximately 1952 to 1962, drummed liquids were poured into the trenches and burned. Full drums of liquid may also have been placed in the trenches. Drummed liquids may have included unusable fuels, paints, sludge, and solvents. Approximately 12,000 to 15,000 pounds of scrap metal from practice bombs and munitions were disposed of in trenches every month.

During the 1995 RFI, soil was analyzed for VOCs, SVOCs, pesticides/polychlorinated biphenyls (PCBs), explosives, total metals, total mercury, total recoverable petroleum hydrocarbons (TRPHs), and total organic carbon (TOC). Groundwater was also analyzed for VOCs, SVOCs, pesticides/PCBs, herbicides, explosives, dioxins/furans, total metals, total mercury, anions, alkalinity, TRPH, cyanide, and sulfide (Ebasco, 1995).

During the 2000 supplemental groundwater sampling event, groundwater was analyzed for VOCs, explosives, total metals, total mercury, anions, and cyanide. During the 2002 supplemental soil sampling program, soil was analyzed for VOCs, SVOCs, metals, mercury, and explosives (FW, 2003). Soil sampling results were used to complete a screening-level ecological risk assessment (SLERA). The risk characterization indicated that risk may be present for multiple trophic-level species from the chemicals of potential ecological concern (COPEC) present in SWMU 114. Additional information is available in the RFI Report Addendum (FW, 2003).

The results of both the 1995 and 2000 groundwater sampling events indicated that aluminum, iron, manganese, chloride, and sulfate concentrations were the only analytes that exceeded the New Mexico Water Quality Control Commission (WQCC) Groundwater Standards. Based on the RFI Report Addendum, there are currently four monitoring wells located at SWMU 114 (see **Table 1-1**) (FW, 2003).

1.4.3 SWMU 117 – Domestic Waste Burial Site

SWMU 117 is located south of the range entrance road in the northeast quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 1-2**). This is a low lying area with a slight topographic depression that is most likely a semi-permanent playa, which receives surface runoff from surrounding areas.

Domestic waste from the control building and possibly unexploded ordnance (UXO - as suggested during a September 1994 site visit) were disposed of at the site. This site was approximately 300 feet by 300 feet in size. Domestic wastes disposed at the site included food waste, solid waste, common household items, and possibly paints, solvents, batteries, pesticides, and herbicides.

During the 1995 RFI, soil was analyzed for VOCs, SVOCs, pesticides/PCBs, explosives, total metals, total mercury, TRPH, and TOC (Ebasco, 1995). Groundwater was not encountered at this site during the 1995 RFI or the 2000 supplemental investigation (i.e., the wells were dry).

During the 2002 supplemental soil sampling program, soil was analyzed for VOCs, SVOCs, metals, mercury, and explosives (FW, 2003). Soil sampling results were used to complete a SLERA. The risk characterization indicated that risk may be present for multiple trophic-level species from the COPEC present in SWMU 117. Additional information is available in the RFI Report Addendum (FW, 2003).

Based on RFI Report Addendum, there are currently four monitoring wells located at SWMU 117 (see **Table 1-1**) (FW, 2003).

1.4.4 SWMU 130 – World War II Cantonment Disposal Site

The area investigated as SWMU 130 is located in the northwest quarter of Section 17, Township 1 North, Range 30 East in Roosevelt County, New Mexico (**Figure 1-2**). Geophysical survey and field sampling activities during the 1995 RFI did not confirm disposal.

During World War II, this area was reportedly used as a cantonment dump/sanitary landfill site. The types of wastes and quantities of waste disposed at the site are unknown, but may include domestic wastes, motor pool waste, UXO, munitions, batteries, oils and fuels, and other discarded materials.

During the 1995 RFI, soil was analyzed for VOCs, SVOCs, pesticides/PCBs, explosives, total metals, total mercury, TRPH, and TOC. Groundwater was also analyzed for VOCs, SVOCs, pesticides/PCBs, herbicides, explosives, dioxins/furans, total metals, total mercury, anions, alkalinity, TRPH, cyanide, and sulfide (Ebasco, 1995).

During the 2000 supplemental groundwater sampling event, groundwater was analyzed for VOCs, explosives, total metals, total mercury, anions, and cyanide. During the 2002 supplemental soil sampling program, soil was analyzed for VOCs, SVOCs, metals, mercury, and explosives. Soil sampling results were used to complete a SLERA. The risk characterization indicated that risk may be present for multiple trophic-level species from the COPEC present in SWMU 130. Additional information is available in the RFI Report Addendum (FW, 2003).

The results of the 1995 groundwater sampling event indicated that aluminum, chromium, iron, chloride, and sulfate concentrations were the only analytes that exceeded the New Mexico WQCC Groundwater Standards. The sampling results from 2000 indicated that aluminum, chromium, iron, manganese, chloride, and sulfate concentrations were the only analytes that exceeded the New Mexico WQCC Groundwater Standards. Based on RFI Report Addendum, there are currently four monitoring wells located at SWMU 130 (see **Table 1-1**) (FW, 2003).

1.4.5 SWMU 131 – Domestic Waste Burial Site

The area investigated as SWMU 131, is located to the east of the Melrose AFR fire station in the northwest quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 1-2**).

This site was reportedly used for the disposal and/or burning of wastes. The site was approximately 0.5 acre in size, but the type and volume of disposed waste is unconfirmed. The site was expected to contain domestic waste and possibly spent fuels, motor oil, batteries, paints, pesticides, and metals, but the geophysical survey and field sampling activities during the 1995 RFI field program did not confirm disposal.

During the 1995 RFI, soil was analyzed for VOCs, SVOCs, pesticides/PCBs, explosives, total metals, total mercury, TRPH, and TOC. Groundwater was also analyzed for VOCs, SVOCs, pesticides/PCBs, herbicides, explosives, dioxins/furans, total metals, total mercury, anions, alkalinity, TRPH, cyanide, and sulfide (Ebasco, 1995).

During the 2000 supplemental groundwater sampling event, only the deep monitoring well had sufficient groundwater for sampling. Groundwater from this well was analyzed for VOCs, explosives, total metals, total mercury, anions, and cyanide. During the 2002 supplemental soil sampling program, soil was analyzed for VOCs, SVOCs, metals, mercury, and explosives. Soil sampling results were used to complete a SLERA. The risk characterization indicated that risk may be present for multiple trophic-level species from the COPEC present in SWMU 131. Additional information is available in the RFI Report Addendum (FW, 2003).

The groundwater sampling results from 1995 indicated that aluminum, iron, manganese, selenium, chloride, and sulfate concentrations were the only analytes that exceeded the New Mexico WQCC Groundwater Standards. The groundwater sampling results from 2000 indicated that aluminum, iron, manganese, chloride, and sulfate concentrations were the only analytes that exceeded the New Mexico WQCC Groundwater Standards. Based on RFI Report Addendum, there are currently two monitoring wells located at SWMU 131 (see **Table 1-1**) (FW, 2003).

1.4.6 SWMU 132 – Disposal/Burn Site

The area investigated as SWMU 132, is located north of the former helicopter pad at the Melrose AFR operations area in the northeast quarter of the southwest quarter of Section 22, Township 1 North, Range 30 East, in Roosevelt County, New Mexico (**Figure 1-2**).

This relatively small site was reportedly used for burning and/or disposal of waste of unknown type and quantity. Possible wastes include garbage, residue from burning, motor oil, and metals, although the geophysical survey and field sampling activities during the 1995 RFI field program did not confirm disposal took place.

During the 1995 RFI, soil was analyzed for VOCs, SVOCs, pesticides/PCBs, explosives, total metals, total mercury, TRPH, and TOC (Ebasco, 1995). Groundwater was not encountered at this site during the 1995 RFI or the 2000 supplemental investigation (i.e., well was dry).

During the 2002 supplemental soil sampling program, soil was analyzed for VOCs, SVOCs, metals, mercury, and explosives. Soil sampling results were used to complete a SLERA. The risk characterization indicated that risk may be present for multiple trophic-level species from the COPEC present in SWMU 132. Additional information is available in the RFI Report Addendum (FW, 2003).

Based on RFI Report Addendum, there is currently one monitoring well located at SWMU 132 (see **Table 1-1**) (FW, 2003).

1.5 ROLES AND RESPONSIBILITIES

This section identifies the roles and responsibilities of key personnel and presents the project schedule for the groundwater monitoring at Melrose AFR.

The names and telephone numbers of key project personnel are provided as follows:

Title	Name	Phone Number
USACE Project Manager	Terry Samson	(402) 995-2737
Cannon AFB Program Engineer/Manager	Hugh Hanson	(575) 784-6031
Tidewater Project Manager	Gary Verban	(703) 288-1844
Tidewater Project Quality Assurance Officer	Jeff Tuttle	(703) 288-1844
Tidewater Program Health and Safety Officer	Ken Fischer	(410) 997-4458

Title	Name	Phone Number
Tidewater Project Chemist	Craig Markowitz	(410) 997-4458
Test America Project Manager	Michelle Johnston	(303) 736-0110

1.6 SCHEDULE

The estimated project schedule for the winter 2010 monitoring event is provided below. The field work is anticipated to take two weeks and is tentatively scheduled to begin in late January or early February 2010. Key project activities include:

Planning:	September 2009 – January 2010
Fieldwork:	January-February 2010
Data Review and Validation:	February 2010-March 2010
Reporting:	March 2010

1.7 WORK PLAN ORGANIZATION

This Groundwater Monitoring WP is organized as follows:

Section 1 – Introduction presents the authority, purpose, scope, site description, roles and responsibilities of key personnel, a schedule, and organization of this WP.

Section 2 – Field Sampling Plan summarizes the data quality objective (DQO) process and field procedures for the Melrose AFR groundwater monitoring program.

Section 3 – Quality Assurance Project Plan describes the project quality assurance (QA)/quality control (QC) procedures to be followed in the field and laboratory.

Section 4 – Health and Safety Plan discusses the health and safety requirements and procedures for groundwater sampling activities.

Section 5 – Project Records and Reporting discusses record keeping and reporting requirements for both field activities and project deliverables.

Section 6 – References provides the references used to develop this WP.

Appendix A presents Standard Operating Procedures.

Appendix B presents Health and Safety Protocols.

Appendix C presents field forms to be used during groundwater sampling activities.

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This section presents sample quantities, locations, and analytical parameters for activities to be completed during groundwater monitoring at Melrose AFR. Groundwater will continue to be monitored at Melrose AFR for the presence of potential contaminants as an interim measure until the SWMUs are fully investigated. Standard operating procedures (SOPs) for groundwater sampling activities are provided in **Appendix A** of this WP. The following field activities will be completed during this groundwater sampling event:

- Inspect monitoring well condition at environmental well locations (SWMUs 114, 117, 130, 131, and 132), and at groundwater quality well network well locations. This includes as many as 30 monitoring wells.
- Measure water levels at as many as 30 monitoring well locations.
- Measure water quality parameters during purging at as many as 30 monitoring wells.
- Collect as many as 30 groundwater samples and ship to approved laboratory for site-specific analysis.
- Document all field activities.

Subsequent field activities for annual and semi-annual groundwater sampling events include the following:

- Measure water levels at as many as 25 monitoring well locations (assuming 5 current wells are abandoned).
- Measure water quality parameters during purging at as many as 25 monitoring wells.
- Collect as many as 25 groundwater samples and ship to approved laboratory for site-specific analysis.
- Document all field activities.

2.1 DATA QUALITY OBJECTIVES

The following paragraphs contain statements used in the DQO development process for groundwater sampling activities at Melrose AFR.

2.1.1 Problem Statement

This groundwater monitoring effort will be used to evaluate groundwater quality at the wells sampled. The results of previous investigations at SWMUs 114, 117, 130, 131, and 132 are insufficient to support whether or not further action is required at these sites.

2.1.2 Decision Statement

Additional groundwater sampling is required to determine whether site–related contaminant concentrations exceed groundwater screening guidelines based on the following hierarchy:

1. WQCC New Mexico Administrative Code (NMAC), Title 20 Environmental Protection, Chapter 6 Water Quality, Part 2 Ground and Surface Water Protection, Section 20.6.2.3103 Subsections A, B, and C and Section 20.6.2.7.WW (NMAC, 2008).
2. United States Environmental Protection Agency (USEPA) Maximum Contaminant Levels (MCLs) (USEPA, 2004). If both a WQCC standard and an MCL have been established for an individual substance, the lower of the two levels will be used as the screening value.
3. Tap water screening levels from the NMED Technical Background Document for Development of Soil Screening Levels, Revision 5.0, Appendix A (NMED, 2009a).
4. Tap water Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites (USEPA, 2009). If RSLs are used as screening values, the RSL for any carcinogenic compound will be multiplied by a factor of 10 to obtain a screening value based on an excess cancer risk of 10^{-5}.

2.1.3 Required Decision Inputs

The following actions will be taken to monitor groundwater at these sites:

- Measure water levels to determine hydraulic gradients and groundwater flow directions.
- Collect groundwater samples to monitor potential site-related contaminant concentrations.

2.1.4 Study Boundaries

Planned groundwater quality well network sampling locations are presented on **Figure 2-1**. The physical locations and approximate horizontal boundaries of the SWMUs are shown on **Figures 2-2** through **2-4**. The three aquifers, as discussed in **Section 1.4.1**, represent the lower study boundaries at Melrose AFR.

2.1.5 Decision Rule

If detected concentrations of site-related contaminants exceed screening guidelines (**Section 2.1.2**), the site may be recommended for further investigation. If not, the site will continue to be monitored for the presence of potential contaminants as an interim measure until the SWMUs are fully investigated. If no useable groundwater monitoring wells are available at a site (i.e., well does not exist or groundwater sample cannot be obtained), a recommendation for further investigation will be considered.

2.1.6 Limits on Decision Errors

The probability of making an incorrect decision based on faulty data will be limited by collecting valid data. Data quality will be maintained by establishing and following approved SOPs for data acquisition, which includes sample collection, storage, and analysis. Sampling and sample handling procedures are documented in SOPs included in **Appendix A**; analytical procedures, including laboratory QA procedures, are described in the QAPP (**Section 3**).

2.2 PERMITS AND CLEARANCES

Security badges and vehicle permits are required for all contractors and contractor vehicles. These badges and permits will be obtained through Base Security prior to commencing work activities. Utility clearances will not be required for groundwater sampling activities at existing monitoring wells (i.e., additional intrusive work is not planned).

2.3 MONITORING WELL INSPECTION

Montioring well inspections will be conducted to assess the overall condition of the wells located at Melrose AFR. Inspections will be documented using the well inspection form included in **Appendix C**. Monitoring well recommendations will be made in the draft and final reports (see **Section 5.2**).

2.4 WATER LEVEL MEASUREMENTS

Prior to the start of the monitoring well sampling event, a water level measurement round will be completed. Water levels will be collected at all accessible monitoring wells to be sampled, prior to groundwater sample collection, to determine groundwater elevations, hydraulic gradients, and groundwater flow directions. Water levels will be measured in the shortest time practical to minimize the effects of water table fluctuations. Water level measurements will be documented in the field logbook and using the Water Level Data Sheet presented in **Appendix C**. Field procedures for water level measurements were developed in accordance with the USACE – Omaha District Geology Scope of Services and are detailed in SOP Number (No.) 1 (see **Appendix A**).

Static water levels and the total depth of each monitoring well will be collected using an electronic water level indicator. A groundwater potentiometric surface map will be prepared and included in the baseline report. Water level measurement, and equipment and personnel decontamination will follow the procedures outlined in SOP Nos. 1 and 5, respectively (see **Appendix A**).

2.5 GROUNDWATER SAMPLING FROM MONITORING WELLS

Groundwater samples will first be collected in areas that are suspected of being least contaminated in order to minimize potential cross contamination. The groundwater sampling event will include the low-flow purging and sampling of as many as 25 monitoring wells. Monitoring wells will be purged and sampled using dedicated pumps wherever feasible. A low-flow bladder pump or equivalent will be used if a dedicated pump is not present or functioning. The proposed monitoring wells to be sampled are presented in **Tables 2-1** and **2-2** and shown on **Figures 2-1** through **2-4**. Groundwater samples will be analyzed for laboratory parameters, and field water quality parameters listed in **Tables 2-1** and **2-2**. Field procedures for groundwater sampling from monitoring wells were developed in accordance with the USACE-Omaha District Geology Scope of Services and are detailed in SOP No. 2 (see **Appendix A**).

Purging and stabilization of field water quality parameters are key to obtaining quality aquifer groundwater samples. Low-flow (i.e., minimal drawdown) purging and sampling techniques, as outlined in USEPA Groundwater Issue paper “Low-Flow (Minimal Drawdown Groundwater Sampling Procedures” (USEPA, 1995) will be attempted in each well.

The field water quality parameters will be observed to determine that representative aquifer water is being purged. Samples will be collected directly from the sampling port connected to the pump, in a specific order. If a well is pumped dry during purging, it will be assumed that the purpose of removing all stagnant water has been accomplished. When a well is evacuated to dryness, the well will be sampled with either disposable bailer, or low-flow pump (dedicated pump, if installed) once sufficient water has recharged back into the well. If a disposable bailer is used, care will be taken to minimize disturbance to the water being sampled.

Purge water will be collected as investigation-derived waste (IDW) and temporarily stored in 55-gallon drums or bulk liquid tanks until appropriate disposal procedures are identified. IDW handling and disposal are discussed in **Section 2.8.**

Standard operating procedures for sampling groundwater from monitoring wells, sample handling, documentation, and tracking, and equipment and personnel decontamination will be followed and are included in SOP Nos. 2, 4, and 5, respectively (see **Appendix A**).

2.6 SAMPLE IDENTIFICATION, HANDLING, FIELD DOCUMENTATION AND SHIPPING

Sample identification, preservation, documentation, and proper shipment procedures are all necessary to obtain acceptable and representative data. The following procedures will be used for sample identification, handling, documentation, and shipment:

Samples collected during site activities will be assigned a discrete sample identification number. The identification number will include the site name/number, sample method and matrix identifier, and monitoring well sample location identification. Monitoring well locations and sample identification numbers are listed in **Tables 2-1** and **2-2**.

- Sample modifiers may also be required for sample identification and these include the following:
  - CH – Characterization sample (used to characterize IDW)
  - TB – Trip blank sample
  - MS/MSD – Matrix Spike/Matrix Spike Duplicate
  - RE – Re-analysis
- Duplicate samples will be blind samples to the laboratory and will be given a unique sample identifier.

- Samples will have appropriate labels describing the sample location, analysis, preservation, preparation, etc.
- Samples will be collected in laboratory-provided containers. **Table 3-11** summarizes the appropriate sample containers, preservation, preparation, and holding times for samples to be analyzed by the designated laboratory.
- All sample information and procedures will be documented on the field sheets (field logbook, daily quality control report [DQCR], sample collection field sheet [SCFS], chain of custody [CoC]).
- Samples will be protected from breakage during shipment by wrapping the bottles in protective wrapping.
- All samples will be accounted for and recorded on the CoC.
- Samples will be placed upright in a cooler with CoCs, and ice to keep samples at 4°C.
- The cooler lid will be closed and taped shut. Custody seals will be placed over points of entry on the cooler.
- Samples will generally be shipped at the end of the day, by an overnight express carrier, to the laboratory for analysis.
- Standard operating procedures for sample identification, handling, documentation, and shipping will be followed and are included in SOP No. 4 (see **Appendix A**).

2.7 EQUIPMENT AND PERSONNEL DECONTAMINATION

All reusable equipment that comes into contact with potentially contaminated water or other material will be decontaminated prior to use at each sampling location. Decontamination procedures for field equipment and personnel are described in the following sections. All equipment will be thoroughly decontaminated before use and between sampling locations. Standard operating procedures for equipment and personnel decontamination were developed in accordance with the USACE – Omaha District Geology Scope of Services and Chemistry Scope of Services, and are included in SOP No. 5 (see **Appendix A**).

2.7.1 Sampling Equipment

Sampling equipment will be decontaminated as follows:

- Exterior surfaces of submersible pumps will be cleaned with an Alconox (or equivalent) wash and rinsed, first with tap water, and then with deionized water. Interior parts of the pump will be cleaned by purging clean water through the pump.
- Probes, transducers, and other measuring equipment will be cleaned with an Alconox (or equivalent) wash and triple rinsed with deionized water.

- Monitoring equipment will be protected from contamination to the extent possible using a protective covering such as a plastic bag. Any direct contamination will be removed with a disposable wipe.

2.7.2 Personnel

Personnel can become contaminated in several ways, including being splashed with liquid chemical products or contaminated water while developing or sampling wells; handling chemical wastes, contaminated water, or contaminated equipment; walking on contaminated soil or through contaminated surface water; and contacting chemical vapors, dusts, fumes, and mists. Personal protective equipment (PPE), including gloves, boots, and clothing will help prevent becoming contaminated (**Section 4**). Decontamination of PPE will help prevent hazardous materials from being transferred from protective clothing to wearer and to clean areas where unprotected individuals can be exposed.

2.8 INVESTIGATION-DERIVED WASTE MANAGEMENT AND DISPOSAL

IDW generated during groundwater sampling activities will include monitoring well purge water and decontamination water. All IDW collected during groundwater sampling will be temporarily containerized in a holding tank, buckets (with lids) or similar containers secured in the bed of the field vehicle. At the completion of daily field activities, the container(s) will be discharged into 55-gallon drums or bulk liquid storage tanks, which will be marked with the following information:

- Date
- Site
- Sampling location (e.g., monitoring well identification)
- Media (purge or decontamination water)
- Contact and telephone number
- The statement “Waste Classification Pending Analytical Results”

The drums will be labeled on the lids and sides using weatherproof paint pens, and recorded in the field logbook. The drums will be given a sequential identification number upon being filled. This identification number will be written on the drum and in a field logbook for future reference. The drums will be stored at location(s) identified by Melrose AFR.

Aqueous IDW from well purging will be contained in a 55-gallon drum. Aqueous IDW from decontamination activities will be segregated from other aqueous IDW and contained in separate drums. Both purge water and decontamination water will be field screened using an organic vapor analyzer (OVA) and head space analysis procedures that are outlined in SOP No. 3 (see **Appendix A**). Used PPE and disposable sampling materials will be treated as solid waste and disposed of at the installation in a trash receptacle.

The following procedures will be completed during the groundwater sampling event:

Monitoring well analytical results from the associated samples will be used to characterize the IDW by applying the “20 Times Rule”. If analytical results are greater than or equal to 20 times any of the Toxicity Characteristic Leaching Procedure (TCLP) regulatory limits, then a waste characterization sample will be collected and analyzed. IDW that is characterized as hazardous waste will be sent to Safety-Kleen 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 Melrose AFR storm water conveyance system. If analytical results for any site-related contaminants are greater than the screening values, then the IDW will be handled as non-hazardous RCRA solid waste and disposed offsite.

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

IDW procedures for subsequent annual and semi-annual groundwater sampling events will depend on previous groundwater sampling results and approval from New Mexico Environmental Department (NMED).

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This QAPP follows USEPA guidance, EPA QA/R-5, March 2001, EPA QA/G5, December 2002 and Department of Defense Quality Systems Manual (DoD QSM) Version 3, January 2006 guidelines. This QAPP also complies with the general requirements contained in the U.S. Army Engineering Manual (EM) 200-1-3 (USACE, 2001).

All individuals and their organizations receiving a copy of the QAPP and any subsequent revisions are identified in the WP. The individual receiving the QAPP will distribute the QAPP to the appropriate project members within their organizations.

Tidewater has been contracted by the USACE Corps of Engineers, Northwestern Division Omaha District (CENWO) to complete groundwater monitoring and evaluate groundwater data collected from potentially contaminated sites, SWMUs 114, 130, and 131 at Melrose AFR and determine if chemicals of concern are leaching into the local aquifers.

In addition, a component of the groundwater monitoring will be to perform an annual water quality and sustainability study which provides an assessment of the hydrogeology and water-quality of Melrose AFR.

3.1 MANAGEMENT RESPONSIBILITIES

The following describes the management responsibilities of all parties involved with Melrose AFR. The project management team members are shown on **Figure 3-1**.

USACE Project Manager (PM) (Terry Samson) – Mr. Samson is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives. The USACE PM's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The USACE PM is the primary point of contact for the project.

Tidewater Program Manager (Richard Yim, P.E.) – Mr. Yim as the Tidewater Program Manager is the Principal-in-Charge for Tidewater, and has overall responsibility to the Omaha District for execution of the delivery order under Tidewater's Environmental Remediation Services (ERS) Single Award Task Order Contract (SATOC).

Tidewater PM (Gary Verban, P.E.) – Mr. Verban is responsible for ensuring the project meets the objectives identified in the project Statement of Work (SOW). As part of the QAPP development, the Tidewater PM is responsible for assembling a qualified and experienced project team to successfully complete the investigation. The Tidewater PM has the overall responsibility to ensure all aspects of the investigation (from planning to completion) have met the project objectives. The Tidewater PM will report directly to the USACE PM. If the Tidewater PM is informed of a significant QA nonconformance issue by the Tidewater QA Officer, it is his responsibility to inform the USACE PM and USACE QA Officer.

Tidewater Program Health and Safety Officer (Ken Fischer, Certified Industrial Hygienist [CIH], P.E.) – Mr. Fischer is responsible for the development, oversight, and enforcement of the HASP; and overall management of the health and safety program for the project.

Tidewater Field Manager (Craig Markowitz) – is responsible for supporting the Tidewater PM by leading and coordinating the day-to-day field activities of the various resource specialists under his supervision. The Tidewater Field Manager will report directly to the Tidewater PM. Specific Field Manager responsibilities include:

- Daily coordination with the Tidewater PM
- Oversight of all field activities (e.g., monitoring well sampling, etc.)
- Daily coordination with the laboratory to ensure sample shipments have been received on time, at the correct temperature and properly preserved
- Identification of noncompliance issues and the implementation of corrective actions

Tidewater Project Health and Safety Officer is responsible for the implementation of the HASP, and communication of all health and safety issues with the Tidewater Field Manager. The Tidewater Project Health and Safety Officer will address any issues that arise during field operations.

3.2 QUALITY ASSURANCE RESPONSIBILITIES

USACE QA Officer/Project Chemist (to be determined [TBD]) – is responsible for reviewing and approving all QAPPs as required by USACE protocols. This includes the adherence to the applicable USACE and USEPA regulations. Additional responsibilities for the project include:

- Conducting external performance and system audits of the contract laboratory (if completed)
- Reviewing and evaluating field procedures of Tidewater field teams

If the USACE QA Officer determines that field or laboratory procedures do not adhere to the established protocols and the data integrity may be impacted, it is his responsibility to inform the USACE PM as well as the Tidewater PM.

Tidewater QA Officer (Jeff Tuttle, P.G.) – Mr. Tuttle is responsible for ensuring all field and laboratory procedures follow those protocols established in the QAPP and meet the regulatory guidance. Additional responsibilities for the project include:

- Conducting external performance and system assessments of the contract laboratory (if completed)
- Evaluating results of performance evaluation sample data
- Reviewing and evaluating field procedures of Tidewater field teams

If the Tidewater QA Officer determines that field or laboratory procedures do not adhere to the established protocols and the data integrity may be impacted, it is his responsibility to inform the Tidewater PM.

Test America Laboratories (Test America) (Karen Kuoppola) QA Officer – Ms. Kuoppola has the responsibility to ensure the laboratory protocols are being followed as required by the QAPP. The QA Officer will review each chemical data package prior to submission to Tidewater. It is the responsibility of the QA Officer to report any technical deficiencies to the laboratory manager and to implement corrective actions. The QA Officer is responsible for informing the Tidewater QA Officer of any issues that may impact data quality. This includes deviations from established protocols. The QA Officers responsibilities include:

- Review of SOPs
- Periodic audits of the laboratory
- Quality assurance of subcontracted analyses (if necessary)

3.3 PROJECT CHEMIST RESPONSIBILITIES

The Tidewater Project Chemist (Craig Markowitz) will be responsible for development of the laboratory SOW, procurement of laboratory services, and the daily communication with the laboratory. Additionally, the Tidewater Project Chemist will address any chain-of-custody discrepancies or laboratory QA/QC anomalies, complete the data management and data review/validation, and determine the usability of the analytical data.

3.4 LABORATORY RESPONSIBILITIES

Test America is responsible for the analysis of samples as identified in this QAPP and will report chemical data as identified in **Section 3.17**. In addition, daily responsibilities include the verification of sample preservation and the temperature of each sample cooler upon receipt. The laboratory PM, Michelle Johnston, will communicate any cooler temperatures that are not within $4^{o}C \pm 2^{o}C$ to the Tidewater Field Manager and Tidewater Project Chemist. The laboratory will also verify that the required chemical preservatives have been marked on the sample labels and CoC forms. For VOC analysis, verification that chemical preservation has been done properly (i.e., hydrochloric acid [HCl] to pH ≤ 2) will be done at the time of sample analysis. Any discrepancies between the CoC and sample labels will be brought to the attention of the Tidewater Field Manager and Tidewater Project Chemist and will be resolved immediately.

3.5 PROJECT OBJECTIVES

The objective of the Melrose AFR groundwater monitoring is to evaluate groundwater data collected from potentially contaminated sites, SWMUs 114, 117, 130, 131, and 132; and determine if chemicals of concern are leaching into the local aquifers. In addition, a component of the groundwater monitoring will be to perform an annual water quality and sustainability study which provides an assessment of the hydrogeology and water quality of Melrose AFR. **Section 2**, the FSP, discusses the project objectives.

3.6 PROJECT SCHEDULE

The estimated project schedule for field activities is presented in the FSP.

3.7 SITE DESCRIPTION

The Melrose AFR description, including location, size and boundaries, history and historical and present uses are presented in **Sections 1.3** through **1.4** of the FSP.

3.7.1 Current Data Input Requirements

The following collectively summarizes the data inputs required to meet the project DQOs at Melrose AFR. Data input requirements are further detailed in **Section 3.34** of this QAPP and DQOs are discussed in **Section 2** of the FSP.

Groundwater samples will be collected from monitoring wells to evaluate potential impacts to the local aquifers from Chemicals of Concern (COCs). Groundwater samples will be analyzed for VOCs, perchlorate, explosives, RCRA metals, project specific inorganics (major ions), and wet chemistry parameters. The list of analytical procedures is identified in **Table 3-1**.

The overall QA objective for this project is to develop and implement procedures for field and laboratory activities that will provide results that will meet the project objectives and are legally defensible in a court of law. This section will provide in greater detail specific project objectives and intended data usages mentioned in **Section 3.5** of this QAPP. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

The following subsection summarizes the precision, accuracy, representativeness, completeness, comparability and sensitivity (PARCCS) to be used for all sample analyses.

3.8 PRECISION

3.8.1 Definition

Precision refers to the degree to which repeated measurements are similar to one another. It measures the agreement (reproducibility) among individual measurements, obtained under prescribed similar conditions. Measurements that are precise are in close agreement. The equations to be used for precision in this project can be found in **Section 3.34** of this QAPP. Precision control limits for chemical data are provided in **Tables 3-2** through **3-5**.

3.8.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates and QA splits at an approximate rate of ten percent duplicate/split of analytical samples collected. The anticipated number of duplicates/splits for this project is found in **Tables 2-1** and **2-2** of the FSP.

3.8.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) between sample results.

For inorganic analyses, laboratory precision will be assessed through the analysis of a laboratory control sample/laboratory control sample duplicate (LCS/LCSD); sample/sample duplicate pair and field duplicate pairs. For organic analyses, laboratory precision will be assessed through the analysis of LCS/LCSD, MS/MSD and field duplicate sample results.

3.9 ACCURACY

3.9.1 Definition

Accuracy is defined as the measure of the closeness of an individual measurement or the average of a number of measurements to the true value. This measurement is generally determined by the percent recovery (%R) of a known value. The equation to be used for accuracy in this project can be found in **Section 3.34** of this QAPP. Accuracy control limits are given in **Tables 3-2** through **3-6**.

3.9.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of trip blanks to assess the potential of cross contamination. Every cooler with aqueous VOC samples will contain a trip blank sample. A source blank will be collected at the beginning of sampling. In addition, field accuracy is assessed by the adherence to all sample handling, preservation, and holding time criteria.

3.9.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of MS/MSD, LCS, surrogate compounds, and the determination of percent recoveries. MS/MSD samples will be collected at a five percent frequency.

3.10 REPRESENTATIVENESS

3.10.1 Definition

Representativeness is defined as a measure of the degree to which data accurately and precisely represents a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary.

3.10.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used. These will include the analysis of trip blank and method blank data. In designing the sampling program, media of concern have been specified.

3.10.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, meeting sample holding times and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of facility conditions. During development of this network, consideration was given to historical activities, existing analytical data, physical setting and processes. The rationale of the sampling network is discussed in detail in the FSP.

3.11 COMPLETENESS

3.11.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected under correct, normal conditions. For this project, data will be considered complete if all QC elements have met the criteria established in this QAPP. Qualified data will be considered usable, and therefore will be considered complete. Data qualified as rejected (R) will not be considered usable or complete. The equation for completeness is presented in **Section 3.34** of this QAPP.

3.11.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid field measurements obtained from all field measurements taken during the investigation. Completeness is impacted if field measurements and/or a sample were not collected from a specified location due to environmental conditions. The equation for completeness is presented in **Section 3.34** of this QAPP. The completeness goal for field measurements and sample collection is 100 percent.

3.11.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The laboratory completeness objective for this project, with respect to parameters identified in **Table 3-1** of this QAPP, is 95 percent or greater.

3.12 COMPARABILITY

3.12.1 Definition

Comparability is a measure of the confidence with which one data set or method can be compared to another.

3.12.2 Measures to Ensure Comparability of Field Data

Measures to ensure field data are comparable will include all persons reviewing the QAPP and FSP prior to mobilization to Melrose AFR. The Tidewater Field Manager will routinely oversee field activities to verify they are being completed as identified in the SOPs. The Tidewater Field Manager will document the oversight findings in the daily reports to management. Any non-compliance issues will be addressed as identified in the Corrective Actions (**Section 3.36**) of this QAPP.

3.12.3 Measures to Ensure Comparability of Laboratory Data

The comparability of laboratory data will be ensured by verifying the laboratory personnel have reviewed the QAPP and have a working knowledge of the SOPs to be used during the analysis of samples for this investigation. The Test America QA Officer will also ensure comparable data by reviewing all data generated to ensure the correct methods have been used. The Tidewater Project Chemist or designee will also review the data to ensure compliance with the various method requirements.

3.13 SENSITIVITY

3.13.1 Definition

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest. Method detection limit (MDL) is defined as the minimum concentration of a substance that can be identified, measured, and reported with a 99 % confidence that the analyte concentration is greater than zero and is determined from repeated analysis of a sample in a given matrix containing the analyte. MDLs have been determined as required in 40 Code of Federal Regulations (CFR) Part 136. The reporting limit (RL) is greater than or equal to the lowest standard used to establish the calibration curve. The RLs for this investigation are generally at least 3 times greater than the MDL. Results greater than the MDL and less than the RL will be qualified estimated (J) by the laboratory.

3.13.2 Sensitivity Requirements for Field Data

The sensitivity requirements for field data are listed on the certificate of analysis (COA) of the calibration standards.

3.13.3 Sensitivity Requirements for Laboratory Data

The laboratory MDLs, RLs and project sensitivity goals are identified in **Tables 3-7** through **3-10**. The laboratory will establish MDLs annually and will analyze MDL verification samples on a quarterly basis. MDL studies for each compound are available upon request. RL verification samples will be analyzed with each instrument calibration.

3.14 TRAINING

The field activities will consist of groundwater sampling. Personnel completing these activities have sufficient knowledge and on-the-job training to follow the procedures required for the activities listed above, including sampling. Field personnel have completed the Occupational Safety and Health Administration (OSHA)-approved basic 40-hour health and safety training Hazardous Waste Operations and Emergency Response (HAZWOPER) course and annual refreshers of the same. The Tidewater Field Manager will have OSHA Field Manager Training. Personnel training requirements are included in the HASP, which will be submitted as part of the Project WP, but at the same time as this QAPP.

3.15 CERTIFICATION

The contract laboratory has current National Environmental Laboratory Accreditation Program (NELAP) certification. Test America is compliant with the most recently published version of the DoD QSM. No additional certifications are required for this investigation.

3.16 QAPP DISTRIBUTION

The Tidewater PM and QA officer will be responsible for ensuring that each project member has access to the most current version of the QAPP and applicable addenda. Documents required as a result of this investigation include the DQCRs, field and laboratory audit reports (if completed), and an annual groundwater monitoring report.

3.17 DATA REPORTING FORMAT AND CONTENT

The hard copy and electronic copy of the laboratory data will be reported following the format identified in the Tidewater request for proposal (RFP). For this project, a QC summary package and raw data package will be required. The contract laboratory will provide electronic data in the Automated Data Review (ADR) format (A1 and A3 files) and Environmental Restoration Program Information Management System (ERPIMS) Prime Project format Version 4.0 (Sample, Test and Result) files. The contents of the QC summary package include:

1. Cover Sheet
2. Laboratory Case Narrative
3. Cooler Receipt Forms
4. CoC copy
5. Analytical Results
6. Surrogate Summary forms
7. Blank Summary forms
8. Laboratory Control Sample Summary forms
9. Matrix Spike/Matrix Spike Duplicate/Laboratory Duplicates Summary Forms

The contents of the raw data package include:

1. Initial Calibration Data
2. Calibration Verification Data
3. Chromatograms
4. Quantitation Reports
5. Instrument Tunings
6. Quality Control Samples (LCS, surrogate, MS/MSD)
7. Preparation and Analytical Run Logs
8. Copies of CoC and Cooler Receipt forms

3.18 RECORDS DISPOSITION

All project files and records will be stored on-site until the Final Report has been approved by USACE. The project files will be moved to an off-site storage facility for a minimum of 10 years. Project information can be attained through a written request to the Tidewater PM. The requested information should be available within 7 working days.

3.19 SAMPLING PROCEDURES

The sampling procedures to be used during the field activities will be consistent for the objectives of this project. The SOPs are presented in **Appendix A** of the FSP. Sample containers, preservatives, and holding time requirements for each parameter and matrix are presented in **Table 3-11**.

3.20 CUSTODY PROCEDURES

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files. Final evidence files, including originals of all laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under someone's custody if:

- The item is in the actual possession of the person
- The item is in the view of the person after being in actual possession of the person
- The item was in actual physical possession but is locked up to prevent tampering
- The item is in a designated and identified secure area

3.20.1 Field Custody and Documentation Procedures

Verifiable sample custody is an integral part of all field and laboratory operations associated with Melrose AFR. Traceable steps will be taken in the field and in the laboratory to document and ensure that all samples have been properly acquired, preserved, identified, and that sample integrity has not been jeopardized. The following sections provide detail related to completing verifiable field and laboratory documentation. Field documentation procedures are outlined in SOP 4 - Sample Identification, Handling, Documentation, Shipping, and Tracking (**Appendix A**).

Field Logbook

Bound field logbooks will be used to record pertinent information during the field activities. Documentation in the field logbook will be sufficient to reconstruct the sampling situation without relying on the memories of the field team members. Information recorded at the beginning of each day will include, but is not limited to:

- Project name and number
- Date
- Signature of any team member entering information on each respective page
- Current weather conditions and daily forecast
- Names of all personnel on site, including subcontractors and site visitors
- Initial PPE level
- Health and safety information

Information recorded during each sampling point will include, but is not limited to:

- Sampling location (sampling point identification)
- Sample identification
- Sampling depth (e.g, depth to water)

- Sample media
- Description of sample
- Chemical analysis requested, sample container, and preservative
- Any modifications to the sampling plan
- Sampling observations (if applicable)
- Field equipment readings
- QC/QA samples collected (if applicable)

In addition, field sketches will be made in the field logbook when appropriate including (but not limited to), sampling location sketches including reference points tied to existing permanent structures in the area (trees, fences, buildings, etc.).

All entries will be made in blue or black indelible ink and no erasures are allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the logbook change. Each page in the field logbook will be signed and dated at the bottom of the page by any team member making entries on the page.

The field logbooks will be identified on the cover by the project name, project number and the logbook number. The logbooks will be stored in the field project files when not in use. At completion of the field activities, the original field logbooks will be submitted to the Tidewater PM to be retained in the project file or released to USACE PM upon written request.

Chain-of-Custody

The purpose of the chain-of-custody procedure is to prevent misidentification of samples, prevent tampering of the samples during shipment and storage, allow easy identification of tampering, and allow for easy tracking of possession. If the chain of custody is broken at any time from sample collection through sample analysis, the Tidewater QA Officer will be notified. The Tidewater QA Officer is responsible for implementing corrective action and responsible for ensuring that all necessary documentation is completed.

If an incorrect entry is made on the CoC, the incorrect information will be crossed out with a single strike mark, and the change initialed and dated by the person making the CoC change.

Three-sheet carbon CoC forms will be used. The original (white) sheet and one copy (yellow) sheet will accompany the samples to the laboratory. The original (white) will ultimately be included in the hard copy sample results. The laboratory will keep the copy (yellow) sheet on file for a minimum of one year. The second copy (pink) sheet will be kept by the sampling team and will be included in the field activity documentation file.

The laboratory will compare the samples entered on the CoC forms with the sample containers received by the laboratory. If the laboratory finds any discrepancies, the laboratory will contact the Tidewater Project Chemist for resolution. The CoC forms will be the primary source of information for the laboratory to enter data into the laboratory's sample tracking system. Additional chain-of-custody procedures are detailed in SOP 4 (**Appendix A**).

Sample cooler packaging is an integral part of field activities. Procedures for proper sample packaging will be followed as identified in SOP 4 (**Appendix A**).

When samples leave the sampler's immediate control (e.g., shipment to laboratory), custody seals will be placed on both the front and back of the shipping container(s). The custody seals will bear the collector's name and the date signed. The sample custody seal is used to ensure that the samples in the shipping container have not been tampered with, therefore ensuring sample integrity.

Sample Collection Field Sheets

To supplement the information recorded in the field logbook, SCFSs will also be completed for each sampling location. The SCFS will be cross-checked for completeness and accuracy at the end of each day. The SCFS will be signed and dated by the sampler making entries on the SCFS. Details of completing the SCFS are included in the appropriate sampling SOPs.

Photographic Documentation

The Tidewater Field Manager may take digital photographs of various field activities as necessary. Details of the photograph including date, time, location, field activity, and description of landmarks in the photograph and the name of the photographer will be recorded in the field logbook. If a file name is associated with the photograph, the file name will also be recorded. All photographs will be downloaded from the digital camera and placed in the project files.

Sample Identification and Labeling

Samples collected during the Melrose AFR activities will have discrete sample identification numbers. The unique sample identifications are necessary to identify and track each of the many samples collected for analysis during the duration of the project. Whenever possible, sample-labeling procedures from previous investigations will be followed. Samples collected during the field activities at Melrose AFR will be labeled with unique sample numbers as indicated in SOP 4 (**Appendix A**).

3.20.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and log-in; sample storage and numbering; sample tracking during preparation and analysis; and storage of data are described in detail in the Test America QAPP. A copy of the laboratory QAPP is available upon request.

3.20.3 Final Evidence Files

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities associated with Melrose AFR. Tidewater maintains the contents of evidence files for the project including all relevant records in a secured, limited-access area. The final evidence file will be maintained for a minimum of 10 years or as required by the regulatory program. The final evidence file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs
- Drawings
- Well installation logs (if completed)
- Laboratory data deliverables
- Data validation reports
- Data assessment reports
- Progress reports, QA reports, groundwater monitoring reports, etc.
- All custody documentation (e.g., CoCs, tags, forms, air bills, etc.)

Groundwater samples will be collected during field activities as part of Melrose AFR sampling. Groundwater samples will be submitted to Test America of Arvada, Colorado. Samples will be analyzed following the methodologies specified in **Table 3-1**. Each analytical method is summarized below.

Hard copy analytical data packages from the laboratory will consist of the QC summary. A pdf copy of the QC summary and raw data package will be provided. A detailed summary of the contents of the data packages is included in **Section 3.17** of this QAPP. In addition, the laboratory will submit electronic data in ADR and ERPIMS Prime Project formats. The turnaround time for all data (hard copy and electronic) will be 21 calendar days.

3.21 FIELD ANALYTICAL METHODS

Field analytical measurements for groundwater samples and the respective field instruments are listed in the following table. Analytical procedures for field analyses are presented in the respective SOPs.

Field Measurement	Field Instrument
Specific Conductance	YSI Model 556 MPS or equivalent
Turbidity	LaMotte Model 2020 Turbidity Meter or equivalent
Dissolved Oxygen	YSI Model 556 MPS or equivalent
pH	YSI Model 556 MPS or equivalent
Temperature	YSI Model 556 MPS or equivalent
Oxidation-Reduction Potential	YSI Model 556 MPS or equivalent
Headspace	MiniRae 2000 PID or equivalent

3.22 LABORATORY ANALYTICAL METHODS

The laboratory SOPs for sample preparation, cleanup, and analysis are based on Test Method for Evaluating Solid Waste, Physical/Chemical Methods, final Update IVB, (USEPA, 2008) and other applicable methods. Specific laboratory practices for the methods listed below, including sample preparation, sample tracking, QA/QC and documentation controls, are provided in the laboratory QAPP (available upon request). Test America is National Environmental Laboratory Accreditation Conference (NELAC) certified for all applicable analyses to be performed at Melrose AFR.

3.22.1 Volatile Organics and Perchlorate

Volatile organics include compounds among varying classes such as halogenated organics, nonhalogenated organics, and aromatic organics. The first two classes generally contain contaminants associated with solvents, such as trichloroethene (TCE), acetone, etc. The third class includes compounds associated with fuels, such as benzene, ethylbenzene, toluene, and xylenes. Perchlorate is a salt derived from perchloric acid, and is used as an oxidizer in rocket fuel and explosives; and is a potential chemical of concern to NMED at Melrose AFR.

Samples will be prepared using Method 5030B (water) and analyzed for VOCs following USEPA SW-846 Method 8260B. Method 5030B uses a purge and trap separation system and Method 8260B employs gas chromatography and mass spectrometry (GC-MS) for detection. The power of GC/MS lies in the capacity for positive identification of relatively low detection limits. Methods 6850/6860 use high performance liquid chromatography (HPLC)/ion chromatography (IC) coupled with electrospray ionization (ESI) mass spectroscopy (MS) for detection of perchlorate. The target analytes, MDLs and RLs are presented in **Table 3-7**.

3.22.2 Explosives

Samples will be prepared and analyzed for explosives following USEPA SW-846 Method 8330B. USEPA Method 8330B which utilizes HPLC and ultraviolet (UV) detection to determine parts per billion (ppb) levels of explosive residues. All compounds reported will be confirmed using a column of dissimilar phase. Typically, the result from the primary column will be reported. Analytes will not be reported unless detected using both columns. The list of targets analytes, MDLs, and RLs is shown in **Table 3-8**.

3.22.3 Metals

The metals analyses for Melrose AFR consist of RCRA and target analyte list (TAL) metals as well as cyanide and project specific metals (major ions). Samples for metals analysis will be prepared by USEPA SW-846 Methods 3010A (aqueous). Aqueous metals samples will be prepared and analyzed for the project specific metals following Method 6010C with the exception of mercury. Mercury preparation and analysis will be completed following USEPA SW-846 Method 7470A (aqueous). Cyanide preparation and analysis will be completed following Method 9010B/9012. Method 6010C involves inductively coupled plasma (ICP) emission spectroscopy to measure characteristic emission spectra by optical spectrometry. Method 7470A is a cold vapor atomic absorption (CVAA) method, which is based on the absorption of radiation at the 253.7 nanometer (nm) wavelength by mercury vapor. USEPA Method 7196A is used to determine the concentration of hexavalent chromium. USEPA Method 7196A is a colorimetric method which is based on color absorption at the 540 nm wavelength of a spectrophotometer. Samples are reacted with diphenylcarbazide in acid solution and analyzed using USEPA Method 7196A. The list of target analytes, MDLs and RLs are shown in **Table 3-9**.

3.22.4 Wet Chemistry Parameters

Wet chemistry parameters are used to determine if natural processes are reducing contaminant concentrations in groundwater over time. The wet chemistry parameters include a variety of analytes, such as nitrate, nitrite, sulfate, sulfide, chloride, etc. Samples will be prepared and analyzed by their associated methods. The target analyte list, MDLs, and RLs are shown in **Table 3-10**.

3.23 FINAL QUALITY CONTROL CHECKS

The overall QA objectives for Melrose AFR are to develop and implement QC procedures for field and laboratory activities that will provide data with the degree of quality consistent with the intended use. The sample set, chemical analysis results, and interpretations should be based on data that meet or exceed QA objectives established for the project.

Quality assurance objectives are expressed in terms of precision, accuracy, and completeness.

3.23.1 Field Quality Control Checks

This section defines the quality control requirements for field sampling activities including QC sample identification and evaluation criteria limits. QC samples are selected for each project based on the project DQOs, project-sampling procedures, and established analytical method requirements. Field QC samples anticipated for the investigation will include trip blanks and field duplicates.

Trip Blank

The trip blank is a sample of organic-free, deionized water that is prepared in the laboratory, shipped to the field site with other sample containers, and returned unopened to the laboratory in each shipping container containing aqueous samples for VOC analysis. Trip blanks will be used to evaluate potential cross-contamination that may occur during sample shipment. A trip blank will be shipped with every cooler containing aqueous samples for VOC analysis. Trip blanks will be analyzed for VOCs only.

Field Duplicate Samples

A field duplicate is a second sample collected at the same location as the original sample and will be used to assess sampling and laboratory precision. Duplicate samples will be collected simultaneously or in immediate succession, following identical collection procedures, and treated in the same manner during sample shipment, storage and analysis. If possible, duplicate sampling locations will be determined by previous sampling results (i.e., wells with known historical contamination will be selected). The sample containers will be assigned an identification number in the field that cannot be identified (blind duplicate) as duplicate samples by laboratory personnel. Field duplicate samples will be labeled as identified in SOP 4 (**Appendix A**). Field duplicate samples will be collected at an approximate rate of ten percent.

3.24 LABORATORY QUALITY CONTROL CHECKS

Test America has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical methods are documented in written SOPs. Each SOP includes a QC section, which addresses the minimum requirements for the procedure. The following paragraphs describe the QC samples required for Melrose AFR. Evaluation criteria for data review and validation are included in **Tables 3-12** through **3-15**.

3.24.1 Method Blank

A method blank is a sample of organic-free, deionized water that is carried through each step of the preparation and analytical method. A method blank sample will be prepared and analyzed with each batch of 20 or fewer samples. Method blank samples will be used to assess potential contamination attributed to laboratory operations during sample preparation and analysis.

3.24.2 Instrument Blank

An instrument blank is a sample of organic-free, deionized water that is analyzed with associated calibrations of laboratory instruments for metals analysis. Instrument blank results will be used to assess potential contamination attributed to specific instrument calibration procedures.

3.24.3 Surrogate Spikes

Surrogate spikes are compounds that will be added to every blank, standard, sample and matrix spike sample as specified in the analytical methodology. Surrogate compounds are generally brominated, fluorinated, or isotopically labeled compounds not expected to be in environmental samples. The results of the surrogate spike will be used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate compound recovery criteria are presented in **Table 3-6**.

3.24.4 Matrix Spikes and Matrix Spike Duplicates

MS/MSD samples are known concentrations of analytes added to a sample and carried through each step of the preparation and analytical method. An MS will be analyzed in duplicate (MSD) for organic analyses. The MS results will be reported in %R and will be evaluated to assess potential matrix inferences. The MSD results will be reported as RPD and will be evaluated to assess laboratory and method precision. All target analytes will be included in the matrix spike sample.

Evaluation criteria for MS/MSD samples are dependent upon sample matrix, analytical instrumentation and analytical method requirements. Evaluation criteria for MS/MSD samples are included in **Tables 3-2** through **3-5**.

3.24.5 Matrix Duplicates

A matrix duplicate (or laboratory duplicate) is a separate aliquot of a sample taken from the sample container and carried through each step of the preparation and analytical method for metals. The results of matrix duplicates will be reported as RPD and will be evaluated to assess laboratory and method precision. Matrix duplicates will be completed for metals, and may be completed for wet chemistry parameters and hexavalent chromium. Matrix duplicate criteria are identified in **Tables 3-4** and **3-5**.

3.24.6 Laboratory Control Samples

LCSs are well-characterized laboratory generated samples used to monitor the laboratory's day-to-day performance of analytical methods. The LCS is a method blank spiked with known concentrations of target analytes. The LCS is carried through each step of the preparation and analytical method. LCS will be reported in %R and used to assess the precision and accuracy of the analytical process independent of matrix effects. Controlling lab operations with LCS (rather than surrogates or matrix spike) offers the advantage of being able to differentiate low recoveries due to procedural errors with those due to matrix effects.

Evaluation criteria for LCS are dependent upon sample matrix, analytical instrumentation and analytical method requirements. LCS evaluation criteria are identified in **Tables 3-2** through **3-5**.

The laboratory, if required by the DoD QSM, will reanalyze any samples analyzed in nonconformance with the QC criteria and if sufficient sample volume is available. It is expected that sufficient sample volumes will be collected to allow for reanalysis when necessary.

The calibration and maintenance history of the project-specified field and laboratory instrumentation is an important aspect of the overall project QA/QC program. All field and laboratory instrumentation will be calibrated prior to use and repeated as necessary. All initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer's instructions and USEPA specification to ensure the equipment is functioning within the tolerances established by the manufacturer and the USEPA method-specific analytical requirements.

Documentation of all calibration activities will be maintained by the laboratory (as applicable) and submitted with the analytical data as requested. The documentation will include standard preparation, calibration curves, calibration verification results, and instrument printouts.

3.25 FIELD INSTRUMENT CALIBRATION

The calibration and general maintenance of field instrumentation will be the responsibility of the Tidewater Field Manager. Calibration procedures are presented in the respective SOPs located in **Appendix A** of the FSP. All documentation pertinent to the calibration and/or maintenance of field equipment will be maintained in a dedicated, active instrument logbook. Entries made into the logbook regarding the status of any field equipment will contain, but are not necessarily limited to, the following information:

- Name and unique identification number (e.g., serial number) of instrument being calibrated
- Date and time of calibration
- Name of person conducting calibration
- Reference standard name and concentration used for calibration (e.g., 100 parts per million [ppm] isobutylene gas)
- Calibration procedure followed
- Description of maintenance or repair (if applicable)
- Date and time that instrument was taken out of service and returned to service (if applicable)
- Other pertinent information

Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation will be removed from service and segregated to prevent inadvertent use. Such equipment will be properly tagged to indicate that it should not be used until the nature of the problem can be ascertained. The Tidewater Field Manager, prior to placement back into service, should approve equipment requiring repair or re-calibration for use. Equipment that cannot be repaired or recalibrated will be replaced. Refer to the HASP for calibration procedures for health and safety monitoring equipment.

3.26 LABORATORY INSTRUMENT CALIBRATION

All laboratory instrumentation will be calibrated in accordance with the respective analytical method. In general, calibration procedures for a specific laboratory instrument will consist of initial calibrations (3 or 5 points), initial calibration verifications, and continuing calibration verification. A further description of the calibration procedures for a specific laboratory instrument is available in the laboratory QAPP (available upon request). The SOP for each analysis performed in the laboratory describes the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution.

The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, serial number, date of calibration, analyst, calibration solutions run, and the samples associated with these calibrations.

3.27 STANDARD/REAGENT PREPARATION

A critical element in the generation of quality data is the purity/quality and traceability of the standard solutions and reagents used in the analytical operations. To ensure the highest purity possible, all primary reference standards and standard solutions will be obtained from the National Institute of Standards and Technology (NIST), the USEPA repository, or other reliable commercial sources. All standards and standard solutions are logged into a database that identifies the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and all other pertinent information.

Standard solutions are validated prior to use. Validation procedures can range from a check for chromatographic purity to verification of the concentration of the standard using a standard prepared at a different time or obtained from a different source. Stock and working standards are checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change of concentration. Care is exercised in the proper storage and handling of standard solutions, and all containers are labeled as to compound, concentration, solvent, expiration date, and preparation date (initials of preparer/date of preparation). Reagents are examined for purity by subjecting an aliquot or subsample to the corresponding analytical method, as well.

A database is used to store essential information on specific standards or reagents. The system is designed to serve various functions (e.g., the system issues warnings on expiration dates and allows chemists to obtain a list of all working standard solutions prepared from the same stock solution). The program also facilitates the management and auditing of reagents and standards. Stock solutions or working standards indicating any deterioration will be replaced immediately.

To ensure that all analytical data generated for this project are reliable, all equipment and instruments will have a prescribed routine maintenance schedule in addition to a calibration schedule. Preventive maintenance will be completed and documented by qualified project personnel.

3.28 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

The field equipment for this project includes a multi-parameter probe for the analysis of pH, temperature, specific conductance, dissolved oxygen, and oxygen reduction potential. In addition, a photoionization detector (PID) and turbidity meter will also be used for this project. Specific preventive maintenance procedures to be followed for field equipment are based on those recommended by the manufacturer. Field instruments will be calibration checked daily before use and calibrated weekly. Calibration checks will be documented in the field logbook. Critical spare parts, such as tape and batteries, will be kept on site to reduce potential downtime. Backup instruments and equipment will be available within 1-day shipment to avoid delays in the field schedule.

3.29 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

The laboratory is responsible for the maintenance of its laboratory equipment. Preventive maintenance will be provided on a scheduled basis to minimize down time and the potential interruption of analytical work. All instruments will be maintained in accordance with manufacturer's recommendations and normal approved laboratory practice.

Designated laboratory personnel will be trained in routine maintenance procedures for all major instrumentation. The laboratory shall designate a supervisory-level person to be responsible for oversight of the laboratory instruments used for this project. When repairs become necessary, they will be performed by either trained staff, or trained engineers/technicians employed by the instrument manufacturer. The laboratory will have multiple instruments, which will serve as backup to minimize the potential down time. All maintenance will be documented and kept in permanent logbooks. The logbooks will be available for review by auditing personnel.

Both scheduled and unscheduled maintenance required by operational failures will be recorded in the logbook. The designated laboratory operation coordinator will review maintenance records on a regular basis to ensure that required maintenance is occurring. The review of the maintenance records will be documented in the logbooks.

3.30 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The Tidewater Field Manager is responsible for ensuring that all consumable materials and ancillary sampling equipment is adequate for its intended use, compatible with other equipment, and free of defects. An informal inspection of all field supplies will be done periodically. The table below summarizes the supply and consumables inspection and acceptance requirements.

Supply Name	Inspection/ Testing Requirements	Acceptance Criteria	Testing Method	Frequency of Testing	Responsible Individual	Expiration Date	Handling / Storage Requirements
Glass sample jars and	Certified as pre-cleaned by supplier	Certified as pre-cleaned by	Review of documentation and visual	Upon receipt	Field Manager	None	Store in dry and secure location

Supply Name	Inspection/ Testing Requirements	Acceptance Criteria	Testing Method	Frequency of Testing	Responsible Individual	Expiration Date	Handling / Storage Requirements
bottles		laboratory	inspection				
VOA Vials	Certified as pre-cleaned by supplier and containing HCl	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Field Manager	3 months	Store in dry and secure location
HDPE / Glass bottles	Certified as pre-cleaned by supplier and containing H_2SO_4	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Field Manager	3 months	Store in dry and secure location
HDPE bottles	Certified as pre-cleaned by supplier and containing Zinc Acetate + NaOH	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Field Manager	3 months	Store in dry and secure location

The goal of data management procedures is to document the procedures for tracking and managing investigative data collected during the field activities associated with Melrose AFR. The primary data management objective is to provide data of known quality to end users and decision-makers. The data management procedures for each field activity are summarized in the associated SOP for each activity. The procedure for overall field activity data management is the responsibility of the Tidewater Field Manager and will be completed as summarized in SOP 4 of the FSP. Laboratory data management is the responsibility of the Test America QA Officer. The management of laboratory data will be completed following the written laboratory SOP for data management and the associated instrument and analytical method SOPs. The SOPs are included in the Test America QAPP (available upon request).

Electronic data will be received from the laboratory in ADR (A1 and A3 files), and ERPIMS Prime Project Version 4.0 (Sample, Test and Result files) formats. The electronic data will be maintained at the Tidewater office.

A field audit may be conducted to verify that sampling is performed in accordance with the procedures established in the FSP and QAPP. A performance and system audit of the laboratory may be conducted to verify analyses are completed as identified in the SOPs. The audits of field and laboratory activities include two independent parts: internal and external audits.

3.31 FIELD PERFORMANCE AND SYSTEM AUDITS

3.31.1 Internal Field Audits

Internal Field Audit Responsibilities

The Tidewater QA Officer or designee may conduct internal audits of field activities, including sampling and field measurements (if necessary). These audits will verify that all established procedures are being followed. The audit will be completed at the beginning of the project and will include a review of all field activities completed at that time.

Internal Field Audit Frequency

Internal field audits may be conducted at least once at the beginning of the site sample collection activities. If warranted, additional field audits may be completed.

Internal Field Audit Procedures

The audits will include examination of field sampling records; field screening analytical results; field instrument operating records; sample collection, handling, and packaging in compliance with the established procedures; maintenance of QA procedures; chain-of-custody; etc. Follow-up audits may be required to correct deficiencies and to verify that QA procedures are maintained throughout the investigation. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation.

3.31.2 External Field Audits

External Field Audit Responsibilities

The USACE QA Officer or designee may conduct external field audits.

External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the USACE.

3.31.2.1 External Field Audit Process

External field audits will be conducted according to the field activity information presented in the QAPP. The external field audit process can include (but not be limited to): sampling equipment decontamination procedures, sample bottle preparation procedures, sampling procedures, examination of field sampling and safety plans, sample vessel cleanliness and QA procedures, procedures for verification of field duplicates, sample preservation and preparation for shipment, as well as field screening practices.

3.32 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits may be conducted to verify documentation and implementation of the QA program, assess the effectiveness of the WP, identify any nonconformances, and verify corrective action of identified deficiencies.

3.32.1 Performance Audits

Performance audits of the laboratory participating in the investigation are performed in accordance with the procedures and frequencies established for SW-846 methodologies by the USEPA. The laboratory may also undergo a performance audit by the USACE QA Officer, which includes performance evaluation, sample analysis, and an inspection.

The Tidewater QA Officer will evaluate the need for additional performance audits with due consideration given to the recommendations of the Tidewater PM. Performance audits are used to quantitatively assess the accuracy of measurement data through the use of performance evaluation and blind check samples. The performance audit, if needed, will be performed by the QA Officer or his/her designee in accordance with documented procedures.

3.32.2 System Audits

The Tidewater QA Officer may conduct a system audit of the fieldwork performance. The Tidewater Field Manager is responsible for supervising and checking that samples are collected and handled in accordance with the approved project plans and that documentation of work is adequate and complete. The Tidewater PM is responsible for overseeing that the project performance satisfies the QA/QC objectives set forth in this QAPP. Reports and technical correspondence will be peer reviewed by an assigned qualified individual, otherwise external to the project, before being finalized.

3.32.3 Audit Records

If an audit is completed, the original records generated for all audits will be retained within the central project files. Records will include audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits, which support audit findings and corrective actions as appropriate.

3.33 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

The primary responsibility for determining the NELAC and DoD QSM compliance of environmental testing laboratories rests with the PM district and members of the project delivery team (e.g., district chemist). It is suggested that districts institute an evaluation mechanism of “documented self declaration”, by the laboratories for compliance with the DoD QSM. Upon implementation of the policy the Hazardous, Toxic and Radioactive (HTRW) Center of Expertise (CX) will transition to a technical assistance role in support of districts, in all aspects of compliance with this policy (e.g., evaluation of laboratory self-declaration); in addition to providing complementary compliance support activities (e.g., additional desk audits, on-site inspections, etc.) (USACE 2004).

3.33.1 Internal Laboratory Audits (Bench Audit)

Laboratory Bench Audit Responsibilities

If performed during this project, the Tidewater QA Officer will conduct the laboratory bench audit.

Laboratory Bench Audit Frequency

The laboratory bench audit will be done on an annual basis.

Laboratory Bench Audit Procedures

The laboratory bench audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, instrument operating records, etc.

3.33.2 External Laboratory Audits

External Laboratory Audit Responsibilities

An external audit may be conducted, as required, by the USACE QA Officer or designee.

External Laboratory Audit Frequency

If performed, the external audit will be conducted prior to the initiation of sampling and analysis activities. These audits may or may not be announced and are at the discretion of the USACE.

Overview of the External Laboratory Audit Process

External audits may include any or all of: review of laboratory analytical procedures, laboratory on-site visits, and/or submission of performance evaluation samples to the laboratory for analysis. Failure of any or all audit procedures chosen can lead to laboratory disqualification and the requirement that another suitable laboratory be chosen.

An external on-site review can consist of: sample receipt procedures, custody, and sample security and log in procedures, sample throughput tracking procedure, review of instrument calibration records, instrument logs and statistics (number and type), review of QA procedures, logbooks, sample prep procedures, sample analytical SOP review, instrument (normal or extends quantitation report) reviews, personnel interviews, review of deadlines and glassware prep, and a close out to offer potential corrective action.

It is common practice when conducting an external laboratory audit to review one or more data packages from sample lots recently analyzed by the laboratory. This review will most likely include, but not be limited to, the following:

- Comparison of resulting data to the SOP or method, including coding for deviations
- Verification of initial and continuing calibrations within control limits
- Verification of surrogate recoveries and instrument timing results, where applicable
- Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable
- Recoveries on control standard runs
- Review of run logs with run times, ensuring proper order of runs
- Review of spike recoveries/QC sample data

- Review of suspected manually integrated gas chromatography (GC) data and its cause (where applicable)
- Review of GC peak resolution for isolated compounds as compared to reference spectra (where applicable)
- Assurance that samples are run within holding times

Ideally, the data should be reviewed while on the premises so that any data called into question can be discussed with the staff.

3.34 SPECIFIC ROUTINE PROCEDURES USED TO EVALUATE DATA PRECISION, ACCURACY, AND COMPLETENESS

The purpose for this investigation falls in line with the DQOs for the site.

Factors considered in this assessment include, but are not limited to:

- The sensitivity parameters chosen based on conditions and chemicals of potential concern (COPCs) involved in a project (i.e., Regional Screening Levels for Chemical Contaminants at Superfund Sites –Screening Levels Industrial Soil and Residential Water Worker [USEPA, 2009])
- The COPCs, as they relate to the data quality level parameters chosen
- The choice of analytical and sample preparation methods for chemicals of concern whose method detection limits will meet or exceed the data quality level concentrations for those contaminants

Once these goals and objectives are evaluated and chosen, analytical data quality will be assessed to determine if the objectives have been met. In addition, the data will be reviewed for indications of interferences to results caused by sample matrices, cross contamination during sampling, cross contamination in the laboratory, and sample preservation and storage anomalies (i.e., sample holding time or analytical instrument problems).

3.34.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample will be spiked with a known amount of the analytes included in **Tables 3-2** through **3-5**. At a minimum, one sample spike should be included in every set of 20 samples tested on each instrument, for each sample matrix to be tested (i.e., groundwater). The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery.

Accuracy is similarly assessed by determining percent recoveries for surrogate compounds added to each field and QC sample to be analyzed for organic analyses. Accuracy for the metals and wet chemistry analyses will also be further assessed through determination of percent recoveries for laboratory control samples (as well as MS samples).

Percent recovery for MS/MSD results is determined according to the following equation:

$$\%R = \left(\frac{Amount\ in\ Spiked\ Sample - Amount\ in\ Sample}{Amount\ of\ Spike\ Added} \right) * 100$$

Percent recovery for LCS and surrogate compound results is determined according to the following equation:

$$\%R = \left(\frac{Amount\ Found\ in\ Spiked\ Sample}{Amount\ of\ Spike\ Added} \right) * 100$$

3.34.2 Precision Assessment

The RPD between the spike and matrix spike, or matrix spike and sample duplicate in the case of metals, and field duplicate pair or laboratory duplicate pair is calculated to compare to precision DQOs and plotted. The RPD is calculated according to the following formula.

$$RPD = \left[\frac{|\ Amount\ in\ Sample\ 1 - Amount\ in\ Sample\ 2\ |}{\frac{Amount\ in\ Sample\ 1 + Amount\ in\ Sample\ 2}{2}} \right] * 100$$

3.34.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$Completeness = \left(\frac{Number\ of\ Valid\ Measurements}{Total\ Number\ of\ Measurements} \right) * 100$$

3.35 OVERALL ASSESSMENT OF DATA

The laboratory data collected during this investigation will be used to evaluate the nature and extent of contamination at the site. The QC results associated with each analytical parameter will be compared to the objectives presented in **Tables 3-2** through **3-6** of this QAPP. Only data generated in association with QC results meeting these objectives will be considered usable for decision-making purposes.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, matrix-specific, parameter-specific, and unit-specific basis. The Tidewater QA Officer or designee will perform this assessment and the results presented and discussed in detail in the annual groundwater monitoring report. Factors to be considered in this assessment of field and laboratory data will include, but not necessarily be limited to, the following.

- Were all samples obtained using the SOPs and methodologies proposed in the QAPP?
- Were all proposed analyses performed according to the laboratory SOPs?
- Were samples obtained from all proposed sampling locations?
- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?
- Were any analytes not expected to be present at the range, or a given unit, identified as target parameters?
- Were all field and laboratory data validated according to the validation protocols, including project-specific QC objectives, proposed in the QAPP?
- Which data sets were found to be unusable (qualified as "R") based on the data validation results?
- Which data sets were found to be usable for limited purposes (qualified as "J") based on the data validation results?
- What effects do qualifiers applied as a result of data validation have on the ability to implement the project decision rules?
- Has sufficient data of appropriate quality been generated to support a human health and/or ecological screening risk assessment?
- Were the human health and/or ecological screening risk assessments conducted properly?
- Can valid conclusions be drawn for groundwater at each well that was investigated?
- Were all issues requiring corrective action, as presented in the monthly QA Reports to management fully resolved?
- Were the project-specific decision rules used as proposed during the actual investigation?
- For any cases where the proposed procedures and/or requirements have not been met, has the effect of these issues on the project objectives been evaluated?
- Based on the overall findings of the groundwater monitoring program and this assessment, were the original project objectives appropriately defined? If not, have revised project objectives been developed?

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented will be documented in the regular QA reports to management. Corrective action will only be implemented after approval by the Tidewater PM, or designee.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Tidewater PM, who in turn will notify the USACE PM. If the problem is analytical in nature, information on these problems will be promptly communicated to the Tidewater QA Officer.

Any nonconformance with the established QC procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP. The Tidewater PM, or designee, will issue a nonconformance report for each nonconformance condition.

3.36 FIELD CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC conformance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, and during the data review and validation. Field activity discrepancies will be discussed with the Tidewater Field Manager who will document the discrepancy in the field logbook. The Tidewater Field Manager will then inform the Tidewater QA Officer and Tidewater PM. The Tidewater PM will define the required corrective action. The Tidewater Field Manager will document the corrective action in the field logbook and will instruct the Tidewater field personnel on the implementation of the corrective action. It will be the responsibility of the Tidewater Field Manager to ensure that the corrective action is properly implemented. A copy of the corrective action documentation will be provided to the Tidewater PM on the same day the corrective measure is implemented. This will enable the Tidewater PM to include the corrective action in the monthly project status report.

The Tidewater PM will document major discrepancies and discuss a recommended corrective action with the USACE. Corrective actions for major discrepancies can be defined as measures that change the number of samples collected, change previously selected sampling locations, and impact the project quality control objectives. Corrective actions for major discrepancies will be approved by the USACE PM. The Tidewater PM and Tidewater Field Manager will be responsible for ensuring that the corrective action is properly implemented and documented.

3.37 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions (broken sample containers, multiple phases in samples, sample labels that do not match the CoC) may be identified during sample log–in, or just prior to analysis. Following consultation with the laboratory analysts and laboratory section leaders, it may be necessary for the Test America QA Officer to approve the implementation of the corrective action. Depending on the condition encountered, the Test America QA Officer may consult the Tidewater QA Officer for input. The laboratory SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract clean-up, automatic reinjection/reanalysis when certain QC criteria are not met, etc. Summaries of method-specific corrective actions are found in SOPs in the Laboratory QAPP. All laboratory corrective actions will be documented and also identified in the case narrative of the data packages.

3.38 CORRECTIVE ACTION DURING DATA REVIEW/VALIDATION

The Tidewater Project Chemist or designee may identify the need for corrective action during either the data review/validation or data assessment. Potential corrective measures may include re-sampling by the Tidewater field personnel (e.g., missed holding times or samples analyzed for incorrect analytes) or re-extraction/re-analysis of samples (e.g., surrogate recoveries outside criteria or sample require dilution for analyte quantitation) by the laboratory. These measures are dependent upon the ability to mobilize the Tidewater field personnel and whether the data to be collected is necessary to meet the required project QA objectives (e.g., holding time was not exceeded for samples to be re-analyzed, etc.). If the Tidewater Project Chemist or designee identifies a corrective action situation, the Tidewater PM will be responsible for approval of corrective actions and also ensuring the implementation of the corrective measure.

Any corrective action that requires resampling or changes to the FSP or QAPP will be defined as a major corrective action. Major corrective actions include, but are not limited to, measures that change the number of samples to be collected, alter previously selected sampling locations or any corrective action that impacts the project quality control objectives. The Tidewater PM will be responsible for contacting the USACE PM and discussing all major corrective actions. Major corrective actions will be approved by the USACE PM before implementation by Tidewater.

3.39 FREQUENCY, CONTENTS, AND DISTRIBUTION OF MONTHLY PROGRESS REPORTS

Progress Reports will be prepared on a monthly basis and will be delivered to the USACE PM by the end of the first full week of the month. The reports will continue, without interruption, until the project has been completed. The frequency of any emergency reports that should be delivered verbally cannot be estimated at the present time.

The progress reports will include the following QA information:

- Progress status with respect to the original project schedule
- Summary of internal field and laboratory assessments (if applicable)
- Summary of all project activities in the last month
- Summary of corrective actions required in the last month
- Summary of anticipated problems with proposed solutions
- Summary of activities to be completed in the next month
- Detailed references to QAPP modifications

If possible, an assessment of the project to date should be conducted with available QC data and overall results in relation to the original project objectives. The Tidewater PM or designee will be responsible for preparing the Progress Reports. The Tidewater PM or designee will also be responsible for documenting and ensuring implementation of any Progress Report comments received from the USACE PM.

3.40 DATA REVIEW AND VALIDATION

Data review and validation is the process by which data are evaluated against a set of accepted criteria to assess quality and validity, and to provide assurance that data are acceptable for their intended use. This section identifies the data review and validation procedures required for Melrose AFR.

3.40.1 Laboratory Internal Data Review

All data are generated and reduced following protocols specified in the Laboratory QAPP. The Laboratory QA Officer or designee will evaluate the quality of the data based on an established set of laboratory guidelines. The laboratory will review the data package to ensure:

- Sample preparation information is correct and complete
- Analysis information is accurate and complete
- The appropriate SOPs have been followed
- Analytical results are correct and complete
- QC samples are within established control limits
- Analytical requirements have been met
- Documentation is complete

The laboratory will prepare and retain full analytical and QC documentation. Such retained documentation can be hard copy (paper), but should also be on another storage media (i.e., compact disc). As needed, the laboratory will supply hard copy of the retained information.

An authorized laboratory employee will sign the laboratory analytical data package signifying the data review was completed.

3.40.2 Tidewater Data Review and Validation

One hundred percent of the data will undergo a data review by the Tidewater Project Chemist or designee using ADR. The data review will include the review of the QC parameters listed below. In general, the review will follow the guidance from **Tables 3-12** through **3-15**. The criteria used to evaluate the QC parameters are those criteria identified in **Tables 3-2** through **3-6**.

- CoC form
- Cooler receipt form
- Holding time/sample preparation
- Case narrative
- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- MS/MSDs
- Surrogate spikes
- Laboratory duplicates
- Laboratory control standards

In addition, approximately 10 percent of the data will undergo a data validation by the Tidewater Project Chemist or designee. This validation will follow the criteria listed in **Tables 3-12** through **3-15**. The validation will use the QC criteria presented in **Tables 3-2** through **3-6** of this QAPP. The validation is a more comprehensive review of the data than the data review. The validation will include all of the elements identified in the review; however the validation will include additional parameter reviews and the recalculation of the raw data. The QC parameters to be validated include the following:

- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks
- MS/MSDs
- Surrogate spikes
- Laboratory duplicates
- Laboratory control standards
- Initial calibration
- Continuing calibration
- Retention time windows
- Interference standard (inductively coupled plasma [ICP] analysis)
- Serial dilution (metals analysis)
- Internal standard areas for gas chromatography / mass spectrometry (GC/MS) analysis
- Mass tuning for GC/MS analysis

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available. It is expected that sufficient volumes of samples will be collected to allow for possible reanalysis if necessary.

Tables 3-12 through **3-14** will be used as guidance during the data review and validation procedures and summarize the general criteria to be used during the review and validation procedures.

3.41 RECONCILIATION WITH USER REQUIREMENTS

The results of all chemical data will be presented in a summary table. The data table will identify the following information:

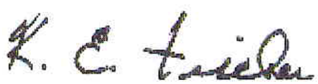
- Field Identification (ID) (location will be included in the field ID)
- Date of sample collection
- Analytical method
- Analytical results
- Method detection limits
- Reporting limits
- Data qualifications (flags)

Data will be reviewed as identified above. As part of the review process, data will be flagged to indicate bias due to outlying QC measurements. Data flagged as J (estimated) or UJ (estimated nondetect) will be used for its intended purposes. Data qualified as R will not be used. The result will be deleted from the table to ensure the data will not be used inadvertently.

HEALTH AND SAFETY PLAN
MELROSE AIR FORCE RANGE

Project Number:	C1086	
Project Manager:	Gary Verban	(703) 288-1844
Site Health and Safety Officer:	Channa Bambaradeniya	(410) 997-4458
Tidewater Corporate Health and Safety Officer:	Ken Fischer, CIH, P.E.	(410) 997-4458
Preparation Date:	February 15, 2010	
Expiration Date:	February 15, 2011	

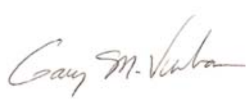
APPROVALS



02/15/10

Ken Fischer, CIH, P.E.
Tidewater Corporate Health and Safety Officer

Date



02/15/10

Gary Verban, P.E.
Project Manager

Date

This HASP is only valid for this specific project, as described in **Section 2** of this document. It is not to be used for other projects or subsequent phases of this project without the written approval of the Corporate Health and Safety Officer. **A copy of this plan is to be maintained at the site at all times during the performance of field activities.**

Disclaimer:

This Health and Safety Plan, and each of its provisions, is applicable only to, and for use only by, Tidewater, its affiliates, and its subcontractors. Any use of this Plan by other parties, including, without limitation, third party contractors on projects where Tidewater is providing engineering, construction management or similar services, without the express written permission of Tidewater, will be at that party's sole risk, and Tidewater shall have no responsibility therefore. The existence and use of this Plan by Tidewater shall not be deemed an admission or evidence of any acceptance of any safety responsibility by Tidewater for other parties unless such responsibility is expressly assumed in writing by Tidewater in a specific project contract.

4.1 INTRODUCTION

The provisions of the plan are mandatory for all Tidewater employees engaged in hazardous material management activities associated with this project that may involve health and safety hazards.

Changing and/or unanticipated site conditions may require modification of this HASP in order to maintain a safe and healthful work environment. Any proposed changes to this plan should be reviewed with a Tidewater Health and Safety Professional prior to implementation. If this is not feasible, the Tidewater safety representative as delegated by the Tidewater Corporate Health and Safety Officer may modify the plan and record all changes in the field logbook; under no circumstances will modifications to this plan conflict with federal, state, or other governmental health and safety regulations.

Tidewater will provide a copy of this plan to each site subcontractor, as necessary, in order to fulfill its obligation under 29 CFR 1910.120(b) to inform subcontractors of site hazards. Each subcontractor is required to provide a HASP that complies with 29 CFR 1910.120 and addresses the activities of its employees relative to this project, or comply with this HASP. A description of the facility, its history, previous investigations, and environmental setting are presented in **Section 1**.

This section presents the HASP for the Groundwater Monitoring Program at Melrose AFR. The activities covered by the HASP include groundwater sampling, handling of potentially contaminated media, decontamination procedures and general activities associated with working at Melrose AFR including the potential for munitions and explosives of concern (MEC) avoidance.

This HASP establishes guidelines and requirements for the safety of field personnel during completion of field activities at Melrose AFR. All employees and subcontractors, if utilized, of Tidewater involved in this project are required to abide by the provisions of the HASP. They are required to read this plan and to sign a Safety Compliance Agreement and Medical Emergency Contact Sheet (**Appendix B**) prior to commencement of work activities. All personnel involved with completion of field activities associated with groundwater monitoring at Melrose AFR are required to have 40-hour OSHA HAZWOPER training and current annual 8-hour HAZWOPER refresher training.

The health and safety guidelines and requirements presented within are based on a review of available information and an evaluation of potential hazards. This HASP outlines the health and safety procedures and equipment required for activities at Melrose AFR in order to minimize the potential for harmful exposures to field personnel.

4.2 CHEMICAL HAZARDS

The Tidewater Hazard Communication Program (Section 8 of the Tidewater Corporate Health and Safety Manual in **Appendix B**)provides personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace.

Exposure to chemical hazards can present a risk of serious injury. This HASP provides the basis to avoid occupational exposure to chemical hazards by using PPE to avoid exposure to chemical hazards.

The greatest risk of chemical exposure is likely to occur during groundwater sampling activities. The potential routes of exposure include inhalation, dermal contact, and ingestion. Inhalation and dermal contact are expected to be the most significant exposure routes. Appropriate PPE and monitoring will be used to help minimize the exposure through these routes. The potential for exposure by ingestion is expected to be low. Personnel will be expected to use good personal hygiene practices and appropriate PPE to minimize the potential for incidental ingestion of environmental media and their associated chemicals.

4.2.1 Investigative Target Chemicals

Target chemicals include the following:

- Trace and major elements
- Hexavalent chromium
- Organic carbon
- Alkalinity
- Phosphorous
- Ammonia
- Nitrate/nitrite
- VOCs
- Perchlorate
- Metals
- Bromide, chloride, fluoride, and sulfate
- Sulfide

4.2.2 Chemicals Brought On Site

The following chemicals will be brought, used, and stored at Melrose AFR. A material safety data sheet (MSDS) for each chemical is presented in **Appendix B**.

- Gasoline and diesel (equipment fuel)
- Isobutylene (calibration gas)
- Liquinox (decontamination)
- Hydrochloric acid (sample preservative)
- Sulfuric acid (sample preservative)
- Sodium hydroxide (sample preservative)
- Zinc acetate (sample preservative)

4.2.3 Hazard Communication Materials

Materials that are considered hazardous materials under the OSHA Hazard Communication Standard (29 CFR 1910.1200) will be used during this project. In accordance with the Tidewater Hazard Communication Program, MSDSs for hazardous materials are included in **Appendix B** of this document. The Site Health and Safety Officer (SHSO) will make copies of these MSDSs available to all personnel, including subcontractors, if any, on this project.

4.3 PHYSICAL AND BIOLOGICAL HAZARDS

There is a risk of physical injury from physical and biological hazards at Melrose AFR. Personnel should be aware of the fact that when protective equipment is worn, visibility, hearing, and manual dexterity are impaired. Slips, trips, and falls are the most common causes of injuries. Organized housekeeping of on site activities is essential in the reduction of slips, trips, and falls. Tidewater employees are to maintain the cleanliness of the site, and inspect work areas for slip and trip hazards. Section 9 of the Tidewater Corporate Health and Safety Manual provides information on worksite housekeeping.

4.3.1 MEC Hazards

It is unlikely that MEC will be encountered during groundwater monitoring fieldwork. However, to ensure the potential for MEC exposures are minimized, Tidewater will follow MEC avoidance procedures during all field activities. The purpose of MEC avoidance during field activities is to absolutely avoid any surface MEC and subsurface anomalies during groundwater sampling, or other field activities. For MEC avoidance at a site where MEC may potentially be present, Tidewater will request a UXO escort.

4.3.2 Explosion and Fire Hazards

No flammable liquids will be brought into the exclusion zone (EZ), with the exception of gasoline or diesel used to fuel engines and motor oil used for engine lubrication. These materials will be kept in closed containers. Storage of large quantities of gasoline or diesel fuel for generators and motor oils is not anticipated.

A minimum of two fire extinguishers will be kept on site at all times. These fire extinguishers will have current inspection tags and will be secured to prevent tip-over. All fire extinguishers will be available for response and will be positioned to be within 10 seconds of a potential fire event.

Compressed gas cylinders, containing a small amount of isobutylene used for the calibration of PID field instruments, will not be allowed in the EZ. Gas cylinders will be stored and used in the support zone. Specific safety requirements for handling compressed gases are found in 8 CFR 1740. No unsecured compressed gas cylinders will be permitted. Calibration of PIDs will be conducted in the support zone prior to and after daily PID usage.

4.3.3 Electrical Hazards

During work activities, the potential for exposure to electrical hazards exists. The primary hazards associated with electrical hazards are shock, burns, arc-blast, fire, and explosion. All motor housings will be guarded, and motors that emit sparks will not be used. Outdoor extensions or indoor extensions in wet locations will be protected by ground fault circuit interrupters (GFCIs).

4.3.4 Heat Stress Recognition and Control

Heat stress monitoring will commence when personnel are wearing impervious PPE, and the ambient temperature exceeds 70°F. If standard work garments (or cotton coveralls) are worn, monitoring will commence at 85°F. Since workers will be working in a warm and humid climate, the potential for heat stress exists. Heat stress can result in dehydration, body temperature elevation, heat rash, and heat stroke. Unless properly attended to, people suffering from heat stress can die. Heat stress can be avoided by taking frequent breaks in the shade and consuming adequate fluids.

4.3.5 Cold Stress Recognition and Control

Protection against cold stress should be initiated when temperatures drop below 45°F.

4.3.6 Noise Hazards

Previous surveys indicate that heavy equipment may produce continuous and impact noise at or above the action level of 85 decibels. All Tidewater personnel within 25 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, will wear hearing protective devices (either muffs or plugs). Tidewater personnel who are in the Medical Surveillance Program are automatically enrolled in the Tidewater Hearing Conservation Program and have had baseline and, where appropriate, annual audiograms. Personnel will wash their hands with soap and water prior to inserting earplugs to avoid initiating ear infections. Additional information regarding the Tidewater Hearing Protection program is located in Section 5 of Tidewater's Corporate Health and Safety Manual in **Appendix B.**

4.3.7 Slip/Trip/Fall Hazards

Personnel should exercise caution when walking around the site to avoid fall and trip hazards. If there are holes or uneven terrain in the work area that could cause site personnel to fall or trip, they must be covered, flagged, or marked to warn personnel. If conditions become slippery, personnel should take small steps with their feet pointed slightly outward to decrease the probability of slipping. Gravel or sand should be spread in muddy areas to reduce slipperiness. Personnel should watch where they are walking and walk only in areas of good stability.

4.3.8 Sanitation

Tidewater employees and subcontractors are to have appropriate personal hygiene facilities including toilets, wash rooms, and eating facilities to protect employees from unsanitary conditions.

4.3.9 Lifting Hazards

The following guidelines will be followed whenever lifting equipment such as portable generators, coolers filled with samples, any other objects that are of odd size or shape, or that weigh over 40 pounds. Safe lifting procedures are described in Section 9 of Tidewater's Corporate Health and Safety Manual in **Appendix B**.

- Get help when lifting heavy loads. Portable generators will only be lifted using a two-person lift.
- When moving heavy objects such as drums or containers, use a dolly or other means of assistance.
- Plan the lift. If lifting a heavy object, plan the route and where to place the object. In addition, plan the communication signals to be used (e.g., "1, 2, 3, lift," etc.)
- Wear sturdy shoes in good conditions that supply traction when performing lifts.
- Keep your back straight and head aligned during the lift and use your legs to lift the load—do not twist or bend from the waist. Keep the load in front of you—do not lift or carry objects from the side.
- Keeping the heavy part of the load close to your body will help maintain your balance.

4.3.10 Hand Tools and Portable Equipment

Field personnel may use hand tools and portable equipment in the activities specified in this HASP. To prevent possible injury to the body, some general guidelines should be applied.

- Keep hand and power tools in good repair and use them only for the appropriate tasks for which they were designed.
- Remove damaged or defective tools from service.

- Keep surfaces and handles clean and free of excess oil to prevent slipping.
- Do not carry sharp tools in pockets.
- Clean tools and return them to a toolbox or appropriate storage area upon completion of a job.
- Wrenches must have a good bite before pressure is applied.
- When working with tools overhead, place tools in a holding receptacle or secure them when they are not in use.
- Do not throw tools from place to place, from person to person, or drop them from heights.
- Use non-sparking tools in atmospheres with flammable or explosive characteristics.
- Avoid use of flammable or explosive chemicals when a safer alternative is available.
- Inspect all tools prior to start-up or use to identify any defects.
- Powered hand tools should not be capable of being locked in the on position.
- Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.
- Do not allow loose clothing, long hair, loose jewelry, rings or chains to be worn while working with power tools.
- Do not use cheater pipes.
- Make provisions to prevent machines from automatically restarting upon restoration of power.

4.3.11 Hand Safety

Tidewater personnel are to perform work that could expose them to hand injury. All Tidewater personnel are to wear protective gloves specific to their task at hand. For sampling activities, Tidewater personnel are to wear nitrile gloves. If cold conditions exist, glove liners should be worn underneath all protective gloves. Physical protection gloves (i.e., leather or Kevlar) should be worn as necessary. Hands are to be kept clean to prevent slipping and contamination. Hand tools should be kept in good repair and sharp tools should be handled with extra care. All tools should be kept in proper storage.

4.3.12 Biological Hazards

The following sections present guidance on identification and avoidance of biological hazards.

4.3.12.1 Insects and Arachnids

During fieldwork, personnel may encounter a wide variety of insects and arachnids including bees, wasps, mosquitoes, ticks, fire ants, spiders, and scorpions. Field personnel are encouraged to use insect repellent when present. Stings from bees, wasps, and ants may cause serious allergic reactions in certain individuals. The SHSO should identify all personnel with known insect allergies or sensitivities before fieldwork begins. If an allergic reaction occurs, a physician's advice should be sought. Personnel with known allergies should carry appropriate medication. Mosquitoes can carry the West Nile virus, which is spread to humans through mosquito bites. Common symptoms of the West Nile virus are, but are not limited to, headache, fever, and extreme muscle weakness, occasionally accompanied by vomiting or skin rashes. If field personnel have been bitten by a mosquito infected by West Nile Virus, and are experiencing the associated symptoms listed above, they should seek medical attention immediately.

Africanized Honey Bees (aka Killer Bees) have been positively identified in New Mexico and are a serious potential hazard. While the sting of one Africanized Honey Bee generally contains slightly less venom than that of the common European Honey Bee, the Africanized Honey Bee is much more aggressive and up to ten times as many bees may respond to a disturbance of the hive. Such a disturbance need not be targeted at the hive itself, as vehicle vibrations, proximity to the hive's territory, and wearing dark colors or scented toiletry items have all been known to provoke attacks from hives. If field personnel have been stung by a bee, the stinger needs to be removed immediately. Use tweezers or something to scrape across the affected area (e.g., credit card) to remove the stinger. Once the stinger is removed, wash area with soap and water and apply ice. Monitor the affected area for any allergic reaction. If field personnel are allergic to bee stings or if an allergic reaction is noticed after a sting, administer doctor prescribed epinephrine (commonly found in an Epi pen) shot after the sting occurs and seek medical attention immediately. The Epinephrine can only be administered to the field member in a manner prescribed by a doctor.

Ticks are parasites that feed on the blood of an animal/human host and can carry severe diseases, such as Rocky Mountain Fever. Symptoms of Rocky Mountain Fever include; a rash that typically starts at the wrists and ankles and spreads to the rest of the body, fever, severe headache, and deep muscle pain. Frequent spot checks of field personnel clothing and exposed skin should be carried out throughout the day. A more complete self check should be completed at the end of the work day. If a tick is found and attached the tick should be removed with tweezers. Grasp the tick as close to the skin as possible and remove with a steady slow motion, pulling straight up. Wash the affected area with soap and water. Monitor the affected area for rash and the body for any other symptoms within three days or up to two months after the bite occurs. If the entire tick is not removed (e.g., the head) or if other symptoms appear, seek medical help immediately. Wear light colored clothes to help see ticks during tick checks. Applying DEET sprays to clothing can also help to repel ticks.

During warm months (spring through early fall), tick-borne Lyme disease also poses a potential health hazard. The longer a disease-carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long-sleeved shirts and long pants (tucked into boots), as well as performing frequent body checks will prevent long-term attachment.

Spider bites can be extremely serious (e.g., those of the black widow or brown recluse). Other spider bites (including that of the tarantula) are unpleasant or uncomfortable, resulting in rashes, itching, and possible infection. The possibility of allergies greatly increases the danger since people are not usually aware of such allergies until they have been bitten. Therefore, spiders should be regarded as a serious potential hazard.

Of the many scorpion species in New Mexico, only the sting of the Arizona Bark Scorpion is of medical importance. The venom of the Arizona Bark Scorpion may produce severe pain (but rarely swelling) at the site of the sting, numbness, frothing at the mouth, difficulties in breathing (including respiratory paralysis), muscle twitching, and convulsions. As with spiders, the possibility of allergies to the venom greatly increases the danger, since people are not usually aware of such allergies until they have been stung. Therefore, all scorpions should be regarded as a serious potential hazard. Care should be taken with lifting or moving or disturbing possible scorpion habitats, such as debris, rocks, or other objects that could provide cover.

4.3.12.2 Reptiles

Poisonous reptiles (e.g., rattlesnakes, etc.) may also be encountered at Melrose AFR. Personnel should check for reptiles before walking through grassy or debris-strewn areas. Care should be taken when lifting or disturbing possible reptile habitats, such as debris, rocks, or other objects that could provide cover.

4.3.12.3 Other Animals

Ground squirrels, rock squirrels, various rats, mice, and other mammals have been known to harbor fleas carrying bubonic plague. Their bites can also transmit rabies and other infections. Some animals pose a special problem because people tend to try to feed them or pet them; this type of increased contact brings a greater potential for danger. Avoid wildlife whenever possible.

4.3.12.4 Plants

Cactus and a variety of other woody plants that contain thorns may be encountered during field activities at Melrose AFR. Physical contact with these spiny/thorny plants may cause puncture wounds or skin irritation and should be avoided. If an individual has come in contact with a spiny/thorny plant, the affected skin area should be washed thoroughly with soap and water and treated to prevent infection. If an allergic reaction occurs, a physician’s advice should be sought.

4.4 PROJECT HAZARD ANALYSES

Aspects of the field investigation contain certain innate risks. **Table 4-3** shows the Project Hazard Analysis for work that will be conducted as part of the groundwater monitoring program. These tasks include: mobilization to and demobilization from Melrose AFR, water level measurement, monitoring well groundwater sampling, field sampling IDW management and disposal, and equipment decontamination. Additional information regarding site history, target chemicals, and scope of field activities is located in the WP (**Section 1**) and the Field Sampling Plan (**Section 2**). Additional information concerning Project Hazards and their control can be found in **Section 4.3**.

4.4.1 Activity Hazard Analysis

An Activity Hazard Analysis (AHA) has been developed for every operation involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or subcontractor is to perform work. The AHAs define the activity being performed, sequence of work, specific safety and health hazards anticipated, control measures, equipment, inspection requirements, training requirements, and the competent person in charge of that phase of work. The following AHAs are included as **Appendix B**.

- Mobilization / Demobilization
- Water Level Measurement
- Monitoring Well Groundwater Sampling
- Field Sampling IDW Management and Disposal
- Equipment Decontamination

4.5 OCCUPATIONAL EXPOSURE ACTION LEVELS

Table 4-4 presents the Occupational Exposure Action Levels which are to be monitored during site activities. Air quality (i.e., background, breathing zone, head space) will be monitored, using a PID during water level measurement and groundwater sampling activities at Melrose AFR. Based on field activities planned as part of the groundwater monitoring program at Melrose AFR, visible dust is not anticipated to be a concern for field personnel. See **Section 4.9** for exposure monitoring and dust suppression procedures.

4.6 RESPONSIBILITIES

Tidewater will have health and safety oversight and coordination responsibilities for Tidewater personnel; each subcontractor, if any, will be held accountable for the safe and healthful performance of work by each of their employees, subcontractors, or support personnel who may enter the site. Tidewater will strictly adhere to the provisions of the HASP, along with any other applicable regulations issued by governmental entities.

Changing and/or unanticipated site conditions may require modification of this HASP in order to maintain a safe and healthful work environment. Any proposed changes to this plan will be reviewed and approved by the Tidewater Corporate Health and Safety Officer prior to implementation. The SHSO as delegated by the Tidewater Corporate Health and Safety Officer may modify the plan and record all changes in the field logbook; under no circumstances will modifications to this plan conflict with federal, state, or other governmental health and safety regulations.

Tidewater will provide a copy of the HASP to each subcontractor in order to fulfill its obligation under 29 CFR 1910.120(b) to inform subcontractors of site hazards. Each subcontractor is to provide an Health and Safety Plan that complies with 29 CFR 1910.120 and addresses the activities of its employees relative to this project, or comply with this APP. In addition, each subcontractor will provide training certifications for 40-hour OSHA HAZWOPER, and 8-hour HAZWOPER refresher training for personnel involved with field activities.

4.6.1 Project Manager (Tidewater)

The PM will direct Tidewater operations. The PM may delegate all or part of these duties to a properly qualified Tidewater SHSO. During fieldwork, the PM assisted by the SHSO, has primary responsibility for the following:

- Seeing that appropriate personal protective equipment and monitoring equipment is available and properly utilized by all on-site Tidewater employees
- Establishing that Tidewater personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies
- Establishing that all Tidewater personnel have completed a minimum of 40 hours of health and safety training and have appropriate medical clearance as required by 29 CFR 1910.120, and have been fit tested for the appropriate respirators
- Seeing that Tidewater personnel are aware of the potential hazards associated with site operations
- Monitoring the safety performance of all Tidewater personnel to see that the required work practices are employed
- Correcting any Tidewater work practices or conditions that may result in injury or exposure to hazardous substances
- Preparing any accident/incident reports for Tidewater activities, and ENG 3394 (**Appendix B**)
- Halting Tidewater site operations, if necessary, in the event of an emergency or to correct unsafe work practices
- Seeing that utility clearances are obtained prior to the commencement of intrusive activities

- Reviewing and approving this project HASP

4.6.2 Site Health and Safety Officer (Tidewater)

The Tidewater SHSO will be present during field activities. The SHSO is responsible for:

- Implementing project HASP and reporting any deviations from the anticipated conditions described in the plan to the PM and, if necessary, the Corporate Health and Safety Officer.
- Determining that monitoring equipment is used properly by Tidewater personnel and is calibrated in accordance with manufacturer's instructions or other standards, and that results are properly recorded and filed
- Checking to assure that Tidewater personnel have current medical clearance and training
- Assuming any other duties as directed by the PM and Tidewater Corporate Health and Safety Officer
- Coordinating with Tidewater health and safety professionals to identify Tidewater personnel for whom special PPE, exposure monitoring, or work restrictions may be required
- Conducting daily site inspections prior to the start of each shift. All inspections must be documented (preferably in a bound field logbook)
- Providing ongoing review of the protection level needs as project work is performed, and informing the PM of any need to upgrade/downgrade protection levels
- Seeing that decontamination procedures described in **Section 4.12** of this document are followed by Tidewater personnel
- Establishing monitoring of Tidewater personnel and recording results of exposure evaluations
- Halting Tidewater site operations, if necessary, in the event of an emergency or to correct unsafe work practices
- Maintaining the visitor log

4.6.3 Corporate Health and Safety Officer (Tidewater)

The Corporate Health and Safety Officer is responsible for:

- Determining the need for periodic audits of field operations to evaluate compliance with this plan
- Providing health and safety support as requested by the SHSO and PM

4.6.4 Project Personnel (Tidewater)

Project personnel involved in investigations and operations are responsible for:

- Taking all reasonable precautions to prevent injury to themselves and to their fellow employees
- Performing only those tasks that they believe can be done safely, and immediately reporting any accidents and/or unsafe conditions to the SHSO or PM
- Implementing the procedures set forth in the HASP, and reporting any deviations from the procedures described in the plan to the SHSO or PM for action
- Notifying the PM and SHSO of any special medical problems (e.g., allergies) and seeing that all on-site Tidewater personnel are aware of such problems
- Reviewing this project HASP and signing a Safety Plan Compliance Agreement

4.6.5 Subcontractor's Safety Representative

Each subcontractor is requested to designate a Subcontractor's Safety Representative (SSR) who is the subcontractor supervisor. The SSR is responsible for the safe and healthful performance of work by his work force and subcontractors. During subcontractor activities on-site, the SSR will perform continuing work area inspections, and conduct safety meetings and safety orientations for all new employees. The SSR will attend periodic safety meetings with the SHSO. The SSR will also investigate accidents and overexposures involving subcontractor personnel.

4.7 TRAINING AND MEDICAL SURVEILLANCE

4.7.1 HAZWOPER Training and Medical Surveillance

All Tidewater and subcontractor personnel working within the EZ of site intrusive activities will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent
- Eight hours of annual refresher training for all personnel (as required)
- Eight hours of supervisor training for personnel serving as Site Health and Safety Officers
- Three days of work activity under the supervision of a trained and experienced supervisor
- At all times, at least two of the fieldworkers will have current first aid and cardiopulmonary resuscitation (CPR) certification.

All Tidewater site personnel are participating in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Current copies of training certificates and statements of medical program participation for all Tidewater personnel are maintained by the headquarters office. A list of site personnel and their training certificates will be provided prior to the start of fieldwork. Required training is further described in Section 4 of Tidewater's Corporate Health and Safety Manual (**Appendix B**).

4.7.2 Behavior Based Safety

Most accidents are due to unsafe behavior, and behavior changes may be made that significantly reduce accident risk. Tidewater employees and Tidewater subcontractors are expected to value safety and to be responsible for their own safety as well as the safety of others. The SHSO is expected to provide clear safety expectations and provide positive and negative feedback for safe and unsafe behavior. Peers are expected to intervene upon observation of an unsafe behavior and to provide positive feedback for safe behavior.

4.7.3 Daily Safety Meeting

Daily Safety Meetings will be conducted prior to initiating field work each day.

4.7.4 Daily Safety Task Analysis

Prior to initiating work each day, the SHSO will perform a daily safety tailgate meeting. Current conditions will be evaluated compared to conditions anticipated and hazards found in the applicable AHA for the activity (i.e., job or task) to be performed that day. If the current AHA does not adequately address unanticipated hazards, the AHA will be updated and approved by the Tidewater Corporate Health and Safety Officer or a Tidewater, certified safety professional (CSP).

4.8 PERSONAL PROTECTIVE EQUIPMENT/ACTION LEVELS

The minimum PPE for site personnel will be Level D which includes:

- Respirator (when in the EZ) only if elevated PID readings are registered.
- Hardhat (when overhead hazards exist)
- Safety glasses with side shields (or impact-resistant goggles)
- Safety boots
- Ear protection in the vicinity of noisy equipment
- Work gloves and/or chemical-resistant gloves
- Tyvek® coveralls (when in the EZ), if warranted.

The minimum PPE requirements for each task are presented on **Table 4-5**.

4.8.1 Respirator Selection

Engineering controls and safe work practices must always be the primary control for air contaminants. Respirators will be used if engineering or work practice controls are not feasible for controlling airborne exposures at levels below acceptable concentrations and as an interim control measure when applicable engineering or work practice controls are being implemented.

Respirators will only be donned if elevated PID readings are registered in the operator breathing zone (OBZ). Respirator use is not anticipated to be required during this groundwater monitoring program.

Once the need for respirators has been established, the respirators will be selected on the basis of the hazard(s) to which the worker is exposed. Only National Institute for Occupational Safety and Health-approved respirators will be issued. Personnel not medically cleared to wear respirators will not be assigned to the project.

4.8.2 Fit Testing

A person wearing a respirator must be clean-shaven in the area of the face piece seal. Long hair, sideburns, and skullcaps that extend under the seal are not allowed. Glasses with temple pieces extending under the seal are not allowed for full-face respirators. Contact lenses may be worn with respiratory protection. Persons with facial conditions (e.g., missing dentures, scars, severe acne) that prevent a proper seal are not allowed to wear a respirator until the condition is corrected.

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been fit tested within the last year. Fit testing will be performed in accordance with accepted fit test procedures presented in Section 6 of Tidewater's Corporate Health and Safety Manual in **Appendix B**. Records of fit testing will be maintained by the employee's office and/or corporate medical surveillance program.

Respirator wearers will perform a user seal check each time the respirator is put on. For air purifying respirators, the positive user seal check is performed by first removing the exhalation valve cover, then placing the palm over the respirator exhalation valve and exhaling gently. The respirator mask should puff out without noticeable leakage. The negative user seal check is performed by placing the palms over both of the respirator cartridges, inhaling gently, and holding the breath for 10 seconds. The respirator mask should remain collapsed on the face without noticeable leakage.

4.8.3 Respirator Use Instructions

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been trained. Personnel must be properly trained and fitted for the each specific type of respirator selected for use (e.g., full-face piece and half-face piece cartridge respirators).

Personnel wearing respirators must receive training in accordance with 29 CFR 1910.134 during initial 40-hour and annual Refresher training for hazardous waste operations. Hands-on training on inspecting and donning a respirator, including user seal checks, will be provided during Site Safety Briefings conducted by the SHSO. Training will be documented in the field logbook.

Particulate respirator cartridges should be changed out when the wearer has difficulty breathing through the cartridges. Chemical gas or vapor respirator cartridges will be changed out at least daily. The fit of a chemical gas or vapor respirator should be rechecked and the cartridges changed if the wearer detects chemical odor or feels chemical irritation on the skin, both indicators of leakage or cartridge breakthrough.

4.8.4 Respirator Inspection

The user will inspect respirators before and after each use. The inspection procedure for air-purifying respirators (e.g., full-face piece and half-face piece cartridge respirators) is presented below.

Examine the face piece for:

- Excessive dirt
- Cracks, tears, holes, or distortion from improper storage
- Inflexibility
- Cracked or badly scratched lenses (full-face only)
- Incorrectly mounted eyeglass lenses or broken or missing mounting clips (full-face only)
- Cracked or broken air purifying element holder, badly worn threads, or missing gaskets

Examine the head straps or head harness for:

- Breaks or cracks
- Broken or malfunctioning buckles
- Excessively worn serration on the head straps, which may permit slippage

Examine the inhalation valves (2) and exhalation valve for:

- Foreign material (e.g., hairs, particles, etc.)
- Improper insertion of the valve body in the face piece
- Cracks, tears, or chips in the valve body, particularly in the sealing surface
- Missing or defective exhalation valve covers

Examine the air-purifying cartridge for:

- Missing or worn cartridge holder gasket
- Incorrect cartridge/canister for the hazard
- Incorrect cartridge installation, loose connections, or cross threading in the holder

- Cracks or dents in the outside case or threads of filter or cartridge/canister

4.8.5 Cleaning of Respirators

Respirators assigned and worn by one individual must be dismantled and thoroughly cleaned and disinfected after each day's use. Visitors or multi-assigned respirators must be cleaned and disinfected after each use. A disinfectant spray or wipe is approved as a disinfectant between uses during the day but not for cleaning and sanitizing after each day's use. Care must be taken to prevent damage from rough handling during the cleaning procedure. After cleaning, respirators must be reassembled. The respirator cleaning procedure is presented below.

- Washing: Disassemble and wash with a mild liquid detergent in warm water (not to exceed 110°F). A stiff bristle (not wire) brush may be used.
- Rinsing: Rinse in clean water to remove all traces of detergent. This is very important to prevent dermatitis.
- Disinfecting: Thoroughly rinse or immerse in a sanitizer provided by the manufacturer. Alternatively, a weak chlorine bleach solution (1 milliliter liquid bleach/liter of water) may be used.
- Final Rinsing: Rinse thoroughly in clean water (110°F maximum) to remove all traces of disinfectant. This is very important to prevent dermatitis.
- Drying: Drain and dry hanging by the straps from racks (take care to prevent damage); or towel dry using clean soft cloths or paper towels.

4.8.6 Maintenance of Respirators

Routine respirator maintenance such as replacing missing valves, gaskets, nose cups etc., must only be performed by trained respirator users or a respirator manufacturer's representative. Only approved replacement parts must be used. Substitution of parts from a different brand or type of respirator invalidates the respirator, which is not permitted. Any respirator suspected of being defective must be removed from service and replaced.

4.8.7 Storage of Respirators

When not in use, respirators must be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. Respirators must be stored in resealable (e.g., plastic zipper-lock storage bags), reusable plastic bags between uses. The respirator storage environment must be clean, dry, and away from direct sunlight. Cabinets or cases are suggested. Storing bagged respirators in vehicles is discouraged due to the potential for damage from other materials or equipment.

4.9 EXPOSURE MONITORING

An organic vapor monitor equipped with a 10.2 or greater electron volt PID will be used to monitor organic vapors at the point of operation and/or the OBZ during intrusive activities at sites with potential volatile organic compound contamination. The monitoring shall be done at intervals of no more than 15 minutes. The PID must be calibrated following the manufacturer's specifications. Calibration must use clean air to "zero" the instrument, and a 100-ppm isobutylene standard to set an additional point. The PID will be calibrated to 100 ppm isobutylene if the primary site constituents are unknown. If the primary site constituents are petroleum related, the PID shall be calibrated to a "benzene equivalent" using the instrument specific response factor. Refer to the manufacturers specifications to determine the "benzene equivalent" response factor.

4.10 SITE CONTROL MEASURES

The SHSO will verify that all site visitors sign the visitors' log. In addition, all Tidewater personnel and site visitors entering the work area must present evidence of their participation in a medical surveillance program and completion of health and safety training programs that fulfill the requirements of this plan.

The SHSO will provide site hazard and emergency action information to all site visitors before they enter the site. This can be done by providing a copy of this HASP to the visitor.

4.11 DECONTAMINATION PROCEDURES

If the monitoring instrument readings indicate respirator use (the 2nd action level of 5 ppm > one minute) in the OBZ, the following steps will be followed whenever personnel leave the exclusion zone/work area:

1. Remove all equipment, sample containers, and notes from the work area. Obtain decontamination solutions and decontamination tools (shovels, auger flights, etc.) by brushing them under a water rinse. A high-pressure steam cleaner may also be used for decontamination. All waste and spent decontamination solutions will be properly contained.
2. Scrub boots with a stiff bristle brush and water. Washtubs and chairs will be provided.
3. Remove outer gloves (and boot covers, if used).
4. Remove hardhat and eye protection.
5. Remove respirator.
6. Remove inner gloves.
7. Wash hands and face.

The decontamination area will be covered with plastic sheeting, which will be replaced when torn or heavily soiled, and at the end of each shift.

Each worker will be responsible for cleaning, sanitizing, and storing their own respirator in accordance with manufacturer's guidance (typical cleaning includes washing in warm water and detergent or sanitizing solution, air drying, and storing in a plastic storage bag.

All spent decontamination fluids (rinse waters, etc.) will be handled as directed by the PM and in accordance with relevant regulations.

4.11.1 Sanitation

Potable water will be made available at the site, either from a pressurized source or commercially available bottled water. Drinking cups will be supplied so personnel will neither drink directly from the source of water nor have to share drinking cups. Sources of non-potable water shall be clearly labeled as such.

Unless toilet facilities are available on site or transportation is readily available to transport personnel to nearby toilet facilities, portable toilet facilities, such as chemical toilets, will be provided on-site.

Washing facilities will also be provided on-site. Soap, clean water, wash basins, and single-use towels will be available for personnel use.

4.11.2 Decontamination – Medical Emergencies

In the event of physical injury or other serious medical concerns, immediate first aid is to be administered in lieu of further decontamination efforts.

4.11.3 Decontamination of Tools

When all work activities have been completed, potentially contaminated non-sampling tools used by Tidewater personnel will be either appropriately decontaminated or properly disposed of as hazardous waste. Equipment and Personnel Decontamination procedures are detailed in AHA No. 4, which is included in **Appendix B**.

All tools will be constructed of non-porous, non-absorbent materials. This will aid in the decontamination process. Any tool, or part of a tool, that is made of a porous/absorbent material, will be discarded and disposed of as IDW if it cannot be properly decontaminated.

Tools will be placed on a decontamination pad or into a bucket and thoroughly washed using a soap solution and brushing, followed by a fresh water rinse. All visible particles are to be removed before the tool is considered clean.

4.12 EMERGENCY INFORMATION

Project emergency contact information is presented in **Table 4-1**.

The hospital route maps are presented as **Figures 4-1** and **4-2**. A copy of the hospital route maps must be readily available in each site vehicle that may be used to transport accident victims to the hospital.

4.13 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

Illnesses, injuries, and accidents occurring on site must be attended to immediately. The USACE Accident Investigation and Reporting form is included in **Appendix B**. The form must be completed and submitted to the Tidewater Corporate Health and Safety Officer within 24 hours of the reported incident for medical treatment cases and within 5 days for other incidents.

With the exception of first aid activities, Tidewater will not act as a responder to emergencies. Emergency contact information is presented in **Table 4-1**. The route to the hospital is presented on **Figures 4-1** and **4-2**.

4.13.1 Discovery of MEC

If at any point during field activities at Melrose AFR, field crews identify what appears to be potential MEC, visible on the ground surface, it will be flagged by field personnel, recorded using global positioning system (GPS), and left in place. The field team will restrict access to the MEC item by placing temporary obstacles around the discovery. Field personnel will also warn off any site visitors. The field team will inform the Cannon AFB Program Engineer/Manager (575-784-6031) and the Tidewater PM (703-288-1844). The Cannon AFB RPM will then contact the responding Explosives Ordnance Disposal (EOD) unit assigned to Melrose AFR. The Tidewater PM will then contact the USACE PM (402-995-2737), and the Tidewater Corporate Health and Safety Officer.

It is Tidewater policy to evacuate personnel from areas involved in hazardous material emergencies and to summon outside assistance from agencies with personnel trained to respond to the specific emergency. This section outlines the procedures to be followed by Tidewater personnel in the event of a site emergency. These procedures are to be reviewed during the on site safety briefings conducted by the SHSO.

In the event of a fire or medical emergency, the emergency numbers identified in **Table 4-1** can be called for assistance.

4.13.2 Places of Refuge

In the event of a site emergency requiring evacuation, all personnel will evacuate to a pre-designated area located a safe distance from any health or safety hazard. The SHSO (in cooperation with a facility representative) will designate a primary assembly area prior to the start of work each day. The daily pre-designated assembly area may have to be re-designated by the SHSO in the event of an emergency where the area of influence affects the primary assembly area. Once assembled, the SHSO shall take a head count. The SHSO will evaluate the assembly area to determine if the area is outside the influence of the situation; if not, the SHSO will redirect the group to a new assembly area where a new head count will be taken.

During any site evacuation, all employees shall be instructed to observe wind direction indicators. Employees will be instructed to travel upwind or crosswind of the area of influence. The SHSO will provide specific evacuation instructions, via the site emergency radio if necessary, to site personnel regarding the actual site conditions.

4.13.3 Fire

Fire prevention procedures are described in Section 10 of Tidewater's Corporate Health and Safety Manual in **Appendix B**. To protect against fires, the following special precautions must be taken:

- Any hot work conducted at Melrose AFR will require a permit to be obtained through the local fire department.
- A detailed inspection of the work area will be conducted to determine if potential fire sources exist.
- The fire sources must be removed to at least 35 feet away before work can commence.
- Type ABC fire extinguishers will be available on site to contain and extinguish small fires.
- The local or facility fire department shall be summoned in the event of any fire on site.

4.13.4 Communication

A communication network must be set up to alert site personnel of emergencies and to summon outside emergency assistance. Where voice communication is not feasible an alarm system (i.e., sirens, horns, etc.) should be set up to alert employees of emergencies. Radio communication may also be used to communicate with personnel in the EZ. Where phone service is not readily available, radios or portable phones should be used to communicate with outside agencies. Site personnel should be trained on the use of the site emergency communication network. Emergency phone numbers shall be posted at the phone or radio used for outside communication. The SHSO is responsible for establishing the communication network prior to the start of work, and for explaining it to all site personnel during the site safety briefing.

Contractors performing work on Melrose AFR will be issued a 2-way radio that allows direct communications to a Melrose AFR on-site Range Control Officer (RCO) that can contact off-site emergency response groups. Cell phone reception is inconsistent and may be used as a back-up system (see below).

- Using the 2-way radio, contact the Melrose AFR RCO, identify yourself, location, and nature of the emergency.
- Follow the Melrose AFR RCO's instructions.

- Should a Cannon AFB Fire Department (FD) contingent be on-site, they will probably respond immediately and, depending on the nature and severity of the event, a Melrose and/or Clovis response team(s) will follow.

- Once a response team arrives, and regardless of the origin, on-site control of the event will be assumed by the responding Crew Chief, Incident Commander, or other person in charge.

All 911 calls made from cellular phones are answered by CLOVIS Dispatch. (Land line 911 calls with a 784 exchange are answered by the Cannon AFB FD Dispatch, but the response process is similar.)

- When making a 911 cell phone call it is important to identify your location as Melrose AFR.

- Supply the Dispatcher with requested information and Dispatcher will pass the information to the appropriate response group.

- Follow the Dispatcher's instructions.

- Depending on the nature and severity of the event, the Melrose Emergency Fire or Ambulance and/or Cannon AFB FD will arrive first and the Clovis response team(s) will follow.

- Once a response team arrives, and regardless of the origin, on-site control of the event will be assumed by the responding Crew Chief, Incident Commander, or other person in charge.

In the event of an emergency, when voice communications are not feasible, personnel will use the hand signals presented in **Table 4-6**.

4.13.5 Emergency Response Team

The emergency response team will consist of employees who assume the following roles:

- Emergency care provider(s)
  - Provide First Aid/CPR as needed.
- Communicator
  - The role of the communicator is to maintain contact with appropriate emergency services, providing as much information as possible, such as the number injured, the type and extent of injuries, and the exact location of the accident scene. The communicator should be located as close to the scene as possible in order to transmit to the emergency care providers any additional instructions that may be given by in route emergency services personnel.
- Site Supervisor

– The site supervisor (usually the SHSO) should survey and assess existing and potential hazards, evacuate personnel as needed, and contain the hazard. Follow up responsibilities include replacing or repairing damaged equipment, documenting the incident, and notifying appropriate personnel/agencies described under incident reporting. Further follow up also entails reviewing and revising site safety and contingency plans as necessary.

4.13.6 Medical Emergencies Response Plan

At least two Tidewater employees will hold a current certificate in American Red Cross Standard First Aid and CPR. This training provides six and one-half hours of Adult CPR and Basic First Aid. If a medical emergency exists, consult the emergency phone number list and request an ambulance immediately. Perform First Aid/CPR as necessary, stabilize the injured, decontaminate if necessary, and extricate only if the environment they are in is dangerous or unsafe and only if the rescuers are appropriately protected from potential hazards they may encounter during the rescue. When emergency services personnel arrive, communicate all first aid activities that have occurred. Transfer responsibility for care of the injured/ill to the emergency services personnel.

Injured person(s) will be transported to Plains Regional Medical Center (575-769-2141) near the intersection of Martin Luther King Jr. Blvd. and 21st Street in Clovis. (Cannon AFB's clinic has limited capabilities.) On-site managers/supervisors/foremen are expected to have quick access to emergency contact information for every person in their charge.

The following items and emergency response equipment will be located within easy access at all times:

- First Aid Kit
- Bee Sting and Snake Bite Kit
- Eyewash – A 15-minute eyewash (required if corrosives are present) or an appropriate amount of portable sterile eyewash bottles will be available on site for flushing foreign particles or contaminants out of eyes. The SHSO will demonstrate the proper operation of the unit(s) prior to the start of work.
- Emergency phone numbers list
- Portable radios for emergency communications in remote areas
- Drugs, inhalants, or medications shall not be included in the First Aid Kit.

Supplies should be re-ordered as they are used.

4.13.7 Incident Report

All site injuries and illnesses must be reported to the SHSO and PM immediately following first-aid treatment. Work is to be stopped until the PM or SHSO and Corporate Health and Safety

Officer have determined the cause of the incident and have taken the appropriate action to prevent reoccurrence. Any injury or illness, regardless of severity, is to be reported. Within two working days of any reportable accident, an Accident Notification Form (**Appendix B**) will be completed. Additionally, USACE Engineering Form 3394 (**Appendix B**) must also be completed. Mr. Hugh Hanson will be notified with 24 hours at (575) 784-6031.

In case of an accident, the field crew will "Notify the Contracting Officer as soon as practical, but not later than [four hours], after any accident meeting the definition of Recordable Injuries or Illnesses or High Visibility Accidents with property damage equal to or greater than $2,000.

"Information shall include contractor name; contract title; type of contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and a brief description of the accident (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until a Government investigation team arrives on site and the Government investigation is conducted."

Tidewater written Accident and Injury Reports is located in Section 17 of Tidewater's Corporate Health and Safety Manual in **Appendix B**.

4.13.8 Operation Shutdown

Under certain extreme hazardous situations the SHSO may request that site operations be temporarily suspended while the underlying hazard is corrected or controlled. During operation shutdown, all personnel will be required to stand upwind to prevent exposure to fugitive emissions. The SHSO, with concurrence from the Tidewater Corporate Health and Safety Officer, will have ultimate authority for operations shutdown and restart.

4.13.9 Spill or Hazardous Material Release

Small spills are immediately reported to the SHSO and are dealt with according to the chemical manufacturer's recommended procedures found on MSDSs. Steps will be taken to contain and/or collect small spills for approved storage and disposal.

4.14 SAFETY RECORDKEEPING

The PM and SHSO are responsible for site recordkeeping. Prior to the start of work, they will review this plan; if there are no changes to be made, they will sign the approval form (PM) or acceptance form (SHSO) and forward a copy to the Tidewater Corporate Health and Safety Officer.

All Tidewater personnel and Tidewater subcontractors will review the HASP and sign the Safety Plan Compliance Agreement Sheet in **Appendix B**; copies of these forms will be maintained in the project file.

The SHSO will conduct a Site Safety Briefing in accordance with **Section 4.7.4** and have all attendees sign the form in **Appendix B**; copies will be maintained in the project file.

Any incident or exposure incident will be investigated, and the Incident Report form and ENG 3394 form (see **Appendix B**) (in coordination with the Tidewater SHSO) will be completed and forwarded to the Tidewater PM and Corporate Health and Safety Officer.

All instrument readings and calibrations, PPE use and changes, health and safety-related issues, and deviations from or problems with this HASP will be recorded in the field logbook.

In addition the following safety records shall be maintained in the project files. These records must be available in the event of an internal or external compliance audit.

- Fit test records (if respirators are used)
- Safety training records
- Medical clearance record
- Visitor Log

SECTIONFIVE Project Records and Reporting

Project reporting requirements include preparation of reports that document all field activities completed during groundwater sampling events at Melrose AFR. These will include draft and final deliverable project reports, as well as documents summarizing field activities. These reports will be based on project records that include field logbooks, and records of conversations, meetings, and correspondence.

5.1 FIELD DOCUMENTATION

Tidewater will complete field logbook entries, sample documentation, and DQCRs whenever sampling is performed that will contain QA/QC information pertaining to field activities (see SOP No. 4 in **Appendix A**). DQCRs will be maintained by the Tidewater Field Manager and crosschecked for completeness at the end of each day. They will be signed and dated by individuals making entries and initialed by the Field Manager. Tidewater will submit field documentation with the chemical characterization, and groundwater monitoring reports, or as requested by Melrose AFR.

Field documentation will typically include:

- Summary of work performed
- Deviation from Scope of Work and/or Work Plan
- Problems encountered
- Key personnel changes
- Pertinent on-site instrument measurements and logbook notes
- Records of conversations with Melrose AFR, regulatory agencies, the public, and other individuals or groups on matters related to this contract.

5.2 PROJECT REPORTS

Tidewater will submit draft and final versions of the annual report in accordance with the Scope of Work. The report shall at a minimum include the following elements:

- Evaluation of monitoring well conditions at existing well locations (includes recommendations for well upgrades, replacement, repairs, rehabilitation, and abandonment, as required)
- Field activities and sampling locations
- Hydrogeologic results and evaluation of water levels and groundwater flow directions
- Chemical data results (field and laboratory)
- Data quality review

- Nature and extent of contamination assessment
- Recommendations for the groundwater monitoring program (includes remedial process optimization-type analysis of analytical parameters and wells, as well as an assessment of a telemetry system for groundwater level measurement)

Field documentation including DQCRs and SCFSs

5.3 DATA MANAGEMENT

Groundwater sampling data will be submitted in a format suitable for entry into the Environmental Resources Program Information Management System (ERPIMS) and the Air Force Restoration Information Management System (AFRIMS).

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SOPs Included:

SOP No. 1 Water Level Measurement

SOP No. 2 Monitoring Well Groundwater Sampling

SOP No. 3 Sample Identification, Handling, Documentation, Shipping, and Tracking

SOP No. 4 Equipment and Personnel Decontamination

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1) B.1 – Health and Safety Forms

2) B.2 – Activity Hazard Analyses

3) B.3 – Tidewater Corporate Health and Safety Manual

4) B.4 – Material Safety Data Sheets

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APPENDIX B.1
HEALTH AND SAFETY FORMS

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APPENDIX B.2
ACTIVITY HAZARD ANALYSES

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APPENDIX B.3
TIDEWATER CORPORATE HEALTH AND SAFETY MANUAL

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APPENDIX B.4
MATERIAL SAFETY DATA SHEETS

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FINAL WORK PLAN
ANNUAL GROUNDWATER MONITORING
MELROSE AIR FORCE RANGE
NEW MEXICO

February 2010

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TIDEWATER INC

FEBRUARY 2010

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TIDEWATER INC

FEBRUARY 2010

FINAL WORK PLAN, ANNUAL GROUNDWATER MONITORING, MELROSE AIR FORCE RANGE, NEW MEXICO

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TABLE 1-1
SWMU 114, SWMU 117, SWMU 130, SWMU 131, AND SWMU 132, AND GROUNDWATER QUALITY NETWORK
MONITORING WELLS AND DEPTHS
MELROSE AIR FORCE RANGE, NEW MEXICO

Monitoring Well ID	Well Construction Depth (ft)
Solid Waste Management Unit 114[1]	
M114MW001	182.0
M114MW002	184.0
M114MW003	183.8
M114MW004	183.4
Solid Waste Management Unit 117[1]	
M117MW001	43.2
M117MW002	43.0
M117MW003	43.0
M117MW004	43.3
Solid Waste Management Unit 130[1]	
MAO1MW001	162.4
MAO1MW002	157.0
MAO1MW003	161.0
MAO1MW004	161.9
Solid Waste Management Unit 131[1]	
MAO2MW001D	184.5
MAO2MW001S	49.6
Solid Waste Management Unit 132[1]	
MAO3MW001	42.1
Groundwater Quality Well Network[2]	
MWQ-2	245
MWQ-3	164
MWQ-4	Unknown
MWQ-5	103
MWQ-6	Unknown
MWQ-7	101
MWQ-8	Unknown
MWQ-10	60
MWQ-14	Unknown
MWQ-18	148
MWQ-19	203
MWQ-20	Unknown
MWQ-21	Unknown
MWQ-22	Unknown
MWL-6	Unknown

Notes:

[1]Monitoring well data for SWMUs are from Supplemental Groundwater Sampling Event in 2000 (FW 2003)

[2]Groundwater Quality Well Network only includes wells to be sampled with coordinates. Well depth data is from Melrose AFR monitoring well information (Langman, Gebhardt, and Falk 2004)

ID = Identification
ft = feet

TABLE 2-1
GROUNDWATER MONITORING WELL NETWORK
PROPOSED SAMPLING LOCATIONS AND PARAMETERS
MELROSE AIR FORCE RANGE, NEW MEXICO

Sample Location ID	Sampling Freaquency	Sample ID	Analytical Parameters								
			RCRA, Cyanide, and Major Elements[1]	Mercury[2]	Perchlorate[3]	Alkalinty[4]	Chloride, Nitrate, Nitrite, and Sulfate[5]	Total Dissolved Solids[6]	Field Water Quality Parameters[7]	Field Duplicate Samples[8]	MS/MSD Samples[9]
Groundwater Quality Well Network											
MWQ-2	Annual	MWQ-2	X	X	X	X	X	X	X		X
MWQ-3	Annual	MWQ-3	X	X	X	X	X	X	X		
MWQ-4	Annual	MWQ-4	X	X	X	X	X	X	X		
MWQ-5	Annual	MWQ-5	X	X	X	X	X	X	X		
MWQ-6	Annual	MWQ-6	X	X	X	X	X	X	X	X	
MWQ-7	Annual	MWQ-7	X	X	X	X	X	X	X		
MWQ-8	Annual	MWQ-8	X	X	X	X	X	X	X		
MWQ-10	Annual	MWQ-10	X	X	X	X	X	X	X		
MWQ-14	Annual	MWQ-14	X	X	X	X	X	X	X		
MWQ-18	Annual	MWQ-18	X	X	X	X	X	X	X		
MWQ-19	Annual	MWQ-19	X	X	X	X	X	X	X		
MWQ-20	Annual	MWQ-20	X	X	X	X	X	X	X		
MWQ-21	Annual	MWQ-21	X	X	X	X	X	X	X		
MWQ-22	Annual	MWQ-22	X	X	X	X	X	X	X	X	
MWL-6	Annual	MWL-6	X	X	X	X	X	X	X		
		Totals	15	15	15	15	15	15	15	2	1

Notes:
Sampling locations are the same as 2007 USGS Sampling Locations.
Laboratory analysis will be completed by TestAmerica, Inc. (TestAmerica).

[1] DoD QSM RCRA metals (As, Ba, Cd, Cr, Pb, Se, Ag) and other metals (Ca, Mg, K, Na, Ti) will be analyzed by the laboratory using USEPA Method SW-846 6010C. Cyanide will be analyzed using USEPA Method SW-846 9012. **Samples will be filtered and preserved upon arrival to the laboratory.**

[2] Mercury will be analyzed by the laboratory using USEPA Method SW-846 7470A. **Samples will be filtered and preserved upon arrival to the laboratory.**

[3] Perchlorate will be analyzed by the laboratory using USEPA Method SW-846 6850 or 6860.

[4] Alkalinity will be analyzed by the laboratory using USEPA Method 310.2.

[5] Chloride, nitrate, nitrite, and sulfate will be analyzed by the laboratory using USEPA Method 9056.

[6] Total dissolved solids will be analyzed by the laboratory using USEPA Method 160.1.

[7] Field water quality parameters include: dissolved oxygen, oxidation/reduction potential, turbidity, specific conductance, pH, and temperature.

[8,9] QC duplicates and MS/MSDs will be analyzed for the full analytical suite of parameters.

DoD QSM = Deparment of Defense Quality Systems Manual Final Version 3
ID = identification
MS/MSD = matrix spike/matrix duplicate
QA = quality assurance
QC = quality control
SW-846 = Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, USEPA SW-846, Final Update IV
USEPA = United States Environmental Protection Agency

TABLE 2-2
SWMU 114, SWMU 117, SWMU 130, SWMU 131, AND SWMU 132 GROUNDWATER MONITORING WELLS
PROPOSED SAMPLING LOCATIONS AND PARAMETERS
MELROSE AIR FORCE RANGE, NEW MEXICO

Sample Location ID	Sampling Freaquency	Sample ID	Analytical Parameters										
			VOCs[1]	Explosives[2]	RCRA, Cyanide, and Major Metals[3]	Mercury[4]	Chloride, Nitrate, Nitrite, and Sulfate[5]	Perchlorate[6]	Alkalinity[7]	Total Dissolved Solids[8]	Field Water Quality Parameters[9]	Field Duplicate Samples[10]	MS/MSD Samples[10]
Solid Waste Management Unit 114													
MW-001	Semi-annual	M114MW001	X	X	X	X	X	X	X	X	X		
MW-002	Semi-annual	M114MW002	X	X	X	X	X	X	X	X	X		
MW-003	Semi-annual	M114MW003	X	X	X	X	X	X	X	X	X	X	
MW-004	Semi-annual	M114MW004	X	X	X	X	X	X	X	X	X		
Solid Waste Management Unit 117[A]													
MW-001	Semi-annual	M117MW001	X	X	X	X	X	X	X	X	X		
MW-002	Semi-annual	M117MW002	X	X	X	X	X	X	X	X	X		
MW-003	Semi-annual	M117MW003	X	X	X	X	X	X	X	X	X		
MW-004	Semi-annual	M117MW004	X	X	X	X	X	X	X	X	X		
Solid Waste Management Unit 130													
MW-001	Semi-annual	MAO1MW001	X	X	X	X	X	X	X	X	X	X	X
MW-002	Semi-annual	MAO1MW002	X	X	X	X	X	X	X	X	X		
MW-003	Semi-annual	MAO1MW003	X	X	X	X	X	X	X	X	X		
MW-004	Semi-annual	MAO1MW004	X	X	X	X	X	X	X	X	X		
Solid Waste Management Unit 131[B]													
MW-001D	Semi-annual	MAO2MW001D	X	X	X	X	X	X	X	X	X		
MW-001S	Semi-annual	MAO2MW001S	X	X	X	X	X	X	X	X	X		
Solid Wastemanagement Unit 132[C]													
MW-001	Semi-annual	MAO3MW001	X	X	X	X	X	X	X	X	X		
		Totals[17]	15	15	15	15	15	15	15	15	15	2	1

Notes:

Semi-annual sampling frequency will be conducted twice per year (e.g., 15 samples per event, 30 samples per year).
Laboratory analysis will be completed by TestAmerica, Inc. (TestAmerica).

[A] Based on RFI Report Addendum, monitoring wells were installed but were dry in 1995 and 2000. Site visit will confirm if these wells can be sampled.
[B] Based on RFI Report Addendum, 2 monitoring wells were installed. Shallow well (MW-001S) was dry in 1995 and 2000. Site visit will confirm if these wells can b sampled.
[C] Based on RFI Report Addendum, 1 monitoring well was installed. It was dry in 1995 and 2000.
[1] DoD QSM VOCs will be analyzed by the laboratory using USEPA Method SW-846 8260B.
[2] Explosives will be analyzed by the laboratory using USEPA Method SW-846 8330B.

[3] DoD QSM RCRA metals (As, Ba, Cd, Cr, Pb, Se, Ag) and other metals (Ca, Mg, K, Na, Ti) will be analyzed by the laboratory using USEPA Method SW-846 6010C. Cyanide will be analyzed using USEPA Method SW-846 9012. **Samples will be filtered and preserved upon arrival to the laboratory.**

[4] Mercury will be analyzed by the laboratory using USEPA Method SW-846 7470A.**Samples will be filtered and preserved upon arrival to the laboratory.**
[5] DoD Bromide, Chloride, Fluoride, Nitrate, Nitrite, and Sulfate will be analyzed by the laboratory using USEPA Method SW-846 9056.
[6] Perchlorate will be analyzed by the laboratory using USEPA Method SW-846 6850 or 6860.
[7] Alkalinity will be analyzed by the laboratory using USEPA Method SW-846 310.1.
[8] Total Dissolved Solids will be analyzed by the laboratory using USEPA Method 160.1.
[9] Field water quality parameters include: dissolved oxygen, oxidation/reduction potential, turbidity, specific conductance, pH, and temperature.

[10] QC duplicates and MS/MSDs will be analyzed for the full analytical suite of parameters.

DoD QSM = Deparment of Defense Quality Systems Manual Final Version 4.1
ID = identification
MS/MSD = matrix spike/matrix duplicate
QA = quality assurance
QC = quality control
SW-846 = Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, USEPA SW-846, Final Update IV
VOC = volatile organic compound
USEPA = United States Environmental Protection Agency

TABLE 3-1
LABORATORY ANALYTICAL METHODS
MELROSE AIR FORCE RANGE, NEW MEXICO

Parameter	Analyte List	Water	Analytical Method
Volatile Organic Compounds	DoD QSM List*	5030B	USEPA SW-846 8260B
Explosives	DoD QSM List**	Method	USEPA SW-846 8330B
RCRA and Major Metals	Project Analyte List***	3010A/7470A	USEPA SW-846 6010C, 7470A
Chloride	Chloride	Method	USEPA SW-846 9056A
Sulfate	Sulfate	Method	USEPA SW-846 9056A
Nitrate	Nitrate	Method	USEPA SW-846 9056A
Nitrite	Nitrite	Method	USEPA SW-846 9056A
Perchlorate	Perchlorate	Method	USEPA SW-846 6860
Hexavlatent Chromium	Hexavlatent Chromium	Method	USEPA SW-846 7196A
Total Cyanide	Total Cyanide	Method	USEPA SW-846 9010B/9012A
Alkalinity	Alkalinity	Method	Standard Methods 2320B
Total Dissolved Solids	Total Dissolved Solids	Method	Standard Methods 2540C

Notes: All metals will be analyzed by USEPA SW-846 Method 6010C and mercury by USEPA SW-846 Method 7470A.
Metals will be filtered and preserved at the laboratory.
*Project Analyte List is shown in Table 3-7
**Project Analyte List is shown in Table 3-8
***Project Analyte List is shown in Table 3-9
Method - Preparation is provided in the method
USEPA SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, USEPA SW-846, Final Update IV.
USEPA - United States Environmental Protection Agency

TABLE 3-2
ACCURACY AND PRECISION FOR VOC AND PERCHLORATE ANALYSIS
MELROSE AIR FORCE RANGE, NEW MEXICO

Spiking Compound	Accuracy (%R)	Precision (RPD)
	Water	Water
1,1,1,2-Tetrachloroethane	80-130	30
1,1,1-Trichloroethane	65-130	30
1,1,2,2-Tetrachloroethane	65-130	30
1,1,2-Trichloroethane	75-125	30
1,1-Dichloroethane	70-135	30
1,1-Dichloroethene	70-130	30
1,1-Dichloropropene	75-130	30
1,2,3-Trichlorobenzene	55-140	30
1,2,3-Trichloropropane	75-125	30
1,2,4-Trichlorobenzene	65-135	30
1,2,4-Trimethylbenzene	75-130	30
1,2-Dibromo-3-chloropropane	50-130	30
1,2-Dibromoethane	80-120	30
1,2-Dichlorobenzene	70-120	30
1,2-Dichloroethane	70-130	30
1,2-Dichloropropane	75-125	30
1,3,5-Trimethylbenzene	75-130	30
1,3-Dichlorobenzene	75-125	30
1,3-Dichloropropane	75-125	30
1,4-Dichlorobenzene	75-125	30
2,2-Dichloropropane	70-135	30
2-Butanone	30-150	30
2-Chlorotoluene	75-125	30
2-Hexanone	55-130	30
4-Chlorotoluene	75-130	30
4-Methyl-2-pentanone	60-135	30
Acetone	40-140	30
Benzene	80-120	30
Bromobenzene	75-125	30
Bromochloromethane	65-130	30
Bromodichloromethane	75-120	30
Bromoform	70-130	30
Bromomethane	30-145	30
Carbon disulfide	35-160	30
Carbon tetrachloride	65-140	30
Chlorobenzene	80-120	30
Chloroethane	60-135	30
Chloroform	65-135	30
Chloromethane	40-125	30
cis-1,2-Dichloroethene	70-125	30
cis-1,3-Dichloropropene	70-130	30
Dibromomethane	75-125	30
Dichlorodifluoromethane	30-155	30
Ethylbenzene	75-125	30
Hexachlorobutadiene	50-140	30
Isopropylbenzene	75-125	30
m & p-Xylene	75-130	30
Methyl tert-butyl ether	65-125	30
Methylene chloride	55-140	30
n-Butylbenzene	70-135	30
n-Propylbenzene	70-130	30
Naphthalene	55-140	30
o-Xylene	80-120	30
p-Isopropyltoluene	75-130	30
sec-Butylbenzene	70-125	30
Styrene	65-135	30
tert-Butylbenzene	70-130	30
Tetrachloroethene	45-150	30
Toluene	75-120	30
trans-1,2-Dichloroethene	60-140	30
trans-1,3-Dichloropropene	55-140	30
Trichloroethene	70-125	30
Trichlorofluoromethane	60-145	30
Vinyl chloride	50-145	30
Perchlorate	80-120	15

Notes: The accuracy and precision values are applicable to MS/MSD and LCS/LCSD samples.

The laboratory will re-analyze the analytical batch if 10% of compounds are outside evaluation criteria or if one compound has a recovery of less than one half the lower limit.

%R - Percent recovery

LCS/LCSD - Laboratory control sample/Laboratory control sample duplicate

MS/MSD - Matrix spike/Matrix spike duplicate

RPD - Relative Percent Difference

TABLE 3-3
ACCURACY AND PRECISION FOR EXPLOSIVES ANALYSIS
MELROSE AIR FORCE RANGE, NEW MEXICO

Spiking Compound	Accuracy (%R) Water	Precision (RPD) Water
1,3,5-Trinitrobenzene	65-140	30
1,3-Dinitrobenzene	45-160	30
2,4,6-Trinitrotoluene	50-145	30
2,4-Dinitrotoluene	60-135	30
2,6-Dinitrotoluene	60-135	30
2-Amino-4,6-dinitrotoluene	50-155	30
2-Nitrotoluene	45-135	30
3-Nitrotoluene	50-130	30
4-Amino-2,6-dinitrotoluene	55-155	30
4-Nitrotoluene	50-130	30
HMX	80-115	30
Nitrobenzene	50-140	30
RDX	50-160	30
Tetryl	20-175	30

Note: The accuracy and precision values are applicable to MS/MSD and LCS/LCSD samples.

%R - Percent recovery

LCS/LCSD - Laboratory control sample/Laboratory control sample duplicate

MS/MSD - Matrix spike/Matrix spike duplicate

RPD - Relative percent difference