DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 49TH WING (ACC)
HOLLOMAN AIR FORCE BASE NEW MEXICO

19 April 2017

ADAM M. KUSMAK, GS-13, USAF
Chief, Installation Management Flight (49 CES/CEI)
49th Civil Engineer Squadron (49 CES)
Holloman Air Force Base, NM

Mr. Chuck Hendrickson, Project Manager
RCRA Corrective Action Section (6MM-RC)
U.S. Environmental Protection Agency
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Hendrickson,

Holloman AFB is pleased to submit Responses to USEPA Comments dated August 10, 2016 regarding the Non-Time Critical Removal Action Work Plan dated July 13, 2016 for the TS851a Former Skeet Range Munitions Response Site at Holloman Air Force Base.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions regarding this submittal, please contact me at (575) 572-6675 or by email at adam.kusmak@us.af.mil.

Sincerely,

KUSMAK.ADAM.M.1263331806
Digitally signed by KUSMAK.ADAM.M.1263331806
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USAF, cn=KUSMAK.ADAM.M.1263331806
Date: 2017.04.26 11:09:54 -06'00'

ADAM M. KUSMAK, GS-13, USAF

Attachment(s): Response to USEPA Comments on *TS851a Former Skeet Range Non-Time Critical Removal Action Work Plan.*

cc:

(w/Atch)
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(w/Atch)
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Common Comment and Response Worksheet (Version 3)

Date	Surveillance Activity Number	Document Title (version)	Contract/TO Number
3/22/2017		TS851a Former Skeet Range QAPP Holloman AFB	FA8903-13-C-0008

Item	Source	Section	Page	Para	Line	Class	Comment	Response
1	USEPA	Exec. Summary				M	The UFP-QAPP is "to outline the Non-Time Critical Removal Action (NTCRA) of polycyclic aromatic hydrocarbons (PAHs)-impacted soils to achieve site closeout (SC)". EPA previously non-concurred with Air Force's April 2014 EE/CA report on this site in a November 26, 2014 comment letter. This UFP-QAPP does not address the deficiencies detailed in that non-concurrence letter, proposing delineation and removal only of PAH-contaminated soils at sub-site TS851a; existing site contamination of skeet shot and target debris should also have been addressed. The work plan is also non-responsive to NMED's letters dated July 14, 2014 and April 26, 2016 regarding this site. This NTCRA work plan will be insufficient to adequately remediate either TS851a or TS851 and thus cannot achieve site closeout.	**Comment noted.** The Air Force is aware of the EPA non-concurrence (dated November 26, 2014) and the NMED disapprovals (dated September 4, 2015 and April 26, 2016) of the 2014 TS851a EE/CA. AF decided to prepare and submit this NTCRA WP for the following reasons: (1) This WP addresses only TS851a MRS and not TS851 MRS which, due to presence of lead shot/clay target debris on the surface of the site, was the main reason EPA and NMED disapproved the previous document (i.e., TS851a EE/CA). (2) The comment # 4 in the EPA non-concurrence letter (dated November 26, 2014) for TS851a EE/CA stated: "As an alternative to such sampling of the entire site, Holloman may wish to consider a presumptive remedy of removal of surface soils for the majority of the shot/skeet contaminated area, with sampling used to define the limits, horizontal and vertical, of necessary removal." This is exactly what AF is proposing to perform during the NTCRA described in this WP for TS851a MRS. All PAH-contaminated soil down to 3 feet depth will be removed during the NTCRA. During this removal, all lead shot, and tagret debris present on the surface of the site will also be removed from TS851a MRS. Please note that independently of the results of the pre-excavation soil sampling along the site boundary (Figure 5 in the NTCRA WP), the soil within the entire boundary of the TS851a MRS will be excavated down to 3 feet and replaced with the clean import soil. (3) NMED requested in their letter dated April 26, 2016 the submission of the NTCRA WP by June 27, 2016. Since all PAH-contaminated soil and lead shot/clay target debris will be removed from this site, The Air Force opinion is that the TS851a MRS will be adequately remediated and can achieve site closeout.
2	USEPA	WS #18				M	Sampling soil over the interval of 0-36" does not seem representative of risk exposure scenarios. If the bulk of the COCs such as PAHs are present in, for example, only the upper 2 or 3 inches of soil, this sampling interval would highly dilute that surface contamination, giving unrepresentatively low results for assessment of exposures to surface soil. The soil sampling interval(s) should be either corrected, clarified and/or justified.	**Agreed.** Since the soil within the entire boundary of the TS851a MRS will be excavated down to 3 feet (independently of pre-excavation soil sampling results), the size of the sampling interval for pre-excavation soil sampling is not so relevant. However, the sampling protocol outlined on Worksheet #18 has been revised to indicate that "pre-excavation" and "disposal characteristic"" samples will be collected from 0 - 18" and 18" - 36". In addition, the "post-excavation" confirmatory samples will be collected from the surface or 0 - 2" of the excavation floor and sidewalls. This change will be reflected throughout the text where applicable**.**

Column B: Source (Commenter/Authority)

Column C: Section Number of Comment

Column D: Page Number of Comment (first page associated with comment)

Column E: Paragraph number, on page, of Comment

Column F: Line Number (within Paragraph above) of Comment

Column G: Comment Classification

Column H: Comment

Column I: Response

(C) Critical: Critical comments will result in a critical issue. Provide convincing support.

(M) Major: Major comments are significant concerns that may result in a major issue. This category may be used with a general statement of concern followed by a detailed comment on the specific entries in the document that, considered in total, constitute the concern.

(S) Substantive: An entry in the document that appears to be or is potentially unnecessary, misleading, incorrect, or confusing.

(A) Administrative: Administrative comments correct inconsistencies between different sections, typographical and grammatical errors.

Notes: Comments must be actionable ("add the following text:…", "delete…", "change text to:")
Place only one comment per row.
Classify comment as C, M, S, or A.

TS851a - FORMER SKEET RANGE

NON-TIME CRITICAL REMOVAL ACTION WORK PLAN

UNIFORM FEDERAL POLICY QUALITY ASSURANCE PROJECT PLAN

HOLLOMAN AIR FORCE BASE
NEW MEXICO

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

Prepared for

AIR FORCE CIVIL ENGINEER CENTER
2261 Hughes Ave., Suite 155
Joint Base San Antonio Lackland, Texas 78236-9853

April 2016~~7~~

Prepared by:

FPM Remediations, Inc.
181 Kenwood Avenue
Oneida, NY 13421

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UFP-QAPP TS851a - Former Skeet Range

Remedial Investigation

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Site:

Former Skeet Range TS851a
Holloman Air Force Base
New Mexico

Author: _____
Peter Corigliano

Title: Site Manager
Date: _____

Submitted to:
Mr. Chuck Hendrickson
USEPA, Region 6 (6PD-F)
1445 Ross Ave, Suite 1200
Dallas, TX 75202-2733

Reviewer: _____
Ivana Raicevic, Ph.D.

Title: Holloman AFB MMRP Installation Manager, FPM
Date: _____

Prepared for:

Air Force Civil Engineer Center (AFCEC)
2261 Hughes Ave., Suite 155
Joint Base San Antonio Lackland,
Texas 78236-9853

Reviewer: _____
Jeffrey B. Hackworth, PGp, PG

Title: MMRP Manager
Date: _____

Prepared by:
FPM Remediations, Inc.
181 Kenwood Avenue, Oneida, NY 13421

July 2016

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Table of Contents

List of Tables

List of Figures

List of Appendices

LIST OF ABBREVIATIONS AND ACRONYMS

amsl	above mean sea level
AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Environmental Excellence
bgs	below ground surface
BNA	Base, Neutral, and Acid
°C	degrees Celsius
CA	Corrective Action
CAS	Chemical Abstracts Service
CCV	Continuing Calibration Verification
CEIE	Civil Environmental and Infrastructure Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CES	Civil Engineer Squadron
CFR	Code of Federal Regulations
CO	Contracting Officer
CoC	Chain of Custody
COD	Coefficient of Determination
COR	Contracting Officer Representative
CSE	Comprehensive Site Evaluation
CV	Calibration Verification
CZRX	Environmental Center of Excellence Restoration - Execution
DD	Decision Document
DERP	Defense Environmental Restoration Program
DFTPP	Decafluorotriphenylphosphine
DGPS	Differential Global Positioning System
DL	Detection Limit
DMM	Discarded Military Munitions
DoD	Department of Defense
DQI	Data Quality Indicator
DQO	Data Quality Objective
EICP	Extracted Ion Current Profile
ERPIMS	Environmental Restoration Program Information Management System
ESS	Enterprise Sourcing Squadron
°F	Fahrenheit
FPM	FPM Remediations, Inc.
ft	foot or feet
H&S	Health and Safety
HAFB	Holloman Air Force Base
HDR	HDR Environmental, Operations and Construction, Inc.
HGL	HydroGeoLogic, Inc
HSP	Health and Safety Plan
ICAL	Initial Calibration
JBSA Lackland	Joint Base San Antonio Lackland
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LOD	Limit of Detection

LOQ	Limit of Quantitation
LTM	Long Term Monitoring
MC	Munitions Constituents
MEC	Munitions and Explosives of Concern
mg/kg	milligram(s) per kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSPP	Munitions Response Site Prioritization Protocol
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NA	Not Applicable
NFA	No Further Action
NMED	New Mexico Environment Department
No.	Number
NTCRA	non-time critical removal action
O&M	Operation and Maintenance
PAH	Polycyclic Aromatic Hydrocarbons
PBR	Performance Based Remediation
PDS	Post Digestion Spike
PE	Performance Evaluation
%	percent
PKB	Environmental Contracting
PM	Project Manager
POC	point of contact
ppm	parts per million
PT	Proficiency Testing
QA	Quality Assurance
QC	Quality Control
QSM	Quality Systems Manual
r	Correlation Coefficient
RF	Response Factor
%R	Percent Recovery
RPD	Relative Percent Difference
RPM	Restoration Program Manager
RRT	Relative Retention Time
RSL	Residential Screening Level
SARA	Superfund Amendments and Reauthorization Act
SC	Site Closeout
Shaw	Shaw Environmental, Inc.
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
TBD	To Be Determined

TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TO	Task Order
USACE	United States Army Corps of Engineers
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
UFP-QAPP	Uniform Federal Policy – Quality Assurance Project Plan
UXO	Unexploded Ordnance
WP	Work Plan
XRF	X-ray fluorescence

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Executive Summary

Introduction

This Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) Work Plan (WP) is prepared to outline the Non-Time Critical Removal Action (NTCRA) of polycyclic aromatic hydrocarbons (PAHs)-impacted soils to achieve site closeout (SC) at Site TS851a Former Skeet Range at Holloman Air Force Base (HAFB) (**Figure 1**).

FPM Remediations, Inc. (FPM) has been contracted by the Air Force Civil Engineer Center (AFCEC) under Contract FA8903-13-C-0008 to conduct Performance Based Remediation (PBR), in compliance with U.S. Environmental Protection Agency (USEPA) and New Mexico Environment Department (NMED) regulatory requirements, at certain sites at HAFB. Signatures for the AFCEC (lead organization) Contracting Officer's Representative Project Manager and the Contracting Officer's Representative Alternate Quality Manager, along with the USEPA (federal regulatory agency) Project Manager, and the HAFB Environmental Restoration Manager are provided on Worksheet #1 and #2 (Title and Approval Page).

The United States Air Force (USAF) defines a site as having achieved SC when all active management and monitoring at the environmental cleanup site have been completed, no additional environmental cleanup funds will be expended at the site, and the USAF has obtained regulatory concurrence. SC occurs when cleanup goals have been achieved in accordance with the final Decision Document (DD) (if regulatory structure[s] require a DD for the site) that allow unrestricted use of the property. That is, no further long term monitoring (LTM) and/or institutional controls (ICs) are required by either the regulator or the USAF and that all site decommissioning has been completed. Achieving SC may include, but not be limited to, the dismantling, removal, recycling, reclamation and/or disposal of all remedial activity systems and ancillary equipment above and underground to return the site to its natural state. Well abandonment and site restoration is to be completed in accordance with Base and regulatory requirements. Regulatory concurrence may include variations such as "no further active remediation", "regulatory closure with restrictions", "conditional site closure" or other functional equivalents. These variations would involve requirements for LTM and would therefore not allow for unrestricted use, and as such is not SC.

The NTCRA for the TS851a Former Skeet Range Site is being performed under the USAF Military Munitions Response Program (MMRP) under the authority of the Defense Environmental Restoration Program (DERP) and in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The Department of Defense (DoD) has established the MMRP under the DERP to address DoD sites with unexploded ordnance (UXO), discarded military munitions (DMM), and munitions constituents (MC) located on current and former military installations.

Site Background

The TS851a Former Skeet Range was originally part of TS851 Munitions Response Area (MRA) (comprised of the TS851, TS851a, and TS851b Munitions Response Sites [MRSs]) and consists

of 3.1 acres, located in the southeastern portion of HAFB. Based on the Modified Comprehensive Site Evaluation (CSE) Phase I Report (Shaw Environmental, Inc. [Shaw], 2010), the outline of what appeared to be a two-position skeet range was visible at this location in a historical U.S. Army Corps of Engineers (USACE) aerial photograph from 1972. The skeet range was used for small arms training and practice with moving targets, and the firing direction of the range appeared to be oriented to the northeast. Typically, skeet ranges were used for training and/or recreational target shooting. Information collected during the Modified CSE Phase I indicated that there is no potential for munitions impacts from the Former Skeet Range beyond the installation boundaries, because the site lies within the boundary of HAFB. No further documentation has been provided regarding the history of munitions-related activities in this area.

During the CSE Phase II visual surveys (HDR Environmental, Operations and Construction, Inc. [HDR], 2013), small arms debris associated with 12-gauge shotgun, 9 millimeter (mm), .38-caliber, and .45-caliber weapons were observed during the visual reconnaissance. Small arms debris associated with 9mm, .38-caliber, and .45-caliber are not typical to skeet range activity. Areas with dense clay target debris were also documented within the typical target fall-out zone for the skeet range. Based on a review of the Final Modified CSE Phase I and CSE Phase II reports, lead shot was observed on the ground surface during the visual survey for the Modified CSE Phase I, and the highest concentration was noted within 500 feet (ft) of the firing points. There was no indication that Munitions and Explosives of Concern (MEC) larger than small arms were present, and the CSE Phase II X-ray fluorescence (XRF) results for lead in the soil were all below the NMED Soil Screening Levels (SSLs) and USEPA Residential Screening Levels (RSL) of <400 milligram per kilogram (mg/kg). During the active time period for the MRA, clay targets contained various PAH compounds. It was found during the CSE Phase II that the PAH concentrations in soils exceeded USEPA RSLs in 9 of the 28 samples.

Based on the CSE Phase II findings, it was recommended that the Former Skeet Range MRA be split into three MRSs (**Figure 2**). TS851 Former Skeet Range MRS (30.8 acres) was recommended for no further action (NFA) due to the lack of MEC and MC exceeding USEPA RSLs. TS851a Former Skeet Range MRS (3.1 acres) was recommended for further munitions response action based on elevated PAH concentrations and visual confirmation of clay target debris. The boundary of TS851a MRS was also adjusted to extend slightly beyond the original MRA boundary to the southwest based on PAH contamination outside the original MRA boundary. TS851b Former Skeet Range MRS was not accessed during the CSE Phase II since the site was occupied by a contaminated soil remediation area and recommended to be administratively closed out of the MMRP. Based on the CSE Phase II results, this NTCRA UFP-QAPP WP addresses the TS851a Former Skeet Range MRS.

The TS851a Former Skeet Range MRS exhibits relatively flat topography (Shaw, 2010). Site features for Site TS851a Former Skeet Range are provided on **Figure 2.**

The vegetation at HAFB is consistent with that of the Tularosa Basin and includes mesquite, creosote bush, and grasses. Succulents such as cactus, agave, and yucca are also present. There are sensitive species that currently receive no federal protection and include: lichen (A. *clauzadeana*), proposed for rare and endangered listing and the grama grass cactus, included due to its former candidate status (HDR, 2013).

There are no structures within the TS851a Former Skeet Range MRS and the area consists of desert scrubland and roads. However, the Fourth Space Command Complex is adjacent to the MRS and

is covered entirely by buildings or pavement, and is encompassed by fencing. Due to the neighboring Fourth Space Command Complex being a high security area, authorization to work in the surrounding areas requires coordination with base security forces and the Fourth Space Command Complex security (Shaw, 2010).

There is no fencing or other access control to the MRS, but access to HAFB requires admittance through the security gate and there is a fence around the entire installation. Therefore, access to the TS851a Former Skeet Range MRS is restricted to the general public, but is open to base personnel, contractors, and base residents. Trespasser access is unlikely due to the security for the Fourth Space Command Complex (Shaw, 2010).

Depth to groundwater in the area ranges from 5 ft to 50 ft below ground surface (bgs). Groundwater flow is generally toward the southwest with localized influences from the variations in base topography with shallower groundwater found on the southern end of the base (HDR, 2013).

Project Organization

This UFP-QAPP is organized into thirty-seven worksheets as specified by Uniform Federal Policy for QAPPs (AFCEE, 2006). The Policy is intended to insure in an orderly fashion, the problem definition, approach to resolving the problem, and quality assurance/quality control (QA/QC) activities to insure that the data collected is usable. The table of contents for this document presents a listing of all the UFP-QAPP Worksheets. The field sampling and reporting portions of the UFP-QAPP will be implemented by qualified FPM staff as identified in UFP-QAPP Worksheets #5, 6 and 7. The laboratory analyses will be conducted by SGS Accutest – Laboratories Inc. Orlando according to DoD Quality Systems Manual (QSM) Version 5.0, July 2013 (DoD, 2013) (UFP-QAPP Worksheet #23).

Scope of Work / Sampling and Analysis

The specific objective of the NTCRA is to eliminate residual PAH contamination above the USEPA RSLs at the TS851a Former Skeet Range MRS. ~~As the USEPA RSLs are more stringent than the NMED SSLs, P~~these ~~values will be used as the p~~roject action limits for removal criteria will be set to the more stringent of either the USEPA RSLs or NMED SSLs. The scope of work is as follows and as presented in Worksheet 17.

- Review of available background data concerning historical site activities and investigations.
- Based on the results of the previous investigations (summarized in **Figures 3** and **4**), collect up to an estimated ~~20~~ 22 soil samples at the site from shallow soil borings (up to ~~an~~ a maximum estimated depth of 3~~2~~ ft bgs) advanced using a hand auger. Detailed soil sampling depths and locations are provided hereafter and methodology is described in Standard Operating Procedure (SOP) Number (No.) 2 (**Appendix A**). Analyze for PAHs using an off-site fixed base laboratory by USEPA SW-846 Method 8270D Selective Ion Monitoring (SIM). Proposed soil sample locations are illustrated in **Figure 5**.
- Analyze an estimated ~~up to 10~~ 10 soil samples from within the proposed excavation area for Toxicity Characteristic Leaching Procedure (TCLP) analysis for disposal characteristics (USEPA SW-846 Method 1311).
- Compare the results to USEPA RSLs (USEPA, 2015) and NMED Soil Screening Levels (NMED, 2017) to determine the excavation boundaries.

- Excavate soil with PAH concentrations exceeding USEPA RSLs. The anticipated Haul Route is illustrated in **Figure 6**.
- Collect confirmatory samples from 0 to 2 inches bgs (analyze for PAHs using an off-site fixed base laboratory by USEPA SW-846 Method 8270D SIM) and backfill/restore site. **Figure 7** illustrates proposed confirmatory sample locations.
- Prepare the After Action Report detailing the removal action, excavated boundaries, all NTCRA field activities, and confirmatory sampling results. The After Action Report will include updated Munitions Response Site Prioritization Protocol (MRSPP) scoring elements.

Project Records and Data Management Plan

FPM will maintain field records sufficient to recreate all sampling and field measurement activities and to meet all Environmental Restoration Program Information Management System (ERPIMS) data loading requirements. The requirements listed in UFP-QAPP Worksheet #18 will apply to all measuring and sampling activities.

Investigation and Interim Measure Soil Removal Waste Management

Investigation and Interim Measure Soil Removal Waste Management is outlined in Worksheet #14. Described activities will be completed in accordance to the Project Health and Safety Plan (HSP) (FPM, 2014).

Introduction

The primary purpose of this Uniform Federal Policy (UFP)-Quality Assurance Project Plan (QAPP) Work Plan (WP) is to present the excavation, site restoration and field sampling activities for the Non-Time Critical Removal Action (NTCRA) at the TS851a Former Skeet Range (**Figure 2**). This NTCRA WP is prepared using the Optimized UFP-QAPP format http://www.epa.gov/fedfac/pdf/ufp_qapp_worksheets.pdf. The scope of work to be completed for this project is summarized in **Table 1**.

Table 1
Holloman AFB PBR
TS851a Former Skeet Range
Scope of Work

Work Element	Monitoring Matrix	Preliminary Site Chemical of Concern	Site Objective
polycyclic aromatic hydrocarbons (PAHs) Contamination Delineation	Soil	PAHs	Establish Excavation Boundaries
NTCRA Field Activities (Soil Removal and Confirmatory Sampling)	Soil	PAHs	Site Closeout

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QAPP Worksheet #1 & #2 – Title and Approval Page

1. Project Identifying Information

    a. Site name/project name: Holloman Air Force Base (HAFB)/Performance Based Remediation (PBR) NTCRA

    b. Site location/number:

    TS851a – Former Skeet Range

    c. Contract/work assignment number: FA8903-13-C-0008; Task Order (TO): Not Applicable (NA)

2. Lead Organization

    a. Lead Organization Project Manager:

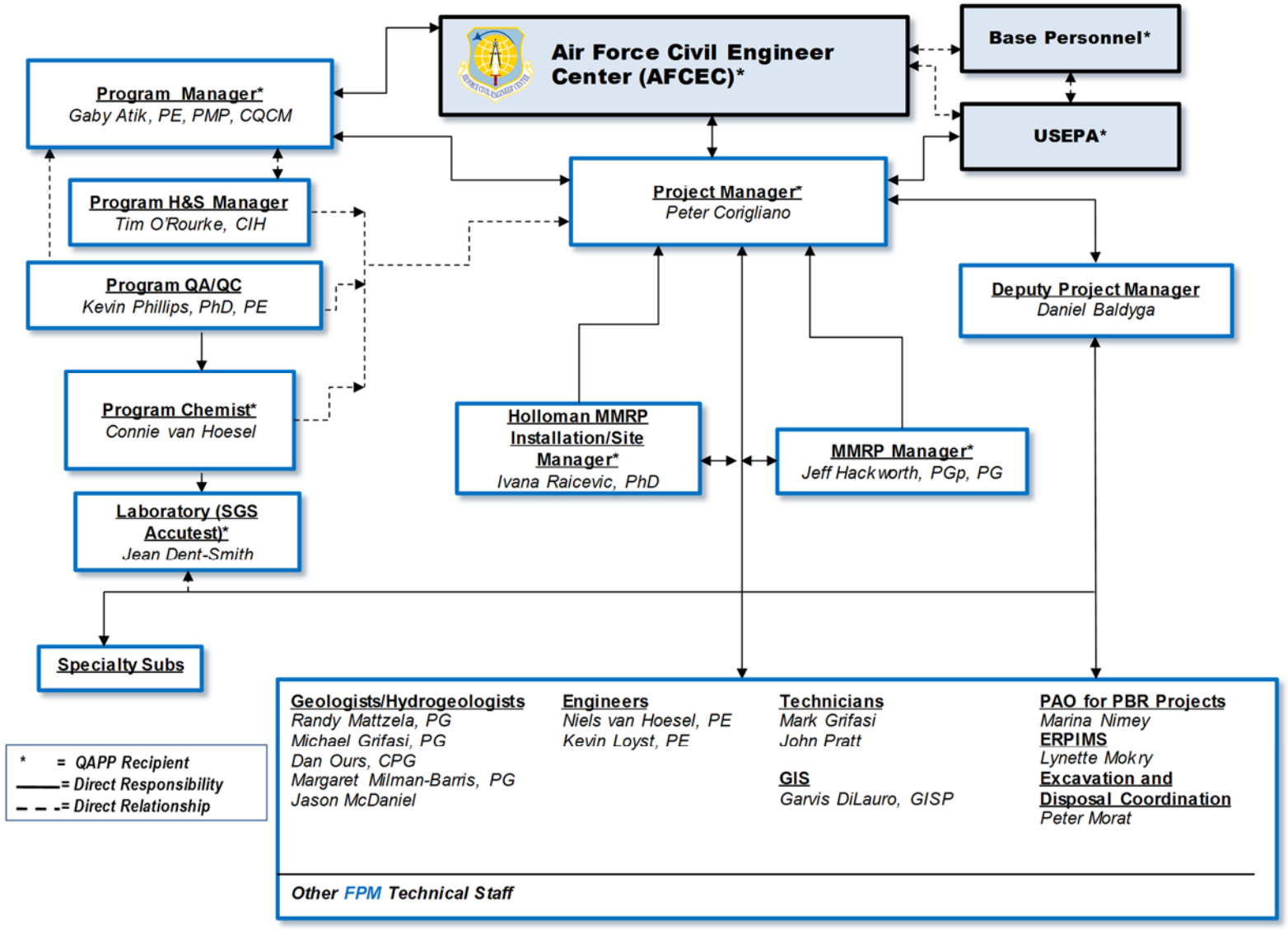
    _____ _____

    Brian Renaghan
    Date
    AFCEC/CZRX

3. Plans and Reports from previous investigations relevant to this project:

Date	Title	Site
2010	Final Report - Modified Comprehensive Site Evaluation (CSE) Phase I, Holloman Air Force Base, New Mexico	Former Skeet Range
2011	Holloman Air Force Base, New Mexico – CSE Phase II Final Work Plan, Military Munitions Response Program.	Former Skeet Range
2011	Basewide Background Study Report, Holloman Air Force Base, NM.	Former Skeet Range
2013	Final Report - CSE Phase II, Holloman Air Force Base, NM.	TS851

QAPP Worksheet #3 & #5 – Project Organization and QAPP Distribution



QAPP recipients' contact information is provided below:

QAPP Recipients	Title	Organization / Address	Telephone Number (No.)	E-mail Address
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Brian Renaghan	Contracting Officer Representative (COR)	AFCEC/Environmental Center of Excellence Restoration - Execution (CZRX)/2261 Hughes Ave., Suite 155, (JBSA Lackland), Texas 78236-9856	210-395-0710	Brian.renaghan@us.af.mil
Rita Leal	Contract Specialist	772 ESS/PKB/2261 Hughes Ave., Suite 163, (JBSA Lackland), Texas 78236-9856	210-395-8228	Rita.leal@us.af.mil
David Griffin	Chief Holloman AFB Environmental	49 Civil Engineer Squadron (CES)/Civil Environmental and Infrastructure Engineering (CEIE)/550 Tabosa Ave Holloman AFB, NM 8830	575-572-5395	David.griffin.5@us.af.mil
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Jeff Hackworth PG	MMRP Manager	FPM/5811 University Heights BLVD., Suite 101, San Antonio, TX 78249	210-495-7744	j.hackworth@fpm-remediations.com
Ivana Raicevic, PhD.	Holloman AFB MMRP Installation Manager	FPM/5811 University Heights BLVD., Suite 101, San Antonio, TX 78249	210-495-7744	i.raicevic@fpm-remediations.com
Jean Dent-Smith	SGS Accutest Laboratories Inc.– Orlando PM	4405 Vineland Road Suite C-15 Orlando, FL 32811	407-425-6700	jeans@accutest.com

QAPP Worksheet #4, #7, & #8 – Personnel Qualifications and Sign-Off Sheet

Organization: AFCEC

Project Personnel	Title	Education/Experience	Specialized Training/Certifications	Signature/Date
Naomi Alvarado	CO			
Brian Renaghan	AFCEC/CZRX – COR			

Organization: Holloman AFB

Project Personnel	Title	Education/Experience	Specialized Training/Certifications	Signature/Date
David Griffin	Chief Holloman AFB Environmental			

Organization: FPM

Project Personnel	Title	Education/Experience	Specialized Training/Certifications	Signature/Date
Gaby Atik, PE, PMP, CQCM	Program Manager	B.S.C.E., Master in Engineering, Engineering Management / Environmental Systems, 20+ years of environmental experience.		
Kevin Phillips Ph.D., PE	Quality Assurance (QA) / Quality Control (QC) Officer	Ph.D. Environmental Engineering, M.S. Hydrodynamics, B.C.E., Civil Engineering. 30+ years of experience	Licensed Professional Engineer in New York, New Jersey, Pennsylvania, Connecticut, Maryland, Massachusetts, Alabama, and Texas	

Project Personnel	Title	Education/Experience	Specialized Training/Certifications	Signature/Date
Jeff Hackworth, PGp, PG	MMRP PM	B.S. Geophysics PG 26+ years of environmental experience	Registered Geophysicist: California Registered Professional Geologist: Tennessee	
Tim O'Rourke, CIH	Health and Safety (H&S) Manager	Certified Industrial Hygienist 15 years' experience		
Connie van Hoesel	Program Chemist/ Chemical QC Manager	M.S. Environmental Engineering, B.A. Chemistry, 12 years' experience		
NTCRA Field Team[1]	NTCRA Field Team Personnel	Various	H&S Training per 29 Code of Federal Regulations 1910.120 Tailgate meeting to discuss daily plans and procedures	

Organization: Laboratory

Project Personnel	Title	Education/Experience	Specialized Training/Certifications	Signature/Date
Jean Dent-Smith	SGS Accutest Laboratory Inc. PM		SGS Accutest Laboratory Inc. is a Department of Defense (DoD) Accredited laboratory. Accreditation certificate is provided in **Appendix B**.	

Notes:
All sampling personnel will be trained using sampling techniques described in the Standard Operating Procedures (SOPs) (**Appendix A**). All field personnel (including sub-contractors) certifications will be electronically retained by FPM for review.

QAPP Worksheet #6 – Communication Pathways

Communication Drivers	Organization	Name	Contact Info	Procedure (timing, pathways, etc.)
Point of contact (POC) with USEPA Region 6	49 CES/CEIE	David Griffin	575-572-5395	Mr. Griffin is the Chief HAFB Environmental
	AFCEC/CZRX - COR	Brian Renaghan	210-395-0710	Mr. Renaghan is the AFCEC COR PM.
Overall Project Management	AFCEC/CZRX - COR	Brian Renaghan	210-395-0710	Mr. Renaghan is the AFCEC COR PM.
Program and Project Activities and Issues	FPM Program Manager	Gaby Atik, PE, PMP, CQCM	315-336-7721	Is the primary interface with AFCEC and ensures performance objectives are met.
Daily Field Progress Reports	Holloman AFB MMRP Installation Manager	Ivana Raicevic, PhD	210-495-7744	Supervises field sampling and Operation and Maintenance (O&M) activities. Authors status and completion reports. Reports to PM and/or AFCEC and HAFB within three days of the change. Once approved, the UFP-QAPP recipients will receive a copy of the change.
Sampling and Remediation Activities	Holloman AFB MMRP Installation Manager	Ivana Raicevic, PhD	210-495-7744	Responsible for all sampling and remediation activities to assure goals are attained. Reports to AFCEC and HAFB daily during field efforts.

Communication Drivers	Responsible Entity	Name	Phone No.	Procedure (timing, pathways, etc.)
Project QA/QC	QA/QC Officer	Kevin Phillips PhD., PE	631-737-6200	Will determine corrective action for field, data interpretation, and reporting issues
Reporting Lab Data Quality Issues	Chemical QC Manager	Connie van Hoesel	315-336-7721	Will determine corrective action for lab data quality issues
Field and Analytical Corrective Actions	Chemical QC Manager	Connie van Hoesel	315-336-7721	Will determine corrective action for field and analytical issues
Release of Analytical Data	Chemical QC Manager	Connie van Hoesel	315-336-7721	No analytical data can be released until it has been reviewed by the Chemical QC Manager and data validation has been completed.
QAPP Amendments	AFCEC/CZRX - COR	Brian Renaghan	210-395-0710	Any major changes to the QAPP must be approved by Brian Renaghan before the changes can be implemented.

QAPP Worksheet #9 – Project Planning Session Summary

No site-specific planning sessions have been held to date, however one will be planned two weeks after the document is submitted for review. Two meetings have been held discussing PBR contract objectives. If any meetings are held with USEPA Region 6, AFCEC, and/or HAFB regarding scoping and/or elements specifically relating to this UFP-QAPP, this worksheet will be revised accordingly.

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QAPP Worksheet #10 – Conceptual Site Model

Site Background

The TS851 Former Skeet Range Munitions Response Area (MRA) (comprised of the TS851, TS851a, and TS851b Munitions Response Sites [MRSs]) consists of 33.9 acres, and is located in the southeastern portion of Holloman AFB. Based on the Modified CSE Phase I report (Shaw Environmental, Inc. [Shaw], 2010), the outline of what appeared to be a two-position skeet range was visible at this location in a historical US Army Corps of Engineers (USACE) aerial photograph from 1972. The skeet range was used for small arms training and practice with moving targets, and the firing direction of the range appeared to be oriented to the northeast. Typically, skeet ranges were used for training and/or recreational target shooting. Information collected during the Modified CSE Phase I indicated that there is no potential for munitions impacts from the Former Skeet Range to be located beyond the site boundaries, because the site lies within the boundary of HAFB. No further documentation has been provided regarding the history of munitions-related activities in this area.

During the CSE Phase II visual surveys (HDR Environmental, Operations and Construction, Inc. [HDR], 2013), small arms debris associated with 12-gauge shotgun, 9mm, .38-caliber, and .45-caliber weapons were observed during the visual reconnaissance. Small arms debris associated with 9mm, .38-caliber, and .45-caliber are not typical to skeet range activity. Areas with dense clay target debris were also documented within the typical target fall-out zone for the skeet range. Based on a review of the Final Modified CSE Phase I and CSE Phase II reports, lead shot was observed on the ground surface during the visual survey for the Modified CSE Phase I, and the highest concentration was noted within 500 feet (ft) of the firing points. There was no indication that Munitions and Explosives of Concern (MEC) was present, and the CSE Phase II X-ray fluorescence (XRF) results for lead in the soil were all <400 milligram per kilogram (mg/kg). During the active time period for the MRA, clay targets contained various PAH compounds. It was found during the CSE Phase II that the PAH concentrations in soils exceeded USEPA Residential Screening Levels (RSLs) in nine of the 28 samples.

Based on the CSE Phase II findings, it was recommended that the Former Skeet Range MRA be split into three MRSs (**Figure 2**). TS851 Former Skeet Range MRS (30.5 acres) was recommended for no further action (NFA) due to the lack of MEC and munitions constituents (MC) exceeding USEPA RSLs. TS851a Former Skeet Range MRS (3.1 acres) was recommended for further munitions response action based on elevated PAH concentrations and visual confirmation of clay target debris. The boundary of TS851a MRS was also adjusted to extend slightly beyond the original MRA boundary to the southwest based on PAH contamination outside the original MRA boundary. TS851b Former Skeet Range MRS was not accessed during the CSE Phase II since the site was occupied by a contaminated soil remediation area and recommended to be administratively closed out of the MMRP. Based on the CSE Phase II results, this NTCRA WP addresses the TS851a Former Skeet Range MRS only and not the TS851 or TS851b MRSs or TS851 MRA.

Physical and Environmental Setting

Structures

There are no structures within the TS851a Former Skeet Range MRS and the area consists of desert scrubland and roads. However, the Fourth Space Command Complex is adjacent to the MRS and contains multiple buildings. Due to the neighboring Fourth Space Command Complex being a high security area, authorization to work in the surrounding areas requires coordination with base security forces and the Fourth Space Command Complex security (Shaw, 2010).

There is no fencing or other access control to the MRS, but access to HAFB requires admittance through the security gate and there is a fence around the entire installation. Therefore, access to the TS851a Former Skeet Range MRS is restricted to the general public, but is open to base personnel, contractors, and base residents. Trespasser access is unlikely due to security for the Fourth Space Command Complex (Shaw, 2010).

Climate

HAFB is located in a semi-arid region within the northern Chihuahuan Desert. The climate is similar to other semi-arid regions with warm to hot summer days, cool nights, and mild winters. Monthly mean high temperatures range from 55 degrees Fahrenheit (°F) in January to 93.6 °F in August. Monthly mean low temperatures range from 29 °F in January to 66 °F in July. Evapotranspiration is usually high due to dry air, large daily solar radiation totals, seasonally high winds, and warm temperatures. Prevailing wind directions lead to seasonal fluctuations in precipitation, and can result in frontal storms from the north, the Pacific, or Caribbean cyclonic systems. HAFB receives an average annual rainfall of 13.20 inches, and approximately half of this falls during the summer monsoons between the months of July and September. These monsoon thunderstorms are usually short and intense, and occurrences are highly variable from year to year. One or two short-term events may account for a large percentage of the net annual precipitation. Average annual snowfall is approximately 4.5 inches (HydroGeoLogic, Inc. [HGL], 2007).

Topography

HAFB lies within the Tularosa basin of south-central New Mexico. The basin is considered a closed basin, because no surface water can run from it. This area is part of the Mexican Highland section of the Basin and is characterized by fault block mountains interspersed with low desert plains and basins. The base lies on relatively flat alluvial plains below the Sacramento Mountains. The White Sands dune field borders the plain on the west. Elevations range from 4,000 to 4,250 ft above mean sea level (amsl) (HDR, 2013).

The location of the TS851a Former Skeet Range MRS exhibits relatively flat topography (Shaw, 2010).

Soil and Vegetation Types

The U.S. Department of Agriculture Soil Conservation Service identified three primary soil types associated with HAFB: several associations and complexes of Holloman, Gypsum Land, and Yesum soils, located in the flats; Dune Land, found in the White Sands dunes; and Mead silty clay loam soil, found in the alluvial floodplains (HGL, 2007). None of the soil types are very productive, due to high gypsum and salt content, and all are highly susceptible to both wind and water erosion when the vegetation is sparse or the soil is exposed (HDR, 2013).

The vegetation at HAFB is consistent with that of the Tularosa Basin and includes mesquite, creosote bush, and grasses. Succulents such as cactus, agave, and yucca are also present. There are sensitive species that currently receive no federal protection and include: lichen (*A. clauzadeana*), proposed for rare and endangered listing and the grama grass cactus, included due to its former candidate status (HDR, 2013).

Geology and Hydrogeology

HAFB is located in the Tularosa Basin, a downfaulted, closed, intermountain basin associated with the southern portion of the Rio Grande Rift. The Sacramento Mountains to the east, San Andres Mountains, and the White Sands National Monument to the west are the prominent features. The Tularosa Basin is thought to have formed approximately 35 million years ago as a result of faulting, with the most recent formational activity having occurred as recently as 10,000 years ago. Erosion of the uplifted material and fluvial deposits from the Rio Grande River resulted in the fill found in the Tularosa Basin, and consist of coarse- to fine-grained alluvial fan deposits along the rims of the basin that gradually become finer-grained alluvial, fluvial, and lacustrine deposits in the basin interior. Extensive evaporate deposits within the interior basin, such as selenite, are also present (HDR, 2013).

Streams that are sustained by groundwater which discharges within the basin include Salt Creek and Malpais Spring. It is estimated that the groundwater resources of the Tularosa Basin contain over 100 million-acre feet of brackish groundwater. A wide range of water chemistries including sodium chloride, carbonate, and sulfate-based brine waters exist in the basin and water with salinity from 1,000 parts per million (ppm) Total Dissolved Solids (TDS), approximately equal to fresh water, to over 20,000 ppm TDS, approximate to sea water, can be found within the basin. The predominance of groundwater occurs as an unconfined aquifer in the unconsolidated deposits of the central basin. The primary source of groundwater recharge is percolation of rainwater and a minor contribution from stream run-off along the western edge of the Sacramento Mountains (HDR, 2013).

Depth to groundwater in the area ranges from 5 ft. to 50 ft. below ground surface (bgs). Groundwater flow is generally toward the southwest with localized influences from the variations in base topography with shallower groundwater found on the southern end of the base (HDR, 2013).

Hydrology

The only permanent water in the Tularosa Basin is found in small streams between Alamogordo and Three Rivers, New Mexico. There are no perennial streams within HAFB or in the nearby surrounding landscape; however, a set of perennial pools exist within the base. They are the final one-third of the Lost River, a set of pools near the confluence of Ritas and Malone Draws, and the Salt Lakes just south of the Lost River and Camera Pad Road Pond. There are at least nine prominent east-west drainages that receive flows during seasonal thunderstorms. The largest of these drainages is the Lost River drainage system, including Malone Draw, Carter Draw, and Ritas Draw. Construction activities have disrupted the natural flow of this wetland ecosystem (HDR, 2013).

There are no wetlands within the TS851a Former Skeet Range MRS (Shaw, 2010).

Sensitive Ecosystems

As of 2010 when the Modified CSE I Report was published, no federally listed species covered under the Endangered Species Act resided at HAFB. Several federally listed species, however, have been observed at the base in the past. Mountain plover (proposed federally threatened) nested at Lake Holloman during the 1980s. Brown pelicans (federally endangered) are occasionally observed at Lake Holloman and associated constructed wetlands. Peregrine falcons (recently delisted) regularly forage at Lake Holloman. Five other sensitive species currently receive no federal protection: a lichen (*A. clauzadeana*), proposed for rare and endangered listing; the grama grass cactus, included due to its former candidate status; the White Sands pupfish, a state-endangered species; the western burrowing owl, a species of concern; and the western snowy plover, also a species of concern.

According to the 2011 Integrated Natural Resource Management Plan, White Sands Pupfish (*Cyprinodon tularosa*) habitat exists at HAFB. This species is considered a Federal Species of Concern (formerly a Federal Category 2 species) and is listed by the State of New Mexico as 'threatened'. The species is managed under the jurisdiction of the New Mexico Department of Game and Fish. There is no potential White Sands Pupfish habitat areas associated with the TS851a Former Skeet Range MRS (HDR, 2013). The MRS does not support suitable habitat for ecologically sensitive species and there are no known ecologically sensitive areas identified within the MRS.

Current and Future Land Use

As previously mentioned the Fourth Space Command Complex is located to the northwest of the TS851a Former Skeet Range MRS, is covered entirely by buildings or pavement, and is encompassed by fencing. The TS851a Former Skeet Range MRS is open space consisting of desert scrubland and dirt roads (HDR, 2013). No future land use changes are anticipated.

Previous Investigations

Two previous investigations, a Modified CSE Phase I Report (USACE, 2010) and an MMRP CSE Phase II Report (HDR, 2013), have been completed at the former TS851 Skeet Range MRA (and subsequently the TS851a Former Skeet Range MRS).

Modified Comprehensive Site Evaluation Phase I - 2010

In support of the MMRP at HAFB, the CSE Phase I was performed to characterize the site; evaluate actual or potential release(s) of hazardous substance(s), pollutant(s), or contaminant(s) to migration/exposure pathways (groundwater, soil, and air) from MRAs; and evaluate associated targets of concern. The Modified CSE Phase I accumulated and evaluated information on HAFB relating to the possible presence of MEC, site physical conditions, and current and future land uses and activities. Information sources included archival records from HAFB, interviews with HAFB personnel, additional archival information collected from public sources, and observations made during the visual surveys. This information was reviewed and used to evaluate the extent of MEC and/or potential for MC exposure at the site (Shaw, 2010).

The TS851 Former Skeet Range MRA was identified using an aerial photograph from 1972, and a visual survey revealed lead shot from small arms, clay target debris typical to the time period, and the remains of at least one firing point. Based on the Phase I findings, a CSE Phase II was recommended (Shaw, 2010).

Comprehensive Site Evaluation Phase II – 2013

The CSE Phase II (HDR, 2013) activities compiled and evaluated information on HAFB relating to the possible presence of MEC and associated soil contamination from MC. The CSE Phase II field investigation occurred from October 2011 to March 2012. During the field investigation visual survey transects were completed within the TS851 Former Skeet Range MRA boundary (**Figure 2)**. The northwestern portion of the MRA was not surveyed due to the Fourth Space Command Complex which is entirely paved and fenced-in. A controlled 30-ft buffer zone was maintained around the fenced area. Additionally, a small portion of the MRA on the eastern range fan was not surveyed due to a fenced petroleum contaminated soil remediation area (HDR, 2013).

Clay target debris was observed within 300 ft of the historical firing points. Two firing points were still discernible; however, all other range infrastructure has been removed. Lead shot was also observed within the area (HDR, 2013). The lead shot and clay target debris observed are consistent with historical skeet range usage. In addition to the aforementioned debris, pistol bullets of 9mm, .38, and .45 calibers were also documented, these are not typically associated with skeet range activities. It was determined that the total area impacted by clay target debris was approximately 3.1 acres.

Surface and subsurface soil sampling was also performed to evaluate potentially impacted environmental media from range related MC. The CSE Phase II Report recommended splitting the MRA into the three following MRSs which were scored individually utilizing the Munitions Response Site Prioritization Protocol (MRSPP). TS851 MRS (30.5 acres) encompasses the portion of the MRA not impacted by PAH or lead contamination. The TS851 MRS received a Priority of 8 (Priority 1 being the highest potential hazard and Priority 8 being the lowest potential hazard). This MRS was recommended for NFA. The TS851a MRS (3.1 acres), delineated based on the visual extent of clay target debris, is defined as the portion of the MRA impacted by MC impacted soil. **TS851a was given a Priority of 5, and is the only MRS that was recommended for further munitions response action.** TS851b MRS (0.3 acres) was not investigated during the CSE Phase II due to access restrictions and an ongoing petroleum contaminated soil staging area. The TS851b Former Skeet Range MRS was administratively closed out of the USAF MMRP (HDR, 2013).

Source, Nature, and Extent of Contamination

Land associated with the TS851a Skeet Range MRS was used as a skeet range. During the use of the site, lead shot, small arms bullets and debris, and clay targets (potentially containing PAH compounds) were deposited on the surface of the skeet range. PAH compounds are considered the primary range-related contaminant which may have been released directly to the soil during the initial deposition activity or through weathering. No MEC was discovered and there were no explosive safety concerns identified during previous investigations. Surface soil sampling for lead during the CSE Phase II showed that lead from small arms ammunition does not pose a risk under any potential land use scenarios.

Previous studies report that the upper limit for background lead concentration at HAFB is 10.87 mg/kg, and the statewide background lead concentrations for New Mexico soils ranges from 7.0 to 21 mg/kg. Of the 68 samples analyzed by the XRF screening during the CSE Phase II (**Figure 3**): 12 samples yielded results below the limit of detection (12 mg/kg); 23 samples yielded results within the state background range, and all other samples (33 samples) yielded results above

background screening limits. The highest reported XRF value was 154 mg/kg. All samples analyzed were below the NMED SSL and USEPA RSL of 400 mg/kg (HDR, 2013).

In addition, at the conclusion of the XRF sampling at MMRP sites during the CSE Phase II, twelve correlation samples were selected and sent to the analytical laboratory to determine whether XRF results can be considered definitive and can be used for decision making purposes. The results of the linear regression analysis for HAFB yield a correlation coefficient of 0.99, indicating that the XRF data may be considered definitive and as a result may be used for remedial decision-making. Therefore, XRF analysis have shown that lead was not a concern for human health or the environment at the MRA (HDR, 2013).

Based on visual locations within the clay target debris area, a total of twenty-eight soil samples were collected for laboratory analysis of PAHs at a fixed-base laboratory. Samples included 20 surface soil, two subsurface soil from the 6-12 inch depth interval, two subsurface soil samples from the 12-18 inch depth interval, and four background surface soil samples. PAHs in soils exceeded the USEPA human health screening levels for at least one of the following analytes; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene in nine of the 28 samples analyzed.

QAPP Worksheet #11 – Project/Data Quality Objectives

1. State the Problem

What are the nature and extent of PAH contamination in the soil at the TS851a Former Skeet Range? Is further action necessary to address residual concentrations of PAHs that may pose a threat to human health or is NFA appropriate?

2. Identify the Goals of the Study

The specific objective of this investigation is to develop a refined and updated understanding of the extent (vertical and horizontal) and distribution of PAHs in soil at the TS851a Former Skeet Range. This information will be used to support a NTCRA.

3. Identify Information Inputs

Soil samples will be collected (locations will be based on previous investigations) and soil samples will be analyzed at an off-site laboratory (SGS Accutest Laboratories, Inc.) for PAHs (USEPA SW-846 Method 8270D Selective Ion Monitoring [SIM]).

4. Define the Boundaries of the Study

The spatial limits of work at TS851a are illustrated in **Figure 2.** Sampling locations (surface soils and subsurface soils to 3 ft bgs) for PAHs are shown in **Figures 4, 5 and 7**.

5. Develop the Analytical Approach

The following decision rules will be utilized to link potential results with conclusions or future actions.

Decision Rule 1. Soil samples from 0 to 3 ft bgs will be collected for PAH analysis to determine the presence of contamination, as follows:

- ***If*** PAHs are detected above the Limit of Detection (LOD) (see Worksheet #15) in a sample, ***then*** it will be determined that the corresponding compound is present and included as a detect in the existing analytical dataset for the site (see Decision Rule 2).
- ***If*** PAHs are not detected above the LOD (see Worksheet #15) in a sample, ***then*** it will be determined that the compound is not present and included as a non-detect in the existing analytical dataset for the site (see Decision Rule 2).

Decision Rule 2. The site will be reassessed based on the existing dataset (comprised of historical and new data) to determine if further action is necessary, as follows:

- ***If*** the concentration of PAHs in soil are less than the respective project action limits (see Worksheet #15), ***then*** it will be determined that no further remedial action is needed.
- ***If*** the concentration of PAHs in soil exceeds the project action limits (see Worksheet #15), ***then*** it will be determined that the associated location will be included with the soil removal delineated boundary (see Decision Rule 3).

Decision Rule 3. Removal of contaminated soil that exceeds the project action limits (see Worksheet #15) with confirmation soil sampling data to determine if additional action is necessary, as follows:

- ***If*** the excavation confirmation concentrations of PAHs in soil are less than the respective project action limits (see Worksheet #15), ***then*** it will be determined that no further remedial action is needed.
- ***If*** the excavation confirmation concentrations of PAHs present in soil are greater than the respective project action limits (see Worksheet #15), ***then*** it will be determined that removal will be required of the material that exceeds the project action limits (see Worksheet #15) (repeat Decision Rule 3).

6. Specify Performance or Acceptance Criteria

Sample analytical results will be compared to the project action limits as shown in Worksheet #15. Worksheet #37 describes the usability assessment of the data. Decision criteria include data quality and usability. To ensure the quality of the data, all data will be reviewed, verified, and validated in accordance with this QAPP. To ensure usability of laboratory data, appropriate laboratory methods have been selected to provide the necessary laboratory detection limits (DLs). Acceptance criteria for the analytical data are listed in Worksheet #28.

7. Develop the Detailed Plan for Obtaining Data

The sampling design and rationale are presented in Worksheet #17. Worksheets #16, #17, and #18 describe the details of the sampling. Worksheets #19, #20, #24-28, and #30 specify analysis design requirements.

QAPP Worksheet #12 – Measurement Performance Criteria

Matrix	**Soil**	**Data qualifier definitions, and full data review/validation criteria are listed in Tables 12-2 and 12-3**			
Analytical Group	**PAHs**				
Conc. Level	**Low to High**				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), and/or Analytical (A)**
SOPs No. 1 and No. 2	USEPA 8270D by SIM/SOP MS008	Precision – Lab	RPD <20 percent (%) Proficiency Testing (PT) sample criteria determined independently by reference laboratory	Matrix Spike (MS)/Matrix Spike Duplicate (MSD), Laboratory Control Sample (LCS)/ Laboratory Control Sample Duplicate (LCSD), and/or Proficiency Testing (PT) Sample	A
			Refer to Worksheet #24	Calibration – Initial and Continuing	
		Precision – Field/Laboratory	If both the parent and duplicate values are > 5x limit of quantification (LOQ), then 30% RPD for aqueous samples, 50% for soil. If either the parent or duplicate value is < 5X the LOQ, then the difference between the parent and duplicate must be < 2X the LOQ.	Field Duplicates	S&A
		Accuracy/Bias	See Table 12-1	LCS, MS/MSD Surrogate spike	A
			Refer to Worksheet #24	Calibration – Initial and Continuing	

QAPP Worksheet #12 – Measurement Performance Criteria

Sampling Procedure[1]	Analytical Method/SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), and/or Analytical (A)
SOPs No. 1 and No. 2 (continued)	USEPA 8270D by SIM/SOP MS008	Accuracy/Bias Contamination	No target compounds > ½ LOQ	Method blanks	A
				Equipment blanks	S&A
		Representativeness	Holding time compliance per 40 Code of Federal Regulations (CFR) 136 and/or method	Holding time	A
		Quantitation Limit	LOQ > LOD LOD & LOQ must be verified quarterly. LODs are verified quarterly per method, matrix, and instrument by analyzing a sample at the LOD concentration.	Standard that is at or below the LOQ as the lowest point on the calibration curve.	A
		Sensitivity	Sample results will be reported to the DL.	Sample results that are less than the LOQ, but greater than the DL, will be reported with a **J**-flag. Quarterly LOD verification.	A
		Completeness	90% for aqueous samples and 95% for soil samples.	Data Completeness Check	S&A

Notes:
[1] Reference No. from QAPP Worksheet #21
[2] Reference No. from QAPP Worksheet #23

Table 12-1
Accuracy and Precision Criteria for Chemical Analysis

Spiking Compound	Accuracy (%R)		Precision (RPD)	
	Aqueous	Soil	Aqueous	Soil
PAHs				
Acenaphthene	48-114	44-111	20	20
Acenaphthylene	35-121	39-116	20	20
Anthracene	53-119	50-114	20	20
Benzo(a)anthracene	59-120	54-122	20	20
Benzo(a)pyrene	53-120	50-125	20	20
Benzo(b)fluoranthene	53-126	53-128	20	20
Benzo(g,h,i)perylene	44-128	49-127	20	20
Benzo(k)fluoranthene	54-125	56-123	20	20
Chrysene	57-120	57-118	20	20
Dibenz(a,h)anthracene	44-131	50-129	20	20
Fluoranthene	58-120	55-119	20	20
Fluorene	50-118	47-114	20	20
Indeno(1,2,3-cd)pyrene	48-130	49-130	20	20
1-Methylnaphthalene	41-115	43-111	20	20
2-Methylnaphthalene	39-114	39-114	20	20
Naphthalene	43-114	38-111	20	20
Phenanthrene	53-115	49-113	20	20
Pyrene	53-121	55-117	20	20
Surrogates:				
Nitrobenzene-d5	55-111	44-125		
2-Fluorobiphenyl	53-106	46-115		
Terphenyl-d14	58-132	58-133		

Notes:
%R – Percent Recovery
RPD – Relative Percent Difference

Table 12-2
Data Qualifier Definitions

Qualifier	Description
J	Estimated. The analyte was positively identified; the quantitation is an estimation due to discrepancies in meeting certain analyte-specific QC criteria, or the concentration is less than the sample limit of quantitation.
UJ	The analyte was not detected. The result is estimated due to discrepancies in meeting certain analyte-specific QC criteria.
B	Blank contamination. The analyte was found in the sample at a concentration similar to that observed in a blank.
R	Rejected. The data are rejected due to deficiencies in meeting QC criteria and may not be used for decision-making.

Table 12-3
Data Review/Validation Criteria for USEPA Method 8270D SIM

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	FPM Flagging Criteria
LOD determination and verification	At initial set-up and subsequently once per 12-month period; otherwise quarterly LOD verification checks shall be performed.	See DoD QSM v 5. LOD verification checks must produce a signal at least 3 times the instrument's noise level.	Repeat detection limit determination and LOD verification check at higher level and set LOD.	LOD is 2-4x the detection limit.	Apply **R**-flag to data without a valid LOD verification
LOQ establishment and verification	At initial set-up and subsequently once per 12-month period; otherwise quarterly LOQ verification checks shall be performed.	See DoD QSM v 5. LOQ must be set within the calibration range prior to sample analysis.	N/A	N/A	N/A
Holding time	Every sample	Soil Semivolatile Organic Compounds (SVOCs): 14 days to extract, 40 days to analysis. Groundwater SVOCs: 7 days to extract, 40 days to analysis.	Contact FPM as to additional measures to be taken.	None	Apply **J**-flag to detects and **UJ**-flag to non-detects to samples < 2X holding time criteria. Apply **J**-flag to detects and **R**-flag to non-detects to samples > 2X holding time criteria.
Sample temperature	Every cooler	4±2 degrees Celsius (°C)	Contact FPM as to additional measures to be taken.	None	Samples arriving at temperature 6-10°C, apply **J**-flag to detects and **UJ**-flag to non-detects. Samples received at temperature > 10°C, **R**-flag all results.
Tuning	Prior to calibration and every 12 hours during sample analysis	Refer to method for specific ion criteria.	Retune instrument and verify. Rerun affected samples.	Problem must be corrected. No samples may be accepted without a valid tune.	Apply **R**-flag to data without a valid tune
Breakdown check (DDT method 8270C only)	At the beginning of each 12-hour period, prior to analysis of samples	Degradation ≤ 20% for DDT.	Correct problem then repeat breakdown check		Apply **R**-flag to data analyzed if DDT degradation is not met.

Minimum five point initial calibration for all analytes (ICAL)	ICAL prior to sample analysis	Each analyte must meet one of the three options below:	Correct problem then repeat initial calibration	Problem must be corrected. No samples may be run until ICAL has passed	Apply **R**-flag to data without a valid ICAL
		Option 1: RSD for each analyte $\leq$ 15%		Minimum 5 levels for linear and 6 levels for quadratic.	Apply **R**-flag to data without a valid ICAL
		Option 2: linear least squares regression $r^2 \geq 0.99$		If the specific version of a method requires additional evaluation (e.g., RFs or low calibration standard analysis and recovery criteria) these additional requirements must also be met.	
		Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.			
Second source calibration verification	Once after each ICAL	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.	Apply **R**-flag to data without second source verification.
Evaluation of relative retention times (RRTs)	Each sample	RRT of each target analyte in each calibration standard within ± 0.06 RRT units.	Correct problem, then rerun ICAL	Laboratories may update the retention times based on the continuing calibration verification (CCV) to account for minor performance fluctuations or after routine system maintenance.	Apply **R**-flag to data outside retention time window

Manual Integration	All	Acceptance by FPM Chemist	Provide justification for each instance of manual integration	Laboratory will provide chromatograms before and after each manual integration	Apply **R**-flag to all compounds with improper integration
Calibration verification (CV)	Daily before sample analysis; after every 12 hours of analysis time; and at the end of the analytical batch run.	All reported analytes and surrogates within ± 20% of true value. All reported analytes and surrogates within ± 50% for end of analytical batch CCV.	Recalibrate, and reanalyze all affected samples since the last acceptable CCV; or immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and re-calibrate; then reanalyze all affected samples since the last acceptable CCV.	If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Flag all results for the specific analyte(s) in all samples since last acceptable calibration verification.	Apply **J**-flag to detects and **UJ**-flag to non-detects if average RF not met High bias: Apply **J**-flag to detects Low bias: Apply **J**-flag to detects and **UJ**-flag to non-detects
Internal standards verification	In all field samples and standards	Retention time ± 10 seconds from retention time of the midpoint standard in the ICAL; Extracted ion current profile (EICP) area within - 50% to + 100% of ICAL midpoint standard	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples analyzed while system was malfunctioning is mandatory.	Sample results are not acceptable without a valid IS verification.	If corrective action fails in field samples, apply **J**-flag to detects and **UJ**-flag to non-detects to analytes with IS recoveries between 30%-50% or > 150%. Apply **R**-flag to samples with IS recoveries < 30%.
LCS	One per preparatory batch	QC acceptance criteria specified in UFP-QAPP Table 12-1.	Correct, re-prep and reanalyze the LCS and all samples in the associated batch for failed analytes, if sufficient material is available.	Problem must be corrected. Results may not be reported without a valid LCS. Flagging is only appropriate in cases where the samples cannot be reanalyzed.	High bias: Apply **J**-flag to detects. Low bias: Apply **J**-flag to detects and **UJ**-flag to non-detects. Very low bias (%R<30%): Apply **J**-flag to detects and **R**-flag to non-detects.

MS/MSD	One per preparatory batch per matrix	QC acceptance criteria specified in UFP-QAPP Tables 12-1.	Examine the project-specific Data Quality Objectives (DQOs). Contact FPM as to additional measures to be taken.	For matrix evaluation only. If MS results are outside QC limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	For the specific analyte(s) in the parent sample, apply **J**-flag to detects if acceptance criteria are not met. MS/MSD data should not be used alone to qualify data.
Laboratory sample duplicate	One per preparatory batch per matrix (if MS/MSD is not performed)	RPD $\leq$ 20% (sample and sample duplicate)	Examine the project-specific DQOs. Contact FPM as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply **J**-flag to detects if acceptance criteria are not met.	Data shall be evaluated to determine the source of difference. Apply **J**-flag to detects if acceptance criteria are not met.
Surrogate spike	All field and QC samples	QC acceptance criteria specified in UFP-QAPP Table 12-1.	For QC and field samples, correct problem, then re-prep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available. If obvious chromatographic interference with surrogate is present, reanalysis may not be necessary.	Analytes identified in UFP-QAPP Table 12-1.	High bias: Apply **J**-flag to detects Low bias: Apply **J**-flag to detects and **UJ**-flag to non-detects. Very low bias (%R<10%): Apply **J**-flag to detects and **R**-flag to non-detects. For SVOCs, no qualification when only one surrogate is outside QC criteria.
Results reported between DL and LOQ	N/A	N/A	N/A	N/A	Apply **J**-flag to all results between DL and LOQ.
Field Duplicate	One per 10 field samples	See UFP-QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2).	N/A	N/A	Apply **J**-flag to detects and **UJ**-flag to non-detects.

QAPP Worksheet #13 – Secondary Data Uses and Limitations

Data Type	Data Source	How Data Will Be Used	Limitations on Data Use
Soil Data	Holloman Air Force Base, Basewide Background Study Report, 2011, NationView, LLC., NMED.	To assess potential areas of contamination and focus data collection activities in specific site areas where contamination is most likely. To determine if further soil sample collection appears warranted or to establish contamination/excavation boundaries.	Secondary data may not meet all DQOs, and, therefore, may not be able to be used without limitation.
Soil Data	Holloman Air Force Base, Comprehensive Site Evaluation Phase II Report, September 2013, HDR. Historical maps, records, and various documents relating to historic site use, CSE Phase I information, soil sample collection and contamination delineation. USACE and HDR Environmental, Operations and Construction, Inc.		

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QAPP Worksheet #14 and #16 – Project Tasks & Schedule

The project schedule is provided in **Appendix C.**

Summary of Project Tasks

Sampling Tasks (Performed by FPM)**:**

- Specific discussion of the sampling approach and sampling design and rationale is provided in Worksheet #17.
- Soil sampling will assess the absence or presence of contamination. Soil sampling will assess the effectiveness of excavations removing residual contamination. Sample locations will be surveyed using Differential Global Positioning System (DGPS) equipment.
- Samples will be collected using the SOPs attached as **Appendix A** of this UFP-QAPP.

Analysis Tasks (Performed by SGS Accutest Laboratories, Inc):

- SGS Accutest Laboratories, Inc. will analyze samples for PAHs using USEPA SW-846 Method 8270D SIM.

QC Tasks – All Projects:

1. MS/MSDs will be collected at an approximate frequency of 5%.
2. Duplicates will be collected at a rate of 10% and analyzed by SGS Accutest Laboratories, Inc. to assess field and laboratory precision.
3. Equipment blanks will be collected from each type of non-disposable, decontaminated sampling device.
4. Laboratory performance evaluation samples will be collected at each site to assess the laboratory's ability to provide defensible data of a known quality.
5. Data validation will be conducted on 100% of all analytical data collected.

Secondary Data – All Projects:

Previously collected data will be evaluated. Secondary data may not meet all DQOs, and, therefore, may not be able to be used without limitation. See Worksheet #13.

Summary of Project Tasks

Data Management Tasks – All Projects: Data will be delivered in an ERPIMS database compatible format after data verification/validation have been performed and data qualifiers have been added.
Waste Management Tasks – All Projects: 1. Soils sampled but not used for laboratory analysis will be containerized in 55 gallon Department of Transportation approved drums. Soils contained in 55 gallon drums will be characterized for proper disposal off site. Decontamination water (if non disposable sampling equipment is used) will also be collected in drums and analyzed for disposal off site.
Documentation and Records – All Projects: 1. All field documentation will be recorded in indelible ink in bound field books. These will summarize all daily field activities, weather conditions, personnel present, visitors, etc. All samples collected will be documented as to their location, which will be measured using a DGPS. Each day's samples and associated field measurements shall be recorded on field sampling forms. Chain of Custody (CoC) forms, bills of lading, airbills, and sample logs will be prepared and retained for each sample. 2. A copy of the final UFP-QAPP will be retained in a central project file (electronically on a server) and in print form in the onsite office, as well as in the Administrative Record.
Data Packages – All Projects: SGS Accutest Laboratories, Inc. will provide data packages in accordance with those identified in DOD QSM 5.0, Appendix A, Stage 4 or CLP-Like deliverables, which contain the information necessary for independent, third-party data validation.
Assessment / Audit Tasks – All projects: Field Sample Collection and Documentation Audits: to be determined (TBD)

Summary of Project Tasks

Data Review Tasks – All projects

1. For the samples, SGS Accutest Laboratories, Inc. will verify that all data are complete for samples received. All data package deliverable requirements will be met. Data will be 100% verified by FPM in accordance with this UFP-QAPP. A data verification report will be prepared for each lab work order (lab data package).

2. Verified and validated data and all related field logbooks/notes/records will be reviewed to assess total measurement error and determine overall usability of the data for project purposes. Data limitations will be determined and data will be compared to Project Quality Objectives and required Action Limits. Corrective Action will be completed as necessary. Final validated data are placed in the ERPIMS database, with any necessary qualifiers and tables, charts and graphs generated.

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QAPP Worksheet #15 – Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Soils

Analytical Group: PAHs (SW-846 Method 8270D SIM)

Concentration Level: Low to Medium

Analyte	Chemical Abstracts Service (CAS) No.	USEPA Screening Levels[1] Residential Soil (mg/kg)	NMED Hazardous Waste Bureau Residential Soil SSL (mg/kg)[2]	Achievable Laboratory Limits[3]	
				Level of Detection (LOD) (mg/kg)	Limit of Quantitation (LOQ) (mg/kg)
Acenaphthene	83-32-9	3,60060	3,480	0.033	0.067
Acenaphthylene	208-96-8	NA	NA	0.033	0.067
Anthracene	120-12-7	18,0800	17,400	0.033	0.067
Benzo(a)anthracene	56-55-3	0.16	1.5348	0.007	0.013
Benzo(a)pyrene	50-32-8	0.016	1.0.153	0.007	0.013
Benzo(b)fluoranthene	205-99-2	0.16	1.53	0.007	0.013
Benzo(g,h,i)perylene	191-24-2	NA	NA	0.007	0.013
Benzo(k)fluoranthene	207-08-9	1.6	15.3	0.007	0.013
Chrysene	218-01-9	16	153	0.007	0.013
Dibenz(a,h)anthracene	53-70-3	0.016	0.153	0.007	0.013
Fluoranthene	206-44-0	2,40040	2,320	0.033	0.067
Fluorene	86-73-7	2,40040	2,320	0.033	0.067
Indeno(1,2,3-cd)pyrene	193-39-5	0.16	1.53	0.007	0.013
1-methylnaphthalene	90-12-0	18	NA	0.007	0.013
2-methylnaphthalene	91-57-6	240	NA	0.007	0.013
Naphthalene	91-20-3	3.8	49.71,160	0.007	0.013
Phenanthrene	85-01-8	NA	1,740	0.007	0.013
Pyrene	129-00-0	1,800	1,740	0.007	0.013

Notes:

[1] May 2016 USEPA Regional Residential Screening Levels.

[2] NMED Soil Screening Levels ~~February~~ March 2012~~7 (updated July 2015)~~.

[3] Achievable LODs and LOQs are limits that an individual laboratory can achieve when performing a specific analytical method.

NA - Not Applicable

QAPP Worksheet #17 – Sampling Design and Rationale

The Holloman TS851a Former Skeet Range proposed pre-excavation and confirmation sampling locations are shown in **Figures 5 and 7**, respectively. Site specific details are provided below. All field parameter measurements will be documented in the daily chemical QC reports which will be included as part of the After Action Report.

Soil samples will be collected to further delineate soil contamination above USEPA residential screening levels for PAHs. Toxicity Characteristic Leaching Procedure (TCLP) samples will also be collected and analyzed to determine disposal characterization. Results will be used to determine if additional actions are necessary at the site. Previously collected background soil sample data will be used during data evaluation to determine potentially impacted soil areas. This information will be provided in the After Action Report.

Former Skeet Range TS851a

Utilizing historical data, ~~approximately 1~~ shallow soil samples will be collected from areas previously identified as containing clay target debris and areas containing PAH contamination based on skeet range lead shot dispersion. Proposed sample locations are shown on **Figures 5** (pre-excavation) **and 7** (confirmation) and historical sample locations and associated data is shown on **Figures 3** (lead sampling locations) **and 4** (PAH sampling locations). Results will be used to delineate impacted areas at the site.

Soil Sampling

Soil samples will be collected at depth intervals ranging from 0 to 36 inches bgs as specified on Worksheet #18 depending on the location and historical sample data from the adjacent area. Samples will be analyzed for PAHs by USEPA Method 8270D SIM. Results from laboratory analysis will be used to determine if the areal extent of contamination has been determined, or if further delineation is necessary.

QAPP Worksheet #18 – Sampling Locations and Methods

Sampling Location	Matrix	Depth (inches)	Analytical Group	Concentration Level	No. of Sample Locationss[1]	Sampling SOP Reference	Rationale for Sampling Location
TS851a Former Skeet Range – Pre-excavation	Soil	0 – ~~36~~18 and 18 – 36	PAHs	Low-to-Medium	11	SOP No. 1 and No. 2	To determine the vertical and areal extent of residual soil contamination.
TS851a Former Skeet Range – Post-excavation[2]	Soil	0 – ~~36~~2	PAH	Low-to-Medium	17	SOP No. 1 and No. 2	Confirmatory sampling to ensure residual contamination has been excavated.
TS851a Former Skeet Range (disposal characteristic)	Soil	0 – 18 and 18 – 36~~36~~	TCLP	Low-to-Medium	5	SOP No. 1 and No. 2	Disposal Characteristics

Notes:
[1] Proficiency Testing and split samples will be collected as specified by AFCEC.
[2] The number of post excavation confirmatory samples may vary based on the boundary and volume of the excavations.

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QAPP Worksheet #19 & #30 – Sample Containers, Preservation, and Hold Times

Laboratory: SGS Accutest Laboratories, Inc., 4405 Vineland Road, Suite C-15 Orlando, FL 32811, Jean Dent-Smith jeans@accutest.com,
407-425-6700.

List any required accreditations/certifications: DoD Environmental Laboratory Accreditation Program accreditation, compliant with the most recently published version of the DoD QSM Version 5.

Backup-up Laboratory: None

Sample Delivery Method: FedEx

Data Package Turnaround: 20 Days

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[1]	Sample Volume[2]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[3] (preparation / analysis)
Soil	PAH	SW-846 8270D SIM/MS008/OP007	30 grams	(1) 8 ounce jar	Cool, 4 °C	14 days to extraction / 40 days for analysis
Soil	TCLP PAHs	SW-846 1311/OP040/MS008	30 grams	(1) 8 ounce jar	Cool, 4 °C	180 days to TCLP extraction / 180 days for analysis

Notes:
[1] Refer to the Analytical SOP References table (Worksheet #23).
[2] The minimum sample size is based on analysis allowing for sufficient sample for reanalysis. Additional volume is needed for the laboratory MS/MSD sample analysis.
[3] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

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QAPP Worksheet #20 – Field QC Summary

Matrix	Analytical Group	No. of Field Samples[2]	No. of Field Duplicate Samples[3]	No. of Matrix Spikes[4]	No. of Matrix Spike Duplicates[4]	No. of Blanks (Trip)[5]	No. of Equipment Blanks[6]	No. of Proficiency Testing Samples	Total No. of Samples
Soil	PAH	11	1	1	1	0	0	As specified by AFCEC	14
	PAH	17	2	1	1				21
	TCLP	20	0	0	0				20
							0		55
								Total[7]	55

Notes:
[1] Specify the appropriate reference letter or No. from the Analytical SOP References table (Worksheet #23).
[2] The No. of samples collected may vary depending on field conditions.
[3] Total No. of field duplicate samples will meet project goal of 10%.
[4] Total MS/MSD Samples will meet project goal of 5%.
[5] Trip blank samples are not required for coolers containing PAH samples.
[6] Equipment blanks will be collected from non-disposable decontaminated sampling devices at a rate of 1 per day of field sampling only if non-disposable equipment is used.

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QAPP Worksheet #21 – Field SOPs

SOPs are located in **Appendix A**.

Reference No.[1]	Title, Revision Date and / or No.	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP No. 1	Surface and Near Surface Soil Sampling	FPM	Grab/hand auger	N	Includes descriptions and procedures for surface soil sampling.
SOP No. 2	Sub-Surface Soil Sampling	FPM	Hand Auger or Direct Push Rig	N	Includes descriptions and procedures for sub-surface soil sampling.
SOP No. 3	Sediment Sampling	FPM	Grab/hand auger	N	Includes descriptions and procedures for sediment sampling.
SOP No. 4	Surface Water Sampling	FPM	Grab	N	Includes descriptions and procedures for surface water sampling.
SOP No. 5	Sample Handling, Documentation, and Tracking	FPM	N/A	N	Includes sample packaging, shipping, and CoC requirements.
SOP No.6	Decontamination	FPM	N/A	N	Includes descriptions and procedures for decontamination of personnel and equipment.
SOP No. 7	Global Positioning System (GPS) Measurements	FPM	GPS units	N	Includes description and procedures for marking data points using GPS units.
SOP No. 8	Equipment Calibration	FPM	Various field parameter measuring equipment	N	Includes descriptions and procedures or calibrating field parameter measuring equipment.

Notes:
[1] FPM SOPs are not project specific, as such the SOP document may include SOPs that are not relevant to the immediate project and/or tasks.

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QAPP Worksheet #22 – Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Calibration Activity	SOP Reference[1]	Responsible Person	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action
Trimble XRT2 and Nomad DGPS	No daily calibration activity. Initial receiver settings are programmed by manufacturer	SOP No. 7	Field personnel	Verify real-time location with base map on receiver and determine accuracy	Observe displayed location and actual location.	Daily	Within 0.5ft if static.	Manufacturer service

Notes:
[1] The Project Sampling SOP References table is found on Worksheet #21.

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QAPP Worksheet #23 – Analytical SOPs

Laboratory SOPs are located in **Appendix B**.

SOP Reference No.	Title, Revision Date, and / or No.	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	Modified for Project Work? (Y/N)
OP007	Extraction of Semi-volatile Organics (BNAs) from Solid Samples, Aug 2013	Definitive	Soil/Prep Method	Sonic Disruptor	No
OP040	Toxicity Characteristic Leaching Of Semivolatile Organics And Metals (TCLP), Aug 2014	Definitive	Soil Leachate/TCLP Procedure Metals SW-846 1311	TCLP Tumbler	No
MS008	Analysis of Semivolatile Organics by method 8270D SIM, November 2015	Definitive	Semivolatiles SW-846 8270D SIM	HP6890/5973, HP6890/5975	No

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QAPP Worksheet #24 – Analytical Instrument Calibration

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Responsible Person	SOP[1]
HP6890/5973HP6890/5975	Semivolatiles, SW-846 8270D SIM, 5 points minimum	Major maintenance (per method) or second consecutive failure of opening CCV warrants recalibration	Each analyte must meet one of the three options: Option 1: CAL %RSD for each analyte ≤ 15%; Option 2: linear least squares regression for each analyte: r2 ≥ 0.99; Option 3: non-linear least squares regression (quadratic) for each analyte: r2 ≥ 0.99.	Instrument maintenance, standard inspection, retuning and recalibration Reanalyze samples affected by failing CCVs	Laboratory Analyst	MS008

Notes:
[1] The Analytical SOP References table is found on Worksheet #23.

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QAPP Worksheet #25 – Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Reference SOP[1]
HP5890/5973 HP6890/5975	Injector port, column maintenance, source cleaning	SW-846 8270D SIM	Leak test, column and injector port inspection, source insulator integrity	Need for maintenance determined by passing calibration and Decafluorotri-phenylphosphine (DFTPP) – see MS008	Passing DFTPP and CCV, passing Internal Standard response	Column clipping and/or reconditioning, seal and liners replacement, filaments and insulators as needed	Laboratory Analyst	MS008

Notes:
[1] The Analytical SOP References table is found on Worksheet #23. Laboratory Standard Operating Procedures are subject to revision and updates during duration of the project, lab will use the most current revision of the SOP at the time of analysis.

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QAPP Worksheet #26 & #27 – Sample Handling, Custody, and Disposal

Sampling Organization: FPM Remediations, Inc.

Laboratory: SGS Accutest Laboratories, Inc.

Method of sample delivery: FedEx

Number of days from reporting until sample disposal: 30

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference
Sample Labeling	FPM Remediations Inc., Field Personnel	SOP #5
CoC Form Completion	FPM Remediations Inc., Field Team Leader	SOP #5
Packaging	FPM Remediations Inc., Field Personnel	SOP #5
Shipping Coordination	FPM Remediations Inc., Field Personnel	SOP #5
Sample Receipt, Inspection, & Log-in	SGS Accutest Laboratories Inc., Randy Shields	SGS Accutest Laboratories Inc., SOPs MS008 and OP040
Sample Preparation and Determinative Analysis	SGS Accutest Laboratories Inc., Mark Erstling (Organics)	SGS Accutest Laboratories Inc., SOPs MS008 and OP040
Sample Custody and Storage	SGS Accutest Laboratories Inc., Randy Shields	SGS Accutest Laboratories Inc., SOPs MS008 and OP040
Sample Disposal	SGS Accutest Laboratories Inc., Randy Shields	SGS Accutest Laboratories Inc., SOPs MS008 and OP040

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QAPP Worksheet #28 – Analytical Quality Control and Corrective Action

Matrix	Leachate
Analytical Group	PAHs
Analytical Method / SOP Reference	EPA SW-846 8270D SIM/MS008

QC Sample	Frequency / No.	Method / SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch	<1/2 RL	The source of the contamination is investigated and eliminated before proceeding with further analysis. Corrective actions are: 1.-Samples ND – report with qualification 2.-Samples >10X contamination level – report with qualification 3.-Samples <10x contamination – re-extract and reanalyze. Insufficient sample - qualify and footnote	Analyst/Prep analyst	Absence of interference/ contamination	No target compounds > ½ LOQ

QAPP Worksheet #28 – Analytical Quality Control and Corrective Action

Laboratory Control Sample (LCS)	1 per extraction batch	%Recovery = (Calculated Value/True Value) *100%; acceptance limits listed in Table 12-1	Source of poor recovery is investigated and eliminated before proceeding with further analysis, corrective actions are: 1. Biased high, samples ND – report with qualifications. 2. Biased low – re-extract and reanalyze. Insufficient volume – qualify and footnote	Analyst/Prep analyst	Laboratory Accuracy/Method bias in ideal matrix	%Recovery = (Calculated Value/True Value) *100%; acceptance limits listed in Table 12-1
Matrix Spike (MS)	1 per 20 samples or one for each extraction batch	%Recovery = (Calculated Value - Sample Value/True Value) *100%; acceptance limits listed in Table 12-1	If the recoveries indicate that the problem is procedure related, re-extraction and re-analysis is required. If the recoveries indicate that the failures are matrix-related, refer to Blank Spike as measure of method performance in clean matrix. The project Chemist will be contacted and a decision will be made to either report the data as is with a notation in the analytical narrative or if the samples should be re-extract and re-analyzed.	Analyst/Prep analyst	Precision and Accuracy in field samples	%Recovery = (Calculated Value - Sample Value/True Value) *100%; acceptance limits listed in Table 12-1

QAPP Worksheet #28 – Analytical Quality Control and Corrective Action

Matrix Spike Duplicates (MSD)	1 per 20 samples or one for each extraction batch	%Recovery = (Calculated Value – Sample Value/True Value) *100%; acceptance limits listed in Table 12-1 RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2 acceptance limits listed in Table 12-1	See above	Analyst/Prep analyst	Precision and Accuracy in field samples	%Recovery = (Calculated Value – Sample Value/True Value) *100%; acceptance limits listed in Table 12-1 RPD (%) = [(XA-XB)/ XM] * 100 Where: XA and XB are the concentration in the MS and MSD, and XM is the average value of the concentrations in the MS and MSD, (XA + XB)/2 acceptance limits listed in Table 12-1
Surrogate Spikes	Every sample	%Recovery = (Calculated Value/True Value) *100%; acceptance limits listed in Table 12-1	Reason for poor recoveries is investigated and eliminated before further analytical activities. Corrective actions are: 1.-High bias, samples ND – report with qualification. 2.-Low bias – re-extract and reanalyze. Insufficient volume – qualify and footnote	Analyst/Prep analyst	Individual sample preparation efficiency control	%Recovery = (Calculated Value/True Value) *100% acceptance limits listed in Table 12-1

QAPP Worksheet #28 – Analytical Quality Control and Corrective Action

Internal standards (IS)	Every sample	IS Area = -50% to +100% of CCV	If failure is due to instrument performance issues, the problem must be identified, corrected, and the sample must be re-analyzed. If no instrument problem is found the sample must be re-analyzed. If upon re-analysis the responses are still not within limits, the problem may be considered sample matrix interference	Analyst	Instrument sensitivity control	Detector Stability

QAPP Worksheet #29 – Project Documents and Records

Project Documents and Records:

Record	Generation	Verification	Storage location/archival
Field logbook and data collection sheets	FPM Field Team Leader	FPM Site Manager, Peter Corigliano	Project file and Electronic Storage, FPM office
Daily field reports			Electronic storage in project files, FPM office
Chain of Custody form	FPM Field Staff	FPM Site Manager, Peter Corigliano and SGS Accutest Laboratories Inc., Randy Shields	Project file and Electronic storage, FPM office and SGS Accutest Laboratories, Inc. permanent project records folder
Custody seals			Not stored; condition upon cooler receipt recorded on Sample Receiving Checklist
Sample labels			Not stored
Air bills	FPM Field Staff and Shipper (FedEx)	FPM Field Team Leader	Project file, FPM office
Deviations	FPM Field Team Leader and FPM Site Manager, Peter Corigliano	FPM Project Manager	Project file and Electronic Storage, FPM office
Corrective Action Reports	FPM Project Manager, Peter Corigliano	COR	Project file, FPM office
Correspondence among project team	Various	N/A	Electronic storage in project files, FPM office

Project Assessments:

Record	Generation	Verification	Storage location/archival
Field audit checklists	FPM Site Manager, Peter Corigliano	FPM Project ManagerJeff Hackworth	Project files and electronic storage, FPM office
Data Packages	SGS Accutest Laboratories, Inc. analytical personnel, Mark Erstling (Organics), Dave Metzgar (Metals)	SGS Accutest Laboratories, Inc. Project Manager, Jean Dent-Smith	
Data verification checklists	FPM Chemical QC Manager, Connie van Hoesel	FPM Project/Site Manager, Peter Corigliano	
Data validation report			
Data usability assessment report			

Laboratory Records

Record	Generation	Verification	Storage location/archival
Shipping Receipt or Freight Bill	SGS Accutest Laboratories, Inc. Sample Receiving personnel, Randy Shields	SGS Accutest Laboratories, Inc. Project Manager, Jean Dent-Smith	Initially stored in SGS Accutest Laboratories, Inc. permanent project records folder; after job completion & invoicing, stored in ERPIMS
Sample Receiving Checklist			
Condition Upon Receipt Anomaly Form			
Priority form			
Chain of Custody form	FPM Field staff	SGS Accutest Laboratories, Inc. Sample Receiving personnel, Randy Shields	Stored in SGS Accutest Laboratories, Inc. permanent project records folder and in the Project file and Electronic Storage at FPM's office
Internal Chain of Custody Report	SGS Accutest Laboratories, Inc. Sample Receiving personnel, Randy Shields	SGS Accutest Laboratories, Inc. Project Manager, Jean Dent-Smith	SGS Accutest Laboratories, Inc. electronic storage and ERPIMS

Record	Generation	Verification	Storage location/archival
Raw data files	SGS Accutest Laboratories, Inc. analytical personnel, Mark Erstling (Organics), Dave Metzgar (Metals)		
Final analytical report			
Other vital records (*e.g.*, instrument maintenance records, QA records)	SGS Accutest Laboratories, Inc.	SGS Accutest Laboratories, Inc.	SGS Accutest Laboratories, Inc. Warehouse

Laboratory Data Deliverables

Record	SVOCs
Cover sheet, Table of Contents, and Case Narrative	x
CoC	x
Analytical Results and Sample Management Records	x
QA/QC Results, Instrument QA/QC Information, Instrument Preparation logs	x
Instrument Quantitation Reports	x
Instrument Chromatograms and Spectra	x

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QAPP Worksheets #31, #32, & #33 – Assessments and Corrective Action

Assessments:

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Review field documentation (log book, field forms, COC forms, etc.)	FPM Project Manager, Peter Corigliano	As work progresses	Will be included in the After Action Report	Marked-up copy of document provided to Field team leader; notify FPM Project Manager	See Worksheet #16
Field sampling audit	FPM Project Manager, Peter Corigliano	Once	TBD	Email or verbal report to describe the deviation from QAPP	Within 2 days of finding deficiency
Internal laboratory assessment	SGS Accutest Laboratories, Inc. Project Manager, Jean Dent-Smith	Once	TBD	Documented in the laboratory report	2 weeks
External AFCEC laboratory audit	AFCEC	Once	TBD	AFCEC report on laboratory assessment	Within 7 days of assessment

QAPP Worksheets #31, #32, & #33 – Assessments and Corrective Action

Assessment Response and Corrective Action:

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Review Field Documents (Logbooks, Sampling Logs, and CoC forms)	Marked up copy of document	Peter Corigliano, FPM	Within 24 hours of finding deficiency	Review of corrected documentation	Field Team Leader, FPM, and Peter Corigliano, FPM	24 hours after notification
Field Sampling Audit	E-mail or verbal report to detail the deviation from QAPP	Peter Corigliano, FPM	Within 2 days of the start of sampling	E-mail and/or phone log	Field Team Leader, FPM, and Peter Corigliano, FPM	2 days
Internal Laboratory Assessment	Lab Report to detail project deviations	SGS Accutest Laboratories, Inc. PM	Within 5 days of sample analysis	Documented in the lab report	SGS Accutest Laboratories, Inc. QA Manager	2 weeks
External AFCEC Laboratory Assessment	AFCEC findings of Laboratory project deviations	Project Chemist, FPM and SGS Accutest Laboratories, Inc. Laboratory Manager	Within 7 days of analysis	AFCEC Report on Laboratory Assessment	Peter Corigliano, FPM, AFCEC, and SGS Accutest Laboratories, Inc. Laboratory	4 weeks

QAPP Worksheet #34 – Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (Conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
Field Records			
5	Field log books	X	X
6	Chain-of-custody forms	X	
7	Groundwater purge logs	X	X
8	Equipment calibration records	X	X
9	Relevant correspondence	X	X
10	Field audit reports	X	X
11	Field corrective action reports	X	X
Analytical Data Package			
12	Cover sheet (laboratory identifying information)	X	X
13	Case narrative	X	X
14	Internal laboratory chain-of-custody	X	X
15	Sample receipt records	X	X
16	Sample chronology	X	X
17	Communication records	X	X
18	LOD/LOQ establishment and verification	X	X
19	Standards traceability	X	X
20	Instrument calibration records	X	X
21	Definition of laboratory qualifiers	X	X
22	Results reporting forms	X	X
23	QC sample results	X	X
24	Corrective action reports	X	X
25	Raw data	X	X
26	Electronic data deliverable	X	X

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QAPP Worksheet #35 – Data Verification Procedures

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field log book	QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including QC samples were collected and that sample collection locations are documented. Verify that changes or exceptions were documented and reported.	Daily – Site Manager
CoC forms	QAPP	Verify the completeness of chain-of-custody forms. Examine entries for consistency with the field logbook. Verify that the required volume of sample has been collected. Verify that sample IDs and analytes are correct and legible. Verify that all required signatures and dates are present.	Daily – Field team leader At conclusion of sampling event – Site Manager and Project Manager
Laboratory deliverable	QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Compare the data package with the chain-of-custody forms to verify that results were provided for the correct analytes for all the collected samples. Check the sample receipt records to ensure sample condition upon receipt was noted. Review the narrative to ensure that all QC exceptions are described	Before sending to FPM – Laboratory QA Manager Upon receipt –Chemical Project QA Manager
Audit Reports, Corrective Action Reports	QAPP	Verify that all planned audits were conducted. Examine any audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Project QA Manager

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QAPP Worksheet #36 – Data Validation Procedures

Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator
Soil	PAHs and TCLP	Low-to-High	DoD QSM 5	Connie van Hoesel, FPM Chemical QC Manager
Soil	PAHs and TCLP	Low-to-High	QAPP Worksheets #12, #15 and #24. QAPP Tables 12-1 through 12-3	Connie van Hoesel, FPM Chemical QC Manager

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QAPP Worksheet #37 – Data Usability Assessment

A complete (100%) data review will be performed on the samples collected during the sampling event. The review will consist of verification and validation based on completeness and compliance checks of sample receipt conditions and both sample-related and instrument-related QC results, as addressed in Worksheet #12. Any flags that limit the usability of the data shall be applied to all associated samples; flags are listed in Table 12-2.

The Data Usability Assessment will be performed by FPM personnel (Connie van Hoesel, FPM Chemical QC Coordinator). Note that the Data Usability Assessment will be conducted on verified/validated data. After the Data Usability Assessment is completed, data deemed appropriate for decision-making purposes will be used to assess contaminant extents at this site at HAFB. The results of the Data Usability Assessment will be presented in the After Action Report. The following items will be assessed and conclusions drawn based on their results.

Precision: Results of field duplicates will be presented separately in tabular format for each sample pair when results are reported above the LOD. For each field duplicate pair, the results will be assessed as stated in Table 12-3. MS/MSD RPDs are calculated by the laboratory and those with RPDs outside the criteria established in Table 12-1 will be listed in tabular form in the data verification report. A discussion will follow summarizing the results of the laboratory precision. Any conclusions about the precision of the analyses will be drawn and any limitations on the use of the data will be described.

Accuracy/Bias Contamination: Results for all laboratory method blanks will be evaluated and analytes detected in these blanks will be listed in tabular form in the data verification report. Laboratory data will be qualified based on the criteria listed in Table 12-3. A discussion will follow summarizing the results of the laboratory accuracy/bias. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described.

Overall Accuracy/Bias: Results for all LCS, surrogate and MS/MSD recoveries that are outside evaluation criteria will be presented in tabular format in the data verification reports. The results will be checked versus the criteria listed in Table 12-1. A discussion will follow summarizing the overall accuracy/bias. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn and any limitations on the use of the data will be described.

Performance Evaluation: PE samples will be evaluated and if discrepancies are discovered they will be investigated and the effect on field sample results will be determined and discussed with FPM, SGS Accutest Laboratories, Inc., and AFCEC. A discussion of PE sample results will be included with QC sample discussion and aid in data defensibility. If results from PE samples are outside the expected values, an investigation will be completed to determine the source of the discrepancy. A corrective action report will be prepared to document the results of the investigation and to address whether re-sampling or reanalysis is required. If the cause is determined to also affect all samples that were collected, then an evaluation of the reliability of the field sample results will be made and reported in the data usability assessment and After Action Report.

Representativeness: Representativeness is a qualitative measure of the degree to which data accurately and precisely represent a characteristic of a population, and is mainly addressed in the

sample design. A measure of representativeness can also be obtained by assessing holding times and blank data. Any conclusions about the representativeness of the samples will be drawn and any limitations on the use of the data will be described.

Comparability: In accordance with this UFP-QAPP, the data are comparable when collection techniques, measurement method and reporting procedures are the same for each data set.

Completeness: A completeness check will be performed on all data generated by the laboratory. Completeness criteria are presented on Worksheet #12. Completeness will be calculated as the No. of data points for each analyte that is deemed usable (not rejected) divided by the total No. of data points for each analyte. A discussion will follow summarizing the results of the calculation of data completeness. Any conclusions about the completeness of the data will be drawn and any limitations on the use of the data will be described. Data completeness addresses only those samples that are collected and only data that is analyzed by the laboratory.

Graphics: Figures and maps will be prepared showing the site specific sampling locations and results.

Reconciliation: Each of the measurement performance criteria listed in Worksheet #12 will be examined to determine if the objective was met. Each analysis will be evaluated separately in terms of the major impacts observed from the data verification/validation, DQIs and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Usability of the data will be based on the quality assessment. After establishing the usability of the data, it will be determined if the DQO was met and if project action limits were met. The final report will include a summary of all points that comprised the reconciliation of each objective. Any conclusions or limitations on the usability of any of the data will be described.

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FIGURES

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