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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

QUALITY PROGRAM PLAN
FOR REMEDIAL CONSTRUCTION AT SITE RW-06

April 2009

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2050 Wyoming Blvd. SE
Kirtland AFB, New Mexico 87117-5270

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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

QUALITY PROGRAM PLAN
FOR REMEDIAL CONSTRUCTION AT SITE RW-06

April 2009

Prepared for

Air Force Center for Engineering and the Environment (AFCEE)
3300 Sidney Brooks
Brooks City- Base, Texas

Contract No. FA8903-04-D8693
Delivery Order 0005

Prepared by

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12000 Crownpoint Drive, Suite 150
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NOTICE

This Quality Program Plan (QPP) was prepared for the Air Force Center for Engineering and the Environment (AFCEE) by Cabrera Services, Inc. (CABRERA) to present the vision for implementation of activities required to locate, excavate, package, transport, and dispose of radiological and chemical waste materials located in nine trenches and five surficial hot spots at Site RW-06, Radioactive Burial Site 11, also known as Solid Waste Management Unit (SWMU) 6-30, in accordance with Worldwide Environmental Restoration And Construction (WERC) Contract FA8903-04-8693-0005 for Kirtland Air Force Base, New Mexico, under the base's Environmental Restoration Program (ERP). This project also includes a post-remediation Final Status Survey (FSS) of the site. The limited objectives of this document and the ongoing nature of the ERP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this plan, as subsequent facts may become known that may make this report premature or inaccurate.

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13. ABSTRACT

This QPP, WP, FSP, and SSHP presents relevant information about the excavation, segregation, waste stream characterization and transportation and disposal for the remediation of Site RW-06 in accordance with Section F.2 of Module IV of the EPA, Region 6, Hazardous Waste Permit (Identification No, NM9570024423) for Kirtland Air Force Base, New Mexico, under the base's Environmental Restoration Program (ERP).

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40 CFR 270.11

DOCUMENT CERTIFICATION

APRIL 2009

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To be provided in final document

_____

Ludie W. Bitner YF-02

Chief, Restoration Section

This document has been approved for public release.

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Juventino R. Garcia, GS-13, DAF

377 ABW Public Affairs

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NATURAL RESOURCE INJURY

The Natural Resource Injury (NRI) program is a mechanism designed to restore natural resources injured by hazardous substance releases. The NRI program measures the extent of injury to natural resources and determines environmental pathways, necessary restoration measures, costs, and liability. The NRI requires parties responsible for contamination and injuries to pay for losses. In certain cases, restoration may include replacement or acquisition of equivalents for habitats; populations of wildlife; and human services, including hunting, fishing, and recreational activities.

The NRI program is carried out by various federal, state, and tribal trustees for fish, wildlife, other living resources, water, lands, and protected areas. Trusteeship is derived from treaties (federal and tribal), statutes (federal and state), and other regulations. Federal agencies responsible for land management include the National Park Service; United States Fish & Wildlife Service; Bureau of Land Management; United States Department of Agriculture, including the United States Forest Service; Department of Defense; and the Department of Energy.

The NRI program has established a restoration fund to be used to restore resources lost or injured by the release of hazardous materials and oil spills. The NRI program has been traditionally associated with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). CERCLA directed the Department of Interior to prepare rules for NRI at hazardous waste sites and for emergency incidents involving CERCLA substances. The integration of the NRI with the Resource Conservation and Recovery Act (RCRA) is currently being considered by the Department of Defense under the proposed Range Rule.

CERCLA and RCRA provide tools to clean up contaminants from the environment. However, these cleanup programs focus on human health and environmental concerns related to human health. The programs are primarily carried out by the U.S. Environmental Protection Agency (EPA) working with the states. These programs do not concentrate on restoring natural resources, although cleanup may prevent further injuries to natural resources. The CERCLA and RCRA programs often do not deal with downstream and offsite contaminated sediments outside National Priority List and Solid Waste Management Unit boundaries. With regard to injuries to natural resources, CERCLA states the following: 1) responsible parties are liable for compensatory damages for injuries to natural resources owned, managed, or controlled by government agencies or Indian tribes; 2) government agencies and Indian tribes may assess and collect the damages, acting on behalf of the public as trustees for the injured natural resources; and 3) recovered damages must be used to restore, rehabilitate, replace, or acquire the equivalent of the injured natural resources. Therefore, the NRI program was established to ensure restoration and compensation where needed and appropriate.

Conclusions and Recommendations:

The RW-06 SWMU at Kirtland Air Force Base is unlikely to require an NRI program. Previous recommendations from the Resource Conservation and Recovery Act Facility Investigation Report for Solid Waste Management Unit 6-30, Radioactive Burial 11 (RW-06) in October 2007 included excavation of nine disposal trenches, waste segregation, and transport and disposal of chemical and radiological wastes to appropriate off-site disposal facilities.

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ENVIRONMENTAL JUSTICE CONSIDERATION

Presidential Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* requires identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority and low-income populations. For purposes of this report, the population within a 50-mile radius around Kirtland AFB was considered. Demographic and economic census information presented in *Addressing Environmental Justice under the National Environmental Policy Act at Sandia National Laboratories/New Mexico* was used as a primary reference.

The populations living within a 50-mile radius of Kirtland AFB, which exceed 49 percent of the total population according to census data, are evaluated with regard to health and environmental effects from activities at Kirtland AFB. Similarly, the low-income population, which exceeds 21 percent of the general population, was analyzed for effects from corrective measures activities at Kirtland AFB.

Minority populations are considered to be all *people of all color* except white people who are not Hispanic. In 1990, 49 percent (51 percent by 1996) of New Mexico's population was minority (Census, 1998). Neighborhoods having minority population percentages exceeding the minority population percentage of 49 percent (slightly more conservative than 51 percent) were identified on a block-by-block basis, with clusters of blocks known as block groups.

The Bureau of the Census characterizes persons in poverty (low-income persons) as those whose incomes are less than a statistical poverty threshold. The threshold is a weighted-average based on family size and age of family members. For instance, the 1990 census threshold for a family of four was based on a 1989 household income of $12,674 (Census, 1990). By 1996, the household income threshold rose to $16,036 (Census, 1997). In 1989, 21 percent of New Mexico's population was listed in poverty or designated as having low income (Census, 1996). By 1996, the estimated percentage stood at 24 percent (Census, 1997). In this analysis, low-income block groups (same as above) occur where the low-income population percentage in the block group exceeds the poverty percentage for the state of New Mexico.

According to 1990 census data, approximately 280,360 minority individuals from an approximate total population of 609,500 reside within the 50-mile radius. This represents 46 percent of the total radius-of-influence (ROI) population (SNL, 1997).

Block groups having less than 21 percent low-income individuals were not considered to contain a large number of low-income neighborhoods because they contain less than or equal to the state average of 21 percent. Approximately 85,330 persons were identified as being low income, representing approximately 14 percent of the ROI population.

This distribution of low-income population has a strong correlation to minority populations of Blacks, Native Americans, and Hispanics. For example, portions of the Pueblo of Isleta, south of the city, have high percentages of low-income individuals. To the southeast of Kirtland AFB, the rural Hispanic villages of Tajique, Torreon, and Escobosa are also low income. To the north of Kirtland AFB, high concentrations of low-income populations are located in the Pueblos of Jemez, Santo Domingo, and Cochiti, as well as in the rural Hispanic villages of La Cienega and Jemez Springs. High concentrations of low-income populations occur west of Kirtland AFB, along the Rio Grande, in the predominantly Hispanic South Valley neighborhoods. In addition, small pockets of low-income populations reflect the locations of Black neighborhoods such as the Kirtland Addition and South Broadway/East San Jose area.

The environmental and human health effects considered include potential impacts to surface and groundwater from contamination, restricted access by Native Americans to traditional cultural sites,

biological resources, air quality, and noise. Based on the analysis of any potential impacts, there would be no disproportionately high or adverse impacts to minority and low-income populations.

PREFACE

This Quality Program Plan (QPP) was prepared for AFCEE by CABRERA to present relevant information about the identification of waste trench locations, characterization, excavation, segregation, packaging, transportation and disposal of all waste material located in nine trenches at Site RW-06 in accordance with Section F.2 of Module IV of the EPA, Region 6, Hazardous Waste Permit (Identification No, NM9570024423) for Kirtland Air Force Base, New Mexico, under the base's Environmental Restoration Program (ERP). This work is performed under the authority of the AFCEE WERC contract number FA8903-04-8693, Delivery Order 0005. Mr. Joseph Urrutia is the AFCEE Project Manager for this program.

This program will be conducted under the Kirtland AFB Environmental Restoration Section Chief and Project Manager, Mr. Ludie W. Bitner. Key CABRERA personnel involved in the project include Mr. Mark Tepperman, Professional Geologist (PG), Project Manager; Mr. John Hackett, Certified Health Physicist (CHP), Professional Engineer (PE), Project Engineer; Mr. Paul Schwartz, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP), Corporate Safety Manager; Mr. Hank Siegrist, PE, CHP, Corporate Radiation Safety Officer; and Mr. David Wacker, Senior Scientist. This QPP was prepared by a team of multidisciplinary engineers, compliance, and quality control professionals.

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Mark Tepperman, PG

Project Manager

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ATTACHMENTS

ACRONYMS AND ABBREVIATIONS

ACRONYM / ABBREVIATION	DEFINITION
4WD	four-wheel drive
α	Alpha
β	Beta
σ	Sigma; one standard deviation
µ	Mu; micro
%	percent
µCi	microcurie
µCi/ml	microCuries per milliliter
A	sample activity
ACGIH	American Conference of Government Industrial Hygiene
AEA	Atomic Energy Act
AFB	Air Force Base
AFCEE	Air Force Center For Engineering and the Environment
AFIs	USAF instructions
AFSC	Air Force Safety Center
ALARA	As Low As Reasonably Achievable
^{241}Am	americium-241
ANSI	American National Standards Institute
ASTM	American Society for Test Methods
ATV	all-terrain vehicle
^{198}Au	gold-198
^{140}Ba	barium-140
bgs	below ground surface
BMP	Best Management Practices
BBP	Blood Borne Pathogens
°C	degrees Celsius
^{14}C	carbon-14
^{45}Ca	calcium-45
^{141}Ce	cerium-141
^{143}Ce	cerium-143
cm	centimeters
^{57}Co	cobalt-57
^{137}Cs	cesium-137
CABRERA	Cabrera Services, Inc.
CAD	computer-aided design
CAR	Corrective Action Report
CDC	Center for Disease Control
CDL	Commercial driver's license
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code Of Federal Regulations
CGP	Construction General Permit
CHP	Certified Health Physicist
CIH	Certified Industrial Hygienist
CLASS	Cabrera Large Area Scanning System

ACRONYM / ABBREVIATION	DEFINITION
cm	centimeters
cm^2	centimeter squared
COC	chain-of-custody
COPC	contaminants of potential concern
COR	Contracting Officer's Representative
cpm	counts per minute
CPR	Cardio Pulmonary Resuscitation
^{51}Cr	chromium-51
CRZ	Contamination Reduction Zone
CSP	Certified Safety Professional
CU	counting uncertainty
CV	coefficient of variation
cy	cubic yard
dBA	decibels
DCGLs	Derived Concentration Guideline Levels
decon	decontamination
DGPS	Differential Global Positioning System
dpm	disintegrations per minute
DoD	Department of Defense
DOT	U.S. Department Of Transportation
DQCR	Daily Quality Control Report
DQOs	Data Quality Objectives
DROs	diesel range organics
Earth Worx	Earth Worx Environmental Services, LLC.
EIN	Employer Identification Number
ELQ	exempt and limited quantity
EM	electromagnetic
EM Profiling	electromagnetic induction or terrain conductivity survey
EPA	U.S. Environmental Protection Agency
ERP	Environmental Restoration Program
ERPIMS	Environmental Resources Program Information Management System
ESC	erosion and sediment control
eV	electron voltage
Ez	Exclusion Zone
FIDLER	Field Instrument For The Detection Of Low Energy Radiation
FLM	Field Laboratory Manager
FSP	Field Sampling Plan
FSS	Final Status Survey
ft	foot/feet
FT	Field Technician
FTL	Field Team Leader
g	glass
Geo Solutions	Geo Solutions Limited, Inc.
GIS	Geographic Information System
GM	Geiger-Mueller
GM Pancake	Ludlum 44-9
GPL	off-site laboratory

ACRONYM / ABBREVIATION	DEFINITION
GPS	Global Positioning System
GRO	gasoline range organic
GSAP	Generator Site Access Permit
GTCC	greater than Class C
GWS	Gamma walkover survey
H_0	null hypothesis
^{3}H	tritium
H_a	alternate hypothesis
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	hydrochloric acid
HDPE	high-density polyethylene
^{203}Hg	mercury-203
HP	Health Physics
HPGe	high purity germanium
HSM	Health and Safety Manual
HTRW	Hazardous Toxic and Radioactive Waste
Hz	hertz
^{59}I	iodine-59
^{131}I	iodine-131
ICM	Interim Corrective Measure
ID	identification
IDW	investigation derived waste
IMCs	intermodal containers
IRS	U.S. Internal Revenue Service
IU	instrument uncertainties
JMC	Joint Munitions Command
kHz	kilohertz
^{85}Kr	krypton-85
^{88}Kr	krypton-88
^{140}La	lanthanum-140
L	liter
LBGR	Lower Bound Gray Region
Lc	Critical Value
LCS	Laboratory Control Samples
LDM	Laboratory Data Manager
LIMS	Laboratory Information Management System
LLRW	low level radioactive waste
LLRMW	mixed Class A LLRW and RCRA hazardous waste
LQAC	Laboratory Quality Assurance Coordinator
LQAM	Laboratory Quality Assurance Manual
LQAP	Laboratory Quality Analysis Plan
LTs	Laboratory Technicians
LTM	long-term monitoring
m	meter
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols
MARSSIM	Multi Agency Radiation Survey and Site Investigation Manual
ml	milliliter

ACRONYM / ABBREVIATION	DEFINITION
MCA	multi-channel analyzer
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDL	Method Detection Limits
MeV	megaelectron Volts
MFEM	multi-frequency electromagnetic
MFP	mixed fission products
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
min	minute
MQO	measurement quality objectives
mrem/yr	millirem per year
MSDS	Materials Safety Data Sheet
MSG	Mission Support Group
MS/MSDs	Matrix Spike/Matrix Spike Duplicates
NAD 83	North American Datum
NaI	sodium iodide
^{95}Nb	niobium-95
nCi	nanocuries
NELAC	National Environmental Laboratory Accreditation Conference
NIST	National Institute Of Standards And Technology
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollution Discharge Elimination System
NRI	Natural Resource Injury
NRC	Nuclear Regulatory Commission
OLM	On-site Lboratory Manager
OSHA	Occupational Safety and Health Administration
OVM	organic vapor monitor
P	polyethylene
PC	Project Chemist
PC	personal computer
PCBs	polychlorinated biphenyls
pCi	picocurie
pCi/g	picoCuries per gram
PDF	Portable Document Format
^{144}Pe	praseodymium-144
PE	Professional Engineer
PG	Professional Geologist
PID	Photoionization Detector
PM	Project Manager
POC	Point-of-Contact
Poly	Polyethylene
PPE	personal protective equipment

ACRONYM / ABBREVIATION	DEFINITION
Ppm	parts per million
PSD	parallel swathing device
PSN	Proper Shipping Name
PTL	Project Team Lead
PU	preparation uncertainties
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCM	Quality Control Manager
QPP	Quality Program Plan
^{226}Ra	radium-226
^{228}Ra	radium-228
RA-C	Remedial Action Construction
RAM	radioactive material
RC	Remedial Constructors
RCOC	radiological contaminants of concern
RCRA	Resource Conservation and Recovery Act
RE	relative error
REGe	reverse electrode germanium
RFI	RCRA Facility Investigation
RIC	USAF Radioisotope Committee
RLs	Reporting Limits
ROC	radionuclide of concern
ROIs	regions of interest
ROPC	radionuclides of potential concern
RPD	relative percent differences
RPP	Radiation Protection Plan
RSD	relative standard deviations
RSI	Radiation Solutions Incorporated
RSO	Radiation Safety Officer
RSP	Radiation Safety Program
^{103}Ru	ruthenium-103
^{106}Ru	ruthenium-106
RUSLE	Revised Universal Soil Loss Equation
RWP	Radiation Work Permit
S	standard deviation
SAP	Sampling and Analysis Plan
SDC	Site Data Coordinator
SEDD	Staged Electronic Data Deliverables
S&H	Safety and Health
SNL/NM	Sandia National Laboratory/New Mexico
SNM	Special Nuclear Material
SOHM	Safety & Occupational Health Manager
SOP	Standard Operating Procedure
SOR	Sum of the Ratios
SOW	statement of work
sq ft	square feet

ACRONYM / ABBREVIATION	DEFINITION
sq m	Square meter
^{89}Sr	strontium-89
^{90}Sr	strontium-90
SRM	Site Remediation Manager
SRSL	Site Radiation Safety Lead
SSLs	soil screening levels
SRSO	Site Radiation Safety Officer
SSHO	Site Safety And Health Officer
SSHP	Site Safety And Health Plan
SU	survey units
SVOCs	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
SWPPP	Storm Water Pollution Prevention Plan
SZ	Support Zone
T&D	transportation and disposal
TAL	target analyte list
TAT	turnaround time
TBD	to be determined
TCLP	Toxicity Characteristic Leaching Procedure
TEDE	Total Effective Dose Equivalent
^{228}Th	thorium-228
^{230}Th	thorium-230
^{232}Th	thorium-232
^{234}Th	thorium-234
^{235}Th	thorium-235
Tl	thallium
TLD	Thermoluminescent Dosimeter
TLVs	Threshold Limit Values
TPU	Total Propagated Uncertainty
TRU	transuranic
^{234}U	uranium-234
^{235}U	uranium-235
^{238}U	uranium-238
USAF	United States Air Force
USEI	US Ecology of Idaho
UT	Utah
UTM	Universal Transverse Mercator
UV	ultraviolet
VOCs	Volatile Organic Compounds
W_R	Wilcoxon Rank Sum test statistic
WAC	Waste Acceptance Criteria
WERC	Worldwide Environmental Restoration And Construction
WP	Work Plan
WRS	Wilcoxon Rank Sum
WQS	water qualifying standards
XRF	x-ray fluorescence
^{89}Y	yttrium-89

ACRONYM / ABBREVIATION	DEFINITION
^{90}Y	yttrium-90
YU	yield uncertainty
^{65}Z	zinc-65
ZnS	zinc sulfide
^{95}Zr	zirconium-95

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1.0 INTRODUCTION

This document was prepared for the Air Force Center for Engineering and the Environment (AFCEE) by Cabrera Services, Inc. (CABRERA) to guide the remediation and Final Status Survey (FSS) to obtain closure for Site RW-06, Radioactive Burial 11, also known as Solid Waste Management Unit (SWMU) 6-30 (hereafter referred to as RW-06 or the Site) at Kirtland Air Force Base (AFB), New Mexico. The project is being conducted in accordance with Worldwide Environmental Restoration and Construction (WERC) Contract FA8903-04-8693, Task Order 0005, under the Kirtland AFB Environmental Restoration Program (ERP).

1.1 Purpose and Objectives

This Quality Program Plan (QPP) presents the overall vision for implementation of activities required to locate, excavate, segregate, characterize, stage, transport, and dispose of all waste material located in 9 trenches and 5 discrete surficial contaminated spots at RW-06. In addition, the QPP provides guidance for demonstrating compliance with clean up requirements and conducting a radiological Final Status Survey. Activities described in this QPP are consistent with the AFCEE Statement of Work (SOW), dated 23 April 2008, and the CABRERA proposal, dated 26 June 2008, implementing the 2007 RCRA Facility Investigation (RFI) recommendation to excavate and dispose of all waste associated with historical United States Air Force (USAF) activities at the RW-06 site.

This QPP together with the attached Work Plan (WP), Sampling and Analysis Plan (SAP, including the Field Sampling Plan [FSP] and Quality Assurance Project Plan [QAPP]), and the Site Safety & Health Plan (SSHP) comprise the documents implementing the RFI recommendations and are required reading for CABRERA staff participating in this work effort. The documents shall be readily available to the field team while field activities are being conducted.

1.2 Quality Program Plan Organization

The QPP presents the project background, organization, methods, procedures, facilities and reporting requirements that will be implemented to complete remediation, including a Multi Agency Radiation Survey and Site Investigation Manual (MARSSIM) Final Status Survey (FSS) in accordance with USAF and MARSSIM guidelines, while maintaining a safe and productive work environment. The QPP describes the overall plan for conducting the FSS and remedial action at RW-06 in accordance with the AFCEE Statement of Work (SOW) entitled, *Remedial Action Construction at RW-06, Radioactive Burial Site 11 at Kirtland Air Force Base, New Mexico* (Project Number MHMV20087027), dated 23 April 2008. The following project-specific technical plans are included as attachments to the QPP:

- WP at Attachment I
- SAP at Attachment II
  - FSP at Attachment IIa
  - QAPP at Attachment IIb
- SSHP at Attachment III

A comprehensive list of acronyms and list of references for the project is included in the QPP. The QPP forms the framework and provides the vision that brings together all elements of the technical plans for conducting the project.

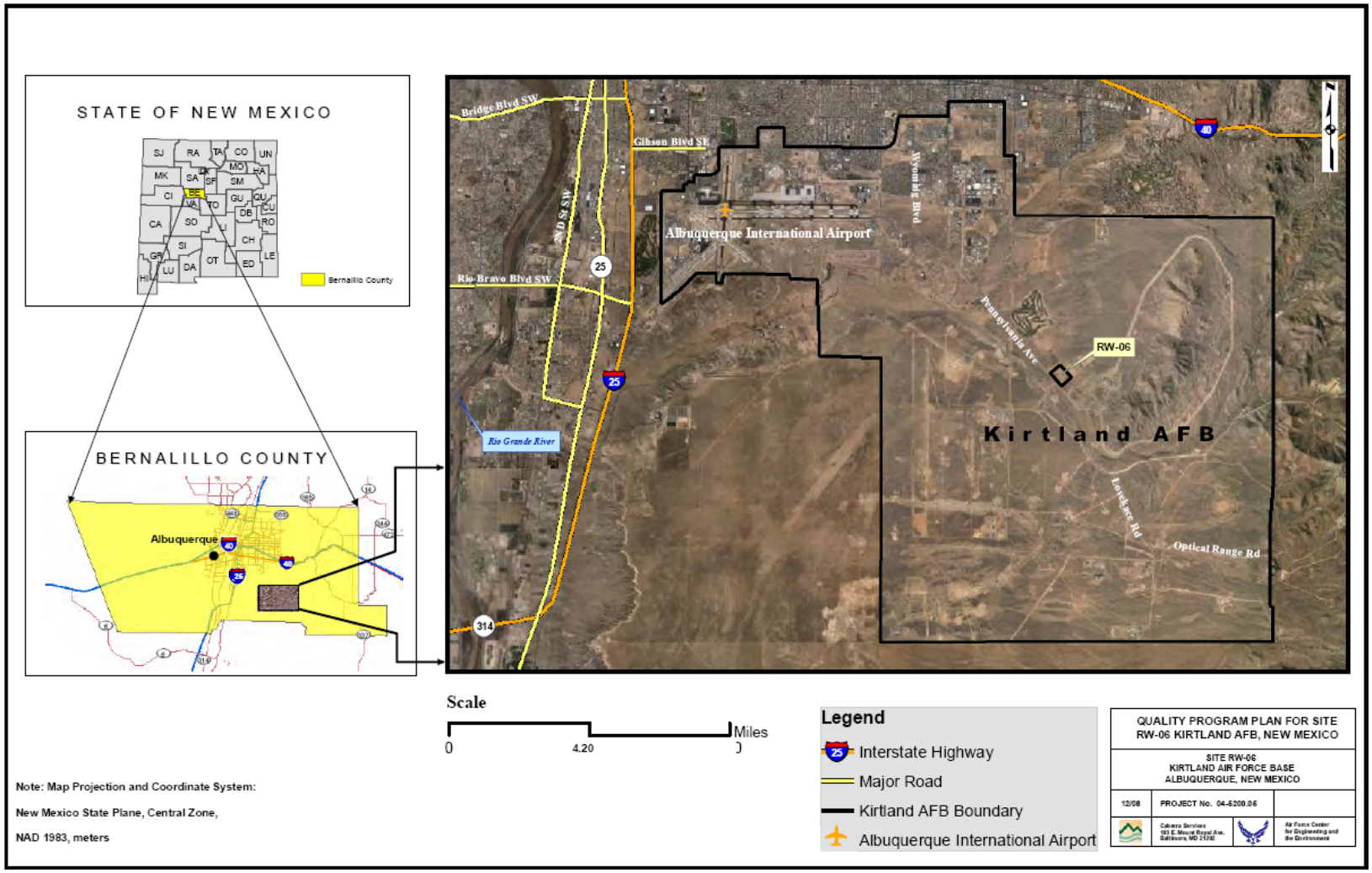
The WP provides technical guidance for implementing the field activities necessary to completing the objectives identified in the AFCEE Statement of Work and is subdivided into the following broad categories: Site Preparation, Radiological Support and Characterization, Surficial Discrete Spot Removal, Waste Excavation, Segregation and Reuse Testing, Waste Packaging, Staging, Transportation and Disposal, MARSSIM FSS, and Backfill and Site Restoration. The following sub-plans contained in the WP describe methodologies, procedures, and instructions for site activities to support the characterization

and remediation field activities, in accordance with the project SOW: Site Preparation Plan, Siting Analysis Plan, Excavation Plan, Erosion Control Plan, Transportation Plan, Remediation Management Plan, and Demobilization and Closure Plan.

The SAP provides technical guidance for all project activities related to collection and analysis of environmental media samples, quality assurance (QA) and quality control (QC), and data management. The SAP is subdivided into two sub-plans: an FSP and a QAPP. The FSP includes guidance and information on sampling objectives, sample media types, sample locations and collection frequency, sampling equipment and procedures, sample handling and analysis, field measurements, and record keeping. The QAPP contains guidance for QA and QC activities, including data quality objectives (DQOs), sample custody and handling, equipment calibration and maintenance, field laboratory management, sample analysis protocols, and data management.

The SSHP contains guidance and procedures for ensuring that health and safety standards are met during all field activities in accordance with 29 Code of Federal Regulations (CFR) 1910.120 and 29 CFR 1926 (construction industry standards) for workers at hazardous waste sites and with USAF requirements. The SSHP includes a hazard analysis, site worker training requirements, personnel protection methods, medical surveillance requirements, monitoring procedures, site controls, and emergency response instructions.

Figure 1-1. Site Location Map



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2.0 PROJECT BACKGROUND AND REMEDIATION HISTORY

The site history and summaries of previous radiological investigations are summarized below, and are taken from a report entitled *Resource Conservation and Recovery Act Facility Investigation Report for Solid Waste Management Unit 6-30, Radioactive Burial 11 (RW-06)*, prepared by CH2M Hill for HQ AFCEE Environmental Restoration Division, Brooks City-Base, Texas 78235-5363, dated October 2007 (USAF, 2007). This report documents RFI activities that occurred at RW-06 in 2006.

2.1 Summary

2.1.1 Operational History of the Radiation Effects Laboratory Associated with RW-06

In March 1960, the Biophysics Division's Biomedical Branch began operations in new isolated quarters on Sandia Base (a former U.S. Army facility located on what is now the east side of Kirtland AFB and merged with Manzano Base and Kirtland AFB in 1971). The Radiation Effects Laboratory was planned to include facilities for maintaining 10 to 12 domestic-type animals for experimental purposes; a microbiological laboratory; an isolated irradiation laboratory; a medium level radioisotopes laboratory; and a laboratory for rearing experimental animals.

In 1961, the Biophysics Division was involved in various projects related to radiation hazards. Potential effects of radiation on personnel were evaluated through research on large animals approaching the size of a human to produce more realistic data for human exposures. Accounts from 1961-1962 specifically discuss exposing sheep and mice to various radiation and irradiation processes. Many of the in-house experiments are reported to have taken place at the Radiation Effects Laboratory, also referred to as the animal farm.

In 1963, the Biophysics Division is reported to have expanded its in-house research capabilities. The reported complement of animals that were available for research at the animal farm included "approximately 300 sheep, 25 to 30 burros, dogs, goats, and chickens". Also during 1963 a project entitled *Operation Roller Coaster* was undertaken, which involved exposure of animals to a plutonium cloud at planned distances downwind. The actual plutonium exposure took place at the Nevada Test Site and did not occur at Kirtland AFB. Reportedly 84 beagles, 84 burros, and 132 sheep were transferred to the Nevada Test Site for exposure. Six of each animal species were reportedly sacrificed immediately following exposure for pathologic evaluation while the others were sacrificed at later time periods. Exposed animals that were to be held for later sacrifice were transferred to several facilities, possibly including the animal farm facility at Kirtland AFB; however, the number of actual animals that were returned is not reported. During 1964, the overall focus of the Biophysics Branch was almost exclusively devoted to investigation of radiation hazards from space environments in support of the USAF man-in-space capability. There are no specific reports of activities or animal testing at the Radiation Effects Laboratory.

Throughout 1965, the focus of the Biophysics Branch remained devoted to investigation of radiation hazards from space environments and high altitudes. Ongoing animal testing in support of these projects is reported to have continued, although details regarding exact animals and numbers of animals are not provided as specifically as in previous years' accounts. Reference to the irradiation of sheep and beagles at the Sandia Pulsed Reactor Facility was made in a 1965 waste disposal document, described further in Section 2.1.2. Additional animal testing is reported to have involved irradiation of test subjects using the Cobalt-60 facility located near the Radiation Effects Laboratory.

The 1969 annual report provides accounts of large animal irradiation experiments that took place throughout the period from 1965 through 1970. Descriptions of experiments involving irradiation exposure of sheep, rats, and beagles are made. Specific references are made to the exposure of at least 308 sheep and 16 beagles during this period, although it is not stated that these were the only animals used as part of research experiments during that time.

The 1970 annual report indicates that the Biophysics Division was discontinued in 1970. The Radiation Effects Laboratory was transferred to the "Laboratory's Civil Engineering Division". Any remaining experimental animals are reported to have been auctioned, or destroyed, depending on the condition of the animal.

2.1.2 Disposal History at RW-06

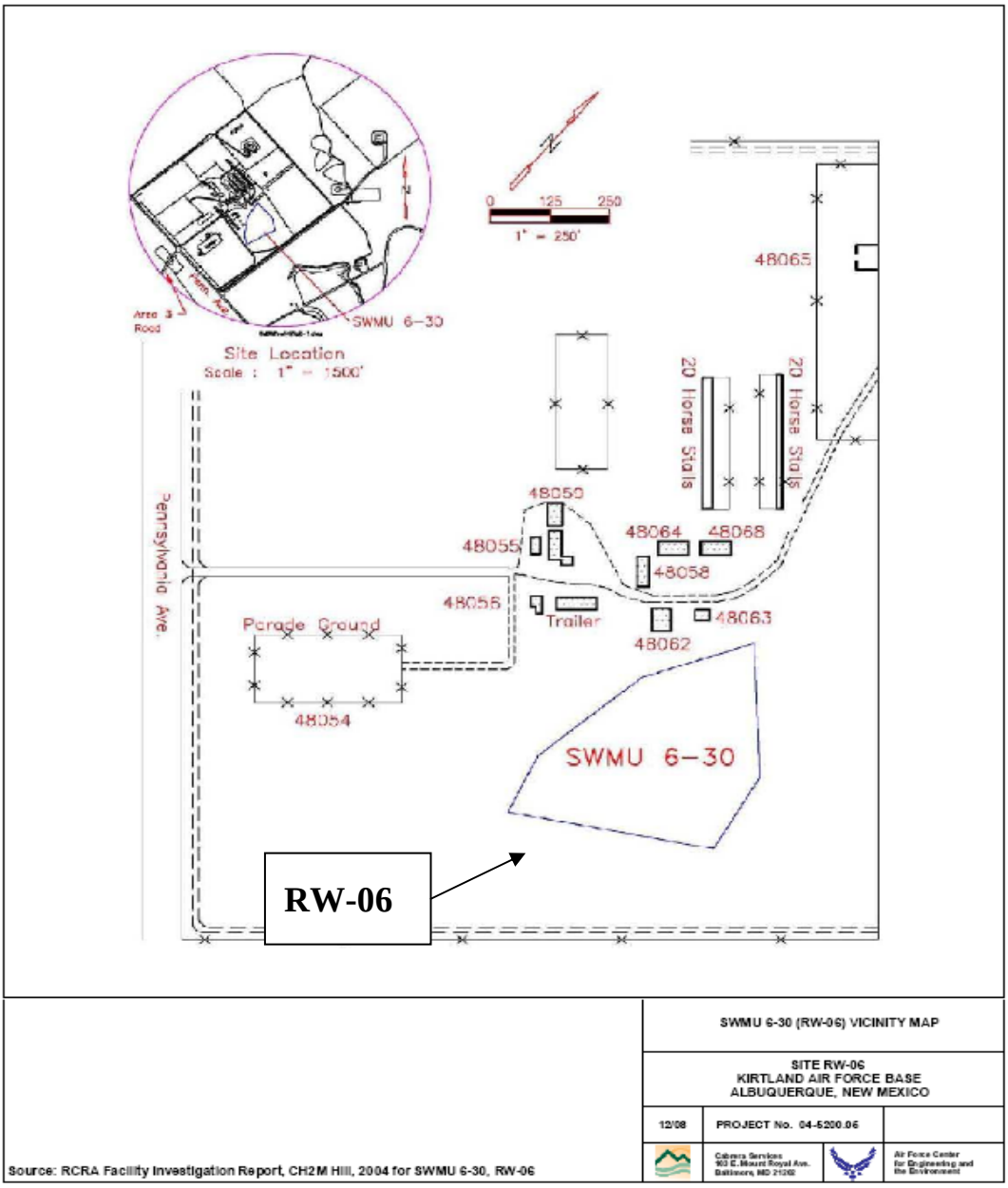
The documents entitled, *Procedures for the Disposal of Radioactive Wastes* (dated 1965) and *Radioactive Wastes Survey* (dated 1 July 1971) provide some details of waste disposal practices, locations, and expected contaminants of concern at RW-06 (Figure 2-1). The 1965 document specifically describes four waste disposal pits, which, at the time of writing in 1965, were closed. These pits are described as being 9 ft deep, 2 ft wide and about 50 ft long. Pits were reported as being covered with a minimum of 4 ft of earth and two of the pits were surfaced with asphalt while the remaining two had compacted earth covers. These four pits were reportedly enclosed in a fenced area. Material disposed in these pits was reported as animal carcasses, animal excreta, and contaminated solid waste (USAF, 1965). Most contaminated solid waste was reported as having been placed in steel drums prior to burial, although some waste was sealed in double, plastic bags. Animal carcasses were buried both by sealing in steel drums and by direct burial without a container. High-level waste and most liquid wastes are reported to have been disposed of through appropriate USAF channels and therefore, presumably, were not placed in the disposal pits.

In the 1965 USAF document, 2 other disposal trenches that were in use at the time of writing also were described. These 2 disposal trenches were described as being 20 feet (ft) deep, 6 ft wide, and roughly 100 ft long. As with the other trenches, waste was described as being contained in steel drums or plastic bags prior to disposal. The total amount of waste disposed in each trench was limited by the amount of total radioactivity that would be present based on the radioactivity of the materials disposed. It was reported that at the end of 1965 one of the disposal trenches (pit No. 5) was only one-quarter (25 %) full based on disposed waste activity to that point. The 1971 *Radioactive Wastes Survey* (USAF, 1971) corroborates the same general operation and disposal methods at the Radiobiology Laboratory as those presented in the 1965 document.

Based on the 1965 *Procedures for the Disposal of Radioactive Wastes* document, an estimate was made of the possible maximum remaining isotope activity potentially present in materials disposed of in the SWMU 6-30 trenches to that date. The total maximum possible activity was estimated by comparing the total stock of radioisotopes that had been distributed to the facility in 1959 and comparing those volumes to the current stock at the time of writing in 1965. The difference between the original volumes and the 1965 stock, taking into account volumes known to have been used through other applications, was assumed to be the maximum amounts of radioactive materials that could be present in the disposed waste material.

According to the 1965 document, the radionuclides with total potential activities greater than 1 microcurie (μCi) included calcium-45 (^{45}Ca), cerium-144 (^{144}Ce), praseodymium-144 (^{144}Pe), cesium-137 (^{137}Cs), iodine-59 (^{59}I), mercury-203 (^{203}Hg), krypton-85 (^{85}Kr), ruthenium-106 (^{106}Ru), strontium- 90 (^{90}Sr), yttrium-91 (^{91}Y), zinc-65, and zirconium-95 (^{95}Zr), niobium-95 (^{95}Nb). Other possibly present isotopes all with total potential activities less than, or equal to, 1 μCi included gold-198 (^{198}Au), barium-140 (^{140}Ba), lanthanum-140 (^{140}La), cerium- 141 (^{141}Ce), cobalt-57 (^{57}Co), chromium-51 (^{51}Cr), iodine-131 (^{131}I), radium-226 (^{226}Ra), ruthenium-103 (^{103}Ru), strontium-85 (^{85}Sr), strontium-89 (^{89}Sr), yttrium-90 (^{90}Y), mixed fission products (MFP), and possible trace amounts of plutonium-239 (^{239}Pu). These calculated volumes were only estimates and this does not necessarily mean that all, or any, of the listed radioisotope volumes were actually present in the waste emplaced in the disposal trenches.

Figure 2-1. SWMU 6-30 (RW-06) Vicinity Map



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Of the listed radionuclides only four possess half-lives long enough to theoretically still be present in significant quantities after 40 years of decay - ^{85}Kr, ^{90}Sr, ^{137}Cs, and ^{226}Ra. ^{85}Kr is an inert gas and is not expected to remain at the site. Calculations for potential remaining activity for these and all other listed radionuclides were discussed in the *RCRA Facility Investigation Sampling and Analysis Plan for Solid Waste Management Unit 6-30, Radioactive Burial 11 (RW-06)* (USAF, 2006). That plan concluded that ^{239}Pu was not likely to be present at the site based on historical process information.

2.2 Investigatory Activities

This section summarizes the previous investigations of the RW-06 disposal area, describes the preliminary site conceptual model, describes the 2006 RFI field activities, and presents an evaluation of the data collected during the field investigation.

2.2.1 Summary

Numerous investigations were conducted at the RW-06 site including radiation surveys, geophysical surveys, extensive site sampling, installation of a groundwater monitoring well, and installation of a horizontal borehole. These investigations are discussed in detail in the sections below.

2.2.2 Previous Investigations

2.2.2.1 Documentary Data

The primary documentary data for RW-06 are the write-ups of historical accounts of site activities, operations, and disposal practices that were discussed in preceding sections. The first environmental assessment of the SWMU consisted of a Phase 1 records and historical review study which identified the site as a radioactive burial trench-and-fill operation in use from 1960 to 1971 (USAF, 1981). Kirtland AFB personnel visited the site in the early 1980s with Dr. Jelle DeBoer, a former director of the research facility. Dr. DeBoer confirmed that the general location of the former disposal trenches were within the designated SWMU 6-30 area (Davidson, 2003).

As part of the Appendix IV, Stage 2D-1 RFI (discussed in more detail in subsequent sections of this plan) in June 1994, geophysical surveys were conducted to further define the extent and depth of the disposal trenches. These results were combined with information from aerial photographs taken in 1966 and 1979, and from observed ground features (depressions, anomalous vegetation, and surface debris). The combined data sets were used to construct a map of probable trench areas. These data indicated that as many as nine disposal trenches were potentially present, although historical operational reports specifically describe only 6 disposal trenches.

The geophysical investigation did not use permanent surveyed benchmarks to which anomaly locations and suspected trenches were correlated. The geophysical investigations used the existing fence line as benchmarks for referencing the geophysical data. However, the fence line has changed over time. All subsequent investigations at the site used the conclusions on likely trench locations that were synthesized from the June 1994 investigation.

An interim corrective measure (ICM) was performed at RW-06 in 1996. The ICM activities included the installation of a security fence to surround the former burial trenches and the horizontal well installed by Sandia National Laboratories/New Mexico (SNL/NM) (USAF, 1997).

2.2.2.2 Field Data

Preliminary Investigation Phases

A Phase 2 Stage 1 field investigation reported in 1985 included the advancement of 2 exploratory boreholes, down to a depth of 100 ft, at the south end of the site. Sampling from these boreholes identified only sodium and iron in soil samples in excess of the screening levels used at that time. Lead,

mercury, silver, total organic halogens, oils and greases, and pesticides were not detected. Field-screening for gamma radiation performed on the drill cuttings identified no activities above background (USAF, 1985). In January 1988, a surface radiological survey, a subsurface magnetic survey, and a mercury vapor survey were performed at the site. All surface radiation levels were found to be consistent with background levels. A total of 21 anomalies were identified by the magnetic survey. Of these 21 anomalies, 13 were attributed to surface or shallow subsurface metal objects that could often be observed visually. The remaining eight anomalies were described as having the magnetic characteristics of significant masses of buried metal, such as buried drums. Many of these anomalies were oriented in linear configurations, often in association with surface depressions, which suggested subsidence of a disposal trench. The largest identified magnetic anomaly was associated with a linear depression and an exposed drum was observed. The exposed drum referred to in the 1988 survey is no longer visible at the site; and the final disposition of the drum is unknown. No mercury vapors were detected in any of the shallow test boreholes installed in the areas of the significant magnetic anomalies (USAF, 1988).

A June 1992 radiation survey to determine possible air and surface soil contamination identified no radiation levels above background conditions (Caputo, 1992). A SNL/NM technology demonstration project, consisted of installing a horizontal borehole beneath the 6 southernmost trenches; field monitoring for mercury vapors and volatile organic compounds (VOCs); measuring gamma radiation in soil adjacent to the borehole using a downhole gamma-ray spectrometer; and sampling soil gas for mercury and VOCs. This investigation did not identify radiation levels above background conditions or contaminated soil vapor, though detailed field screening and analytical results for mercury vapor and VOCs were not included within the technology demonstration report (Floran, 1994). In November 2006, SNL/NM plugged and abandoned the horizontal borehole.

Appendix IV, Stage 2D-1 RFI

The Appendix IV, Stage 2D-1 RFI (USAF, 1994) was conducted to determine the possible nature and extent of disposal trench contamination and included surface and subsurface soil sampling in soil adjacent to the trenches. Thirty-six boreholes were installed with four to five soil samples collected per borehole for a total of approximately 170 individual soil samples. Soil samples were analyzed for petroleum hydrocarbon gasoline range organics (GROs) and diesel range organics (DROs), VOCs, semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, cyanide, gross alpha and gross beta radiation levels, ^{226}Ra, radium-228 (^{228}Ra), soil pH, and soil moisture.

The locations of the Appendix IV, Stage 2D-1 investigation boreholes are shown on Figure 2-3. The site map with the soil boring locations that was utilized during the Appendix IV, Stage 2D-1 investigation is zoomed in on the apparent trench areas. Although other site landmarks and fence lines are not depicted on this figure, the general trench shapes are consistent with those depicted on subsequent investigation maps. Therefore, relative boring locations can be distinguished.

Analytical results from the Appendix IV, Stage 2D-1 indicated the presence of 7 VOCs including, acetone; ethylbenzene; methylene chloride; tetrachloroethene; toluene; 1,1,1-trichloroethane; and xylenes. These VOCs were detected at low concentrations and in limited number of the soil samples. None of the detected VOCs exceed the current New Mexico Environment Department (NMED) residential soil screening levels (SSLs). A total of 8 SVOCs including: benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; di-n-butyl phthalate; bis(2-ethylhexyl)phthalate; fluoranthene; phenanthrene; and pyrene were detected at low levels and in a limited number of the site soil samples. None of the detected SVOCs exceeded the current NMED residential SSLs. Both DROs and GROs were detected at low levels and in a limited number of the site soil samples.

Antimony, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, vanadium, and zinc were detected in some soil samples at concentrations that exceeded the NMED-approved background concentrations. Most of the background exceedences occurred in a limited number of soil samples. Copper concentrations exceeded the NMED-approved background concentration of 17 milligrams per kilogram (mg/kg) in almost all soil samples. The maximum copper concentration was

1,210 mg/kg detected in sample RB-11-16 at a depth of 28 to 30 ft. Chromium (1,130 mg/kg), iron (45,300 mg/kg), molybdenum (429 mg/kg), and vanadium (100 mg/kg) were detected in 1 soil sample, RB-11-30 at a depth of 13 to 17 ft, at concentrations that exceed their NMED residential SSLs. This was the only sample that exceeded any NMED residential SSLs. Samples collected from both shallower and deeper sampling depths within the borehole did not show elevated metals concentrations.

Activities for gross alpha, gross beta, and ^{226}Ra were slightly greater than background activities for some of the soil samples. All soil activities were within one order of magnitude of the background activities.

1997 Phase 2 RFI

A Phase 2 RFI was conducted at SWMU 6-30 in June and July 1997 (USAF, 1998). The field investigation program was designed to determine if contamination was present within the trenches and in the underlying soils. Boreholes were installed within the apparent disposal trenches using a direct-push drill rig. Since previous investigations did not indicate high levels of radiation would be encountered in the trench, this investigation phase included sampling directly in the apparent trenches. The number of boreholes per trench was based on trench length (approximate 30-ft spacing between boreholes). The depths of boreholes within each trench were based on trench depth with the shallow trenches having 20-ft borehole depths and deep trenches having 30-ft borehole depths (Figure 2-2).

A total of 32 boreholes were advanced at the site with 4 to 6 soil samples collected per borehole for a total of approximately 160 individual soil samples. Soil samples were collected from each borehole at 5-ft intervals to the bottom of the trench and from 2 additional sampling intervals below the bottom of the trench (10 ft below the bottom of the trench). Boring locations are shown on Figure 2-4. Samples were field-screened using a photoionization detector (PID), a beta-gamma meter, and a mercury vapor detector. Samples were analyzed for VOCs, SVOCs, TAL metals, mercury, cyanide, gross alpha and beta radiation levels, gamma spectroscopy, soil pH, and soil moisture.

Analytical results from the 1997 Phase 2 RFI indicated the presence of 1 VOC, acetone, detected in a limited number of samples and at low levels. A total of 3 SVOCs including bis(2-ethylhexyl)phthalate, phenol, and styrene were detected at low levels and in a limited number of the site soil samples. None of the detected VOCs or SVOCs exceeded the current NMED residential SSLs.

Arsenic, barium, beryllium, chromium, cobalt, copper, lead, nickel, vanadium, and zinc were detected in some soil samples at concentrations that exceeded their NMED-approved background concentrations. Most of the background exceedences occurred in a limited number of soil samples. Copper concentrations exceeded the NMED-approved background concentration of 17 mg/kg in almost all soil samples. The maximum copper concentration was 3,020 mg/kg detected in sample RB-11-48 at a depth of 23 to 25 ft. Iron (38,100 mg/kg) and vanadium (81.4 mg/kg) each were detected in one soil sample at concentrations that exceed their NMED residential SSLs. Arsenic was detected in a number of soil samples that exceed the NMED residential SSL of 3.9 mg/kg. It should be noted that the NMED-approved background concentration of arsenic is 4.4 mg/kg which is greater than the NMED residential SSL. The maximum arsenic concentration was 14.7 mg/kg.

Activities for gross alpha, gross beta, ^{226}Ra, thorium-234 (^{234}Th), and uranium-235 (^{235}U) were slightly greater than background activities for some of the soil samples. All soil activities were within one order of magnitude of the background activities. Screening level risk assessments conducted using the radionuclide data collected indicated that the potential dose and excess cancer risk posed by any radioactive material at RW-06 did not exceed EPA guidelines.

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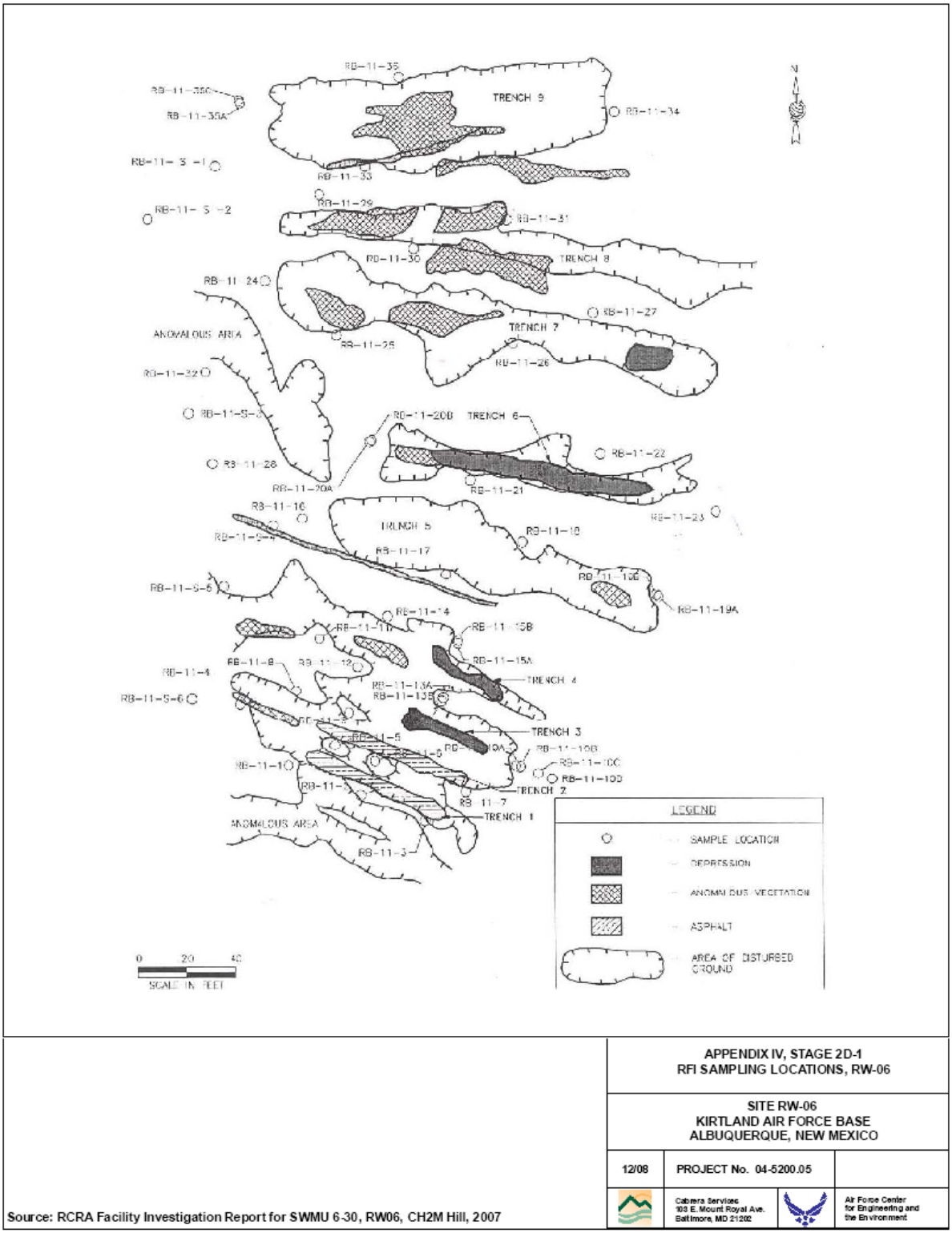
Figure 2-2. Appendix IV, Stage 2D-1 RFI Sampling Locations, RW-06



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1999 Phase 3 RFI

The Phase 3 RFI at RW-06 was conducted in August and September 1999. Investigation activities included installing 1 groundwater monitoring well (Kirtland AFB-6301), downhole geophysical logging, and laboratory analyses. To avoid intrusive work within the boundaries of the actual SWMU area, the groundwater monitoring well was installed outside of the fenced area, within 50 ft of the west fence line of the southernmost tip of the SWMU area (Figure 2-3). Following installation of the monitoring well, groundwater samples were collected and analyzed for VOCs, SVOCs, metals, pesticides, polychlorinated biphenyls (PCBs), herbicides, total petroleum hydrocarbons (GROs and DROs), cyanide, nitrate, nitrite, anions, and radionuclides. Nitrate was detected at a concentration of 6.0 mg/L in the groundwater sample and 5.7 mg/L in duplicate groundwater sample.

These concentrations exceed the NMED-approved background value for nitrate in groundwater of 4 mg/L but do not exceed the New Mexico Water Quality Control Commission (NMWQCC) groundwater standard of 10 mg/L. The concentrations of VOCs, SVOCs, metals, and radionuclides were all below the applicable screening levels.

Following installation, monitoring well KAFB-6301 was added to the Kirtland AFB Long-Term Monitoring (LTM) program. Groundwater samples are collected on an annual basis from the well and analyzed for VOCs, organochlorine pesticides, chlorinated herbicides, mercury, dissolved metals, chloride, fluoride, nitrate, sulfate, total organic carbon, total organic halides, phenols, gross alpha, gross beta, radium, radon, uranium, and gamma spectroscopy. Nitrate continues to occur at concentrations that exceed NMED-approved background of 4 mg/L but do not exceed the NMWQCC standard. All detected constituents are below regulatory standards.

2006 RFI

RW-06 was investigated in October 2006. The RFI included the excavation of 533 linear ft of exploratory trenches that cut through the former disposal trenches. The trenches and excavated soil and wastes were field screened for radionuclides. Soil samples were collected from the exploratory trenches and analyzed for metals and radionuclides. Based on the laboratory data, soil samples did not generally contain metals or radionuclides at concentrations exceeding New Mexico Environmental Department (NMED)-approved background concentrations.

A variety of waste materials, including laboratory wastes and animal remains, were identified in the exploratory trenches. Of the waste materials, 2 laboratory waste items including a carboy (3-gallon [gal] polyethylene bottle) and plastic zip top bag containing alkaline batteries, broken electronic components and soil were found during the excavation activities as contaminated with primarily ^{137}Cs and americium-241 (^{241}Am). These items were removed from the site and placed in the custody of the Kirtland AFB Radiation Safety Officer (RSO). No other wastes were found to have elevated alpha or beta radiation. Based on the results of the 2006 RFI activities, the RW-06 trenches are believed to contain the wastes described in the historical documents. RCRA contaminants were not present in the soil.

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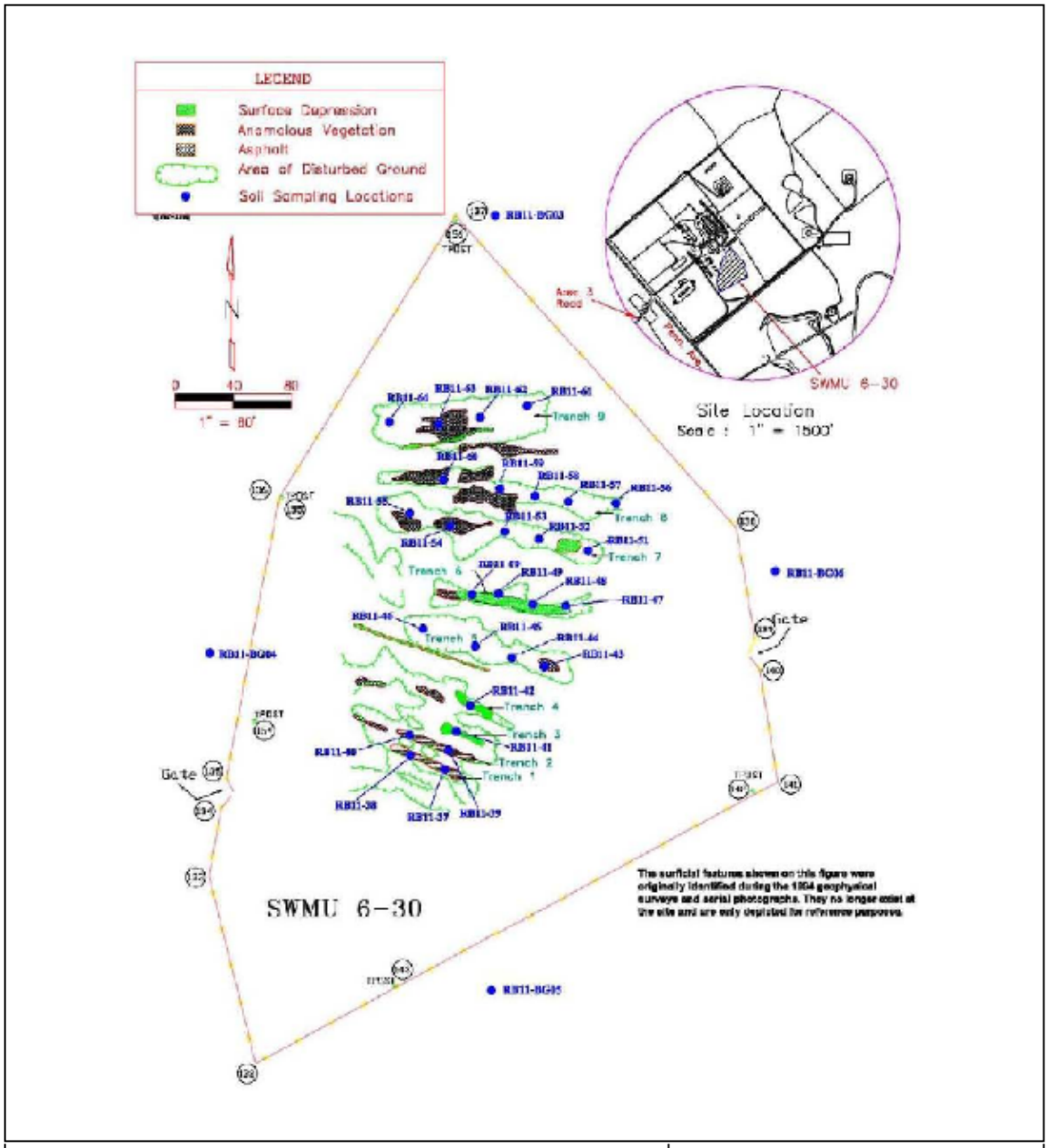
Figure 2-3. 1999 RFI Sampling Locations, RW-06



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Summary of Historical Waste Characterization

Historically, the possible contaminants of concern at RW-06 have been considered to be VOCs, SVOCs, petroleum hydrocarbon GROs and DROs, metals, cyanide, and potentially a variety of alpha, beta, and gamma emitting radionuclides.

These suites of contaminants have been the focus of several previous investigations on the site. However, no sample results to date have indicated that any of these types of contaminants except for radionucliudes exceed the regulatory release levels.

The extensive soil sampling program that has been conducted in and around the disposal trench areas (roughly 68 boring locations and over 300 individual soil samples) has verified that gross soil contamination with VOCs, SVOCs, or petroleum hydrocarbons resulting from bulk disposal of these compounds is not present. The mobile nature of these compounds would have led to ancillary subsurface soil contamination horizontally or vertically around the disposal trenches if the contaminants had been directly disposed of into these trenches. The NMED appears to be in agreement with the conclusion that widespread VOC, SVOC, or petroleum hydrocarbon contamination is not present at the site. This is based on the 01 November 2002 letter from the NMED with comments on the draft RW-06 SAP, which did not request any additional sampling for these contaminants.

Therefore, the only suspected major remaining compound classes of concern at RW-06 are metals and radioactive isotopes. These were retained as contaminants of potential concern (COPC) due to their immobile nature, or to the possibility that material was disposed of in drums or containers that may still be intact, and therefore locally-containing the contamination from migrating into the surrounding soil. Therefore, metals and radionuclides are the only major contaminant classes of concern that are expected to be addressed. During investigation activities, if field evidence such as soil staining or field instrument detections suggests the presence of other contaminants of concern, then the field sampling program and analytical suite will be expanded, as appropriate.

2.2.3 2008 Planning Survey Results

A planning survey was completed by CABRERA in October 2008 and consisted of a driveover gamma survey, a geophysical investigation with Global Positioning System (GPS) to locate trenches and assist in identifying trench geometry, and the collection and analysis of subsurface soil for chemical and radiological parameters to assist with waste characterization and identification of constituents of potential concern for use during the excavation and segregation of materials as part of the remedial action. Geophysical results have helped to confirm three of the trench locations and to identify potential buried metallic objects. See Figure 4-1 of the WP (Attachment I) for geophysical anomalies identified during the planning survey.

The driveover gamma survey was conducted using the CABRERA Large Area Scanning System (CLASS) on 100% of the site within the fenced area (approximately 3 acres) at RW-06. The CLASS consists of an Radiation Solutions Incorporated (RSI) RS-701 integrated controller and data acquisition system, a digital gamma ray spectrometer/multi-channel analyzer (MCA), a data controller, 2 RSX-256 4-liter (256 cubic inch) sodium-iodide (thallium activated) (NaI(Tl)) gamma scintillation detectors, an GPS, and an external high resolution Trimble Pro XH GPS receiver. Radiation and location information is collected by the system at a very high data transfer rate (nominally 1 data point every second), and stored in an incorruptible data file for real-time feedback and data validation/post-processing. The gamma data were spatially correlated with the GPS coordinates and incorporated into a Geographic Information System (GIS) to map radioactivity concentrations at the site.

Geophysical surveys were conducted over 100% of the fenced area at RW-06 to identify the locations of disposal trenches containing various waste materials and to map the locations of buried containers within those trenches that may contain low-level radiological or chemical wastes. A multi-frequency electromagnetic (MFEM) profiler (GEM 2) was used to collect data simultaneously at a rate of several

points per second in user-selectable frequencies varying from 300 hertz (Hz) to 96 kilohertz (kHz) in two modes (in-phase and quadrature). The frequencies were selected to cover the range available (i.e., 300 Hz to 96 kHz). Lower frequencies respond to deeper targets, whereas the higher frequencies are more sensitive to shallower targets (i.e., less than 3 ft to greater than 6 ft deep). The quadrature and in-phase components of the signal were recorded for each frequency. The GEM 2 was mounted on a non-metallic sled towed by a four-wheel drive (4WD) all-terrain vehicle (ATV) during data collection. A GPS antenna was mounted on the sled over the GEM 2 receiver to collect X-Y coordinates so that any geophysical anomalies can be correlated to the gamma survey and can be reoccupied for further investigation. Elevated radioactivity (predominantly ^{137}Cs) was identified at 5 locations in the southeast section of the RW-06 site. These have been added to the remediation project as discrete contaminated surface soil spots to be excavated as part this remedial action (see Figure 4-1 of the WP).

Subsurface samples were collected with a GeoProbe™ direct push drilling rig operated by Earth Worx Environmental Services (Earth Worx). A minimum of 3 borings were each advanced to a depth of 20 ft below ground surface (bgs) in each delineated trench (assumed to be 9 trenches), with samples collected at 2 depths from each boring location, including 1 from the bottom of each borehole. Exact locations were determined in the field at the discretion of the field team. A total of 1 subsurface soil sample was collected at an additional 11 biased locations at the site based on the results of both the driveover gamma and surface geophysical surveys. A minimum of 10% of the samples were collected as field duplicates for quality control purposes.

Following removal of soil cores from the borings, each core was visually inspected, described, and logged. The full length of each core was scanned for gross gamma count rate using a Field Instrument for the Detection of Low Energy Radiation (FIDLER) detector and screened with a photoionization detector (PID) for possible volatile contaminants. Staining and other physical parameters were also used for sample selection.

All samples were analyzed off-site by GPL Laboratories. All analyses were performed for each sample with the exception of ^{90}Sr and Isotopic Uranium, which were performed on only 10% of the samples (as determined by the field team). A total of four (4) samples were submitted for waste profile characterization using Toxicity Characteristic Leaching Procedure (TCLP) analysis consisting of SVOCs, VOC, metals, PCB/pesticides, herbicides, reactive cyanide, reactive sulfide, pH, and moisture content. Appendix A of the FSP (Attachment IIa to the QPP) presents the results of the planning survey. The results of the project planning survey and field screening were used in the preparation of this QPP, including all attached plans. The driveover gamma survey also identified several surface or near-surface radioactive targets. Direct push soil boring cores did not yield elevated levels of radioactivity or volatile organic vapors when scanned in the field with the FIDLER and PID. Laboratory analyses were used to confirm the findings obtained in the field during the soil boring survey. No visual evidence of waste material was found in the soil cores.

Potential radionuclides of concern (ROCs) from known historical activities such as ^{90}Sr and ^{137}Cs were detected at low levels, and ^{226}Ra was detected at background levels. ^{241}Am was not detected. Based on the potential disposal of medical isotopes at RW-06, carbon-14 (^{14}C) analyses were performed, resulting in detections above the NRC screening level in two samples.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

CABRERA functions as an integral team member in support of this project, working with Kirtland AFB, AFCEE, other USAF organizations, other stakeholders, and our subcontractors to ensure that project objectives are achieved. In executing the activities incorporated in this project, CABRERA anticipates sharing information with other AFCEE contractors, and working in cooperation with communities, regulators, and other government entities. Responsibilities and lines of reporting for the project organization are described in the subsections below and depicted in the organization chart (Figure 3-1). A contact list for key USAF and CABRERA project personnel is provided in Table 3-1.

3.1 USAF Personnel and Responsibilities

3.1.1 Kirtland AFB

Kirtland AFB has primary control and responsibility for RW-06, to include characterization, cleanup, meeting environmental compliance and other regulatory requirements, security, and interface with regulatory and community stakeholders. All requirements are being carried out under this project to support Kirtland AFB efforts to achieve site closure. Kirtland AFB also has responsibility for providing information from previous investigations and remediation efforts related to the RW-06 Site. Mr. Ludie Wayne Bitner will serve as Kirtland AFB Project Manager (PM) and Point of Contact (POC), responsible for coordinating with CABRERA, various USAF organizations, the NMED, Kirtland AFB upper management, and other contractors. Mr. Scott Clark serves as the Assistant PM to Mr. Bitner and is included in all project communication and document reviews to ensure consistency and provide a back-up POC in the absence of Mr. Bitner.

3.1.2 AFCEE

The AFCEE has responsibility for contract management, invoice approval and payment, change order management, and monitoring cost and schedule. In carrying out task assignments under the WERC contract, CABRERA is working in support of the AFCEE mission to provide world class environmental services for the USAF. Ms. Kristi Doll will serve as the AFCEE Contracting Officer's Representative (COR) and primary POC.

3.1.3 Air Force Safety Center

The Air Force Safety Center (AFSC) develops and manages USAF mishap prevention programs and the Nuclear Surety Program. It develops regulatory guidance, provides technical assistance in the flight, ground, and weapons and space safety disciplines, and maintains the USAF database for all safety mishaps. The center oversees all major command mishap investigations and evaluates corrective actions for applicability and implementation USAF-wide. Dr. Steven Rademacher and Captain Joshua Hubbell serve as the POCs and 91B Regulatory Authority for this project.

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Figure 3-1. Project Organization Chart

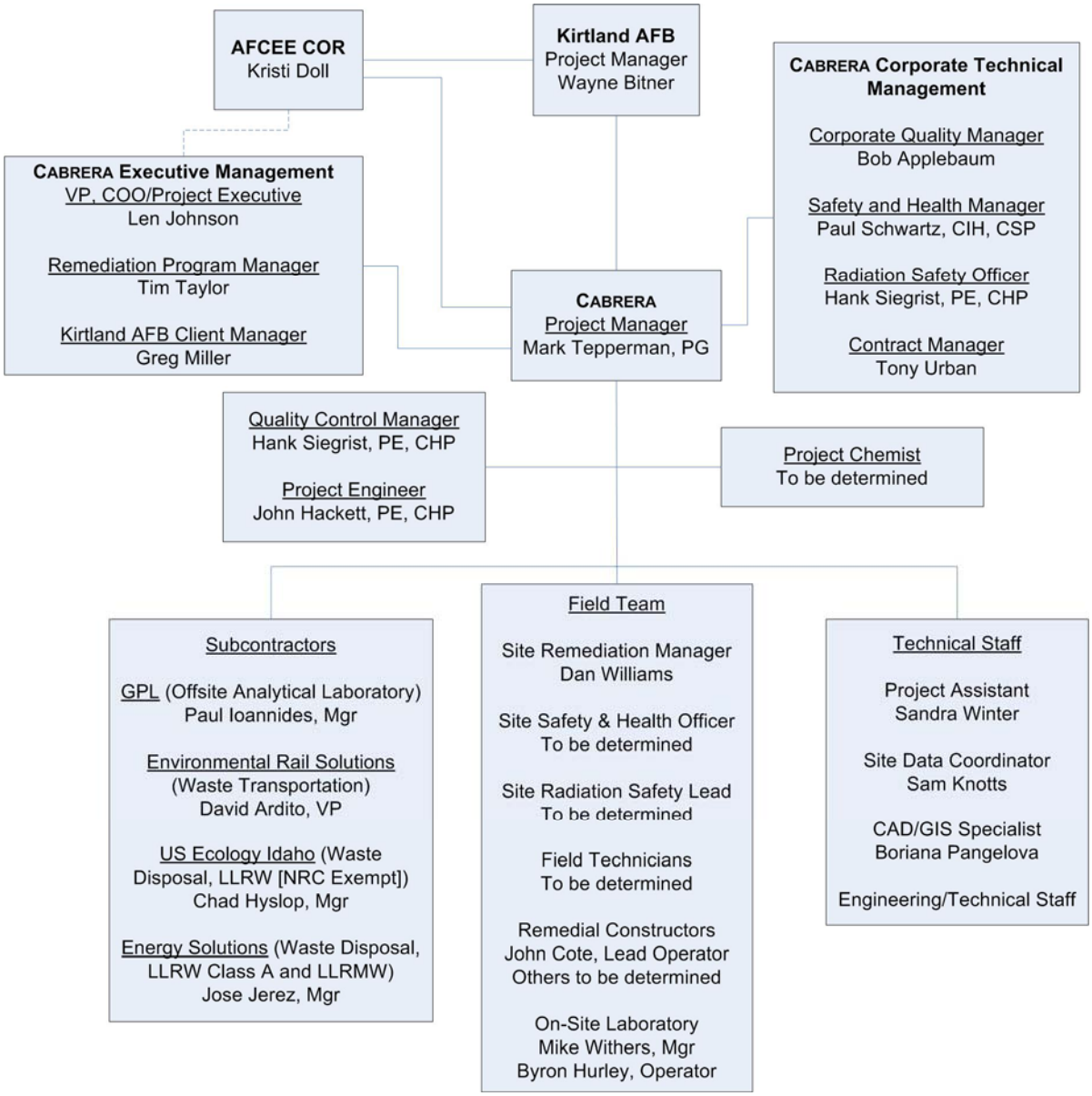

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Table 3-1. Project Contact List

Affiliation	Role	Name	Telephone	Email
Kirtland AFB	Restoration Chief / Project Manager	Wayne Bitner	505-853-3484	ludie.bitner@kirtland.af.mil
Kirtland AFB	Asst. Project Manager	Scott Clark	505-846-9017	Scott.clark@kirtland.af.mil
Kirtland AFB	Base RSO	Captain Bruce Murren	505-846-3625	Bruce.murren@kirtland.af.mil
Kirtland AFB	RSO Alternate	Captain Ernest Scott	505-846-3624	Ernest.scott@kirtland.af.mil
AFCEE	COR	Kristi Doll	210-536-4461	kristi.doll@brooks.af.mil
AFSC	AF 91b Regulator	Dr. Steven Rademacher	505-846-0428	Steven.rademacher@kirtland.af.mil
AFSC	AF 91b Regulator	Captain Joshua Hubbell	505-846-0450	Joshua.Hubbell@kirtland.af.mil
CABRERA	Vice President, COO/ Project Executive	Len Johnson	860-569-0095	ljohnson@cabreraservices.com
CABRERA	Remediation Program Manager	Tim Taylor	781-890-2827	ttaylor@cabreraservices.com
CABRERA	Kirtland AFB Client Manager	Greg Miller	505-250-3978	gmiller@cabreraservices.com
CABRERA	Project Manager	Mark Tepperman	210-967-4300	mtepperman@cabreraservices.com
CABRERA	Corporate Quality Manager	Bob Applebaum	860-569-0095	bapplebaum@cabreraservices.com
CABRERA	Project Engineer	John Hackett	720-887-4065	jhackett@cabreraservices.com
CABRERA	Project Chemist	To Be Determined		
CABRERA	Corporate Safety & Occupational Health Manager	Paul Schwartz	860-569-0095	pschwartz@cabreraservices.com
CABRERA	Corporate Radiation Safety Officer	Hank Siegrist	860-569-0095	hsiegrist@cabreraservices.com
CABRERA	Contract Manager	Tony Urban	860-569-0095	aurban@cabreraservices.com
CABRERA	Project Assistant	Sandra Winter	210-967-4300	swinter@cabreraservices.com
CABRERA	CAD/GIS Specialist	Boriana Pangelova	860-569-0095	BPangelova@cabreraservices.com
CABRERA	Site Data Coordinator	Sam Knotts	210-967-4300	sknotts@cabreraservices.com

Table 3-1. Project Contact List (Continued)

Affiliation	Role	Name	Telephone	Email
CABRERA	Site Remediation Manager	Dan Williams	314-600-8129	dwilliams@cabreraservices.com
CABRERA	Site Safety & Health Officer	TBD		
CABRERA	Site Radiation Safety Lead	TBD		
CABRERA	Field Technicians	TBD		
CABRERA	On-Site Laboratory Manager	Mike Withers		
CABRERA	Remedial Constructors	Jon Cote	860-569-0095	Jcote@cabreraservices.com
GPL Lab	Lab Manager	Paul Ioannides	301-694-5310	ioannides@gplab.com
ERS	Manager	David Ardito	732-212-8140	ersdavid@comcast.net
US Ecology	Manager	Chad Hyslop	208-319-1604	CHYSLOP@americanecology.com
Energy Solutions	Manager	Jose Jerex	801-649-2000	jjerez@energysolutions.com

3.2 CABRERA Personnel and Responsibilities

3.2.1 Project Executive

Len Johnson, Vice President (VP) and Chief Operating Officer (COO), will provide support and guidance to the project team as the Program Executive. Mr. Johnson will be responsible for working with the project team to assure timely identification and resolution of technical issues that may arise, and for providing technical guidance to project personnel through our PM. Staffing and execution of this project is of the highest priority. To assure company staff and resources are available to perform this work in accordance with the proposed schedule, corporate oversight of this project will be the responsibility of Mr. Johnson.

3.2.2 Program Manager

Mr. Tim Taylor, our Remediation Program Manager, will be responsible for ensuring necessary corporate resources are made available to meet project technical and administrative requirements. In addition, the Program Manager will be responsible for reviewing project plans, providing technical guidance and monitoring the progress of remediation activities for the project.

3.2.3 Project Manager

The PM, Mr. Mark Tepperman, Professional Geologist (PG), is responsible for evaluating the appropriateness and adequacy of the technical services provided for the project, and for developing the technical approaches and level of effort required to address each task. He is also responsible for the day-to-day conduct of work, including integration of input from supporting disciplines, USAF, and subcontractors. He will work closely with the Project Engineer during implementation of the field program. The PM will ensure that necessary documents, reviews, and notifications have been performed before the commencement of field-related activities. Specific responsibilities of this role include:

- Initiating project activities
- Directing project planning activities
- Ensuring that qualified technical personnel are assigned to various tasks, including subcontractors
- Identifying and fulfilling equipment and other resource requirements
- Monitoring project activities to ensure compliance with established scopes, schedules, and budgets
- Ensuring overall technical quality and consistency of project activities and deliverables

3.2.4 Project Engineer

The Project Engineer, Mr. John Hackett, Professional Engineer (PE), Certified Health Physicist (CHP), is the project technical liaison to the Project Executive and PM for all field activities. The Project Engineer provides technical guidance and monitoring of field staff ensuring that all personnel adhere to the requirements of the QPP. The Project Engineer will be in frequent communication with the PM and field team leadership, serving as the primary technical authority involving engineering and radiological issues. The Project Engineer will be responsible (along with the PM) for the activities of the field crew and subcontractors to ensure tasks are implemented in accordance with the approved project plans. The Project Engineer shall have the following additional responsibilities:

- Assists the PM in implementation of the QPP

- Provides consultation to the PM on all technical matters
- Ensures compliance with all applicable regulations concerning the handling and transportation of radioactive materials
- Assists with preparation of Corrective Action Reports
- Reviews and provides engineering oversight for all construction and characterization activities
- Reviews and provides technical input for all proposed field changes to project plans
- Performs reviews of instrument calibration records and practices
- Performs reviews of the operation of radiological safety monitoring equipment
- Ensures that field activities are conducted in accordance with project plans and applicable procedures and regulations.

3.2.5 Project Chemist

The Project Chemist (to be determined) is responsible for oversight of all chemistry-related tasks and will ensure that they are conducted in accordance with the SAP. The Project Chemist will act as a point of contact on all chemistry-related issues and shall be responsible for ensuring that all DQOs are met. In addition, the Project Chemist will oversee all data verification, validation, and evaluation.

3.2.6 Quality Control Manager (QCM)

Our QCM, Mr. Hank Siegrist, CHP, PE is responsible for the overall implementation of QC procedures required for both characterization and construction activities for the project. He will review planning documents to ensure completeness and consistency, oversee the field training completed prior to the initiation of field activities, document and review field team recordkeeping related to the on-site laboratory, instrument calibration, soil sampling and radiological and chemical field screening procedures. In addition, the QCM will also oversee implementation of construction QC measures in accordance with the WP. The QCM may conduct periodic audits of on-site procedures and is responsible for the proper determination and implementation of corrective actions. The QCM has the authority to impose proper procedures or to stop work, as specified in the QAPP.

3.2.7 Corporate Safety & Occupational Health Manager (SOHM)

The SOHM, Mr. Paul Schwartz, Certified Industrial Hygienist (CIH), Certified Safety Professional (CSP), is responsible for the review and acceptance of all project SSHPs. No project involving hazardous, toxic, or radioactive materials shall commence without his signed acceptance plan. Additionally, the SHM shall:

- Ensure that the SSHP complies with all Federal, State, and local health and safety requirements, modifying specific aspects of the SSHP as necessary to address field changes that may impact safety
- Evaluate and authorize any changes to the SSHP
- Implement and oversee CABRERA's corporate health and safety program
- Ensure that the Site Safety and Health Officer (SSHO) is appropriately qualified and trained to implement the SSHP. Maintain communication with the SSHO to ensure proper implementation of the SSHP, and provide direction on any significant safety issues that arise in the field.

- Assist in the training of field personnel with respect to the identification and mitigation of site-specific hazards and the use of air monitoring instruments, personal protective equipment (PPE), decontamination procedures, and emergency/spill response
- Conduct periodic site health and safety inspections

3.2.8 Corporate Radiation Safety Officer (RSO)

The RSO, Mr. Hank Siegrist, CHP, PE, is responsible for the acceptance of the portion of the SSHP that addresses radioactive material and/or radiological contamination. Specifically, the RSO shall:

- Ensure that the SSHP complies with all Federal, State, and local requirements related to the handling and transportation of radioactive and/or radiologically contaminated materials
- Implement and oversee CABRERA's Radiation Safety Program (RSP; CABRERA, 2000a), which includes all issues involving licensed radioactive material
- Ensure that the Site Radiation Safety Lead (SRSL) is appropriately qualified and trained to implement the portions of the SSHP related to radiation safety, and that communication is maintained with the SRSL to ensure proper implementation of the SSHP and provide direction on any significant radiation safety issues that arise in the field
- Assist in the training of field personnel with respect to the identification and mitigation of site-specific radiation hazards and the use of radiation monitoring instruments, personal dosimetry, and contamination surveys
- Conduct periodic site radiation safety inspections

3.2.9 Corporate Quality Manager

The Corporate Quality Manager, Bob Applebaum, has company-wide responsibility for consistency in the quality of services and deliverables. Specifically, the Corporate Quality Manager shall:

- Coordinates with the PM and Program Manager in implementing the project-specific quality plans
- Retains the obligation and authority to halt work that is not consistent with CABRERA quality standards

3.2.10 Field Team

The CABRERA field team members are responsible for performing field activities as stipulated in this QPP. In addition to the personnel listed above, the field team members and responsibilities will consist of the following:

Site Remediation Manager (SRM) - The SRM, Mr. Dan Williams, serves as the primary POC during all field operations, reporting directly to the PM. Additional responsibilities of the SRM include: coordination with the Project Engineer for field implementation of the WP; overseeing field data collection and QC activities; and maintaining communication with the field crew and USAF personnel. As SRM, Mr. Williams is responsible for all aspects of the remediation effort including: health and safety adherence to schedule and budgets; daily operations; management of subcontractor activities; and QC for environmental remediation and demolition. The SRM will work with the CABRERA project and corporate management to control costs, meet the schedule goals, and complete the work in a timely and efficient manner with zero accidents.

Site Safety and Health Officer – The SSHO reports directly to CABRERA's corporate SOHM. The SSHO is responsible for verifying the SSHP is followed and that RW-06 Site personnel are appropriately trained

as required. The SSHO has authority to issue stop work orders on-site tasks that he/she believes may be unsafe. When stopped, work will not recommence until the corporate SHM, Corporate RSO and PM approve the restart. The SSHO is also responsible for maintaining personnel training certificates, medical monitoring files (as needed) and preparing accident investigation forms in accordance with the accident avoidance and reporting procedures of the SSHP. . The SSHO will be responsible for conducting appropriate occupational monitoring throughout the project, such as personal air sampling, area air sampling, dust monitoring, and noise monitoring.

Site Radiation Safety Lead – The SRSL is responsible for the day-to-day implementation of the Radiation Safety Program. The SRSL has the authority to shut down any operation that jeopardizes the health and safety of site personnel, the environment, or the local community. In addition, the SRSL has the following responsibilities:

- Provide on-site training of field personnel to convey site-specific radiation protection requirements related to the Radiation Protection Plan (RPP) and applicable standard operating procedures (SOPs)
- Ensure proper implementation of the SSHP during field activities, including requirements for radiological control measures, decontamination procedures, and personal dosimetry
- Provide daily updates during the morning safety briefings to review applicable radiological procedures and alert the field crew to any change conditions or additional radiation safety issues that may arise that day
- Conduct and document all radiological surveys, field instrument QC checks, and personnel radiation monitoring. Maintain applicable documentation, and ensure that the PM and RSO receive copies of all documentation on a daily basis
- Maintain communication with the RSO during field activities and coordinate on any radiological issues that may arise. Investigate incidents involving radioactive or radiologically-contaminated material, and coordinate with the RSO to ensure that all reporting requirements are met
- Continuously monitor the work place for radiologically-unsafe acts or conditions, and initiate corrective actions as necessary

Site Data Coordinator - The Site Data Coordinator (SDC) will be responsible for the collection, organization, and distribution of all site survey and analytical data collected during the project. All completed survey forms, chains of custody (COCs), field log sheets, and other data sheets will be collected and maintained by the SDC throughout the duration of the project. The SDC will track and log all on-site and off-site analytical data.

On-Site Laboratory Manager - The On-Site Laboratory Manager (OLM) will be responsible for the efficient and compliant operation of the on-site gamma spectroscopy laboratory. The OLM will work with the SDC to log and track all on-site sample analyses.

Field Technicians – Field Technicians (FTs) will primarily responsible for assisting with site layout tasks, radiological/chemical surveying, sample collection and packaging, support for the field laboratory, and shipping samples to offsite laboratories. Additional duties include performing periodic instrument checks and radiological surveys (e.g., scans of waste containers and remediation equipment). The Field Technician(s) will also maintain radiological zones and controls, perform surveys of personnel and equipment, and complete instrument and data records with oversight by the SRM and Project Engineer.

Remedial Constructors - Remedial Constructors (RCs) include heavy equipment operators, truck drivers, and laborers who are primarily responsible for conducting activities associated with site set up, excavation, earth moving, waste handling and packaging, waste storage, waste load out and local

transportation, site restoration, and site tear down. RCs will report directly to the SRM and will work in accordance with all approved plans, safety and health regulations, and the directives of the SSHO and SSRL.

3.3 Subcontractor Roles and Responsibilities

Subcontractor services are presently proposed to include the following:

- Temporary Office and On–Site Field Laboratory Facilities – A local vendor will be selected to supply two mobile trailers to house the temporary field office and the on-site field laboratory.
- Sanitary Service – A local vendor will be selected to provide and maintain temporary sanitary facilities, to include a portable chemical toilet for general use near the office trailer and any temporary wash station required
- Equipment Rentals – A local vendor will be utilized to supply rentals of construction equipment, machinery, and some instrumentation, as required.
- Off-site Laboratory Services – GPL, a New Mexico State Certified off-site laboratory, will provide laboratory analysis on all soil samples collected as part of the MARSSIM characterization and waste profile surveys. The off-site laboratory is responsible for samples received and the associated QA and QC of those samples.
- Waste Transportation – Environmental Rail Solutions (ERS) will provide rail car transportation of exempt and non-exempt radioactive waste and mixed chemical/radioactive waste to the US Ecology facility in Idaho and to the Energy Solutions facility in Utah.
- Waste Disposal – US Ecology will receive and dispose of exempt low level radioactive waste (LLRW) material. Energy Solutions will receive and dispose of non-exempt LLRW material and mixed chemical/radioactive waste.

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4.0 RADIONUCLIDES OF CONCERN

Based on the data from historical investigations and the results of the planning survey described in Section 2, the ROCs for the RW-06 are ^{14}C, ^{90}Sr, ^{137}Cs, ^{226}Ra, and ^{241}Am. Table 4-1 lists the ROCs along with the basis for their selection.

Table 4-1. ROC List for RW-06

Radionuclide	Half-Life (yrs)	Basis
^{14}C	5,730	Detection during planning survey
^{90}Sr	28.6	Potential historical inventory
^{137}Cs	30.2	Potential historical inventory; detection during 2006 RFI and planning survey
^{226}Ra	1,600	Potential historical inventory
^{241}Am	432	Detection during 2006 RFI

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5.0 FIELD OPERATIONS OVERVIEW

5.1 Characterization and Spot Remediation

The following is a brief summary of the activities to be conducted during the characterization and remediation efforts at the RW-06 Site. Additional details of RW-06 Site activities are provided in the attached WP, SAP, and SSHP.

- Mobilization and Preliminary Site Preparation Activities - This task includes coordination permit acquisition, notifications, and receipt of all required approvals as detailed in the WP; procurement activities; transportation of equipment, supplies and project personnel to the site; set up of work areas and support facilities; modification of site fencing to facilitate site access and provide appropriate site security; installation of a temporary road for vehicle access; delineation and marking of excavation areas (trenches and spots); project- and site-specific training; and field readiness checks.
- Waste Removal, Segregation, and Packaging – This task consists of surficial discrete spot removal, trench waste excavation, screening to segregate waste streams, packaging of waste streams in accordance with procedures outlined in the WP, along with the associated radiological and chemical laboratory analyses required to support those efforts. The approximate trench dimensions, materials, overburden, and anticipated contaminants are detailed in the WP and are based on previous investigations, prior experience/work at the site, and other project experience with similar sites.
  - Radiological Support and Characterization Subtask – This subtask includes site activities associated with the implementation of the SAP and SSHP.
  - Waste Excavation, Construction – This subtask includes equipment and personnel required to excavate the surficial hot spots and trench waste material from RW-06. Precision excavation methods will be used to segregate potentially clean soil from contaminated soil. Field screening and visual inspection for soil staining from potential chemical contamination will be used initially to identify potentially contaminated materials. Flexible-sided waste containers will be used to store the potentially contaminated waste streams. Apparently clean materials will be stockpiled onsite.
  - Waste Segregation and Reuse Testing - This subtask consists of the work effort required to screen, physically sort and segregate the material excavated at RW-06 to minimize the waste stream volumes requiring offsite disposal and to separate the wastes into disposal categories in order to minimize/control the cost of disposal. It is anticipated the excavated material will fall into one of the following 5 categories:
    - Clean debris suitable for reuse or disposal
    - Clean soil suitable for reuse as backfill material
    - Low-level radioactive waste (LLRW) (exempt under NRC 20.2002)
    - LLRW (Class A)
    - Mixed Class A LLRW and RCRA hazardous waste (LLRMW)

    An onsite laboratory, offsite laboratory, and field screening techniques will be used to demonstrate that non-impacted soils meet regulatory criteria for use as backfill, reducing costs for transportation and disposal of LLRW.
- Waste Packaging, Staging (if required), and Transportation and Disposal (T&D) – This task consists of all activities required to package, stage for short term (if NRC 20.2002 exemption

is not obtained prior to the completion of field work long-term on-site staging will be optional), transport and dispose of the waste generated during the RW-06 remedial action, including both the asphalt currently in place as caps on two of the waste trenches and the fencing surrounding the entire RW-06 area. Based upon the work completed historically it is assumed approximately 2,250 cubic yards (cy) of waste will require off-site disposal.

- Final Status Survey – This task consists of completing a final status survey in accordance with the NRC NUREG 1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Chemical sampling will also be conducted during the FSS phase to demonstrate compliance with the NMED residential soil screening levels.
- Site Backfill and Restoration – After completion of the FSS, the excavated trenches will be backfilled to the extent possible with clean excavated soils meeting the release criteria described in the SAP. In addition, reseeding of native grasses required to restore the site will be performed under this subtask.
- Demobilization – At the conclusion of the field effort, all temporary equipment, remaining supplies and personnel will be demobilized from the Site, and the Site will be restored to its original condition although the current site fencing will be removed at the completion of field activities.

6.0 REPORTING

A Remedial Action-Construction (RA-C) Completion Report will be developed following field activities. The RA-C Completion Report will document and present the results of the FSS and waste characterization, the final disposition of the excavated wastes, and the compliance of analytical data with the project DQOs. The results of all field screening, on-site and offsite laboratory analyses, and post-removal field data will be reduced, summarized, and interpreted; waste disposal activities and quantities will be documented; general construction activities completed will be discussed; and conclusions and recommendations resulting from the FSS will be provided. Appendices will be included to provide raw data, associated permits, disposal documentation, calculations and statistical analyses, maps, and diagrams.

The RA-C Completion Report will be prepared in draft, draft final, and final versions for review by USAF stakeholders, including AFCEE and Kirtland AFB staff, and the NMED. The Reporting task also includes provision of associated Photo Documentation, any requested Raw Data Packages, and the appropriate Lab Use Reports. Data submitted will meet the requirements for an Environmental Resources Program Information Management System (ERPIMS) electronic data deliverable.

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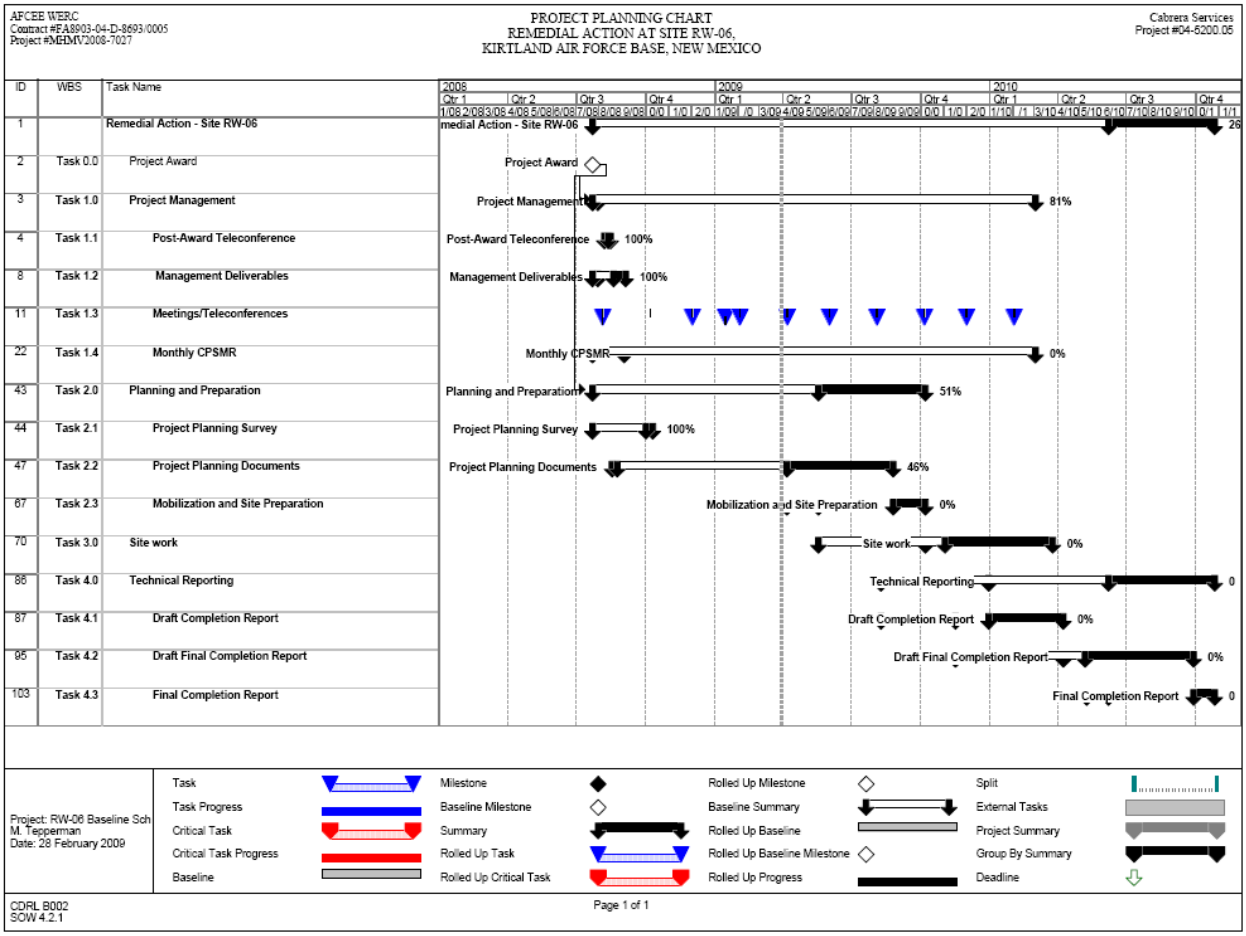
7.0 PROJECT SCHEDULE

The anticipated schedule for completion of all field-related project activities is depicted in Figure 7-1. Mobilization for field activities is scheduled for Summer 2009.

Figure 7-1. Field and Reporting Schedule



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DRAFT FINAL

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

ATTACHMENT I OF THE QUALITY PROGRAM PLAN
REMEDIAL ACTION CONSTRUCTION WORK PLAN
FOR THE REMEDIATION OF SITE RW-06

April 2009

377 MSG/CEANR
2050 Wyoming Blvd. SE
Kirtland AFB, New Mexico 87117-5270

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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

ATTACHMENT I OF THE QUALITY PROGRAM PLAN
REMEDIAL ACTION CONSTRUCTION WORK PLAN
FOR THE REMEDIATION OF SITE RW-06

April 2009

Prepared for

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3300 Sidney Brooks
Brooks City- Base, Texas

Contract No. FA8903-04-D-8693
Delivery Order 0005

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NOTICE

See Quality Program Plan (QPP) for the applicable notice and instructions for obtaining copies of this Remedial Action Construction Work Plan (WP).

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40 CFR 270.11

DOCUMENT CERTIFICATION

See QPP for the applicable document certification.

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NATURAL RESOURCE INJURY

See QPP for Natural Resource Injury (NRI) program information.

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ENVIRONMENTAL JUSTICE CONSIDERATION

See QPP for Environmental Justice Consideration information.

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PREFACE

See QPP preface section for applicable information.

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REMEDIAL ACTION CONSTRUCTION WORK PLAN
FOR THE REMEDIATION OF SITE RW-06

Contract No. FA8903-04-D-8693
Task Order 0005

WORK PLAN APPROVALS

See QPP for applicable USAF approvals.

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REMEDIAL ACTION CONSTRUCTION WORK PLAN
REMEDIATION OF SITE RW-06

Contract No. FA8903-04-D-8693
Task Order 0005

WORK PLAN APPROVALS

See QPP for applicable CABRERA approvals.

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ACRONYMS AND ABBREVIATIONS

A comprehensive list of acronyms may be found in the QPP.

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1.0 INTRODUCTION

This Work Plan (WP) describes the overall approach for preparation, permitting, excavation, segregation, waste characterization, packaging, transportation, and off-site disposal of contaminated soil and debris from 9 former disposal trenches and 5 discrete surficial locations with elevated radiological readings at the RW-06 site (hereafter referred to as "RW-06"), Kirtland Air Force Base (AFB), New Mexico. The WP also provides guidance for documenting project activities and remediation results, daily progress reporting, and recordkeeping. Additional information regarding the purpose and objectives of the remediation efforts described herein may be found in the Quality Program Plan (QPP).

RW-06 occupies approximately 4.5 acres and from 1960 to 1971 was part of a 40-acre facility operated by the Radiobiology Laboratory, Biophysics Branch, Air Force Weapons Laboratory (USAF, 1981). The portion of the Radiobiology Laboratory that was used as a radioactive burial site contained 9 trenches that were used for the disposal of animal carcasses, low-level radioactive material, and other laboratory wastes. RW-06 is located within a fenced field area immediately east-southeast of the former Riding Stables complex.

The WP is incorporated into the QPP as Attachment I. The QPP establishes the overall strategy, organization, roles and responsibilities, project contact list, and environmental restoration history while the WP provides detailed procedures for accomplishing the project objectives in the field. Remediation activities described in the WP are outlined below:

1) Obtaining permits, making appropriate notifications and securing regulatory approval of an alternate lower-cost disposal site for most of the radioactive material removed during remediation prior to mobilization;
2) Procurement and subcontracting activities to secure field support facilities, materials, equipment, offsite laboratory services, sanitary services, electrical hookups, and instrumentation;
3) Mobilization to RW-06 and site preparation, including establishing temporary facilities, services and site controls to facilitate field remediation, ensure worker and public safety as well as environmental protection, and setting up and calibrating an on-site radiological laboratory for the project;
4) Excavating waste trenches and discrete contaminated locations, preliminary field screening and sorting, waste sampling and laboratory analysis for disposal/reuse characterization, and segregation of excavated material;
5) Preparation and submission of waste profiles and applications for waste disposal; obtaining approvals for disposal from waste facilities; and coordination with waste transporters and disposal facilities;
6) Packaging, transporting, and off-site disposal of waste streams;
7) Confirming that project cleanup goals have been met in accordance with the guidance for Final Status Surveys (FSS) contained in United States Nuclear Regulatory Commission (NRC) *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) *Revision 1*. NUREG-1575 (NRC, 2000) for radionuclides of concern and New Mexico Environment Department (NMED) Residential Soil Screening Levels for non-radiological chemical contaminants of concern for the RW-06 site] have been met at the limits of excavation;
8) Backfilling the remediated excavations, completing site restoration, and demobilization; and,
9) Completion of a Remedial Action-Construction (RA-C) Completion Report and a Final Status Survey Report in accordance with MARSSIM to document project activities and site closure.

The WP describes field activities for remediation of RW-06 in accordance with US Air Force (USAF) guidelines as well as maintaining a safe and productive work environment. Subplans are organized within the WP to describe methodologies, procedures, and instructions for site activities, including: Site Preparation Plan, Siting Analysis Plan, Environmental Controls Plan, Excavation Plan, Spill and Discharge Control Plan, Transportation Plan, Remediation Management Plan, and Demobilization and Closure Plan.

Waste handling and segregation are essential components of the WP in order to minimize waste volumes and costs for disposal by segregating high activity soil, containers, and carboys; sizing large debris to avoid disposal facility surcharges; physically screening debris from soil; and performing on-site laboratory analyses to achieve a shorter turnaround time for disposal decisions. Project activities also include assisting Kirtland AFB in pursuing a 10 CFR 20.2002 (NRC) exemption from the NRC, potentially enabling most waste material and debris to be disposed of at the US Ecology Grand View, Idaho facility to reduce disposal cost.

Site activities will be performed using CABRERA's US NRC Decommissioning license in accordance with this WP, CABRERA's *Radiation Safety Program* (RSP) (CABRERA, 2000a), Occupational Safety and Health Administration (OSHA), applicable USAF instructions (AFIs) and standards, and other applicable Federal, State and local regulations.

2.0 SITE DESCRIPTION

See QPP for Site Description information.

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3.0 PREREQUISITE REGULATORY REQUIREMENTS

3.1 Permits, Notifications, and Approvals

Permits, notifications, exemptions, and approvals will be completed and/or acquired prior to scheduled remediation activities in accordance with regulatory and USAF requirements, including minimum advance notification requirements. Copies of all permits, approvals, and notifications will be maintained on site in the temporary office trailer. A list of all prerequisite regulatory requirements anticipated for this project is provided in Table 3-1 and discussed in the following sections.

Table 3-1. Permits, Notifications, Exemptions, and Approvals

Requirement	permit	notification	exemption	approval	Responsible Preparer	Regulatory Body	Timeframe
Pre-Mobilization							
Invoke nation-wide radioactive materials license	**X**	**X**			Corporate RSO	NRC	At least 14 days prior to shipping radioactive sources
Radioactive sources on base		**X**		**X**	Corporate RSO	Kirtland AFB RSO	14 days prior to initiating site activities
Fuel storage		**X**		**X**	Project Engineer	Kirtland AFB Bioenvironmental Engineering	14 days prior to initiating site activities
X-ray fluorescence (XRF) unit		**X**		**X**	Corporate RSO	Kirtland AFB RSO	14 days prior to initiating site activities
Fugitive Dust Control Permit (20.11.20 NMAC)	**X**				Project Engineer	City of Albuquerque Environmental Health Department – Air Quality Division	Submit 10 business days prior to operations Valid for 1 year
Construction General Permit (CGP), includes: • Stormwater Pollution Prevention Plan (SWPPP) • Notice of	**X**	**X**		**X**	Project Engineer	EPA: (all electronically)	Effective for 5 years from issue date • KAFB Compliance reviews SWPPP (Cole Cosgrove) - Minimum 1-2 weeks • Submit NOI 7 days before construction activities - Authorized not less

Requirement	permit	notification	exemption	approval	Responsible Preparer	Regulatory Body	Timeframe
Intent (NOI) • Notice of Termination (NOT)							than 7 days after EPA receipt • Submit the NOT within 30 days after final stabilization
Pre-Excavation							
Utility Clearance		**X**		**X**	SRM	New Mexico One Call (utilities)	Minimum 48 hours prior to excavation Valid for 10 working days
Dig Permit	**X**				SRM	Kirtland AFB Chugach Management Service, JV, Drafting Department (in person)	Submit 10 days prior to excavation Valid for 30 days
Kirtland AFB Landfill Temporary Pass	**X**				SRM	Kirtland AFB Chugach Management Service JV	Expires after 90 days
Waste Transportation and Disposal							
Waste profile		**X**		**X**	Project Engineer	Disposal facility(s)	Submit to KAFB PM 8 weeks following demobilization
Special Nuclear Material (SNM)		**X**		**X**	Project Engineer	Disposal facility(s)	Submit to KAFB PM 8 weeks following demobilization
Generator Site Access Permit (GSAP)	**X**				PM	Utah	Initiate at least 4 months prior to shipment date
Approval to Transport		**X**		**X**	Disposal Facility	Disposal facility(s)	Receive from disposal facility 1 month prior to

Requirement	permit	notification	exemption	approval	Responsible Preparer	Regulatory Body	Timeframe
							shipment date
Uniform Low-Level Radioactive Waste Manifest				**X**	Waste Broker	Signature by authorized government representative	Submit to KAFB PM for review, at least 1 week prior to shipment date
Bill of Lading to accompany waste shipments		**X**		**X**	Waste Broker	Signature by authorized government representative	Submit to KAFB PM for review, at least 1 week prior to shipment date
10 CFR 20.2002 Exemption for Alternate Disposal Facility	**X**			**X**	Kirtland AFB	NRC	

3.1.1 Pre-Mobilization Permits and Notifications

This division of permits and notifications must be completed prior to mobilization to the site. The Project Engineer will be responsible for ensuring that permit applications and notifications are completed correctly and accurately. The PM will be responsible for ensuring that these permits and notifications are completed prior to mobilization.

Requirements related to radioactive sources and instruments must be completed or obtained in order to transport those items onto Kirtland AFB. In general these permits, approvals, and notifications will involve either the NRC and/or Kirtland AFB.

- In accordance with our Materials License, CABRERA must notify the NRC, in writing, at least 14 days prior to initiating site activities that radioactive sources will be shipped to and managed at RW-06 for on-site laboratory instrument calibration. The Corporate RSO is responsible for making the notification to NRC
- CABRERA will notify the Kirtland AFB RSO, in writing, at least 14 days prior to initiating site activities that radioactive sources will be brought onto the base and managed at RW-06 for on-site laboratory instrument calibration and as integral parts of field screening instruments. The Corporate RSO is responsible for making notification to the base RSO. CABRERA will provide a NRC Form 241 (Appendix D) for all calibration sources brought onto the base meeting licensable material criteria.

Permits for stormwater management (SWM), erosion/sediment control (ESC), and dust emissions are required prior to commencing site set-up activities and will be obtained in advance of mobilization. Construction activities (including other land-disturbing activities) that disturb 1 acre or more are regulated under the National Pollution Discharge Elimination System (NPDES) stormwater program. In New Mexico, EPA is the permitting authority responsible for issuing a Construction General Permit (CGP) that

outlines a set of provisions that must be followed to comply with the requirements of the NPDES stormwater regulations. As part of the CGP permit process, a SWPPP will be developed (separate from this plan), reviewed by Kirtland AFB, and submitted to the EPA along with the permit application (Table 3-1). The CGP also includes submission of a Notice of Intent (NOI) and a Notice of Termination (NOT). Additional information about the environmental protection permit requirements includes the following:

- **Fugitive Dust Control Construction Permit** - required for all jobs that will disturb three quarters (¾) of an acre or more of soil. Fugitive dust control plans may be submitted in any format including a copy of a program that complies with any other statute or regulation so long as the plan provides reasonably available control measures whose purpose is to mitigate fugitive dust and the plan meets the objectives of 20.11.20 NMAC. A permit application and plan with the applicable fees must be submitted to the City of Albuquerque Environmental Health Department, Air Quality Division, no less than 10 business days prior to the start of active operations. Within 10 business days of the Department receiving the permit application, plan and fees, the Department will approve the permit, approve the permit with conditions, or deny the permit. Permit applications for surface disturbance can be downloaded at the City of Albuquerque's website:

  http://www.cabq.gov/airquality/dust.html

- **CGP** – requires submission of a site-specific SWPPP for approval in accordance with Section 402 of the Federal Clean Water Act (EPA). ESC and SWM are covered under the SWPPP. The SWPPP will be reviewed and approved by the Kirtland AFB Environmental Compliance staff prior to submitting electronically to EPA. In accordance with the CGP, the SWPPP must be submitted prior to submitting a Notice of Intent (NOI) form to obtain permit coverage. Templates for SWPPP (Customizable Non-PDF Version) and Inspection Reports (Customizable Non-PDF Version) are available at the following World Wide Web sites"

  http://www.epa.gov/npdes/pubs/sw_swppp_template_unauthstates.doc

  http://www.epa.gov/npdes/pubs/sw_swppp_inspection_form.doc

  - **NOI** - a complete and accurate must be submitted to EPA at least 7 days prior to commencement of construction activities covered under the CGP. The NOI application is available on the Internet through the EPA eNOI system. Authorization to discharge stormwater from construction activities under the terms and conditions of the CGP begins 7 calendar days after acknowledgment of receipt of the complete NOI is posted on the EPA NPDES website. Electronic submission through the EPA's eNOI system is faster than submitting a paper NOI. The EPA's eNOI system and the NOI status can be found at the following World Wide Web sites:

    http://cfpub.epa.gov/npdes/stormwater/enoi.cfm

    http://cfpub.epa.gov/npdes/stormwater/noi/noisearch.cfm

  - **NOT** - must be filed within 30 days after cessation of construction activities and final stabilization of the site (70% of disturbed area is revegetated with plants at Kirtland AFB). A completed NOT must be submitted either electronically (strongly encouraged) or by completing the paper Notice of Termination form. A NOT must be submitted within 30 days after another operator assumes the liabilities. That new operator must submit an NOI for coverage. Kirtland AFB may assume responsibility before NOT if satisfied with the revegetation efforts. The NOT must include

    - NPDES permit tracking number for the stormwater discharge

- The basis for submission of the NOT, including: final stabilization has been achieved on all portions of the site; another operator/permittee has assumed control over all areas of the site that have not been finally stabilized; and coverage under an alternative NPDES permit has been obtained
- Name, address, telephone number and U.S. Internal Revenue Service (IRS) Employer Identification Number (EIN)
- The name of the project and street address (or a description of location if no street address is available) of the construction site for which the notification is submitted
- A certification statement signed and dated by an authorized representative and the name and title of that authorized representative.

- **Waivers** - three types of waivers may be granted in lieu of obtaining coverage under the general permit.
  - Rainfall-Erosivity Waiver under 40 CFR 122.26(b) (15) (i) (A) (EPA), is based on the "R" factor from the Revised Universal Soil Loss Equation (RUSLE) and applies to projects where (and when) negligible rainfall/runoff-erosivity is expected (e.g., the rainfall-erosivity factor is less than 5)
  - Water Quality Waivers (2 types) under 40 CFR 122.26(b)(15)(i)(B) (EPA) are based on an analysis that stormwater discharges from small construction activities would not be expected to cause or contribute to exceedances of water qualifying standards (WQS)

3.1.2 Pre-Excavation Permits and Notifications

This division of permits and notifications must be completed prior to commencing any intrusive excavation work. These permits are associated with identifying, marking, and documenting subsurface obstructions in the excavation area to reduce the risk to personnel and critical infrastructure property. In addition, excavation permits and notifications are required by both USAF regulation and by New Mexico state law. The excavation permits have minimum prior notification requirements and are only valid for a specified period of weeks. The SRM will be responsible for ensuring that all required permits and notifications are completed and approved prior to commencing excavation. In addition, the SRM will track the excavation permits and ensure that all are maintained current throughout the excavation activities.

- **Utility Clearance** - New Mexico state law requires anyone responsible for any excavation to provide at least 2 working days (48 hours) notice to owners of underground facilities when a dig is planned. This will be accomplished by notifying New Mexico One Call, Inc. All owners of subsurface utilities have 2 working days before excavation begins to mark the locations of any underground lines or take other appropriate measures to protect them. These location marks are valid for 10 working days before the excavator must request a relocate from the call center. The subsurface utility owners have 2 working days to mark relocates. Call the one call center if any facility is not marked on schedule.

  New Mexico One Call is open from 7:00 am to 5:00 pm, Monday-Friday, except holidays. Requests can be made by:

  - Phone: 1-800-321-2537, toll free from anywhere in the United States or 811 from anywhere in New Mexico
  - Fax: 1-800-727-8809, toll free from anywhere in the United States
  - Online: http://www.nmonecall.org/

New Mexico's excavation law requires the following information to be provided to the one all center:

- Excavator's company name, a contact person's name, phone number, mailing address, or a New Mexico One Call ID number
- Description and purpose of the type of work to be done
- Name of person or company for whom the work is being done
- Whether or not the excavation site is marked in white
- Nearest cross street and accurate physical description of the location and size of the excavation site (e.g. street address, GPS coordinates with degrees in decimal format)
- Driving instructions to a rural excavation site, starting from the nearest community or the intersection of 2 major highways
- Accurate description of area (pre-marked in white) that needs to be spotted
- Any appropriate remarks regarding access to or hazards at the excavation site

- **Kirtland AFB Dig Permit** - can be acquired with a complete and accurate Permit Request form (Appendix D) and a site map with the work area highlighted. Dig areas at the site must be marked in white (paint, tape, etc.) before approval. The form and highlighted site map must be submitted 14 days, but no earlier than 1 month, prior to breaking ground, to:
  - Chugach Management Service, JV, Drafting Department, Building 20686
    - Preferably in person
  - For more information, contact Christine Goodwin at 505-846-9091

3.1.3 Waste Transportation and Disposal

3.1.3.1 Radioactive and Hazardous Waste

Waste transportation and disposal is a highly regulated set of activities requiring careful documentation, advance notifications and approvals, and various state permits. Approval from specific disposal facilities will require waste profiles based on the results of chemical and radiological laboratory analyses performed on soil and soil-like materials. Waste profiles and disposal applications will be provided to the Kirtland AFB PM for review and signature prior to submittal to the waste disposal facility. A Generator Site Access Permit (GSAP) will be obtained by CABRERA at least 2 months prior to shipping any waste into the state of Utah. The PM will be responsible for ensuring that all waste disposal approvals are received prior to initiating waste shipment.

A Notice to Transport must be received from each facility scheduled to receive low level radioactive waste (LLRW) or low level radioactive mixed waste (LLRMW) prior to shipping. At the time of waste shipping, CABRERA will provide waste manifests and bills of lading for each shipment of RCRA hazardous, LLRW, LLRMW, and other wastes shipped off base for disposal. The CABRERA Certified Waste Broker will be ensure that all disposal approvals have been received and that all manifests and bills of lading are completed, accurate, and signed by an authorized Government representative prior to shipment.

3.1.3.2 Kirtland AFB Landfill Permit

Non-hazardous soil and debris may be eligible for disposal at the Kirtland AFB landfill. The Kirtland AFB Civil Engineer and Kirtland AFB Landfill require analytical documentation characterizing the waste prior to consideration for disposal of soil and/or debris from any restoration site. For waste and debris that have been characterized during the completion of the site activities, analyses generated during the characterization process may be used in determination of suitability for disposal. Procedure for obtaining permission to use the KAFB Landfill is as follows:

- Submit a memorandum requesting authorization to dispose of investigative derived waste/site debris to the Kirtland AFB Activities Solid Waste Program Manager: Mr. Steven C. Kitt, 377 MSG/CEANC at 505-846-9014 or steven.kitt@kirtland.af.mil.
- Include in the submittal the name of the point of contact overseeing the activity and their phone number, the location from which the waste was generated/site identifier, the waste analytical results, the hauling companies to be used to transport the waste to the landfill, the roll-off identification numbers, and the license plate numbers to the transport vehicles if not using roll-offs for waste containment.

3.1.3.3 NRC 20.2002 Exemption for Alternate Disposal Facility (Option)

CABRERA will work with Kirtland AFB and the USAF Radioisotope Committee (RIC) to obtain NRC approval of an alternate disposal method in accordance with 10 CFR 20.2002 (NRC). This exemption will allow disposal of non-Class A, exempt low activity radioactive material at the US Ecology facility in Grandview, Idaho, as a lower cost alternative.

3.2 Training, Certification, and Licensing Requirements

All project activities will be conducted in accordance with CABRERA's *Radiation Safety Program* (RSP) (CABRERA, 2000) and applicable Occupational Safety and Health Administration (OSHA) training standards, USAF instructions/standards, and other local and federal statutes. CABRERA'S Standard Operating Procedures (SOPs) that are referenced within this WP are procedures from the CABRERA RSP.

3.2.1 Health and Safety

Details of the health and safety training requirements are provided in Chapter 6.0 of the project SSHP (Attachment III of the QPP). All personnel working on site will have current training and/or certification in radiation worker safety, hazardous waste operator and emergency response (HAZWOPER), site-specific construction safety, personal protective equipment (PPE), and task-specific training (e.g. respiratory equipment). At a minimum, at least one member of the on-site management team will be currently certified in first aid/Cardio Pulmonary Resuscitation (CPR) and Bloodborne Pathogens (BBPs).

3.2.2 Radioactive Materials

Site activities will be performed using CABRERA's NRC Decommissioning license for shipping and storing laboratory calibration sources on site and for handling radioactive waste in accordance with this WP. A copy of CABRERA's NRC radioactive materials license is provided as Appendix A. of this WP.

The CABRERA Certified Waste Broker will hold a current certification by the US Army Joint Munitions Command (JMC), the Department of Defense (DoD) Executive Agency for low-level radioactive waste, to arrange for transportation of the waste, collect or consolidate shipments of waste; or, process waste in some manner in preparation for final disposition. He will be trained in accordance with the requirements in 49CFR, Part 172, Subpart H and will satisfactorily meet all qualification requirements set forth by the US Army JMC.

3.2.3 Material and Waste Transportation

Commercial motor vehicle operators are required to have a valid, current Commercial Drivers License (CDL), issued by a US state transportation department, and appropriate to the size, type, and purpose of the vehicle. In the case of RCRA hazardous and/or radioactive material of any kind requiring placarding, drivers will have a minimum of a Class C CDL with H endorsement, and training in accordance with Department of Transportation (DOT) and State regulations.

3.2.4 Recordkeeping

Records of site personnel training, certifications, approvals, and licensure will be maintained on site by the SRM during all field remediation operations. Copies of all required documents will be submitted to the SRM and the PM prior to personnel commencing any on-site work.

3.3 Mobilization

CABRERA will mobilize necessary facilities, equipment, materials, and personnel to perform the characterization and remediation activities following completion of procurement/subcontracting activities, acquisition of relevant permits and approvals, accomplishing notifications (as described in Section 3.1 of this WP) and receipt of USAF Notice to Proceed. Equipment, materials, and personnel will be mobilized in accordance with the project schedule.

The PM, PA, and Project Engineer will be responsible for ensuring that subcontracts, purchase orders, and notifications to vendors are executed on time to enable mobilization to the field to occur on schedule. For security reasons, mobilization to the base of all personnel, large equipment, support facilities, and drop-shipped materials must be coordinated in advance with the Kirtland AFB PM or his designee.

The table in Appendix E provides a list of equipment and materials anticipated for this project. The list associates each item with related activities and is organized into the following divisions:

- Office Facilities
- Field Laboratory
- Sanitary Facilities
- Equipment Storage Facilities
- Safety Equipment/Instrumentation
- Earth Moving /Handling Equipment
- Sample Collection / Field Screening Equipment
- Field Services licensed electrician
- Consumable supplies
- Waste Storage / Handling

3.4 Site Management

This section describes measures that will be used to control site access, remediation activities, waste storage and handling, and air emissions. Construction activities at RW-06 include excavating, segregating, sorting, packaging, staging, and offsite transportation of soil and debris from 9 waste trenches and 5 discrete contaminated spots spread over an approximate 4.5 acre area.

3.4.1 Siting Analysis Plan

The site layout has been designed to maintain visibility; ensure safe operations; minimize potential risks to site workers, the public, and the environment; and protect nearby soils and vegetation from project activities. Historical information indicates that high level radioactive and chemical materials were previously transported and disposed off base through Air Force channels and were not disposed in the waste trenches at RW-06. This information has been corroborated by characterization activities at the RW-06 site, none of which have identified high contaminant levels. Therefore, it is anticipated that relatively low levels of chemical or radiological contamination is present in material to be removed from RW-06.

Potential fugitive dust from planned construction activities will be controlled to avoid adverse impacts on remediation and nearby Kirtland AFB workers as well as the environment. Alternatives considered to address the potential for airborne dust at RW-06 are: no action; mechanical dust suppression by manually spraying water; providing site workers with respiratory protection; using fabricated or constructed barriers surrounding the excavation areas to contain dust; or a combination water truck/hand held sprayer, respiratory protection, and physical barriers. Based upon the potential for fugitive dust containing low levels of site contaminants, it is anticipated that manually spraying water and/or the use of a water truck will be needed to control fugitive dust.

Traffic access and control measures will be required to maintain worker and public safety, ensure efficient movement of large vehicles and equipment, and reduce the risk of spreading contaminants at the site. Heavy truck and equipment traffic in to, out of, and within the site can result in developing potholes and ruts, potential for vehicle accidents, and delays caused by misdirected vehicles. A temporary access roadway will be constructed from the entrance gate at Pennsylvania Avenue northwestward through the Support Zone (SZ) to the Contamination Reduction Zone (CRZ). The temporary roadway will include access ways and turnarounds to facilitate loading of waste at the edge of the Exclusion Zone (EZ) and minimize the potential for spillage and cross contamination (Figure 3-1). Traffic control including signage and cones for maintaining open lanes for passing traffic and a flagman will be used during truck loading and load-out of staged waste. Specifications for the temporary roadway and signage are provided in Subsection 3.4.2.3 of this plan.

ESC/SWM measures will be required in accordance with Section 402 of he Clean Water Act, as discussed in Section 3.1 of this plan. The excavation and waste staging efforts is likely to result in disturbance of over 1 acre of soil requiring that ESC/SWM controls be put in place. The specific requirements for site-specific ESC/SWM measures are detailed in Subsection 3.4.2.3 of this plan.

Kirtland AFB has primary responsibility for site security associated with the RW-06 remediation project. The SRM has responsibility for ensuring secure work practices to minimize the opportunity or possibility of theft or vandalism by using good housekeeping procedures, ensuring all site equipment and materials are secured in the storage facility with reasonable safety precautions. Any site security issues will be communicated to the PM, Project Engineer, and Kirtland AFB security for resolution.

3.4.2 Site Preparation Plan

3.4.2.1 Site Layout

This subsection identifies the approximate limits of the site; locations for traffic lanes, laydown, storage and support areas; and various site work zones for health and safety management as well as contamination control. The general layout of the site, including the proposed site access and planned locations of the SZ, CRZ, and EZ are depicted on the Site Map (Figure 3-1) and are described further in the subsections that follow. Key elements of the site layout include:

- Site access points consisting of main external entrance gate, internal control point for entering the EZ, and service gate (New Gate) for restricted use as access during waste and backfill hauling activities
- Primary two-way access road from Pennsylvania Avenue leading to the office/laboratory area and RW-06 site
- One-way temporary construction road planned for use during the waste load-out phase of project activities
- The SZ located to the west/southwest of the RW-06 site
- The CRZ located between the EZ and the SZ

- The EZ consisting of potentially-contaminated areas where excavation, segregation, sifting/sorting and waste packaging activities will occur
- Material handling, waste staging, and non-impacted soil staging areas located within the EZ
- Clean laydown, storage, and truck parking area

3.4.2.2 Work Zones

Support Zones

The SZ is the least restrictive on-site work zone based on the concept that this are is not contaminated. At least one member of the site management team will be present in the SZ, and maintain communications with the remediation team working in the EZ. All temporary support facilities and equipment will be located within SZ to include, at a minimum, the items listed in Table B-3-3 (Appendix E) for office equipment, field laboratory, sanitary facilities, temporary storage container, laydown area, and consumable supplies.

During site preparation, temporary office and field laboratory trailers will be set up within the SZ as depicted in Figure 3-1. The temporary office facility will serve as the site command post and will consist of a mobile office trailer or container office, minimum 40 ft x 8 ft x 8 ft, divided into at least 2 rooms with built in shelving, desks, and file cabinets. The mobile office will be equipped with central air conditioning, overhead fluorescent lighting, and standard electrical wiring. Office trailers will be blocked and leveled and equipped with OSHA compliant stairs, tie-downs, and security bars (Appendix E).

Figure 3-1. Site Layout Map

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An on-site field laboratory will be set up in the SZ for conducting analyses of soil to provide an estimate of radionuclide concentrations that represent the location being measured (Figure 3-1). The laboratory will be contained within a modified mobile office trailer, minimum 40 ft x 8 ft), divided into 2 rooms to provide adequate space for sample storage, preparation, analysis. The field lab will have at least 1 room equipped with built in desk, filing cabinet, and shelving; will be air conditioned, overhead fluorescent lighting, and standard electrical wiring; and will be provided with stairs and security bars (Appendix E). Details regarding laboratory facilities, instrumentation, and equipment are described in the Sampling and Analysis Plan (SAP).

Electric power will be obtained for both the office trailer and the field laboratory through a service connection installed from existing power lines at the site by a licensed electrician. It is anticipated that an electrical drop from a pole transformer is available for electrical needs on-site.

A lockable steel storage container, approximately 30 ft long, will be set up within the SZ of the site to provide temporary equipment and materials storage. The storage container will have fully opening double doors at one or both ends, tamper-proof locking system, and ground-level entry and loading.

A sanitary facility area will be established in the vicinity of the office and laboratory trailers. The sanitary facility will consist of a portable chemical toilet (standard Porta-John™ or equivalent) procured from a local vendor who will deliver and maintain it on site for the duration of the project. An eye wash station for emergency decontamination will also be placed in the area reserved for the sanitary facility. A 20 cy dumpster will be positioned near this area for general trash collection.

A material and equipment laydown area will be established in the former stable area, west of the impacted area (see Figure 3-1). Surface grading with a dozer will be performed in selected uncontaminated support zone areas to facilitate use for material and equipment laydown. The equipment and material storage area will serve as the primary rally point in the event of an on-site emergency. As needed, discrete laydown locations will be constructed by placing crushed stone over minimum 20-mil, non-woven geotextile membrane.

The former administration building for the RW-06 site is identified on Figure 3-1 as "Administration Building". To the extent practical based upon the ability to restore power to the building, the field crew will use this facility throughout the duration of field activities to supplement space in the field office and laboratory trailers. Additional restroom facilities may be brought on-site as necessary.

Cellular phones will be provided for the duration of the field activities for on-site communications. At least 1 member of the field management team will be stationed inside the EZ with a cellular phone at all times when work is in progress.

With the concurrence of the CABRERA PM and Kirtland AFB PM, the site layout may be altered at the discretion of the SRM to adjust to site conditions.

Contamination Reduction Zone

The CRZ, located between the EZ and the SZ, is the area where personnel enter and leave the EZ. Personnel don PPE before or in the CRZ, prior to entering the EZ. Upon egress from the EZ, personnel will decontaminate as necessary, doff used PPE and undergo "frisking" with a pancake probe prior to leaving the CRZ to enter the SZ.

A section of the CRZ designated for personnel will be constructed at the existing RW-06 gate using rope, caution tape, t-posts or other alternative means, including a clearly delineated line of demarcation between the CRZ and the SZ. Another section of the CRZ designated for vehicles will be delineated alongside the personnel CRZ to provide for decontamination and frisking of vehicles and heavy equipment. It is anticipated that most heavy equipment to be used in the EZ will remain in the EZ for the duration of the job; however radiological release surveys and additional decontamination will be performed for all vehicles and equipment upon egress from the EZ and prior to leaving the CRZ to enter

the SZ. Personal and equipment decontamination waste and spent PPE will be collected within the CRZ and managed along with other contaminated waste on the project. Chapter 5.0 (RSP) of the project SSHP presents a detailed description of decontamination and frisking/release surveys for personnel and equipment leaving the CRZ when entering the SZ.

Exclusion Zones

The EZ on this project consists of potentially-contaminated areas where excavation, segregation, sifting/sorting and waste packaging activities will occur. Based on the initial driveover radiation survey completed in October 2008, the area within the existing inner chain link fence at RW-06 will initially be considered the EZ at the start of field activities. Depending on logistics, the EZ may be reduced and modified to consist of smaller areas as remediation progresses and Final Status Survey (FSS) results become available. The existing inner chain link fence will be removed during site preparation and the boundaries of the EZ will be indicated with a temporary construction fence (orange plastic), and signage consistent with the project RSP in the SSHP (Attachment III of the QPP). Entrance into the EZ will be restricted to project personnel with appropriate training - including HAZWOPER and radiation safety training (a condition of CABRERA's NRC radioactive materials license) – and medical clearances. Authorized visitors without the requisite training will be escorted by the SRM, Radiation Safety Lead, or Site Safety and Health Officer when entering the EZ or CRZ. All persons entering the EZ must enter through the CRZ, don the appropriate PPE, and abide by the SSHP and Radiation Work Permits (RWPs) as described in the project SSHP. All personnel and equipment exiting the EZ must be surveyed at the control point to ensure that they are free of radiological contamination.

Contaminated waste, debris, and non-impacted soil may be temporarily staged in small soil stockpiles (up to approximately 250 cy) within an EZ prior to being placed into waste containers. If temporary or long-term storage is required, waste material may be staged in intermodal containers in the EZ or in areas staged outside the EZ designated for the storage of waste awaiting final characterization. The waste stockpile and non-impacted staging areas will be sufficiently removed from the trenches to facilitate sloping/benching of the excavation zones and access to excavations. Areas selected for waste staging will be lined with a minimum 20-mil, non-woven geotextile membrane to avoid cross contamination of underlying soil and surrounding areas. Additional measures will be implemented to ensure contamination control, including:

- Geotextile membrane or minimum 6-mil polyethylene sheeting cover to prevent precipitation from entering the stockpile and prevent runoff. Scrim-reinforced geotextile membrane covers will have a minimum weight of 26 pounds per 1,000 square feet. The cover will be secured as needed to prevent it from being removed by wind and to direct storm water away from the stockpile.
- Berms, hay bales or silt fence will be constructed around staged material left on site for more than one day and will be a minimum of 6" high.

3.4.2.3 General Requirements

Site Security

A chain link fence running perpendicular to Pennsylvania Avenue and along the unnamed road to the east of the site currently provides a barrier to accessing RW-06. That fence will be incorporated into the site security system to control access. It will be inspected daily and any gates will be locked when not in use during remediation. Pending approval from appropriate site personnel, a new, external access point will be created and maintained on the southeastern side of the EZ. A portion of the fence will be removed and a lockable gate installed to control access and provide ingress from the side road along the southeastern boundary of the site for construction equipment, personnel, and trucks during site preparation and waste/backfill hauling activities. The gate will be constructed of steel chain link material or equivalent,

compatible in weight with the existing fence and sufficient to maintain its structural integrity throughout the project.

The interior fence currently surrounding the remediation area (Figure 3-1) will be removed as part of remedial activities to enable adequate waste staging and heavy equipment access and maneuverability. This fence will not be replaced at the completion of remediation activities. A temporary construction fence will be placed around the EZ to mark the boundary and prohibit uncontrolled access to potentially contaminated areas. The temporary fence will be established as shown in Figure 3-1 with adjustments made in the field to create adequate work space.

In addition, open excavations will be secured with temporary barricades at the end of each work day. Barricades will conform to the applicable portions of the American National Standards Institute (ANSI) standard D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways* (ANSI, 1971), as required in 29 CFR 1926, Subpart G (OSHA). The barricades will consist of A-frames and engineer grade reflective crossbars with at least 1 flashing barricade light per excavation.

RW-06 is located in a relatively isolated area of Kirtland AFB. Kirtland AFB will have primary control and responsibility for site access and security outside the locked fence during this effort. Access will be coordinated through the Kirtland AFB 377 MSG/CEANR. The SRM will be responsible for administering site control during ongoing project activities. The temporary field office will serve as the site security command post during site operations. No additional security measures are anticipated for the site.

Radioactive sources used to calibrate field instrumentation will be locked in secure site storage trailer when not in use. Small containers of flammable liquids will be stored in safety cans or a cabinet designed for flammable storage. Radiologically and chemically-contaminated materials collected during remediation will be placed in containers and covered during remediation as appropriate.

Construction Road

A temporary construction road will be laid down from the new access gate on the southeast of the site pass through the site to the northwest to facilitate the equipment and vehicles required to load-out waste (Figure 3-1). Low spots will be filled with suitable material such as 3-in minus stone.

The temporary roadway will be approximately 24 ft in width with traffic proceeding one-way from east to west to facilitate loading of waste at the edge of the EZ and minimize the potential for spillage and cross contamination (See Figure 3-1). A minimum of 5" gravel will be used the first 50 ft into the site from the access road to the site to minimize soil tracked from the site onto Kirtland roadways. If necessary, a culvert will be established near the current road to ensure continuous flow for surface water/rain through the ditch along the road.

Traffic Control

Signage will be used to control traffic flow within the site and to provide warnings to drivers traveling on the access road to the southeast of the site regarding vehicles entering/leaving the roadway at the site entrance gate. Black on orange warning signage will be set up on the shoulder along the access road 500 feet both east and west of the temporary entrance. Signage will state "Construction Entrance 500 Feet" in accordance with ANSI standard D6.1-1971 (ANSI, 1971). Construction roll-up signs may be used. Sign frames will be weighted down (e.g. sand bagged) to prevent being toppled by the wind. On-site traffic control signage will be erected, as needed, to indicate parking areas, no entry areas, and traffic flow directions. All signage will be black on reflective orange and will conform to ANSI D6.1-1971 (ANSI, 1971) and 29 CFR 1926, Subpart G standards (OSHA).

Environmental Control Systems and Monitoring Program

Environmental control systems will be implemented prior to excavation activities, and throughout the remediation process. Environmental controls will include erosion and sedimentation control,

management of storm water runoff, protection of environmentally sensitive areas, and the minimization of possibly contaminated dust emissions.

ESC/SWM

The purpose of ESC/SWM is to minimize soil erosion and sediment migration due to site activities. Therefore, prior to the start of any intrusive work and for the duration of excavation, ESC/SWM will be installed and monitored during all phases of the cleanup.

Details of the specific measures planned for ESC/SWM are provided in the SWPPP which is part of the CGP issued by EPA. A CGP will be obtained prior to the initiation of field activities at the site. The SWPPP will select and develop Best Management Practices (BMPs) needed to minimize sediment transport, soil erosion, and to prevent storm water from infiltrating excavation areas and other potentially contaminated areas. The accumulation of storm water will be monitored to assess whether it has become impacted. If storm water accumulates in an open trench where known contamination is present, the storm water will be captured, sampled and discharged as appropriate based upon sample results.

At a minimum, ESC/SWM measures will include:

- A minimum of 5" gravel will be used the first 50 feet of the temporary road to be constructed for truck and vehicle access to the site to minimize soil tracked from the site onto Kirtland AFB roadways
- Silt fence where appropriate
- Culverts to allow drainage where potentially impacted by site roadways
- Temporary re-seeding, sodding, or geotextile will be used if the site is to be idled for more than 21 days; temporary control measures will be implemented by the 14th day of idled work
- Records of rainfall events greater than 0.5" in 24 hours will be maintained during site activities and the site will be inspected on a daily basis for evidence of erosion from site activities and the SWPPP will be amended to reflect a mitigation of any identified erosion

Dust Control

Dust control will be implemented throughout the remediation process to minimize exposure to airborne radioactive particulates. Water will be applied as the primary dust suppression measure, minimizing the impact to ambient air quality, visibility, nearby soil and vegetation, and personnel. Water will be obtained from a potable source, ensuring contaminants are not present. Runoff and generation of free liquids for waste disposition will be prevented by applying water using a misting nozzle during dust suppression.

Dust suppression will be performed on site by applying water around open excavations, along unimproved site roadways used for the project, on stockpiled soil, and on open patches of soils without ground cover vegetation. Water for dust suppression may be applied on localized spot remediation and debris removal locations using portable sprayers to prevent dust generation during these remediation activities, and by using a water truck for larger scale dust suppression site-wide. During high wind events, increased controls, to be specified in the Fugitive Dust Control (Surface Disturbance) Permit, will be used. These controls may include stopping work during extreme wind events.

Respirators will be maintained on site for use by remediation workers as either personal preference or in the unlikely event results of air and/or industrial hygiene monitoring dictate the need for respiratory protection. The potential for fugitive dust is also addressed in Section 5.9 of the project SSHP (Attachment III of the QPP) where personal breathing zone and ambient air monitoring are detailed for the project.

Spill Prevention and Control

Procedures and responsibilities for spill prevention, response activities and cleanup associated with the remediation and waste transportation at the Site are presented in this section, which briefly identifies the potential sources of spills during remediation, and the methods that will be implemented to prevent spills, limit impact to the environment in the event of a spill and protect personnel and the public from exposure or injury.

On-site storage of petroleum products or hazardous materials will be minimal. Gasoline and diesel fuel will be stored in USAF-approved Type II metal containers of five gallons or less. Fuel containers will be stored on-site in metal equipment trailers located away from office and laboratory facilities. A CABRERA employee will monitor all refueling operations. Refueling will occur over a drip pan to minimize the potential for small spills. No waste oil or hydraulic fluid will be stored on site.

The use of solvents or hazardous materials is not anticipated for this project. Decontamination activities on site will use water and commercially available, biodegradable cleaners, (e.g., Simple Green™).

If a hazardous material is released, the Kirtland AFB Radiation Safety Officer (RSO) or designee will be immediately notified, and the CABRERA PM will contact the CABRERA SOHM, the AFCEE COR, and the Kirtland AFB 377 MSG/CEANR PM as soon as possible. They will initiate appropriate actions to stop and contain the spill. If it is safe to do so, site personnel will attempt to locate the source of the release, prevent further release, and contain the spilled and/or affected materials as follows:

- Hazards will be identified based on available information from witnesses or material identification documents (e.g., placards, Material Safety and Handling Sheet [MSDS], logs, etc.)
- The potential hazards will be evaluated to determine the proper personal protection levels, methods, and equipment necessary for the response
- If necessary, the release area will be evacuated, isolated, and secured
- Work zones, including an access control point will be set up
- If possible, spill containment will initially be made without entering the immediate hazard area
- Personnel with the PPE, training, methods and equipment necessary to perform the work, will make entry to the release area

The decontamination procedures established in the SSHP (Attachment III of the QPP) will be used after the response is completed. Prior to release of equipment, the CABRERA PM, or Kirtland AFB RSO, or designee will determine if radiological surveys are warranted. If site personnel cannot safely respond to an environmental release, evacuation of the area may be warranted. Appropriate emergency response organizations shall be notified in the event of a significant spill (uncontrolled release of toxic, hazardous, flammable, corrosive, or radioactive materials that may pose a threat to the work force, local population or environment). Upon arrival at the site, the Kirtland AFB RSO or designee will brief emergency responders of the current site status and any potential hazards.

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4.0 REMEDIATION MANAGEMENT PLAN

CABRERA will remediate radioactive contamination in soil and debris buried in 9 trenches and in surface soil at 5 small discrete locations at the RW-06 site (Figure 4-1). Remediation of RW-06 will follow a specific process designed to efficiently and effectively remove contaminated material, sort the material into component waste streams for disposal purposes; characterize each waste stream; and package, handle, transport, and dispose of or re-use the material such that disposal costs are controlled and resource conservation practices are followed. The remediation process is depicted in the color-coded flow diagram provided in Figure 4-2 and consists broadly of the following numbered general activities groups (referred to hereafter as Series) each comprised of discrete subset of numbered steps (Series numbers in parentheses correspond to the numbered Series depicted in the flow diagram):

- Excavation and initial surveying (Series 1)
- Preliminary field screening and sorting (Series 2)
- Final testing and segregation (Series 3)
- Material disposition (Series 4)

The following subsections to Chapter 4.0 provide details regarding the remediation process. Details regarding documentation that the remediation of RW-06 has met radiological and chemical cleanup criteria are provided in Section 5.0. Backfilling and site restoration are described in Section 6.0.

4.1 Excavation and Initial Surveys (Series 1)

In general, excavation and initial surveys will proceed in an iterative sequence at each location. Following identification of each remediation area, soil will be removed in lifts. After each lift, the bottom and sidewalls of the excavation hole or trench will be surveyed for radioactivity levels and volatile organic vapor using field screening instruments as well as visually inspected. After recording all data results in a field logbook, the next lift will be excavated followed by field screening. This iterative process will continue until each location is excavated to a pre-determined depth. The hole or trench will be surveyed to ensure that no evidence of contamination remains and to document the final conditions. Preliminary field screening and sorting of the waste (Series 2) will begin immediately after the material is excavated. Further details on confirming that excavation operations have achieved their objectives are presented in Section 5.0.

4.1.1 Identification of Excavation Areas (Step 1a)

The initial remediation activities consist of steps to identify and mark each area (trench or discrete spot) scheduled for excavation (Figure 4-1). The location of contaminated surface spots will be re-established first using Global Positioning System (GPS) coordinates (Table 4-1) determined during the October 2008 planning survey along with the use of a Ludlum model 44-10 or 44-20 gamma scintillator, a Ludlum model 44-9 Geiger Mueller probe and a portable x-ray fluorescence (XRF) instrument. The perimeter of each spot will be physically marked in the field using pin flags, stakes or paint.

Estimated trench perimeters will be identified and marked in the field prior to excavation using GPS coordinates (Table 4-2) developed during the October 2008 planning survey. The presence of asphalt caps over 2 trench locations, and visible evidence of subsidence and altered vegetation will also be used to help establish the estimated trench perimeters.

Go to Section 4.1.2 (Steps 1b, 1d, 1f)

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Figure 4-1. RW-06 Discrete Spot and Waste Trench Locations

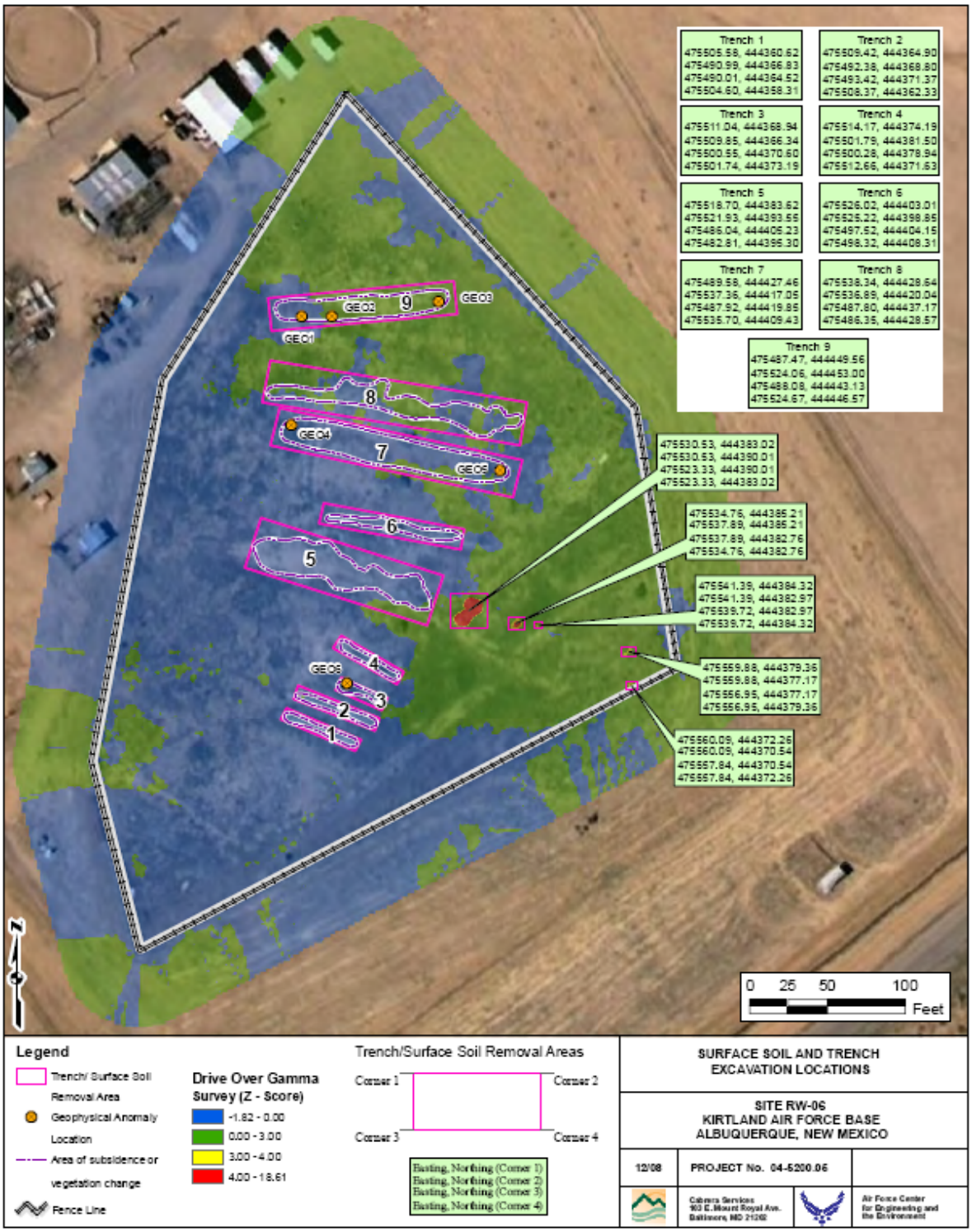

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Figure 4-2. Remediation Process Diagram

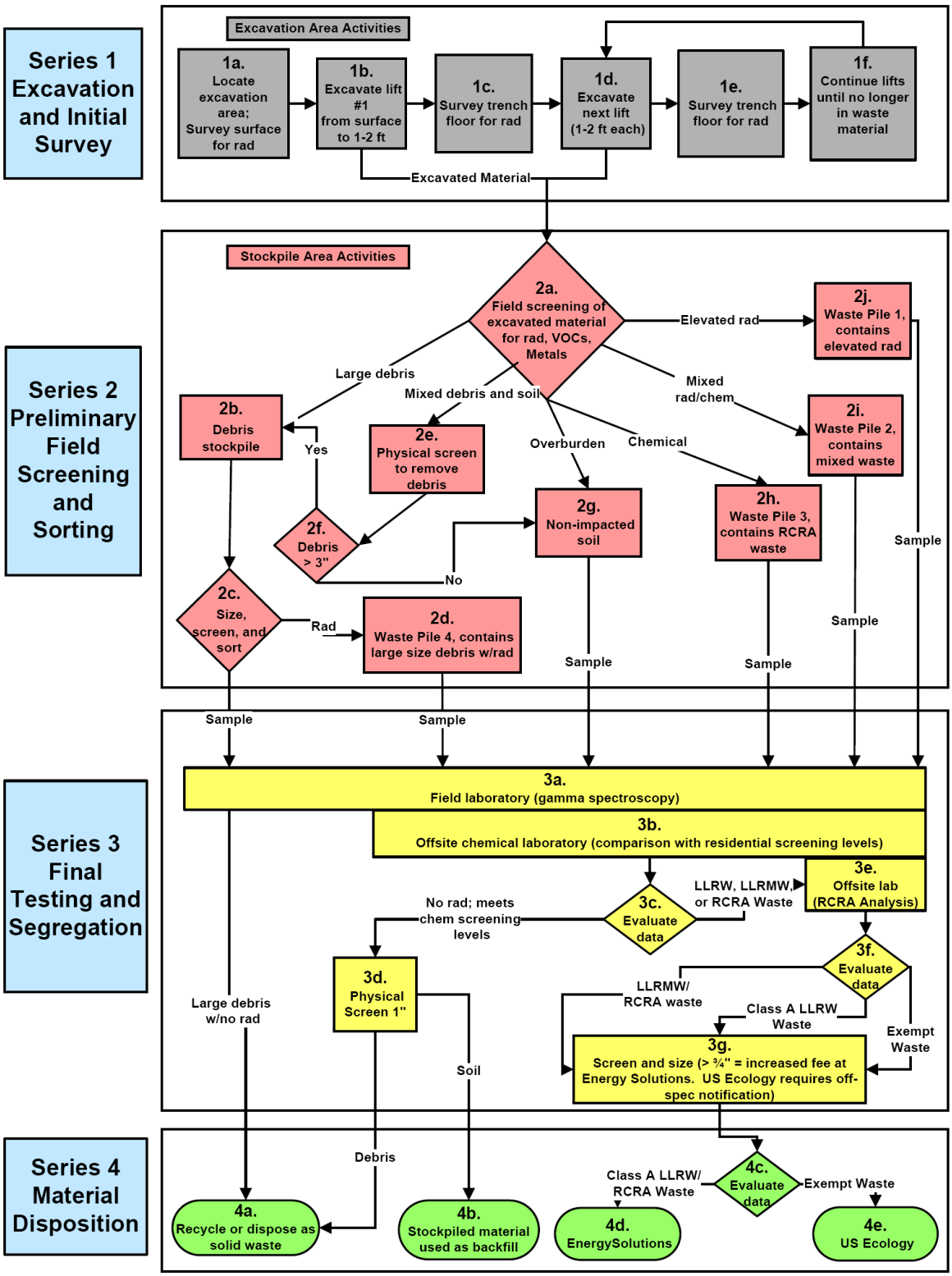

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Table 4-1. Contaminated Surface Spot Locations and Excavation Depths

Soil Removal Area	Corner[(1)]	Easting	Northing	Estimated Depth (ft bgs)
Area A	1	475530.53	444383.02	1
	2	475530.53	444390.01	
	3	475523.33	444390.01	
	4	475523.33	444383.02	
Area B	1	475534.76	444385.21	1
	2	475537.89	444385.21	
	3	475537.89	444382.76	
	4	475534.76	444382.76	
Area C	1	475541.39	444384.32	1
	2	475541.39	444382.97	
	3	475539.72	444382.97	
	4	475539.72	444384.32	
Area D	1	475559.88	444379.36	1
	2	475559.88	444377.17	
	3	475556.95	444377.17	
	4	475556.95	444379.36	
Area E	1	475560.09	444372.26	1
	2	475560.09	444370.54	
	3	475557.84	444370.54	
	4	475557.84	444372.26	

Notes:
(1) Corner numbers refer to a rectangle representing the trench outline as follows:
1 = upper left
2 = upper right
3 = lower left
4 = lower right

Table 4-2. Trench Locations and Estimated Excavation Depths

Trench Designation	Corner[(1)]	Easting	Northing	Estimated Depth (ft bgs)
Trench 1	1	475505.58	444360.62	10
	2	475490.99	444366.83	
	3	475490.01	444364.52	
	4	475504.6	444358.31	
Trench 2	1	475509.42	444364.9	10
	2	475492.38	444368.8	
	3	475493.42	444371.37	
	4	475608.37	444362.33	
Trench 3	1	475511.04	444368.94	10

Trench Designation	Corner[(1)]	Easting	Northing	Estimated Depth (ft bgs)
	2	475509.85	444366.34	
	3	475500.65	444370.6	
	4	475501.74	444373.19	
Trench 4	1	475514.17	444374.19	10
	2	475501.79	444381.5	
	3	475500.28	444378.94	
	4	475512.66	444371.63	
Trench 5	1	475518.7	444383.62	20
	2	475521.93	444393.55	
	3	475486.04	444405.23	
	4	475482.81	444395.3	
Trench 6	1	475526.02	444403.01	20
	2	475525.22	444398.85	
	3	475497.52	444404.15	
	4	475498.32	444408.31	
Trench 7	1	475490.57	444403.01	20
	2	475487.48	444414.75	
	3	475535.18	444403.18	
	4	475538.26	444415.89	
Trench 8	1	475538.34	444428.64	20
	2	475536.89	444420.04	
	3	475487.8	444437.17	
	4	475486.35	444428.57	
Trench 9	1	475487.85	444449.74	20
	2	475488.81	444438.01	
	3	475525.5	444440.98	
	4	475524.55	444452.71	

Notes:
(1) Corner numbers refer to a rectangle representing the trench outline as follows:
1 = upper left
2 = upper right
3 = lower left
4 = lower right

4.1.2 Excavation Activities (Steps 1b, 1d, and 1f)

4.1.2.1 Excavation Sequence

Remediation of RW-06 will commence with excavation of contaminated waste from 5 discrete surficial contaminated spots to the depths indicated in Table 4-1. Upon completion of discrete spot removal, remediation will proceed with excavation of the 9 trenches to the depths indicated in Table 4-2.

As each lift is completed at a specific trench or spot, initial surveys of the in-situ soils (Step 1c) will be conducted by radiation field technicians (FTs) using gamma scanning instrumentation as discussed in

Subsection 4.1.3 of this plan. Excavated material will be transported to the staging area and further screened in accordance with the Series 2 activities discussed in Section 4.2 of this plan.

Discrete Contaminated Spots

Excavation of the 5 discrete surface spots will proceed with removal of 1-ft lifts guided using a Ludlum model 44-10 gamma scintillator, and a Ludlum model 44-9 Geiger Mueller probe to identify elevated radioactivity in the surface soil. Contaminated soil will be removed from these locations using a combination of mechanical (e.g., excavator and/or front end loader) and/or hand excavation (shovel) methods as determined by the SRM. Based on results of the planning survey of October 2008, contaminated soil is expected to a depth of 1 ft below ground surface (bgs). If contaminated soil is present below that depth, excavation activities will continue until clean soil is reached.

Waste Trenches

Waste trenches will be excavated following completion of discrete spot removal. Excavation of the waste trenches will proceed downward with removal of 1- to 2-ft lifts. Overburden and contaminated soil will be removed from these locations using primarily mechanical (e.g., excavator and/or front end loader) methods as directed by the SRM. Soil excavation and initial surveys will continue to the estimated depths based on previous investigations (Table 4-2).

Preliminary field screening and sorting of excavated soil will follow the steps shown in the Series 2 activities group on the project flow diagram (Figure 4-2). Details regarding Series 2 activities, preliminary waste categories, and waste staging are provided in Subsection 4.2 of this plan.

4.1.2.2 Excavation Methods

Excavation activities will be performed in accordance with OSHA requirements as set forth in 29 CFR 1926.650 (Subpart P) (OSHA). All trench walls will be benched or appropriately sloped to meet the requirements for worker access. Under no circumstances will workers be allowed access to any excavation deeper than 3 ft bgs without proper shoring or benching/sloping in place (see SSHP, Attachment III of the QPP).

Remediation will be performed by personnel with requisite safety training and relevant experience. All project personnel will have current HAZWOPER and CABRERA radiation safety training as discussed in the SSHP (Attachment III of the QPP). Personnel operating large construction equipment will have had heavy equipment operations training.

The SRM will work with the equipment operator(s) and SSHO each day to plan the excavation activities for that day. At a minimum they will establish daily objectives and goals; evaluate equipment positioning for safety and efficiency of excavation, loading, and staging activities; discuss lessons learned from the previous day; and review the project work process. A record of their discussions will be incorporated into the Daily Quality Control Report (DQCR).

Mechanical Excavation

Mechanical excavation methods will be the primary means of soil and debris removal. Excavation will be carried out by an experienced equipment operator(s), FTs, and laborers. Excavation equipment will consist of a CAT 330 excavator with quick release bucket (or equivalent), a CAT 988 front loader with bucket (or equivalent), and a CAT D6 bulldozer (or equivalent). The front-end loader will be equipped with 8-ft forks for use in lifting waste material container bags. The bulldozer will be used for cover removal and general grading operations. Front-end loader will be used to move waste within the EZ from excavation zones to staging areas.

Remediation will begin with the 4 southern trench locations (see Figure 4-1) by excavating discrete narrow trenches, approximately 2 standard bucket widths wide (approximately 6 ft in total width) to a depth of approximately 10 ft. Following completion of the southern trenches, remediation of the northern

5 trenches will be initiated. Excavation is anticipated to terminate at a depth of 20 ft bgs in the northern 5 trenches. Therefore, soil benching or sloping will be required to a depth of approximately 10 ft; the final 10 ft of excavation (to an approximate total depth of 20 feet) will be completed using the discrete narrow trench method discussed above for the southern 4 trenches. Any adjacent contaminated soil exceeding project release criteria for project radionuclides of concern and cleanup goals for chemical contaminants of concern will also be removed.

At the discretion of the SRM, excavations to determine the physical locations and extent of trenches may be performed prior to remediating the individual trenches. The SRM will confer with the Project Engineer and PM prior to initiating exploratory excavations.

Precision excavation methods will be used to segregate potentially clean soil from contaminated soil: trenches will be excavated one at a time; excavation will proceed in lifts of approximately 1 to 2 ft; and field screening (Section 4.2) with visual inspection for soil staining (potential chemical contamination) and for potentially contaminated debris materials. Care will be given to minimize the quantity both soil cover and potentially contaminated soil/waste removed.

Trench removal activities will consist of:

- Removing material directly into a dump truck for transportation to a material handling and waste staging area located in the southeast section of the site and segregating uncontaminated overburden soil in separate stockpiles for possible later reuse on site to backfill remediated areas
- Removing waste from the trenches using bulk/production excavation methods to achieve efficiencies
- Guided excavation of soil at the physical edge of buried waste in the trenches to minimize waste quantities requiring packaging, transport and off-site disposal
- Transporting, Performing Field Screening, Segregating Based Upon Field Screening Results and Packaging excavated material for staging and final off-site transport and disposal

Hand Excavation

Hand excavation will be conducted by experienced FTs and laborers using standard long-handled shovels appropriate for digging in the local soils. Soil excavated by hand will be placed either directly into waste containers or into the bucket of a front-end loader for movement to the waste staging area. Personnel will have requisite site-specific training and experience, will conduct the work with well-maintained equipment and tools, and will follow safe work practices in accordance with the SSHP (Attachment III of the QPP).

Removal of Uncontaminated Trenches Cover Soil

Uncontaminated soil cover material will be excavated from the top of trenches and staged in temporary stockpiles on site for later reuse to backfill remediated trenches. Excavation of soil cover material will be performed in 1-ft lifts using mechanical methods until visible evidence of waste is encountered or field screening results indicate the potential presence of contamination. It is anticipated that up to 4 ft of uncontaminated soil cover material may be removed from some of the trenches. Preliminary field screening (Series 2) of soil cover will be performed in accordance with Section 4.2 of this plan. Asphalt caps will be removed from the 2 southern-most trenches prior to removing soil cover material. The asphalt debris will be staged separately from stockpiled soil cover material.

Excavation of Trenches

The trench excavation will be performed using a Cat 330 excavator or equivalent. The design limits of excavation are estimated to consist of approximately 12,425 cy, including 2,250 cy of waste material and approximately 10,175 cy of uncontaminated soil. This volume of uncontaminated soil consists of cover material excavated to gain access to the underlying trenches as well as soil excavated to maintain stable

trench sidewalls to allow entry for performing gamma walkover surveying (anticipated for the northern 5 trenches only). Soil removed for sloping or benching purposes will be stockpiled separate from waste and potentially-contaminated soil, and managed in the same manner as trench cover soil. All material removed from the trenches will be direct loaded into dump trucks and transported to the material handling area (if waste) or the non-impacted soils area (if presumed clean and debris-free). Trench excavation will proceed until all visible evidence of contamination (e.g., the presence of containerized or bulk waste, debris, animal remains, reworked soil, and discolored/stained soil) has been removed and natural soils are encountered. Waste will be excavated from the trenches in 1- to 2-ft lifts with initial surveying (Step 1c) conducted on the excavation bottom and side walls between lifts (Subsection 4.1.3).

Trench excavation sloping and/or benching anticipated for the northern 5 trenches will be in accordance with the Occupational Safety and Health Act (OSHA) *Standards for the Construction Industry*, 29 CFR 1926 (OSHA, 1998) and will proceed as excavation continues with depth to ensure safe access to perform gamma walkover surveys and *in situ* characterization. Personnel will not be allowed to enter excavations greater than 3 ft in depth. Multiple trenches will be open at the same time to provide for efficient sequencing of excavation, field screening, segregation, confirmation sampling/laboratory analysis and packaging for transport/disposal. Caution tape will be placed around open trench areas when active excavation is not underway to serve as a visible indicator to remediation workers within the fenced RW-06 site. Groundwater is not expected to be encountered during excavation activities. Precautions to ensure trench safety are discussed further in the SSHP.

Staging

Waste debris and soil excavated from the trenches will be placed temporarily in piles of up to 100 cy in the material handling area of the EZ staging to facilitate preliminary field screening and sorting. All stockpiled soil and soil-like material will undergo preliminary field screening and sorting in accordance with the Series 2 process (Section 4.2) to determine the waste category. A tracked excavator or a rubber tire front end loader will direct load into dump trucks or stage excavated soil and soil-like material in 100-cy piles based on the preliminary waste category. Stockpiled soil material will be wetted or covered with minimum 6-mil polyethylene sheeting and/or tarps to minimize fugitive dust. The stockpiled material will then be tested and segregated in accordance with the Series 3 process (Section 4.3) to confirm suitability for reuse or for disposal characterization.

Any individual containers (drums, carboys, etc.) containing chemicals removed during trench excavation will be segregated in a separate area of the material handling area for in-field radiological screening and compatibility testing, and disposal characterization analyses at an off-site radiological and chemical laboratory. Procedures for handling containers with unknown contents will be maintained in a binder in the office trailer on site. Field radiological and VOC headspace screening, compatibility testing and disposal characterization laboratory analyses are described in the project SAP (Attachment II of the QPP).

Go to Section 4.2 (Series 2)

Equipment Decontamination

Before exiting a controlled radiological area, all tools and equipment will be decontaminated and released in accordance with Cabrera SOP *OP-018: Decontamination of Equipment and Tools,* and *OP-004: Unconditional Release of Materials from Radiological Controlled Areas* (CABRERA, 2000e). The complete equipment decontamination process is described in Section 5.4 of the SSHP. Once the equipment is in the decon facility, affected areas will be dry wiped and hand cleaned with a wet rag or a scrubbing tool. If necessary a low or high pressure detergent wash with brushing will be used. Equipment that cannot be decontaminated will be removed and disposed of as radioactive waste.

Following final decontamination, equipment and tools will be surveyed for radiological contamination to determine its release status. The decontaminated equipment will be surveyed, and observed count rates will be compared to the unrestricted release requirements presented in Table 5-1 of the SSHP. Equipment and tools will be released from the site only if they meet the unrestricted release criteria.

4.1.3 Initial Surveying Process (Steps 1c, 1e, 1f)

Initial surveying will be performed on trench bottoms and sidewalls following removal of each lift of soil. The initial surveys are designed to identify potentially contaminated areas during excavation to support precise removal of waste material, reduce waste volumes requiring offsite disposal, to document the results of waste removal efforts, and provide data for the FSS. The initial survey will be used to determine the initial sorting of excavated material into radioactive and non-radioactive stockpiles.

As each lift is completed at a specific trench or spot, initial surveys of the in-situ soils (Step 1c) will be conducted by FTs using a NaI(Tl) gamma scintillation detector (Ludlum Model 44-10, 44-20, or equivalent) equipped with a minimum cable length of approximately 20 ft. Down to a depth of 3 ft, the FTs will conduct the initial surveys by entering the shallow trench. At depths below 3 ft, the FTs will work from a rubber-tired (4WD), 40 ft. boom manlift equipped with a rotating platform and basket capable of holding 2 people.

The initial surveys will measure activity associated with radionuclides. Results of all initial survey data measurements will be recorded in a field notebook at the time of collection and input to an electronic spreadsheet (MS Excel) daily on site. Data will be included in the DQCR and submitted to the PM at the end of each day.

The final extent of excavation will be confirmed based on a MARSSIM FSS and results of off-site chemical laboratory analysis for soil samples collected from the limits of contamination as discussed in the SAP (Attachment II of the QPP). Confirmation of the limits of excavation is described in Section 5.0 of this plan.

4.2 Preliminary Field Screening and Sorting (Series 2)

Preliminary Field Screening and Sorting (Series 2) activities (Figure 4-2) are designed to provide a field-level screening process that initiates sorting and segregating the excavated material in order to minimize the final waste stream volumes requiring offsite disposal. Series 2 screening will be followed by Final Testing and Segregation (Series 3), as described in Section 4.3 of this plan, to refine the waste segregation and confirm earlier findings. The intended final result of the overall process is to separate the wastes into 3 contamination categories in order to minimize and control the cost of disposal.

It is anticipated that the excavated material will fall into 1 of 5 broad categories as a result of the preliminary screening and sorting process:

- Clean debris (Steps 2b, 2c, 2d; Subsection 4.2.1)
- Clean soil for reuse onsite as backfill (Step 2e, 2f, 2g; Subsection 4.2.2)
- LLRMW - mixed radioactive/RCRA chemical waste (Step 2h; Subsection 4.2.3)
- RCRA waste - chemically contaminated (Step 2i; Subsection 4.2.4)
- LLRW – low level radioactive waste (Step 2j; Subsection 4.2.5)

Based on visual inspection, larger (greater than 3 in) solid debris (e.g. metal, whole containers, plastics, bones, building materials, books, etc.) will be separated from soil and soil-like material. The debris will be stockpiled separately from soil materials (Step 2a).

Soil and soil-like material up to a 3-in size will be transported to the stockpile area for visual inspection and preliminary field screening. The material will be visually inspected for evidence of chemical contamination (staining), then screened with hand-held field instruments - Geiger Mueller (pancake) probe (Ludlum 44-9-18) with a telescoping handle and flexible neck, XRF to evaluate metals concentrations, and photo-ionization detector (PID) to perform soil headspace screening for VOCs,- and then sorted based on the results of screening (Step 2a).

Preliminary screening data measurements will be recorded in a field notebook at the time of collection and input to an electronic spreadsheet (MS Excel) daily on site. Data will be included in the DQCR and submitted to the PM at the end of each day.

4.2.1 Clean Debris (Steps 2b, 2c, 2d)

The stockpiled solid debris will be grouped by size (greater than or less than 10 in dimension), screened with hand-held field instruments - Geiger Mueller (pancake) probe (Ludlum 44-9-18) with a telescoping handle and flexible neck, XRF, and PID - to detect radioactive and chemical contaminants, and sorted based on the results of screening (Step 2c).

Large pieces of debris screened for radiological contamination in the field and found to meet NRC *Regulatory Guideline 1.86* release criteria as described in the project SSHP (Attachment III of the QPP) will be considered uncontaminated and not containing licensable material. Debris exhibiting activity levels above NRC release criteria will be considered contaminated and will be staged for further testing and segregation. Large pieces of radioactively-contaminated debris will be sized to below EnergySolutions 10 in by 10 in by 12 ft criteria to avoid surcharges for disposal of oversized material. Sizing will be performed using the excavator bucket, a hydraulic or rotary hammer, or as determined by the SRM (Step 2c).

The debris will then proceed along one of the following process pathways:

- Any debris found to be radioactive will be separated, sampled (Step 2d), and the sample submitted for on site laboratory testing (Series 3).

Go to Section 4.3 (Series 3)

- Debris not found to be contaminated with radioactivity will be separated and staged using the excavator or front-end loader for recycling, reuse, or disposal (Series 4).

Go to Section 4.4 (Series 4)

4.2.2 Clean Soil for Reuse Onsite as Backfill (Step 2e, 2f, 2g)

4.2.2.1 Overburden or Slope/Bench Soil (Step 2g)

Previous RW-06 investigations and CABRERA experience with excavations at the site indicate that a significant volume of soils in and around the trenches constituting overburden cover did not contain disposed materials, and did not appear impacted by radioactive or chemical contamination. Overburden soil (assumed top 4 ft) and soil removed for sloping and benching trenches will initially be assumed uncontaminated and will be staged separately from all other lift materials in 100 cy piles using the excavator, dump truck, and/or front-end loader. This soil will also undergo field screening and inspection following the same procedure used for all other wastes. Soil whose field screening results indicate no evidence of radiological or other contamination (i.e., no staining/discoloration or visual evidence of contamination) will be characterized for the purpose of evaluating potential for reuse as on-site backfill material. Samples of the overburden soil will be submitted for laboratory testing and segregation in accordance with the Series 3 process (Section 4.3)

Go to Section 4.3 (Series 3)

4.2.2.2 Non-contaminated Lift Soil (Steps 2e, 2f)

Soil and soil-like material displaying no visual or field screening evidence of contamination will be considered clean. The clean soil will be processed through a mechanical screen plant consisting of 3-in grizzly and/or ¾–in shaker screens to separate out small pieces of debris (Step 2e). Debris material will be aggregated for recycling, reuse, or offsite disposal (Step 2f). The remaining clean soil and soil-like material will be combined with clean overburden soil for use on site as backfill (Step 2g) and staged separately in the EZ in 100 cy piles using the excavator, dump truck, and/or front-end loader. Samples of

the non-contaminated lift soil will be submitted for laboratory testing and segregation in accordance with the Series 3 process (Section 4.3)

Go to Section 4.3 (Series 3)

4.2.3 LLRMW - Mixed Radioactive/RCRA Chemical/ Waste (Step 2h)

Waste material exhibiting both elevated radioactivity levels and evidence of chemical contamination (staining, odor, or elevated PID and/or XRF) will be considered potential LLRMW. LLRMW will be segregated and staged in a separate area of the waste staging area from other excavated waste for further characterization. Samples will be submitted to the on-site laboratory in accordance with the Series 3 process activities (Section 4.3).

Go to Section 4.3 (Series 3)

4.2.4 RCRA Waste - Chemically Contaminated (Step 2i)

Waste material exhibiting evidence of chemical contamination (staining, odor, or elevated PID and/or XRF) will be considered potential chemically contaminated RCRA waste. RCRA waste will be segregated and staged in a separate area of the waste staging area from other excavated waste for further characterization. Samples will be submitted to the on-site laboratory in accordance with the Series 3 process activities (Section 4.3).

Go to Section 4.3 (Series 3)

4.2.5 LLRW – Low Level Radioactive Waste (Step 2j)

4.2.5.1 Trench Waste

Material/items exhibiting elevated activity levels as determined by scanning with field instrumentation will be considered potential LLRW. This material will be segregated and placed in a separate area of the lined staging area for further characterization. Samples will be submitted to the on-site laboratory in accordance with the Series 3 process activities (Section 4.3).

Go to Section 4.3 (Series 3)

4.2.5.2 Discrete Contaminated Spots

Waste soil from discrete spots will be assumed contaminated with radioactive material, since these areas were identified based on elevated activity, and will be considered potential LLRW. This soil will be placed with the trench material identified as potential LLRW in the lined staging area for further characterization. Samples will be submitted to the on-site laboratory in accordance with the Series 3 process activities (Section 4.3).

Go to Section 4.3 (Series 3)

4.3 Final Testing and Segregation (Series 3)

Grab samples of all soil and soil-like material will be collected and submitted to both the on-site field laboratory and the offsite commercial laboratory (GPL Laboratory) for the purposes of confirming the preliminary field screening, characterization, and waste profiling. The grab samples will be collected from each type of stockpiled (e.g., potential LLRW, LLRMW, RCRA chemical, and non-contaminated) material and analyzed in accordance with the SAP (Attachment II of QPP). Based on the results of laboratory analysis, all soil and soil-like material will be assigned to one of the categories outlined in Section 4.2 of this plan.

Excavated soils categorized through field screening measurements as either uncontaminated or potentially contaminated (i.e., field indication of radiological and/or chemical contamination), will be sampled at a frequency of 1 grab sample per 25 cy for gamma spectroscopy analysis in the on-site laboratory and 1 grab sample per 25 cy for gamma spectroscopy analysis in the off-site laboratory.

4.3.1 Field Laboratory Screening (Step 3a)

The field laboratory will analyze samples by gamma spectroscopy for radionuclides specified in Table 6-1 of the project FSP (Attachment IIa of the QPP), using EPA Method 901.1 (modified). Radiological data will be reported as pCi/g dry weight along with estimated total propagated uncertainty and MDC in pCi/g dry weight. Work will be performed in accordance with CABRERA Standard Operating Procedures (SOPs). The on-site field laboratory will be staffed full-time by the Field Laboratory Manager (FLM) responsible for ensuring all aspects of on-site laboratory operations (see QPP). The FLM will be supported by the Site Data Coordinator (SDC) who is responsible for ensuring that data resulting from both on site and off site laboratory analysis conform to the data requirements defined in the project SOW and the SAP, tracking and managing laboratory data, and laboratory data reporting. Laboratory Technicians (LTs) will assist with sample preparation, handling, storage, and analysis. Details regarding the field laboratory instrumentation, procedures, and processes are provided in the project SAP (Attachment II of the QPP).

The data will be reviewed, verified, and validated as specified in the project QAPP. Data will be quantitatively analyzed for direct comparison to investigation levels and qualitatively reviewed to determine further investigative actions during the project. Data from the field laboratory will be recorded as specified in the project QAPP (Attachment IIb of the QPP).

Soil found to be below project screening levels (NRC and NMED) for all radionuclides will be considered non-radioactive for purposes of both disposal and re-use as backfill. Material exhibiting concentrations of radionuclides above the screening levels will be considered contaminated and will require offsite disposal. The final disposition will be determined following analysis in the offsite laboratory.

Go to Section 4.3.2 (Step 3b)

4.3.2 Offsite Chemical Laboratory Screening (Step 3b)

Samples will be submitted to an offsite environmental testing laboratory, GPL Laboratories, in accordance with the procedures described in the project SAP (Attachment IIb of the QPP). The staff of the on-site laboratory will be responsible for preparing, packaging, shipping, and documenting all samples sent to the offsite laboratory. Samples will be analyzed for VOCs (Target Compound List), semi-volatile organic compounds (SVOCs), total metals (Target Analyte List), and isotopic uranium (Ref SOW 8.2).

The data will be reviewed, verified, and validated as specified in the project QAPP. Data will be quantitatively analyzed for direct comparison to investigation levels and qualitatively reviewed to determine further investigative actions during the project. Data from the field laboratory will be recorded as specified in the project QAPP (Attachment IIb of the QPP).

Soil found to be below project screening levels (NRC and NMED) soil screening levels for all contaminants will be considered non-chemically contaminated for purposes of both disposal and re-use as backfill. Soils containing contaminants at levels above NMED residential screening levels and/or NRC soil screening levels will be considered contaminated and will be segregated into the waste categories described above for offsite disposal. The final disposition will be determined following analysis in the offsite laboratory.

Go to Section 4.3.3 (Step 3c)

4.3.3 Non-Contaminated Waste (Step 3c)

Soil and soil-like material found to be non-contaminated based on the results of both the on-site (Step 3a) and offsite laboratory (Step 3b) analyses will be considered eligible for re-use on site as backfill, recycling, or off site disposal as non-hazardous solid waste. Soil confirmed to be uncontaminated in accordance with this plan will be processed through a 3-in grizzly screen to ensure all but the smallest debris is removed and to facilitate compaction:

- Chunks of uncontaminated soil larger than 3-in diameter (e.g., clods of caliche soil) will either be crushed using the excavator to reduce its size below 3 in and reused as on-site backfill, will be offered to Kirtland AFB for re-use elsewhere on the base, or will be disposed at a local off-site landfill as uncontaminated daily cover or construction debris (Series 4, Step 4a)
- Uncontaminated soil containing less than 10% material larger than 3-in diameter will be reused on site as backfill material (Series 4, Step 4b).

Go to Section 4.4 (Series 4)

4.3.4 Offsite Chemical Laboratory Waste Characterization (Step 3d)

Soil and soil-like material found to be contaminated based on the results of both the on-site (Step 3a) and offsite laboratory (Step 3b) analyses will be considered waste requiring offsite disposal. Composite samples of this material will be collected for final waste profiling at a frequency of 1 sample per 100 cy associated with each waste stream. Samples will undergo full Toxicity Characteristic Leaching Procedure (TCLP) analysis in accordance with the project SAP (Attachment II of the QPP). The waste will be categorized as LLRW, LLRMW, or RCRA chemically contaminated (Step 3f) for selection of the disposal facility (Series 4, Steps 4c, 4e, 4f).

4.3.5 Sizing Contaminated Soil for Disposal (Step 3g)

Soil with elevated activity destined for disposal at the EnergySolutions facility in Clive, Utah based upon disposal criteria specified in the project FSP (Attachment IIa of the QPP) will require mechanical screening to achieve disposal facility size limits for "soil and soil-like waste", in order to avoid higher unit rates for disposal. Soil confirmed to be contaminated with radioactive material in accordance with this plan will be processed through a 0.75-in (3/4-in) grizzly screen to ensure all but the smallest debris is removed and to facilitate compaction. Contaminated soil and soil-like waste disposed at US Ecology-Idaho will not need to be mechanically screened as they do not impose size-related surcharges for that material.

Go to Section 4.4 (Series 4)

4.3.6 Final Waste Categorization

Wastes may fall into one of the following categories; the anticipated disposal facility associated with each waste stream category is listed in parentheses:

- Class A LLRW (EnergySolutions, Clive, UT)
- NRC-exempt LLRW (US Ecology, Grandview, ID)
  - total activity less than 2,000 pCi/g
- LLRMW (EnergySolutions, Clive, UT)
- Chemical waste (Local RCRA-permitted landfill)
- Non-hazardous soil and debris waste (Kirtland AFB landfill)

Wastes will be initially categorized according to the screening and onsite analyses described, to be verified by TCLP and final radiological testing. Levels of radioactive constituents in LLRW will comply with the waste acceptance criteria (WAC) of the appropriate disposal facility. All radioactively-contaminated debris will be considered Class A LLRW. All soils identified as radioactively-contaminated through field screening will be considered to be potentially NRC-exempt, subject to verification through offsite testing. Based on the levels of radioactive contamination removed and the types of wastes generated, an exemption request for alternate disposal under 10 CFR 20.2002 (NRC) may be pursued. Any LLRW determined to be non-exempt from NRC regulations will be disposed at EnergySolutions.

The Project Engineer and Project Chemist will review all onsite and offsite analytical data for compliance with project DQOs, and will compare data with WAC requirements. The Project Engineer will work with the Project Chemist, Waste Broker, and CABRERA RSO to determine the final disposition of the waste. Analytical data will be used to prepare waste profiles and shipping manifests. All waste categorization results will be documented using the form provided in Appendix F.

4.4 Material Disposition (Series 4)

This section identifies the sources, classifications, and disposition of wastes that have been generated during remediation activities performed at the RW-06.

4.4.1 Sources of Waste Materials

Excavation activities are anticipated to result in generation of contaminated soil and soil-like material, possible debris (both contaminated and uncontaminated), and support equipment used during site activities. A summary of these sources is provided in Table 4-3.

Table 4-3. Sources of Waste Materials at the RW-06 Site

Source	Description of Materials
Remediation of Trenches and Discrete Contaminated Spots	Class A LLRW soils and debris NRC-Exempt LLRW contaminated soils and debris Class A LLRMW contaminated soils RCRA chemically contaminated soils Non-contaminated debris and soil
Remediation and decontamination Activities	Spent PPE, disposable sampling and support equipment, and decontamination wastewater
Other	Common trash and garbage Sanitary Wastewater (Porto John)

4.4.1.1 Radiological Waste Classification for Transportation

It is anticipated that all containers generated and handled during Site remedial activities will meet the requirements as non-regulated Exempt Quantities as per 49 CFR 173.436 (DOT, 2005). Prior to offering radiological waste generated from site remediation for off-site transportation, a determination will also be made as to its classification pursuant to the "hazardous material" transport regulations of the DOT.

In general, radiological material from the site could fall within the following DOT classifications, as defined in CFR Title 49 (DOT, 2005):

- *Class 7 Radioactive Materials* - Radiological material is regulated as *Class 7* if the activity concentration and activity limit for consignment are greater than the exempt values for each individual radionuclide listed in 49 CFR 173.436.
- *Non-DOT Regulated* – Wastes that do not meet the criteria or ROCs described above for Class 7 materials are not regulated as hazardous pursuant to the DOT regulations and therefore the placarding, labeling, manifesting, and shipping requirements of 49 CFR 171 through 174. However, although non-DOT (and non-NRC) regulated, shipment of this type of material under the 91(b) Program [a reference to Section 91(b) of the Atomic Energy Act (AEA) of 1954, as amended (42 U.S.C 2121)] (NRC), requires the use of Chain-of-Custody and labels in accordance with USAF waste management guidance.

4.4.1.2 RCRA Hazardous Waste

Although unlikely to be generated during remediation activities at the Site, it is still possible that generating and handling wastes that are also subject to the RCRA "hazardous waste" management regulations (40 CFR 260 - 282) could occur during this project. A solid waste may be a RCRA "hazardous waste" if it appears on one or more specific lists or if it exhibits any of the following characteristics of hazardous waste: ignitability, corrosivity, reactivity, and/or toxicity. The regulatory definitions for each of these "characteristic" hazardous wastes are contained in 40 CFR 261.21 through 261.24. "Listed" hazardous wastes from specific and non-specific sources, discarded commercial chemical products, off-specification species, container residues, and spill residues thereof are identified in 40 CFR 260.30 through 261.38. Hazardous wastes identified as being either listed or characteristic must be managed in accordance with RCRA hazardous waste management regulations (40 CFR 261 through 282) (EPA).

Based on historical data compiled for the Site, it is not anticipated that any listed wastes are present at the Site within the areas subject to the remedial action. There is no known past co-mingling of contaminated soil and debris to be removed during this remediation project with listed hazardous waste. Hazardous waste characteristics are identified through laboratory analysis of waste materials or based on the waste generator's knowledge of the process generating the waste. Historical laboratory results, including analysis of TCLP extracts from soil samples collected from the Site have not indicated the presence of characteristic hazardous waste.

Spent PPE, equipment, and materials that are co-mingled with hazardous waste can themselves be classified as hazardous waste based on the "derived from rule" [40 CFR 261.3(c)(2)(i)] (EPA). However, since hazardous waste is not anticipated to be present in remediation wastes at this Site, this will probably not be an issue on this project. It is anticipated that PPE generally will be classified as radiological waste rather than hazardous waste, since most spent PPE will be generated during the removal and handling of radiological material. If some portion of remediation wastes generated during this project is found to be classified as hazardous waste by characteristic, that portion of spent PPE generated during the removal and handling of those wastes will be segregated from the other PPE and disposed along with the hazardous waste itself.

4.4.1.3 Mixed Waste (LLRMW)

Mixed wastes are defined by the Low Level Radioactive Waste Policy Act (NRC), Public Law 96-573, and it's implementing regulations, as containing radioactive material not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined by Section 11e.(2) of the AEA (NRC) as well as hazardous waste under RCRA, 40 CFR 239-282 (EPA) (and the State equivalent thereof). Remediation wastes from the Site under this project are not anticipated to contain hazardous waste, and therefore, LLRMW is not anticipated to be of concern on this project. If however, such mixed waste is identified (and confirmed via laboratory analytical sampling), the materials

would require segregation from the radiological waste for characterization and would be hauled by a permitted hazardous waste transporter to an off-site facility both permitted and licensed to receive and treat mixed wastes.

4.4.1.4 Other Regulated Waste

In addition to the waste classifications identified above, remediation activities have the potential of resulting in the generation of wastes that are not classified as radiological material or hazardous waste but may contain hazardous substances requiring special management procedures (referred to herein as Other Regulated Wastes), including:

- **Trash** – Uncontaminated trash includes spent packaging, equipment, and garbage that have not been impacted by radioactive or hazardous substances at the Site. Trash and rubbish will be stored on-site in appropriate containers (i.e., trash cans) and will be picked up by a local solid waste hauler for disposal at an off-site solid waste facility licensed by the State of New Mexico.
- **Sanitary Wastewater** – The use of portable toilets will result in the generation of sanitary wastewater. Potentially contaminated (chemical or radiological) wastewater will not be stored, discharged, or otherwise come into contact with the sanitary facilities. Sanitary wastewater will periodically be collected by a local sanitary service provider for off-site disposal at a municipal wastewater treatment facility.

4.4.2 Regulatory Requirements

The following prerequisite requirements must be met prior to shipment of any waste materials from the Site:

- All wastes associated with RW-06 are owned by Kirtland AFB, and all shipping and disposal papers shall identify Kirtland AFB as the generator.
- The person performing shipping activities associated with radioactive, hazardous, or mixed waste, i.e., the Broker, will be trained in accordance with the requirements in 49CFR, Part 172, Subpart H and will satisfactorily meet all qualification requirements set forth by the US Army JMC and the USAF.
- The Broker performing shipments for the Site shall ensure that the following administrative requirements are addressed prior to any shipment of materials off-site.
    - The Broker shall ensure that all terms, conditions, and restrictions set forth in the project QPP are adhered to for all Site waste management and transportation activities
    - The Broker shall ensure that all shipments of waste for disposal are prepared in accordance with the accepting facilities waste acceptance criteria (WAC)
    - All materials being shipped via rail must be identified by the most appropriate Proper Shipping Name in accordance with the Hazardous Materials Tables in 49CFR.
    - If hazardous or mixed wastes are being generated, these wastes must be identified by the most appropriate US EPA Waste Code in accordance with 10CFR40.
    - For any hazardous or mixed wastes generated, all notifications and certifications for waste material subject to the land disposal restrictions must be completed in accordance with 40CFR, Part 268.

4.4.3 Waste Management Plan

Exempt and non-exempt LLRW, LLRMW, RCRA waste, and non-contaminated waste may be generated as a result of remediation activities and Site support activities during this scope of work. The volume of each waste stream will vary depending upon area and concentration of the contamination encountered. Original estimates place the total anticipated volume of soil LLRW at less than approximately 2,250 cy.

Approximately 80% of this volume is anticipated for disposal at the US Ecology facility in Grand View, Idaho, as NRC-exempt radioactive material (pending a NRC 20.2002 exemption); and 17% will be disposed as licensable Class A LLRW and 3% as LLRMW at the Energy Solutions facility in Clive, Utah. All other debris will be disposed of by CABRERA through an approved scrap disposal facility or the Kirtland AFB recycling center, as deemed appropriate.

4.4.3.1 Waste Packaging

Contaminated soil and soil-like waste (i.e., soil with very small pieces of debris comprising less than 10 percent of the waste volume) excavated during trench removal will initially be staged on site pending completion of all waste sorting, screening, testing, characterization, and segregation activities. The type, size, and volume of waste (e.g., LLRW, LLRMW, RCRA chemical, non-contaminated, large debris) will determine the packaging requirements. All excavated waste materials will first be transported to the waste staging area within the EZ and placed in stockpiles of no more than 250 cy.

Soil and soil-like material categorized as LLRW, LLRMW, or RCRA contaminated will be placed into flexible-sided, 12-ton capacity (approximately 9.56 cy) IP-1 waste containers (LiftPac™ or equivalent) to facilitate contamination control and transport for placement in final packaging. The waste containment bags will meet DOT standards for industrial packages, as defined in 49 CFR 173.410/411. Non-contaminated soil will be stockpiled in the temporary waste staging area for reuse as backfill (DOT, 2005).

Large debris (greater than 10 in x 10 in x 12 ft) categorized as radioactive or RCRA contaminated will be sized and placed in 25 cy IP-1 intermodal containers, then staged on site pending transfer to the rail spur for shipment to the disposal facility. Large debris categorized as non-contaminated will be stockpiled in the temporary waste staging area pending delivery directly to a recycling or industrial waste disposal facility.

To meet fissile packaging exceptions (49 CFR 173.453 [b]), storing high concentrations (i.e., greater than 1 gram of Pu per 200 grams of surrounding soil) of discrete Pu particles in small packages will be avoided. If necessary, soil blending may be performed to lower the average activity in each waste container or bag (DOT, 2005).

4.4.3.2 Short-Term Staging

The filled waste containment bags will be staged on site in the waste storage area pending transfer to an off-base rail spur for transshipment (to Energy Solutions or to US Ecology) or direct transportation via truck (local industrial waste landfill) to a disposal facility. In the event that the waste is accepted for disposal and removed from the site within 90 days of the end of remediation activities, the containment bags will remain in the staging area. It is anticipated that any non-radioactive RCRA hazardous (chemically contaminated) waste, Class A LLRW/LLRMW, and non-contaminated debris will likely be removed from the site within 90 days.

All sediment control measures, such as hay bales or silt fence, will remain in place. Containment bags will be covered with waterproof tarps to provide additional protection from water infiltration. Gates to the site will remain locked during this period. CABRERA will provide periodic monitoring and inspection on a weekly basis.

Any non-Class A radioactive waste may be eligible for alternate disposal at the US Ecology in Grand View, ID, pending receipt of an exemption from the NRC under the provisions of 10 CFR 20.2002 (hereafter referred to as a '20.2002 exemption'). Kirtland AFB will make application for a 20.2002 exemption when the total volume of eligible waste is known. This process is anticipated to take longer than 90 days to complete, in which case the optional procedures described in Subsection 4.4.3.3 of this plan will be enacted (NRC).

4.4.3.3 Long-Term Staging (Optional)

Pending receipt of a 20.2002 exemption from the NRC, the proposed exempt LLRW will likely require staging for a period beyond the 90 days specified in Subsection 4.4.3.2 of this plan. This waste will be placed into IP-1 25 cy intermodal containers (IMCs) and staged on site. Prior to implementing this option, the SRM and PM will obtain written authorization from the Kirtland AFB PM and AFCEE COR.

Waste, if any, that falls into any category that cannot accepted by EnergySolutions for disposal will be set aside and stored in accordance with its characteristics in a designated location pending determination of the appropriate method of disposal. Waste streams or packaged waste that is not Class A waste, e.g. Class B or Class C waste, will be set aside for determination of the appropriate disposal option. Waste that does not meet the disposal site SNM limitations as indicated in the EnergySolutions WAC will also be set aside for determination of the appropriate disposal option. These wastes will also be transferred to IMCs for staging.

All sediment control measures, such as hay bales or silt fence, will remain in place. Containment bags will be cut open to allow soil to fill the IMCs more efficiently. Gates to the site will remain locked during this period. CABRERA will provide periodic monitoring and inspection on a weekly basis.

4.4.4 Transportation and Disposal

4.4.4.1 Waste Disposal Acceptance Process

The results of all laboratory analyses for each waste stream, both from on site and offsite facilities, used to complete waste profiles will meet the requirements of EnergySolutions, US Ecology, and any other disposal facility determined capable of receiving waste (i.e. RCRA hazardous only or non-hazardous material) from this site. Until an exemption is approved for alternate disposal at the US Ecology facility, it is assumed that that all LLRW and LLRMW will be disposed at the EnergySolutions facility. RCRA hazardous chemically contaminated waste does not require disposal at EnergySolutions and will be disposed at the closest facility licensed for the material as characterized by the laboratory analyses.

Requirements for EnergySolutions Facility in Clive, Utah

Shipping and disposal of Class A LLRW and LLRMW at the EnergySolutions facility will require the following:

- Radioactive Waste Profile Record (Energy Solutions Form #EC-0230)
- Special Nuclear Material (SNM) Exemption Certification (Energy Solutions Form #EC-0230-SNM)
- Energy Solutions Shipping Checklist
- Utah Generator Site Access Permit (GSAP) issued to CABRERA – required to receive Notice to Transport from Energy Solutions
- Notice to Transport (issued by Energy Solutions prior to shipping waste)
- Bill of Lading (required at the time of shipment offsite)
- Hazardous Waste Manifest (required at the time of shipment offsite)

The waste profile for Energy Solutions will meet the following requirements:

- Identify and quantify radioactivity in waste to properly classify the waste in accordance with 10 CFR 61 (NRC) and the EnergySolutions WAC.
- Determine the U-235 mass and uranium enrichment to verify the waste meets the EnergySolutions WAC and determine the appropriate waste packaging for transport and disposal in accordance with DOT regulations and 10 CFR 71 (NRC), if applicable.

- Determine the hazardous characteristics of the waste to guide further processing of the material and verify the waste meets the EnergySolutions WAC.
- Address each of the parameters listed on the EnergySolutions Waste Profile Record.

EnergySolutions is precluded from accepting the following waste:

- Waste that is determined to be greater than Class A, i.e., Class B, Class C or greater than Class C (GTCC)
- Waste containing special nuclear material in excess of the concentrations or quantity specified in the WAC
- Mixed waste that contains hazardous materials not identified in their RCRA Part B permit (check with Energy Solutions)

Requirements for US Ecology Facility in Grand View, Idaho

Disposal of NRC- exempt LLRW at the US Ecology facility will require the following:

- NRC 20.2002 Exemption (as applicable)
- Waste Profile
- SNM
- Notice to Transport
- Bill of Lading
- Hazardous Waste Manifest

Requirements for Kirtland AFB Landfill

Once waste is approved for disposal at the Kirtland AFB landfill, a Kirtland AFB Landfill Pass will be issued to the requestor for the waste hauling vehicle (see Subsection 3.1.3.2 of this plan). Kirtland AFB landfill personnel will request a copy of the waste disposal authorization letter and landfill pass upon delivery of the waste to the landfill.

Landfill passes are issued in 2 separate categories: a Short Term (less than 90 days duration) Temporary Pass and a Long Term Pass (more than 90 days duration). The Short Term pass is non-renewable and has a set expiration date. The Long Term pass is issued for projects lasting over 90 days and requires revalidation at the end of each calendar year quarter.

Passes are issued on Monday, Wednesday, and Thursdays only, between 8:00 a.m. and 10:00 a.m. at the 377 CEO, Chugach Management Service JV, Service Contracts QA section located in Building 20683 (Civil Engineering Warehouse). Kirtland AFB landfill hours of operations are 7:00 a.m. to 3:45 p.m. Monday through Friday, and 7:00 a.m. to 12:00 p.m. on Saturdays. The landfill is closed on legal holidays and when weather conditions warrant, i.e., high winds or excessive precipitation. At the time of initial issue or revalidation of the Landfill Pass, the contractor must have the following in possession:

- A valid contract issued by a US Government Contracting Agency for work to be accomplished on Kirtland AFB: the Title Page, the Performance Period Page, and if on an option year of the contract, the Option Authorization and Acceptance Page for the continued use of a pass
- A valid vehicle registration
- A valid Proof of Insurance
- A valid Bernalillo County Emissions Certificate. This certificate is required if the vehicle is gasoline powered, newer than 1974 and its gross weight is 26,000 pounds or less. If vehicle

is registered outside of Bernalillo County and will be working on Kirtland AFB more than 60 days out of the year, a Bernalillo County emission's certificate will be required. Diesel operators are asked to provide their exempt status certificates

- A sub-contractor appointment letter or contract. Any company hired by the Prime Contractor to accomplish a portion of their contract, will provide, on the Prime Companies letterhead, a letter of appointment which gives a clear performance period of sub-contractor work. If a formal contract is available and it has performance dates this document can be used in place of a letter

General Acceptance Process for Radioactive and Hazardous Waste

The Project Engineer will be responsible for preparation of all waste acceptance documents for each waste stream. Prior to completing these forms, the preparer will verify the forms used are the most recent version and are intended for use at the specific disposal facility for the waste stream. Documents will be reviewed by the PM, the CABRERA corporate RSO, and the CABRERA Broker prior to submission to the Kirtland AFB PM for review and signature. All documents prepared by CABRERA for disposal acceptance and shipping will be signed by the Kirtland AFB PM or his designee.

At a minimum, the waste profile package will include: all associated forms obtained from the disposal facility, analytical data summaries from the laboratories, calculations and a narrative providing historical context and a description of the waste. The SNM exemption is also a required part of the application for disposal and will be submitted along with the waste profile package.

Following approval of each waste acceptance package will be submitted by the Kirtland AFB PM, the package will be submitted to the appropriate disposal facility. For Energy Solutions, a copy of the CABRERA GSAP must also be submitted. The PM will coordinate with the facility, the CABRERA Broker, and the Project Engineer to ensure that the package is received, clarified, and processed in a timely manner. Following review and acceptance, a Notice to Transport will be issued by the disposal facility. The PM will then coordinate with the Project Engineer, CABRERA Broker, SRM, Kirtland AFB PM, disposal facility, and waste transporter to arrange for transfer of the waste to the rail spur and shipping to the facility.

4.4.5 Waste Transfer and Transport

Segregated waste material with no radiological or chemical contamination identified through field screening, on-site, and off-site analysis will be disposed of by CABRERA through an approved scrap disposal facility or local solid waste landfill. Waste material will be staged in waste bags or in roll-offs for transportation via truck to the disposal facility.

Waste material with NRC-exempt LLRW contamination or exempt radiological plus chemical contamination packaged in soft-sided waste bags will be loaded onto trucks, transported to an off base rail spur, transloaded to open gondola rail cars, and shipped via railroad to the appropriate disposal facility, Energy Solutions in Clive, Utah, or US Ecology in Grand View, Idaho depending upon receipt of an NRC 20.2002 exemption. Waste material that has been staged in IMCs will be loaded onto rail flat cars. Rail cars will subsequently be transported to the appropriate disposal facility.

Class A LLRW or LLRMW or non-exempt plus chemical contamination will be packaged in waste bags and loaded onto trucks for transportation to open gondola rail cars. Rail cars will subsequently be transported to a landfill managed by Energy Solutions in Clive, Utah.

Loading of waste bags onto trucks and transloading to rail cars will be accomplished using either a crane (minimum 30-ton capacity) or large front-end loader capable of lifting at least 12 tons. All IMCs will be loaded and transloaded using a minimum 100-ton capacity crane. Cranes will be run by licensed, experienced operators assisted by trained and experienced riggers. Each truck will have a release survey completed before leaving the RW-06 site.

4.4.5.1 Regulatory Requirements

All LLRW will be properly packaged and surveyed in accordance with all applicable local, state and federal regulations, including DOT Hazardous Materials Regulations (DOT, 2005). Once a waste container is loaded, the container will be assigned a sequential number and labeled as "Radioactive." A log of all loaded waste containers will be kept by the SRM for submission to the USAF for tracking purposes. Packaging, labeling, and marking requirements vary according to classification of material and activity level, but in any case will be consistent with CABRERA Standard Operating Procedure AP-13, *Packaging Radioactive Material*, a copy of which will be maintained on site.

The Project Engineer and CABRERA Certified Waste Broker are responsible for ensuring all requirements for shipments by public conveyance are met to ensure that the containers can eventually be shipped to an approved offsite waste disposal facility. A surface contamination survey (i.e., smear sampling and counting) will be performed to ensure compliance with 49 CFR 173.441 and 49 CFR 173.443. Any exterior areas of radioactivity that exceed release criteria will be decontaminated. The following minimum packaging requirements apply for materials to be shipped (DOT, 2005):

- All Exempt and Limited Quantity (ELQ) shipments will be packaged in 'strong-tight' packaging. CABRERA will use sealed plastic coolers for all sample shipments.
- Packaging must, at a minimum, meet the applicable requirements contained in 49 CFR 173.24, General Requirements for Packaging and Packages.
- Containers must be properly sealed to prevent leakage of any materials.
- Containers must be reasonably clean. They must not have any waste materials, or gross accumulation of other material that could be mistaken for waste on the outer surface, as is possible.
- Each container that requires labeling must be properly labeled in accordance with the requirements of 49 CFR 172 Subpart E.
- Each container that requires marking must be properly marked in accordance with the requirements of 49 CFR 172 Subpart D and/or 49 CFR 173.421 and 425.
- All packaging and preparation of materials for transport from the Site shall be in strict adherence to the requirements of 49 CFR and all other applicable federal, state, local and disposal site regulations.
- Materials shall be packaged and the packaging inspected in accordance with the requirements of Reference 49 CFR, Part 173 for the Proper Shipping Name (PSN) and DOT Subtype of the material being offered for transport.
- Packages with specific radioactivity concentrations greater than the tabular limits found in 49 CFR 173.436 will be shipped as Class 7 hazardous material. The values for each quantified nuclide will be assessed using the "unity rule" with the overall summed value less than or equal to 1.0. If these limits are exceeded, the appropriate proper shipping name will be "Radioactive Material, Low Specific Activity, n.o.s." or "Radioactive Material, Surface Contaminated Object, n.o.s." and must adhere to all packaging requirements.
- All packages offered for transport will be properly marked and labeled in accordance with the requirements of Reference 1, Part 172 prior to shipment.
- All hazardous materials (unless otherwise exempted) will have DOT hazardous materials shipping papers prepared in accordance with Parts 172.200 - 172.205.
- Additional forms will be prepared as may be required by federal, state, and local ordinances, and by receiving site license or acceptance criteria.

In addition, proper accountability will be taken to ensure the waste classification remains as NRC Class A waste and does not reach concentrations for consideration as Class B or transuranic (TRU) waste (i.e., greater than 100 nCi/g standard for waste classification requiring special disposal considerations as per 40 CFR 191.02(i) [EPA] and 10 CFR 61.55 [NRC]). Each truck driver will be provided with a completed and signed manifest and bill of lading for the load they are hauling to the rail spur.

4.4.5.2 Records of Disposal

Final certification of disposal sent from the receiving facilities will be reviewed by the Project Engineer for accuracy and completeness, and will be maintained with all project records. A complete inventory of all radioactive waste containers transported for offsite disposal and certificates of disposal will be provided to the Kirtland AFB PM. as part of the RA-C Completion Report for the project.

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5.0 FINAL STATUS SURVEY

The success of the remedial action will be verified by performing a FSS consistent with MARSSIM for radiological contaminants, ensuring that results are below levels specified in 10 CFR 20.1402 (25 mrem/yr) (NRC) and by ensuring all sidewall and trench floor samples are below the NMED requirements identified in the *Approved Background Concentrations Sandia National Laboratories/Kirtland AFB* (NMED 1997) and *NMED Soil Screening Level (SSL) Guidelines*, (NMED, 2006) for chemical constituents.

The details of FSS and confirmation sampling efforts, described in the project SAP, will include gamma walkover surveys, the collection and laboratory analysis of systematic and biased samples from the limits of surface and trench excavations to demonstrate compliance with criteria for free release of the site.

Soil samples will be analyzed at an off-site laboratory for chemical constituents to demonstrate that NMED residential soil screening levels have been achieved at the limits of the surface spot and trench excavations. Soil sampling frequencies, analytical methods and requirements, and quality control criteria for chemical constituents are identified in the SAP.

Field screening, on-site laboratory, and off-site laboratory analytical results will be evaluated as described in the SAP. Field screening and laboratory analytical data as well as QC evaluation results will be presented in the RA-C Completion Report for the project.

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6.0 BACKFILLING AND SITE RESTORATION

Remediated surface spots and trenches will be backfilled following verification that project release criteria identified in Section 5.0 have been achieved and upon approval by the Kirtland AFB PM.

Soil excavated to ensure safe trench side slopes and overburden that exhibits concentrations below NRC and NMED criteria cited in Section 5.0 will be reused to backfill remediated surface spots and trenches.

Additional backfill material will be imported from a borrow source at Kirtland AFB to be designated by the USAF to supplement reuse of excavated RW-06 soils to backfill the remediated excavations, if required. Excavations will be backfilled to approximately match surrounding grades. Soil will be placed in approximately 1- to 2-ft lifts back into the trenches and compacted until firm using a front loader and/or excavator. Disturbed portions of the site will be re-graded as necessary to ensure appropriate drainage. Backfilled, re-graded and disturbed SZ areas will be reseeded using a Kirtland AFB approved native grass seed mix (Appendix G).

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7.0 DEMOBILIZATION

CABRERA will demobilize from the site at the conclusion of remediation and site restoration activities. All field personnel, temporary trailers, construction equipment, field laboratory instruments, remaining consumable supplies, sanitary facilities, and support vehicles will be removed from the site. Equipment will be decontaminated as appropriate and release surveys performed and documented in accordance with the SSHP (Attachment III of the QPP). Any temporary constructed haul roads will be removed at the completion of construction unless approval is obtained to leave roads in place. Electrical support facilities will be terminated and removed by a licensed electrical subcontractor. Erosion control measures will be removed after vegetation is established

In accordance with our Materials License, the CABRERA RSO will notify the NRC of removal of radioactive sources at least 14 days prior to shipping. In addition, the RSO will notify the NRC job site status and the disposition of any associated licensed radioactive material within 30 days following completion of site activities.

If waste material requires staging pending receipt of a 10 CFR 20.2002 (NRC) exemption to allow transport of waste material to the US Ecology facility in Grand View, ID, the waste material will be covered with a minimum 6-mil plastic that will be weighted down to prevent wind impacts. Additionally, the waste will be fenced using temporary construction fencing pending transportation and disposal. CABRERA personnel will inspect the staged material weekly to ensure site security. The waste material will be transported and disposed of as identified in Section 4.0 of this plan following receipt of the NRC exemption and acceptance of the waste by US Ecology.

The Kirtland AFB PM along with the CABRERA SRM and QC personnel will perform a final inspection at the conclusion of the field portion of the project prior to demobilization. A punch list of any incomplete or unacceptable items of work will be documented and included in the DQCR for submittal to the PM. Items identified during this final inspection will be corrected prior to completing all demobilization activities.

Site conditions following demobilization will be documented by the SRM and site QC personnel to include at a minimum: photographs of all areas affected by site activities; documents related to removal and return of heavy equipment; and completion of the final inspection form (Appendix H). A complete inventory of all radioactive waste containers transported for offsite disposal and certificates of disposal will be provided to the Kirtland AFB PM as part of the RA-C Completion Report for the project.

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8.0 FIELD OPERATIONS RECORDKEEPING AND DOCUMENTATION

This section describes procedures for documenting field operations activities through proper recordkeeping. A discussion of recordkeeping for sampling and analysis activities is provided in the Quality Assurance Project Plan (QAPP) (Attachment IIb of the QPP). The objectives of the record keeping and documentation task are to: archive project data and procedures to substantiate the results of remediation activities; provide timely access to an organized body of data to facilitate analysis and decision making; provide a useful index of project information; and facilitate the reporting of project progress.

The following sections describe the practices and procedures to be used for daily site operations activities, waste handling and storage, and demobilization. All written documentation will be completed with indelible ink. Corrections to documentation will consist of placing a single line through an incorrect entry, noting corrected information, and initialing and dating the changes. All electronic files, including but not limited to: plans, reports, laboratory data, field forms, communications, and scanned images of logbooks will be saved to the project files on the CABRERA NY server (\\Nydc1\NewYork1). Any files saved to computer hard drives will be backed up on a monthly basis on a CABRERA server where project files are maintained.

8.1 Daily Quality Control Reports

During the field investigation, daily quality control reports (DQCRs) will be prepared. These DQCRs will be scanned and archived so that they can be transferred through e-mail more efficiently to the PM and project personnel. The original paper copy will be dated and signed by the SRM or his designee. Copies of the DQCRs will be transmitted to the PM on a daily basis.

DQCRs will serve to document the daily activities occurring on the project. The weather for each day and any additional environmental conditions or observations pertinent to field activities will be documented. The level of PPE worn at the site for that day will be recorded. A list of team members present and their role on the project, as well as visitors to the immediate investigation area, will be included. Any meetings or briefings will be summarized. Significant issues that may require coordination with Kirtland AFB, Air Force Safety Center (AFSC), and/or the Air Force Center for Engineering and the Environment (AFCEE) will be discussed. Work completed for the day and the project will be discussed. Any changes or delays in the project will also be discussed, along with any safety issues that may arise. A list of photographs taken of site activities and conditions will be recorded to include subject, location, sequence number, and name of person taking the photograph. A copy of the DQCR form is provided in Appendix B.

8.2 Field Logbook and Forms

The SRM or his designee will maintain the project field logbook and field records. Forms for recording sampling, safety, equipment maintenance, and waste handling will be provided as needed to technicians in the field. Copies of these forms are provided in Appendix B.

8.3 Documentation Procedures/Data Management and Retention

The Project Engineer is responsible for ensuring project field logbooks, individual team member logbooks, field data forms (e.g., sample collection forms), sample chain of custody forms, and copies of all electronic data files are filled out properly and collected at the completion of field work. The Project Manager is responsible for ensuring that all written and electronic documentation generated in the field is placed in the electronic project files on the CABRERA server, and that project documents are maintained for at least five years.

Table 8-1. Field Operations Documents

Requirement	Preparer	Frequency	Submittal Deadline (to QC)	QC Reviewer
DQCR	SRM/SDC	1 per field day	0800 hrs the day after the period covered	Project Engineer/PM
Waste Pile Investigation Form	Rad FT / SDC	1 per waste pile/lift	0900 hrs the day after investigating the pile	Project Engineer
Trench Investigation Form	Rad FT / SDC	1 per trench/lift	0900 hrs the day after investigating the trench	Project Engineer
Trench Summary Form	Rad FT / SDC	1 per trench	0900 hrs the day after investigating the trench	Project Engineer
Field Logbooks	Rad FT / SRM	Notes completed daily	Copies provided at the end of each week of field activities	Project Engineer
Final Inspection Checklist	SRM	1 per demobilization	One day following demobilization	PM/Kirtland PM

Note:

- The FSP contains forms associated with analytical laboratory sample collection.
- All deadlines are job site time zone.

9.0 REFERENCES

A comprehensive list of references is located in Section 8.0 of the QPP.

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APPENDIX A

CABRERA SERVICES INC. RADIOACTIVE MATERIALS LICENSE

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Amendment No. 01

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	In accordance with letter dated September 20, 2004,
1. Cabrera Services, Inc.	3. License number 06-30556-01 is amended in its entirety to read as follows:
2. 473 Silver Lane East Hartford, Connecticut 06118-1152	4. Expiration date June 30, 2010
	5. Docket No. 030-25316 Reference No.

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Any byproduct material with atomic numbers 1 through 83	A. Any	A. 100 curies per radionuclide and 100 curies total
B. Any byproduct material with atomic numbers 84 through 103	B. Any	B. 1 curie per radionuclide and 1 curie total
C. Uranium and Thorium	C. Any	C. 10,000 kilograms
D. Any special nuclear material	D. Any	D. 200 grams uranium-233, or 350 grams uranium-235, or 200 grams plutonium, or any combination of these provided the sum of the ratios does not exceed unity

9.Authorized use:

A through D: Receipt, storage, use, and/or possession incident to the following activities:

(1) Decontamination, decommissioning, and remediation of facilities and grounds, equipment, and containers;
(2) Site characterization;
(3) Solidification and treatment of wastes;
(4) Packaging for transport;

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(5) Transport in packages or containers approved for use under the provisions of 10 CFR Part 71, for transfer to licensees authorized to receive the materials, in accordance with the terms and conditions of licenses issued by the NRC or an Agreement States; and
(6) As calibration sources and reference standards for operational testing of radiation detection equipment.

CONDITIONS

10. Licensed material may be used only at temporary job sites of the licensee anywhere in the United States where the U.S. Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.

11. A. Licensed material shall be used by, or under the supervision of, Lorenzo Cabrera, Raymond E. Holmes; Steven Masciulli, Paul H. Schwartz, Henry Siegrist, and David J. Watters.

    B. The Radiation Safety Officer for this license is Steven Masciulli, CHP, CSP.

12. Except for calibration sources and reference standards, possession of licensed material at each temporary job site shall be limited to material originating from each site. This material must either be transferred to an authorized recipient or remain at the site and activities authorized by this license are completed.

13. This license does not authorize the use of licensed material at temporary job sites for uses already specifically authorized by the customer's license. If a customer also holds a license issued by the NRC or an Agreement State, the licensee shall establish a written agreement between the licensee and the customer specifying which licensed activities shall be performed under the customer's license and supervision, and which licensed activities shall be performed under the licensee's supervision pursuant to this license. The agreement shall include a commitment by the licensee and customer to ensure safety, and any commitments by the licensee to help the customer clean up the temporary job site if there is an accident. A copy of the this agreement shall be included in the notification required by Condition 17.A. of this license.

14. Pursuant to 10 CFR Parts 30.11, 40.14, 70.14, and Condition 10 of this license, the licensee is exempted from the requirements of 10 CFR Parts 30.35, 40.36 and 70.25 to establish decommissioning financial assurance.

15. Notwithstanding the requirements in 10 CFR Parts 30.32(i), 40.31(j), and 70.22(i), the licensee is not required to establish an emergency plan. Before taking possession of licensed material at a temporary job site in quantities requiring an emergency plan, the licensee shall either:

    (1) Obtain NRC approval of an evaluation demonstrating that an emergency plan is not required pursuant to 10 CFR Parts 30.32(i), 40.31(j), and 70.22(i); or

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(2) Submit written confirmation to the Regional Administrator, U.S. Nuclear Regulatory Commission, Region I, ATTN: Director, Division of Nuclear Materials Safety, 475 Allendale Road, King of Prussia, Pennsylvania 19406, that the licensee personnel have been trained and will follow the provisions of an existing emergency plan approved by the NRC or an Agreement State for the temporary job site.

16. If approved by the Radiation Safety Officer specifically identified in this license, the licensee may take reasonable action in an emergency that departs from conditions in this license when action is immediately needed to protect public health and safety and no action consistent with all license conditions that can provide adequate or equivalent protection is immediately apparent. The licensee shall notify the NRC before, if practicable, and in any case, immediately after taking such emergency action using reporting procedure specified in 10 CFR Part 30.50(c).

17. A. At least 14 days before initiating activities at a temporary job site, the licensee shall notify, in writing, the Regional Administrator, U.S. Nuclear Regulatory Commission, Region I, ATTN: Director, Division of Nuclear Materials Safety, 475 Allendale Road, King of Prussia, Pennsylvania 19406. The notification shall include the following information:

(1) Estimated type, quantity, and physical/chemical form(s) of material;
(2) Specification of site location;
(3) Description of project activities including waste management and disposition;
(4) Estimated project start date and duration; and
(5) Identification of and information on how to contact key project personnel.

B. Within 30 days of completing activities at each job site location, the licensee shall notify, in writing, the Regional Administrator, U.S. Nuclear Regulatory Commission, Region I, ATTN: Director, Division of Nuclear Materials Safety, 475 Allendale Road, King of Prussia, Pennsylvania 19406, of the temporary job site status and disposition of any licensed material used.

18. The licensee shall maintain records of information important to decommissioning each temporary job site at the applicable job site pursuant to 10 CFR Parts 30.35(g), 40.36(f), and 70.25(g). The records shall be made available to the customer upon request. At the completion of activities at a temporary job site, the licensee shall transfer these records to the customer for retention.

19. Licensed material shall not be used in or on human beings.

20. A. Sealed sources shall be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement State.

B. Notwithstanding Paragraph A of this Condition, sealed sources designed to primarily emit alpha particles shall be tested for leakage and/or contamination at intervals not to exceed 3 months.

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C. In the absence of a certificate from a transferor indicating that a leak test has been made within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under 10 CFR 32.210 or under equivalent regulations of an Agreement State, prior to the transfer, a sealed source received from another person shall not be put into use until tested and the test results received.

D. Sealed sources need not be tested if they contain only hydrogen-3; or they contain only a radioactive gas; or the half-life of the isotope is 30 days or less; or they contain not more than 100 microcuries of beta- and/or gamma-emitting material or not more than 10 microcuries of alpha-emitting material.

E. Sealed sources need not be tested if they are in storage and are not being used; however, when they are removed from storage for use or transferred to another person and have not been tested within the required leak test interval, they shall be tested before use or transfer. No sealed source shall be stored for a period of more than 10 years without being tested for leakage and/or contamination.

F. The leak test shall be capable of detecting the presence of 0.005 microcurie (185 becquerels) of radioactive material on the test sample. If the test reveals the presence of 0.005 microcurie (185 becquerels) or more of removable contamination, a report shall be filed with the U.S. Nuclear Regulatory Commission in accordance with 10 CFR 30.50(c)(2), and the source shall be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Commission regulations.

G. Tests for leakage and/or contamination, including leak test sample collection and analysis, shall be performed by the licensee or by other persons specifically licensed by the U.S. Nuclear Regulatory Commission or an Agreement State to perform such services.

H. Records of leak test results shall be kept in units of microcuries and shall be maintained for 5 years.

21. Sealed sources or detector cells containing licensed material shall not be opened or sources removed from source holders by the licensee.

22. The licensee shall conduct a physical inventory every six months, or at other intervals approved by the U.S. Nuclear Regulatory Commission, to account for all sources and/or devices received and possessed under the license. Records of inventories shall be maintained for 5 years from the date of each inventory and shall include the radionuclides, quantities, manufacturer's name and model numbers, and the date of the inventory.

23. The licensee is authorized to transport licensed material in accordance with the provisions of 10 CFR Part 71, "Packaging and Transportation of Radioactive Material."

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24. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated February 20, 2000
B. Letter dated May 27, 2000

For the U.S. Nuclear Regulatory Commission

Date September 28, 2004

Sattar Lodhi, Ph.D.
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406

85140782

NRC FORM 241 (8-2008) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0013 EXPIRES: 11/30/2011

Estimated burden per response to comply with this mandatory collection request: 15 minutes. This notification is required so that NRC may schedule inspection of the activities to ensure that they are conducted in accordance with requirements for protection of the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0013), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

REPORT OF PROPOSED ACTIVITIES IN NON-AGREEMENT STATES, AREAS OF EXCLUSIVE FEDERAL JURISDICTION, OR OFFSHORE WATERS

(Please read the instructions before completing this form)

1. NAME OF LICENSEE *(Person or firm proposing to conduct the activities described below)*	**2. TYPE OF REPORT** ☐ INITIAL ☐ CHANGE
3. ADDRESS OF LICENSEE *(Mailing address or other location where licensee may be located)*	4. LICENSEE CONTACT AND TITLE
	5. TELEPHONE NUMBER *(Include Area Code)* / 6. FACSIMILE NUMBER *(Include Area Code)*

7. ACTIVITIES TO BE CONDUCTED UNDER THE GENERAL LICENSE GIVEN IN 10 CFR 150.20

☐ WELL LOGGING ☐ LEAK TESTING AND/OR CALIBRATIONS ☐ TELETHERAPY/IRRADIATOR SERVICE

☐ PORTABLE GAUGES ☐ OTHER (Specify) ⇒ _____

☐ RADIOGRAPHY ⇒ REGISTERED AS USER OF PACKAGING (CERTIFICATES OF COMPLIANCE NUMBERS) _____

8. CLIENT NAME, ADDRESS, CITY/COUNTY, STATE, ZIP CODE	9. ACTUAL PHYSICAL ADDRESS OF WORK LOCATION *(Street and Number or other location. Give as complete an address or directions as possible.)*
	10. CLIENT TELEPHONE NUMBER *(Include Area Code)* / 11. WORK LOCATION TELEPHONE NUMBER *(Include Area Code)*

12. DATES SCHEDULED		13. NUMBER OF WORK DAYS	14. ADD	15. DELETE	16. LOCATION REFERENCE NUMBER
FROM	TO				NUMBER TO BE ASSIGNED BY NRC

LIST ADDITIONAL WORK SITES ON SEPARATE SHEET(S) TO INCLUDE ALL INFORMATION CONTAINED IN ITEMS 9-16 ABOVE.

17. LIST RADIOACTIVE MATERIAL, WHICH WILL BE POSSESSED, USED, INSTALLED, SERVICED, OR TESTED
(Include description of type and quantity of radioactive material, sealed sources, or devices to be used.)

18. AGREEMENT STATE SPECIFIC LICENSE WHICH AUTHORIZES THE UNDERSIGNED TO CONDUCT ACTIVITIES WHICH ARE THE SAME, EXCEPT FOR LOCATION OF USE, AS SPECIFIED IN ITEM 9. ABOVE *(One copy of the specific license must accompany the initial NRC Form 241.)*	LICENSE NUMBER	STATE	EXPIRATION DATE

19. CERTIFICATION *(MUST BE COMPLETED BY APPLICANT)*

I, THE UNDERSIGNED, HEREBY CERTIFY THAT:

a. **All information in this report is true and complete.**

b. **I have read and understand the provision of the general license 10 CFR 150.20 eprinted on the instructions of this form; and I understand that I am required to comply with these provisions as to all byproduct, source, or special nuclear material which I possess and use in non-Agreement States or offshore waters under the general license for which this report is filed with the U.S. Nuclear Regulatory Commission.**

c. **I understand that activities, including storage, conducted in non-Agreement States under general license 10 CFR 150.20 are limited to a total of 180 days in calendar year. With the exception of work conducted in off-shore waters, which is authorized for an unlimited period of time in the calendar year.**

d. **I understand that I may be inspected by NRC at the above listed work site locations and at the Licensee home office address for activities performed in non-Agreement States or offshore waters.**

e. **I understand that conduct of any activities not described above, including conduct of activities on dates or locations different from those described above or without NRC authorization, may subject me to enforcement action, including civil or criminal penalties.**

CERTIFYING OFFICER - RSO or Management Representative *(Name and Title)*	SIGNATURE	DATE

WARNING: False statements in this certificate may be subject to civil and/or criminal penalties. NRC regulations require that submissions to the NRC be complete and accurate in all material respects. 18 U.S.C. Section 1001 makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

FOR NRC USE ONLY	REVIEWING OFFICIAL *(Typed/Printed Name and Title)*	SIGNATURE	DATE	TOTAL USAGE -- DAYS TO DATE

NRC FORM 241
(8-2008)

APPROVED BY OMB: NO. 3150-0013
EXPIRES: 11/30/2011

U.S. NUCLEAR REGULATORY COMMISSION

REPORT OF PROPOSED ACTIVITIES IN NON-AGREEMENT STATES, AREAS OF EXCLUSIVE FEDERAL JURISDICTION, OR OFFSHORE WATERS

PLEASE READ THIS INFORMATION AND THESE INSTRUCTIONS BEFORE COMPLETING NRC FORM 241

Section 150.20 of 10 CFR 150 establishes a general license authorizing any pers on who holds a specific license from an "Agreement State" (a State with which the U.S. Nuclear Regulatory Commission has entered i nto an effective agreement under subsection 274b of the Atomic Energy Act of 1954) where the licensee maintains an office for di recting the licensed activity and at which radiation safety records are normally maintained, to conduct the same activity in Non-Agr eement States, areas of exclusive Federal jurisdiction, or in offshore waters if the specific license issued by the Agree ment State does not limit the authorized activity to specified locations or installations.

INSTRUCTIONS

Licensees cannot perform work in areas of exclusive Federal jurisdiction withou t either (a) filing NRC Form 241 for reciprocity in accordance with 10 CFR 150.20(b) or (b) applying for a specific NRC license. An area of exclusive Federal jurisdiction is an area over which the Federal government exercises legal control without interference from the jurisdiction and administration of State law. For example: If the work is to be performed on Federal property in an Agreement St ate, the licensee must first determine the jurisdictional status of the area where the licensee plans to work. If the jur isdictional status of the work site is unknown to the licensee, the Agreement State licensee should contact the Federal agency that c ontrols the facility where the work is to be performed. A written statement concerning the jurisdictional status is not required in or der to file for reciprocity; however, it is recommended that the Agreement State licensee obtain such a statement for the file for future re ference and inspection purposes.

For licensees seeking to conduct activities under reciprocity for the first tim e in a calendar year, submit this Form, one copy of the Agreement State specific license and the fee specified in fee Category 16, 10 C FR 170.31. NRC must receive this filing at least 3 days before the licensee engages in activities permitted under the General Lice nse established by Section 150.20 of 10 CFR 150.

In general, the preferred method of filing is through the facsimile transmissio n of NRC Form 241, a copy of the Agreement State license, and evidence that the appropriate fee requirements will be met within 3 days. This evidence can be a copy of the check or a copy of NRC Form 629, if paying by credit card, that will be mailed to the NRC. The licensee should receive confirmation (by telephone, e-mail, or facsimile) that NRC has received the facsimile. Alternati vely, the licensee may file the required information through the mail or other means as long as NRC receives the information at leas t 3 days before the licensee engages in the activity.

In completing NRC Form 241, it is important that the information submitted on N RC Form 241 be specific regarding the location and date of use as well as the activity requested. If it is not possible to provid e complete information, such as addresses for the locations of work, the licensee should provide as much information as possible. The lice nsee is responsible for providing additional information as revisions or clarifications as soon as such information becomes available.

Item 2.

For licensees seeking to conduct activities under reciprocity for the first tim e in a calendar year, submit this Form, one copy of the Agreement State specific license and the fee specified in fee Category 16, 10 C FR 170.31. NRC must receive this filing at least 3 days before the licensee engages in activities permitted under the General Lice nse established by Section 150.20 of 10 CFR 150. The licensee should check the "initial" box if this is the first submission of Form 241 for the year.

For modifications such to the information submitted on the initial NRC Form 241 , such as additional work locations, changes to radioactive material, work activities, information that clarifies or deletes sp ecific locations or work sites, modifies work site contacts, or adds or deletes dates of work, licensees should file by NRC Form 241 or letter, so that NRC receives the filing at least 3 days prior to engage in such activity. Licensees should check the "change" box to indicate ch anges to the information provided on the initial NRC Form 241. It is not necessary to resubmit the Agreement State license unless t he license has been amended since the filing of the initial NRC Form 241. No fee is required for changes.

NRC Form 241 may be used for submitting multiple work locations and clients for initial filings of NRC Form 241, as well as for submitting revisions and clarifications to previous filings. Separate sheets m ay be used provided it includes all of the requested information in Items 9-16 of NRC Form 241.

Under the general license, reciprocity activities are authorized only as long a s the licensee holds a valid radioactive material license. If the license expires during the year, an extension letter or a renewed licens e issued by the regulating agency must be subjitted to NRC before performing any additional work under reciprocity.

Items 12. - 16.

Under the general license, reciprocity activities, including storage (usage), c onducted in non-Agreement States and areas of exclusive Federal jurisdiction, are limited to a total of 180 days in any calen dar year except for work conducted in off-shore waters, which is authorized for an unlimited period of time in a calendar year. NRC tr acks reciprocity usage on the basis of approved usage days. NRC will not approve any activity under the general license which causes the total usage days to exceed 180 days, except for work conducted in off-shore waters. NRC may note and notify the licensee that a filing proposes reciprocity activities which approach or would exceed the 180-day limit. It is important that licensees track the da ys of use and clarify or delete dates of work when applicable.

Item 12. should reference the proposed beginning and ending dates of work for e ach work location with the total number of days worked recorded in Item 13. Item 14. should be completed to show additional wo rk dates different from those provided on the initial NRC Form 241 and Item 15. should indicate dates when work was not performed, as initially requested, that need to be deleted from the total work days. The Location Reference Number in Item 16. is generated by the NRC for use in tracking reciprocity activities and is specific for each work location. The Location Reference Number should be re ferenced for any revisions or clarifications to work location information.

Item 18 Licensees should identify the specific make and model numbers of sealed sources and devices.

NOTE: Inspections by NRC of activities performed in non-Agreement States, areas of ex clusive Federal jurisdiction, or offshore waters by Agreement State licensees operating under the general license in 10 C FR 150.20 will be conducted at the listed work site location(s). Failure to file an NRC Form 241 may result in the issuan ce of a notice of violation, the proposed imposition of a civil penalty, or an order suspending, modifying, or revoking t he license as specified in the "General Statement of Policy and Procedures for NRC Enforcement Actions."

Agreement State licensees seeking to conduct activities under Reciprocity shoul d file this Form, one copy of the Agreement State license, and the appropriate fee with the U.S. Nuclear Regulatory Commission Re gional Administrator listed below for the region in which the Agreement State that issued the specific license is located:

IF THE AGREEMENT STATE LICENSE IS ISSUED BY:

Alabama, Florida, Georgia, Kentucky, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New York, North Carolina, Rhode Island, South Carolina, or Tennessee,

SEND APPLICATION AND FEE PAYMENT TO:

Regional Administrator
Division of Nuclear Material Safety
ATTN: Reciprocity Request
Nuclear Materials Safety Branch
U.S. Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia, PA 19406-1415
Telephone Number (800) 432-1156
Facsimile Number (610) 337-5393

IF THE AGREEMENT STATE LICENSE IS ISSUED BY:

Arizona, Arkansas, California, Colorado, Idaho, Kansas, Louisiana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, or Washington,

SEND APPLICATION AND FEE PAYMENT TO:

Regional Administrator
Division of Nuclear Material Safety
ATTN: Reciprocity Request
U.S. Nuclear Regulatory Commission, Region IV
612 E. Lamar Boulevard, Suite 400
Arlington, TX 76011-4125
Telephone Number (817) 860-8100
Facsimile Number (817) 860-8263

IF THE AGREEMENT STATE LICENSE IS ISSUED BY:

Illinois, Iowa, Ohio, or Wisconsin,

SEND APPLICATION AND FEE PAYMENT TO:

Regional Administrator
Division of Nuclear Material Safety
ATTN: Reciprocity Request
U.S. Nuclear Regulatory Commission, Region III
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352
Telephone Number (630) 829-9887
Facsimile Number (630) 515-1259

150.20 Recognition of Agreement State Licensees

(a)(1) Provided that the provisions of paragraph (b) of this section have been met, any person who holds a specific license from an Agreement State, where the licensee maintains an office for directing the licen sed activity and retaining radiation safety records, is granted a general license to conduct the same activity in (i) Non-Agreement Sta tes; (ii) Areas of exclusive Federal jurisdiction within Agreement States; and (iii) Offshore waters.

(2) The provisions of paragraph (a)(1) of this section do not apply if the spec ific Agreement State license limits the authorized activity to a specific installation or location.

(b) Notwithstanding any provision to the contrary in any specific license issue d by an Agreement State to a person engaging in activities in a non-Agreement State, in an area of exclusive Federal jurisdicti on within an Agreement State, or in offshore waters under the general licenses provided in this section, the general licenses provi ded in this section are subject to all the provisions of the Act, now or hereafter in effect, and to all applicable rules, regulations, and orders of the Commission including the provisions of §§ 30.7 (a) through (f), 30.9, 30.10, 30.14(d), 30.34, 30.41, and 30.51 to 30.63, inclusive, of part 30 of this chapter; §§ 40.7 (a) through (f), 40.9, 40.10, 40.41, 40.51, 40.61, 40.63 inclusive, 40.71 and 40.81 of part 40 of this chapter; §§ 70.7 (a) through (f), 70.9, 70.10, 70.32, 70.42, 70.52, 70.55, 70.56, 70.60 to 70.62 of part 70 of this chapter; §§ 74.11, 74.15, and 74.19 of part 74 of this chapter; and to the provisions of 10 CFR parts 19, 20 and 71 and subparts C through H of par t 34, §§ 39.15 and 39.31 through 39.77, inclusive, of part 39 of this chapter. In addition, any person engaging in activities in non- Agreement States, in areas of exclusive Federal jurisdiction within Agreement States, or in offshore waters under the general l icenses provided in this section:

(1) Shall, at least 3 days before engaging in each activity for the first time in a calendar year, file a submittal containing an NRC Form 241, "Report of Proposed Activities in Non-Agreement States"' a copy of its Agr eement State specific license, and the appropriate fee as prescribed in § 170.31 of this chapter with the Regional Administrator of the U.S. Nuclear Reg ulatory Commission Regional Office listed on the NRC Form 241 and in appendix D to part 20 of this chapter for the Region in which the Agreement State that issued the license is located. If a submittal cannot be filed 3 days before engaging in ac tivities under reciprocity, because of an emergency or other reason, the Regional Administrator may waive the 3-day time requirement p rovided the licensee:

i) Informs the Region by telephone, facsimile, an NRC Form 241, or a letter of initial activities or revisions to the information submitted on the initial NRC Form 241;

(ii) Receives oral or written authorization for the activity from the Region; a nd

(iii) Within 3 days after the notification, files an NRC Form 241, a copy of th e Agreement State license, and the fee payment.

(2) Shall file an amended NRC Form 241 or letter with the Regional Administrato r to request approval for changes in work locations, radioactive material, or work activities different from the information contain ed on the initial NRC Form 241.

(3) Shall not, in any non-Agreement State, in an area of exclusive Federal juri sdiction within an Agreement State, or in offshore waters, transfer or dispose of radioactive material possessed or used under the general licenses provided in this section, except by transfer to a person who is--

(i) Specifically licensed by the Commission to receive this material; or

(ii) Exempt from the requirements for a license for material under § 30.14 of this chapter.

(4) Shall not, under the general license concerning activities in non-Agreement States or in areas of exclusive Federal jurisdiction within Agreement States, possess or use radioactive materials, or engage in the activities authorized in paragraph (a) of this section, for more than 180 days in any calendar year, except that the general license in paragraph (a) of this section concerning activities in offshore waters authorizes that person to possess or use radioactive materials, or engage in the activities authorized, for an unlimited period of time.

(5) Shall comply with all terms and conditions of the specific license issued b y an Agreement State except such terms or conditions as are contrary to the requirements of this section.

[35 FR 7725, May 20, 1970, as amended at 38 FR 1273, Jan. 11, 1973; 46 FR 44152 , Sept. 3, 1981; 46 FR 50781, Oct. 15, 1981; 52 FR 41700, Oct. 30, 1987; 55 FR 10406, Mar. 21, 1990; 56 FR 54779, Oct. 23, 1991; 58 FR 52414, Oct. 8, 1993; 62 FR 1665, Jan. 13, 1997; 62 FR 28973, May 28, 1997; 66 FR 5443, Jan. 19, 2001; 66 FR 32469, June 1 4, 2001; 67 FR 78149, Dec. 23, 2002; 68 FR 58825, Oct. 10, 2003]

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APPENDIX B

FIELD FORMS

Daily Quality Control Report

Example Chain of Custody Form

Daily Instrument QC Form

Trench Investigation Form

Trench Summary Form

Waste Pile Investigation Form

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CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

Day/Date: _____

DAILY QUALITY CONTROL REPORT

Kirtland AFB RW-06 Remedial Construction – Project No. 04-5200.05
Contract No. FA8903-04-D-8693 Task Order 0005

This field report shall be completed each day that field activities are performed at the RW-06 Site. Attach an additional sheet of paper, if necessary, to adequately complete each required entry.

Kirtland PM: L. Wayne Bitner **Precipitation:** _____

AFCEE PM: _____ **Wind**: _____

Cabrera PM: Mark Tepperman **Temperature**: _____

SUBCONTRACTORS ON SITE (Identify subcontractors onsite by company name):

WORK PERFORMED (Briefly describe project tasks that were performed. Reference appropriate logs if details necessary

PROJECT SCHEDULE (Describe impact of day's work, if any, on overall project schedule):

PROBLEMS, NON-CONFORMANCES, CORRECTIVE ACTIONS, NOTIFICATIONS (Describe any hazards, injuries, regulatory or procedural issues, items of non-compliance, etc. Identify individuals contacted as a result of these items. Include name/title/organization/time contacted/and a summary of content of discussion):

SITE VISITORS, CONTACTS (Identify any non-project personnel that visited the site or made contact with project personnel. Include names/titles/organizations/time of contact/ and any other pertinent details of the conversation):

DQCR prepared by:

Print Name	Signature	Title
		Site Remediation Manager

GPL LABORATORIES
7210A Corporate Ct.
Frederick, MD 21703
301-694-5310

CHAIN OF CUSTODY

GPL Project Manager:	Client Name:	Phone:	
Project Name:	Address:	Cell:	
Purchase Order:	City, State	Zip Code	

Comments: H=Hold Analysis Request X=Analyze

Preservatives and Containers

Sample Information | **Methods for Analysis** | **RUSH**

No.	Client Name, address and phone #	Date Sampled	Time Sampled	Matrix	Sampler's Initials																QC (MS/MSD)	TOTAL BOTTLES
1							X	X	X	X	X	X	X	X	X	X		X					4
2							X									.							
3																							
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Sample Matrix: WG= Groundwater; SO= Soil; WS= Surface Water; AA= Ambient Air; WQ= Water Quality

Total number of samples 4

Relinquished By:	**Date:**	**Time:**
Received By:	**Date:**	**Time:**
Relinquished By:	**Date:**	**Time:**
Received By:	**Date:**	**Time:**
Relinquished By:	**Date:**	**Time:**

For Lab Use

GPL WORK ORDER #:_____

COOLER RECEIPT CONDITION

Cabrera Services, Inc.

HP Instrumentation Logbook

Project Name

Client Contract#: _____

Cabrera Project #: _____

12 Apr 2007 Rev. 1

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

Instrument Pass/Fail Criteria

I. Quantitative Instruments [2929, 2224-1 / 2360 (if required)]						
			Criteria (cpm)			
Make	Model	SN	-3s	-2s	+2s	+3s

II. Qualitative Instruments [MicroRem, Model 3/44-9, 2221/44-20, etc]				
			Criteria (cpm)	
Make	Model	SN	-20%	+20%

Project#_____

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

Source Data Page

Source	Activity (dpm or µCi)	S/N	Half Life (years)	Assay Date (if NIST)	Vendor

Project#_____

CABRERA SERVICES
RADIOLOGICAL · ENVIRONMENTAL · REMEDIATION

Instrument Inventory Log

Make	Model	Probe	S/N	Cal Cert Rcv'd?	Date Rec'd	Date Returned	Comments

Project#_____

CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

HP INSTRUMENT QC FIELD LOG

units: cpm or µrem/hr
(circle one)

Make	Model	S/N	Probe	S/N	Cal Date

Bkg Count Time	Source #1 Count Time	Source #2 Count Time	Source #1 ID	Source #2 ID	Cal Due Date

Date(s)										
Intial QC's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Init.**
Bkgd											
Source #1											
Source #2											

Daily QC's

Date	Bkgd	Source #1 ( ) α/β/γ	Source #2 ( ) α/β/γ	Battery OK?	Comments	Init.
				Yes / No		
				Yes / No		
				Yes / No		
				Yes / No		
				Yes / No		
				Yes / No		
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				Yes / No		
				Yes / No		
				Yes / No		
				Yes / No		
				Yes / No		
				Yes / No		

Project#:_____Project Name:_____

CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

HP INSTRUMENT QC FIELD LOG

units: cpm or µrem/hr
(circle one)

Daily QC's						
Date	**Bkgd**	**Source #1 ( ) α/β/γ**	**Source #2 ( ) α/β/γ**	**Battery OK?**	**Comments**	**Init.**
				Yes / No		
				Yes / No		
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				Yes / No		

CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

HP INSTRUMENT QC FIELD LOG

units: cpm or µrem/hr
(circle one)

Daily QC's						
Date	**Bkgd**	**Source #1 ( ) α/β/γ**	**Source #2 ( ) α/β/γ**	**Battery OK?**	**Comments**	**Init.**
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Project#:_____Project Name:_____

CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

HP INSTRUMENT QC FIELD LOG

units: cpm or µrem/hr
(circle one)

Daily QC's						
Date	**Bkgd**	**Source #1 ( ) α/β/γ**	**Source #2 ( ) α/β/γ**	**Battery OK?**	**Comments**	**Init.**
				Yes / No		
				Yes / No		
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Project#:_____Project Name:_____

CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

HP INSTRUMENT QC FIELD LOG

units: cpm or µrem/hr
(circle one)

Daily QC's						
Date	**Bkgd**	**Source #1 ( ) α/β/γ**	**Source #2 ( ) α/β/γ**	**Battery OK?**	**Comments**	**Init.**
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CABRERA SERVICES
RADIOLOGICAL • ENVIRONMENTAL • REMEDIATION

HP INSTRUMENT QC FIELD LOG

units: cpm or µrem/hr
(circle one)

Daily QC's						
Date	**Bkgd**	**Source #1 ( ) α/β/γ**	**Source #2 ( ) α/β/γ**	**Battery OK?**	**Comments**	**Init.**
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				Yes / No		

Project#:_____Project Name:_____

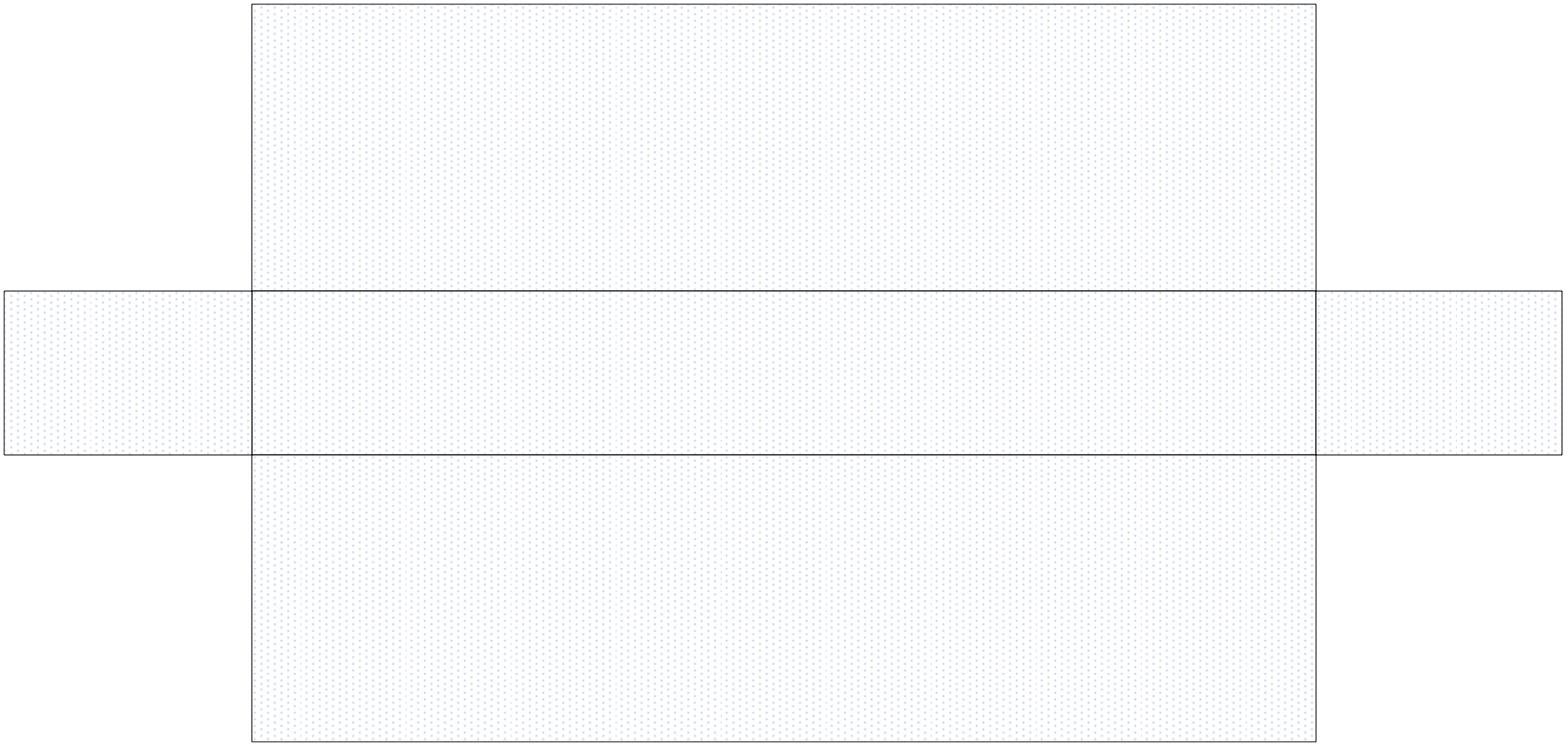
Project Number:_____

Project Name:_____

Trench Investigation Form

Trench: Lift: Depth: Dimensions:	Visual Inspection of Trench Soil:

N



W

Instrument Meter S/N: Probe S/N: Technician: Survey Date:	Range of Measurement (cpm) North Wall: Bottom: South Wall: Ends:	Instrument Flag Valve: Reviewed By:

Project Number:_____

Project Name:_____

Trench Summary Form

Final Trench Dimensions

Depth: _____ Northing: _____ _____ Total excavated volume: _____ Total RCRA waste: _____

Width: _____ Easting: _____ _____ Total Class A LLRW _____ Total non-impacted soil:_____

Length: _____ Elevation:_____ _____ Total NRC-Exempt LLRW: _____

Depth	Lithology

Trench Profile and Waste Locations

Note: Not to scale.

Depth

			Field Screen Results				
Lift	Depth Range	Samples Collected	Gamma	Beta-Gamma	XRF	PID	Visual Inspection
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Comments:

Prepared By:_____ Date:_____ Cabrera Services, Inc Page_____of_____

Project Number:_____

Project Name:_____

Waste Pile Investigation Form

PID		XRF		Beta-Gamma	
No.	Measurement	No.	Measurement	No.	Measurement
1		1		1	
2		2		2	
3		3		3	
4		4		4	
5		5		5	
6		6		6	
7		7		7	
8		8		8	
9		9		9	
10		10		10	
11		11		11	
12		12		12	
13		13		13	
14		14		14	
15		15		15	
16		16		16	
17		17		17	
18		18		18	
19		19		19	
20		20		20	
21		21		21	
22		22		22	
23		23		23	
24		24		24	
25		25		25	

Investigation Level:

Trench:

Lift:

Depth:

N

Note: Insert diagram of waste pile identifying locations of screening areas

Surveyed By:	Date:	Instrument	Make/Model	Serial #	β Eff.	γ Bkg	β Bkg	γ Bkg	Cal. Due	Comments:
		XRF								
		PID								
		Beta-Gamma								
Reviewed By:	Date:									

Prepared By:_____ Date:_____

Cabrera Services, Inc.

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APPENDIX C

APPLICABLE CABRERA FIELD PROCEDURES

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APPLICABLE CABRERA OPERATING PROCEDURES

(SOPs TO BE MAINTAINED ON SITE IN A SEPARATE BINDER)

Procedure Number	Title
OP-001	Radiological Surveys
OP-002	Air Sampling and Analysis
OP-004	Unconditional Release of Material from Radiological Control Areas
OP-005	Volumetric and Material Sampling
OP-008	Chain of Custody
OP-009	Use and Control of Radioactive Check Sources
OP-011	Procurement and Receipt of Radioactive Material
OP-012	Opening Radioactive Material Containers
OP-014	Contamination Containment Devices
OP-015	Step-Off Pads
OP-017	Empty Transport Vehicle Radiological Surveys
OP-018	Decontamination of Equipment and Tools
OP-019	Radiological Posting
OP-020	Operation of Contamination Survey Meters
OP-021	Alpha-Beta Counting Instrumentation
OP-022	Operation of Ionization Chambers
OP-024	Direct Reading Dosimeters
OP-025	Operation of Ohaus Triple Beam Balance
OP-026	Drying Soil Samples By Microwave Oven
OP-027	Operation of Ohaus Ranger Counting Scale
OP-028	Preparation of Samples for Gamma Spectroscopic Analysis
OP-029	Gamma Spectroscopy Laboratory Operational Procedures

OP-032	Water Evaporation from Containers Within Radiologically Controlled Areas
OP-035	Operation Procedure for Trimble XR-Pro
OP-036	IDW Management
OP-037	Use of Photoionization Detector
OP-040	Personal Air Monitoring
OP-041	Calibration of Air Sampling Pumps
OP-042	Dosimeter Reader for Electronic Dosimetry
OP-043	Personnel and Clothing Contamination Report
OP-051	Trimble GPS
OP-052	Surface and Subsurface Soil Sampling
OP-057	VOC Headspace Monitoring
OP-058	Health Physics Instrument General Quality Control Procedure
OP-059	Field Activity Documentation
OP-060	Sample Numbering
OP-061	Sample labeling
OP-062	Sample Handling, Packaging & Shipping
OP-063	Composite Soil Sampling
OP-064	Onsite Sample Storage
OP-065	Soil Stockpiling
OP-066	Sample Tracking Log
OP-067	DOT - IATA Shipping
OP-068	Soil Sifting
OP-100	Truck and Trailer Routine Checkout/Maintenance

APPENDIX D

PERMIT APPLICATION FORMS

Kirtland AFB Dig Permit

NRC Form 241

EPA Notice of Termination

Fugitive Dust Permit: http://www.cabq.gov/airquality/dust.html

EPA Construction General Permit: http://www.epa.gov/npdes/pubs/cgp2008_finalpermit.pdf

EPA Stormwater Pollution Prevention Plan:
http://www.epa.gov/npdes/pubs/sw_swppp_template_unauthstates.doc

EPA Electronic Stormwater Notice of Intent: http://cfpub.epa.gov/npdes/stormwater/enoi.cfm

New Mexico One Call: http://www.nmonecall.org/

Generator Site Access Permit: https://secure.utah.gov/gsapa/gsapa

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BASE CIVIL ENGINEER DIGGING PERMIT REQUEST

DATE | Dig Permit #:

LOCATION:_____

CONTRACT #, WORK ORDER# ECT:_____

___ IMMEDIATE EMERGENCY ____ NORMAL _____

PLANNED DIG DATE/TIME_____

Detailed description of work (holes, trenching, etc):

PRINTED NAME OF RESPONSIBLE REQUESTOR:

CONTACT INFORMATION:
Primary:
Alternate:

Organization/Company Name

I understand that that authorization to dig is conditional upon completing the entire form and compliance with the guidelines briefed as well as compliance with applicable OSHA and AFOSH requirements. I understand the exact location of a buried line may be located approximately four (4) feet on either side of the marked location.

	COORDINATING ORGANIZATION	COORDINATORS ACTIONS & REMARKS		COORDINATORS NAME & PHONE
UTILITIES	ELECTRICAL DISTRIBUTION Call 846-8145	☐ Marked ☐ Clear	Remarks:	
	DOMESTIC AND RAW WATER Call 846-7863 / 846-1552	☐ Marked ☐ Clear	Remarks:	
	SEWER MAINS Call 846-7863 / 846-1552	☐ Marked ☐ Clear	Remarks:	
	GAS MAINS Call 846-7863 / 846-1552	☐ Marked ☐ Clear	Remarks:	
OPERATIONS	PAVEMENTS & STORM DRAINS Call 846-5650/846-2994	☐ Marked ☐ Clear	Remarks:	
	IRRIGATION IS CURRENTLY SERVICEABLE CALL 6-1803	☐ Marked ☐ Clear	Remarks:	
	ELECTRICAL Call 853-6493	☐ Marked ☐ Clear	Remarks:	
	CATHODIC PROTECTIONS CECX 846-4633	☐ Marked ☐ Clear	Remarks:	
	TRAFFIC & ALARMS 853-6495	☐ Marked ☐ Clear	Remarks:	
	FUEL/POL LINES Call 934-2733	☐ Marked ☐ Clear	Remarks:	
	LP GAS, WATER AND SEWER SERVICE LINES/LATERALS Call 846-5293 934-9664	☐ Marked ☐ Clear	Remarks:	
	FIRE PROTECTION SYSTEMS Call 846-5293/934-9664	☐ Marked ☐ Clear	Remarks:	
CEC	ENVIRONMENTAL 2050 Wyoming Blvd. 20685	☐ Marked ☐ Clear	Remarks:	
OTHER BASE AGENCIES	EOD Building 20413 846-2229	☐ Marked ☐ Clear	Remarks:	
	COMMUNICATIONS Call 846-8411 bldg 20420 Rm D	☐ Marked ☐ Clear	Remarks:	
	SECURITY POLICE Resource Protection Call 846-6209 bldg 20220	☐ Marked ☐ Clear	Remarks:	
	FIRE DEPARTMENT Call 846-8305	☐ Marked ☐ Clear	Remarks:	
	WEAPONS SAFETY 841-914 or 841-4229	☐ Marked ☐ Clear	Remarks:	
	GROUND SAFETY 846-4227 or 853-0268	☐ Marked ☐ Clear	Remarks:	
	COMMERCIAL UTILITIES New Mex ONE CALL 260-1990 48 Hours before digging			

CLEARANCE IS : ☐**APPROVED (For 30 Days from Approval date)** ☐**DISSAPPROVED (Reason)**

APPROVING CIVIL ENGINEERING SIGNATURE | APPROVAL DATE | EXPIRATION DATE

A COPY OF THIS APPROVED FORM MUST BE AT THE DIGGING SIGHT UNTIL COMPLETE

AF Form 103 (Locally Produced Form CMSJV 103 (10/01/03) Rev. 12/08

NRC FORM 241 (8-2006) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0013 EXPIRES: 11/30/2011

Estimated burden per response to comply with this mandatory collection request: 15 minutes. This notification is required so that NRC may schedule inspection of the activities to ensure that they are conducted in accordance with requirements for protection of the public health and safety. Send comments regarding burden estimate to the Records and FOIA/Privacy Services Branch (T-5 F53), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0013), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

REPORT OF PROPOSED ACTIVITIES IN NON-AGREEMENT STATES, AREAS OF EXCLUSIVE FEDERAL JURISDICTION, OR OFFSHORE WATERS

(Please read the instructions before completing this form)

1. NAME OF LICENSEE *(Person or firm proposing to conduct the activities described below)*

2. TYPE OF REPORT ☐ INITIAL ☐ CHANGE

3. ADDRESS OF LICENSEE *(Mailing address or other location where licensee may be located)*

4. LICENSEE CONTACT AND TITLE

5. TELEPHONE NUMBER *(Include Area Code)*

6. FACSIMILE NUMBER *(Include Area Code)*

7. ACTIVITIES TO BE CONDUCTED UNDER THE GENERAL LICENSE GIVEN IN 10 CFR 150.20

☐ WELL LOGGING ☐ LEAK TESTING AND/OR CALIBRATIONS ☐ TELETHERAPY/IRRADIATOR SERVICE

☐ PORTABLE GAUGES ☐ OTHER (Specify) ⇒

☐ RADIOGRAPHY ⇒ REGISTERED AS USER OF PACKAGING (CERTIFICATES OF COMPLIANCE NUMBERS)

8. CLIENT NAME, ADDRESS, CITY/COUNTY, STATE, ZIP CODE

9. ACTUAL PHYSICAL ADDRESS OF WORK LOCATION *(Street and Number or other location. Give as complete an address or directions as possible.)*

10. CLIENT TELEPHONE NUMBER *(Include Area Code)*

11. WORK LOCATION TELEPHONE NUMBER *(Include Area Code)*

12. DATES SCHEDULED		13. NUMBER OF WORK DAYS	14. ADD	15. DELETE	16. LOCATION REFERENCE NUMBER
FROM	TO				NUMBER TO BE ASSIGNED BY NRC

LIST ADDITIONAL WORK SITES ON SEPARATE SHEET(S) TO INCLUDE ALL INFORMATION CONTAINED IN ITEMS 9-16 ABOVE.

17. LIST RADIOACTIVE MATERIAL, WHICH WILL BE POSSESSED, USED, INSTALLED, SERVICED, OR TESTED
(Include description of type and quantity of radioactive material, sealed sources, or devices to be used.)

18. AGREEMENT STATE SPECIFIC LICENSE WHICH AUTHORIZES THE UNDERSIGNED TO CONDUCT ACTIVITIES WHICH ARE THE SAME, EXCEPT FOR LOCATION OF USE, AS SPECIFIED IN ITEM 9. ABOVE. *(One copy of the specific license must accompany the initial NRC Form 241.)*	LICENSE NUMBER	STATE	EXPIRATION DATE

19. CERTIFICATION *(MUST BE COMPLETED BY APPLICANT)*

I, THE UNDERSIGNED, HEREBY CERTIFY THAT:

a. **All information in this report is true and complete.**

b. **I have read and understand the provision of the general license 10 CFR 150.20 reprinted on the instructions of this form; and I understand that I am required to comply with these provisions as to all byproduct, source, or special nuclear material which I possess and use in non-Agreement States or offshore waters under the general license for which this report is filed with the U.S. Nuclear Regulatory Commission.**

c. **I understand that activities, including storage, conducted in non-Agreement States under general license 10 CFR 150.20 are limited to a total of 180 days in calendar year. With the exception of work conducted in off-shore waters, which is authorized for an unlimited period of time in the calendar year.**

d. **I understand that I may be inspected by NRC at the above listed work site locations and at the Licensee home office address for activities performed in non-Agreement States or offshore waters.**

e. **I understand that conduct of any activities not described above, including conduct of activities on dates or locations different from those described above or without NRC authorization, may subject me to enforcement action, including civil or criminal penalties.**

CERTIFYING OFFICER - RSO or Management Representative *(Name and Title)*	SIGNATURE	DATE

WARNING: False statements in this certificate may be subject to civil and/or criminal penalties. NRC regulations require that submissions to the NRC be complete and accurate in all material respects. 18 U.S.C. Section 1001 makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

FOR NRC USE ONLY	REVIEWING OFFICIAL *(Typed/Printed Name and Title)*	SIGNATURE	DATE	TOTAL USAGE -- DAYS TO DATE

NRC FORM 241
(8-2008)

APPROVED BY OMB: NO. 3150-0013
EXPIRES: 11/30/2011

U.S. NUCLEAR REGULATORY COMMISSION

REPORT OF PROPOSED ACTIVITIES IN NON-AGREEMENT STATES, AREAS OF EXCLUSIVE FEDERAL JURISDICTION, OR OFFSHORE WATERS

PLEASE READ THIS INFORMATION AND THESE INSTRUCTIONS BEFORE COMPLETING NRC FORM 241

Section 150.20 of 10 CFR 150 establishes a general license authorizing any pers on who holds a specific license from an "Agreement State" (a State with which the U.S. Nuclear Regulatory Commission has entered i nto an effective agreement under subsection 274b of the Atomic Energy Act of 1954) where the licensee maintains an office for di recting the licensed activity and at which radiation safety records are normally maintained, to conduct the same activity in Non-Agr eement States, areas of exclusive Federal jurisdiction, or in offshore waters if the specific license issued by the Agree ment State does not limit the authorized activity to specified locations or installations.

INSTRUCTIONS

Licensees cannot perform work in areas of exclusive Federal jurisdiction withou t either (a) filing NRC Form 241 for reciprocity in accordance with 10 CFR 150.20(b) or (b) applying for a specific NRC license. An area of exclusive Federal jurisdiction is an area over which the Federal government exercises legal control without interference from the jurisdiction and administration of State law. For example: If the work is to be performed on Federal property in an Agreement St ate, the licensee must first determine the jurisdictional status of the area where the licensee plans to work. If the jur isdictional status of the work site is unknown to the licensee, the Agreement State licensee should contact the Federal agency that c ontrols the facility where the work is to be performed. A written statement concerning the jurisdictional status is not required in or der to file for reciprocity; however, it is recommended that the Agreement State licensee obtain such a statement for the file for future re ference and inspection purposes.

For licensees seeking to conduct activities under reciprocity for the first tim e in a calendar year, submit this Form, one copy of the Agreement State specific license and the fee specified in fee Category 16, 10 C FR 170.31. NRC must receive this filing at least 3 days before the licensee engages in activities permitted under the General Lice nse established by Section 150.20 of 10 CFR 150.

In general, the preferred method of filing is through the facsimile transmissio n of NRC Form 241, a copy of the Agreement State license, and evidence that the appropriate fee requirements will be met within 3 days. This evidence can be a copy of the check or a copy of NRC Form 629, if paying by credit card, that will be mailed to the NRC. The licensee should receive confirmation (by telephone, e-mail, or facsimile) that NRC has received the facsimile. Alternati vely, the licensee may file the required information through the mail or other means as long as NRC receives the information at leas t 3 days before the licensee engages in the activity.

In completing NRC Form 241, it is important that the information submitted on N RC Form 241 be specific regarding the location and date of use as well as the activity requested. If it is not possible to provid e complete information, such as addresses for the locations of work, the licensee should provide as much information as possible. The lice nsee is responsible for providing additional information as revisions or clarifications as soon as such information becomes available.

Item 2.

For licensees seeking to conduct activities under reciprocity for the first tim e in a calendar year, submit this Form, one copy of the Agreement State specific license and the fee specified in fee Category 16, 10 C FR 170.31. NRC must receive this filing at least 3 days before the licensee engages in activities permitted under the General Lice nse established by Section 150.20 of 10 CFR 150. The licensee should check the "initial" box if this is the first submission of Form 241 for the year.

For modifications such to the information submitted on the initial NRC Form 241 , such as additional work locations, changes to radioactive material, work activities, information that clarifies or deletes sp ecific locations or work sites, modifies work site contacts, or adds or deletes dates of work, licensees should file by NRC Form 241 or letter, so that NRC receives the filing at least 3 days prior to engage in such activity. Licensees should check the "change" box to indicate ch anges to the information provided on the initial NRC Form 241. It is not necessary to resubmit the Agreement State license unless t he license has been amended since the filing of the initial NRC Form 241. No fee is required for changes.

NRC Form 241 may be used for submitting multiple work locations and clients for initial filings of NRC Form 241, as well as for submitting revisions and clarifications to previous filings. Separate sheets m ay be used provided it includes all of the requested information in Items 9-16 of NRC Form 241.

Under the general license, reciprocity activities are authorized only as long a s the licensee holds a valid radioactive material license. If the license expires during the year, an extension letter or a renewed licens e issued by the regulating agency must be subjitted to NRC before performing any additional work under reciprocity.

Items 12. - 16.

Under the general license, reciprocity activities, including storage (usage), c onducted in non-Agreement States and areas of exclusive Federal jurisdiction, are limited to a total of 180 days in any calen dar year except for work conducted in off-shore waters, which is authorized for an unlimited period of time in a calendar year. NRC tr acks reciprocity usage on the basis of approved usage days. NRC will not approve any activity under the general license which causes the total usage days to exceed 180 days, except for work conducted in off-shore waters. NRC may note and notify the licensee that a filing proposes reciprocity activities which approach or would exceed the 180-day limit. It is important that licensees track the da ys of use and clarify or delete dates of work when applicable.

Item 12. should reference the proposed beginning and ending dates of work for e ach work location with the total number of days worked recorded in Item 13. Item 14. should be completed to show additional wo rk dates different from those provided on the initial NRC Form 241 and Item 15. should indicate dates when work was not performed, as initially requested, that need to be deleted from the total work days. The Location Reference Number in Item 16. is generated by the NRC for use in tracking reciprocity activities and is specific for each work location. The Location Reference Number should be re ferenced for any revisions or clarifications to work location information.

Item 18 Licensees should identify the specific make and model numbers of sealed sources and devices.

NOTE: Inspections by NRC of activities performed in non-Agreement States, areas of ex clusive Federal jurisdiction, or offshore waters by Agreement State licensees operating under the general license in 10 C FR 150.20 will be conducted at the listed work site location(s). Failure to file an NRC Form 241 may result in the issuan ce of a notice of violation, the proposed imposition of a civil penalty, or an order suspending, modifying, or revoking t he license as specified in the "General Statement of Policy and Procedures for NRC Enforcement Actions."

Agreement State licensees seeking to conduct activities under Reciprocity shoul d file this Form, one copy of the Agreement State license, and the appropriate fee with the U.S. Nuclear Regulatory Commission Re gional Administrator listed below for the region in which the Agreement State that issued the specific license is located:

IF THE AGREEMENT STATE LICENSE IS ISSUED BY:

Alabama, Florida, Georgia, Kentucky, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New York, North Carolina, Rhode Island, South Carolina, or Tennessee,

SEND APPLICATION AND FEE PAYMENT TO:

Regional Administrator
Division of Nuclear Material Safety
ATTN: Reciprocity Request
Nuclear Materials Safety Branch
U.S. Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia, PA 19406-1415
Telephone Number (800) 432-1156
Facsimile Number (610) 337-5393

IF THE AGREEMENT STATE LICENSE IS ISSUED BY:

Arizona, Arkansas, California, Colorado, Idaho, Kansas, Louisiana, Nebraska, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, or Washington,

SEND APPLICATION AND FEE PAYMENT TO:

Regional Administrator
Division of Nuclear Material Safety
ATTN: Reciprocity Request
U.S. Nuclear Regulatory Commission, Region IV
612 E. Lamar Boulevard, Suite 400
Arlington, TX 76011-4125
Telephone Number (817) 860-8100
Facsimile Number (817) 860-8263

IF THE AGREEMENT STATE LICENSE IS ISSUED BY:

Illinois, Iowa, Ohio, or Wisconsin,

SEND APPLICATION AND FEE PAYMENT TO:

Regional Administrator
Division of Nuclear Material Safety
ATTN: Reciprocity Request
U.S. Nuclear Regulatory Commission, Region III
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352
Telephone Number (630) 829-9887
Facsimile Number (630) 515-1259

150.20 Recognition of Agreement State Licensees

(a)(1) Provided that the provisions of paragraph (b) of this section have been met, any person who holds a specific license from an Agreement State, where the licensee maintains an office for directing the licen sed activity and retaining radiation safety records, is granted a general license to conduct the same activity in (i) Non-Agreement Sta tes; (ii) Areas of exclusive Federal jurisdiction within Agreement States; and (iii) Offshore waters.

(2) The provisions of paragraph (a)(1) of this section do not apply if the spec ific Agreement State license limits the authorized activity to a specific installation or location.

(b) Notwithstanding any provision to the contrary in any specific license issue d by an Agreement State to a person engaging in activities in a non-Agreement State, in an area of exclusive Federal jurisdicti on within an Agreement State, or in offshore waters under the general licenses provided in this section, the general licenses provi ded in this section are subject to all the provisions of the Act, now or hereafter in effect, and to all applicable rules, regulations, and orders of the Commission including the provisions of §§ 30.7 (a) through (f), 30.9, 30.10, 30.14(d), 30.34, 30.41, and 30.51 to 30.63, inclusive, of part 30 of this chapter; §§ 40.7 (a) through (f), 40.9, 40.10, 40.41, 40.51, 40.61, 40.63 inclusive, 40.71 and 40.81 of part 40 of this chapter; §§ 70.7 (a) through (f), 70.9, 70.10, 70.32, 70.42, 70.52, 70.55, 70.56, 70.60 to 70.62 of part 70 of this chapter; §§ 74.11, 74.15, and 74.19 of part 74 of this chapter; and to the provisions of 10 CFR parts 19, 20 and 71 and subparts C through H of par t 34, §§ 39.15 and 39.31 through 39.77, inclusive, of part 39 of this chapter. In addition, any person engaging in activities in non- Agreement States, in areas of exclusive Federal jurisdiction within Agreement States, or in offshore waters under the general l icenses provided in this section:

(1) Shall, at least 3 days before engaging in each activity for the first time in a calendar year, file a submittal containing an NRC Form 241, "Report of Proposed Activities in Non-Agreement States"' a copy of its Agr eement State specific license, and the appropriate fee as prescribed in § 170.31 of this chapter with the Regional Administrator of the U.S. Nuclear Reg ulatory Commission Regional Office listed on the NRC Form 241 and in appendix D to part 20 of this chapter for the Region in which the Agreement State that issued the license is located. If a submittal cannot be filed 3 days before engaging in ac tivities under reciprocity, because of an emergency or other reason, the Regional Administrator may waive the 3-day time requirement p rovided the licensee:

i) Informs the Region by telephone, facsimile, an NRC Form 241, or a letter of initial activities or revisions to the information submitted on the initial NRC Form 241;

(ii) Receives oral or written authorization for the activity from the Region; a nd

(iii) Within 3 days after the notification, files an NRC Form 241, a copy of th e Agreement State license, and the fee payment.

(2) Shall file an amended NRC Form 241 or letter with the Regional Administrato r to request approval for changes in work locations, radioactive material, or work activities different from the information contain ed on the initial NRC Form 241.

(3) Shall not, in any non-Agreement State, in an area of exclusive Federal juri sdiction within an Agreement State, or in offshore waters, transfer or dispose of radioactive material possessed or used under the general licenses provided in this section, except by transfer to a person who is--

(i) Specifically licensed by the Commission to receive this material; or

(ii) Exempt from the requirements for a license for material under § 30.14 of this chapter.

(4) Shall not, under the general license concerning activities in non-Agreement States or in areas of exclusive Federal jurisdiction within Agreement States, possess or use radioactive materials, or engage in the activities authorized in paragraph (a) of this section, for more than 180 days in any calendar year, except that the general license in paragraph (a) of this section concerning activities in offshore waters authorizes that person to possess or use radioactive materials, or engage in the activities authorized, for an unlimited period of time.

(5) Shall comply with all terms and conditions of the specific license issued b y an Agreement State except such terms or conditions as are contrary to the requirements of this section.

[35 FR 7725, May 20, 1970, as amended at 38 FR 1273, Jan. 11, 1973; 46 FR 44152 , Sept. 3, 1981; 46 FR 50781, Oct. 15, 1981; 52 FR 41700, Oct. 30, 1987; 55 FR 10406, Mar. 21, 1990; 56 FR 54779, Oct. 23, 1991; 58 FR 52414, Oct. 8, 1993; 62 FR 1665, Jan. 13, 1997; 62 FR 28973, May 28, 1997; 66 FR 5443, Jan. 19, 2001; 66 FR 32469, June 1 4, 2001; 67 FR 78149, Dec. 23, 2002; 68 FR 58825, Oct. 10, 2003]

This Form Replaces Form 3517-7 (8-98)
Refer to the Following Page for Instructions

Form Approved OMB Nos. 2040-0086 and 2040-0211

NPDES FORM

United States Environmental Protection Agency
Washington, DC 20460

Notice of Termination (NOT) of Coverage Under an NPDES General Permit for Stormwater Discharges Associated with Construction Activity

Submission of this Notice of Termination constitutes notice that the party identified in Section II of this form is no longer authorized to discharge stormwater associated with construction activity under the NPDES program from the site identified in Section III of this form. All necessary information must be included on this form. Refer to the instructions at the end of this form.

I. Permit Information

NPDES Stormwater General Permit Tracking Number:

Reason for Termination (Check only one):

- ☐ Final stabilization has been achieved on all portions of the site for which you are responsible.
- ☐ Another operator has assumed control, according to Appendix G, Section 11.C of the CGP, over all areas of the site that have not been finally stabilized.
- ☐ Coverage under an alternative NPDES permit has been obtained.
- ☐ For residential construction only, temporary stabilization has been completed and the residence has been transferred to the homeowner.

II. Operator Information

Name:

IRS Employer Identification Number (EIN): –

Mailing Address:

Street:

City: State: Zip Code: -

Phone: - - Fax (optional): - -

E-mail:

III. Project/Site Information

Project/Site Name:

Project Street/Location:

City: State: Zip Code: -

County or similar government subdivision:

IV. Certification Information

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 properly gathered and evaluated 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.

Print Name: _____

Print Title: _____

Email: _____

Signature: _____

Date: _____

Instructions for Completing EPA Form 3510-13

Notice of Termination (NOT) of Coverage Under an NPDES General Permit for Stormwater Discharges Associated with Construction Activity

NPDES Form | This Form Replaces Form 3517-7 (8-98) | Form Approved OMB Nos. 2040-0086 and 2040-0211

Who May File an NOT Form
Permittees who are presently covered under the EPA-issued National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction Activity may submit an NOT form when final stabilization has been achieved on all portions of the site for which you are responsible; another operator has assumed control in accordance with Appendix G, Section 11.C of the General Permit over all areas of the site that have not been finally stabilized; coverage under an alternative NPDES permit has been obtained; or for residential construction only, temporary stabilization has been completed and the residence has been transferred to the homeowner.

"Final stabilization" means that all soil disturbing activities at the site have been completed and that a uniform perennial vegetative cover with a density of at least 70% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures (such as the use of riprap, gabions, or geotextiles) have been employed. See "final stabilization" definition in Appendix A of the Construction General Permit for further guidance where background native vegetation covers less than 100 percent of the ground, in arid or semi-arid areas, for individual lots in residential construction, and for construction projects on land used for agricultural purposes.

Completing the Form
Type or print, using uppercase letters, in the appropriate areas only. Please place each character between the marks. Abbreviate if necessary to stay within the number of characters allowed for each item. Use only one space for breaks between words, but not for punctuation marks unless they are needed to clarify your response. If you have any questions about this form, refer to *www.epa.gov/npdes/stormwater/cgp* or telephone the Stormwater Notice Processing Center at (866) 352-7755. Please submit original document with signature in ink - do not send a photocopied signature.

Section I. Permit Number
Enter the existing NPDES Stormwater General Permit Tracking Number assigned to the project by EPA's Stormwater Notice Processing Center. If you do not know the permit tracking number, refer to *www.epa.gov/npdes/stormwater/cgp* or contact the Stormwater Notice Processing Center at (866) 352-7755.

Indicate your reason for submitting this Notice of Termination by checking the appropriate box. Check only one:

Final stabilization has been achieved on all portions of the site for which you are responsible.

Another operator has assumed control according to Appendix G, Section 11.C over all areas of the site that have not been finally stabilized.

Coverage under an alternative NPDES permit has been obtained.

For residential construction only, if temporary stabilization has been completed and the residence has been transferred to the homeowner.

Section II. Operator Information
Provide the legal name of the person, firm, public organization, or any other entity that operates the project described in this application and is covered by the permit tracking number identified in Section I. The operator of the project is the legal entity that controls the site operation, rather than the site manager. Provide the employer identification number (EIN from the Internal Revenue Service; IRS). If the applicant does not have an EIN enter "NA" in the space provided. Enter the complete mailing address, telephone number, and email address of the operator. Optional: enter the fax number of the operator.

Section III. Project/Site Information
Enter the official or legal name and complete street address, including city, state, zip code, and county or similar government subdivision of the project or site. If the project or site lacks a street address, indicate the general location of the site (e.g., Intersection of State Highways 61 and 34). Complete site information must be provided for termination of permit coverage to be valid.

Section IV. Certification Information
All applications, including NOIs, must be signed as follows:
For a corporation: By a responsible corporate officer. For the purpose of this Part, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this Part, a principal executive officer of a federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

Include the name, title, and email address of the person signing the form and the date of signing. An unsigned or undated NOT form will not be considered valid termination of permit coverage.

Paperwork Reduction Act Notice
Public reporting burden for this application is estimated to average 0.5 hours per notice, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding the burden estimate, any other aspect of the collection of information, or suggestions for improving this form including any suggestions which may increase or reduce this burden to: Chief, Information Policy Branch, 2136, U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Include the OMB number on any correspondence. Do not send the completed form to this address.

Visit this website for mailing instruction:
www.epa.gov/npdes/stormwater/mail

Visit this website for instructions on how to submit electronically:
www.epa.gov/npdes/stormwater/enoi

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APPENDIX E

PROJECT EQUIPMENT AND MATERIALS

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Description	Quantity	Cabrera Owned	Other Owned	Purchase	Rent / Lease	Subcontract	Units of Measure
Office / Sanitary Facilities							
Site trailer 8 ft x 40 ft w stairs / security bars	1		x		x		Month
Trailer mob/demob, block, level, tie down	1		x		x		Each
Refrigerator (small)	1		x		x		Month
Project specific cell phone	2		x		x		Month
Project specific broadband card	1	x			x		Month
Printer/scanner/copier	1	x			x		Each
Office supplies	1		x	x			Lot
Tables (4) and chairs (8)	1	x			x		Lot
Water cooler	1		x		x		Month
Port-a-potty	1		x		x		Month
Conex storage container (40 ft)	1		x		x		Month
Field Survey, Scan, Sample							
Ludlum 44-9 Pancake G-M Detector	2	x			x		Month

Description	Quantity	Cabrera Owned	Other Owned	Purchase	Rent / Lease	Subcontract	Units of Measure
Ludlum 44-10 NaI(Tl) 2" x 2" Gamma Scintillator	2	x			x		Month
Check Sources	2	x			x		Month
PID Organic Vapor Monitor	2	x			x		Month
Calibration gas	2			x			Each
AC power conditioner	2	x			x		Month
Liquid Scintillation sample counter	1	x			x		Month
Hand auger	1	x			x		Month
Shelter for drying oven	1		x	x			Lot
XRF Rental with Stand	1		x		x		Month
XRF Cup Supplies (box of 100)	2		x	x			Each
Field Laboratory							
Site trailer 8 ft x 40 ft w stairs / security bars	1		x		x		Month
Trailer mob/demob, block, level, tie down	1		x		x		Each

Description	Quantity	Cabrera Owned	Other Owned	Purchase	Rent / Lease	Subcontract	Units of Measure
NIST QA Source	1	x			x		Month
Lab propane drying oven 44,000 BTU	1	x			x		Month
Lab scale	1	x			x		Month

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APPENDIX F

WASTE CATEGORIZATION FORM

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Kirtland AFB RW-06 Remedial Construction

Waste Classification Worksheet

Container Number(s):	
Package Type:	
Waste Physical Description: Primary Constituents (w/ concentrations):	
TCLP Data Package: TCLP Data Reviewers:	
Radiological Data Package(s): Radiological Data Reviewers:	
Approximate Volume:	Approximate Weight:
Waste Designation and Disposal Facility:	
<u>Approvals:</u> Waste Broker: CABRERA RSO: Project Engineer: Project Chemist:	 Date: Date: Date: Date:

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APPENDIX G

KIRTLAND AFB APPROVED GRASS SEED MIX

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SECTION 1012
NATIVE GRASS SEEDING

1012.1 GENERAL:

Work under this section consists of preparing all area indicated on the plans for native grass seeding, furnishing and installing all seed, fertilizer and soil amendments as specified herein and on the plans, or as authorized by the ENGINEER.

1012.2 REFERENCES:

1012.2.1 This Publication:

Section 1011 Turf Grass Seeding

1012.3 WORK AREA/TIMING:

1012.3.1 Areas that are disturbed by the CONTRACTOR that are outside the construction limits shown on the plans or authorized by the ENGINEER shall be seeded with native grasses as specified herein at no cost to the OWNER.

1012.3.2 The seeding of disturbed areas shall commence upon completion of the other work in the area.

1012.4 MATERIALS:

1012.4.1 Native Seed: The native seed species and rate of application shall be as shown below and shall be used based on the type of soil or as specified on the plans or in the Supplemental Technical Specification.

1012.4.1.1 Sandy Soils: (mainly west side areas). Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

Variety/ Common Name	Genus/ Species	P.L.S/Acre
"Paloma" Indian rice grass	Oryzopsis hymenoides	5.0
"Viva" Galleta grass	Hilaria jamesii	1.0
"Niner" Side oats grama	Bouteloua curtipendula	3.0
"Hatchita" Blue grama	Bouteloua gracilis	1.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Fourwing saltbush (NM Region)	Atriplex canescens (de-winged)	1.0
Total rate		12.0 lbs/ acre

1012.4.1.2 Clay, Clay Loam, and Sandy gravelly clay loam soils: (mainly valley and east side areas). Seed rate is given in pounds of pure live seed (P.L.S.) per acre.

Common Name	Genus-species	PLS/acre
"Paloma" Indian rice grass	Oryzopsis hymenoides	2.0
"Viva" Galleta grass	Hilaria jamesii	2.0
"Niner" Sideoats grama	Bouteloua curti pendula	2.0
"Hatchita" Blue grama	Bouteloua gracilis	3.0
Sand dropseed (NM Region)	Sporobolus cryptandrus	1.0
Four-wing saltbush (NM Region)	Atriplex canescens (de-winged)	1.0 1.0
Scarlet globemallow		1.0
Total rate		11.0 lbs/ac

NOTE: If the area to be seeded is along a recreational trail of any type the seed mixes for either type of soil listed above shall exclude the one (1) pound per acre of Four-wing saltbush. The seeding rate shall be lowered by one (1) pound per acre.

1012.4.1.3 Seeds may be pre-mixed by a seed dealer. Each bag of seed shall be sealed and labeled by the seed dealer in accordance with Federal Seed Laws and New Mexico Department of Agriculture Labeling Laws. This includes: variety, kind of seed, lot number, purity, germination, percent crop, percent inert, percent weed (including noxious weeds), origin, test data and net weight. Federal Seed Laws require that analysis shall be no older than 5 months for seed shipped interstate and no older than 9 months for seed shipped intra-state. The ENGINEER shall receive all labels from all bags of seed used for verification.

1012.4.2 Fertilizer and Soil Amendments: Unless otherwise specified on the plans or in the Supplemental Technical Specification, no fertilizer or other soil amendments are required on areas specified to receive native seeding. If fertilizer and/or other soil amendments are required they shall be in accordance with Section 1011 of these specifications.

1012.4.3 MULCH:

1012.4.3.1 Hay Mulch: Perennial native or introduced grasses of fine-stemmed varieties shall be used unless otherwise specified on the plans. At least 65 percent of the herbage by weight of each bale of hay shall be 10 inches in length or longer. Hay with noxious seed or plants will not be acceptable. Rotted, brittle, or moldy hay will not be acceptable. Marsh grass or prairie hay composed of native grass of species to be seeded will be acceptable. Tall wheat grass, intermediate wheat grass, switch grass, or orchard hay will be acceptable if cut prior to seed formation. Marsh grass hay shall be composed of mid and tall native, usually tough and wiry grass and grass-like plants found in the lowland areas within the Rocky Mountain region. Hay shall be properly cured prior to use. Hay which is brittle, short fibered or improperly cured is not acceptable.

1012.7.2 Hay Mulch: Hay mulch shall be applied at a minimum rate of 1.5 tons per acre of air dry hay.

1012.7.3 Straw Mulch: Straw mulch shall be applied at a minimum rate of 2.5 tons per acre of air dry straw.

1012.7.4 Crimping: Hay and/or Straw mulch shall be crimped into the soil. The mulch shall be spread uniformly over the area either by hand or with a mechanical mulch spreader. When spread by hand, the bales of mulch shall be torn apart and fluffed before spreading. Mulching will not be permitted when wind velocity exceeds 15 miles per hour. The mulch shall be wetted down and allowed to soften for 15 to 20 minutes prior to crimping. A heavy disc such as a mulch-tiller, with flat serrated discs at least 1/4 inch in thickness, having dull edges and the disc spaced 6 inches to 8 inches apart shall be used to crimp (or anchor) the mulch into the soil to a minimum depth of 2 inches or as specified on the plans or the Supplemental Technical Specifications. The discs shall be of sufficient diameter to prevent the frame of the equipment from dragging the mulch.

The crimping operations shall be across the slope where practical but not be parallel to prevailing Westerly winds (270 degrees magnetic). Crimping shall be in a general north-south direction or by tight interlocking "S" curves to avoid straight east-west crimp lines.

If small grain straw mulch is used it shall be crimped in two (2) directions in a cross-hatch pattern.

1012.7.5 Gravel Mulch: Gravel mulch shall be placed by hand or by mechanized equipment that provides full coverage at a uniform thickness of 2 inches in depth.

1012.7.6 Erosion Control Matts, Fabric or Blankets: the type of erosion control mats, fabric or blankets used shall be as specified on the plans or the Supplemental Technical Specifications or as approved by the ENGINEER. The anchoring of the erosion control items shall be as per the manufacturer's recommendations.

1012.8 PROTECTION OF NATIVE GRASS SEEDED AREA:

1012.8.1 GENERAL: The CONTRACTOR shall be responsible for protecting and caring for seeded areas until final acceptance of the work and shall repair at his expense any damage to seeded areas caused by pedestrian or vehicular traffic or vandalism.

1012.9 INSPECTION FOR NATIVE GRASS AREA:

1012.9.1 The following inspection shall be the minimum required inspections to native grass during the course of construction. Additional inspections shall be made at any time at the discretion of the ENGINEER.

1012.9.2 It shall be the responsibility of the CONTRACTOR to notify the ENGINEER, in writing, 48 hours in advance of each required inspection.

1012.9.3 The sequence of required inspections shall not be changed from the sequence listed below. The CONTRACTOR shall not proceed with work of the next sequence without written approval of the work of the previous sequence. Payment will not be approved for items which have not been inspected and approved in writing.

1012.9.3.1 Each phase of soil preparation shall be inspected in process.

1012.9.3.2 Finish grade shall be inspected.

1012.9.3.3 Seed shall be inspected prior to seeding.

1012.9.3.4 Seeded area shall be inspected after completion.

1012.9.3.5 Final inspection of the project and acceptance.

1012.10 MEASUREMENT AND PAYMENT

1012.10.1 MEASUREMENT: The measurement of native grass seeding shall be by the acre.

1012.10.2 Payment: Payment shall be made at the contract unit price per acre of native grass seeding complete in place, which shall include the seed, fertilizer, (if required) area preparation, seeding, soil amendments, (if required) and mulching.

1012.5.2 Straw Mulch: Small grain such as wheat, barley, rye, or oats will not be allowed except by prior approval of the ENGINEER and with the concurrence of the Air Division, Environmental Health Department. Alfalfa or the stalks of corn, maize or sorghum is not acceptable. Material which is brittle, shorter than 10 inches or which breaks or fragments during the crimping operation will not be acceptable.

1012.4.3.3 Gravel Mulch: Gravel mulch shall be crushed or screened gravel 3/4" to 1" maximum size with a minimum of one angular face unless otherwise specified.

1012.4.3.4 Erosion Control Matts, Fabric or Blankets: The type of erosion control mats, fabric or blankets used shall be as specified or allowed on the plans or in the Supplemental Technical Specifications.

1012.5 SEED BED PREPARATION:

1012.5.1 General:

1012.5.1.1 Prior to the starting of any seed bed preparation the final grades of all earth work shall be inspected and approved by the ENGINEER.

1012.5.1.2 No preparation shall be performed when the surface is wet or muddy or when the soil moisture content is such that the soil is not fully loosened by the discing operation.

1012.5.1.3 The extent of seed bed preparation shall not exceed the area on which seeding, mulching and crimping operations can be completed prior to crusting or wind or water erosion of the prepared surface - if erosion, crusting or re-compaction occurs, the affected area shall be re-worked beginning with seed bed preparation. Depth of preparation must be approved by the ENGINEER prior to the seeding and mulching operations.

1012.5.2 Mechanical Preparation: The seed bed shall be loosened to a minimum depth of 6" (six inches) by means of disc or harrow. Area of heavy or compacted soil may require additional preparation such as chiseling or ripping if discing alone does not result in preparation to the full minimum depth of 6". The soil shall be worked to a smooth surface free of clods, stones 4" and larger or any other debris or foreign material that could interfere with seeding or crimping equipment operations.

1012.5.3 Hand Preparation: Areas which cannot be prepared with mechanized equipment because of small size irregular shape or slope angle may be prepared to a minimum depth of 2" using hand tools or a rototiller. Any such areas will be specified on the plans.

1012.6 SEEDING:

1012.6.1 General:

1012.6.1.1 Seeding shall not start until the seed bed preparation has been inspected and approved by the ENGINEER.

1012.6.1.2 No more area may be seeded than can be covered with mulch and crimped, or covered with gravel mulch or erosion control mats by the end of the work day. No seeding operations may be conducted when steady wind speed exceeds 10 miles per hour. If winds exceed 10 mph while seeding is underway, seeding operations will be halted and any areas seeded to that point completed.

1012.6.2 Seed Application:

1012.6.2.1 Drill Seeding: Drill seeding is required unless otherwise specified on the plans or in the Supplemental Technical Specifications. Seed shall be applied with a "rangeland" type seed drill equipped with packer wheels. Seed shall be drilled to a maximum depth of 1/2" unless otherwise specified. Direction of seeding shall be across slopes and on the contour whenever possible.

1012.6.2.2 Broadcast Seeding: Seed may be applied using the broadcast method when size, irregular shape or slope angle exceeding 3.1 prevents the use of a seed drill. Seed may be broadcast by hand or by means of a mechanical seeder provided that the seed is evenly distributed over the seeding area. Areas of broadcast seeding will be hand raked to cover seed. Areas which are broadcast seeded shall be seeded at rate which is double that used for drill seeding.

1012.6.2.3 Seeding With Gravel Mulch: Areas to receive gravel mulch will be seeded at the broadcast seed rate with 1/2 the seed applied prior to application of gravel and 1/2 the seed applied on the surface of the gravel. Water shall be applied in quantity sufficient to wash seed from the surface and into the gravel.

1012.6.2.4 Hydro Seeding: Hydro seeding will not be allowed on areas of non-irrigated native grass seeding unless specified on the plans or in the Supplemental Technical Specifications or authorized by the ENGINEER.

1012.7 MULCHING:

1012.7.1 General:

1012.7.1.1 All seeded areas shall be mulched unless otherwise specified on the plans or in the Supplemental Technical Specifications.

1012.7.1.2 On seeded areas that are level or have slopes 3:1 or less, any of the four (4) types of mulching or erosion control specified herein may be used. On seeded areas that have slopes steeper than 3:1 only gravel mulch or erosion control materials may be used as specified on the plans and in the Supplemental Technical Specifications.

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APPENDIX H

PROJECT FINAL INSPECTION FORM

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Final Inspection Checklist

Inspected By:		Owner Representative:	
Date:		Title:	
Time:		Project Number:	
Area Description:		Project Name:	

	Acceptable	Unacceptable	NA	Status/Description	Corrective Actions
Sanitary Facilities					
Trailers					
Connex storage containers					
Other support features					
Temporary roads					
Electrical support					
Erosion control					
Cabrera instruments					
Rental equipment					
Backfill					
Seeding / Grading					
Any damages					
Other					

DRAFT FINAL

KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

ATTACHMENT IIB OF THE QUALITY PROGRAM PLAN
QUALITY ASSURANCE PROJECT PLAN
FOR REMEDIAL ACTION CONSTRUCTION AT SITE RW-06

April 2009

377 MSG/CEANR
2050 Wyoming Blvd. SE
Kirtland AFB, New Mexico 87117-5270

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KIRTLAND AIR FORCE BASE
ALBUQUERQUE, NEW MEXICO

ATTACHMENT IIB OF THE QUALITY PROGRAM PLAN
QUALITY ASSURANCE PROJECT PLAN
FOR REMEDIAL ACTION CONSTRUCTION AT SITE RW-06

April 2009

Prepared for

Air Force Center for Engineering and the Environment (AFCEE)
3300 Sidney Brooks
Brooks City- Base, Texas

Contract No. FA8903-04-D8693
Delivery Order 0005

Prepared by

Cabrera Services, Inc.
12000 Crownpoint Drive, Suite 150
San Antonio, TX 78233

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NOTICE

See Quality Program Plan (QPP) for the applicable notice and instructions for obtaining copies of this Quality Assurance Project Plan (QAPP).

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40 CFR 270.11

DOCUMENT CERTIFICATION

APRIL 2009

See QPP for the applicable document certification.

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NATURAL RESOURCE INJURY

See QPP for Natural Resource Injury (NRI) program information.

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ENVIRONMENTAL JUSTICE CONSIDERATION

See QPP for Environmental Justice Consideration information.

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PREFACE

See QPP preface section for applicable information.

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List of Appendices

ACRONYMS AND ABBREVIATIONS

A comprehensive list of acronyms may be found in the QPP.

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1.0 INTRODUCTION

1.1 Overview

This Quality Assurance Project Plan (QAPP) establishes an overall project quality assurance (QA) plan for measurement and analytical requirements in support of remediation and final status survey (FSS) activities within the boundaries of the RW-06 area at Kirtland Air Force Base (AFB), New Mexico (hereafter referred to as RW-06 or the Site). This QAPP presents the requirements for conducting sampling and surveys during the remedial construction activities for RW-06 as described in the Quality Program Plan. Additional information regarding the purpose and objectives of the remediation efforts described herein may be found in the QPP.

RW-06 occupies approximately 4.5 acres and from 1960 to 1971 was part of a 40-acre facility operated by the Radiobiology Laboratory, Biophysics Branch, Air Force Weapons Laboratory (USAF, 1981). The portion of the Radiobiology Laboratory that was used as a radioactive burial site contained 9 trenches that were used for the disposal of animal carcasses, low-level radioactive material, and other laboratory wastes. RW-06 is located within a fenced field area immediately east-southeast of the former Riding Stables complex.

The QAPP is incorporated into the QPP as Attachment IIB. The QPP establishes the overall strategy, organization, roles and responsibilities, project contact list, and environmental restoration history while the QAPP identifies data quality objectives (DQOs), laboratory analysis methodologies and requirements, specific QC and QA activities, and data assessment activities designed to achieve the data quality goals of the project. This QAPP also presents the objectives, procedures, functional activities, and specific QC and QA activities associated with the radiological surveying, sampling, and analysis activities to be performed at the site. The collection, screening, and management of remediation samples and other field data gathering activities for this project are described in the project FSP. This QAPP and the referenced FSP address measurement and analytical requirements for the remediation operations aspects of this project.

The QAPP consists of the following sections:

- Section 1.0 presents the Introduction.
- Section 2.0 presents the Off-Site Laboratory Organization and Responsibilities .
- Section 3.0 presents the Project Organization and Responsibilities.
- Section 4.0 presents the Data Quality Objectives.
- Section 5.0 presents the Sampling and Data Collection.
- Section 6.0 presents the Analytical Procedures.
- Section 7.0 presents the Data Quality Indicators.
- Section 8.0 presents the Data Reduction/Calculation of Data Quality Indicators.
- Section 9.0 presents the Field and Laboratory Operations Documentation.
- Section 10.0 presents the Data Assessment Procedures.
- Section 11.0 presents the References.

1.2 Purpose and Scope

The purpose of this QAPP is to describe the standards for execution of survey, sampling, field screening, and laboratory analysis activities in support of remediation activities for this project. These standards

include the DQOs, work to be performed to fulfill the objectives, and methods used to obtain defensible, interpretable data.

This document provides appropriate QA procedures and QC measures to be applied for remediation of the Site and describes the organization and responsibilities of key individuals at the subcontract laboratories and the RW-06 project team. Of primary importance, this QAPP addresses:

- QA objectives;
- Analytical laboratory procedures;
- Field and laboratory custody procedures;
- Calibration, maintenance, and field procedures and protocols;
- Data reduction, validation, and reporting;
- Internal QC checks;
- QA performance and system audits;
- Preventive maintenance procedures and schedules;
- Data assessment and presentation;
- Corrective actions; and
- QA reports to management.

The following paragraphs give a brief view of the primary staff and the responsibilities of the management, QC and QA, and primary task leadership for the field and laboratory tasks. Project activities will be performed within the framework of the organization and functions described in this section, as well as in the FSP. The organization for the project is designed to provide clear lines of responsibility and authority. This control structure provides for the following:

- Identifying lines of communication and coordination;
- Monitoring project schedules and performance;
- Managing key technical resources;
- Providing periodic progress reports;
- Coordinating support functions such as laboratory analysis and data management; and
- Rectifying deficiencies.

Off-site laboratory personnel providing services in support of this project will perform work in strict compliance with the scope of work (SOW) for the activity. Off-site laboratory corporate-level QA personnel (independent of the project) at the off-site laboratories will have the authority to review, audit, and document compliance, identify deficiencies, and recommend corrective actions.

QA personnel at the off-site laboratories will have sufficient authority, organizational freedom, and ability to:

- Identify QA problems;
- Initiate, recommend, or provide solutions to QA problems through designated channels;
- Ensure that program activities, including processing of information, deliverables, and installation or use of equipment, are reviewed in accordance with QA objectives;
- Ensure that deficiencies and non-conformances are corrected; and
- Ensure that further processing, delivery, or use of data is controlled until the proper disposition of a non-conformance, deficiency, or unsatisfactory condition.

2.0 OFF-SITE LABORATORY ORGANIZATION AND RESPONSIBILITIES

Off-site laboratory services will be provided by GPL Laboratories (GPL). GPL currently possesses and will maintain National Environmental Laboratory Accreditation Conference (NELAC) certification for the duration of project activities requiring analysis of samples in support of waste disposal.

The functional roles for GPL are described in the Laboratory Quality Assurance Manual (LQAM), presented as Appendix A to this Plan. From the project perspective, the structure is designed to facilitate information exchange between the subcontractor laboratories and CABRERA project team members. Information exchanges include planning, technical requirements, schedules, sample identification; preservation procedures; sample container requirements; sample collection procedures; decontamination protocols; and sample labeling, packing, holding times, and shipping. An organization chart for the off-site laboratory is presented in the LQAM.

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3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

See QPP for project organization and responsibilities for the RW-06 site.

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4.0 DATA QUALITY OBJECTIVES

The overall QA objective for field screening and sampling on this project is to implement procedures for sampling, Chain-of-Custody, laboratory analysis, and reporting of physical/chemical and radiological data that will provide results that are legally defensible. Specific procedures for Chain-of-Custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. DQOs are presented below for the final status survey, routine monitoring during remediation activities, and sampling of media to be used for backfill or to be disposed of as radioactive waste.

4.1 Requirements for Data Quality Objectives

DQOs are designed to address the data requirements of a project and should include the following elements:

Intended Use(s) of Data:

- Determining whether the data satisfy project objectives

Data Need Requirements:

- Data user perspective (i.e., risk, compliance, remedy, or responsibility) satisfied;
- Contaminant or characteristic of interest identified;
- Media of interest identified;
- Required sampling areas or locations and depths identified;
- Number of samples required (fixed number or dynamic estimate; probabilistic, or non-probabilistic basis); and
- Reference concentration of interest or other performance criteria (e.g., action level, compliance standard, decision level, design tolerance) identified.

Appropriate Sampling and Analysis Methods:

- Sampling method (e.g., discrete or composite sample, sampling equipment and technique, quality control/quality assurance samples) identified; and
- Analytical method (e.g., sample preparation, laboratory analysis, method detection limit and quantification limit, laboratory quality assurance/quality control) identified.

DQOs are qualitative and quantitative statements that specify the quality of data required to support decisions during remediation. Overall, the objective is to assure that the data collected during the sampling effort meets qualitative sufficiency standards for adequacy (i.e., how "good" is the data) and to meet quantitative values to document/confirm compliance of the "good" data with respect to some reference standards or values. This requires that data meet certain basic characteristics of satisfactory usability (e.g., precision, accuracy, representativeness, completeness, comparability, and sensitivity of data) as well as be able to meet or exceed certain numerical standards or values (e.g., remedial clean-up goals or waste acceptance criteria), such that the end user(s) can reasonably rely on the data.

The characteristics of precision, accuracy, completeness, representativeness, comparability and sensitivity are discussed in Section 6.0. Details on how each of these characteristic requirements are calculated and implemented as part of the QA process are described in Section 7.0.

4.2 Data Quality Objectives for Final Status Survey

DQOs for the RW-06 site are provided below and consist of the following steps (EPA, 2006):

- State the problem,
- Identify the decision,
- Identify inputs to the decision,
- Define the study boundaries,
- Develop the decision rule,
- Specify tolerable limits on decision errors, and
- Optimize the design.

4.2.1 Step 1: State the Problem

The goal of the remediation is to identify and remove and dispose of radioactive and chemical contaminants present at RW-06 (burial pits and surface contamination) and restore the site soil to levels below NRC screening levels and NMED residential soil screening levels for all contaminants. The objective of remediation support and FSS activities is to obtain data of sufficient quality and quantity to support unrestricted release of the RW-06 site.

4.2.2 Step 2: Identify the Decision

The objective of this step is to develop decision statements that require site data to address the problem statement above.

4.2.2.1 Principal Study Question

Do the concentrations of the radionuclides of concern (ROCs) and other potential contaminants at the RW-06 site exceed applicable levels for unrestricted release?

4.2.2.2 Decision Statements

The following statements assume that ROC concentrations exceed release levels. Decision statements should be evaluated sequentially, as shown below.

A) Determine whether survey unit (SU) ROC concentrations exceed background concentrations by more than the acceptable release criteria.

B) If SU ROC concentrations exceed background concentrations by more than the acceptable release criteria, then affected SUs must be remediated to levels satisfying the release criteria.

4.2.3 Step 3: Identify Inputs to the Decision

The objective of this section is to identify the informational inputs that will be required to resolve the decision statements identified above. This section also describes the sources of those inputs, determines which inputs require environmental measurements, and discusses the means of obtaining the required inputs. The following site characteristics must be determined to resolve the applicable decision statements.

4.2.3.1 Concentration of residual ROCs in SUs:

This information will be used to determine whether a SU exceeds the applicable release criteria. This data will facilitate decision-making regarding whether additional remediation may be required in specific SUs.

4.2.3.2 Information Sources:

Concentrations of residual radioactive material in the survey units will be determined by means of:

- Direct surface radioactivity measurements;
- Transferable radioactivity measurements (using smears);
- Volumetric sampling and analysis of surface soils in RW-06 SUs, and debris and material samples from trenches; and
- Exposure rate surveys.

4.2.4 Step 4: Define the Study Boundaries

4.2.4.1 Define the Target Population

The target population of interest consists of the contents of the burial trenches, contaminated soils in and under those trenches, and five identified surface soil contamination areas.

4.2.4.2 Spatial Boundaries of the Decision Statement

The spatial boundaries are limited to the trenches, the areas of elevated surface activity, and surrounding areas within RW-06 shown in Figure 4-1 of the FSP. The maximum anticipated depth for any trench is 20 ft.

4.2.4.3 Constraints on Data Collection

Radiological data collection during trench collection may be constrained due to weather conditions which may impact field screening equipment or result in unsafe conditions. Decisions will be made regarding small areas in SUs that may exhibit elevated levels of radioactivity.

4.2.5 Step 5: Develop the Decision Rules

4.2.5.1 Parameter of Interest

Parameters of interest are the mean, median, and standard deviation of data collected during the study. Based on the data distribution characteristics resulting from FSS data collection, the preceding parameters may be transformed to equivalent descriptive measures (e.g., logarithms, etc.) to allow more representative statistical testing. By using a graded approach to data testing as discussed below, decisions will be made according to the decision rule stated at the end of this section.

4.2.5.2 Scale of Decision Making

Decisions are made on two fundamental scales, the SU and the smaller localized areas of elevated activity. Localized areas or excavated containers with elevated radiation levels are evaluated on an ongoing basis throughout the field effort. In cases where clear indications of elevated measurements are observed, decisions on remediation, SU subdivision, etc., may be conducted, as appropriate. On a larger scale, and as a final determination, data will be evaluated on a SU specific basis.

Decision Inputs

- ROCs – A discussion of the ROCs associated with this project is provided in Section 4 of the QPP.

- Measurement and Data Assessment Inputs - - Assessment of the following data sources will be performed to help ensure that the criteria in the decision rules have been met.
    - Average ROC activity concentrations
    - Small areas of elevated activity
    - Surface scan survey results

4.2.5.3 Decision Rules

Decisions on a SU's acceptability for release are based on compliance with the evaluation criteria. Inputs to this decision will be based on a graded approach to data analysis intended to avoid unnecessary analytical and/or remediation efforts, while also ensuring that project data quality objectives are met.

- Measurements colleted with field instrumentation will be compared with appropriate action levels based on upper estimates of background and/or surface contamination limits from NRC Regulatory Guide 1.86 (NRC, 1974).
- For average residual radioactivity found within SUs, the unity rule, or Sum of the Ratios (SOR), will be used to ensure that the total dose is within the required 25 mrem/year. When multiple contaminants are present within a SU, site radiological conditions are evaluated using the SOR and a DCGL of SOR = 1.0. If all sample SORs are equal to or less than 1.0, the SU will meet the release criteria. If not, the Wilcoxon Rank Sum (WRS) or Sign test will be applied to the data.

4.2.6 Step 6: Define Acceptable Decision Errors

The hypotheses being tested as part of the DQO process are:

Null Hypothesis (H_o): The median concentration in the SU exceeds the background by more than the $DCGL_w$, or the SOR is less than or equal to 1.0 for multiple ROCs.

and,

Alternative Hypothesis (H_a): The median concentration in the SU does not exceed the background by more than the $DCGL_w$, or the SOR is less than or equal to 1.0 for multiple ROCs.

Appendix D in MARSSIM (NRC, 2000a), provides a discussion regarding decision errors. This discussion includes the concept that acceptable error rates must be balanced between the need to make appropriate decisions and the financial costs of achieving high degrees of certainty.

Errors can be made when making site remediation decisions. The use of statistical methods allows for controlling the probability of making decision errors. When designing a statistical test, acceptable error rates for incorrectly determining that a site meets or does not meet the applicable decommissioning criteria must be specified. In determining these error rates, consideration should be given to the number of sample data points that are necessary to achieve them. Lower error rates require more measurements, but result in statistical tests of greater power and higher levels of confidence in the decisions. In setting error rates, it is important to balance the consequences of making a decision error against the cost of achieving greater certainty.

Acceptability decisions are often made based on acceptance criteria. If the mean and median concentrations of a contaminant are less than the associated acceptance criteria, for example, the results can usually be accepted. In cases where data results are not so clear, statistically based decisions are necessary. Statistical acceptability decisions, however, are always subject to error. Two possible error types are associated with such decisions.

The first type of decision error, called a Type I error, occurs when the H_o is rejected when it is actually true. A Type I error is sometimes called a "false negative." The probability of a Type I error is usually

denoted by alpha (α). Consequences of Type I errors include higher potential doses to future site occupants than prescribed by the dose-based criterion.

The second type of decision error, called a Type II error, occurs when the H_o is not rejected when it is actually false. A Type II error is sometimes called a "false positive." The probability of a Type II error is usually denoted by beta (β). The power of a statistical test is defined as the probability of rejecting the null hypotheses when it is false. It is numerically equal to 1-β where β is the Type II error rate. Consequences of Type II errors include unnecessary remediation expense and project delays.

For the purposes of the FSS, the acceptable error rate for both Type I and Type II errors is five percent (i.e., $\alpha = \beta = 0.05$).

4.2.7 Step 7: Optimize the Design

As data are collected and analyzed, the assumptions in this plan should be reviewed for accuracy. Field screening techniques, soil sampling, sample analysis, gamma measurements, and the DQO process will be utilized, as appropriate, throughout remediation support and FSS activities to focus efforts and minimize costs. Since the number of samples calculated in Section 5.3.2 of the FSP is based on previous data and conservative assumptions, the sample density and SU class may be adjusted if the latest data indicate that conditions are significantly different than the initial assumptions.

4.2.8 FSS Measurement Quality Objectives for Chemical and Radiological Data

Measurement quality objectives (MQOs) for chemical and radiological data measurements include the routine, standard QC measurements specified in the analytical methods, typically made on laboratory-prepared standard materials and samples to monitor MQOs for accuracy and precision. The MQOs for radiological analyses for the ROCs identified for the RW-06 FSS are presented in Table 4-1. Laboratory QC checks will include the following:

- Calibration checks
- Laboratory control samples
- Tracer recovery
- Matrix spike samples (where appropriate)
- Duplicate samples
- Method blank samples

Some of the checks listed above are procedure or instrument specific and will not necessarily apply to all analyses. Specific QC checks vary with the analytical methods and instrumentation used.

For laboratory-generated QC measurement data, the accuracy, or bias, the MQOs are generally accepted industry values. Acceptable values for the analytical methods, parameters, and sample matrices for the project ROCs are included in Table 4-1. QC results that are not within the acceptance limits may result in qualification of the data, resampling and analysis, or other corrective actions that may be indicated.

The subcontractor analytical laboratory will report the measured result, minimum detectable concentrations (MDC), and the total propagated uncertainty.

Table 4-1. Measurement Quality Objectives for ROCs

ROC	Analysis (1)	Evaluation Criteria (pCi/g) (2)	Detection Limit (pCi/g)	Accuracy Soil Percent Recovery (3)		Precision Z_{Rep} (4)
Carbon-14 (^{14}C)	LSC	11.6	1.0	70	130	±2
Strontium-90 (^{90}Sr)	LSC or GP	1.72	0.1	70	130	±2
Cesium-137 (^{137}Cs)	Gamma Spectrometry	11.0	1.0	70	130	±2
Radium-226 (^{226}Ra)	Gamma Spectrometry	0.7	0.05	70	130	±2
Americium-241 (^{241}Am)	Gamma Spectroscopy	2.1	0.20	70	130	±2

(1) Radiochemical separations followed by identified counting technique. LSC = liquid scintillation counting; GP = gas proportional counting
(2) pCi/g = picocuries per gram.
(3) Lower and upper range of acceptable values.
(4) Z_{Rep} = replicate Z-score.

MQOs for chemical constituents analyzed by the toxicity characteristic leaching procedure (TCLP), total metals, and other procedures for waste profiling purposes will conform to industry standards. Analyte-specific MQOs are not listed here.

5.0 SAMPLING AND DATA COLLECTION

5.1 Sampling Protocols

This section describes the components of the sampling and field screening procedures that will be performed to meet the QA and QC objectives for site remediation. Project-specific forms have been developed and are located in Appendix B of the WP. Standard forms that will be used for sampling and field screening during the course of the project are included in the CABRERA Operating Procedures, Appendix C of the WP.

5.1.1 General Sampling Protocols

This section summarizes field procedures used to collect and manage samples and perform field screening in support of Site remediation. Detailed procedures associated with sampling and field screening are provided and discussed in the FSP, including QC specifications, documentation requirements, field forms, stepwise descriptions of the procedure, and special conditions or precautions that must be considered during field sampling and screening. The rationale and procedures selected for use during the DQO development process are documented in the FSP, along with specification of media and the types, frequencies and locations for sampling, on-site screening and off-site laboratory analysis. The Site Remediation Manager (SRM) will ensure that Field Personnel understand the purpose and objectives of each sampling and screening event prior to beginning each such event. Topics of review and discussion with the team may include: schedules, responsibilities, sampling locations, types of samples to be collected (both field samples and QC samples), number of samples collected, sample identification numbering schemes, preservation requirements, parameter(s) to be screened and/or analyzed, sampling and field screening procedures, equipment decontamination procedures, and Chain-of-Custody requirements. Field Personnel will read and be cognizant of applicable sections of this QAPP before planning or performing the fieldwork. The PM and SRM will ensure that Field Personnel also have copies of the project work plans in the field which include the CABRERA radiological standard operating procedures.

5.1.2 Sampling Equipment Decontamination

Equipment decontamination is an integral part of the data collection and QA process. The implementation of proper decontamination practices and procedures will begin in the field prior to use of sample collection equipment. If non-dedicated field sampling equipment is used, it will be decontaminated prior to use and after sample collection at each location in accordance with CABRERA Operating Procedure OP-018, *Decontamination of Equipment and Tools*, included in Appendix C of the WP. Equipment to be decontaminated may include stainless steel scoops, trowels, bowls, spoons, and/or hand augers. Other equipment that may not directly contact sample materials, such as shovels for collecting large volumes of soil from which a sample may be collected, will be cleaned to remove visible soil residues using dry or wet manual wiping.

Items requiring more aggressive decontamination methods such as pressure washing or steam cleaning will be transferred to the site equipment decontamination pad for decontamination.

Swipe samples will be collected from decontaminated equipment and screened on site to confirm the absence of removable surface (radiological) contamination. Large-area swipe samples (or smears) will be collected from decontaminated sampling equipment and field counted for gross alpha and beta contamination with a portable detector prior to use at a subsequent sampling location or final release from the Site.

5.1.3 Sample Custody

Sample possession during sampling efforts must be traceable from the time of collection until the results are verified and reported. Sample custody procedures provide a mechanism for documentation of

information related to sample collection and handling to achieve this objective. This section contains a general discussion of sampling custody practices, which address potential problems with labeling errors, transcription errors, preservation errors, etc. Overall, proper training prior to sample collection activities and the QC checking discussed in this plan are the mechanisms that detects and corrects errors, and are applicable to samples collected for on-site and off-site analyses.

Documentation procedures have been standardized to ensure that important information pertaining to each sample is recorded. Sample custody procedures for this program are based on EPA- recommended protocols that emphasize careful documentation of sample collection and transfer data. The Site Data Coordinator will be responsible for Field Team adherence to proper custody and documentation procedures for sampling operations.

Custody, which refers to the physical possession of a sample and the storage of that sample in a secure area, is typically considered in three parts: sample collection, laboratory or field screening, and final (evidence) files. Sample custody forms will be used to document the relevant information for each sample collected for laboratory analysis. Sample Chain-of-Custody (COC) forms will be used for samples that are delivered to both the off-site laboratory(s), as well as the on-site laboratory.

A master sample logbook will be maintained on site to provide additional documentation for sample collection. Off-site subcontract analytical laboratory(s) will retain raw data and other supporting records related to sample analysis for a minimum of five years.

5.1.4 Field Sampling Operations

Each sample collected will be assigned a unique field sample number, which will be indicated on the sample label attached to the container. The details of the field sample numbering system are described in Section 5.2.6. Sample labels serve to identify the sample by documenting the client name, project name, sample identification, sample type, who collected it, when it was collected, analyses required, and the preservation method(s) used. Both the sample label and COC form will contain the sample identification numbers in order to track and enter sample information into a database for the Site. These labels will be completed with an indelible ink pen or generated by a computer, and will be affixed securely to the sample container immediately upon collection. Both on-site COCs and off-site analysis COC forms will be used. On-site COC forms will track all samples until they are packaged for shipment to the off-site laboratory.

COC records will be sequentially numbered to facilitate tracking of individual samples. After the sample identification information is entered in the field logbook, it will be entered on the COC form, which will be either transported to the on-site laboratory or shipped with the samples that are designated for off-site laboratory analysis. Use of the same COC procedures for both on-site and off-site samples will help minimize record keeping errors in the field. A legible copy of the COC form will then be placed in a document control file.

Samples that are designated for on-site analysis will be stored in appropriate containers with the COC. For samples that are designated for off-site analysis, a custody seal will be affixed to each of two opposite corners of sample coolers prior to shipment to off-site laboratories. The custody seals will serve as an indicator of tampering and must remain intact until the cooler is opened at the laboratory.

5.1.5 Field Logbooks

Documentation of field sampling will be performed to ensure data validity and facilitate analysis and evaluation. Field Personnel are responsible for recording field activities on the appropriate field documentation forms in sufficient detail to allow the significant aspects of the event to be reconstructed without relying on memory. After sample collection and before proceeding to the next sampling location, the samplers will complete the following procedures:

- Enter the sample into the Field COC record;

- Apply signed custody seals to the container lid (for off-site shipments); and
- Complete appropriate forms or logbook entries.

A master project field logbook will be maintained by the SRM or another designated Field Team member (such as the Site Data Coordinator) at the site to record information pertinent to daily activities, the field sampling program, and the equipment preparation efforts. Field logbooks will be bound, with pages numbered and entries made in permanent, waterproof ink. The SRM and/or Site Data Coordinator will review field log entries daily/weekly and sign or initial the final page for each day. Upon completion of the field activities, logbooks will become part of the final project file. Entries in the master project field logbook will include the following information:

- Author, date, and times of arrival at and departure from the work site;
- Weather conditions (e.g., temperature, humidity, wind speed, precipitation);
- Identification of subcontractors working on the site;
- Description of field activities and summary of daily tasks;
- Names of field crew members;
- Sample information and identification or references to appropriate logs/forms;
- Volume and identification of excavated soil and containment sacks generated;
- Field observations;
- Any problems or non-conformances associated corrective actions, notifications made as a result, and a summary of the content of discussions;
- The impact of the day's activities on the project schedule; and
- Site visitors or communications with non-project personnel, organizations, or agencies (e.g., regulators, property owners, press, other USAF personnel).

Individual field notebooks will be maintained by the Site Data Coordinator and other designated members of the Field Team. These notebooks will be all-weather type with numbered pages, and entries will be made in permanent waterproof ink. Field notebooks will be presented to, and reviewed by, the SRM as appropriate. Entries in the field notebooks will include the following information:

- Author, date, and times of field survey or sampling activities;
- Description of the field activity;
- Names of field crew members;
- Sample collection method;
- Number and volume of sample(s) collected;
- Information regarding sampling changes and scheduling modifications;
- Details of the sampling location (including a sketch maps, if necessary);
- Field observations;
- Types of field instruments used and purpose of use;
- Field measurements made (e.g., radiological, chemical, etc.);
- Sample identification number(s) and sample documentation information; and
- Log photographs taken.

5.1.6 Daily Quality Control Report

Daily field activities, including a description of the sequence of events, will be recorded on a Daily Quality Control Report (DQCR). A sample DQCR form is provided in Appendix B of the WP. The SRM or Site Data Coordinator will be responsible for ensuring that activities are documented in the field DQCR. At a minimum, the field DQCR will include the following information for the specific day:

- Site/project identification;
- Weather conditions (e.g., temperature, humidity, wind speed, precipitation);
- Identification of subcontractors working on site;
- Tasks/activities performed;
- References to appropriate field logs for each activity performed, if details are necessary;
- Any problems or non-conformances associated corrective actions, notifications made as a result, and a summary of the content of discussions;
- Manpower and equipment log form;
- The impact of the day's activities on the project schedule; and
- Site visitors or communications with non-project personnel, organizations, or agencies (e.g., regulators, property owners, press, other USAF personnel).

CABRERA will submit to the designated USAF representative a DQCR for each day that field activities are conducted. The DQCR will be signed and dated by the CABRERA SRM or Site Data Coordinator and will be submitted to the USAF COR or designee on an on-going basis as fieldwork continues.

5.1.6.1 Radiological Survey and Release Forms

Copies of radiological survey and release forms completed for rail cars, equipment, materials, tools, loaded waste containment bags, air monitors, and personnel will be maintained on-site. The forms, included in CABRERA Operating Procedure OP-001, *Radiological Surveys*, and OP-004, *Radiological Release of Material from Radiological Control Areas*, listed in Appendix C of the WP, will be completed by Health Physics (HP) Technicians and reviewed and approved by the Site Radiation Safety Lead (SRSL) prior to being provided to the Site Data Coordinator for document retention.

5.1.6.2 Daily Tailgate Meeting Sign-in and Safety Report

Prior to starting each day's activities, the field team will conduct a morning tailgate preparation and safety awareness meeting, as discussed in the project SSHP. This form will serve as the daily sign-in form for field team members as well as Site visitors. A daily safety summary report will also be completed to document field activities, safety levels, and notation of any safety incidents. Templates for these forms are included in the appendices to the SSHP; completed forms will be included with the DQCR submitted to the USAF.

5.1.6.3 Annotation of Maps

Copies of site base maps or sketches and project forms will be used by the field teams to record key site conditions and to show approximate locations of field structures, field staging or decontamination areas, RCAs, utilities, permanent and temporary land surveying benchmarks, excavations and waste management areas, and other appropriate site information as appropriate. The maps or sketches will be maintained by the SRM during field activities and transferred to the project files for a record of sampling locations.

5.1.6.4 Calibration Log

Equipment calibration logs will be recorded in field logbooks and transferred to, and maintained in, electronic calibration logs to document the calibration measurements and frequencies of site equipment/instrumentation.

5.1.6.5 Corrections to Documentation

Measurements performed and samples collected will be documented in field logs. Field Personnel will initial each page as it is completed. Corrections will be made by drawing a line through the incorrect entry and writing in the correct entry. The person making the correction will date and initial the correction. There will be no erasures or deletions from the field logs.

5.1.7 Sample Locations

Numerous types of samples will be collected at the Site in support of remediation. Specific details of the location and methodology of each type of sample are included in the FSP.

5.2 Sampling Method Requirements

5.2.1 Sample Handling

The SRM is responsible for ensuring that samples are collected by the Field Team with properly decontaminated equipment and placed in properly cleaned sample containers. Sample bottles and containers to be use for off-site laboratory analysis will be received directly from the subcontract laboratory in sealed cartons and certified as clean according to EPA Level I requirements, as appropriate. Additional sample containers and/or equipment not provided by the contract laboratory will be obtained from commercial vendors. The preparation, handling, and "certified clean" condition of the containers received from the vendors will conform to the same standards as those for the containers obtained from the off-site contract laboratories.

Sampling and preservation procedures will be as mandated by each respective test method, as defined in the laboratory's SOPs and the LQAM. Proper sample containment, preservation methods, holding times, and shipping and COC procedures will be followed to preserve the integrity of the sample before it is analyzed.

The sample handling requirements discussed below are applicable to samples prepared for off-site laboratory analysis and, where appropriate, for samples prepared for on-site screening and on-site laboratory analysis.

5.2.2 Sample Containers

Collected samples for both on-site and off-site laboratory analyses will be collected and stored in the appropriate sample containers as identified in the laboratory's SOPs and the LQAM (solid samples). Once collected in the appropriate sample container, the samples will be stored (and, for those samples requiring off-site analyses, shipped to the off-site subcontract laboratory) in high-density polyethylene (HDPE) coolers and/or shipping containers in accordance with laboratory protocols for the specific analysis method and client requirements. Samples for on-site radiological laboratory analysis will be transferred to the on-site laboratory following collection or placed in coolers for temporary storage in the field and transferred to the on-site laboratory by the end of each day. Sample containers that are prepared for off-site analyses will be packed in coolers for shipping to minimize the potential for breakage. The use of ice or coolant packs is not necessary for coolers containing samples that will be submitted for off-site radiological and geotechnical laboratory analyses, as they may be stored and shipped at ambient temperatures. Ice will be placed in coolers containing samples that will be submitted for off-site chemical laboratory analysis.

5.2.3 Sample Holding Times

Sample preservation and holding time requirements will not be applicable for radiological and geotechnical laboratory analyses and matrices. Samples for either on-site or off-site radiological analyses will not be subject to laboratory/analytical QA limitations based on holding times. Soil containing ROCs may be stored indefinitely without an adverse impact on the quality of radiological data from alpha spectroscopy. However, timely handling and delivery of samples to the off-site laboratory is desirable

from the perspective of project efficiency, scheduling, and performance of field activities. Samples for off-site chemical analyses (e.g., VOCs, SVOCs, metals, etc.) will be subject to the preservation and holding time requirements of defined in the laboratory's SOPs and the LQAM.

5.2.4 Sample Receipt

The off-site laboratory will follow laboratory standard operating procedures for handling, identifying, and controlling samples, and COC procedures to maintain the validity of the samples.

A Sample Custodian will inspect sample containers for integrity upon receipt of samples. The presence of leaking or broken containers or custody seals will be noted on the COC form. The sample custodian will sign the COC form (with date and time of receipt), thus assuming custody of the samples. CABRERA's PM and SRM will be notified immediately by the subcontract laboratory of evidence of leakage, breakage, or tampering of samples or containers.

The information on the COC form will be compared with that on the sample labels to verify sample identity. Any inconsistencies will be resolved with CABRERA's PM or designee before sample analysis proceeds.

5.2.5 Sample Labels

Labels will be affixed to sample containers during sampling activities. Sample labels are waterproof and will be completed with an indelible ink pen or computer generated label and affixed to the sample container. Sample labels will be affixed to all samples (i.e., those for both on-site and off-site laboratory analysis).

Information will be recorded on each sample container label at the time of sample collection. The information to be recorded on the labels will be as follows:

- Sample identification number;
- Sample type (discrete or composite);
- Site name and location number;
- Analysis to be performed;
- Type of chemical preservative present in container (if any);
- Date and time of sample collection; and
- Sampler's name and initials.

5.2.6 Sample Identification

A sample-numbering scheme will be used to identify each sample designated for on-site and off-site laboratory analysis. The purpose of this numbering scheme is to provide a tracking system for the retrieval of analytical and field data on each sample. Each sample generated will be assigned a unique, sequential number to ensure that there is no duplication. Subsequent sequential numbers for each unique location will be assigned to ensure that the next sequential number will be used, even when returning to a unique location that has been sampled previously.

Sample identification numbers will be used on sample labels or tags, field data sheets and/or logbooks, COC records, and other applicable documentation used during the project. Field Sample Identifiers for a given site will be stored in a temporary database until the samples are being prepared for shipment to the laboratory at the end of the sampling event. The COC form will be prepared at that time for samples destined for off-site laboratory analysis by selecting the Field Sample Identifiers from the list, thereby providing a double check that the Field Sample Identifier on the sample bottle is consistent with the COC. A summary of the sample-numbering scheme to be used for the project is presented in Table 5-1. In general, the numbering scheme will include a Project Code, Sample Matrix Code, Location Code, and

Sample Number, in that sequence. Additional information regarding the sample, such as collection date and time, will be recorded in duplicate on a field sampling form and in a sampling logbook.

Table 5-1. Sample ID and Numbering Methodology

Sample ID Component	Description	
Remediation Support Samples: Project-Sample-Location-Number		
Project Code	RW6	Kirtland AFB RW-06 Site
Sample Matrix Code	SO	Soil/Debris – i.e., collected from overburden, trench waste volume, trench remediation limits or background location
	WCS	Soil - Waste characterization
	WCW	Wastewater - Effluent characterization
	WMS	Soil - Waste disposal monitoring
	WMW	Water - Waste disposal monitoring
	AS	Air - Excavation air monitoring station
	BZ	Air – Breathing zone monitoring
	SM	Rad - Smear/wipe sample
	OT	Other - Description to be recorded in logbook
Location Code	XX YYY	XX - Trench (01 through 09) YYY – Waste Container (e.g., 001)
Number	001 - 099 101 - 199 201 - 299	Parent Sample Field Duplicate Lab Duplicate
Final Status Samples: Project-Sample-Location-Number		
Project Code	RW6	Kirtland AFB RW-06 Site
Sample Matrix Code	FSS	Final status survey
Location	SU01 - SU11	Designate survey unit (add survey unit numbers as needed)
Number	001 - 099 101 - 199 201 - 299	Parent Sample Field Duplicate Lab Duplicate

5.2.7 Chain of Custody

The ability to demonstrate that samples have been obtained from the locations stated and that they have reached the off-site laboratory without alteration is a major consideration for environmental data. Evidence of collection, shipment, laboratory receipt, and laboratory custody until sample disposition will be documented to accomplish this goal. Documentation will be accomplished through a COC record that indicates each sample and the individuals responsible for sample collection, shipment, and receipt.

Off-site laboratory COC forms will contain the following information at a minimum:

- Project name and number;
- Initials of sampler;
- The sample number, date and time collected, and sample type;
- Analyses requested;
- Any special instructions and/or sample hazards; and
- Date and time that the sample is relinquished with the signature and name of company of the individual that is relinquishing it.

The purpose of sample custody procedures is to document the history of sample containers and samples from the time of preparation through sample collection, shipment, and analysis. An item is considered to be in one's custody if one or more of the following conditions apply:

- It is in a person's actual possession;
- It is in view after being in physical possession; and/or
- It is locked up so that no one can tamper with it after the sample is in physical custody.

The following laboratory COC procedures will be followed for samples submitted to the laboratory for chemical, radiological, or physical properties analysis:

- Each individual Field Sampler is responsible for the care and custody of samples they collect until the samples are properly transferred to temporary storage or for shipping;
- The Site Data Coordinator will be responsible for shipping the samples from the field to the laboratory and proper completion and accuracy of the COC form;
- The original copy of the COC form will be inserted in a sealable plastic bag and placed inside the cooler/container used for sample transport after the field copy of the form has been detached, or a copy has been produced;
- The signatures of the person relinquishing and receiving the samples, as well as the date and time, will be documented each time the samples are transferred;
- A copy of the carrier air bill or bill of lading will be used as custody documentation during times when samples are being shipped and will be retained as part of the permanent COC documentation;
- The laboratory will record the condition of the sample containers upon receipt;
- The COC form will be delivered by facsimile or electronically to CABRERA from the laboratory upon receipt of the samples;
- Changes or corrections to the information documented by the COC form (including, but not limited to, field sample identification or requested analyses) must be changed and initialed by the person requesting the change. A copy of the COC form will be altered, initialed, and forwarded to the laboratory, where it will supersede the original COC form in situations where the request comes from CABRERA; and
- A copy of the COC form and any documented changes to the original will be returned from the laboratory as part of the final analytical report to CABRERA's PM. This record will be used to document sample custody transfer from the sampler to the laboratory and will become a permanent part of the project file.

5.2.8 Sample Packaging and Shipping

The objective of sample handling procedures is to ensure that samples arrive at the off-site subcontract laboratory intact and free of external contamination. Samples will be packed and shipped in accordance with applicable US Department of Transportation (DOT) regulations, and US Nuclear Regulatory Commission (NRC) regulations, as applicable.

5.2.8.1 Sample Packaging

Sample containers intended for shipment to off-site laboratories will be packaged in thermally insulated, rigid-body coolers. Samples will be packaged, classified, labeled, shipped, and tracked in accordance with CABRERA Operating Procedures OP-005, *Volumetric and Material Sampling*. Samples will be stored in a secure area under the direct Site control during the time period between collection and shipment.

Two custody seals will be placed on each cooler used for sample transport to ensure that no sample tampering occurs between the time that the samples are placed in the coolers and the time the coolers are opened for analysis at the off-site laboratory. These seals will consist of a tamper-proof adhesive material placed across the lid and body of the shipping coolers. Custody seals will be signed and dated by the individual responsible for completing the COC form and packaging the samples in the cooler.

5.2.8.2 Additional Requirements for Shipment of Samples

Transportation of hazardous materials is regulated by the DOT in accordance with Title 49 of the Code of Federal Regulations, 49 CFR (DOT, 2005). Samples generated during project activities will be transported in accordance with procedures that ensure compliance with regulatory requirements.

5.2.8.3 Sample Shipping

Samples will be shipped to the off-site laboratory(s) as soon as possible following collection. To the extent possible, samples with short holding times will be identified, packaged, and shipped to the off-site laboratory on the same day as collection. Additionally, shipment of samples at the end of the week (e.g., collection on Friday and shipment overnight to arrive on Saturday) will not be completed without approval from the receiving laboratory to ensure that the samples do not sit in un-refrigerated environments for more than the one night that is anticipated.

5.2.9 Verification/Documentation of Cooler Receipt Condition

The off-site laboratory(s) will follow their standard operating procedures for handling, identification, control, and COC procedures and to maintain the validity of the samples. Project-specific laboratory sample custody protocols are discussed in the LQAP.

5.3 Photographic Records

Photographs of sample collection and direct measurement activities may be taken during the field operations. All photographs will be documented in a project logbook or approved forms.

5.4 Data Media

The data media shall be physical and electronic in the form of project data logs (physical) and diskette with hard-drive and CD-ROM backup.

5.5 Data Backup and Security Policy

Electronic data is subject to damage and/or loss if not properly protected. As such, all project electronic data will be downloaded from its collection device (e.g., laptop computers, data loggers, GPS data collectors, etc.) on a daily basis. At the conclusion of each day's survey activities, electronic data collected that day to appropriate removable media (e.g., CD, zip disk, or equivalent) will be backed up and the backup removed from the site. The backup will not be stored in the same building in which the original project electronic data is stored.

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6.0 ANALYTICAL PROCEDURES

Analytical procedures that will be used to meet the project DQO and QA requirements are discussed below, including Minimum Detectable Concentrations (MDCs) for radiological analyses/screening, and Method Detection Limits (MDLs) and Reporting Limits (RLs) for physical/chemical analyses/screening:

- On-site radiological screening,
- On-site radiological (gamma spectroscopy) laboratory analysis,
- On-site screening for non-radiological parameters,
- Off-site radiological laboratory analysis,
- Off-site physical/chemical laboratory analysis, and
- Off-site geotechnical laboratory analysis.

Preventive maintenance, calibration procedures and frequency, laboratory/field QC procedures, performance and system audits, and non-conformance/corrective actions are also discussed herein.

6.1 Methods for Off-Site Laboratory Analyses

GPL will perform radiological, physical, and chemical laboratory analyses of soil/waste and air. Procedures for these analyses are based on the American Society for Test Methods (ASTM) and EPA methods identified in the FSP. Off-site laboratory MDLs consistent with DQOs for these analyses are also identified in Table 4-1. Analytical methods for off-site laboratory analysis will be carried out in accordance with the laboratory's Standard Operating Procedures, QA procedures, and QA program, included in Appendix A.

Off-site physical/chemical laboratory analysis will be performed to characterize and monitor soil/debris to verify compliance with disposal facility WAC. The TCLP and total metals analyses will be performed in accordance with the appropriate ASTM and SW-846 methods. These analyses will also be performed in accordance with the Department of Defense Quality Systems Manual. The following criteria are included in the specified methods (as applicable):

- Sample preservation and holding times;
- Initial and continuing calibration (method-specific criteria);
- Detection limits (historical performance-based criteria);
- Laboratory blanks (SW-846 criteria);
- Laboratory control sample (historical performance-based criteria);
- Surrogate spike recoveries (historical performance-based criteria);
- MS/duplicate analysis (historical performance-based criteria); and
- Internal standard area (method-specific criteria).

Documentation and record maintenance for off-site laboratory analyses will be in accordance with SW-846 requirements, as appropriate, and the individual LQAM. All analytical reports will require full documentation of each analysis performed, including all QC and calibration information and raw data.

Methods for off-site laboratory analyses will be carried out in accordance with the subcontract laboratory's Standard Operating Procedures, QA procedures, and QA program (Appendix A).

6.2 Methods for On-Site Radiological Laboratory Analysis

On-site radiological laboratory analyses will be performed using a high purity germanium (HPGe) system, known commercially as a reverse electrode germanium (REGe) detector. The REGe gamma

spectroscopy system will be used during remediation operations to perform field analysis of volumetric samples prior to or following removal of the material from the trenches. The on-site laboratory analysis of these volumetric waste samples will provide data to support determination that WAC have been met. System efficiency calibration will be either based on detector response to a National Institute of Standards and Technology- (NIST-) traceable standard or based on a mathematical calibration derived from instrument response to a NIST-traceable standard. If a mathematical calibration is utilized, it will be verified using a NIST-traceable standard. System energy calibrations will be performed using a designated standard with known gamma energies.

Samples for on-site radiological analysis will be collected and prepared in accordance with CABRERA's Operating Procedures OP-005, *Volumetric and Material Sampling*, OP-025, *Operation of Ohaus Triple Beam Balance*, and OP-028, *Preparation of Samples for Gamma Spectroscopy Counting*. Sample preparation will consist of heating in an oven for moisture removal, grinding and sieving the dried samples, and subsequent transfer into Marinelli containers prior to gamma spectroscopy analysis. Procedures for the operation of the on-site laboratory, as applicable to the REGe, are provided in CABRERA's Operating Procedure OP-029, *Laboratory Gamma Spectroscopy Operational Procedure*. An on-site Laboratory Operator will perform spectral analysis during each measurement, which will encompass the evaluation of spectra for problems such as peak shift, high dead-time and other potential inconsistencies in spectral structure. The integrity of the sample analysis results will be reviewed for each sample. This review will encompass the analysis of sample results for spectral energy shift, agreement between progeny activities assumed to be in secular equilibrium, the presence of potentially unidentified radionuclides, potential source model inconsistencies, as well as other potential inconsistencies.

Count times will be long enough to achieve sufficient MDCs for each radionuclide to meet applicable disposal facility WAC.

6.3 Quality Assurance for On-Site Radiological Laboratory

Initial and daily calibrations of the on-site gamma spectroscopy system will be performed using a mixed-gamma, NIST-traceable source. Gamma spectroscopy system QA will be ensured by tracking peak energy, peak resolution, and net peak area for a high and low energy peak, based on daily counts of a designated source. This source will consist of cobalt-60 (for the high-energy peak at 1,332.5 keV) and a low energy gamma emitter (e.g., americium-241 at 59.54 keV, cadmium-109 at 88.01 keV, etc.). These QA checks will be performed in accordance with CABRERA Operating Procedures OP-009, *Use and Control of Radioactive Check Sources*, and OP-029, *Gamma Spectroscopy Laboratory Operational Procedures*. Instrument control charts will be generated and evaluated in accordance with this procedure. QC data and each spectral data report will be reviewed and included as part of the project Remedial Action Completion Report.

6.3.1 Field Radiological Screening

CABRERA will perform on-site radiological screening in support of remediation operations. Procedures for radiological surveys are described in the following CABRERA Operating Procedures, included in the FSP, Appendix A:

- OP-001, Radiological Surveys, Rev. 1;
- OP-002, Air Sampling and Analysis, Rev. 0;
- OP-004, Unconditional Release of Materials from Radiological Control Areas, Rev 1;
- OP-009, Use and Control of Radioactive Check Sources, Rev. 0;
- OP-017, Empty Transport Vehicle Radiological Survey, Rev. 0;
- OP-020, Operation of Contamination Survey Meters, Rev. 0;
- OP-021, Alpha-Beta Counting Instrumentation, Rev. 0;

- OP-023, Operation of Micro-R meters, rev. 0;
- AP-008, Dosimetry Program; Rev. 0.

6.4 Field Screening for Non-Radiological Parameters

Samples collected during excavation will be screened for the potential presence of VOCs. A PID will be used to perform this work. An RL of one part per million (ppm) total VOCs above background will be used for this work, as compared to an Action Level of five ppm. The PID will be calibrated daily in accordance with manufacturers' specifications and will provide for sufficient accuracy in evaluating the potential presence of elevated VOC concentrations. Procedures for VOC Headspace Screening are described in the CABRERA Operating Procedures.

Because VOC levels can fluctuate considerably over the course of a day, ambient background measurements for VOCs will be recorded in the morning, mid-day, and afternoon, at a minimum. Background measurements will also be recorded if the weather or wind direction changes, or if there are significant changes in work activities near the background measurement location. More frequent background monitoring may be required if there is the potential for non-site organic contaminants nearby (e.g., vehicle emissions from the road adjacent to the site) that could impact the evaluation of ambient background concentrations of VOCs. Daily background measurements will be logged in the project/field logbook.

Metals levels in excavated soils and debris will be screened using an x-ray fluoroscopy (XRF) instrument. The XRF will be used in accordance with manufacturers' specifications, and will be calibrated and/or checked for QC parameters on a daily basis.

6.5 Preventive Maintenance

The primary objective of a preventive maintenance program is to promote the timely and effective completion of a measurement effort. The preventive maintenance is designed to minimize the downtime of crucial sampling and/or analytical equipment due to expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas:

- Establishment of maintenance responsibilities;
- Establishment of maintenance schedules for major and/or critical instrumentation and apparatus; and
- Establishment of an adequate inventory of critical spare parts and equipment.

CABRERA's inventory and primary calibration facility will maintain sufficient radiological instrumentation redundancy that precludes the need for an on-site repair and maintenance capability. Maintenance and/or repair of equipment are performed by the equipment manufacturer or authorized representative under contract or purchase order.

6.6 Responsibilities and Procedures

Equipment and apparatus used in a contractor's environmental measurement programs fall into two general categories:

- Equipment permanently assigned to a specific laboratory (e.g., alpha spectroscopy), and
- Field sampling equipment available for use on an as-needed basis (e.g., field meters).

Maintenance of laboratory instruments is the responsibility of the off-site laboratories. Generally, the Field Laboratory Manager is responsible for the instruments and equipment in his or her work area. The Field Laboratory Manager will establish maintenance procedures and schedules for each major equipment item. This responsibility may be delegated to laboratory personnel, although managers retain responsibility for ensuring adherence to prescribed protocol. Laboratories are bound by analytical

contractual agreements to maintain the ability to produce data that meet the project objectives and to follow method specifications. This ensures that adequate spare parts, maintenance, schedules, and emergency repair services are available.

Maintenance responsibilities for field characterization/monitoring equipment and the On-Site Radiological Laboratory are assigned to the Field Laboratory Manager and SRSL. However, the Field Team using the equipment is responsible for checking the status of the equipment prior to use, and reporting any problems encountered. The Field Team is also responsible for ensuring that critical spare parts are included as part of the field equipment checklist and that non-operational field equipment is removed from service and a replacement obtained.

6.6.1 Field Equipment

As discussed in Section 6.7, the field equipment will be properly calibrated, charged, and in good general working condition prior to the beginning of each working day. Maintenance and calibration of equipment prior to field use will be a prerequisite. Field instruments will be maintained in accordance with manufacturers' specifications, as appropriate.

Field instruments will be properly protected against inclement weather conditions during the field work. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of the ranges that will be encountered during cold-weather working conditions. Field equipment will be taken out of the field and placed in a cool, dry room for overnight storage at the end of each working day. Field instrumentation and equipment maintenance, repair, and calibration procedures will be in accordance with the manufacturers' specifications.

Field task leads will also inspect equipment for fluid leaks prior to the start of each working day.

6.6.2 Laboratory Equipment

6.6.2.1 Maintenance Schedules

The ability to generate valid analytical data requires that analytical instrumentation be properly maintained. The effectiveness of any maintenance program depends largely on adherence to specific maintenance schedules for each major equipment item. Other maintenance activities are conducted on an as-needed basis. Each laboratory will be responsible for maintaining service contracts or in-house service personnel for major instruments. These service contracts will not only provide for routine preventive maintenance, but also for emergency repair service. Manufacturers' recommendations will provide the primary basis for the established maintenance schedules, and manufacturers' service contracts will provide the primary maintenance for many major instruments (e.g., GC instruments and analytical balances). The elements of an effective maintenance program include the following, which are discussed in the ensuing subsections:

- Instrument maintenance logbooks;
- Instrument calibration and maintenance; and
- Available spare parts.

Preventive maintenance procedures to be followed by the off-site laboratories are identified in the LQAM.

Preventive maintenance procedures will be developed for use where instructions are not provided in the manufacturer-supplied operator's manual. As applicable, each department will maintain a major equipment and measurement standards list. A record of instrument maintenance, calibration and repair, if applicable, will also be maintained. The supervisor and operating personnel are responsible for complying with department maintenance schedules.

6.6.2.2 Instrument Maintenance Logbooks

Each analytical instrument will be assigned an instrument logbook. Maintenance activities are to be recorded in the instrument logbook, and the information entered will include:

- Date of service;
- Person performing service;
- Type of service performed and reason for service;
- Replacement parts installed (if appropriate); and
- Miscellaneous information.

If service is performed by the manufacturer, a copy of the service record will be taped into the page facing the notebook page or filed separately where the above information is entered.

6.6.3 Spare Parts

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment down time. The inventory includes those parts (and supplies) that:

- Are subject to frequent failure;
- Have limited useful lifetimes; or
- Cannot be obtained in a timely manner should failure occur.

The CABRERA SRM and the subcontract Laboratory Managers will be responsible for maintaining adequate field and laboratory inventories of instrumentation, equipment, and appropriate spare parts. The instrument operators have the responsibility, with the appropriate laboratory or field leader, to ensure that an acceptable inventory of spare parts is maintained.

6.7 Calibration Procedures and Frequency

This section contains brief descriptions of the analytical methods and calibration procedures for the field measurements that may be collected during the site activities. In cases where instruments not listed in this section are to be used, specific information on calibration and frequency for that instrument will be provided. Calibration procedures for field instrumentation are performed to ensure that the instruments are operating properly and produce data that can satisfy the objectives of the sampling program. These screening level data are used to monitor worker health and safety and to assist sample collection. Field instruments used for this program include:

- Instruments for measuring surface and subsurface radioactivity:
    - Two channel alpha/beta counting system (for performing gross alpha and beta counting of swipes and air samples); and
    - Detectors and rate meters for screening personnel and equipment for radiological contamination.
    - Field NaI Detectors used for gamma walkover surveys
- Global Positioning Satellite (GPS) receivers/data loggers (Trimble® or equivalent models) for logging various location measurements (i.e., scan measurements or sample locations)
- Real-time organic vapor monitoring instruments:
    - FIDs, PIDs, such as HNu®, organic vapor monitor (OVM), and Micro TIP®
- Real-time metals monitoring instruments
    - Niton XRF
- Real-time dust monitoring instruments:
    - Dust monitoring equipment such as DustTrak provide real time airborne dust (particulate matter) concentrations or can be set to run for extended periods to calculate Threshold Limit Values (TLVs).

While portable radiation detection instruments are typically not calibrated in the field, to ensure that some instruments are operating properly and are producing accurate and reliable data, routine operational QC checks will be performed prior to use and verified during use. Factory calibrations will be performed at a frequency recommended by the manufacturer. At a minimum, factory calibrations of radiation detection instruments will be performed annually and after factory repair.

In cases where instrument calibration is performed in the field, calibration procedures will be provided to the field crew with the instrument. The PM or designee will confirm that these procedures are shipped with the instruments included with the equipment prior to shipping the instruments. Field calibrations will be performed or checked at the beginning of the day and at the end of the day, at a minimum. The instrument will be serviced in the field if field calibration reveals that the instrument is outside established accuracy limits. The instrument will be returned to the manufacturer for immediate repair and servicing as necessary. A backup instrument will be available for each of the critical real-time instruments used in the field. Calibration records will contain the following information:

- Instrument name and identification number,
- Name of person performing the calibration,
- Date of calibration,
- Calibration points,
- Results of the calibration,
- Manufacturer's lot number of the calibration standards, and
- Expiration dates for the field standards, where applicable.

The SRM or designee will inspect equipment to ensure its proper working condition prior to the beginning of each working day. Field equipment and instruments will be properly protected against inclement weather conditions during the field execution. Field equipment and instruments will be properly decontaminated, taken out of the field, and placed in a cool, dry room for overnight storage and charging, as appropriate to the instrument at the end of each working day.

6.7.1 Radiation Detection Instrument Calibration and Field Checks

Instruments used during surveys will have current calibration/maintenance records kept on site for review and inspection. The records will include, at a minimum, the following:

- Name of the equipment,
- Equipment identification (model and serial number),
- Manufacturer,
- Date of calibration, and
- Calibration due date.

Instrumentation shall be maintained and calibrated to manufacturers' specifications to ensure the instruments have the required traceability, sensitivity, accuracy, and precision. Instruments will be calibrated at a facility possessing appropriate NRC or Agreement State licenses for performing calibrations using NIST-traceable sources. Instruments will be checked daily to ensure that the calibration is current (i.e., not expired). Instruments will be operationally checked daily (i.e., QC or source checks) to ensure they respond in a consistent manner when exposed to known radiation sources. Records of daily source checks will be maintained and filed in the project file, along with control charts associated with each instrument. The following subsections describe initial setup and daily QC checks performed on each type of radiation detection instrument listed above.

6.7.1.1 Geiger-Mueller Detectors

Geiger-Mueller and alpha detectors will be used for routine gross alpha and beta/gamma contamination monitoring. These detectors will be used in conjunction with a rate meter that reads out in counts per unit time. Ten source measurements will be made on a source representative of the radiation type and energy expected from radiological contaminants prior to initial detector use. The mean of the observed count rate will be calculated from the initial 10 source measurements. Thereafter, detectors will be source-checked daily, with an acceptance criterion of ± 20% of the mean of the initial 10 source counts. Instrument response will be recorded and evaluated against that criterion. Instruments with response rates outside the ± 20% acceptance criterion will be removed from service.

6.7.1.2 Alpha-Beta Handheld and Alpha-Beta Sample Counter

The alpha-beta field instruments and sample counter will be used to perform gross alpha and gross beta analyses on surfaces, smear samples, and air samples as appropriate. Alpha-beta instruments will use a solid plastic scintillator coupled to an appropriate dual-channel scaler instrument. Prior to initial alpha-beta instrument use, 10 alpha background counts, 10 beta background counts, 10 alpha source counts, and 10 beta source counts will be performed. The background counts will be used to calculate minimum detectable activity for the instrument at various count times. The initial source checks will be used to calculate acceptance criteria for subsequent daily source checks, which involves calculating the mean and standard deviation of both the alpha and beta initial source counts. The acceptance criteria for each channel will then be set at ± 2σ or 3σ from the mean, as described below.

Daily alpha and beta source checks will be performed and evaluated against these acceptance criteria. The source check may be repeated a single time if an alpha beta counting system channel falls outside 2σ of the mean but is within 3σ of the mean,. The instrument will be removed from service if the result is still outside 2σ. The channel will be removed from service if a single source check falls outside 3σ.

Results of both alpha and beta daily checks will be plotted on individual instrument control charts, which will be reviewed by the SRSL.

6.7.1.3 Field NaI Detectors

NaI detectors will be used to measure gross gamma radiation levels during surface walkover surveys. These detectors will be used in conjunction with a ratemeter/scaler that reads out in counts per unit time (i.e., counts per minute [cpm]) and total counts during the time interval for the scaler reading. Prior to initial detector use, a minimum of ten 1-minute measurements will be made on a source representative of the gamma energy expected from radiological constituents of potential concern (e.g., ^{137}Ce). A minimum of ten 1-minute measurements will also be made with the source removed to determine the instruments expected response to ambient background. Background will be monitored qualitatively to assess daily variations that may impact instrument minimum detectable concentrations (MDCs). From the initial source measurements, the mean of the observed count rate will be calculated. Thereafter, the instrument will be source checked twice daily, at the beginning and end of each day the instrument is used to collect data. The acceptance criteria are ± 20% of the mean of the initial source counts. Personnel will recheck geometry, source type, location of potential extraneous radiation sources, and perform a source response check recount for instruments that exceed the acceptance criteria. If the recount is within acceptance criteria, then the instrument may be used. If the recount remains outside the acceptance criteria, then the RTL will be notified, a corrective action request initiated.

6.7.2 GPS System

By design, the GPS unit does not require calibration, using data received from the satellite constellation to determine the precision and accuracy of its readings. To provide additional QC for this system, the GPS system will be checked daily against a calibration point. The calibration point will be selected upon commencement of fieldwork and will consist of a benchmark or monument of known location, if available. If no monument or benchmark is available, a stable site feature unlikely to move during the project (e.g., fencepost, pavement intersection, etc.) will be chosen.

Prior to initial GPS use, ten static positional readings will be obtained at the calibration point. From these positional readings, a mean position will be determined. This position will be expressed in units of northing/easting, latitude/longitude, or other equivalent unit. The position will also be referenced to a horizontal North American Datum (NAD 83). Thereafter, the GPS unit will be checked against the calibration point at least daily. The acceptance criterion for GPS daily checks will be within one meter of the calibration point. GPS units exhibiting positional error in excess of one meter will be removed from service. Results of the daily checks will be recorded and posted to a GPS control chart, which will be reviewed by a qualified engineer.

6.7.3 Organic Vapor Monitoring Instrument Calibration

Real-time instruments (photoionization detectors [PIDs]) will be used to verify that excavated soils do not exhibit elevated concentrations of VOCs. The calibration frequency for a PID is described below. Due to the rigors of field use, backup instruments will be available for the duration of the project. Detailed procedures for calibration and operation of these instruments are available from the distributors.

Portable PIDs are highly sensitive to aromatic compounds, moderately sensitive to unsaturated chlorinated compounds, and less sensitive to aliphatic hydrocarbons. The instrument can respond to organic compounds with ionization potentials less than the rated electron voltage (eV) of the ultraviolet (UV) bulb in the unit. Since the PID screening will be used as a screening method for a wide range of VOCs, an 11.7 eV bulb will be used to provide the greatest range of coverage of ionization energies that are capable of detection. Calibration procedures will generally consist of first "zeroing" the PID to ambient air (not in the vicinity of the excavation zones or active equipment/vehicles) and then calibrating to a known reference standard gas (100 parts per million isobutylene). Specific calibration procedures for

the PID to be used will be provided in the manufacturers operation and maintenance manual that accompanies the PID and will be stored at all times with the unit.

6.7.4 Metals Monitoring Instrument Calibration

The XRF instrument will be calibrated against a known standard according to manufacturer's recommendations.

6.7.5 Dust Monitoring Instrument Calibration

Real-time dust monitoring equipment will be used to monitor levels of nuisance/fugitive dust in excavation areas during active remediation to confirm the effectiveness of dust suppression activities. Intermittent dust monitoring will be conducted using a DustTrak or equivalent aerosol monitor with data logging capability during work activities that may result in hazardous particulates becoming airborne. Monitoring locations will be chosen based upon the anticipated tasks as well as wind and weather conditions. The DustTrak units are factory calibrated and don't require calibration. Certain models do provide the user with the option of completing field calibrations using an internal reference source. In such cases, detailed procedures for calibration and operation of the instrument are available from the distributors.

6.7.6 Laboratory Equipment Calibration

This subsection provides the general requirements for calibration of measuring and test equipment and instruments used in sample analysis in the on-site laboratory. Calibrations for the instrumentation used by the off-site laboratory are addressed in the laboratory-specific LQAM. This program is designed to ensure that instruments are calibrated to operate within manufacturers' specifications and that the required traceability, sensitivity, and precision of the equipment/instruments are maintained. Measurements that affect the quality of an item or activity will be taken only with instruments, tools, gauges, or other measuring devices that are accurate, controlled, calibrated, adjusted, and maintained at predetermined intervals to ensure the specified level of precision and accuracy.

An instrument's response to known reference materials must be determined before being used as a measuring device. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. Sample measurements will be performed within the calibrated range of the instrument. Preparation of reference materials used for calibration will be documented in a laboratory notebook.

Laboratory instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is expressed as a correlation coefficient.

Continuing calibration usually includes measurement of the instrument response to fewer calibration standards and requires instrument response to compare certain limits (e.g., 10%) of the initial measured instrument response. Continuing calibration may be used within an analytical sequence to verify stable calibration throughout the sequence and/or to demonstrate that instrument response did not drift during a period of nonuse.

The following subsections present calibration procedures for the following instruments:

- On-site laboratory gamma spectrometer,
- On-site gas chromatograph
- Balances, and
- Thermometers

Alternative procedures used as specified in the instrument calibration procedures for various instruments used in the laboratory, which are not in this QAPP, will be provided in the laboratory LQAM.

6.7.6.1 On-site Laboratory Gamma Spectrometer

Prior to counting samples, the detector and associated electronics must be energy- and efficiency-calibrated. Energy calibration is performed by counting a radioactive source containing known gamma ray emitting radionuclides, at a fixed amplifier gain. An energy calibration factor is then generated by determining the channel numbers corresponding to full energy peak centroids from gamma rays emitted over the full energy range of interest from multi-peaked and/or multi-nuclide radioactivity sources. Efficiency calibration is accomplished by counting a calibrated source of a particular geometry at a reproducible source-to-detector orientation. The measured emission rate of the calibration standard is then compared to the actual disintegration rate to determine the detector counting efficiency. The values for energy and efficiency calibration are maintained in configuration files, which are referenced when analyzing samples.

The system calibrations will be checked daily, when the system is in use, by measuring and tracking peak energy, peak resolution, and net peak area for a high and low energy peak, based on daily counts of a designated source. This source will consist of ^{60}Co (for the high-energy peak at 1,332.5 keV and a low energy gamma emitter (e.g., ^{241}Am at 59.54 keV, ^{109}Cd at 88.01 keV, etc.). Instrument control charts will be generated and evaluated in accordance with the following acceptance criteria: peak energies must be within ± 1 keV of the expected peak energy, the investigation limits for peak resolution (FWHM) and photopeak count rates are ± 2σ and the corresponding action limits are set at ± 3σ. If the QC parameters are within the investigation level, the system is ready for use. If any parameter falls outside the investigation level, but within the action level, the check shall be repeated once. If the second count is still outside the investigation level, or any count is outside the action level, the detector shall be taken out of service until the problem is resolved. After the problem is resolved, the system must pass two consecutive checks prior to being placed back in operation. The QC data and each spectral data report will be reviewed for trends and corrective actions taken in response to out of control conditions.

6.7.6.2 Balances

Laboratory balances will be calibrated and serviced annually by a qualified service technician. Calibration of the balances will be verified daily against three NIST-traceable, Class S-certified weights. The Class S weights used by the analysts for the daily balance checks will be calibrated annually by a qualified service technician. The calibration of the balances will be verified at the masses that bracket the measurements performed on the balances. Acceptance criteria will be clearly identified in the balance log. A maximum performance criterion of ±1% will be applied to top-loading balances, and ±0.1% to analytical balances.

6.7.6.3 Thermometers

Oven and refrigerator thermometers will be calibrated annually against a NIST-certified thermometer in the range of interest. Annual calibrations will be recorded in a calibration notebook. Daily readings will be recorded from the respective oven or refrigerator.

6.7.6.4 Records

Records will be maintained as evidence of required calibration frequencies, and equipment will be marked suitably to indicate calibration status. If marking on the equipment is not possible, records traceable to the equipment will be readily available for reference.

6.8 Laboratory/Field QC Procedures

Internal quality control is achieved by collecting and/or analyzing a series of QC samples including duplicate, replicate, blank, spike, and spike duplicate samples to ensure that the analytical results are

within quality control limits specified by the program. QC samples are used to assess laboratory performance and gauge the likelihood of cross-contamination associated with both field and laboratory activities. QC samples may be collected and analyzed only in conjunction with samples designated for laboratory analysis. QC sample results are used to quantify precision and accuracy and identify any problems or limitations associated with sample results.

6.8.1 Field Quality Control

Field QC samples will be documented in field logbooks and submitted to the laboratory. The QA goals for the program are to eliminate or minimize the potential for inconsistencies in protocols, including the field protocols themselves, which can introduce error into the data collection process. To achieve this goal, standard operating procedures have been developed and will be followed by Field Personnel as consistently as possible given the variability of natural conditions encountered in the field. The SRM will monitor the field implementation of the standard operating procedures. Any deviation from standard operating procedures necessitated by unanticipated field conditions will be fully documented as they occur and reported to the PM.

6.8.2 Analytical Sequence QC

Laboratory QC is necessary to control the analytical process, to assess the accuracy and precision of analytical results, and to identify likely causes for atypical analytical results. The QC checks in the laboratory are specific to the analytical method and generally include the use of the following QC samples as appropriate for the method.

Details of the off-site analytical laboratory's QC program are described in their LQAM (see Appendix A). In general, internal laboratory QC checks will consist of the following:

- Instrument performance checks,
- Instrument calibration,
- Retrieval of documentation pertaining to instrument standards, samples, and data,
- Documentation of sample preservation and transport and analytical methodology, and
- Analysis of QC samples.

6.8.3 Batch/Matrix-Specific/Performance-Based QC

Quality control samples will be collected and analyzed as stated below. The frequency of sample collection will be as specified below or as otherwise stated in the project FSP.

6.8.3.1 Field Quality Control Samples

Field Duplicate – As a measure of the representativeness of sampling, field duplicate samples (co-located grab samples) will be collected at a minimum frequency of 1 duplicate for every 20 samples collected. The field duplicates will be prepared and analyzed using the same procedures and equipment used for other samples.

Swipe Samples - Swipe samples will be obtained from various sources and will be analyzed for gross alpha and gross beta radiation in the field swipe counter. Quality control measurements for the swipe samples will consist of re-counting of approximately 5% of swipes in the on-site radiological laboratory.

Solid Waste Disposal Screening Samples – Samples will be collected from waste and will be analyzed in the on-site radiological laboratory and off-site laboratory as outlined in Table 4-1. A field duplicate or split sample will be collected for approximately 5% of the samples collected.

6.8.3.2 Laboratory Quality Control Samples

Matrix Spike/Matrix Spike Duplicates (MS/MSDs) - MS/MSDs are samples in which known amounts of compounds are added in the laboratory before extraction and analysis. Two aliquots of the sample are

spiked for the duplicate analysis. The results of the duplicate spiked samples are used to measure the % recovery of each spiked compound and compare the recovery between samples, which provides estimates of the accuracy and precision of the method. When reviewed in conjunction with other QC data, MS/MSD data may indicate the need for reanalysis using a more appropriate method. However, any MS/MSD samples analyzed at the off-site laboratories in the same sample analysis group (i.e., MS/MSD of like samples that were obtained from other sources) may be included in the laboratory deliverable package for review by CABRERA personnel.

Matrix spikes are typically not used for gamma spectrometry measurements and are not included among the QC measurements intended for the on-site laboratory portion for this project.

Laboratory Method Blanks - Method blank results indicate laboratory control of interferences from the analytical system, reagents, and glassware on sample results. Method blanks for each type of analysis are typically performed at a frequency of one per sample extraction/analytical batch to detect or account for instrument responses to other types of interference. For gamma spectrometry, the sample processing may not involve the addition of reagents. In that case, a blank consisting of a material with a similar matrix and in a geometry identical to that of the samples will be analyzed as a blank. Blanks will be analyzed by both the on-site and off-site radiological and chemical laboratories at a rate of one per analytical batch of no more than 20 samples.

Laboratory Control Samples - Laboratory control/check samples are laboratory certified samples that are fortified (spiked) with the analyte of interest and analyzed with the associated sample batch. It is spiked usually in the mid-calibration range and is selected based on the sample matrix (solid or liquid). These samples are used to demonstrate that the instrument and the method are operating within acceptable accuracy limits and that the analytical system is in control. Laboratory Control Samples (LCS) are required for analytical methods performed in the laboratory, and their preparation and the required frequency of analysis is described in each analytical standard operating procedure, and will be completed by the off-site radiological and chemical laboratories for the purposes of their internal QC.

Laboratory Duplicate Samples - Laboratory duplicates are repeated but independent determinations of the same sample, by the same analyst, at essentially the same time, and under the same conditions. Duplicate samples are obtained by splitting a field sample into two separate aliquots and performing two separate analyses on the aliquots. The analysis of laboratory duplicate samples monitors the precision of the analytical method, as well as the ability of the sample preparation technique to produce a homogeneous sample. In some case, there may not be enough sample material available to prepare actual duplicate samples for gamma spectrometry. In such cases, samples will be subjected to duplicate counts. Laboratory duplicates samples will be analyzed by both the on-site and the off-site laboratories. Duplicates will be analyzed at a rate of one per analytical batch of no more than 20 samples.

Calibration Standards - Initial calibration is performed as required for each analytical method, usually using a range of calibration standards with the low standard near the detection limit for the compound. These standards are used to determine the linear dynamic range for the initial instrument calibration. EPA, NIST, or other approved standards will be used when possible. Calibration is discussed in more detail in Section 6.7 of this QAPP.

6.8.4 Control Limits

The analytical control limits and acceptance criteria used by the off-site laboratories are presented in the off-site laboratory LQAM (see Appendix A). The corrective action activities listed in the LQAM are to be used as guidelines to identify any problems and correct the problem before proceeding. The off-site laboratory may follow alternative corrective action in accordance with the LQAM (Appendix A).

6.8.5 Reporting Checks

After laboratory data have been made available, the data will be compiled into tables for the report to facilitate the assessment of results. An independent check of the data entered into these tables will be performed for accuracy and completeness, and corrections will be made as necessary as discussed in Sections 6.10 and 10.1 of this QAPP.

6.9 Performance and System Audits

A QA audit is an independent appraisal of a measurement system. It typically includes a performance evaluation using apparatus and/or standards that are different from those used in the measurement system. It also may include an evaluation of the potential of the system to produce data of adequate quality to satisfy the objectives of the measurement efforts. The independent, objective nature of the audit requires that the auditor be functionally independent of the sampling/analytical team.

QA audits play an important role in an overall QA/QC program. Audits may consist of two types: system audits and performance audits. The purpose of a system audit is to determine whether appropriate program systems are in place. A performance audit is used to indicate whether those systems are properly functioning.

6.9.1 Contractor Quality Control

CABRERA's Corporate QC Manager, Project QC Manager, PM, and Project Engineer are the persons responsible for the design and/or performance of QC systems and audits for this project, while USAF's designated Quality Assurance Representative is responsible for designing and implementing QA audits. Since audits represent, by definition, independent assessments of a measurement system and associated data quality, the auditor must be functionally independent of the measurement effort to ensure objectivity. However, the auditor is experienced with the objectives, principles, and procedures of the measurement efforts to perform a thorough and effective evaluation of the measurement system. The auditor's technical background and experience provide a basis for appropriate audit standard selection, audit design, and data interpretation. The ability to identify components of the system that are critical to overall data quality is especially important, so the audit focuses heavily upon these elements. The auditor also has writing skills sufficient to clearly document the findings and recommendations of the audit. The function of the auditor is to:

- Observe procedures and techniques in use in the various measurement efforts, including field sampling and analysis;
- Check and verify instrument calibration records;
- Assess the effectiveness of and adherence to the prescribed QC procedures;
- Review document control and CoC procedures;
- Submit audit samples of comparable composition as those being tested for analysis;
- Review the malfunction reporting procedures;
- Identify and correct any weaknesses in the sampling/analytical approach and techniques;
- Assess the overall data quality of the various sampling/analytical systems; and
- Challenge the various measurement systems with certified audit standards.

6.9.2 Project System Audits

The auditor may, on an announced or unannounced basis, call for a corporate project audit (system audit). CABRERA's PM will respond by submitting this project QAPP and the project CQCP. The auditor will determine if the QAPP and CQCP are in place functionally and whether the required reviews have been and are being conducted. Certain projects may be identified for a more formal audit. These audits will involve an in-depth evaluation of the implementation of the QAPP for the project as they apply to field and data analysis and reduction procedures.

6.9.3 Technical Performance Audits

Technical performance audits will be performed on an ongoing basis during the project as field data are generated, reduced, and analyzed. Numerical analyses, including manual calculations, mapping, and computer modeling, will be documented and will be the subject of performance audits in the form of QC review, numerical analysis, and peer review. Records of numerical analyses will be legible, reproduction quality, and complete enough to permit logical reconstruction by a qualified individual other than the originator.

6.9.4 Field Audits

In accordance with CABRERA radiological Operating Procedure AP-004, *Radiological Compliance Audits*, periodic in-field performance audits may be conducted by the CQCSM, or designee, for the particular discipline of field activities. The purpose of field audits is to ensure that the methods and protocols detailed in this QAPP and the standard operating procedures are being consistently adhered to in the field. The QA auditor will prepare checklists prior to an audit to ensure completeness of the review and to document the results of the audit. Items to be examined may include, as appropriate:

- The availability and implementation of approved work procedures;
- Calibration and operation of equipment;
- Packaging, storage, and shipping of samples obtained; and
- Documentation procedures.

The records of field operations will be reviewed to verify that field-related activities were performed in accordance with appropriate project procedures. Items reviewed would include, but not be limited to:

- The calibration records of field equipment,
- Daily field activity logs,
- COC documentation, and
- Field logs.

During an audit and upon its completion, the auditors will discuss the findings with the individuals audited and cite any corrective actions to be initiated. Findings will be noted on the audit checklist and the results provided to CABRERA's PM and USAF's Project Engineer. CABRERA's PM will ensure that the corrective actions are implemented.

6.9.5 Laboratory Audits

The laboratories' internal audit protocols are described in the LQAM. The Laboratory Quality Assurance Coordinator (LQAC) will audit the performance of the laboratory on this project as part of internal laboratory audits. The audit will consist of a review of systems, procedures, and documentation. Deficiencies/deviations will be documented, and a summary report prepared.

The laboratory will participate in external performance audits, if initiated by USAF. These performance audits may be in the form of laboratory tours and procedure or recordkeeping reviews, or in the form of

blind performance samples submitted by the field crews. Details of the external performance audits will be specified by USAF.

Written reports of any additional outside audits performed by regulatory and independent certifying agencies/entities on the results of these audits will be distributed to USAF's Project Engineer and CABRERA's PM.

6.10 Non-Conformance/Corrective Actions

During the course of the site project, it is the responsibility of CABRERA's PM, Site Remediation Manager, Project Engineer, and the Field Team Members to see that measurement procedures are followed as specified and that measurement data meet the prescribed acceptance criteria. It is imperative that prompt action be taken to correct the problem(s) in the event that a problem arises.

Problems or questions about field or analytical data quality that may require corrective action are documented by the Site Remediation Manager and reported to CABRERA's PM. Corrective actions may be required if QC results exceed method or project criteria, reporting or flagging errors are identified, or requested information has not been reported. Laboratory response usually involves a written explanation of the problem or reissuing laboratory reports and/or electronic data files. If significant data quality problems have occurred and the data are critical to decision making, samples may be reanalyzed or recollected and reanalyzed. That determination must be made by CABRERA's PM in association with CABRERA's Corporate QC Manager, Project Chemist, and Project Engineer, and through discussions with USAF project staff.

6.10.1 Field Activities

The initial responsibility for monitoring the quality of field measurements and observations lies with the field personnel. CABRERA's Project QC Manager and Project Engineer are responsible for verifying that QC procedures are followed. This requires that the Project QC Manager and Project Engineer assess the correctness of field methods and the ability to meet QC/QA objectives. Any non-conformance with established procedures presented in the project plans will be identified and corrected. CABRERA's PM will be notified and will be responsible for issuing a non-conformance report for each non-conforming condition. In addition, corrective actions will be implemented and documented in the appropriate field logbook. Non-conforming conditions include:

- Improper instrument calibrations or operational checks;
- Improper survey or sampling procedures;
- Physical or documentation discrepancies with samples upon receipt at the laboratory; and
- Physical or documentation discrepancies with waste material upon receipt at disposal facility.

CABRERA's PM shall be notified in the event discrepancies are discovered by field personnel, during a desk or field audit or during data assessment. CABRERA's PM will immediately suspend applicable operations until the extent of the discrepancy and its impact on the accuracy and the validity of the data can be assessed. The cause of the discrepancy will be identified and corrective actions, such as procedure revisions or personnel retraining, will be instituted to prevent a reoccurrence. Re-surveys or re-sampling will be performed, if necessary, to correct the discrepancy. CABRERA's PM will notify USAF's Project Engineer of the identified problem, corrective action(s), and the impact on the overall project.

6.10.2 Laboratory Analyses

The responsibility to monitor the quality of the analytical system lies with the off-site laboratory. The laboratory will verify that QC procedures are followed and that the results of analysis of QC samples are within the acceptance criteria. This requires that the laboratory assess the correctness of the following items, as appropriate:

- Sample preparation procedures;
- Initial calibrations and calibration verifications;
- Method blank results;
- Laboratory control standards;
- Laboratory duplicate analyses; and
- MS/MSD results.

If the assessment reveals that any of the QC acceptance criteria are not met, the laboratory must immediately assess the analytical system to correct the problem. The Analyst will notify the Laboratory Section Manager and LQAC of the problem and, if possible, will identify potential causes and corrective action.

The nature of the corrective action obviously depends on the nature of the problem. For example, the corrective action may require recalibration of the analytical system and reanalysis of all samples since the last acceptable continuing calibration standard if continuing calibration verification is determined to be out of control.

The Analyst documents the problem, the corrective action, and the data demonstrating that the analytical system is in control when the appropriate corrective action measures have been defined and the analytical system is determined to be "in control." Copies of the documentation are provided to the Laboratory Section Manager for inclusion in the narrative.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency noted in the case narrative. Where sample results are impaired, the Laboratory Project Manager or Group Leader will be notified and appropriate corrective action (e.g., re-analysis) will be taken.

The approach to corrective action procedures for individual analyses will be based on the recommendations included in the specific analytical protocol and the off-site laboratory's LQAM/standard operating procedures.

6.10.3 Corrective Action Report

CABRERA's PM, or other project team members will initiate a corrective action request in the event that QC results exceed acceptability limits, or upon identification of some other problem or potential problem. Method-specified responses are presented in Section 6.8. Problems such as these will be followed up by CABRERA's PM, Project QC Manager, and Project Engineer. Corrective action may also be initiated by the PM based on QC data or audit results. Corrective actions may include the use of data qualifier flags, reanalysis of the sample or samples affected, re-sampling and re-analysis, and recommending a change in procedures, depending on the severity of the problem. Problems that require corrective action are documented by the use of a Corrective Action Report (CAR).

6.10.4 Recommendations for Corrective Action

A system for issuing formal Recommendations for Corrective Action will be established to address significant and systematic deficiencies identified during audits or other independent QC/QA reviews of field and laboratory procedures.

The specific procedures and structure of corrective action systems vary among suppliers, but the system will provide structure and formats for:

- Recommendations issued by the auditor, Project QC Manager, Project Engineer, or SRSL;
- Requests to address specific problems or deficiencies identified during audits of laboratory or

field operations;

- A specific, recommended time frame for response and implementation of corrective actions; and
- If satisfactory resolution is not obtained, requests to higher levels of management until a corrective action is agreed upon, or until another response is deemed sufficient.
- Recommendations for Corrective Action will be issued only by a member of the auditing group, or by their designee in a specific role. Each Recommendation for Corrective Action will address a specific problem or deficiency, usually identified during QC/QA audits of laboratory or project operation (Section 6.9). Although the Recommendation for Corrective Action system (and form) provides for distinguishing among problems of different urgency, Recommendations for Corrective Action are typically issued only to address significant, systematic deficiencies. Each of these formal written recommendations requires a written response from the responsible party (i.e., to whom the Recommendation for Corrective Action was issued). A system exists to track these Recommendations for Corrective Action and their corresponding responses. On a monthly basis, a summary of the "unresolved" Recommendations for Corrective Action is prepared by the audit group and issued to management. These reports list Recommendations for Corrective Action that have been issued to the work areas that each manager is responsible for and the current status of each. Each Recommendation for Corrective Action response requires verification by the auditing group that the corrective action has been implemented before the status is changed in the monthly report. In the event that there is no response to the Recommendation for Corrective Action within 30 days, or if the corrective action is disputed, the recommendation and/or conflict is pursued to successively higher management levels until the issue is resolved.

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7.0 DATA QUALITY INDICATORS

7.1 Precision

7.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

7.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field replicates/duplicates.

7.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. The equations to be used for precision in this project are presented in Section 8.0 of this QAPP. Precision control limits are included in the LQAM for the subcontract laboratories, included in Appendices A and B.

7.2 Accuracy

7.2.1 Definition

Accuracy is the degree of agreement between observed and accepted reference values.

7.2.2 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) and/or LCS and the determination of percent (%) recoveries. The equation to be used for accuracy in this project can be found in Section 8.0 of this QAPP. Accuracy control limits are given in the laboratory standard operating procedures.

7.3 Completeness

7.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that would be expected under normal conditions.

7.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from measurements taken in a project. The equation for completeness is presented in Section 8.0 of this QAPP. Field completeness for this project will be greater than 90 %.

7.3.3 Laboratory Completeness Objectives

Laboratory completeness is an indication of the amount of valid measurements made on a project. The equation for completeness is presented in Section 8.0 of this QAPP. Laboratory completeness for this project will be greater than 90 %. Representativeness

7.3.4 Definition

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

7.3.5 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring the FSP is followed and that proper sampling techniques are used. Field duplicates will be collected as a measure of sampling representativeness.

7.3.6 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing field-duplicated samples. The sampling network is designed to provide data representative of facility conditions.

7.4 Comparability

7.4.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is also dependent on the application of similar QA objectives.

7.4.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring the FSP is followed and that proper sampling techniques are used.

7.4.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. As a measure of comparability between the on-site and off-site laboratory, a portion of all samples analyzed on site will be sent to the off-site laboratory for confirmatory analyses. The results of these analyses will be evaluated as discussed in Section 8.2.3.

7.5 Sensitivity

7.5.1 Definition

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected or quantified. Detection limits (e.g., instrument and method) and quantitation limits are commonly used to measure sensitivity.

7.5.2 Measures to Ensure Sensitivity of Field Data

Sensitivity is dependent upon the proper selection, calibration and operation of field instrumentation, and will be satisfied by ensuring the FSP is followed and that instrumentation is properly calibrated and operated.

7.5.3 Laboratory Sensitivity Objectives

Sensitivity in the laboratory is ensured by using the proper analytical methods with detection limits that meet the identified DQOs. Analytical methods for this project have been selected to achieve the required detection limits to support the DQOs. Section 8.3 presents a more detailed discussion of detection limits and sensitivity objectives.

8.0 DATA REDUCTION/CALCULATION OF DATA QUALITY INDICATORS

Evaluation/assessment of measurement data ensures that QA objectives for a program are met and quantitative measures of data quality are provided. Data evaluation procedures, calculations, and applications used for this project are based on the Guidance for Data Quality Assessment Process: Practical Methods for Data Analysis (QA/G-9), (EPA, 2000c).

There is a distinction between routine QC and data assessment conducted as a part of laboratory operations, and the project-related data assessment process conducted after data have been reported. As discussed in this section, both types of data assessment will be addressed for this project. It is assumed that the planning, standard procedures, and monitoring activities conducted during the sampling and analysis process serve to control the process as much as possible to produce data of sufficient quality for project needs. Any part of the process that can not be controlled and to what extent that may affect the quality of the reported data will be identified after the data are reported.

Routine QC procedures conducted in off-site subcontract laboratory(s) are established in the published analytical methods referenced herein, other information in this QAPP, and standard operating procedures in the subcontractors' LQAM. The laboratory(s) are responsible for following those procedures and operating the analytical systems within statistical control limits. These procedures include proper instrument maintenance, calibration and continuing calibration checks, and internal QC sample analyses at the required frequencies for the project (i.e., method blanks, LCS, MS/MSDs, laboratory duplicates). One of the additional ongoing data assessment processes is maintaining control charts for representative QC sample analyses to monitor system performance. This provides verification that the system is in statistical control and indicates when performance problems occur so problems can be corrected as soon as possible. Subcontract laboratory(s) will provide the results of associated QC sample analyses when reporting sample data so CABRERA project staff can evaluate the performance of the analytical process.

Problems with analytical data often occur in spite of precautions taken in planning and execution of the sampling and analysis task. In these cases, the data assessment conducted by CABRERA project staff after the data have been reported will identify the problem, determine which data are affected, state how these data may be limited for use in the intended applications, and make recommendations for corrective actions as necessary.

8.1 Formulas

Several of the data review/assessment acceptance criteria involve specific calculations. The appropriate formulas are presented below.

8.1.1 Instrument Response Linearity (Calibration)

Acceptance criteria for certain non-radiological instrument response linearity checks are based upon the correlation coefficient, r, of the best-fit line for the calibration data points. The correlation coefficient reflects the linearity of response to the calibration standards and is calculated as:

$$r = \frac{n\sum(xy) - \left(\sum x\right)\left(\sum y\right)}{\sqrt{\left[n\left(\sum x^2\right) - \left(\sum x\right)^2\right]\left[n\left(\sum y^2\right) - \left(\sum y\right)^2\right]}}$$

Where:

x	=	Calibration concentrations;
y	=	Instrument response (peak area); and
n	=	Number of calibration points (x, y data pairs)

8.1.2 Precision

The degree of agreement between the numerical values of a set of duplicate samples performed in an identical fashion constitutes the precision of the measurement. Precision is checked during collection of data using field methods and/or instruments by reporting measurements at one location and comparing results. The measurements are considered sufficiently precise only if the values are within a specified % of each other. Control limits for control sample analyses, acceptability limits for replicate analyses, and response factor agreement criteria specified for calibration and internal QC checks are based upon precision.

Control limits for control sample analyses, acceptability limits for replicate analyses, and response factor agreement criteria specified for calibration and internal QC checks for laboratory analyses subject to duplicate analysis are based upon precision in terms of the coefficient of variation (CV) or the RPD. The standard deviation (S) of a sample set is calculated as:

$$S = \sqrt{\frac{\sum (x - \bar{x})^2}{(n-1)}}$$

Where:

x	=	Individual measurement result;
$\bar{x}$	=	Mean value of individual measurement results; and
n	=	Number of measurements.

The CV as a % is then calculated as:

$$CV = \left(\frac{S}{\bar{x}}\right) \text{ x } 100$$

The RPD calculation allows for the comparison of two analysis values in terms of precision with no estimate of accuracy. RPD is calculated as:

$$RPD = \frac{|m - M|}{\overline{M}} \text{ x } 100$$

Where:

m	=	First measurement value;
M	=	Second measurement value; and
M	=	Mean value of M and m.

CV is related to RPD for duplicate measurements by the following:

$$CV = \frac{RPD}{\sqrt{2}}$$

RPD evaluations are not typically performed on radiological samples because of the possibility of the results being net negative, e.g. sample concentration being lower than representative background sample. If this happens, RPD will falsely return agreement between the two samples. Instead, it is recommended that a replicate Z-Score method be used instead as recommended in Chapter 18 of the Multi-Agency Radiological Laboratory Analytical Protocols (MARLAP) manual (EPA, 2004). Z_{Rep} evaluates a sample result against a duplicate (or QA sample), including the stated uncertainties of each sample. The formula for Z_{Rep} is:

$$Z_{Rep} = \frac{Sample - Duplicate}{\sqrt{\sigma^2_{Sample} + \sigma^2_{Duplicate}}}$$

Where:

Sample	=	first sample value (original),
Duplicate	=	second sample value (duplicate),
Sample	=	total propagated measurement uncertainty of the sample, and
Duplicate	=	total propagated measurement uncertainty of the duplicate

The calculated Z_{Rep} results should be compared to a performance criteria of ±2. Duplicate analyses that result in a Z_{Rep} outside of ±2 (the warning limits) should be investigated for possible discrepancies in analytical precision or sources of disagreement within the following assumptions:

- The sample measurement and duplicate or replicate measurement are of the same normally distributed population;
- The standard deviations represent the true standard deviation of the measured population

8.1.3 Accuracy

Accuracy is the degree of agreement of a measurement, X, with an accepted reference or true value, T. Accuracy is usually expressed as the difference between the two values, X-T, or the difference as a % of the reference or true value, 100(X-T)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system and is assessed by means of reference samples and % recoveries. Error may arise from personnel, instrument, or method factors.

The accuracy of data collected using field instruments is difficult to quantify. However, accuracy can be qualitatively maximized by strict adherence to standard protocols and, where applicable, to manufacturers' operating and calibration procedures. This will ensure that data are accurate and within the manufacturer's reported accuracy limits.

Two types of analytical check samples can be used: LCS (blank spike) and MS. Analytical accuracy is expressed as the % recovery of an analyte that has been added to the control samples or a standard matrix (e.g., blank soil, analyte-free water, etc.) at a known concentration prior to analysis.

The accuracy of data is typically summarized in terms of relative error (RE). This calculation reflects the degree to which the measured value agrees with the actual value, in terms of % of the actual value. Relative error is calculated as:

$$\%\ \text{RE} = \frac{\text{Measured Value - Actual Value}}{\text{Actual Value}} \times 100$$

This way of expressing accuracy allows for a comparison of accuracy at different levels (e.g., different concentrations) and for different parameters of the same type (e.g., different compounds analyzed by the same method). Control sample analyses are typically evaluated using this calculation.

Another calculation is frequently used to assess the accuracy of a procedure. Percent recovery is a calculation used to determine the performance of many of the QC checks, where:

$$\%\ \text{Recovery} = \frac{\text{Measured Value}}{\text{Actual Value}} \times 100$$

Another similar calculation used to determine the performance of a method for recovery of a spike concentration added to a sample is the % spike recovery calculation. The % spike recovery is determined as:

$$\%\ \text{Spike Recovery} = \frac{[(\textit{Measured Sample Value Plus Spike}) - (\textit{Measured Sample Value})]}{(\textit{Value of Spike Added})} x 100$$

8.2 Control Limits

Control limits for central tendency and variability are generated by a laboratory to statistically monitor system performance. These limits are within method specified tolerances. The analytical control limits and acceptance criteria are presented in the off-site laboratory LQAM (see Appendix A).

Data reviewed to perform each of the above procedures and the implications to sample results are discussed in each of the following subsections.

8.2.1 Blank Data Assessment

As noted in Section 5.0, method blanks are analyzed to identify sources (external to the sample) of interference specific to radiological and chemical analyses. The samples associated with the blank may be qualified to evaluate whether some or all of the detected analytes may be from laboratory sources if interference is indicated in method blanks. If the concentrations reported in the samples are similar to the blank concentrations, it is likely that all of the contamination was introduced, and this assessment is typically made by the analytical laboratory and reported in the analytical deliverable package. If the method blank contamination exceeds one-half the reporting limit, the laboratory shall evaluate whether reprocessing of the samples is necessary based on the above criteria. The concentrations of common laboratory contaminants shall not exceed the reporting limit. Any sample associated with a blank that fail these criteria checks shall be reprocessed in a subsequent preparation batch, except when the sample analysis resulted in a non-detect. If no sample volume remains for reprocessing, the results shall be reported with appropriate data qualifying codes.

8.2.2 Accuracy

As previously defined, accuracy is associated with correctness, and is a comparison between a measured value and a known, or "true" value. Accuracy is calculated from MS or LCS results.

MS and LCS results are reported by the laboratory as % recovery and are compared to the accuracy objectives addressed in Section 7.2. Results that do not satisfy the objectives are assigned a data qualifier flag to indicate uncertainty associated with inaccuracy. An LCS is a simulated sample, with a matrix similar to that of the actual samples, to which a known concentration of one or more analytes is added. An MS is a known concentration of an analyte added to an actual sample. MS and LCS analyses are not necessarily used for all types of radiological analyses. As an example MS are typically not used for gamma spectrometry and used infrequently for alpha spectrometry. The off-site laboratory LQAM describes the use of MS and LCS. Samples from the same preparation batch may be qualified if recovery for either the MS or LCS is outside the established limits. Matrix spike results are generally more sample-specific. Results for samples collected from similar conditions and/or handled in the same batch can be examined if MS recovery is outside the established limits. Those results may also be qualified if any results appear atypical and can be related to specific limitations such as poor or enhanced recovery for specific compounds and will noted in the analytical report. Further investigation or corrective action may be taken to find methods to reduce the interferences.

Confidence intervals can be calculated for an analytical method if performance audit samples are submitted or a series of MSs are analyzed. The results are used to define confidence intervals for the recovery of each compound analyzed.

8.2.3 Laboratory Precision

Precision is a measure of variability between duplicate or replicate analyses, and is calculated for field and laboratory duplicates/replicates. By definition, field or total precision incorporates laboratory precision, however the precision of the field duplicates most importantly a measure of the heterogeneity of the samples. Precision is calculated as the RPD or Z_{Rep} between duplicate samples or analyses, or matrix spike/matrix spike duplicates as appropriate. Results that do not satisfy the objectives are assigned a data qualifier flag indicating uncertainty associated with imprecision.

An average RPD may be calculated and reported as a measure of overall analytical precision for compounds with multiple measurements. For this project, precision will be monitored for both the on-site and off-site laboratories using the equations presented in Section 8.1.2, for the RPD or the Z_{Rep}. The RPD is generally used only for non-radiological parameters. For this project, the preferred parameter for the radiological data is the Z_{Rep}. As one measure of the performance of the on-site radiological laboratory, a portion of samples analyzed there will be subject to confirmatory analyses by the off-site laboratory. Agreement between the two laboratories will be evaluated by calculating the Z_{Rep} for the interlaboratory duplicate analyses. The specific samples collected or analyzed in duplicate are flagged if they do not satisfy the QA objectives. In addition, associated samples may be flagged to indicate variability due to poor precision. When results indicate poor field duplicate precision, the source of the variability may be due to laboratory procedures or operations, or from field procedures (e.g., samples collected by the same sampling team or from using the same equipment). Close evaluation of the duplicate results should indicate the most likely source of variability, and the corresponding samples will be qualified as warranted. Samples processed and analyzed in the same batch will be more closely evaluated, and any anomalous results will be qualified when poor laboratory precision is encountered.

The LQAC is responsible for ensuring that data qualifier flags are assigned to the data as required by the established QC criteria, and that they are reported and understood by project staff using the data for specific applications. The LQAC is also responsible for initiating corrective actions for analytical problems identified during the QC data assessment process. These corrective actions range from verifying that the method was in statistical control during the analytical runs, to re-analysis or re-sampling.

8.3 Sample Quantitation/Reporting Limits (Limit of Detection)

This subsection presents and defines limits to be used in describing detectable concentrations. The Critical Value (Lc) is defined as the response threshold used to decide whether the analyte concentration of a sample is above that of the blank. The MDC describes the sensitivity of an analysis to measure a specific radionuclide or radiation, while a MDL describes that for a non-radiological (i.e., chemical) laboratory analyses. Laboratory detection limits are primarily a function of instrument sensitivity, sample geometry, target analyte, and count time. A MDC or MDL is an a priori value that describes the smallest contaminant concentration that a given detection system can detect a specified % (confidence level) of the time.

8.3.1 Procedures

For radiological analyses, the performing laboratory will determine (a) L_c in order to properly qualify each result prior to reporting, and (b) MDC to demonstrate that it can meet or exceed the required MDC or quantitation limits. For the alpha spectroscopy that will be utilized for the sample analyses, the Lc and MDC value associated with each measurement is reported along with the analytical result. Additionally, the recommendations specified in Attachment 20A of MARLAP will be followed. Similarly, for chemical analyses, the performing laboratory will determine the MDLs and RLs to demonstrate that project goals can be met (i.e., WAC as discussed in Section 4.0).

8.3.2 Radionuclide Detection Limits

The generic form of the Lc equation is provided below (EPA, 2004). This generic form allows the use of non-uniform count times between the background and sample counts and varying confidence factors:

$$L_c = z_{1-\alpha}\sqrt{R_B T_s\left(1+\frac{t_s}{t_b}\right)}$$

Where:

$Z_{1-\alpha}$ = Confidence Factor (generic)
R_B = Background count rate

t_B = Background count time
t_B = Sample count time

The more common application of the Lc equation is the "Currie equation" (Currie, 1968), which is a simplification of the above equation where the background and sample count times are the same and a 95% confidence interval is used, i.e. $\alpha = 0.05$ or $Z_{1-\alpha} = 1.645$:

$$L_c = 2.33\sqrt{C_B}$$

Where:
2.33 = Statistical factor
C_B = Background counts

The MDC values required of the radiological laboratories (on-site and off-site) along with the site-specific WAC are presented in Table 4-1 for the specific analytical methods for this project. The recommendations specified in Attachment 20A of MARLAP will be followed.

A minimum detectable activity (MDA) value is generated during each analysis to determine MDC values for the alpha spectroscopy performed by the laboratory. The MDC is derived by adjusting the MDA value for the mass of the sampled media. The equation by which MDA is calculated for alpha spectroscopy is:

$$MDA = \frac{4.65\sqrt{C_B} + 2.71}{2.22 * Y * V * Eff * A * T_S}$$

Where:
2.71 = Statistical Factor (95% Confidence Level)
4.65 = Confidence Factor (95% Confidence Level)
C_B = Background counts
2.22 = dpm to picoCurie conversion factor
Eff = Detector efficiency
Y = Chemical yield
V = Sample volume/weight
A = Abundance
T_S = Sample count time

The chemical yield is calculated as:

$$Y = \frac{C_T}{T * Eff * D_T}$$

Where:
C_T = Total Counts in the Tracer Peak.
T = Count Time (in minutes).
Eff = Detector Efficiency.
D_T = dpm of Tracer added to each sample.

8.3.3 Minimum Detectable Activity Determination for Field Instrumentation

MDA values for field instrumentation are determined a priori using characteristic detector values and anticipated sample and background count times. The equation by which MDA is calculated is:

$$MDA\left(\frac{dpm}{100cm^2}\right) = \frac{3 + 3.29\sqrt{R_B * T_{S+B}\left(1 + \frac{T_{S+B}}{T_B}\right)}}{Eff * T_{S+B} * \frac{PA}{100cm^2}}$$

Where:

3	=	Statistical Factor (95% Confidence Level)
3.29	=	Confidence Factor (95% Confidence Level)
R_B	=	Background count rate (cpm)
Eff	=	Detector efficiency
T_B	=	Background count time (min)
T_{S+B}	=	Sample count time (min)
PA	=	Probe active area (cm^2), if applicable

8.3.4 Chemical Method Detection Limits and Reporting Limits

For chemical analyses, the MDL is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero, and is determined from analysis of a sample in a given matrix containing the analyte. MDLs are calculated for each analyte and given analytical method from series of equations as provided in 40 CFR 136, Appendix B. The RL is the limit above which a laboratory feels confident in reporting its results for a specific analyte and analytical procedure, assuming that all the method-specified sample weights, volumes, and processing steps have been employed. This limit is the level where the laboratory believes results are not subject to laboratory-induced contamination or other sources of bias, and are typically set by the laboratory as two to three times the MDL.

8.4 Total Propagated Uncertainty

Total Propagated Uncertainty (TPU) is an estimate of the overall uncertainty in a radiometric measurement. The components of the TPU are classified as either random or systematic. The random uncertainties, also called counting uncertainties, derive from the statistically random (i.e., normally distributed) nature of radioactive decay and are estimated as the square root of the total number of counts acquired during an analysis. Counting uncertainty (CU) always applies to the measurement of the analyte of interest in a radiological measurement. In cases where the chemical yield is determined by the analysis of a radioactive tracer, that yield uncertainty (YU) is also a random uncertainty and is estimated as the square root of the total number of tracer counts acquired. CU and YU are calculated in activity units to afford comparability to the sample result.

Systematic uncertainties are attributable to actual errors in the measurement of a physical quantity. For example, the results of those gravimetric measurements are not normally distributed if a balance has an accuracy of ± 0.1%, but rather are assumed to be biased by that amount. Estimates of systematic uncertainties in the lab are somewhat subjective, but should be supported by empirical data whenever possible. Systematic uncertainties associated with the preparation of a sample are called preparation uncertainties (PU) and are defined based on the number of volumetric and gravimetric measurements, quantitative transfers, etc. The PU also includes an estimate of the uncertainty introduced by that technique in the case of chemical yield determinations made by the measurement of a stable carrier, or by gravimetric measurement of a final precipitate or residue. Systematic uncertainties associated with the analysis, called instrument uncertainties (IU) include biases associated with sample positioning, standard values, calibration coefficients, etc. PU and IU are typically provided as a % of the final result. PU and IU are expressed in activity units by multiplying the % by the sample activity (A) to afford comparability to the sample results.

All contributions to TPU are considered to be independent of each other. Consequently, the individual contributions are combined as the square root of the sum of the squares. The final TPU result is expressed in activity units, such a picoCuries per gram (pCi/g) or microCuries per milliliter (µCi/ml).

$$TPU = \sqrt{CU^2 + YU^2 + \left(A * PU\right)^2 + \left(A * IU\right)^2}$$

TPU is expressed as a value at a specific confidence interval. The convention is to provide the TPU at the two-sigma confidence interval. This asserts approximately a 95% confidence level that the actual sample value is within the reported uncertainty range of the calculated result.

8.5 Completeness

Completeness is a measure of the degree to which the amount of sample data collected meets the scope and a measure of the relative number of analytical data points that meet the acceptance criteria, including accuracy, precision, and any other criteria required by the specific analytical method used. Completeness is defined as a comparison of the actual numbers of valid data points and expected numbers of points expressed as a %.

The QA objectives for completeness will be based upon a project goal of 90%. The ability to meet or exceed this completeness objective depends on the nature of samples submitted for analysis. If data cannot be reported without qualifications, project completion goals may still be met if the qualified data, i.e., data of known quality even if not perfect, are suitable for the specified project goals.

Difficulties encountered while handling samples in the on-site or any of the off-site laboratories (radiological or physical/chemical) as well as unforeseen complications regarding analytical methods, may affect completeness during sample analysis. Access to various areas and/or media along with unanticipated difficulties with sample collection may affect field data completeness. Accordingly, to ensure that 90% completeness is obtained, certain efforts may need to be employed, including, but not limited to re-sampling.

Completeness is calculated after the QC data have been evaluated, and the results applied to the measurement data. In addition to results identified as being outside of the QC limits established for the method, broken or spilled samples, or samples that could not be analyzed for any other reason are included in the assessment of completeness. The % of valid results is reported as completeness. The completeness will be calculated as follows:

$$Completeness\ (\%) = \frac{T - (I + NC)}{T} \times 100$$

Where:

T	=	Total number of expected measurements for a method and matrix;
I	=	Number of invalidated results for a method and matrix; and
NC	=	Number of results not collected (e.g., bottles broken etc.) for a method and a matrix.

8.6 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. The representativeness criterion is best satisfied by making certain that sampling locations are properly selected and a sufficient number of samples are collected. Representativeness is addressed by describing sampling techniques and rationale used to select sampling locations. The EPA approved and standardized sampling procedures will be used where practical, and considered as guidance

in other cases, in conjunction with the survey and sampling design developed in the FSP to ensure the representativeness of sample data.

8.7 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. The comparability of the data, a relative measure, is influenced by sampling and analytical procedures. By providing specific protocols to be used for obtaining and analyzing samples, data sets should be comparable regardless of who obtains the sample or performs the analysis.

The analytical laboratory will be responsible for enhancing comparability using the following controls:

- Use of current, standard EPA-approved methodology for sample preservation, holding, and analysis;
- Consistent reporting units for each parameter in similar matrices;
- EPA- or NIST-traceable standards, when available;
- Analysis of EPA QC samples, when available; and
- Participation in inter-laboratory performance evaluation studies.

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9.0 FIELD AND LABORATORY OPERATIONS DOCUMENTATION

The data reduction, review, and reporting procedures described in this section will ensure that complete documentation is maintained, transcription and data reduction errors are minimized, quality of the data is reviewed and documented, and reported results are properly qualified. Off-site laboratory data production and management is described in the LQAM (Appendix A). CABRERA will maintain documentation and records to support information provided to USAF for the RW-06 remediation project. These records will be forwarded to USAF, if requested. Original copies of field data, field records, analytical data, training records, and other project-specific documentation will be retained by CABRERA in a manner and for durations required in CABRERA Operating Procedure, AP-001, *Record Retention*.

9.1 Field and Technical Data

The field and technical data (excluding off-site laboratory results) that will be collected during a remediation can generally be characterized as either "objective" or "subjective" data. Objective data (e.g., radiological field screening results) include direct measurements of field data such as field screening/analytical parameters, land survey data, air monitoring flow rates, equipment calibration records, and water level and water volume measurements. Subjective data include descriptions and observations such as descriptions of sampling locations and conditions, and physical descriptions of soil samples.

9.1.1 Data Reduction

Field data will be exported from data collection devices, as appropriate, and imported to appropriate data base management systems. Original field forms will be filed as hard copies for later review and verification of electronic copies of such data. Field data may also be imported into selected geospatial modeling software to allow for the preparation of radionuclide distribution documents as required.

Subjective data will be filed as hard copies for later review and incorporation into technical reports, as appropriate. The subjective data will be formatted into a usable medium, such as a computer database program. The database will allow for the generation of summary tables, graphs, and figures while maintaining the integrity and accountability of the original data.

9.1.2 Electronic Data

Electronic data collected during the day will be backed-up at the end of the same day in the field (e.g., to CD, zip drive, or 'memory stick') and before processing or editing. This is an archive of the raw data and, once created, will not be altered. More than one day's data may go on a single back-up media. Field computer(s) used to store Differential Global Positioning System (DGPS) data will be backed up weekly. Raw archived data will be stored in a different location from weekly backups. Electronic DGPS data will be provided daily to off-site data processing specialists. The time and date that data files are transmitted will be recorded in the data logbook. File names will be verified by comparison with field notes and corrected if necessary, following approval by CABRERA's PM.

9.1.3 Photographs

Photographs taken during the project will be noted in the field logbook. At least two permanent reference points will be recorded for each photograph taken to document location-sensitive sampling points (e.g., background sampling locations) points or to facilitate relocating the point at a later date. An attempt will be made to include reference points in the photographs. One or more site photograph reference maps will be prepared as required in addition to the information recorded in the field logbook.

9.1.4 Data QC Review

A QC review of objective field and technical data for usability will be performed on two different levels. In the first level QC review, data will be examined at the time of collection, following standard

procedures and QC checks. Data will be reviewed for anomalous values after reduction into tables or arrays in the second level QC review. Inconsistencies or anomalies discovered in the QC review will be immediately resolved, if possible, by seeking clarification from the field personnel responsible for collecting the data. Inconsistencies and anomalies will be documented during the review process.

Subjective field and technical data will be approved for use by reviewing field reports for reasonableness and completeness. Random checks of sampling and field conditions will also be made to review recorded data at that time to confirm the recorded observations. Peer review also will be incorporated into the data QC review process whenever possible, particularly for subjective data, to maximize consistency among Field Personnel.

9.2 Sample Management Records

Environmental and radiological samples will be handled under strict COC procedures beginning in the field. CABRERA's Site Remediation Manager or designee will be the field sample custodian and will be responsible for ensuring that the procedures outlined in the QAPP are followed. Sample custody for field activities will include the use of COC forms, sample labels, custody seals, and field logbooks. Dedicated field logbooks will be used throughout the project to document field activities. Supplies and reagents (source and lot numbers, if appropriate) used for field measurements will be recorded in the field logbooks.

Once samples are transported to the off-site laboratory, custodial responsibility is transferred to the Laboratory Sample Manager to assure that the appropriate procedures and methods are followed. LQAM will detail the laboratory COC and sample storage procedures. The laboratory will fax a copy of the fully executed COC forms to CABRERA's Site Remediation Manager and Site Data Coordinator each day samples are received. This fax will also be used to confirm that the cooler(s) were received by the subcontractor laboratory(s). The subcontract laboratory will keep final evidence files containing relevant and appropriate project sample information. This sample information includes, but is not limited to the following items:

- COC records;
- Sample log-in receipt forms;
- Copies of laboratory sheets;
- Copies of bench sheets;
- Instrument raw data printouts;
- Chromatograms;
- Pertinent correspondence memoranda; and
- Final report file.

If agreed upon by all parties, the laboratory can email scanned copies of the COC.

9.3 Data Reduction

Data reduction is performed by the individual subcontract Laboratory Analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will depend on the specific analytical method and the number of discrete operations (extractions, dilutions, and levels/concentrations) involved in obtaining a sample that can be measured.

For those methods using a calibration curve, sample response will be applied to the linear regression line to obtain an initial raw result, which is then factored into equations to obtain the estimate of the concentration in the original sample. Rounding will not be performed until after the final result is

obtained to minimize rounding errors, and results generally will not be expressed in more than two significant figures.

Copies of raw data and calculations used to generate the final results will be retained on file to allow for reconstruction of the data reduction process at a later date.

9.4 Laboratory Data Review

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, QC sample results, and performance evaluation samples. These reviews are performed before submitting data to the subcontract Laboratory's Project Manager.

Criteria for analytical data review/verification include checks for internal consistency, transmittal errors, laboratory protocol, and laboratory QC. QC sample results and information documented in field notes will be used to interpret and evaluate laboratory data. The subcontract laboratory's QA section independently conducts a review of the data package to eliminate technical errors that might affect the quality of the data.

The subcontract laboratory will complete standard review procedures, including:

- Proofing analyses requested with analyses performed;
- Preliminary data proofing for anomalies—investigation and corrections, where possible;
- Proofing of laboratory data sheets for reporting limits, holding times, surrogate recovery performance, and spike recovery performance; and
- Double-checking computerized data entry, if required.

The subcontractor Laboratory Project Manager or Group Leader will review data for consistency and reasonableness with other generated data and determine whether program requirements have been satisfied. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analyses should be repeated. Standard data qualifiers will be applied to results that fail to meet the laboratories acceptance criteria.

The subcontractor laboratory Data Reporting Section will verify that the report deliverable is complete and in proper format, and screen the report for compliance with laboratory and client QC and QA requirements prior to final review/signoff by the Laboratory Project Manager or Group Leader,. The subcontractor Laboratory Project Manager or Group Leader will be the final subcontract laboratory review prior to reporting the results to CABRERA's PM. The subcontractor laboratory Project Manager will also perform a final completeness check before submitting the data report to CABRERA.

The subcontract laboratory's QA Section will independently conduct a complete review of selected projects to determine whether laboratory and client QC and QA requirements have been met. Discrepancies will be reported to the Laboratory Project Manager or Group Leader for resolution.

9.5 Data Reporting Procedures

9.5.1 Data Package Format and Contents

Off-site analytical data resulting from the remediation will be presented to CABRERA in written reports. The reports will consist of a presentation of the raw analytical data, summaries of the review and verification effort, as appropriate, as well as interpretative findings relative to the data. This information will allow new data review to be performed.

Reports will contain final results (uncorrected for blanks and recoveries), analytical methods, detection limits, surrogate recovery data, and results of QC samples (where applicable). In addition, special analytical problems and/or any modifications of referenced methods will be noted. The number of

significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Data are generally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of activity or mass per unit volume (e.g., pCi/L or µg/L). Concentrations in solid or semisolid matrices are expressed in terms of activity or mass per unit mass of sample (e.g., pCi/g or mg/kg).

The final data reports provided by the off-site laboratories will be a Level IV report and will include:

- Cover page/laboratory chronicle;
- COC sample request form;
- Sample data (including QC sample) results;
- Laboratory instrument calibration data; and
- Case narrative describing data qualifiers, sample collection, sample preparation and analysis dataset, and a description of any technical problems encountered with the analysis;

Where applicable, QC results include MS/MSDs, method blanks, and LCS.

Data generated by the on-site laboratory for the purpose of characterizing waste to meet WAC, will be tabulated in an organized manner by the Laboratory Manager and provided to the SRSL and CQCSM for use in the development of waste transportation documentation.

9.5.2 Electronic Deliverables

This project relies heavily on field data collected and stored electronically. Electronic data are subject to damage and/or loss if not properly protected. Accordingly, project electronic data will be downloaded from its collection device (e.g., laptop computers, data loggers, GPS data collectors, etc.) on at least a daily basis. Electronic data collected will be backed up to appropriate removable media (e.g., CD, zip disk, or equivalent) at the conclusion of each day's activities.

Electronic submittals provided to USAF will be in Adobe® Acrobat Portable Document Format (PDF). The subcontracted off-site laboratories (except the geotechnical laboratory) will also provide Staged Electronic Data Deliverables (SEDD). Original files including, but not limited to, documents and databases will also be provided to USAF, if requested. Original files to be submitted shall include working copies of any documents/data in the appropriate Microsoft® format (e.g., Word, Excel, Access, etc.). Data collected and generated will be submitted to the USAF in Microsoft® Excel format. A complete, comprehensive laboratory analytical package will also be submitted in searchable PDF format on CD-ROM.

Table 9-1 identifies the approximate number of copies of Data Reports that will be required for the remediation activities.

Table 9-1. Submittals to the USAF

Deliverable	Electronic Compact Disc -Read Only Memory (copies)	Paper (copies)
Memos and Status Reports	0	5
Draft Reports	1	10
Final Reports	1	10

9.6 Data Management Procedures

The results for samples analyzed in support of this project will be entered into an electronic data report as described in Section 9.5.2.

9.6.1 Laboratory Turnaround Time

The laboratory turnaround time (TAT) varies by analyte and analytical method and is specified in the Pace contract, unless otherwise agreed upon.

9.6.2 Data Archival/Retention Requirements

Field, laboratory, and cartographic data within the subcontractor laboratory(s)' database system collected during site remediation will be archived on durable electronic media. Backup media containing databases and programs or software utilities will be maintained in a secure location. CABRERA will retain relevant and appropriate project information in project files.

Information contained in these files may include, but not necessarily limited to, the following items:

- Field notes and information;
- Correspondence, meeting notes, and telephone memoranda;
- COC records, laboratory information, and sample receipt forms;
- Data evaluation, reference, and audit information; and
- Copies of reports.

Hard copy data and data storage media will be archived in a manner and for durations required in CABRERA Operating Procedure, AP-001, *Record Retention*.

9.6.3 Standard Reports

Subcontractor laboratory project reports will include a section (or appendix) on QA review. This review will summarize field documentation, field audits, field screening, sample collection and method analysis, duplicate samples, field blanks, sample holding times, MS recoveries, surrogate recoveries, MSD results, and laboratory method blank results as applicable. Any corrective actions taken will also be discussed.

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10.0 DATA ASSESSMENT PROCEDURES

10.1 Data Quality Review

Data quality review includes the review of analytical data, field and laboratory QA reports, and all data submittals. CABRERA's PM will direct the Project Team in the final verification and reconciliation of the data results and the data review process with the project DQOs in regard to:

- The perspective of the end data user;
- Concentrations of the RCOCs and chemical analytes;
- The final number of samples, sampling locations, and site media;
- Lateral and vertical study boundaries; and
- Performance and appropriateness of the field survey techniques and laboratory analyses and methods that were utilized.

10.1.1 Analytical Data Review

The purpose of analytical data review is to eliminate unacceptable data and to identify data for any data quality limitations identified during review. In addition to the subcontractor laboratory QA review, data deliverables will be evaluated, at a minimum, for the following:

- Compliance with requested testing,
- Completeness of analytical report, and
- Confirmation of receipt of requested deliverables.

The discussion of data assessment presented in this section pertains to the project-related assessment of data performed after data have been reported and laboratory analyses have been completed. These data assessment procedures will be completed by CABRERA personnel (e.g., the PM, Project Engineer, SRSL, or other designated personnel), and will be completed to the extent appropriate/possible for both on-site and off-site laboratory analytical results.

At a minimum, data will be reviewed at the testing laboratory by the off-site laboratory LQAC, and at the Site by the Project QC Manager and Project Engineer, to evaluate the sampling and analytical performance. Data assessment procedures that will be performed for the RW-06 Site remediation include:

- Initial review of analytical and field data for complete and accurate documentation, holding time compliance, and required frequency of QC samples;
- Review COC documents to verify sample identities;
- Review sample log-in documents to verify any potential problems with custody seals, container integrity, sample preservation, labeling, etc.;
- Review LCS data as a measure of analytical accuracy. LCS data will be compared to the certified acceptable ranges of analytical values; and
- Identify and report any potential problems, such as MS or RPD values outside of acceptance criteria.
- Evaluation of blank results to identify systematic contamination;
- Statistical calculations for accuracy and precision using the appropriate quality control sample results; and
- Estimates of completeness, in terms of the % of valid data.

This process will identify analytical methods and compounds for which the QA objectives are not satisfied. Re-analysis or re-sampling may be recommended as a corrective action at this time if data are determined to be unacceptable for the intended application.

Quality Control results will be reported by sample matrix and analytical method in tabular form. The measurement data will be discussed and qualified as appropriate based on the QC results. For example, MS interference will influence specific samples or matrices, while laboratory blank contamination will influence samples extracted or analyzed on a specific day or during a specific analytical run.

A second level, or summary, table may be constructed in cases where there are a large number of QC analyses of one type. The summary tables will typically report mean or pooled statistics to describe the overall performance of the method. For example, the summary table of duplicate sample results might report the average RPD for duplicates measured for the compound, and indicate the number of individual RPDs that do not meet the acceptance criteria. This type of table can serve as an indication of the overall QC results. A summary assessment of the data presented in these tables will be prepared for each phase of sampling, as appropriate.

Custom table formats will be used as an aid to interpretation of the sampling data. The particular format will depend on how the QC results are expected to influence the analytical data and will be developed by data management staff through discussion with the users. For example, QC results may be grouped with analytical batches, field collection batches, or summarized for the entire project.

The data review report (for samples subject to full data review) will include a narrative explanation of what samples the report applies to, a reference to the criteria or procedures used for data review, and a description of which results were determined to be unacceptable for the intended application and why.

This report will accompany the QC data summary.

10.1.2 Field QA Reports

CABRERA's Site Remediation Manager or desginee will provide the CABRERA PM and Project Engineer with QA/QC progress reports at weekly intervals. CABRERA's PM will be immediately notified of field QC situations requiring corrective action. CABRERA's Corporate QC Manager will also be copied for all corrective action documentation.

10.1.3 Laboratory QA Reports

The subcontractor Laboratory QA Coordinator will provide project reports specific to the delivery order to CABRERA's PM, as requested. These reports summarize QA activities for the reporting period, including results of performance audits (external and internal), results of system audits (external and internal), summaries of corrective action to remedy out-of-control situations, and recommendations for revisions of laboratory procedures to improve the analytical systems. CABRERA's PM will be immediately notified of laboratory QA situations requiring immediate corrective action.

10.1.4 Data Submittals

Analytical reports will summarize the departures from approved protocols in the case narratives. Important data findings will be incorporated into the case narratives, where appropriate. Analytical reports in their entirety will be submitted to USAF as a separate document and/or transmitted in an electronic format at the request of the USAF.

10.2 Data Verification/Validation

Independent, third party review of the laboratory data is not currently scheduled or provided for in the USAF SOW, but may be utilized on an as-needed basis as indicated by data-quality conditions. The USAF will be contacted for direction to proceed prior to utilization, if such is implemented.

10.3 Project Completeness Assessment

Project completeness assessment is the measure of the volume of qualified data compared to the planned data volume and whether that data is sufficient to meet project objectives. The QA objectives for completeness will be based upon a project goal of 90%. Data completeness is addressed in detail in Section 8.5 of this QAPP.

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11.0 REFERENCES

See QPP for a complete list of references for the RW-06 project.

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APPENDIX A

GPL LABORATORY QUALITY ASSURANCE MANUAL

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