CAFB

LETTER OF TRANSMITTAL

URS

DATE: 11 January 2005
PROJECT NO.: 16169869.00002

TO: USACE, Omaha District

ATTN: Jane Davey

RE: Work Plan for Supplemental Assessment of AOCs A, B, and C at Cannon AFB

RECEIVED
MAR 2005
NMED Hazardous Waste Bureau

ENCLOSED ARE THE FOLLOWING:

- ☐ Daily Field Report(s) No.(s) For Period
- ☒ Report Copies ☐ Plans ☐ Instructions and Requests
- ☐ Other

FOR YOUR:

- ☒ Approval ☐ Files ☐ Comments
- ☐ Distribution ☐ Information ☐ Use

REMARKS:

Enclosed please find either three copies (USACE) or two copies (Cannon AFB) of the Work Plan for the Supplemental Assessment of AOCs A, B, and C at Cannon AFB.

We are tentatively planning to complete the fieldwork during the week of 07 February 2005. If this timeframe is not convenient for you, please let us know. Thank you.

Jeff Voelker

PLEASE NOTIFY US IF ENCLOSURES LISTED ARE NOT RECEIVED.

FROM: Jeff Voelker

COPIES TO: Pete Zamie, Cannon AFB

URS Corporation
12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154
(402) 334-8181
Fax (402) 334-1984

DRAFT REPORT

RECEIVED
MAR 2005
NMED Hazardous
Waste Bureau

WORK PLAN

INCLUDES:

- QUALITY ASSURANCE PROJECT PLAN
- SITE SAFETY AND HEALTH PLAN

SUPPLEMENTAL ASSESSMENT OF AREAS OF CONCERN A, B, & C CANNON AFB, NEW MEXICO

January 2005

TABLE OF CONTENTS

Section 1 Introduction 1-1
1.1 Purpose and Scope 1-1

Section 2 Cannon AFB Facility Description 2-1
2.1 Setting – Physical Geography 2-1
2.2 Demographics and Land Use Near Cannon AFB 2-1
2.3 Climatology 2-1
2.4 Geology 2-2
2.5 Hydrogeology 2-4
2.6 Soils 2-5
2.7 Background Metals Concentrations in Soil 2-6
2.8 Water Quality 2-6

Section 3 Decision Process 3-1
3.1 Description of the Decision Process 3-1
3.2 Development of Site Conceptual Exposure Models (SCEMs) 3-2
3.3 Critical Data 3-4
3.4 Detection Limits 3-4
3.5 Evaluation of Background Concentrations 3-4
3.6 Screening-Level Human Health Risk Evaluation Methodology 3-5
3.6.1 Derivation of Screening Criteria 3-5

Section 4 Field Sampling Procedures 4-1
4.1 AOC A (MOGAS Spill Site, SS-19) 4-1
4.1.1 Site Description 4-1
4.1.2 Sampling Objectives 4-1
4.1.3 Sampling Locations, Frequencies, and Analysis 4-2
4.1.3.1 Soil Borings 4-2
4.2 AOC B (JP-4 Fuel Spill Site, SS-18) 4-2
4.2.1 Site Description 4-2
4.2.2 Sampling Objectives 4-3
4.2.3 Sampling Locations, Frequencies, and Analysis 4-3
4.2.3.1 Soil Borings 4-3
4.3 AOC C (Blown Capacitor Site, OT-10) 4-4
4.3.1 Site Description 4-4
4.3.2 Sampling Objectives 4-4
4.3.3 Sampling Locations, Frequencies, and Analysis 4-5
4.3.3.1 Soil Borings 4-5
4.4 Sample Designation 4-5
4.5 Sampling Equipment and Procedures 4-6
4.6 Sample Handling, Documentation, and Analysis 4-7

Section 5 References 5-1

TABLE OF CONTENTS

List of Tables

Table 2-1	Summary of Background Elemental Concentrations in Soil Samples at Cannon AFB, New Mexico
Table 4-1	Projected Soil Sampling Breakdown – AOC A (MOGAS Spill Site)
Table 4-2	Projected Soil Sampling Breakdown – AOC B (JP-4 Fuel Spill Site)
Table 4-3	Projected Soil Sampling Breakdown – AOC C (Blown Capacitor Site)
Table 4-4	Containers, Preservation, and Holding Times for Soil Samples

List of Figures

Figure 1-1	Site Plan and Location of Areas of Concern
Figure 2-1	Generalized Geologic Strata at Cannon Air Force Base
Figure 2-2	Water Well Locations on and near Cannon Air Force Base
Figure 2-3	Distribution of Soils by Type at Cannon Air Force Base
Figure 3-1	Decision Diagram for Supplemental Assessment at AOCs A, B, and C
Figure 3-2	Site Conceptual Exposure Model for AOC A - Human Exposures
Figure 3-3	Site Conceptual Exposure Model for AOC B - Human Exposures
Figure 3-4	Site Conceptual Exposure Model for AOC C - Human Exposures
Figure 4-1	Site Plan and Sampling Locations for AOC A
Figure 4-2	Site Plan and Sampling Locations for AOC B
Figure 4-3	Site Plan and Sampling Locations for AOC C

List of Appendices

Appendix A	Quality Assurance Project Plan
Appendix B	Site Safety and Health Plan
Appendix C	Standard Operating Procedures
Appendix D	NMED Soil Screening Levels

ACRONYMS & ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
A-E	Architect-Engineer
AFB	Air Force Base
AOC	Area of Concern
B.P.	Before Present
bgs	below ground surface
BRA	Baseline Risk Assessment
CEC	cation exchange capacity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter(s)
cm/sec	centimeters per second
cm/yr	centimeters per year
COC	chain-of-custody
COPC	chemical of potential concern
DPDO	Defense Property Disposal Office
DQCR	daily quality control report
DQO	Data Quality Objective
EPA	Environmental Protection Agency
ft/yr	feet per year
FS	Feasibility Study
FSP	Field Sampling Plan
gal/ft	gallons per foot
gpm	gallons per minute
HQ	hazard quotient
IEUBK	Integrated Exposure Uptake Biokinetic
J	estimated value
JP-4	jet propellant 4
km/hr	kilometers per hour
L/min	liters per minute
MCL	Maximum Contaminant Level
m^3/m	cubic meters per meter

m/yr	meters per year
µg/dL	micrograms per deciliter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mm	millimeter(s)
MOGAS	motor gasoline
mph	miles per hour
msl	mean sea level
MS/MSD	matrix spike/matrix spike duplicate
NMED	New Mexico Environment Department
NWR	National Wildlife Refuge
PCB	polychlorinated biphenyl
PPE	personal protective equipment
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
SB	soil boring
SCFS	sample collection field sheet
SCEM	Site Conceptual Exposure Model
SSHP	Site Safety and Health Plan
SOP	Standard Operating Procedure
SOW	Scope of Work
SSL	soil screening level
SVOC	semivolatile organic compound
TCL	Target Compound List
TM	Technical Manager
TPH	Total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
U	not detected
UJ	estimated as nondetect

URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
USCS	Unified Soil Classification System
USDA-SCS	United States Department of Agriculture – Soil Conservation Service
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTL	upper tolerance limit
VOC	volatile organic compound
W-C	Woodward-Clyde
WHA	Walk, Haydel, & Associates, Inc.
WP	Work Plan

1.1 PURPOSE AND SCOPE

This Work Plan (WP) describes the field sampling requirements to complete supplemental assessments of three Areas of Concern (AOCs) at Cannon Air Force Base (AFB) near Clovis, New Mexico. These AOCs are AOC A, AOC B, and AOC C. A map of Cannon AFB and the locations of the three AOCs are shown on Figure 1-1.

This WP also describes the investigative activities that will be used to provide the information necessary to determine the presence or absence of chemical contamination, which may pose an unacceptable risk to human health or the environment at the three AOCs.

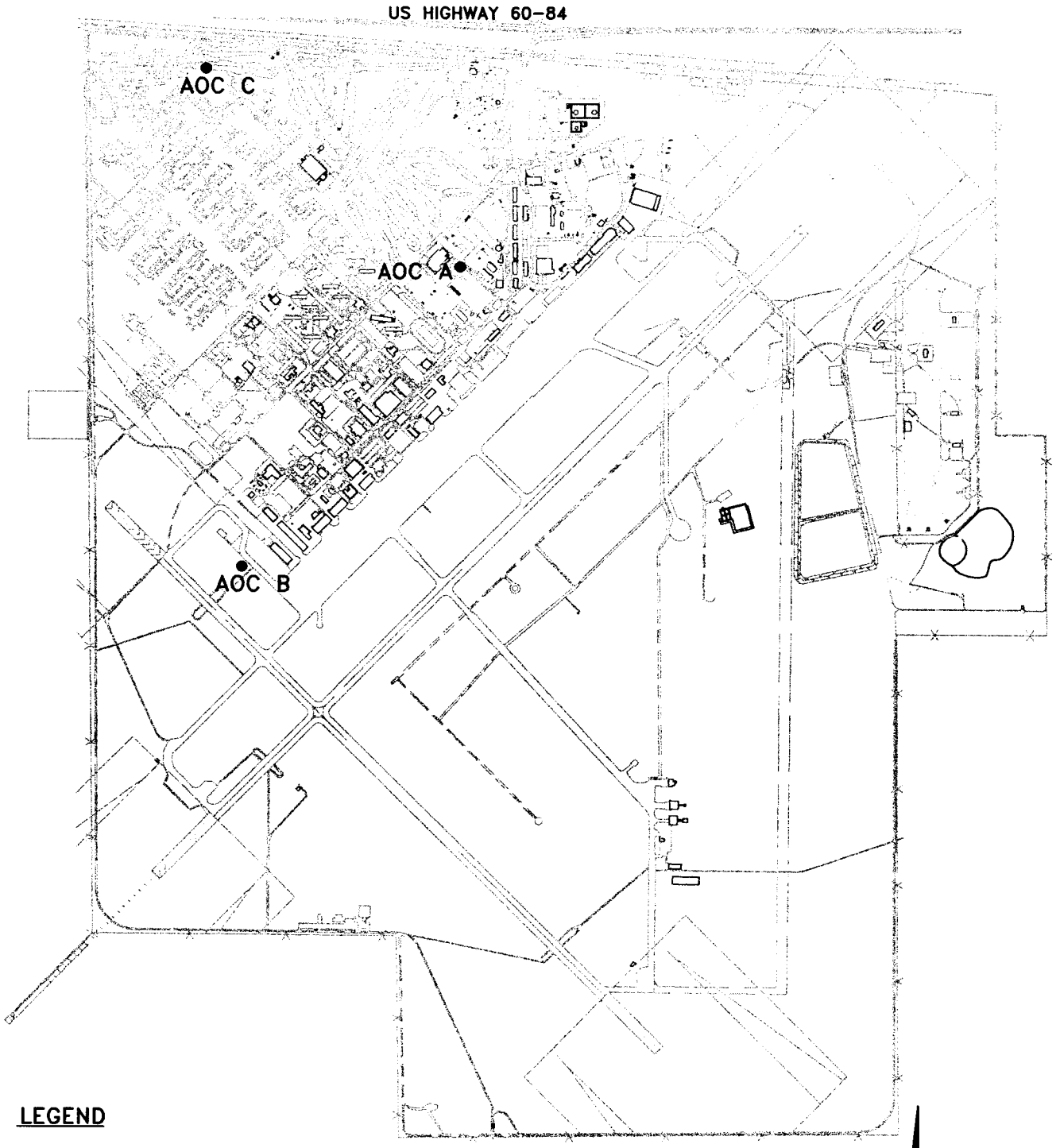
This WP is based on and meets the data requirements established in the Scope of Work (SOW) provided by United States Army Corps of Engineers (USACE), Omaha District. It includes preparing planning documents, completing a field investigation (surface and subsurface soil sampling), analyzing field samples for chemicals, evaluating the chemical data, comparing the analytical results to established soil screening levels (SSLs), and preparing the supplemental assessment report.

This WP is organized as follows:

- Section 2 provides a description of Cannon AFB.
- Section 3 discusses the decision process that will be used, including information on site conceptual exposure models and screening-level health risk evaluation methodology.
- Section 4 describes field sampling procedures and site-specific sampling objectives.
- Section 5 provides a list of the references used to produce this WP.

The appendices contain the following information:

- Appendix A – Quality Assurance Project Plan (QAPP)
- Appendix B – Site Safety and Health Plan (SSHP)
- Appendix C – Standard Operating Procedures (SOPs)
- Appendix D – New Mexico Environment Department (NMED) SSLs



LEGEND

AOC ● AREA OF CONCERN

SWMU No.	DESIGNATED AREA
AOC A	SS-19 MOGAS SPILL
AOC B	SS-18 JP-4 FUEL SPILL
AOC C	OT-10 BLOWN CAPACITORS SITE

N

2000 1000 0 2000

SCALE IN FEET

SITE PLAN AND LOCATION OF AREAS OF CONCERN
CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO

DRN. BY: DPG	DATE: 12/20/04	PROJECT NO. 16169869	FIG. NO. 1-1
CHK'D. BY: .	DATE:		

January 07, 2005 1:33:33 p.m.
Drawing: T:\CANNON\16169869\2\Fig1-1.dwg

2.1 SETTING – PHYSICAL GEOGRAPHY

Cannon AFB is situated in the Southern High Plains Physiographic Province in the Llano Estacado subprovince. The Llano Estacado is a nearly flat plain sloping gently (10 to 15 feet per mile) to the east and southeast. Elevations in the eastern New Mexico portion of the Llano Estacado exceed 4,000 feet above mean sea level (msl). In the vicinity of Cannon AFB, elevations range from 4,250 feet to 4,350 feet above msl.

The most prominent geomorphic features in the vicinity of Cannon AFB are blowouts and broad, widely spaced valleys. Less common landforms are relict sand dunes located along the northern side of the Portales Valley south of the Base. Relict dunes are not found on or near Cannon AFB.

Blowouts are broad shallow depressions, which form as the result of soil eroded by wind. Blowouts commonly collect surface runoff from small to moderate sized drainage areas. During periods of rainfall, runoff collects in blowouts to form ephemeral playa lakes. Playas have no external surface drainage. Water is lost by infiltration to the soil and evaporation; without recharge, playa lakes persist for only a few days or weeks. Three playas are located within the Base, and several more are found to the north and east of the Base.

Stream valleys tend to be fairly broad and widely spaced. Streams are ephemeral and drainages are poorly developed. No streams exist on or near Cannon AFB. Running Water Draw and Frio Draw, located about 10 and 20 miles, respectively, north of Cannon AFB, are the nearest streams. These are second-order streams. Both streams are very straight, flow southeast, and have rectilinear drainage patterns with short laterals (W-C 1991).

2.2 DEMOGRAPHICS AND LAND USE NEAR CANNON AFB

Cannon AFB is located just south of U.S. Highway 60-84 in a farming and ranching area (Figure 1-1). The majority of the land surrounding Cannon AFB is productive, irrigated farmland or grassland. The major crops are wheat, sorghum, sugar beets, corn, cotton, alfalfa, barley, and peanuts. The land is also used for cattle grazing, both beef and dairy, and Clovis is considered the "Cattle Capital of the Southwest." There were 32,767 people living in Clovis in 1990, while the Cannon AFB population was estimated to be 4,650 in 1990 (W-C 1991).

2.3 CLIMATOLOGY

The climate of east-central New Mexico is classified as tropical semi-arid, with summer temperature and precipitation maxima. Average monthly temperatures range from a January low of 12°C (39°F) to a July high of 26°C (78°F). Extreme daily temperatures range from -24°C (-11°F) to 41°C (106°F) (Lee Wan and Associates 1990). Average monthly precipitation ranges from 1 cm (0.4 inches) in winter to 6.9 cm (2.7 inches) in July. The maximum-recorded 24-hour rainfall is 12.2 cm (4.8 inches), which occurred in August. Rainfall occurs on eight or more days per month during the summer precipitation maximum. Mean annual precipitation is approximately 41 cm (16 inches). The mean annual evapotranspiration rate is 181.4 cm/yr (71.4

inches/yr) (Lee Wan and Associates 1990). Prevailing winds are from the west at an average of 5 km/hr (3.1 mph) during fall, winter, and spring. During the summer, winds are from the south at an average of 3.7 km/hr (2.3 mph).

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

Dust is frequently entrained into the atmosphere in this region of the country because of gusty winds and the semiarid climate. The Texas Panhandle-eastern New Mexico area is considered the worst area in the United States for windblown dust. Occasionally, this windblown dust is of sufficient quantity to restrict visibility. Most of the seasonal dust storms occur in March and April, when the wind speeds are typically high (i.e., average 5 km/hr) (W-C 1991).

2.4 GEOLOGY

The near-surface stratigraphic units of interest at Cannon AFB are the Late Miocene-Late Pliocene-age Ogallala Formation and the Early Triassic Dockum Group as shown in Figure 2-1.

The Dockum Group consists of three formations. The stratigraphically lowest unit is the Santa Rosa Sandstone. Overlying the Santa Rosa Sandstone are the Chinle and Redonda Formations. The Chinle and Redonda Formations are composed mainly of red shales with lesser interbedded sands, and are known locally as "redbeds." The top of the Dockum Group is marked by an erosional nonconformity having relief of up to several hundred feet (Lee Wan and Associates 1990).

Overlying the Dockum Group redbeds is the Ogallala Formation. The Ogallala Formation extends from eastern New Mexico and Colorado into Texas, Oklahoma, Kansas, Nebraska, and South Dakota. Drillers' logs from Cannon AFB indicate that the Ogallala Formation varies from 360 feet to 415 feet in thickness. The incised upper surface of Triassic redbeds strongly influences Ogallala thickness. Paleo valleys in the post-Triassic nonconformity are deep and trend dominantly east to west. Ogallala thickness may thus vary significantly over short north to south distances.

The Ogallala is erosionally truncated to the south along the abandoned Portales Valley, to the west along the Pecos River Valley, and to the north in a series of ephemeral stream valleys. The Ogallala Formation extends more than 125 miles to the east before terminating as an escarpment in Briscoe County, Texas. Springs and seeps are common along the erosional margins of the Ogallala.

The Ogallala dips gently and monoclinally to the southeast in the vicinity of Cannon AFB. As reported in Lee Wan and Associates (1990), data suggest that some quaternary warping may have occurred; however, most of these structures are located well to the northwest and southwest

of Cannon AFB. No faults or buried structural lineaments are known to exist in the vicinity of Cannon AFB.

The Ogallala Formation is composed of unconsolidated poorly sorted gravel, sand, silts, and clays. The base of the Ogallala is generally marked by a gravel, cobble, and boulder deposit. This basal member contains sediments derived from igneous and sedimentary rocks transported from the mountains to the west. The Ogallala Formation was laid down as stream and overbank deposits formed within coalescing alluvial fans. These fans form a broad pediment along the eastern flank of the Rocky Mountains. As is typical of alluvial deposits, Ogallala internal stratigraphy varies vertically and horizontally over short distances.

Except where strongly cemented by calcium carbonate (caliche), the sediments of the Ogallala are loose and friable. Authigenic and allogenic clays are found as a trace to abundant matrix mineral (Lee Wan and Associates 1990). As reported by Lee Wan and Associates (1990), five zones have been distinguished within the Ogallala of east central New Mexico on the basis of clay minerals. Smectites (montmorillonites) and attapulgite (with sepeotite) are the dominant clays throughout the Ogallala. Illite is a lesser, but persistent clay, as is kaolinite. Smectite is a swelling clay, causing deep cracks to form in dry surface soils. Smectite in particular and, to a lesser extent, attapulgite and illite, are clays with moderate to high cation exchange capacities (CEC). The formation as a whole should therefore have a relatively high CEC, which should inhibit the migration of charged contaminants, and especially ionic forms of metals.

Caliche is a major feature of the Ogallala Formation, occurring as nearly continuous to discontinuous layers throughout. A generalized geologic section at Cannon AFB is shown in Figure 2-1. Caliche is hard, white to pale tan on fresh surfaces, weathering to gray, and has a chalky appearance. Caliche forms as calcium carbonate, leached from overlying sediments, and precipitates in the pore space of the host sediments. Precipitation is caused by the evaporation of downward percolating water. The caliche may thus mark the position of ancient vadose zones. As reported in Lee Wan and Associates (1990) radiocarbon dates for the upper "climax" caliche range from approximately 27,000 years Before Present (B.P.) to approximately 42,000 years B.P.

Caliche is relatively soluble in acidic water (i.e., water with a pH less than 7) or in waters containing dissolved carbon dioxide. The top surface of the uppermost or "climax" caliche in a fresh outcrop typically shows solution etching.

The Ogallala has numerous continuous to discontinuous caliche layers throughout its thickness. The climax caliche, is pisolitic (i.e., consisting of spherical concentrically laminated aggregates 1 to 10 mm in diameter) (Lee Wan and Associates 1990). The pisolites are thought to have formed as the caliche was repeatedly chemically-weathered and brecciated during Pleistocene pluvials (wet climate episodes) and later recemented during drier intervals. This upper caliche crops out around playas and the bounding escarpments of the Ogallala, and is locally termed "caprock." The climax caliche is typically 3 to 5 feet thick. Caliches that occur lower in the Ogallala are platy and harder. Caliche may be thin or absent below playas (W-C 1991).

2.5 HYDROGEOLOGY

The lower portion of the Ogallala Formation is the primary regional aquifer for both potable and irrigation water. No deeper aquifers are utilized in the vicinity of Cannon AFB. The Ogallala aquifer is part of the High Plains Aquifer that extends continuously from Wyoming and South Dakota into New Mexico and Texas. In east-central New Mexico, the Ogallala aquifer rests on Dockum Group redbeds, which serve as the basal confining layer. The Ogallala is a water table, or unconfined, aquifer (Lee Wan and Associates 1990). The Ogallala aquifer has a southeasterly regional gradient of about 13 feet/mile. Well yields vary from less than one gallon per minute (gpm) in thin silts and sands, and up to 1,600 gpm in thick sands and gravels (Lee Wan and Associates 1990). Water quality is generally good, with hardness and fluorides being somewhat high (Lee Wan and Associates 1990).

At Cannon AFB, the depth to groundwater is greater than 200 feet, and the Ogallala aquifer has an average saturated thickness of 120 feet based on mid-1960s data. Saturated thickness ranges from 93 to 143 feet, and is influenced by the configuration of the erosional nonconformity surface marking the top of the Dockum Group. The local groundwater gradient is southeasterly at 7.5 feet/mile (Lee Wan and Associates 1990). Yields in tests of Cannon AFB water wells have ranged from 776 L/min (205 gpm) to 4,353 L/min (1150 gpm). Specific capacities range from 0.14 m^3/m (11.4 gal/ft) to 0.35 m^3/m (27.9 gal/ft) (Lee Wan and Associates 1990).

Very rough estimates of hydraulic conductivity were made from well pump tests in water wells 5 and 9 (Figure 2-2) using the Theis equation. An estimate of hydraulic conductivity for water well 8 was based on water level recovery data using the Bouwer and Rice approach (Lee Wan and Associates 1990). The data used in these calculations were obtained to evaluate pump rates, efficiency, and well yield, and were not intended for use in calculating aquifer properties. The results of these calculations should therefore be considered as first approximations.

Hydraulic conductivity values for water wells 5 and 9 were found to be approximately 2.0×10^{-3} cm/sec. Calculations for water well 8 resulted in a hydraulic conductivity of 2.0×10^{-2} cm/sec. In addition, slug testing of two monitoring wells (MW-O and MW-N) was completed by Woodward-Clyde in February 1995 (W-C 1995a). The estimated hydraulic conductivities from these slug tests were both 3×10^{-3} cm/sec. These estimates appear to be low when compared to published hydraulic conductivity data for sands and gravels. As reported in Lee Wan and Associates (1990), a groundwater flow velocity of about 45 m/yr (150 ft/yr) has been estimated. This calculates out to a hydraulic conductivity of approximately 1.0×10^{-1} cm/sec. Again, this appears to be low when compared with published data (Freeze and Cherry 1979).

The presence of interstitial clays may account for both the variability and the low values of hydraulic conductivities. Boring logs from Cannon AFB IRP projects and published reports (Lee Wan and Associates 1990) indicated that interstitial and interstratified clays are abundant in the Ogallala Formation.

Recharge to the Ogallala is primarily through precipitation. As reported in Lee Wan and Associates (1990), a recharge rate of 0.5 inches/year was calculated using the Theis equation. Lee Wan and Associates (1990) reported that the recharge rate may be as much as 1.0 inches/yr.

Due to the high evapotranspiration rate and low precipitation, recharge probably occurs only during heavy rainfall events in which the infiltration capacity of the soil is exceeded and runoff occurs, or during cool months when precipitation exceeds evapotranspiration. Excess runoff flows to playas, and the presence of water in playas may allow deep percolation to the aquifer. The occurrence of this process is evidenced by the presence of clay deposits in, and thin or nonexistent caliche layers directly below, playas. Caliche is soluble in acidic rainwaters, and is leached over time to form percolation pathways.

Discharge from the Ogallala occurs through well pumping and springs along the eroded margins of the formation. Spring discharge does not occur on or near Cannon AFB. Domestic and irrigation water wells are common on and around the Base, however. The rate of discharge exceeds the rate of recharge. Water levels in the Ogallala have declined steadily from the 1930s to the present. A decline of 50 to 100 feet has been observed in the area around Clovis, New Mexico for the period from the 1930s to 1980. Lee Wan and Associates (1990), states "the largest area of water level decline exceeding 100 feet occurs south of the Canadian River extending from Curry Co., New Mexico to Crosby Co., Texas."

The dominant uses of groundwater in the Cannon AFB area are as potable and irrigation water. Numerous wells are found in the Cannon AFB area, most of which provide only irrigation water (Figure 2-2).

The Ogallala will continue to be used as the primary source of potable and irrigation water for eastern New Mexico. The New Mexico State Engineer designated Curry County as a Water Basin in 1989. This designation allows for regulation of water rights, usage, and well drilling (W-C 1991).

2.6 SOILS

Soils in the vicinity of Cannon AFB are classified as SM to SC under the Unified Soil Classification System (USCS), and as aridisols (calciorthids) under the Soil Conservation Service Comprehensive Soil Classification System. The following summary is based on the Soil Conservation Service Curry County Soil Survey as reported in Lee Wan and Associates (1990).

The most common soil type on the Base is the Amarillo fine sandy loam, 0- to 2-percent slope phase (map symbol Ab on Figure 2-3). This soil consists of a thin sandy A horizon, well-defined clayey B_{1-3} horizons, with a calcic B_3 horizon at depths below 40 inches. The calcic B_3 horizon lies on a calcic C horizon, or on caliche. The Amarillo fine sandy loam is present on all relatively flat surfaces at the Base, but is also found on slopes associated with playas (map symbol Ac).

Clovis fine sandy loams, 0- to 2-percent slope phase (map symbol Cb) and 2- to 5-percent slope phase (map symbol Cc), are very similar to Amarillo fine sandy loams. In the Clovis soils, the depth to the calcic C horizon ranges from 28 to 56 inches. The depth to caliche exceeds 56 inches. Clovis and Amarillo fine sandy loams occur in close association.

In a few limited areas, particularly along the steeper slopes around playas, Mausker fine sandy loam, 0- to 2-percent slope phase (map symbol Ma), and 2- to 5-percent phase (map symbol M6) are found. Mausker fine sandy loams have no B horizons and are very calcareous. The calcic C horizon is within 2 feet of the surface.

The A and B horizons of Amarillo and Clovis fine sandy loams are rapidly to moderately permeable. Mausker fine sandy loam A and Ac horizons are rapidly permeable. Permeabilities in calcic B and C horizons are moderate (Lee Wan and Associates 1990).

2.7 Background Metals Concentrations in Soil

The natural soils in the vicinity of Cannon AFB are alkaline and generally rich in metals. Typically high concentrations of aluminum, iron, magnesium, manganese, and potassium combine with elevated levels of many other metals in the natural soils. Calcium is naturally present in the soils at levels up to nearly 200,000 mg/kg. Tightly cemented layers of "caliche" are present in several horizons in the natural soils and the Ogallala aquifer below.

The background levels of inorganic compounds in surface and subsurface soil at Cannon AFB are presented in Table 2-1 in the form of a mean value and statistical information on the ranges encountered for each element. Table 2-1 has been adapted from a final report by Woodward-Clyde dated September 1997 entitled "Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico". This report summarizes background data for soil from numerous past investigations in the vicinity.

The mean values and upper tolerance limits (UTLs) presented in Table 2-1 are the background levels used in the screening of soil chemical results for the supplemental assessments of AOCs A, B, and C. In addition to comparison to the UTL of the Base-wide background data (which is necessarily from a limited data set), other sources of naturally-occurring metals concentrations, such as USGS (1984), were considered when determining whether metals concentrations are within background levels.

2.8 WATER QUALITY

The groundwater quality at Cannon AFB is generally good, with dissolved solids ranging from 250 to 500 mg/L (Gutentag et al. 1984) and fluorides ranging from 2.2 to 2.7 mg/L (William Matotan and Associates, Inc. 1985).

TABLE 2-1

SUMMARY OF BACKGROUND ELEMENTAL CONCENTRATIONS[1] IN SOIL SAMPLES[2] AT CANNON AFB, NEW MEXICO

	Mean (x)		Standard Deviation (s)		95% Upper Tolerance Limit (UTL)of Background Concentrations	
Element	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil	Surface Soil	Subsurface Soil
Aluminum	5,508	5,932	1,964	2,183	8,950	12,214
Antimony	ND (3)	ND (3)	ND (3)	ND (3)	3.15 (3)	16 (3)
Arsenic	2.1	2.1(4)	0.48	0.96 (4)	3.6	4.3 (4)
Barium	100	210	165	199	670	890
Beryllium	0.35 (4)	0.35 (4)	0.13 (4)	0.17 (4)	0.78 (4)	0.73 (4)
Cadmium	ND (3)	ND (3)	ND (3)	ND (3)	0.435 (3)	1.3 (3)
Calcium	5,645	89,410	11,366	64,611	44,800	237,498
Chromium (total)	7.1	5.6	1.3	2.33	10.5	13.3
Cobalt	2.9	2.6 (4)	1.0	1.4 (4)	6.6	4.7 (4)
Copper	6.8	3.8 (4)	4.6	1.97 (4)	18.3	8.3 (4)
Iron	6,458	5,148	1,349	2,262	10,100	13,148
Lead	6.8	4.7	1.6	1.7	12	8.7
Magnesium	1,066	4,260	390	3,856	1,930	19,300
Manganese	139	83	51	50	307	333
Mercury	0.025 (4)	ND (3)	0.016 (4)	ND (3)	0.056 (4)	0.019 (3)
Nickel	5.5	5.9 (4)	1.6	2.41 (4)	11	14.9 (4)
Potassium	1,345	1,222	413	417	2,691	2,512
Selenium	ND (3)	0.47 (4)	ND (3)	0.31 (4)	0.26 (3)	1.1 (4)
Silver	--- (5)	ND (3)	--- (5)	ND (3)	0.4 (5)	2.65 (3)
Sodium	91	351(4)	10	253 (4)	102	1,227 (4)
Thallium	ND (3)	ND (3)	ND (3)	ND (3)	0.6 (3)	2.65 (3)
Vanadium	14.9	16	2.8	5.2	23.3	32.8
Zinc	15.4	12.1	5.2	4.8	32.2	30.6

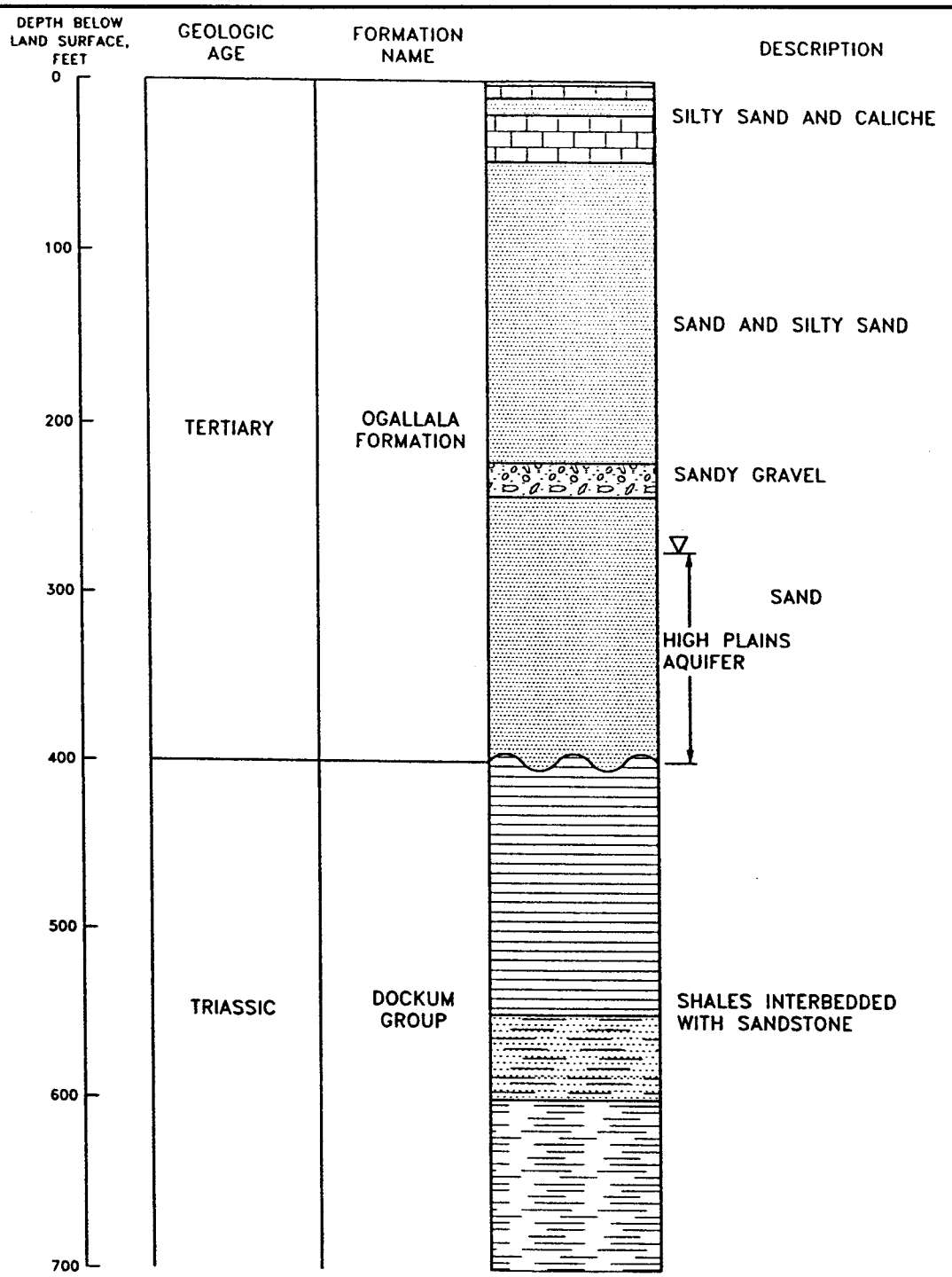
(1) All concentrations are in milligrams per kilogram (mg/kg).

(2) From report entitled "Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico" (W-C 1997).

(3) All analytical samples were nondetect; therefore, a mean and standard deviation was not calculated. One-half the highest reporting limit is used as the 95% UTL. The actual mean, standard deviation, and UTL may be less than these values.

(4) Values determined from a data set including one-half of the reporting limits for nondetects.

(5) Silver was detected in only one sample; therefore, a mean and standard deviation was not calculated. The single detected concentration is used as the 95% UTL.



LEGEND

LITHOLOGIC CONTACT

EROSINOAL UNCONFORMITY

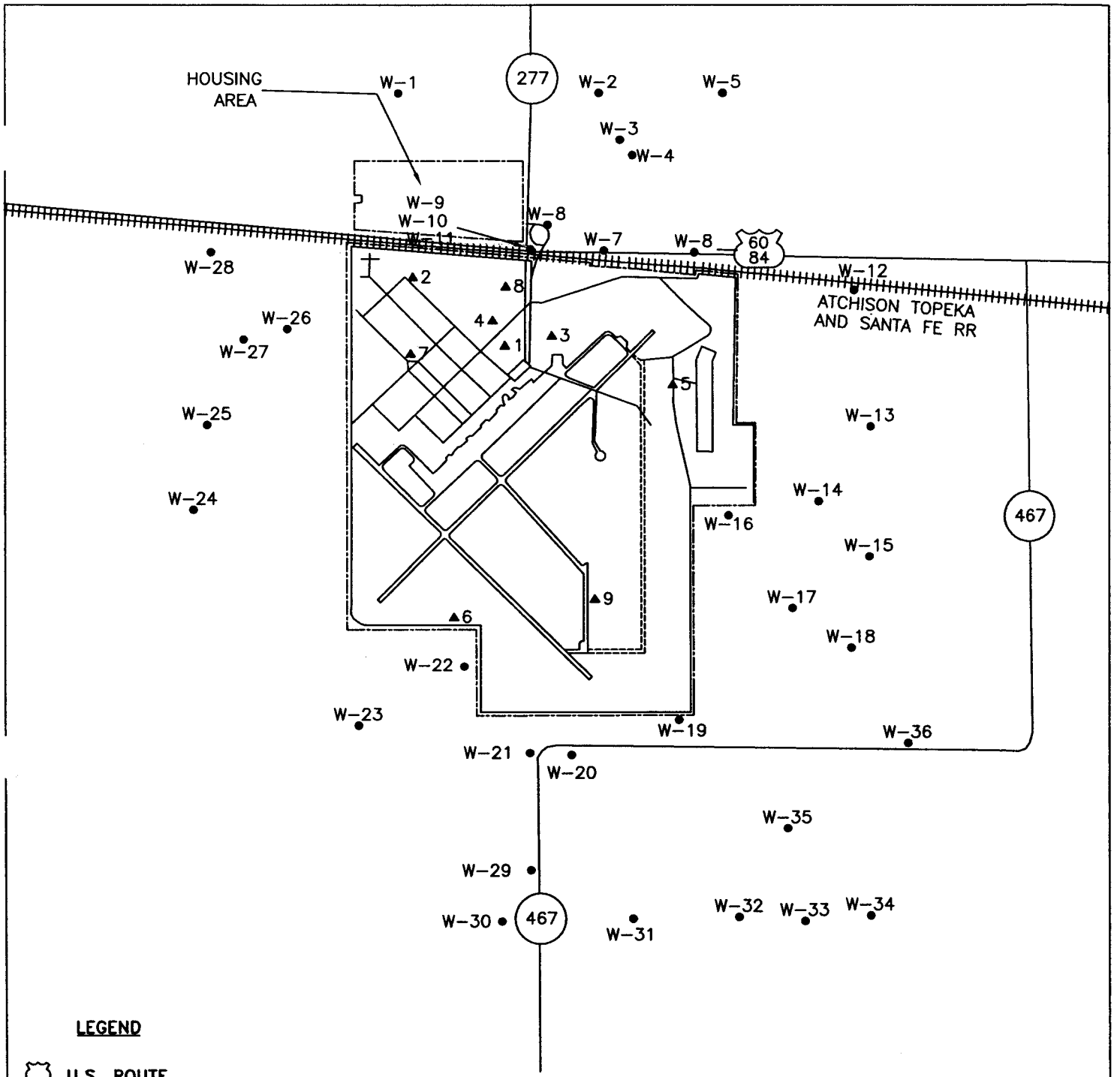
WATER LEVEL

SOURCE: NODIFIED FROM GUTENTAG ET.AL., 1984

GENERALIZED GEOLOGIC STRATA AT
CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO

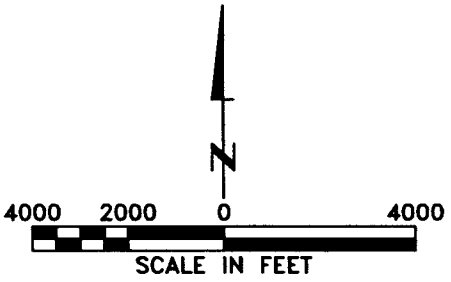
DRN. BY: DPG	DATE: 01/07/05	PROJECT NO.	FIG. NO.
CHK'D. BY:	REVISION:	16169869	2-1

January 07, 2005 2:03:19 p.m.
Drawing: T:\CANNON\16169869\2\fig2-1.dwg



LEGEND

- U.S. ROUTE
- STATE ROUTE
- BASE WATER WELL
- VICINITY WATER WELL

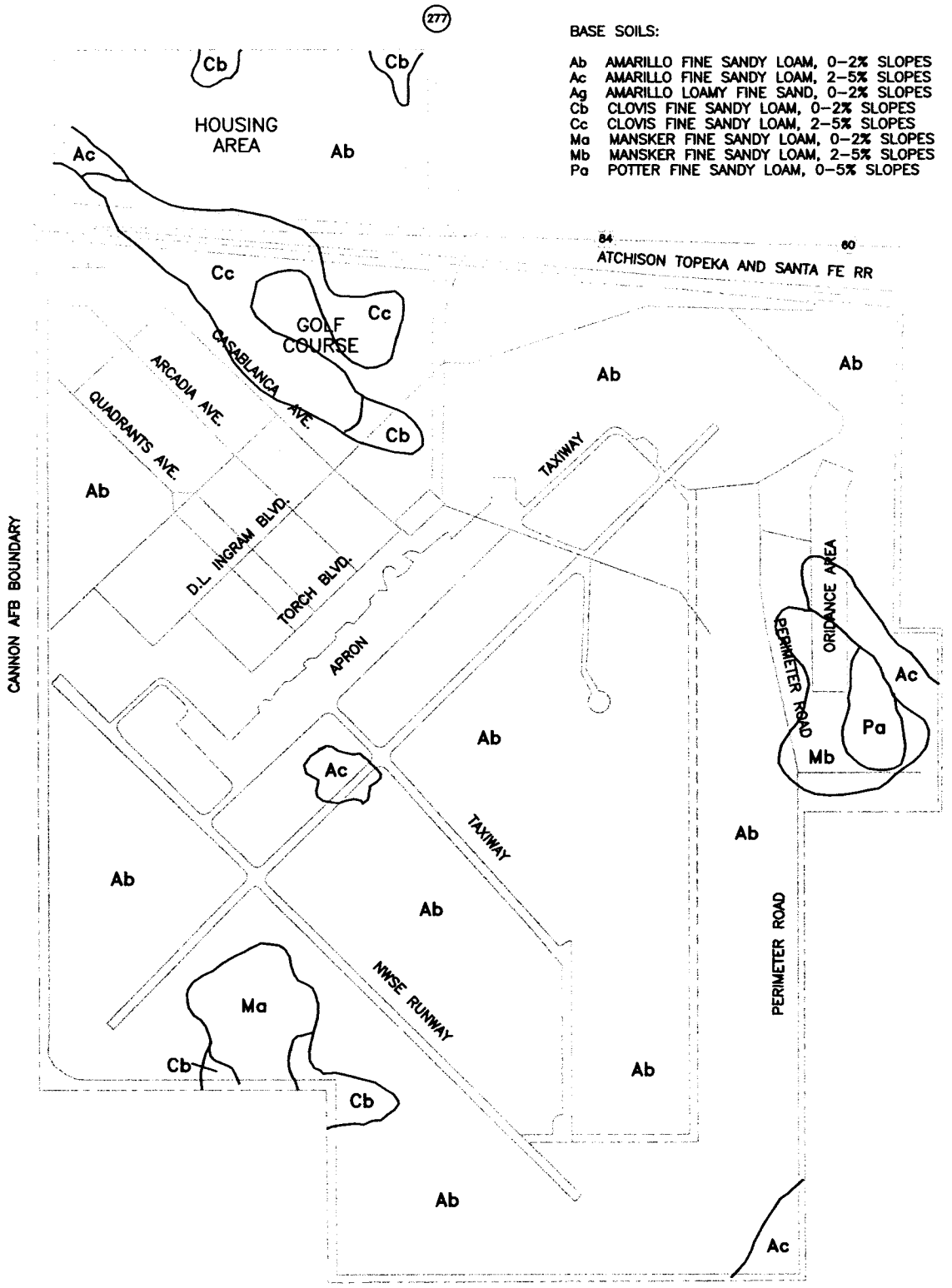


SOURCE: MODIFIED FROM BUTENTAG ET. AL., 1984

WATER WELL LOCATIONS ON AND NEAR
CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO

DRN. BY: DPG	DATE: 12/5/00	PROJECT NO.	FIG. NO.
CHK'D. BY:	REVISION:	16169869	2-2

January 07, 2005 1:35:32 p.m.
Drawing: T:\CANNON\16169869\2\fig2-2.dwg



SOURCE: USDA-S.C.S., SOIL SURVEY OF CURRY COUNTY N.M., 1958

N

2000 1000 0 2000

SCALE IN FEET

January 07, 2005 1:36:59 p.m.
Drawing: T:\CANNON\16169869\2\fig2-3.dwg

DISTRIBUTION OF SOILS BY TYPE AT CANNON AIR FORCE BASE CLOVIS, NEW MEXICO			
DRN. BY: DPG	DATE: 12/5/00	PROJECT NO. 16169869	FIG. NO. 2-3
CHK'D. BY:	REVISION:		

3.1 DESCRIPTION OF THE DECISION PROCESS

The following decision process has been used to assess the data needs and investigative approach for AOCs A, B, and C. The Data Quality Objective (DQO) evaluation process is designed to provide soil data of sufficient quality and quantity to evaluate whether a release has occurred that could pose a risk to human health and to evaluate the need for further evaluation, such as collection of additional data, completion of a Baseline Risk Assessment (BRA), or possibly completion of a Feasibility Study (FS).

A general decision diagram (Figure 3-1) was developed for the Cannon AFB AOCs A, B, and C to present a logical decision process that will be used to evaluate the data resulting from the investigation to assure that project objectives are met.

The soils investigation decision process is designed to identify appropriate actions based on three alternative actions: no further action, interim action, and further investigation or evaluation. The recommendation for the selection of alternative action will depend upon whether chemicals of potential concern (COPCs) are detected in soils at levels that may pose an unacceptable risk to human health or the environment. This section provides a summary of the decision-making process that will be used.

The decision process will be implemented by first evaluating and summarizing existing historical information and analytical data. Historical information will be used to identify COPCs and to identify potential sites of chemical release.

Soil will be sampled and analyzed for COPCs. The analyte lists from which COPCs will be selected are discussed in the QAPP (Appendix A). Site-related COPCs will then be selected based on the results of the sampling program. Metals that do not exceed background levels, and chemicals that are attributable to field or laboratory contamination, will not be included as site-related COPCs. Organic chemicals that do not have USEPA-established toxicity factors will not be evaluated quantitatively, but their potential contribution to site risks will be evaluated qualitatively.

The potential for site-related contaminants to impact groundwater will be assessed by evaluating the vertical distribution of contaminants in the soil column. If the concentrations of COPCs decrease significantly with depth, and the concentrations are below levels that are likely to migrate to groundwater (based on fate and transport properties of the contaminant and the vadose zone), the potential for transport to groundwater will be considered insignificant, and no further action will be recommended. If the concentrations do not decrease with depth, further investigation of the groundwater pathway will be recommended. If the concentrations are at levels that could potentially migrate to groundwater at concentrations of concern (based on comparison to NMED SSLs), fate and transport modeling will be done to evaluate the potential for contaminant transport to groundwater.

Concentrations of COPCs detected will be evaluated for potential human health and environmental risks by comparing maximum detected concentrations (which are likely higher than concentrations to which human receptors would routinely be exposed) to highly

conservative (protective) human health risk-based concentrations (i.e., NMED SSLs). This conservative screening approach permits identifying sites that pose no unacceptable risk under highly conservative exposure assumptions and that, therefore, warrant no further evaluation or action. The approach also permits identification of sites that may warrant further evaluation based on exceedance of stringent risk-based concentrations. The methods used in the screening-level human health risk evaluations are presented in Section 3.6.

The results of this evaluation will be used to make recommendations regarding the three alternatives stated above. The recommendations will be made on the following basis:

- If the vertical extent and lateral extent of contamination has been defined, no threat to human health exists based on comparison of maximum concentrations (excluding metals/pesticides below background, field/lab contaminants) to NMED SSLs, and no potential threat to the environment is apparent, then no further action will be recommended.
- If an unacceptable threat to human health is imminent, a source is well defined, and a source control is readily identified, an interim action to control the source will be recommended.
- If there is a potential significant threat to human health based on exceedance of NMED SSLs, further investigation will be recommended for the site. Further investigation may include additional field investigation and/or a BRA.

3.2 DEVELOPMENT OF SITE CONCEPTUAL EXPOSURE MODELS (SCEMs)

The initial step in the evaluation of the site is the development of a Site Conceptual Exposure Model (SCEM), which provides a framework for evaluating potential risks associated with the site, aids in the identification of data needs, and assists in the identification of appropriate preliminary remediation goals targeted to significant exposure pathways. Upon completion of the field sampling program, the SCEM will be reviewed and modified (if necessary) in order to re-evaluate the site, taking into consideration the analytical results and fate and transport properties of site-related chemicals.

The SCEMs present chemical release sources and transport media, potential human receptors, and intake mechanisms for each potential exposure pathway. An exposure pathway describes the means by which release, transport, and intake by receptor populations of site-related COPCs occurs. An exposure pathway consists of four necessary elements:

- A source and mechanism of chemical release to the environment
- An environmental transport medium for the released chemical (e.g., air, groundwater, or surface water)
- A point of potential human exposure to transported chemicals (e.g., a domestic drinking water well)
- A human intake mechanism (e.g., inhalation or ingestion) at the point of exposure

All four elements must be present for an exposure pathway to be complete and for chemical exposure to occur. In the SCEM, potentially significant pathways are denoted with solid lines,

and pathways that are considered to be insignificant relative to other pathways are denoted with dashed lines.

Potential exposure pathways are evaluated with respect to potential chemical sources at the site. Exposure pathways are considered to be potentially complete if there are chemical release and transport mechanisms and identified exposure points and receptors for that exposure pathway. Incomplete exposure pathways do not result in actual exposure to human or environmental receptors and, therefore, do not pose a potential risk. Incomplete exposure pathways are not shown on the SCEM. Insignificant pathways are those that could conceivably be complete and result in an exposure, but the resulting exposure would undoubtedly be at levels that would not pose a significant risk.

The SCEMs for AOCs A, B, and C are presented in Figures 3-2 through 3-4, respectively. The primary source at AOC A is motor gasoline (MOGAS) spilled at the site, in two separate events, from overturned fuel trucks. The primary source at AOC B is JP-4 fuel that spilled at the site from a fuel truck because of broken fuel line coupling. The primary source at AOC C is three capacitors that were ruptured at the site by a lightning strike, spilling dielectic fluid believed to contain polychlorinated biphenyls (PCBs).

Chemicals from the primary sources may be transported away from the primary source areas, affecting other media that may in turn act as secondary sources. Percolation and leaching of the wastes to the subsurface soil are shown as primary chemical release mechanisms. Subsurface soils are an important secondary source of potential chemical release. Site-related chemicals in soils may infiltrate/percolate through the soil and be released to groundwater.

Other release mechanisms, such as direct contact (soil ingestion and dermal contact), surface runoff, wind erosion, or volatilization to the atmosphere, are also depicted in the SCEMs. Transport by storm runoff is not considered a significant pathway for human exposure at the AOCs because there are no developed drainageways at the sites and portions of the sites are covered with pavement.

Surface soils may provide exposures to Base workers (occupational exposures), hypothetical future construction workers, future trespassers, or residents. AOCs A and B are located in industrialized areas of the Base; therefore, residential development is not a likely future land use. Residential exposures are possible at AOC C because the suspected area is near the Base residential housing areas. Air emissions (volatile and particulates) from surface soil may also provide exposures to Base workers, construction workers, trespassers, and residents. Subsurface soils and air emissions from subsurface soil (i.e., during excavation) may provide exposures to construction workers. Groundwater is used for domestic purposes on and off Base.

Contact with surface soil is considered to be the only complete and significant pathway for ecological receptors. However, due to the small size of the AOCs, it is unlikely that significant populations of valued ecological resources are present at the sites. Therefore, a screening-level ecological risk assessment is not warranted.

3.3 CRITICAL DATA

Critical data are data that are crucial for decision-making (e.g., determining whether a site warrants no further investigation or whether additional investigation should be considered). Critical data may be from special sampling locations or from a selected subset of samples from locations of roughly equal importance. Data from a specific field sample such as a soil sample immediately downgradient of a discharge point, may be designated as critical if it were necessary to know contaminant concentrations at that specific location for source or exposure pathway characterization. In other cases, data from a selected number of any of several field samples (e.g., a subset of all the surface soil samples taken at a site) may be designated as critical when the objective is to estimate mean contaminant concentrations over an area.

Following USEPA guidelines (USEPA 1989), critical data must be from environmental media representing each major exposure pathway and must be 100 percent complete, that is, valid results must be obtained for all data deemed critical. A complete set of critical data may be taken from more than one sample (i.e., if one sample has missing or rejected analytes, data from another comparable sample can be used to complete the critical data set). If the missing or rejected data do not hinder the decision-making process (e.g., they are not potential COPCs), they are not considered to be critical data, and the critical data set is still 100 percent complete. If decisions cannot be made because of missing or rejected data, a recommendation will be made that the project managers determine what corrective action should be taken. COPCs are defined as chemicals that are site-related (i.e., they are derived from the site and are at concentrations that exceed background levels); and that have USEPA-derived toxicity factors (i.e., carcinogenic slope factors or noncarcinogenic reference doses) or that have potential toxicity that can be addressed qualitatively (e.g., lead). COPCs will be derived from the analyte list described in the QAPP (Appendix A). This procedure permits retaining valid data from the original data set and compiling a complete, representative, and valid set of critical data without unnecessary resampling.

3.4 DETECTION LIMITS

To select appropriate analytical methods, method detection limits have been compared with analyte-specific concentrations of concern such as NMED SSLs. SSLs are concentrations that under given exposure assumptions, will produce a specified risk. For this discussion, NMED SSLs are based on excess carcinogenic risks of 1×10^{-5} and a non-carcinogenic hazard quotient of 1.

3.5 EVALUATION OF BACKGROUND CONCENTRATIONS

A comparison of AOC sample concentrations to background concentrations will be used to determine whether metals detected in soil samples are site related. The following sections describe the approach that will be used.

Soils are derived from parent geologic materials as a result of physical, chemical, and biological processes. The soil system is a highly heterogeneous matrix of inorganic and organic

components. The relative proportions of these components are dependent upon factors influencing soil formations, such as topography, climate, depositional processes, and time (Sposito and Page 1984). Total concentrations of metals in soils may vary depending upon location; for example, at the surface, soils are influenced by leaching, runoff, atmospheric deposition, and biotic uptake, as well as anthropogenic activity. The ranges of naturally occurring or "background" concentrations of metals in soils is greatly varied due to the composition of parent material and, therefore, care must be taken in the interpretation of metals data generated during an investigation.

For the supplemental assessments of AOCs A, B, and C, metals concentrations in AOC soils will be compared to background soils concentrations presented in "Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico" (W-C 1997). The approach will compare the maximum concentrations detected at a given AOC to the 95 percent upper tolerance limit (UTL) of the background concentrations. Using this technique, individual samples at the AOCs with high concentrations relative to background levels (i.e., which could represent a site-related release) can be identified. In addition, concentrations detected in AOC soils will be compared to regional soils metals concentrations reported in the literature.

3.6 SCREENING-LEVEL HUMAN HEALTH RISK EVALUATION METHODOLOGY

This section provides a description of the approach that will be used in the screening-level human health risk evaluation for AOCs A, B, and C. Potential human health impacts will be evaluated by comparing maximum chemical concentrations (of chemicals that exceed background) found at the site to NMED SSLs.

The goal of this evaluation process is to make a determination as to whether or not a release has occurred at an AOC that could pose a potential risk to human health. The risk-based approach outlined in this section provides an upper-bound estimate of potential human health impacts because conservative screening criteria and maximum chemical concentrations are used to estimate potential impacts. If the vertical extent and lateral extent of contamination has been defined and no potential human health risks are indicated for an AOC using these conservative criteria, then no further investigation is recommended for the AOC.

3.6.1 Derivation of Screening Criteria

The SSLs will be taken from the NMED table, which is provided in Appendix D (NMED 2004). The latest available version will be used. These SSLs are based on 1×10^{-5}excess cancer risk or a hazard quotient equal to 1 for non-carcinogens. It must be emphasized that this is a highly conservative approach used for screening purposes only; risks that would be estimated in a site-specific quantitative BRA are likely to be much lower than the risk levels calculated using these screening criteria. A maximum chemical concentration that exceeds a screening-level SSL does not mean that a health risk exists because the maximum concentration detected is not the concentration to which people would routinely be exposed, and the exposure assumptions used to derive the SSLs are not site-specific.

For a carcinogen, the soil SSL is the concentration of a chemical in soil that is estimated to result in an excess cancer risk of 1×10^{-5} for carcinogens, assuming long-term (30-year) daily exposures. A range of 1×10^{-6} to 1×10^{-4} (1 in 1,000,000 to 1 in 10,000) is USEPA's target excess cancer risk range for cleanup under CERCLA and the Resource Conservation and Recovery Act (RCRA) (USEPA 1991). Therefore, SSLs based on a target risk of 1×10^{-5} are conservative (protective) values, and exceedances of these SSLs do not necessarily mean that a health risk is present. Exceeding the SSLs may mean, however, that further evaluation of chemical concentrations, exposure assumptions, and carcinogenicity may be warranted.

For noncarcinogens, SSLs are the concentrations in soil that are estimated to result in a "hazard quotient" (HQ) of 1.0. A hazard quotient is the ratio of the estimated daily dose from the assumed exposure to a reference dose (RfD), established by NMED, that is considered safe for a lifetime of daily exposure. A hazard quotient of 1.0 means that no toxic effects are likely to occur, even to sensitive individuals exposed for a lifetime. An HQ above 1 does not mean that toxic effects will necessarily occur, but that further evaluation of exposures and chemical toxicity is required. It should be noted that unlike the risks for multiple carcinogens, the HQs for multiple noncarcinogens cannot simply be added together to account for the additive risks associated with chemical mixtures. To account for noncarcinogenic additivity, SSLs will be divided by 10 for the screening-level human health risk evaluation.

NMED SSLs for soil exposures are based on the ingestion, inhalation, and dermal exposure routes. Soil SSLs are available for industrial and residential scenarios. AOCs A and B are located in industrialized areas of the Base; therefore, industrial SSLs will be used for screening at these sites. AOC C is located near the residential housing areas; therefore, residential SSLs will be used for this area.

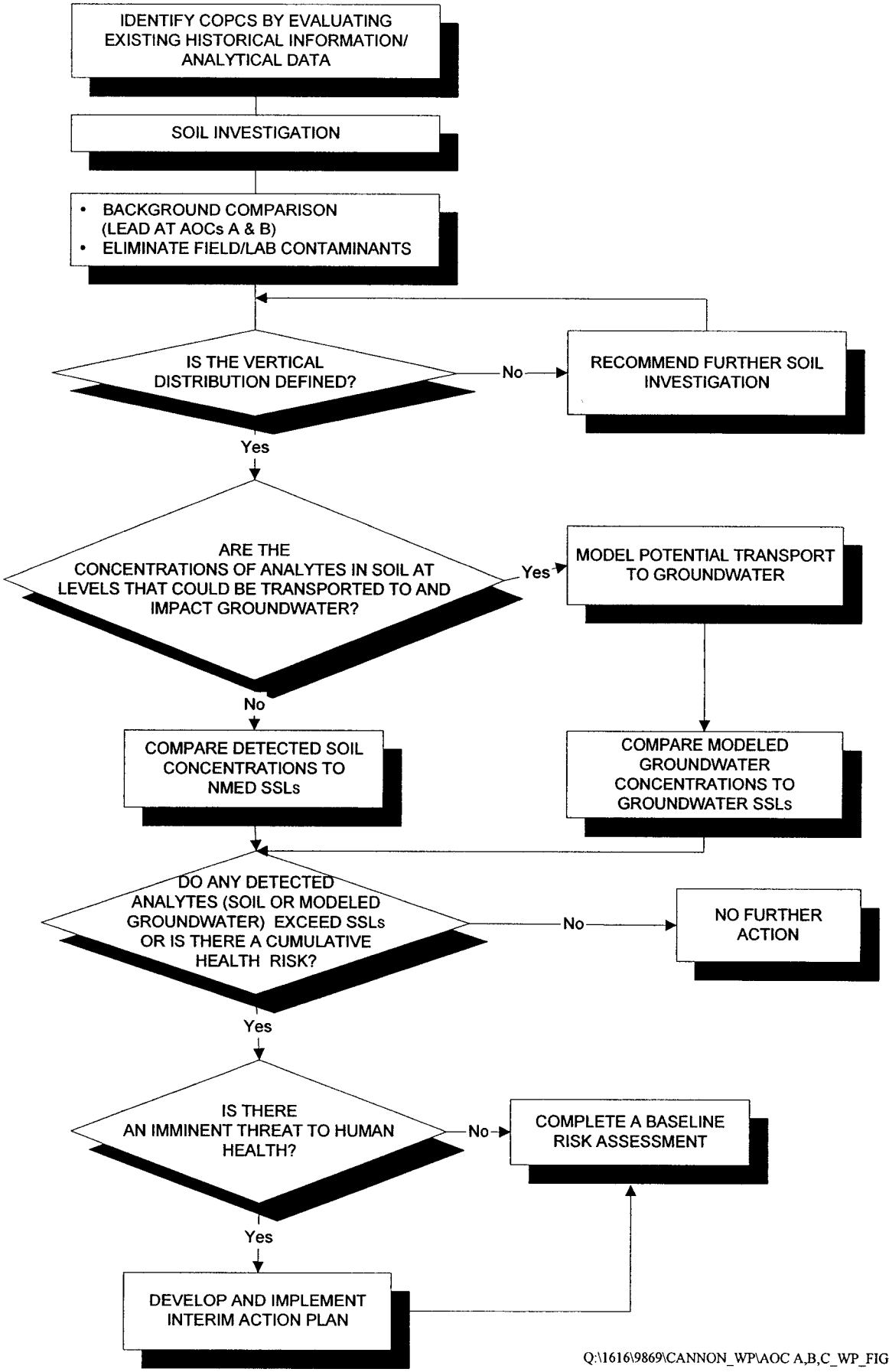
It is important to note that SSLs are not cleanup goals. Cleanup goals are determined on a site-specific basis. Rather, comparing soil concentrations to screening-level SSLs is adopted as a means of screening whether the chemicals in soils could pose a threat to human health. If the screening-level SSLs are not exceeded, no further action is recommended. If the screening-level SSLs are exceeded, further evaluation of potential risks will be completed.

SSLs for Lead in Soil

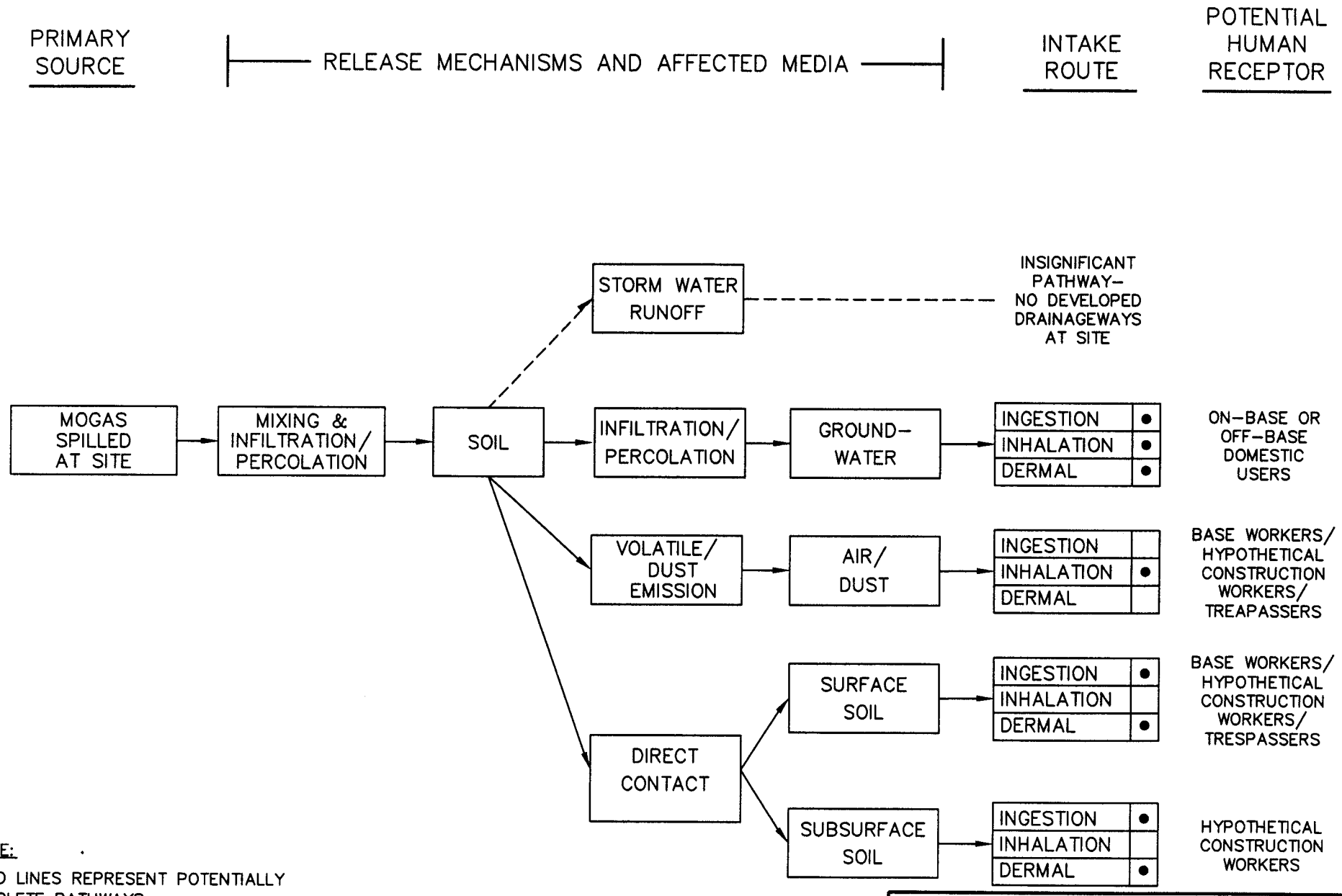
USEPA withdrew the toxicity factor (i.e., the RfD) for lead in 1989, primarily due to the lack of a discernible threshold dose and because of the numerous sources of lead in the environment. However, USEPA guidance (USEPA 1994) recommends an interim soil lead concentration of 400 mg/kg for residential scenarios at Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA) and RCRA corrective action sites. This level is supported by USEPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model (USEPA 1994), which predicts that exposures of children ages 0 to 6 years to soils with approximately these levels will not result in blood lead levels that exceed a level of concern (10 µg/dL) established by the Centers for Disease Control. The interim soil lead concentration is the level above which there is sufficient concern that a site-specific study of risks should be conducted if exposure to children is expected at the site. Based on the 400 mg/kg residential soil-screening level for lead, NMED set the industrial soil SSL for lead at 750 mg/kg.

FIGURE 3-1

CANNON AFB
DECISION DIAGRAM FOR SUPPLEMENTAL ASSESSMENT AT AOCs A, B, AND C



Q:\1616\9869\CANNON_WP\AOC A,B,C_WP_FIGURE3-1.VSD



NOTE:

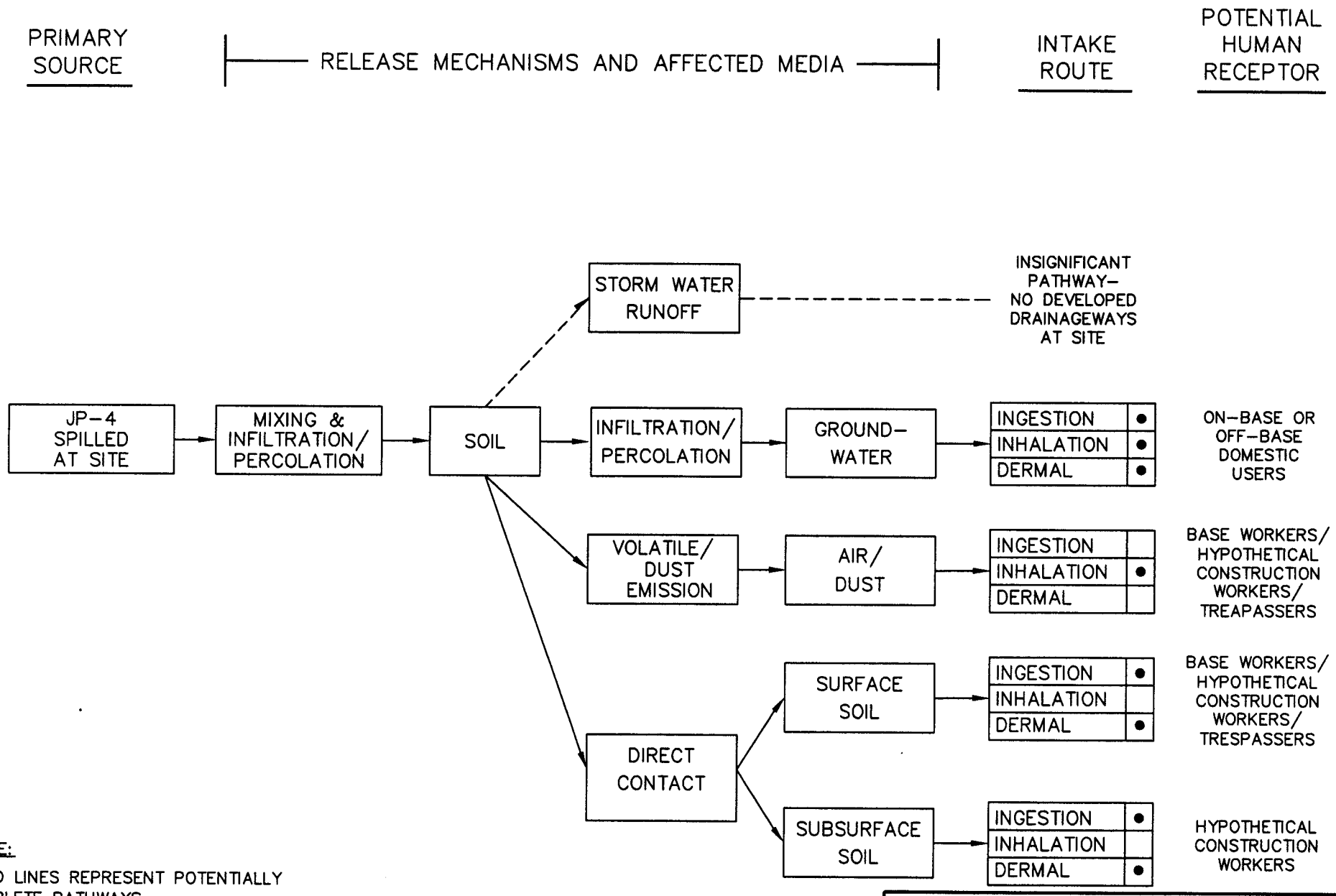
SOLID LINES REPRESENT POTENTIALLY COMPLETE PATHWAYS

DASHED LINES REPRESENT INCOMPLETE OR INSIGNIFICANT PATHWAYS

SITE CONCEPTUAL EXPOSURE MODEL
AOC A – HUMAN EXPOSURES
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 01/06/05	PROJECT NO. 16169869	FIG. NO. 3-2
CHK'D. BY:	DATE:		

January 07, 2005 1:37:42 p.m.
Drawing: T:\CANNON\16169869\2\fig3-2.dwg



NOTE:

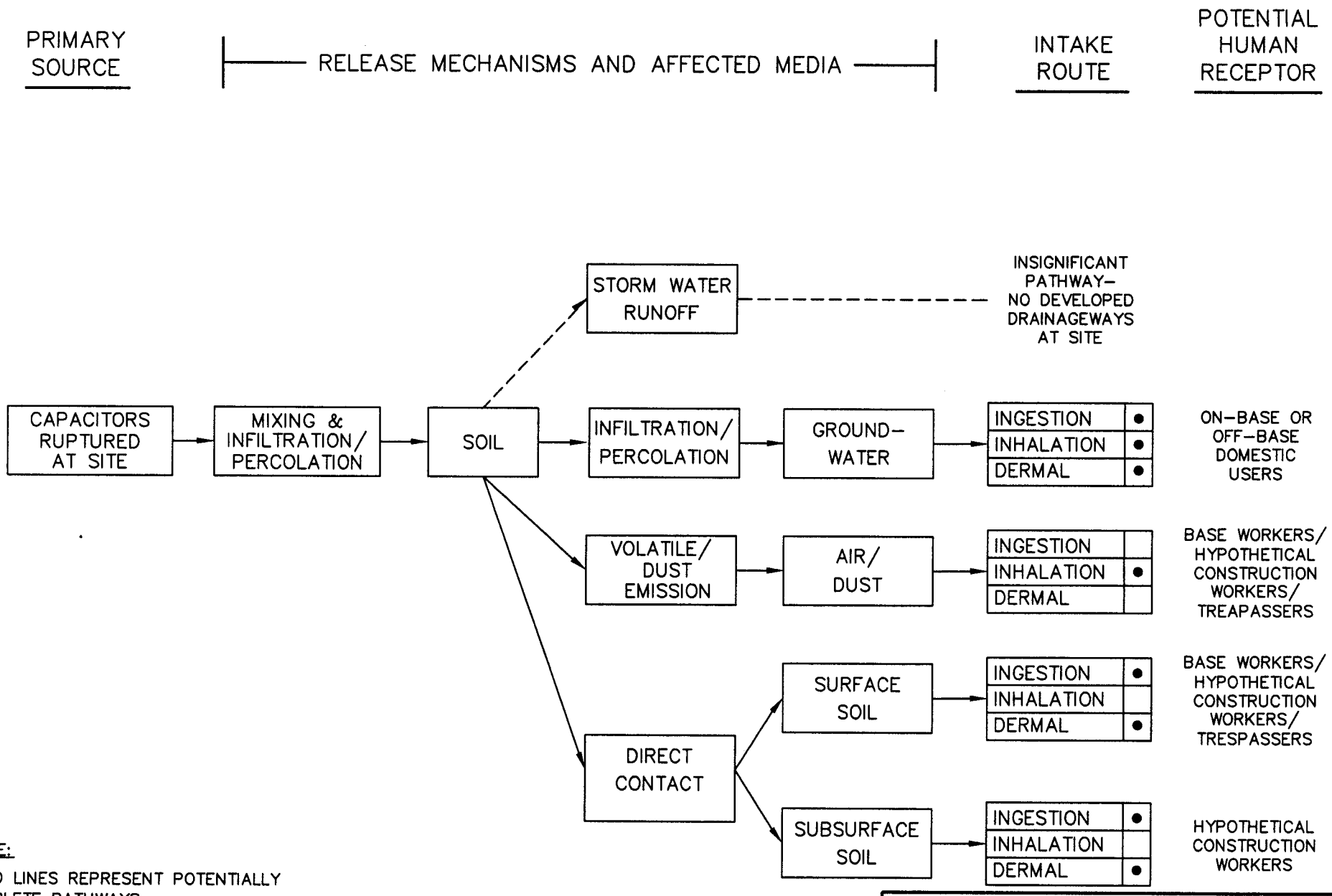
SOLID LINES REPRESENT POTENTIALLY COMPLETE PATHWAYS

DASHED LINES REPRESENT INCOMPLETE OR INSIGNIFICANT PATHWAYS

SITE CONCEPTUAL EXPOSURE MODEL
AOC B – HUMAN EXPOSURES
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 01/06/05	PROJECT NO.	FIG. NO.
CHK'D. BY:	DATE:	16169869	3-3

January 07, 2005 1:38:03 p.m.
Drawing: T:\CANNON\16169869\2\fig3-3.dwg



NOTE:

SOLID LINES REPRESENT POTENTIALLY COMPLETE PATHWAYS

DASHED LINES REPRESENT INCOMPLETE OR INSIGNIFICANT PATHWAYS

SITE CONCEPTUAL EXPOSURE MODEL
AOC C – HUMAN EXPOSURES
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 01/06/05	PROJECT NO.	FIG. NO.
CHK'D. BY:	DATE:	16169869	3–4

January 07, 2005 1:39:06 p.m.
Drawing: T:\CANNON\16169869\2\fig3–4.dwg

The following section provides a description of each of the AOCs being investigated during the supplemental assessments at Cannon AFB. The locations of the AOCs are shown on Figure 1-1. This section describes each AOC and briefly discusses the potential contaminants that may be present at each site, the existing conditions at each AOC, sampling objectives, and proposed sampling locations and frequencies. Sample designation, sampling equipment and procedures, and sample handling, documentation, and analysis are also presented in this section.

Soil sampling will be completed using a truck-mounted drill rig and stainless-steel split-spoon samplers, according to the applicable SOPs in Appendix C. Soil boring locations will be finalized on the basis of utility clearances and drilling rig access, and will be agreed upon by Cannon AFB and USACE personnel before drilling commences.

4.1 AOC A (MOGAS SPILL SITE, SS-19)

4.1.1 Site Description

AOC A is the site of two spills of motor gasoline (MOGAS) from overturned fuel trucks. The site measures approximately 400 by 200 feet. Both spills occurred in the early 1960s at the present location of Argentia Avenue, across from the refueling area of Facility No.379, and southeast of the gymnasium (Building 444) in the north-central region of the Base. The total quantity of MOGAS spilled is estimated to be 2,000 to 3,000 gallons. The physical features of the site were changed in 1977 during the construction of Building 444; a portion of the spill site is now under Argentia Avenue (Radian 1986).

In 1985, two soil borings were each drilled to 60 feet below ground surface (bgs) and sampled as part of a Phase II, Stage 1 investigation conducted by Radian at AOC A. Three soil samples from each boring were analyzed for oil and grease, lead, and purgeable aromatics. Lead and one purgeable organic (1,2-dichloroethene, detected in a duplicate but not in the associated sample) were present in relatively low concentrations (i.e., all concentrations are below the current NMED residential SSLs). No oil and grease was detected in any of the samples (HARZA 1997).

4.1.2 Sampling Objectives

The overall sampling objectives at AOC A (MOGAS Spill Site) are to evaluate the presence or absence of contamination in surface and subsurface soil adjacent to and beneath the location of the two MOGAS spills. This information is required to assess whether any contamination present poses a significant risk to human health or the environment. Media impacted by contamination will be identified and the magnitude of any such impacts will be estimated. Site-specific objectives are to:

- Determine the presence or absence (and vertical and lateral extent, if possible) of contamination at the site.
- Evaluate the potential for constituents of concern in soil, if any, to impact groundwater.
- Develop a site characterization that will permit determination of the need for additional investigation and of the scope of work for the next phase of investigation, if needed.

Information gathered for this investigation will be used to develop a conceptual model of the site.

4.1.3 Sampling Locations, Frequencies, and Analysis

The following site-specific activities will be completed to meet the objectives stated in Section 4.1.2. The projected soil sampling breakdown for AOC A is shown in Table 4-1.

4.1.3.1 Soil Borings

Four soil borings will be drilled to depths of 25 feet bgs at the location of the former spill site using hollow-stem augers. Soil samples will be collected at five-foot intervals beginning at the ground surface (six samples per boring).

Samples will be screened in the field using headspace analysis, and at least one sample from each boring will be submitted for laboratory analysis for individual fuel constituents (i.e., volatile organic compounds [VOCs] and semivolatile organic compounds [SVOCs]) and lead. Samples for VOC analysis will be collected using EnCore® samplers in accordance with SOP No. 19. Samples will be selected for analysis based on headspace readings and field observations (e.g., color and odor). If field screening and observations are all negative for fuel oil contamination, the two deepest samples from each boring will be submitted for analysis.

Each sample will be field screened for headspace analysis in accordance with SOP No. 15. Field screening results will be recorded in the boring logs and in a field logbook. The samples will be submitted for the following chemical analyses:

- Target Compound List (TCL) VOCs by USEPA Method 8260B
- TCL SVOCs by USEPA Method 8270C
- Lead by USEPA Method 6010B

Results of the field investigation will be presented as part of the supplemental assessment report. Chemical analytical results will be compared to NMED soil screening levels. The results will be included in the supplemental assessment report.

4.2 AOC B (JP-4 FUEL SPILL SITE, SS-18)

4.2.1 Site Description

AOC B is the site of a JP-4 spill from an aircraft fuel tank onto a concrete parking apron as a result of a broken fuel line coupling. The spill occurred in 1980 in the west-central portion of the Base. The total quantity of JP-4 spilled is estimated to be 400 gallons. A minor amount of fuel may have infiltrated soil through cracks and joints in the concrete apron, but most of the fuel likely evaporated from atop the apron (HARZA 1997). The site was located on the south parking apron, southwest of Building 120 (CH2M Hill 1983). Since the time of the spill, Building 120 has been moved to a new location and a new facility has been constructed over the site.

As part of the preparations for construction of a new hangar, 13 soil borings were drilled and sampled within 600 feet of AOC B by Radian in 1992. One of these borings (BH-7) was completed within 100 feet of AOC B. Samples from these borings were analyzed for total recoverable petroleum hydrocarbons (TRPH), total petroleum hydrocarbons (TPH) purgeables, TPH extractables, and VOCs. None of the analytes were detected in BH-7 and no significant concentrations of analytes were present in samples from any of the 13 borings (i.e., all concentrations are below the current NMED residential SSLs) (HARZA 1997).

4.2.2 Sampling Objectives

The overall sampling objectives at the AOC B (JP-4 Fuel Spill Site) are to evaluate the presence or absence of contamination in surface and subsurface soil adjacent to the location of the JP-4 spill. This information is required to assess whether any contamination present poses a significant risk to human health or the environment. Media impacted by contamination will be identified and the magnitude of any such impacts will be estimated. Site-specific objectives are to:

- Determine the presence or absence (and vertical and lateral extent, if possible) of contamination at the site.
- Evaluate the potential for constituents of concern in soil, if any, to impact groundwater.
- Develop a site characterization that will permit determination of the need for additional investigation and of the scope of work for the next phase of investigation, if needed.

Information gathered for this investigation will be used to develop a conceptual model of the site.

4.2.3 Sampling Locations, Frequencies, and Analysis

The following site-specific activities will be completed to meet the objectives stated in Section 4.2.2. The projected soil sampling breakdown for AOC B is shown in Table 4-2.

4.2.3.1 Soil Borings

Two soil borings will be drilled to depths of 25 feet bgs off the edge of the concrete parking apron near the former spill site using hollow-stem augers. Soil samples will be collected at five-foot intervals beginning at the ground surface (six samples per boring).

Samples will be screened in the field using headspace analysis, and at least one sample from each boring will be submitted for laboratory analysis for individual fuel constituents (i.e., VOCs and SVOCs) and lead. Samples for VOC analysis will be collected using EnCore® samplers in accordance with SOP No. 19. Samples will be selected for analysis based on headspace reading and field observations (e.g., color and odor). If field screening and observations are all negative for fuel oil contamination, the two deepest samples from each boring will be submitted for analysis.

Each sample will be field screened for headspace analysis in accordance with SOP No. 15. Field screening results will be recorded in the boring logs and in a field logbook. The samples will be submitted for the following chemical analyses:

- TCL VOCs by USEPA Method 8260B
- TCL SVOCs by USEPA Method 8270C
- Lead by USEPA Method 6010B

Results of the field investigation will be presented as part of the supplemental assessment report. Chemical analytical results will be compared to NMED soil screening levels. The results will be included in the supplemental assessment report.

4.3 AOC C (BLOWN CAPACITOR SITE, OT-10)

4.3.1 Site Description

AOC C includes the area where three pole-mounted electrical capacitors ruptured. The incident occurred in 1978 when lightning struck the pole, which housed a total of six capacitors. The site is located near the northwest corner of the Base. Approximately 6 gallons of dielectric oil, believed to contain PCBs, spilled onto the ground.

The residual oil and contaminated soil was excavated and drummed immediately following the incident. The contaminated soil was excavated, placed in 55-gallon drums, and sent off site for disposal by the Defense Property Disposal Office (DPDO). The drummed soil was disposed of off Base in a permitted disposal facility. No visible evidence of the spill was observed during an April 1992 site visit.

4.3.2 Sampling Objectives

The overall sampling objectives at the AOC C (Blown Capacitor Site) are to evaluate the presence or absence of contamination in surface and subsurface soil below and adjacent to the area where the capacitors ruptured and spilled dielectric fluid onto the ground. This information is required to assess whether any contamination present poses a significant risk to human health or the environment. Media impacted by contamination will be identified and the magnitude of any such impacts will be estimated. Site-specific objectives are to:

- Determine the presence or absence (and vertical and lateral extent, if possible) of contamination at the site.
- Evaluate the potential for constituents of concern in soil, if any, to impact groundwater.
- Develop a site characterization that will permit determination of the need for additional investigation and of the scope of work for the next phase of investigation, if needed.

Information gathered for this investigation will be used to develop a conceptual model of the site.

4.3.3 Sampling Locations, Frequencies, and Analysis

The following site-specific activities will be completed to meet the objectives stated in Section 4.3.2. The projected soil sampling breakdown for AOC C is shown in Table 4-3.

4.3.3.1 Soil Borings

All soil samples will be submitted for laboratory analysis for PCBs. Results of the field investigation will be presented as part of the supplemental assessment report. Chemical analytical results will be compared to NMED soil screening levels. For this SWMU, an ecological risk screening will be done according to NMED recommendations. The results will be included in the supplemental assessment report.

Three soil borings will be drilled to depths of 15 feet bgs in the vicinity of the power pole that once supported the capacitors using hollow-stem augers. Soil samples will be collected at five-foot intervals beginning at the ground surface (four samples per boring).

All four samples from each boring (12 total) will be submitted for TCL PCBs analysis using USEPA Method 8082.

Results of the field investigation will be presented as part of the supplemental assessment report. Chemical analytical results will be compared to NMED soil screening levels. The results will be included in the supplemental assessment report.

4.4 SAMPLE DESIGNATION

The sample designation for field (analytical) and quality assurance/quality control (QA/QC) samples is a three letter and seven-digit/letter unique identification for each sample (CAX-YYYY-ZZZ). "CAX" is the facility and site identifier, with "C" for Cannon AFB, "A" for Area of Concern, and "X" representing the letter identifying a specific AOC. For example, the sample designation for AOC B would start as "CAB-."

The next four digits (YYYY) identify the sampling method and specific sampled location. The first two characters will represent the method of sampling. "SB" for soil boring will be used as the first two characters. The last two characters will identify the sample location. Samples from the second soil boring at AOC B would be identified as "CAB-SB02-."

The last set of characters (ZZZ) is the sample identifier. The first number corresponds to the type of sample:

- 0 for soil (analytical) sample
- 1 for soil a matrix spike/matrix spike duplicate (MS/MSD)
- 2 for field duplicate

The MS/MSD should also be labeled the same as the original sample, but should also have "MS/MSD Extra" written on the label.

The last two numbers correspond to the beginning depth of the sample in feet bgs for all soil samples. The following is an example of an identification number:

Soil boring no. 2 Approximate depth of top of sample in feet bgs

CAB - SB02 - 018

Cannon AFB, Area of Concern B Soil analytical sample

Multiple soil samples may be collected from the same boring. The last two digits differentiate among these multiple samples and represent the approximate upper depth at which the sample was collected.

4.5 SAMPLING EQUIPMENT AND PROCEDURES

The anticipated sampling equipment and procedures that will be used to collect samples are described in the SOPs contained in Appendix C of this WP. These SOPs are consistent with procedures identified and described by the USEPA.

Before the sampling event, the Field Manager will meet with the assigned sampling personnel and review the purpose and objectives of the event. This meeting will provide clarification of the sampling event specifics. Topics of discussion and review will include:

- Sampling locations, equipment, and requirements
- Number and type of samples
- Sample identification
- Preservation requirements
- Analytical parameters
- Equipment decontamination procedures
- Chain-of-custody (COC) requirements

The procedures for collecting soil samples will be selected, as appropriate, from the SOPs. The Field Manager will be responsible for ensuring that samples are collected with properly decontaminated equipment and containerized as required by the site-specific sampling procedures.

Decontamination procedures shall be performed in a manner consistent with the most recent USEPA guidelines, but as a minimum shall consist of steam cleaning and/or Alconox, or equivalent wash, followed by a tap water rinse and a double deionized water rinse. Specific decontamination procedures are described in SOP No. 11 in Appendix C.

The projected sampling breakdown summaries for the site are presented in Tables 4-1 through 4-3. The sample containers, preservation requirements, and holding times for soil are summarized in Table 4-4.

4.6 SAMPLE HANDLING, DOCUMENTATION, AND ANALYSIS

The labeling, preservation, handling, shipping, documentation, and tracking procedures for all samples collected at Cannon AFB are described in SOP No. 13, Sample Handling, Documentation, and Tracking.

All sample labels will be completed using waterproof ink and numbered. Soil sample labels will be supplied by URS. Sample containers will be placed in plastic storage bags (double bagged in zipper-lock bags) and wrapped in protective packing material (i.e., foam liners, bubble packing). Samples will then be placed in a cooler with ice (double bagged using 1-gallon zipper-lock bags) for overnight express carrier shipment to the laboratory. A completed and signed COC will be placed in each cooler being shipped.

Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded in a permanently bound weatherproof field book with consecutively numbered pages.

To supplement the information in the field book, sample collection field sheets (SCFSs) and Architect-Engineer (A-E) daily quality control reports (DQCRs) will also be completed, forwarded to the USACE Technical Manager (TM), and maintained in URS records for every sample location.

Analyses to be done will be specified on the COC.

TABLE 4-1
PROJECTED SOIL SAMPLING BREAKDOWN – AOC A (MOGAS SPILL SITE)
CANNON AIR FORCE BASE, NEW MEXICO

Media	Parameter	Prep Method	Analytical Method	Field Samples	Field Duplicates	MS/MSD Samples	Total Samples
Soil	TCL VOCs	5035/5030	USEPA SW-846 8260B	8	1	1	10
	TCL SVOCs	3540C	USEPA SW-846 8270C	8	1	1	10
	Lead	3050B	USEPA SW-846 6010B	8	1	1	10

Notes:

MS - matrix spike

MSD - matrix spike duplicate

VOCs - volatile organic compounds

SVOCs - semivolatile organic compounds

TCL - Target Compound List

Soil sampling to 25 feet bgs at four locations will be completed using a drill rig equipped with hollow stem augers.

TABLE 4-2
PROJECTED SOIL SAMPLING BREAKDOWN – AOC B (JP-4 FUEL SPILL SITE)
CANNON AIR FORCE BASE, NEW MEXICO

Media	Parameter	Prep Method	Analytical Method	Field Samples	Field Duplicates	MS/MSD Samples	Total Samples
Soil	TCL VOCs	5035/5030	USEPA SW-846 8260B	4	0	0	4
	TCL SVOCs	3540C	USEPA SW-846 8270C	4	0	0	4
	Lead	3050B	USEPA SW-846 6010B	4	0	0	4

Notes:

MS - matrix spike

MSD - matrix spike duplicate

VOCs - volatile organic compounds

SVOCs - semivolatile organic compounds

TCL - Target Compound List

Soil sampling to 25 feet bgs at two locations will be completed using a drill rig equipped with hollow stem augers.

TABLE 4-3
PROJECTED SOIL SAMPLING BREAKDOWN – AOC C (BLOWN CAPACITOR SITE)
CANNON AIR FORCE BASE, NEW MEXICO

Media	Parameter	Prep Method	Analytical Method	Field Samples	Field Duplicates	MS/MSD Samples	Total Samples
Soil	TCL PCBs	3540C	USEPA SW-846 8082	12	1	1	14

Notes:

MS - matrix spike

MSD - matrix spike duplicate

PCBs - polychlorinated biphenyls

TCL - Target Compound List

Soil sampling to 15 feet bgs at three locations will be completed using a drill rig equipped with hollow stem augers.

TABLE 4-4
CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR SOIL SAMPLES
AOCs A, B, & C
CANNON AIR FORCE BASE, NEW MEXICO

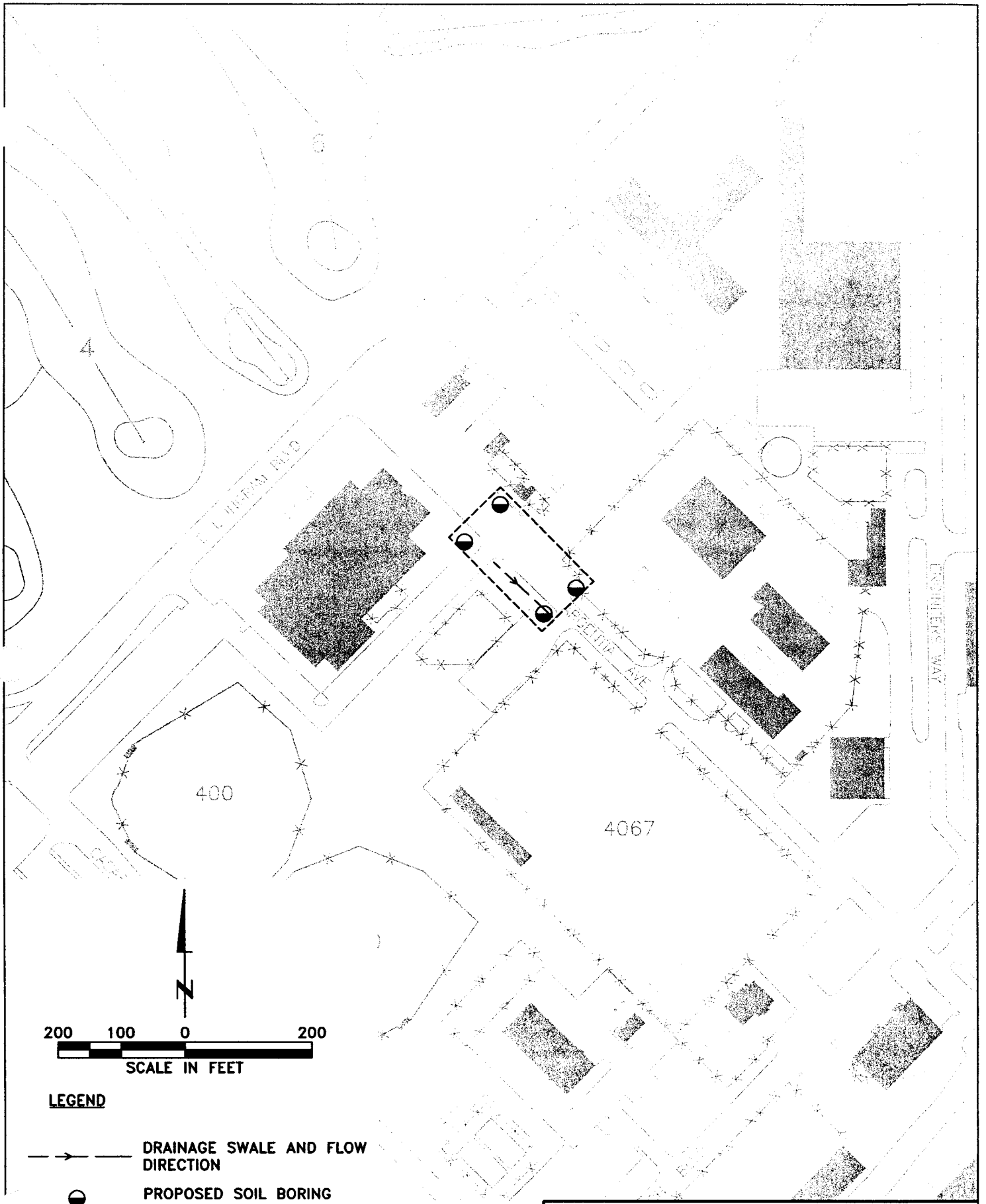
MATRIX	Parameter	Container	Preservative	Holding Time
Soil	TCL VOCs	3 5-g EnCore Samplers	4°C	48 hours preservation, 14 days analysis
	TCL SVOCs	4 oz. glass jar, Teflon lined lid	4°C	14 days extract, 40 days analysis
	TCL PCBs	4 oz. glass jar, Teflon lined lid	4°C	14 days extract, 40 days analysis
	Lead	4 oz. glass jar, Teflon lined lid	4°C	6 months

Notes:

[1] TCL SVOCs and lead will be combined into one 4 oz. glass jar.

[2] Additional sample volume will be collected for samples requiring MS/MSD analysis (coordinate with laboratory).

PCBs - polychlorinated biphenyls
SVOC - semivolatile organic compound
TCL - Target Compound List
VOC - volatile organic compound



LEGEND

DRAINAGE SWALE AND FLOW DIRECTION

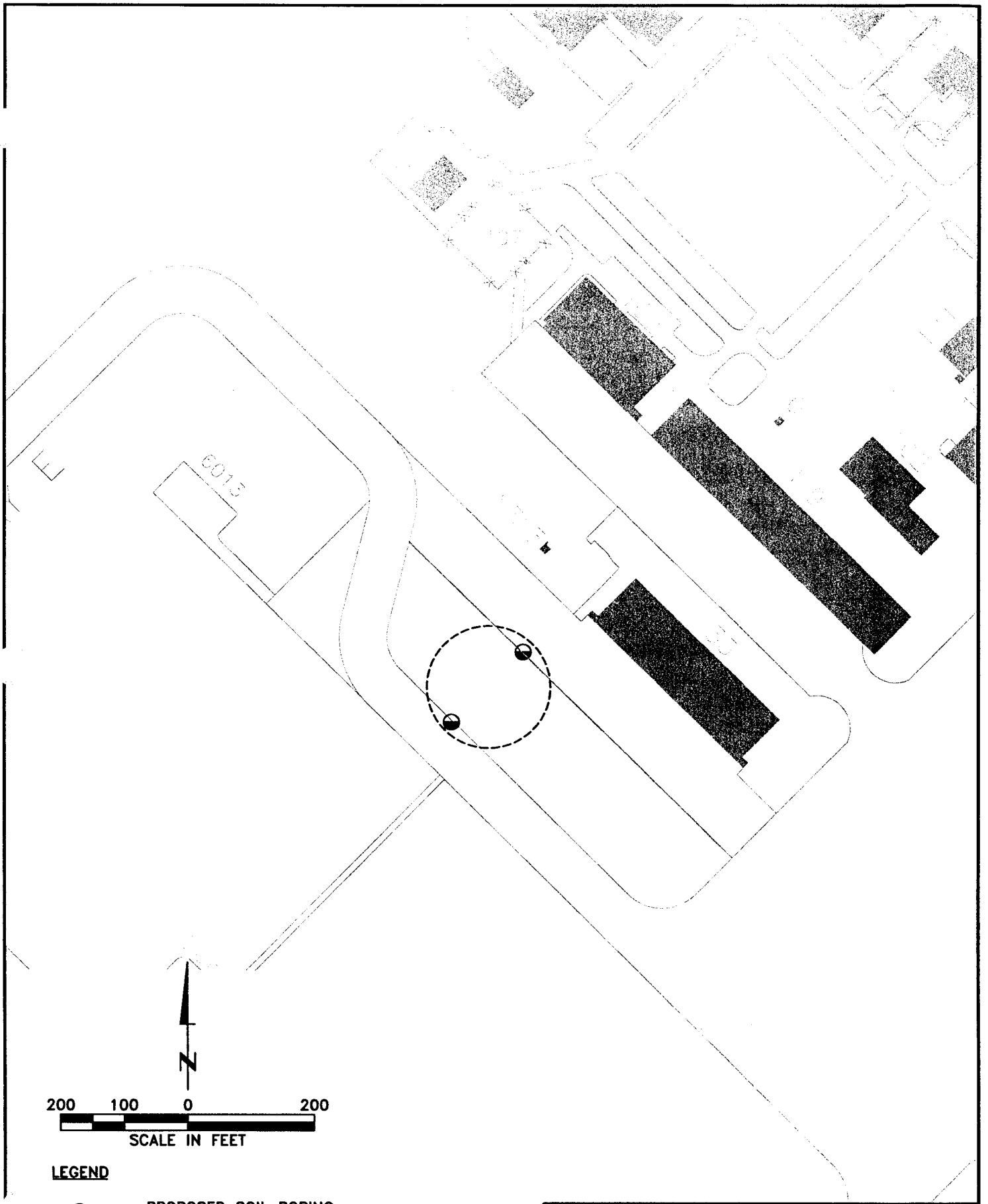
PROPOSED SOIL BORING LOCATIONS

APPROXIMATE SITE BOUNDARY

January 07, 2005 1:39:56 p.m.
Drawing: T:\CANNON\16169869\2\fig4-1.dwg

SITE PLAN AND SAMPLING LOCATIONS FOR
AOC A
CANNION AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 01/07/05	PROJECT NO. 16169869	FIG. NO. 4-1
CHK'D. BY:	REVISION:		



LEGEND

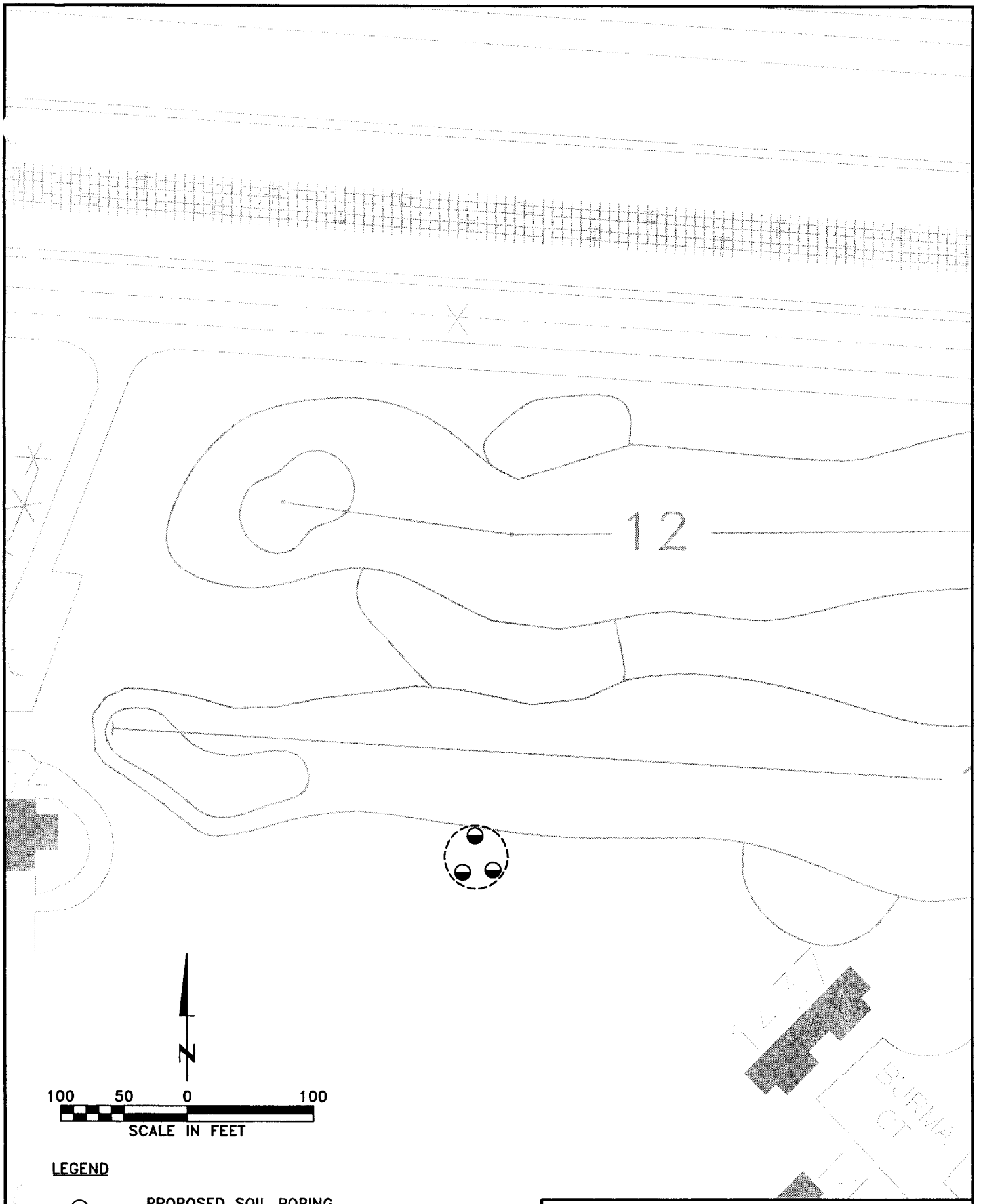
PROPOSED SOIL BORING LOCATIONS

APPROXIMATE SITE BOUNDARY

January 07, 2005 1:41:43 p.m.
Drawing: T:\CANNON\16169869\2\fig4-1.dwg

SITE PLAN AND SAMPLING LOCATIONS FOR
AOC B
CANNION AIR FORCE BASE NEW, MEXICO

DRN. BY: DPG	DATE: 01/07/05	PROJECT NO. 16169869	FIG. NO. 4-2
CHK'D. BY:	REVISION:		



LEGEND

PROPOSED SOIL BORING LOCATIONS

APPROXIMATE SITE BOUNDARY

January 07, 2005 2:21:43 p.m.
Drawing: T:\CANNON\16169869\2\fig4-1.dwg

SITE PLAN AND SAMPLING LOCATIONS
AOC C
CANNION AIR FORCE BASE NEW MEXICO

DRN. BY: DPG	DATE: 01/07/05	PROJECT NO. 16169869	FIG. NO. 4-3
CHK'D. BY:	REVISION:		

Freeze, R.A. and J.A. Cherry. 1979. Groundwater. Prentice-Hall, Inc. Englewood Cliffs, NJ.

Gutentag, Edwin D., et al. 1984. Geohydrology of the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. USGS Professional Paper 1400-B.

Krothe, N.C., J.W. Oliver, and J.B. Weeks. 1982. Dissolved Solids and Sodium in Water from the High Plains Aquifer in Parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. USGS Hydrologic Investigation Atlas HA-658.

Lee Wan Associates, Inc. 1990. RCRA Facility Investigation Work Plan, Field Sampling Plan, and Program Management Plan. Alexandria, Virginia. June.

Sposito, G. and A.L. Page. 1984. Cycling of Metal Ions in the Soil Environment. Metal Ions in Biological Systems, Volume 18. Circulation of Metals in the Environment. H. Sigel, ed. Marcel Dekker, Inc., New York.

United States Department of Agriculture - Soil Conservation Service (USDA-SCS). 1958. Soil Survey of Curry County, New Mexico.

United States Environmental Protection Agency (USEPA). 1986. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846); Final Update III.

United States Environmental Protection Agency (USEPA). 1994a. Guidance for the Data Quality Objectives Process. EPA QA-G4.

United States Environmental Protection Agency (USEPA) 1994b. USEPA Contract Laboratory Program. National Functional Guidelines for Organic/Inorganic Review. EPA540/R-94-012.

United States Environmental Protection Agency (USEPA). 1997. EPA Region 6 Human Health Media-Specific Screening Levels. Dallas, Texas.

United States Environmental Protection Agency (USEPA). 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. Office of Solid Waste and Emergency Response. Washington, D.C. July.

United States Environmental Protection Agency (USEPA) 1992. Guidance for Performing Site Inspections under CERCLA. EPA OSWER Directive 93415.1-05. September.

United States Geological Survey (USGS). 1984. Professional Paper 1270. Element Concentrations in Soil and Other Surficial Materials in the Conterminous United States. By H.T. Shacklette and J.G. Borengen.

Walk, Haydel & Associates, Inc. (WHA). 1990. Installation Restoration Program. Final Remedial Investigation Report, Cannon Air Force Base, New Mexico. Prepared under

contract with Omaha District, Corps of Engineers; Omaha, Nebraska, for Headquarters, Tactical Air Command, HQ, TAC/DEEV; Langley Air Force Base, Virginia.

William Matotan and Associates. 1985. Water Well Master Plan Survey. Prepared for Department of the Air Force, Cannon Air Force Base, New Mexico.

Woodward-Clyde (W-C). 1991. Field Sampling Plan. Remedial Investigation. Phase I (18 SWMUs). Cannon AFB; Clovis, New Mexico.

Woodward-Clyde (W-C). 1992. Remedial Investigation Report for 18 Solid Waste Management Units. Cannon AFB, New Mexico. Prepared for U.S. Army Corps of Engineers, Omaha District; Omaha, Nebraska.

Woodward-Clyde (W-C). 1997. "Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico." Final Report. September.

Woodward-Clyde (W-C). 1993. Appendix I SWMUs Remedial Investigation. Final Report.

Woodward-Clyde (W-C). 1995. Appendix II SWMUs RCRA Facility Investigation. Final Report.

Woodward-Clyde (W-C). 1995. Appendix III SWMUs RCRA Facility Investigation. Final Report.

QUALITY ASSURANCE PROJECT PLAN

SUPPLEMENTAL ASSESSMENT
AOC A, B, & C
CANNON AIR FORCE BASE,
NEW MEXICO

January 2005

Prepared for:

U.S. Department of the Army
Corps of Engineers – Omaha District
Omaha, Nebraska

Contract No. W9128F-04-0001
Task Order 17

Prepared by:

URS
12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154

16169716

TABLE OF CONTENTS

Section 1 Introductions 1-1
1.1 Project Description 1-1
1.1.1 Overall Project Objectives and Decision Statements 1-1
1.2 Facility Description 1-1
1.3 Facility History 1-1
1.4 Project Objectives and Intended Data Usages 1-2
1.4.1 Laboratory Target Parameters 1-2
1.5 Sampling Locations 1-2
1.5.1 Rationale for Selected Sampling Locations 1-2

Section 2 Project Organization and Responsibility 2-1
2.1 Project Organization Chart 2-1
2.2 Management Responsibilities 2-1
2.3 Quality Assurance Responsibilities 2-2
2.4 Laboratory Responsibilities 2-2
2.5 Field Responsibilities 2-3
2.5.1 Special Training Requirements and Certification 2-3

Section 3 Quality Assurance Objectives 3-1
3.1 Precision 3-1
3.1.1 Definition 3-1
3.1.2 Field Precision Objectives 3-1
3.1.3 Laboratory Precision Objectives 3-1
3.2 Accuracy 3-1
3.2.1 Definition 3-1
3.2.2 Field Accuracy Objectives 3-1
3.2.3 Laboratory Accuracy Objectives 3-2
3.3 Completeness 3-2
3.3.1 Definition 3-2
3.3.2 Field Completeness Objectives 3-2
3.3.3 Laboratory Completeness Objectives 3-2
3.4 Representativeness 3-2
3.4.1 Definition 3-2
3.4.2 Measures to Ensure Representativeness of Field Data 3-2
3.4.3 Measures to Ensure Representativeness of Laboratory Data 3-3
3.5 Decision Rules 3-3
3.6 Comparability 3-3
3.6.1 Definition 3-3
3.6.2 Measures to Ensure Comparability of Field Data 3-3
3.6.3 Measures to Ensure Comparability of Laboratory Data 3-3
3.7 Level of Quality Control Effort 3-3

Section 4 Sampling Procedures 4-1

TABLE OF CONTENTS

Section 5 Custody Procedures 5-1
5.1 Field Custody and Documentation Procedures 5-1
5.2 Laboratory Custody Procedures 5-3
5.3 Final Evidence File 5-3

Section 6 Calibration Procedures and Frequency 6-1
6.1 Field Instrument Calibration 6-1
6.2 Laboratory Instrument Calibration 6-1

Section 7 Analytical Procedures 7-1
7.1 Field Analytical Procedures 7-1
7.2 Laboratory Analytical Procedures 7-1
7.2.1 Volatile Organic Compounds (VOCs) 7-1
7.2.2 Semivolatile Organic Compounds (SVOCs) 7-1
7.2.3 Polychlorinated Biphenyls (PCBs) 7-1
7.2.4 Metals 7-2

Section 8 Internal Quality Control Checks 8-1
8.1 Field Quality Control Checks 8-1
8.2 Laboratory Quality Control Checks 8-1

Section 9 Data Reduction, Validation, and Reporting 9-1
9.1 Data Reduction 9-1
9.1.1 Field Data Reduction Procedures 9-1
9.1.2 Laboratory Data Reduction Procedures 9-1
9.2 QC Data Review and Validation 9-1
9.3 Data Reporting 9-3
9.3.1 Field Data Reporting 9-3
9.3.2 Laboratory Data Reporting 9-3

Section 10 Performance and System Audits and Frequency 10-1
10.1 Field Performance and System Audits 10-1
10.1.1 Internal Field Audits 10-1
10.1.1.1 Internal Field Audit Responsibilities 10-1
10.1.1.2 Internal Field Audit Frequency 10-1
10.1.1.3 Internal Field Audit Procedures 10-1
10.1.2 External Field Audits 10-1
10.1.2.1 External Field Audit Responsibilities 10-1
10.1.2.2 External Field Audit Frequency 10-1
10.1.2.3 External Field Audit Process 10-2
10.2 Laboratory Performance and Systems Audits 10-2
10.2.1 Internal Laboratory Audits 10-2
10.2.1.1 Internal Laboratory Audit Responsibilities 10-2
10.2.1.2 Internal Laboratory Audit Frequency 10-2
10.2.1.3 Internal Laboratory Audit Procedures 10-2
10.2.2 External Laboratory Audits 10-2

10.2.2.1 External Laboratory Audit Responsibilities 10-2
10.2.2.2 External Laboratory Audit Frequency 10-2
10.2.2.3 Overview of the External Laboratory Audit Process .. 10-3

Section 11 Preventive Maintenance 11-1
11.1 Field Instrument Preventive Maintenance 11-1
11.2 Laboratory Instrument Preventive Maintenance 11-1

Section 12 Data Precision, Accuracy, and Completeness 12-1
12.1 Evaluation of Data Precision, Accuracy, and Completeness 12-1
12.2 Accuracy Assessment 12-1
12.3 Precision Assessment 12-2
12.4 Completeness Assessment 12-2
12.5 Overall Assessment of Data 12-2

Section 13 Corrective Action 13-1
13.1 Field Corrective Action 13-1
13.2 Laboratory Corrective Action 13-1
13.3 Corrective Action During Data Review / Validation and Assessment .. 13-2

Section 14 Quality Assurance Reports to Management 14-1
14.1 Contents of Project QA Reports 14-1
14.2 Performance and System Audits 14-1
14.2.1 Performance Audits 14-1
14.2.2 System Audits 14-2
14.2.3 Audit Records 14-2

Section 15 References 15-1

TABLE OF CONTENTS

List of Tables

Table 1-1	Laboratory Analytical Methods
Table 1-2	Method Detection Limits and Reporting Limits for Soil VOC Samples
Table 1-3	Method Detection Limits and Reporting Limits for Soil SVOC Samples
Table 1-4	Method Detection Limits and Reporting Limits for Soil Metals Samples
Table 1-5	Method Detection Limits and Reporting Limits for Soil PCB samples
Table 3-1	Project Soil Sampling Breakdown-MOGAS Spill Site (AOC A)
Table 3-2	Project Soil Sampling Breakdown-JP-4 Fuel Spill Site (AOC B)
Table 3-3	Project Soil Sampling Breakdown-Brown Capacitor Site (AOC C)
Table 3-4	Precision Control Limits
Table 3-5	Laboratory Control Sample and Matrix Spike/Matrix Spike Duplicate Accuracy and Precision Criteria for VOC Analysis
Table 3-6	Laboratory Control Sample and Matrix Spike/Matrix Spike Duplicate Accuracy and Precision Criteria for SVOC Analysis
Table 3-7	Laboratory Control Sample and Matrix Spike/Matrix Duplicate Accuracy and Precision Criteria for Metals Analysis
Table 3-8	Laboratory Control Sample and Matrix Spike/Matrix Duplicate Accuracy and Precision Criteria for PCB Analysis
Table 3-9	Surrogate Compound Criteria
Table 4-1	Analytical Methods, Sample Containers, Preservation, and Holding Times for Soil Samples
Table 9-1	Data Review/Validation Criteria for VOC analysis
Table 9-2	Data Review/Validation Criteria for SVOC analysis
Table 9-3	Data Review/Validation Criteria for Metals analysis
Table 9-4	Data Review/Validation Criteria for Polycholorinated Biphenyl analysis

List of Figures

Figure 1-1	Site Plan and Location of Areas of Concern
Figure 2-1	Project Organization

This Quality Assurance Project Plan (QAPP) presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the supplemental assessment to be completed for Areas of Concern (AOCs) A, B, and C at Cannon Air Force Base (AFB), New Mexico. Specific protocols for sampling, sample handling and storage, chain of custody, and laboratory and field analyses are described in this QAPP. Specific Standing Operating procedures (SOPs) are also provided as a means of maintaining consistency with respect to procedures commonly used in conjunction with data collection. SOPs are located in Appendix A of this QAPP.

All QA/QC procedures are structured in accordance with applicable technical standards and United States Environmental Protection Agency's (USEPA's) requirements, regulations, guidance, and specific technical standards. This QAPP has been prepared on behalf of the United States Army Corps of Engineers (USACE) in accordance with USEPA Guidance for Quality Assurance Project Plans, EPA QA/R-5 (March 2001).

1.1 PROJECT DESCRIPTION

The following section summarizes the project objectives.

1.1.1 Overall Project Objectives and Decision Statements

The purpose of subsurface sampling at Cannon AFB is to gather sufficient information to support decisions that help meet the following generalized objectives:

- Confirm the presence or absence of subsurface contamination at each site.
- Determine the concentration of subsurface contamination at each site.
- Assess the potential for contamination migration into and through surrounding environments.

1.2 FACILITY DESCRIPTION

Cannon AFB is located approximately 4 miles west of Clovis, New Mexico. The Base is situated at an elevation ranging from 4,250 to 4,350 feet above mean sea level (msl). The work force on the Base consists of about 4,000 active duty and civilian personnel. A site map showing all locations including sites AOC A, AOC B, and AOC C as part of the investigation is included as Figure 1-1.

1.3 FACILITY HISTORY

The Base was established by the U.S. Department of Defense (DoD) in 1942 as a training facility, first for an Army glider detachment, and later heavy bombers. In May 1947, the Base was inactivated. In July 1951, the Base was reactivated. Since that time, it has been host to several different types of fighter and fighter-bomber aircraft. At the present time, four fighter squadrons that comprise Air Combat Command's (ACC's) 27th Fight Wing are assigned to the Base. The squadrons are the 522nd, 523rd, 524th, and 428th. All fly F-16 aircraft.

1.4 PROJECT OBJECTIVES AND INTENDED DATA USAGES

For this project, it will be necessary to gather sufficient information to evaluate the nature and extent of subsurface contamination at various site locations and also to assess the potential for contamination migration through surrounding environments. This will include the evaluation of subsurface contamination at each site in relation to USEPA guidelines.

1.4.1 Laboratory Target Parameters

Table 1-1 identifies the target parameters for the subsurface sampling at Cannon AFB. Tables 1-2 through 1-5 identify the comprehensive analyte, the laboratory method detection limit (MDL) and reporting limit (RL) for each compound. The contract laboratory will report all concentrations detected above the MDL. Values reported above the MDL and less than the RL will be qualified as estimated "J". The contract laboratory determines MDLs as outlined in 40 CFR, Part 136. The reporting limits are set at the lowest calibration standard and are generally a minimum of 2 to 5 times the MDL.

The comprehensive analyte list selected for the Cannon AFB subsurface sampling is based on historical data. A more specific TAL for each site is tailored to meet the goals as identified in this QAPP.

1.5 SAMPLING LOCATIONS

Sampling locations are all located within the boundaries of Cannon AFB, and are further defined on figure 1-1 of this QAPP.

1.5.1 Rationale for Selected Sampling Locations

The rationales for selected sampling locations were determined based on site history and initial site visits. Refer to the WP or FSP for further details.

TABLE 1-1

LABORATORY ANALYTICAL METHODS

Parameter	Analyte List	Preperation Method Soil	Analytical Method
Volatile Organic Compounds	TCL	5035	USEPA SW-846 8260B
Semivolatile Organic Compounds	TCL	3540C	USEPA SW-846 8270C
Polychlorinated Biphenyls	TCL	3540C	USEPA SW-846 8082
Lead	Lead	3050B	USEPA SW-846 6010B

TAL - Target Analyte List (metals), Contract Laboratory Program Statement of Work
TCL - Target Compound List (listed in this QAPP)
USEPA SW-846 - Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, USEPA SW-846, Final Update IV
USEPA - United States Environmental Protection Agency

TABLE 1-2

METHOD DETECTION LIMITS AND REPORTING LIMITS FOR VOC ANALYSIS

	Soil (µg/kg)	
Volatile Organic Compounds (VOC)	**MDL**	**RL**
1,1,1-Trichloroethane	0.81	5.0
1,1,2,2-Tetrachloroethane	1.24	5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	0.83	5.0
1,1,2-Trichloroethane	0.48	5.0
1,1-Dichloroethane	1.13	5.0
1,1-Dichloroethene	0.79	5.0
1,2,4-Trichlorobenzene	0.52	5.0
1,2,4-Trimethylbenzene	1.18	5.0
1,2-Dibromo-3-chloropropane	2.19	5.0
1,2-Dibromoethane	0.6	5.0
1,2-Dichlorobenzene	0.95	5.0
1,2-Dichloroethane	0.72	5.0
1,2-Dichloropropane	0.62	5.0
1,3,5-Trimethylbenzene	0.97	5.0
1,3-Dichlorobenzene	0.60	5.0
1,4-Dichlorobenzene	0.67	5.0
2-Butanone	0.71	5.0
2-Hexanone	0.16	5.0
4-Methyl-2-pentanone	0.93	5.0
Acetone	2.8	50
Benzene	0.63	5.0
Benzyl Chloride	2.0	20
Bromodichloromethane	0.69	5.0
Bromoform	0.80	5.0
Bromomethane	1.60	10
Carbon disulfide	1.08	5.0
Carbon tetrachloride	0.80	5.0
Chlorobenzene	0.49	5.0
Chloroethane	1.55	5.0
Chloroform	1.43	5.0
Chloromethane	1.82	5.0
cis-1,2-Dichloroethene	1.07	5.0
cis-1,3-Dichloropropene	0.47	5.0
Cyclohexane	0.82	5
Dibromochloromethane	0.85	5.0
Dichlorodifluoromethane	0.83	10
Ethylbenzene	0.64	5.0
Hexachlorobutadiene	0.60	5.0
Isopropylbenzene	1.11	5.0
m,p-Xylene	0.68	5.0
Methyl Acetate	1.0	10
Methyl tert-butyl ether	0.89	5.0
Methylcyclohexane	2.0	20
Methylene chloride	4.58	50
o-Xylene	0.61	5.0
Styrene	0.69	5.0
Tetrachloroethene	0.54	5.0
Toluene	0.65	5.0
trans-1,2-Dichloroethene	1.35	5.0
trans-1,3-Dichloropropene	0.43	5.0
Trichloroethene	0.71	5.0

TABLE 1-2

METHOD DETECTION LIMITS AND REPORTING LIMITS FOR VOC ANALYSIS

	Soil (µg/kg)	
Volatile Organic Compounds (VOC)	**MDL**	**RL**
Trichlorofluoromethane	1.26	5.0
Vinyl acetate	1.0	10
Vinyl chloride	1.68	5.0

MDL - Method Detection Limit
RL - Reporting Limit
µg/kg - micrograms per kilogram

Samples are prepped using methods 5035 (soil) and analyzed by Method 8260B.

TABLE 1-3

METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SEMIVOLATILE ORGANICS ANALYSIS

Semivolatile Organic Compounds	Soil (µg/kg)	
(SVOC)	MDL	RL
1,1'-Biphenyl	NE	330
2,2'-oxybis(1-Chloropropane)	60.0	330
2,4,5-Trichlorophenol	60.1	330
2,4,6-Trichlorophenol	48.3	330
2,4-Dichlorophenol	50.5	330
2,4-Dimethylphenol	43.9	330
2,4-Dinitrophenol	53.7	1600
2,4-Dinitrotoluene	63.8	330
2,6-Dinitrotoluene	60.6	330
2-Chloronaphthalene	52.4	330
2-Chlorophenol	44.3	330
2-Methylnaphthalene	50.4	330
2-Methylphenol	45.2	330
2-Nitroaniline	62.4	660
2-Nitrophenol	47.8	330
3,3'-Dichlorobenzidine	56.3	660
3-Nitroaniline	61.1	660
4,6-Dinitro-2-methylphenol	56.4	1600
4-Bromophenyl phenyl ether	56.6	330
4-Chloro-3-methylphenol	58.8	330
4-Chloroaniline	16.5	660
4-Chlorophenyl-phenylether	60.7	330
4-Methylphenol	46.4	330
4-Nitroaniline	72.8	330
4-Nitrophenol	59.8	1600
Acenaphthene	53.8	330
Acenaphthylene	53.1	330
Acetophenone	NE	330
Anthracene	61.3	330
Atrazine	NE	330
Benzaldehyde	NE	330
Benzo(a)anthracene	58.0	330
Benzo(a)pyrene	50.7	330
Benzo(b)fluoranthene	60.0	330
Benzo(g,h,i)perylene	55.2	330
Benzo(k)fluoranthene	61.0	330
Bis(2-chloroethoxy)methane	49.9	330
bis(2-Chloroethyl)ether	50.0	330
Bis(2-ethylhexyl)phthalate	61.6	330
Butylbenzylphthalate	55.5	330
Chrysene	60.6	330
Carbazole	59.5	330
Caprolactam	NE	330
Di-n-butylphthalate	65.9	330
Di-n-octylphthalate	58.4	330
Dibenzo(a,h)anthracene	59.4	330
Dibenzofuran	57.3	330
Diethylphthalate	62.1	330
Dimethylphthalate	63.3	330
Fluoranthene	65.4	330
Fluorene	61.3	330
Hexachlorobenzene	60.3	330
Hexachlorobutadiene	51.7	330
Hexachlorocyclopentadiene	44.0	330
Hexachloroethane	49.9	330

TABLE 1-3

METHOD DETECTION LIMITS AND REPORTING LIMITS FOR SEMIVOLATILE ORGANICS ANALYSIS

Semivolatile Organic Compounds (SVOC)	Soil (µg/kg)	
	MDL	RL
Indeno(1,2,3-cd)pyrene	60.4	330
Isophorone	57.0	330
N-Nitroso-di-n-propylamine	54.9	330
N-Nitrosodiphenylamine	50.6	330
Naphthalene	50.5	330
Nitrobenzene	49.8	330
Pentachlorophenol	58.7	1600
Phenanthrene	58.2	330
Phenol	43.0	330
Pyrene	54.1	330

NE - Not Evaluated by laboratory
MDL - Method Detection Limit
RL - Reporting Limit
µg/kg - micrograms per kilogram
µg/L - micrograms per liter

Samples are prepped using Methods 3540C (soil) and analyzed by Method 8270C.

TABLE 1-4

METHOD DETECTION LIMITS AND REPORTING LIMITS FOR POLYCHLORINATED BIPHENYLS

	Soil (µg/kg)	
Polychlorinated Biphenyls	**MDL**	**RL**
Aroclor 1016	9.8	500
Aroclor 1221	5.5	500
Aroclor 1232	4	500
Aroclor 1242	2.6	500
Aroclor 1248	1.4	500
Aroclor 1254	1.6	500
Aroclor 1260	3.6	500

MDL - Method Detection Limit
RL - Reporting Limit
µg/kg - micrograms per kilogram
µg/L - micrograms per liter

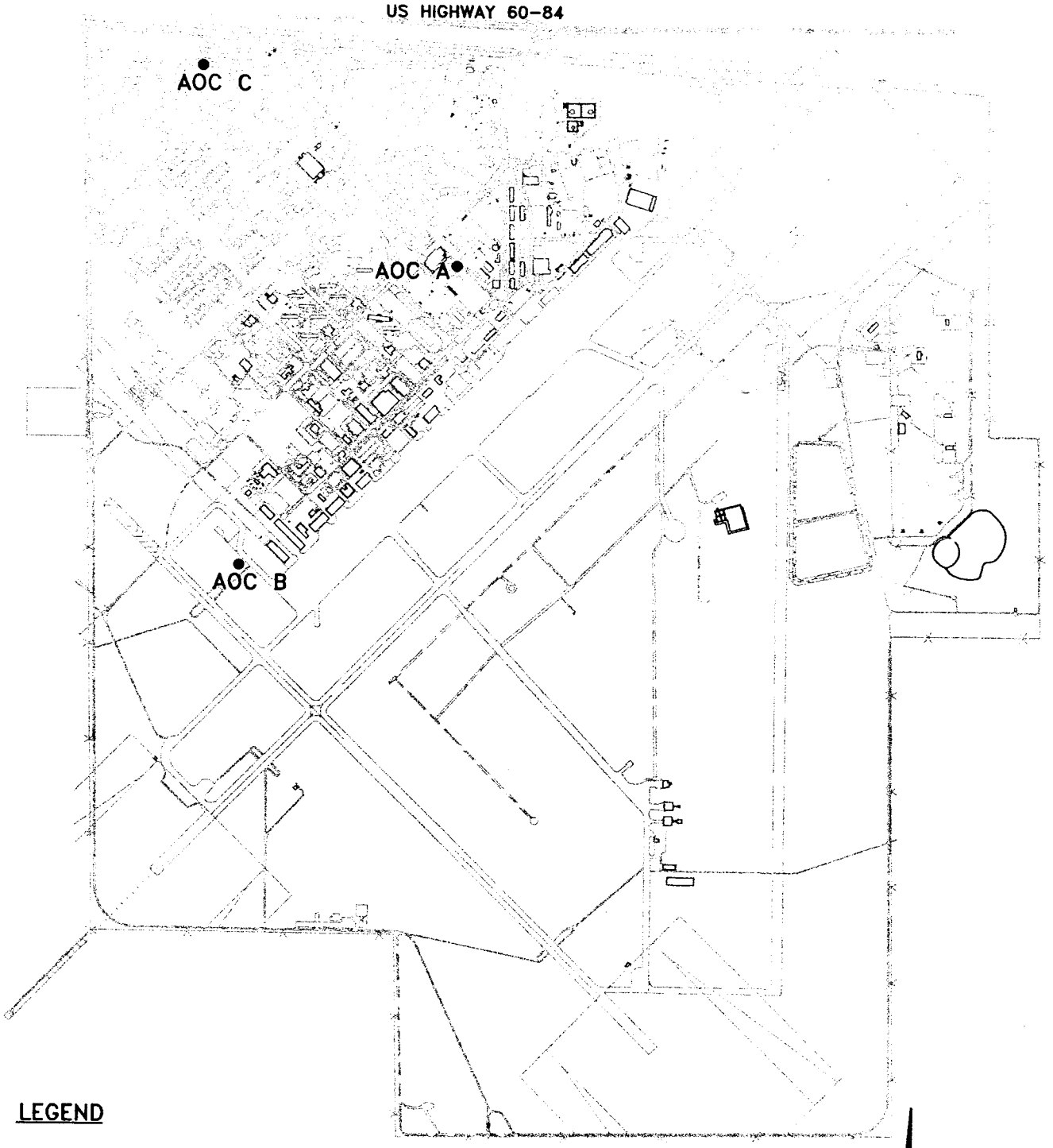
Samples are prepped using Methods 3540C (soil) and analyzed by Method 8082.

TABLE 1-5

METHOD DETECTION LIMITS AND REPORTING LIMITS FOR METALS ANALYSES

	Soil (mg/kg)	
Metals	**MDL**	**RL**
Lead	0.092	0.5

Note: All analytes will be determined by inductively coupled plasma (ICP) Method 6010C
MDL - Method Detection Limit
RL - Reporting Limit
mg/kg - milligrams per kilogram
mg/L - milligrams per liter



LEGEND

AOC ● AREA OF CONCERN

SWMU No.	DESIGNATED AREA
AOC A	SS-19 MOGAS SPILL
AOC B	SS-18 JP-4 FUEL SPILL
AOC C	OT-10 BLOWN CAPACITORS SITE

N

2000 1000 0 2000

SCALE IN FEET

SITE PLAN AND LOCATION OF AREAS OF CONCERN
CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO

DRN. BY: DPG	DATE: 12/20/04	PROJECT NO. 16169869	FIG. NO. 1-1
CHK'D. BY: .	DATE:		

January 07, 2005 1:33:33 p.m.
Drawing: T:\CANNON\16169869\2\Fig1-1.dwg

The various quality assurance, field, laboratory, and management responsibilities of key project personnel are defined below.

2.1 PROJECT ORGANIZATION CHART

The lines of authority are presented in Figure 2-1. This chart includes all individuals discussed in the following section. The proper names of individuals for the positions identified below will be included in Figure 2-1.

2.2 MANAGEMENT RESPONSIBILITIES

Cannon AFB ERP Manager (Pete Zamie)

The Cannon AFB Environmental Restoration Program (ERP) Manager has the overall responsibility to ensure the subsurface sampling meets the stated objectives.

NMED Project Manager (Glenn von Gonten)

The NMED Project Manager has the overall responsibility to ensure the program is in compliance with the State of New Mexico environmental monitoring program.

USACE Project Manager (Jane Davey)

The USACE Project Manager's responsibilities include communicating with the ACC Program Manager and the Cannon AFB Project Manager in regards to overall project costs and schedule compliance.

URS Project Manager (Steve Cox)

The URS Project Manager is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The URS Project Manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully. The URS Project Manager will:

- Define project objectives and develop a detailed work schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints
- Orient all field leaders and support staff concerning the project's special considerations
- Monitor and direct the field leaders
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product

- Review the work performed on each task to ensure its quality, responsiveness, and timeliness
- Review and analyze overall task performance with respect to planned requirements and authorizations
- Approve all reports (deliverables) before their submission to the USACE
- Ultimately be responsible for the preparation and quality of interim and final reports
- Represent the project team at meetings and public hearings

2.3 QUALITY ASSURANCE RESPONSIBILITIES

URS QA Officer (Craig Johnson)

The URS QA Officer reports directly to the URS Project Manager and will be responsible for ensuring that all URS procedures for this project are being followed. In addition, the URS QA Officer will be responsible for the data validation of all sample results from the analytical laboratory. The URS QA Officer will complete a field audit if requested by the USACE and URS project managers at the beginning of the subsurface field sampling activities. Details of the audit procedures are presented in Section 10.

2.4 LABORATORY RESPONSIBILITIES

APPL QA Officer

The APPL Laboratories QA Officer has the overall responsibility for data generated by APPL, as well as the adherence to acceptable practice. The APPL QA Officer will operate independent of the daily laboratory activities, but will communicate data issues through the APPL Project Manager. In addition, the APPL QA Officer will:

- Oversee laboratory QA
- Oversee QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions, if required
- Define appropriate laboratory QA procedures
- Prepare laboratory SOPs
- Sign the title page of the QAPP

APPL Project Manager (Robert J. Wise)

The APPL Project Manager has the overall responsibility to ensure the laboratory analyzes the samples according to the project QAPP.

2.5 FIELD RESPONSIBILITIES

URS Field Manager (Mike Sonderman)

The URS Field Manager is responsible for implementing the QAPP. He is responsible for field equipment calibration, oversight of sample collection, field documentation, submittal of samples to contract laboratories, and preparation of a summary report.

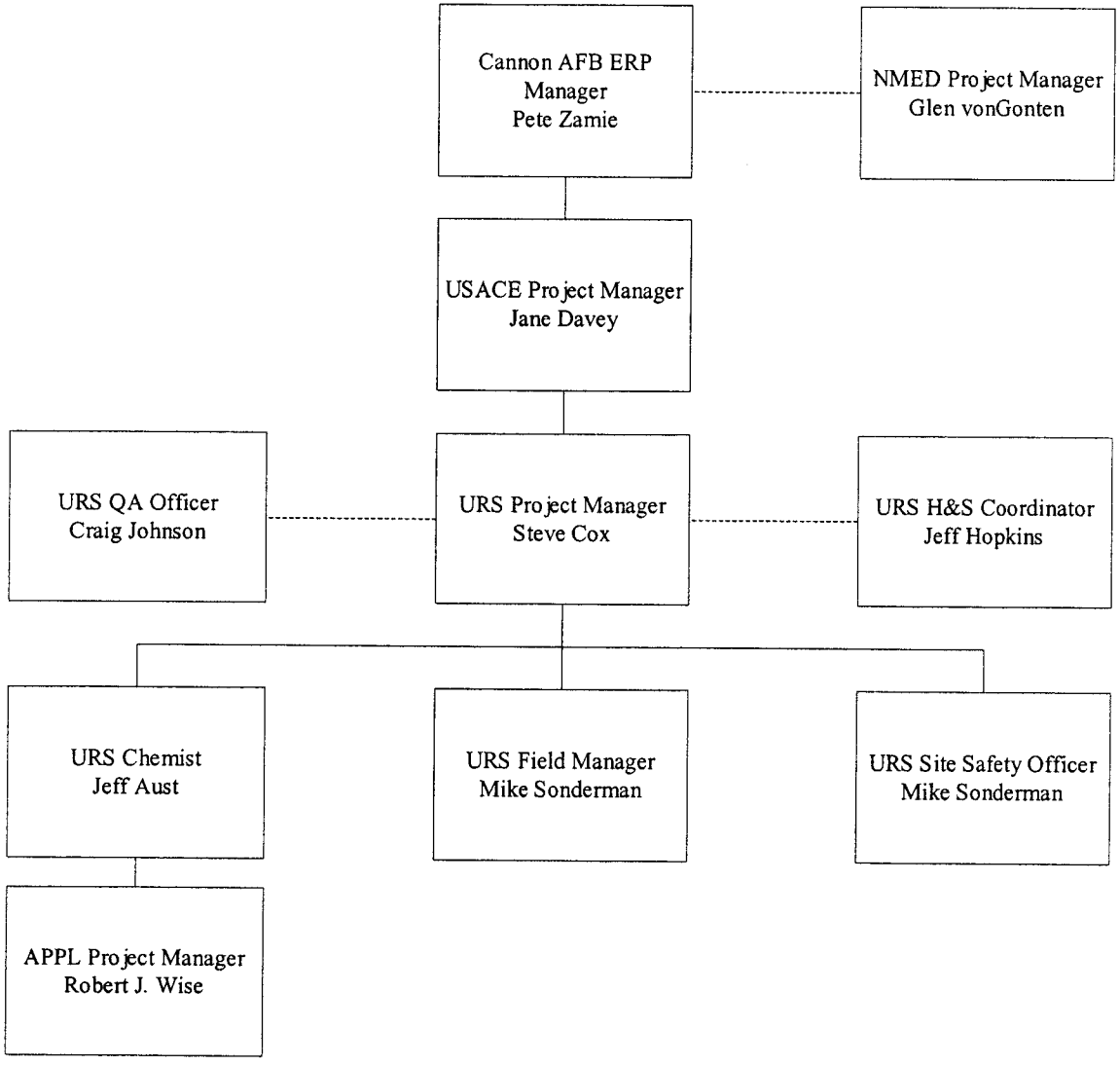
The URS Field Manager is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his/her supervision. The URS Field Manager is a highly experienced environmental professional and will report directly to the URS Project Manager. Specific field team leader responsibilities include:

- Provision of day-to-day coordination with the URS Project Manager on technical issues in specific areas of expertise
- Development and implementation of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements
- Coordinating and managing field staff
- Implementing QC for technical data provided by the field staff, including field measurement data
- Adhering to work schedules provided by the URS Project Manager
- Authoring, writing, and approving of text and graphics required for field team efforts
- Identifying problems at the field team level, resolving difficulties in consultation with the Cannon AFB ERP Program Manager and the URS Project Manager, implementing and documenting corrective action procedures, and provision of communication between team and upper management
- Participating in preparation of the final report

2.5.1 Special Training Requirements and Certification

Field personnel will have completed the OSHA-approved basic 40-hour health and safety training HAZWOPER course and annual refreshers of the same. At all times, at least two of the field workers on scene will have active first aid and CPR certification.

Figure 2-1
Project Organization



The overall QA objective for this project is to develop and implement procedures for field sampling, laboratory analysis, chain-of-custody, and reporting that will provide results which are legally defensible in a court of law. This section will provide specific project objectives and intended data usages mentioned in Section 1 of this QAPP. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP. QC parameters and the frequency of analysis are identified in Tables 3-1 through 3-3.

3.1 PRECISION

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at an approximate rate of 1 duplicate per 20 analytical samples collected.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) between sample results. The equations to be used for precision in this project can be found in Section 12 of this QAPP. Precision control limits are provided in Table 3-4.

For inorganic analyses, laboratory precision shall be assessed through the analysis of a sample/sample duplicate pair and field duplicate pairs. For organic analyses, laboratory precision shall be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference or true value.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks to assess the potential of cross contamination. In addition, field accuracy is assessed by the adherence to all sample handling, preservation, and holding time criteria.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of MS/MSD, standard reference materials (SRM), laboratory control samples (LCS), surrogate compounds, and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 12 of this QAPP. Accuracy control limits are given in Tables 3-5 through 3-9.

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of samples to be collected versus the amount of samples actually collected. The equation for completeness is presented in Section 12 of this QAPP. The field completeness goal for this project is 100 percent. Field completeness will be evaluated throughout field activities.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Laboratory completeness will be evaluated based on the data review/validation findings. The equation for completeness is presented in Section 12 of this QAPP. The laboratory completeness objective for this project, with respect to parameters identified in Table 1-1 of this QAPP, is 95 percent or greater.

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the QAPP is followed and that proper sampling techniques are used. In designing the sampling program, media of concern have been specified.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

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

3.5 DECISION RULES

The project data quality objectives (DQOs) are to provide complete and representative data of known and documented quality for each site at Cannon AFB.

Overall project DQOs and decision rules are discussed in Section 1.

3.6 COMPARABILITY

3.6.1 Definition

Comparability is an expression of the confidence with which one data set can be compared to another.

3.6.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the QAPP is followed and that proper sampling techniques are used.

3.6.3 Measures to Ensure Comparability of Laboratory Data

Analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

3.7 LEVEL OF QUALITY CONTROL EFFORT

Trip blank, method blank, field duplicate, laboratory duplicate, laboratory control samples, standard reference materials (SRM), and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. A method blank will be analyzed by the laboratory with each analytical batch (~20 samples) for organic analyses, and will be re-analyzed if common laboratory contaminants are detected above 5x the RL or when non-laboratory contaminants are reported greater than the RL. Samples for metals analyses will be completed if the blank concentration is < than the RL. If the sample result is greater than 2x the blank concentration, than no action is required.

- Based on SW-846, duplicate samples are analyzed to check for sampling and analytical reproducibility. Field duplicate samples will be collected (as described in table 3-1 of this section) at an approximate 5 percent frequency. The laboratory will analyze laboratory duplicates with each inorganic analytical batch.
- Based on SW-846 MS/MSD samples provide information about the effect of the sample matrix on the extraction/digestion and measurement methodology. Depending on site-specific circumstances, one MS/MSD will be collected for every 20 or fewer investigative samples of a given matrix. MS/MSD samples are designated/collected for organic analyses only. A matrix spike/matrix duplicate (MS/MD) will be collected for inorganic analyses and will also be collected at a frequency of 5 percent.
- Based on SW-846 LCS provide information about the accuracy of the analytical system, independent of matrix. LCS are laboratory-generated sample spikes with target analytes. An LCS is analyzed as part of every analytical batch (~20 samples). Investigative samples and the associated LCS will be re-analyzed if more than 5 percent of the LCS recoveries are less than the lower limit, or any one LCS recovery is less than ½ the lower limit.

The general level of the QC effort will be one field duplicate every 20 investigative samples and MS/MSD. The number of duplicate and field blank samples to be collected are listed in the QAPP.

In addition to the QC parameters identified above, the laboratory analyzes additional QC samples as part of the analytical method. Tables 3-1 through 3-3 summarizes all QC parameters and frequency of analysis for each location.

TABLE 3-1
PROJECT SOIL SAMPLING BREAKDOWN – MOTOR GASOLINE SPILL SITE (AOC A)
CANNON AIR FORCE BASE, NEW MEXICO

Media	Parameter	Prep Method	Analytical Method	Investigative Samples	Field Duplicates	MS/MSD Samples	Total Samples
Soil	TCL VOCs	5035	USEPA SW-846 8260B	8	1	1	10
	TCL SVOCs	3540C	USEPA SW-846 8270C	8	1	1	10
	Lead	3050B	USEPA SW-846 6010B	8	1	1	10

Notes:

MS - matrix spike

MSD - matrix spike duplicate

VOCs - volatile organic compounds

SVOCs - semivolatile organic compounds

TCL - Target Compound List (as described in this QAPP)

Soil sampling to 25 feet bgs at four locations will be by hollow stem auger.

TABLE 3-2
PROJECT SOIL SAMPLING BREAKDOWN – JP-4 FUEL SPILL SITE (AOC B)
CANNON AIR FORCE BASE, NEW MEXICO

Media	Parameter	Prep Method	Analytical Method	Investigative Samples	Field Duplicates	MS/MSD Samples	Total Samples
Soil	TCL VOCs	5035	USEPA SW-846 8260B	4	0	0	4
	TCL SVOCs	3540C	USEPA SW-846 8270C	4	0	0	4
	Lead	3050B	USEPA SW-846 6010B	4	0	0	4

Notes:

MS - matrix spike

MSD - matrix spike duplicate

VOCs - volatile organic compounds

SVOCs - semivolatile organic compounds

TCL - Target Compound List (as described in this QAPP)

Soil sampling to 25 feet bgs at two locations will be by hollow stem auger.

TABLE 3-3
PROJECT SOIL SAMPLING BREAKDOWN – BLOWN CAPACITOR SITE (AOC C)
CANNON AIR FORCE BASE, NEW MEXICO

Media	Parameter	Prep Method	Analytical Method	Investigative Samples	Field Duplicates	MS/MSD Samples	Total Samples
Soil	TCL PCBs	3540C	USEPA SW-846 8082	12	1	1	14

Notes:

MS - matrix spike

MSD - matrix spike duplicate

PCBs - polychlorinated biphenyls

TCL - Target Compound List

Soil sampling to 15 feet bgs at three locations will be by hollow stem auger.

TABLLE 3-4
PRESION CONTROL LIMITS FOR DUPLICATE SAMPLE EVALUATION
CANNON AIR FORCE BASE, NEW MEXICO

	Precision (RPD) Criteria
QC Parameter	**Soil**
VOCs	<50
SVOCs	<50
Metals	<50
PCBs	<50

VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
RPD - Relative Percent Difference

TABLE 3-5

ACCURACY AND PRECISION FOR VOC ANALYSIS

Spiking Compound	MS/MSD Accuracy (%R)	LCS/LCSD Accuracy (%R)	Precision (RPD)
	Soil	Soil	Soil
1,1,1-Trichloroethane	78-132	78-132	30
1,1,2,2-Tetrachloroethane	74-128	74-128	30
1,1,2-Trichloro-1,2,2-trifluoroethane	83-134	83-134	30
1,1,2-Trichloroethane	82-125	82-125	30
1,1-Dichloroethane	83-128	83-128	30
1,1-Dichloroethene	70-137	70-137	30
1,2,4-Trichlorobenzene	64-140	64-140	30
1,2,4-Trimethylbenzene	65-141	65-141	30
1,2-Dibromo-3-chloropropane	82-139	82-139	30
1,2-Dibromoethane	81-128	81-128	30
1,2-Dichlorobenzene	76-126	76-126	30
1,2-Dichloroethane	83-123	83-123	30
1,2-Dichloropropane	83-128	83-128	30
1,3,5-Trimethylbenzene	70-133	70-133	30
1,3-Dichlorobenzene	72-127	72-127	30
1,4-Dichlorobenzene	73-123	73-123	30
2-Butanone	77-125	77-125	30
2-Hexanone	71-136	71-136	30
4-Methyl-2-pentanone	75-129	75-129	30
Acetone	36-181	36-181	30
Benzene	77-130	77-130	30
Benzyl Chloride	72-126	72-126	30
Bromodichloromethane	79-127	79-127	30
Bromoform	75-127	75-127	30
Bromomethane	35-163	35-163	30
Carbon disulfide	75-121	75-121	30
Carbon tetrachloride	80-128	80-128	30
Chlorobenzene	72-126	72-126	30
Chloroethane	52-161	52-161	30
Chloroform	80-127	80-127	30
Chloromethane	52-143	52-143	30
cis-1,2-Dichloroethene	81-137	81-137	30
cis-1,3-Dichloropropene	73-139	73-139	30
Cyclohexane	84-118	84-118	30
Dibromochloromethane	79-127	79-127	30
Dichlorodifluoromethane	68-135	68-135	30
Ethylbenzene	73-127	73-127	30
Hexachlorobutadiene	66-145	66-145	30
Isopropylbenzene	69-131	69-131	30
m,p-Xylene	51-144	51-144	30
Methyl Acetate	65-135	65-135	30
Methyl tert-butyl ether	82-130	82-130	30
Methylcylohexane	65-135	65-135	30
Methylene chloride	69-148	69-148	30
o-Xylene	74-125	74-125	30
Styrene	62-137	62-137	30
Tetrachloroethene	74-129	74-129	30

TABLE 3-5

ACCURACY AND PRECISION FOR VOC ANALYSIS

Spiking Compound	MS/MSD Accuracy (%R)	LCS/LCSD Accuracy (%R)	Precision (RPD)
	Soil	Soil	Soil
Toluene	80-130	80-130	30
trans-1,2-Dichloroethene	78-138	78-138	30
trans-1,3-Dichloropropene	77-134	77-134	30
Trichloroethene	74-129	74-129	30
Trichlorofluoromethane	78-131	78-131	30
Vinyl Acetate	47-162	47-162	30
Vinyl chloride	55-138	55-138	30

%R - Percent recovery

RPD - Relative Percent Difference

VOC - Volatile Organic Compounds

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

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

All analytes are MS/MSD spiking compounds.

Samples are prepped using methods 5035 (soil) and analyzed by Method 8260B.

TABLE 3-6

ACCURACY AND PRECISION FOR SVOC ANALYSIS

Spiking Compound	MS/MSD Accuracy (%R)	LCS/LCSD Accuracy (%R)	Precision (%D)
	Soil	Soil	Soil
1,1'-Biphenyl	NE	NE	30
2,2'-oxybis(1-Chloropropane)	44-123	44-123	30
2,4,5-Trichlorophenol	57-99	57-99	30
2,4,6-Trichlorophenol	36-141	36-141	30
2,4-Dichlorophenol	39-133	39-133	30
2,4-Dimethylphenol	34-124	34-124	30
2,4-Dinitrophenol	25-164	25-164	30
2,4-Dinitrotoluene	34-142	34-142	30
2,6-Dinitrotoluene	41-135	41-135	30
2-Chloronaphthalene	33-139	33-139	30
2-Chlorophenol	38-124	38-124	30
2-Methylnaphthalene	32-136	32-136	30
2-Methylphenol	38-127	38-127	30
2-Nitroaniline	50-101	50-101	30
2-Nitrophenol	41-130	41-130	30
3,3'-Dichlorobenzidine	25-128	25-128	30
3-Nitroaniline	29-114	29-114	30
4,6-Dinitro-2-methylphenol	25-158	25-158	30
4-Bromophenyl phenyl ether	36-140	36-140	30
4-Chloro-3-methylphenol	39-139	39-139	30
4-Chloroaniline	10-100	10-100	30
4-Chlorophenyl-phenylether	34-140	34-140	30
4-Methylphenol	42-122	42-122	30
4-Nitroaniline	25-103	25-103	30
4-Nitrophenol	40-140	40-140	30
Acenaphthylene	35-138	35-138	30
Acenaphthene	43-124	43-124	30
Acetophenone	NE	NE	30
Anthracene	34-136	34-136	30
Atrazine	NE	NE	30
Benzaldehyde	NE	NE	30
Benzo(a)anthracene	42-142	42-142	30
Benzo(a)pyrene	25-143	25-143	30
Benzo(b)fluoranthene	33-150	33-150	30
Benzo(g,h,i)perylene	27-135	27-135	30
Benzo(k)fluoranthene	41-137	41-137	30
bis(2-Chloroethyl)ether	36-134	36-134	30
Bis(2-chloroethoxy)methane	37-132	37-132	30
Bis(2-ethylhexyl)phthalate	38-148	38-148	30
Butylbenzylphthalate	39-142	39-142	30
Carbazole	51-100	51-100	30
Chrysene	36-141	36-141	30
Caprolactam	NE	NE	30
Dibenzo(a,h)anthracene	26-144	26-144	30
Dibenzofuran	36-136	36-136	30
Diethylphthalate	51-126	51-126	30
Dimethylphthalate	33-142	33-142	30
Di-n-butylphthalate	36-151	36-151	30
Di-n-octylphthalate	51-139	51-139	30
Fluoranthene	42-144	42-144	30
Fluorene	27-144	27-144	30
Hexachlorobenzene	37-137	37-137	30

TABLE 3-6

ACCURACY AND PRECISION FOR SVOC ANALYSIS

Spiking Compound	MS/MSD Accuracy (%R)	LCS/LCSD Accuracy (%R)	Precision (%D)
	Soil	Soil	Soil
Hexachlorobutadiene	40-123	40-123	30
Hexachlorocyclopentadiene	25-151	25-151	30
Hexachloroethane	37-117	37-117	30
Indeno(1,2,3-cd)pyrene	30-145	30-145	30
Isophorone	36-136	36-136	30
Naphthalene	32-131	32-131	30
Nitrobenzene	38-132	38-132	30
N-Nitroso-di-n-propylamine	38-132	38-132	30
N-Nitrosodiphenylamine	38-123	38-123	30
Pentachlorophenol	32-150	32-150	30
Phenanthrene	31-141	31-141	30
Phenol	25-126	25-126	30
Pyrene	45-137	45-137	30

%R - Percent recovery
RPD - Relative Percent Difference
Note: The accuracy and precision values are applicable to MS/MSD and LCS/LCSD samples.
Samples are prepped using methods 3540C (soil) and 3520C (water) and analyzed by Method 8270C.
NE - Not evaluated by the laboratory

TABLE 3-7

ACCURACY AND PRECISION FOR METALS ANALYSIS

Spiking Compound	LCS/LCSD Accuracy (%R)	MS Accuracy (%R)	Precision (RPD)
	Soil	Soil	Soil
Lead	80-120	80-120	20

%R - Percent recovery
RPD - Relative Percent Difference
Note: The accuracy and precision values are applicable to MS and LCS/LCSD samples.
Samples are prepped using methods 3050B and analyzed by Method 6010B.

TABLE 3-8

ACCURACY AND PRECISION FOR POLYCHLORINATED BIPHENYLS ANALYSIS

Spiking Compound	LCS/LCSD Accuracy (%R)	MS/MSD Accuracy (%R)	Precision (RPD)
	Soil	Soil	Soil
Aroclor 1016	64-110	64-110	30
Aroclor 1260	61-139	61-139	30

%R - Percent recovery
RPD - Relative Percent Difference
Note: The accuracy and precision values are applicable to MS/MSD and LCS/LCSD samples.
Samples are prepped using methods 3540C (soil) and analyzed by Method 8082.

TABLE 3-9

SURROGATE COMPOUND ACCURACY CRITERIA

QC Parameter	Surrogate	Accuracy (%R) Soil
VOCs	1,2-Dichloroethane-d4	59-129
	Bromofluorobenzene	82-130
	Toluene-d8	61-136
SVOCs	2,4,6-Tribromophenol	71-122
	2-Fluorobiphenyl	60-120
	2-Fluorophenol	44-112
	Nitrobenzene-d5	53-120
	Phenol-d5	51-117
	Terphenyl-d14	64-121
PCBs	Decachlorobiphenyl	44-147
	Tetrachloro-m-xylene	25-147

VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
%R - percent recovery

The sampling procedures to be used in the Cannon AFB QAPP will be consistent with the objectives for this project. The SOPs are presented in Appendix C of the Supplemental Assessment Work Plan. The specific field SOPs that may be used are listed below. Sample containers, preservatives, and holding time requirements for each parameter and matrix are presented in Table 4-1.

- SOP No. 4 Subsurface Drilling and Soil Sampling
- SOP No. 11 Equipment Decontamination
- SOP No. 13 Sample Handling, Documentation, and Tracking
- SOP No. 15 Headspace Analysis
- SOP No. 16 Boring Abandonment
- SOP No. 17 Permits and Clearances
- SOP No. 19 EnCore® Sampling Method

TABLE 4-1
CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR SOIL SAMPLES
AOCs A, B, & C
CANNON AIR FORCE BASE, NEW MEXICO

MATRIX	Parameter	Container	Preservative	Holding Time
Soil	TCL VOCs	3 5-g EnCore Samplers	4°C	48 hours preservation, 14 days analysis
	TCL SVOCs	4 oz. glass jar, Teflon lined lid	4°C	14 days extract, 40 days analysis
	TCL PCBs	4 oz. glass jar, Teflon lined lid	4°C	14 days extract, 40 days analysis
	Lead	4 oz. glass jar, Teflon lined lid	4°C	6 months

Notes:

[1] TCL SVOCs and lead will be combined into one 4 oz. glass jar.

[2] Two to three times the normal number of sample containers may need be collected for samples requiring MS/MSD and percent moisture analysis (coordinate with laboratory).

PCBs - polychlorinated biphenyls

SVOC - semivolatile organic compound

TCL - Target Compound List

VOC - volatile organic compound

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

A sample or evidence file is under your custody if:

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

5.1 FIELD CUSTODY AND DOCUMENTATION PROCEDURES

Field logbooks will provide the means of recording data collecting activities performed during the investigation. As such, entries will be described in as much detail as possible so that persons going to the facility could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- Estimated project end date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection equipment being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel, and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. All entries will be made in permanent ink, signed, and dated. If an incorrect entry is made, the information will be crossed out with a single strike mark, which is initialed by the sampler. Whenever a sample is collected or a measurement is made, a detailed description of the location, which may include compass and distance measurements or latitude and longitude information (e.g., obtained by using a

global positioning system) will be recorded. The number of the photographs taken, if any, will also be noted. All equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the SOPs presented in Appendix C of the Supplemental Assessment Work Plan. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume, and number of containers. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples, which will receive a unique sample identification number, will be noted.

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain-of-custody intact. The protocol for specific sample numbering and other sample designations are included in the QAPP. Examples of field custody documents and instructions for completion are presented in Appendix A of this QAPP.

- The field sampler is personally responsible for the care and custody of the samples until they are relinquished or properly dispatched. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented in WP.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather. Sample labels will be affixed to the sample containers using clear tape.
- A properly completed chain-of-custody form will accompany all samples. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to the permanent laboratory, or to/from a secure storage area.
- Samples will be properly packaged on ice at 4°C ± 2°C for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be closed and secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by the field team leader. The cooler will be secured with strapping tape in at least two locations.

As part of the field documentation, Sample Collection Field Sheets (SCFS) will be generated. The SCFS will summarize the sample collection data (i.e., parameters). Daily Quality Control Reports (DQCRs) will also be generated, describing the quality control parameters taken for that day. Drilling logs of each boring will also be generated along with SCFS and DQCRs. Examples of each of these forms can be found in the WP.

5.2 LABORATORY CUSTODY PROCEDURES

Laboratory custody procedures for sample receiving and log-in, sample storage and numbering, tracking during sample preparation and analysis, and storage of data are described in the laboratory QAPP (available upon request).

5.3 FINAL EVIDENCE FILE

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities as described in this QAPP. URS is the custodian of the evidence file and maintains the contents of evidence files for the investigation, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited-access area and under custody of the URS Project Manager.

The final evidence file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs
- Drawings
- Soil boring logs
- Laboratory data deliverables
- Data validation reports
- Data assessment reports
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (tags, forms, air bills, etc.)

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.1 FIELD INSTRUMENT CALIBRATION

All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which readings were taken, and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will likewise be documented.

6.2 LABORATORY INSTRUMENT CALIBRATION

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

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

Subsurface soil samples will be collected during field sampling activities as part of the Cannon AFB QAPP. All samples will be sent to APPL Laboratories of Fresno, California, for analysis as outlined in tables 1-1 to 1-5.

7.1 FIELD ANALYTICAL PROCEDURES

Field analytical procedures for subsurface samples include continual monitoring with a Photo Ionization detector (PID). Refer to SOP No. 15 in Appendix C of the Work Plan for specific procedures.

7.2 LABORATORY ANALYTICAL PROCEDURES

The contract laboratory will implement the project-required SOPs. These laboratory SOPs for sample preparation, cleanup, and analysis are based on *Test Method for Evaluating Solid Waste, Physical/Chemical Methods, Final Update III, March 2001* and other applicable methods. The laboratory will report all detections above the MDL. Values above the MDL and below the RL will be qualified as estimated "**J**". MDL's were determined as outlined in 40 CFR, Part 136. The RL's are typically at least 3-5 times the MDL.

Table 1-1 identifies the laboratory analytical methods and the succeeding sections summarize the analytical methods that will be used during this investigation.

7.2.1 Volatile Organic Compounds (VOCs)

Volatile organic compounds (VOCs) include compounds among varying classes such as halogenated organics and non-halogenated aliphatic and aromatic organics. The first class of compounds generally contains contaminants associated with solvents such as TCE. The other classes include compounds associated with petroleum hydrocarbons, such as BTEX.

Method 8260B is a purge-and-trap gas chromatographic (GC) method appropriate for analysis of suspected VOCs and employs mass spectrometry (MS) for detection. Table 1-2 presents the comprehensive VOC project analyte list, as well as the MDLs, and RLs.

7.2.2 Semivolatile Organic Compounds (SVOCs)

Method 8270C (SW-846) is a GC/MS method for determining extractable base/neutral and acid compounds. This procedure will include the general classes of compounds, such as phenols, nitrosamines, PAHs, phthalate esters, etc. A list of the target analytes, the MDLs, and RLs is included in Table 1-3. Tentatively identified compounds (TICs) will not be reported.

7.2.3 Polychlorinated Biphenyls (PCBs)

Samples to by analyzed for total polychlorinated biphenyls (PCBs) will be prepared using Method 3540C and analyzed by USEPA Method 8082 using a GC equipped with an electrolytic conductivity detector (ELCD). All compounds detected above the RL will be confirmed using a column of dissimilar phase. Analytes will not be reported as detected unless detected on both

columns. The laboratory will report the higher of the two concentrations detected. The target analytes, MDLs and RLs, are provided in Table 1-5.

7.2.4 Metals

Samples will be analyzed for total metals by Method 6010B/7470A. Interpretation of metals data can be complex, particularly when background and/or naturally occurring levels complicate the analysis.

The following are various factors, which influence the use of particular methods:

- Detection limits
- Interference
- Stability
- Project-specific DQOs

Lead will be prepared by USEPA Method 3050A and will be analyzed by USEPA Method 6010B, inductively coupled plasma atomic emission spectroscopy (ICP-AE). Table 1-4 provides MDLs and RLs for metals.

8.1 FIELD QUALITY CONTROL CHECKS

The QC criteria for each field measurement are provided in Section 3 of this QAPP. Assessment of field sampling precision and bias will be made by collecting field duplicates for laboratory analysis. Collection of the samples will be in accordance with the applicable SOPs, presented in Appendix C of the Work Plan and will be collected at the frequency indicated in Tables 3-1 through 3-3 of this QAPP.

8.2 LABORATORY QUALITY CONTROL CHECKS

The contract laboratory has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing as laboratory SOPs, and each SOP includes a QC section which addresses the minimum QC requirements for the procedure. The internal QC checks differ slightly for each individual procedure, but in general, the QC requirements include the following:

- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks
- MS/MSDs
- Surrogate spikes
- Laboratory control samples
- Interference check samples
- Serial dilutions
- Laboratory duplicates
- Initial calibration
- Calibration verification
- Internal standard areas for GC/MS analysis
- Mass tuning for GC/MS analysis

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

All data generated through field activities, or by the laboratory operation, shall be reduced and validated prior to reporting. The laboratory shall disseminate no data until it has been subjected to validation procedures, which are summarized in the succeeding sections.

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

All field data will be written into field logbooks immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Periodically throughout the field sampling effort, the Field Manager, identified in Section 2 of this QAPP, will review the forms to determine whether any errors have been made by the field crew.

9.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures are located in the laboratory QAPP (available upon request).

9.2 QC DATA REVIEW AND VALIDATION

One hundred percent of the data will undergo a QC data review by the URS Project Chemist or designee. In general, the QC data review will follow the guidance from *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review (2001)* and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (2002)*, where applicable to SW-846 methodologies. The criteria used to evaluate the QC parameters are those criteria identified in Tables 3-4 through 3-9. The QC data review will include the review of the QC parameters listed below:

- Data package completeness
- Chain of custody
- Cooler receipt form
- Case narrative
- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Matrix spike/matrix spike duplicates
- Surrogate spikes
- Laboratory control samples
- Field duplicates
- Laboratory duplicates

- Professional judgment

In addition, approximately 10 percent of the data will undergo a data validation by the URS Project Chemist or designee. This validation will also follow the *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review (2001)* and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (2002)*, where applicable to SW-846 methodologies. The validation will use the QC criteria presented in Tables 3-4 through 3-9. The validation is more comprehensive than the QC data review. The validation will include all of the elements identified in the review; however the validation will include additional parameter reviews and the recalculation of the raw data. The QC parameters to be validated include the following:

- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Calibration blanks
- Initial Calibration
- Initial and Continuing Calibration Verification
- Internal standard areas for GC/MS analysis
- Mass tuning for GC/MS analysis
- MS/MSDs
- Surrogate spikes
- Laboratory control samples
- Serial dilutions (inorganic analyses)
- Interference check sample (ICP analysis)
- Laboratory duplicates

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

While the referenced *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review (2001)* and *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (2002)* documents will be used as guidance during the data review and validation procedures, the document was written for Contract Laboratory Program (CLP) Statement of Work (SOW) analyses. Since samples will be analyzed by USEPA SW-846 methods, the Guidelines will be used where applicable to the analytical methodologies used for analysis. Tables 9-1 through 9-4 summarize the general criteria to be used during the QC data review and validation procedures.

9.3 DATA REPORTING

Data reporting procedures will be carried out for field and laboratory operations as indicated below.

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field and documentation of all field calibration activities.

9.3.2 Laboratory Data Reporting

The task of reporting laboratory data begins after the independent validation activity has been concluded. The URS QA Officer must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. In addition to the record of chain-of-custody, the report format shall consist of the following:

Case Narrative

- Date of issuance
- Laboratory analysis performed
- Any deviations from intended analytical strategy
- Laboratory batch number
- Numbers of samples and respective matrices
- QC procedures utilized and also references to the acceptance criteria
- Laboratory report contents
- Project name and number
- Condition of samples 'as-received'
- Discussion of whether or not sample holding times were met
- Discussion of technical problems or other observations which may have created analytical difficulties
- Discussion of any laboratory QC checks which failed to meet project criteria
- Signature of the Laboratory QA Officer

Chemistry Data Package

- Case narrative for each analyzed batch of samples
- Summary page indicating dates of analyses for samples and laboratory QC checks
- Cross referencing of laboratory sample to project sample identification numbers

- Description of data qualifiers to be used
- Sample preparation and analyses for samples
- Sample results (Analytical results will be reported as estimated **J** when detected above the MDL and below the RL.)
- Raw data for sample results and laboratory QC samples (including LCS, MS/MSD, surrogates, and method blanks)
- Results of (dated) initial and continuing calibration checks, and GC/MS tuning results

All chemical data will also be submitted in electronic format. The data will be submitted in the ERPIMS format.

TABLE 9-1

DATA REVIEW / VALIDATION CRITERIA FOR VOC ANALYSIS

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Holding Time (HT)	Every Sample	days	All	Encore samples preserved in sodium bisulfate within 48 hours of sampling.	HT < 14 days, no action. 14 days < HT < 28 days qualify sample J/UJ. HT > 28 days qualify sample R. For soil samples, HT<48 hours, no action. 48 hours<HT qualifiy all results R.
Tuning	Every 12-hour analytical shift	BFB	target mass 50	15-40% of mass 95	Professional judgment
			target mass 75	30-60% of mass 95	Professional judgment
			target mass 95	relative abundance	Professional judgment
			target mass 96	5-9% of mass 95	Professional judgment
			target mass 173	0.00-2% of mass 174	Professional judgment
			target mass 174	50-100% of mass 95	Professional judgment
			target mass 175	5-9% of mass 174	Professional judgment
			target mass 176	95-101% of mass 174	Professional judgment
			target mass 177	5-9% of mass 176	Professional judgment
Initial Calibration		RF (SPCCs)	Chloromethane	≥ 0.10	Qualify associated data J/UJ
			1,1-Dichloroethane	≥ 0.10	Qualify associated data J/UJ
			Bromoform	≥ 0.10	Qualify associated data J/UJ
			Chlorobenzene	≥ 0.30	Qualify associated data J/UJ
			1,1,2,2-Tetrachloroethane	≥ 0.30	Qualify associated data J/UJ
			All other target analytes	≥ 0.05	Qualify associated data J/R.
		RSD	All target analytes	≤ 30%	Qualify associated data J/UJ
Continuing Calibration	Every 12-hour analytical shift	RF (SPCCs)	Chloromethane	≥ 0.10	Qualify associated data J/UJ
			1,1-Dichloroethane	≥ 0.10	Qualify associated data J/UJ
			Bromoform	≥ 0.10	Qualify associated data J/UJ
			Chlorobenzene	≥ 0.30	Qualify associated data J/UJ
			1,1,2,2-Tetrachloroethane	≥ 0.30	Qualify associated data J/UJ
			All other target analytes	≥ 0.05	Qualify associated data J/R.
		%D	CCCs	± 20%	Qualify associated data J/UJ
			other target analytes	± 30%	Qualify associated data J/UJ

TABLE 9-1

DATA REVIEW / VALIDATION CRITERIA FOR VOC ANALYSIS

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Method Blank	Every Batch	Method Blank	Common contaminants	≤ 5 x RL	Contamination ≥ 5 x RL, reanalyze associated data. IDL < contamination ≤ 5 x RL, qualify associated detect sample data < 10 x blank contamination as non-detect (U).
			Other Analytes	≤ RL	Contamination ≥ RL, reanalyze associated data. IDL < contamination ≤ RL, qualify associated detect sample data < 5 x blank contamination as non-detect (U).
Surrogates	Every sample	%R	All spiking compounds	See QAPP Table 3-9	If %R < criteria, qualify all data J/UJ; if %R > criteria, qualify detected compounds as J.
			Any surrogate	< 10%	Qualify associated data J/R.
Laboratory Control Sample/Laboratory Control Sample Duplicate	Every Batch	%R	All spiking compounds	See QAPP Table 3-5	If %R < criteria, qualify associated data and compounds J/UJ; if %R > criteria, qualify associated detected compounds as J. Data will not be qualified if the LCS and LCSD recoveries are within criteria and the RPD is out.
		RPD	All spiking compounds		
			Any LCS Compound	< 10%	Qualify associated data and compounds J/R.
Internal Standard	Every sample	IS area count	All IS	-50% or +100%	Qualify associated data J/UJ, R if extremely low
			All IS	± 30 seconds	Qualify associated data R.
Matrix Spike/Matrix Spike Duplicate	Every Batch	%R	All spiking compounds	See QAPP Table 3-5	If %R < criteria, qualify associated compounds in parent sample J/UJ, if %R > criteria, qualify associated detected compounds in parent sample as J. Note: Organic data are not qualified using MS/MSD data alone. Other QC parameters will be reviewed. Data will not be qualified if the MS and MSD recoveries are within criteria and the RPD is out.
		RPD	All spiking compounds	See QAPP Table 3-5	
			Any MS compound	< 10%	Qualify associated data J/R in parent sample.
Field Duplicate	10%	RPD	All analytes	Soil - 50%	If RPD > 50%, qualify associated data J.

Note: The criteria above is general guidance. Professional judgment will be used to determine appropriate actions and may not necessarily follow the above criteria.

TABLE 9-2

DATA REVIEW / VALIDATION CRITERIA FOR SVOC ANALYSIS

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Holding Time (HT)	Every Sample	days	All	14 days extraction / 40days analysis - soil	HT < 14/40 days, no action. 14/40 days < HT < 28/80 days qualify sample J/UJ. HT > 28/80 days qualify sample R.
Tuning	Every 12-hour analytical shift	DFTPP	target mass 51	30-60% of mass 198	Professional judgment
			target mass 68	0.00-2% of mass 69	Professional judgment
			target mass 69	0.00-100% of mass 198	Professional judgment
			target mass 70	0.00-2% of mass 69	Professional judgment
			target mass 127	40-60% of mass 198	Professional judgment
			target mass 197	0.00-1% of mass 198	Professional judgment
			target mass 198	Relative abundance	Professional judgment
			target mass 199	5-9% of mass 198	Professional judgment
			target mass 275	10-30% of mass 198	Professional judgment
			target mass 365	1-100% of mass 198	Professional judgment
			target mass 441	0.01-100% of mass 443	Professional judgment
			target mass 442	40-100% of mass 198	Professional judgment
			target mass 443	17-23% of mass 442	Professional judgment
Initial Calibration		RF	SPCCs	≥ 0.05	Qualify associated data J/R
			All other target analytes	≥ 0.05	Qualify associated data J/R
		RSD	All target analytes	≤ 30%	Qualify associated data J/UJ
Continuing Calibration	Every 12-hour analytical shift	RF	CCCs	≥ 0.05	Qualify associated data J/R.
			All other target analytes	≥ 0.05	Qualify associated data J/R.
		%D	CCCs	± 20%	Qualify associated data J/UJ
			All other target analytes	± 30%	Qualify associated data J/UJ

TABLE 9-2

DATA REVIEW / VALIDATION CRITERIA FOR SVOC ANALYSIS

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Method Blank	Every Batch	Method Blank	Common contaminants	≤ 5 x RL	Contamination ≥ 5 x RL, reanalyze associated data. IDL < contamination ≤ 5 x RL, qualify associated detect sample data < 10 x blank contamination as non-detect (U).
			Other Analytes	≤ RL	Contamination ≥ RL, reanalyze associated data. IDL < contamination ≤ RL, qualify associated detect sample data < 5 x blank contamination as non-detect (U).
Surrogates	Every sample	%R	All spiking compounds	See QAPP Table 3-9	If %R < criteria of two per fraction, qualify all data J/UJ; if %R > criteria of two per fraction, qualify detected compounds as J.
			Any surrogate	< 10%	Qualify associated fraction data J/R.
Laboratory Control Sample/Laboratory Control Sample Duplicate	Every Batch	%R	All spiking compounds	See QAPP Table 3-6	If %R < criteria, qualify associated data and compounds J/UJ; if %R > criteria, qualify associated detected compounds as J. Data will not be qualified if the LCS and LCSD recoveries are within criteria and the RPD is out.
		RPD	All spiking compounds		
			Any LCS Compound	< 10%	Qualify associated data and compounds J/R.
Internal Standard	Every sample	IS area count	All IS	-50% or +100%	Qualify associated data J/UJ, R if extremely low
			All IS	± 30 seconds	Qualify associated data R.
Matrix Spike/Matrix Spike Duplicate	Every Batch	%R	All spiking compounds	See QAPP Table 3-6	If %R < criteria, qualify associated compounds in parent sample J/UJ, if %R > criteria, qualify associated detected compounds in parent sample as J. Note: Organic data are not qualified using MS/MSD data alone. Other QC parameters will be reviewed. Data will not be qualified if the MS and MSD recoveries are within criteria and the RPD is out.
		RPD	All spiking compounds	See QAPP Table 3-6	
			Any MS compound	< 10%	Qualify associated data J/R in parent sample.
Field Duplicate	10%	RPD	All analytes	Soil - 50%	If RPD > 50%, qualify associated data J.

Note: The criteria above is general guidance. Professional judgment will be used to determine appropriate actions and may not necessarily follow the above criteria.

TABLE 9-3

DATA REVIEW / VALIDATION CRITERIA FOR METALS

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Holding Time (HT)	Every Sample	months (days)	All Compounds	6 months	HT < 6 months, no action. 6 months < HT < 9 months qualify sample J/UJ. HT > 9 months qualify sample R.
Initial Calibration		%R	6010 metals	± 10%	Qualify associated data J/R
Initial Calibration Verification	After Initial Calibration	%R	All Compounds	± 10%	Reanalyze ICV . If repeated failure, recalibrate instrument.
Continuing Calibration	Every 12-hour analytical shift	%R	All Compounds	± 10%	Qualify associated data J/UJ
Serial Dilution	Every Batch	%D	All Compounds	± 10%	Qualify associated data J/UJ
ICP Interference Check Sample	Initially	%R	6010 metals	± 20%	Qualify associated data J/UJ
Method Blank	Every Batch	Method Blank	All Compounds	≤ RL	Contamination ≥ RL, reanalyze associated data. IDL < contamination ≤ RL, qualify associated detect sample data < 5 x blank contamination as non-detect (U).
Laboratory Control Sample	Every Batch	%R	All spiking compounds	See QAPP Table 3-7	If %R < criteria, qualify associated data and compounds J/UJ; if %R > criteria, qualify associated detected compounds as J.
			Any LCS Compound	< 20%	Qualify associated data J/R
Matrix Spike/Matrix Spike Duplicate	Every Batch	%R RPD	All spiking compounds	See QAPP Table 3-7	If %R > upper limit, qualify parent sample detects J; if %R 30% - 79% qualify parent sample data J/UJ; if %R < 30%, qualify parent sample data R. Data will not be qualified if the MS and MSD recoveries are within criteria and the RPD is out.
			Any MS compound	< 10%	Qualify sample parent sample data R.

TABLE 9-3

DATA REVIEW / VALIDATION CRITERIA FOR METALS

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Laboratory Duplicate	Every Batch	RPD	All analytes	20%	If RPD > 20% and concentration > 5 x RL in parent and duplicate, qualify associated data J.
Field Duplicate	10%	RPD	All analytes	Soil - 50%	If RPD > 50%, qualify associated data J.

Note: The criteria above is general guidance. Professional judgment will be used to determine appropriate actions and may not necessarily follow the above criteria.
Samples were only being analyzed for Lead for the invetigation at Aoc A, Aoc B, Aoc C.

TABLE 9-4

DATA REVIEW / VALIDATION CRITERIA FOR PCBs

Parameter	Frequency	Measurement	Analyte	Criteria	Action
Holding Time (HT)	Every Sample	days	All Compounds	14 days extraction / 40days analysis - soil	HT < 14/40 days, no action. 14/40 days < HT < 28/80 days qualify sample J/UJ. HT > 28/80 days qualify sample R.
Initial Calibration		R	All Compounds	0.990	Qualify associated data J/R
		RSD	All Compounds	≤ 20%	Qualify associated data J/R
Continuing Calibration	Every 12-hour analytical shift	%D	All Compounds	≤ 15%	Qualify associated data J/UJ
Method Blank	Every Batch	Method Blank	All Compounds	≤ RL	Contamination ≥ RL, reanalyze associated data. IDL < contamination ≤ RL, qualify associated detect sample data < 5 x blank contamination as non-detect (U).
Surrogates	Every sample	%R	All spiking compounds	See QAPP Table 3-9	If %R < criteria, qualify all data J/UJ; if %R > criteria, qualify detected compounds as J.
			Any surrogate	< 10%	Qualify associated data J/R.
Laboratory Control Sample/Laboratory Control Sample Duplicate	Every Batch	%R	All spiking compounds	See QAPP Tables 3-8	If %R < criteria, qualify associated data and compounds J/UJ; if %R > criteria, qualify associated detected compounds as J. Data will not be qualified if the LCS and LCSD recoveries are within criteria and the RPD is out.
		RPD	All spiking compounds		
			Any LCS Compound	< 10%	Qualify associated data and compounds J/R.
Matrix Spike/Matrix Spike Duplicate	Every Batch	%R	All spiking compounds	See QAPP Tables 3-8	If %R < criteria, qualify associated compounds in parent sample J/UJ, if %R > criteria, qualify associated detected compounds in parent sample as J. Note: Organic data are not qualified using MS/MSD data alone. Other QC parameters will be reviewed. Data will not be qualified if the MS and MSD recoveries are within criteria and the RPD is out.
		RPD	All spiking compounds	See QAPP Tables 3-8	
			Any MS compound	< 10%	Qualify associated data J/R in parent sample.
Field Duplicate	10%	RPD	All analytes	Soil - 50%	If RPD > 50%, qualify associated data J.

Note: The criteria above is general guidance. Professional judgment will be used to determine appropriate actions and may not necessarily follow the above criteria.

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

10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

If performed, internal audits of field activities including sampling and field measurements, will be conducted by the URS QA Officer or designee. These audits will verify that all established procedures are being followed. The audit will be completed at the beginning of the project and will include a review of all field activities completed at that time.

10.1.1.2 Internal Field Audit Frequency

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

10.1.1.3 Internal Field Audit Procedures

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

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

If performed, external field audits may be conducted by the USACE QA Officer or designee and/or the USACE Project Manager or designee.

10.1.2.2 External Field Audit Frequency

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

10.1.2.3 External Field Audit Process

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

10.2 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

10.2.1 Internal Laboratory Audits

10.2.1.1 Internal Laboratory Audit Responsibilities

If performed during this project, the internal laboratory audit will be conducted by the URS QA Officer.

10.2.1.2 Internal Laboratory Audit Frequency

The internal system audits will be done on an annual basis, while the internal performance audits will be conducted on a quarterly basis.

10.2.1.3 Internal Laboratory Audit Procedures

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

The performance audits will involve preparing blind QC samples and submitting them, along with project samples, to the laboratory for analysis throughout the project. The URS QA Officer will evaluate the analytical results of these blind performance samples to ensure the laboratory maintains acceptable QC performance.

10.2.2 External Laboratory Audits

10.2.2.1 External Laboratory Audit Responsibilities

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

10.2.2.2 External Laboratory Audit Frequency

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

10.2.2.3 Overview of the External Laboratory Audit Process

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

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

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

- Comparison of resulting data to the SOP or method, including coding for deviations
- Verification of initial and continuing calibrations within control limits
- Verification of surrogate recoveries and instrument timing results, where applicable
- Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable
- Recoveries on control standard runs
- Review of run logs with run times, ensuring proper order of runs
- Review of spike recoveries/QC sample data
- Review of suspected manually integrated GC data and its cause (where applicable)
- Review of GC peak resolution for isolated compounds as compared to reference spectra (where applicable)
- Assurance that samples are run within holding times

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

11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

Specific preventative maintenance procedures to be followed for field equipment are based on those recommended by the manufacturer. Field instruments will be calibrated daily before use and checked every twelve hours of operation. Calibration checks will be documented in the instrument calibration log book. Critical spare parts, such as tape and batteries, will be kept on site to reduce potential downtime. Backup instruments and equipment will be available within 1-day shipment to avoid delays in the field schedule.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of the QA Program Plan, a routine preventative maintenance program is conducted by the contract laboratory to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees regularly perform routine scheduled maintenance and repair of (or coordinate with the vendor for the repair of) all instruments. All maintenance that is performed is documented in the laboratory's operating record. All laboratory instruments are maintained in accordance with manufacturer's specifications. The frequency of laboratory preventive maintenance is identified in the laboratory QAPP (available upon request).

12.1 EVALUATION OF DATA PRECISION, ACCURACY, AND COMPLETENESS

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

- The contaminants known and/or suspected to be of concern on a project, as they relate to the data quality level parameters chosen
- The choice of analytical and sample preparation methods for contaminants of concern whose method detection limits will meet or exceed the data quality level concentrations for those contaminants

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

12.2 ACCURACY ASSESSMENT

In order to assure the accuracy of the analytical procedures, an environmental sample shall be spiked with a known amount of the analytes included in Tables 3-4 through 3-9. At a minimum, one sample spike should be included in every set of 20 samples tested on each instrument, for each sample matrix to be tested (i.e., surface/ground water, sediment, and soil). The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the un-spiked sample determines the percent recovery.

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

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

$$\% R = \frac{(\text{Amount in Spiked Sample} - \text{Amount in Sample}) \times 100}{\text{Known amount added}}$$

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

$$\% R = \frac{\text{Experimental Concentration} \times 100}{\text{Known amount added}}$$

12.3 PRECISION ASSESSMENT

The relative percent difference (RPD) between the spike and matrix spike, or matrix spike and sample duplicate in the case of metals, and field duplicate pair or laboratory duplicate pair is calculated to assess precision DQOs. The RPD is calculated according to the following formula:

$$RPD = \frac{(\text{Amount in Sample 1} - \text{Amount in Sample 2}) \times 100}{0.5\ (\text{Amount is Sample 1} + \text{Amount in Sample 2})}$$

12.4 COMPLETENESS ASSESSMENT

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

$$Completeness = \frac{(\text{number of valid measurements}) \times 100}{(\text{number of measurements planned})}$$

12.5 OVERALL ASSESSMENT OF DATA

The laboratory data collected during this investigation will be used to evaluate site contaminant migration and compliance with the Cannon AFB QAPP. The QC results associated with each analytical parameter will be compared to the objectives presented in Tables 3-4 through 3-9 of this QAPP. Only data generated in association with QC results meeting these objectives will be considered usable for decision-making purposes.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, parameter-specific, and unit-specific basis. This assessment will be performed by the URS QA Officer and the results presented and discussed in detail in the final investigation report. Factors to be considered in this assessment of field and laboratory data will include, but not necessarily be limited to, the following:

- Were all samples obtained using the methodologies and SOPs proposed in the QAPP?
- Were all proposed analyses performed according to the SOPs provided in the laboratory QAPP?
- Were samples obtained from all proposed sampling locations and depths?
- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?
- Were any unexpected target analytes present at a site?
- Were all field and laboratory data validated according to the validation protocols, including project-specific QC objectives, proposed in the QAPP?
- Which data sets were found to be unusable (qualified as "R") based on the data validation results?

- Which data sets were found to be usable for limited purposes (qualified as "J") based on the data validation results?
- What effects do qualifiers applied as a result of data validation have on the ability to implement the project decision rules?
- Has sufficient data of appropriate quality been generated to support the Cannon AFB QAPP?
- Can valid conclusions be drawn at each site under investigation?
- Were all issues requiring corrective action fully resolved?
- Were the project-specific decision rules used as proposed during the actual investigation?
- For any cases where the proposed procedures and/or requirements have not been met, has the effect of these issues on the project objectives been evaluated?
- Have any remaining data gaps been identified and summarized in the final investigation report?
- Based on the overall findings of the investigation and this assessment, were the original project objectives appropriately defined? If not, have revised project objectives been developed?

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

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

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

13.1 FIELD CORRECTIVE ACTION

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc., due to unexpected conditions. In general, the Field Manager, URS QA Officer, or the URS Project Manager may identify the need for corrective action. The field staff in consultation with the Field Manager will recommend a corrective action. The URS Project Manager will approve the corrective measure, which will be implemented by the field team. It will be the responsibility of the URS Project Manager to ensure the corrective action has been implemented. All corrective actions implemented will be documented in the field logbooks, SCFS, and DQCRs.

13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions (such as broken sample containers, multiple phases, low/high pH readings, potentially high concentration samples) may be identified during sample log-in or just prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for the laboratory QA Officer to approve the implementation of corrective action. Depending on the condition encountered, the laboratory QA Officer may consult the URS QA Officer for input. Conditions during or after analysis that may automatically trigger corrective action or optional procedures include dilution of samples, additional sample extract cleanup, automatic re-injection/reanalysis when certain QC criteria are not met, etc. A summary of method-specific corrective actions are available in the laboratory QAPP (available upon request). All laboratory corrective actions will be documented and identified in the case narrative of the data packages.

13.3 CORRECTIVE ACTION DURING DATA REVIEW / VALIDATION AND ASSESSMENT

The need for corrective action may be required during either the data review/validation or data assessment. Potential types of corrective action may include re-sampling by the field team or re-extraction/re-analysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded, etc.). If the URS QA Officer identifies a corrective action situation, it is the URS Project Manager who will be responsible for approving the implementation of corrective action, including re-sampling, during data assessment. All corrective actions of this type will be documented by the URS Project Manager.

14.1 CONTENTS OF PROJECT QA REPORTS

The URS Field Manager will report to the URS Project Manager on a daily basis regarding progress of the fieldwork and quality control issues associated with field activities.

The laboratory maintains detailed procedures for laboratory record keeping in order too support the validity of all analytical work. Each data set report submitted to the QA/QC Coordinator will contain the laboratory's written certification that the requested analytical methods were run and that all QA/QC checks were within established control limits for all samples analyzed.

After receipt of all analytical data, the URS Project Chemist will submit a Data Review Report for each data set to the URS QA Officer and the URS Project Manager describing the accuracy and precision of the data. Verbal reports will be provided following the receipts of individual packages as they are received. If any QA problems are encountered, the laboratory Project Manager will call the URS Project Chemist immediately for corrective action and issue a written report to the URS Project Chemist. The URS Project Chemist will immediately report the QA problem to the URS QA Officer and the Project Manager.

After the fieldwork is complete and the final analyses are completed, reviewed and validated, a final report will be prepared. The report will summarize the quality assurance and audit information (if completed), indicating any corrective actions taken and the overall results of QAPP compliance. The URS Project Chemist (or designee) will prepare this final summary and submit this to the QA Officer for review. The report will be utilized during the decision making-process and will be incorporated as part of the Final Report.

14.2 PERFORMANCE AND SYSTEM AUDITS

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

14.2.1 Performance Audits

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

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

14.2.2 System Audits

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

14.2.3 Audit Records

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

U.S. Environmental Protection Agency (USEPA). 2001. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. SW846. Fourth Edition. Final Update III, 2001.

U.S. Environmental Protection Agency (USEPA). 2001. Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review. Office of Emergency and Remedial Response (OERR). EPA 540-R-00-006. June 2001.

U.S. Environmental Protection Agency (USEPA). 2002. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. Office of Emergency and Remedial Response (OERR). EPA 540-R-01-008. July 2001.

URS Corporation (URS). 2004. Final Work Plan Volume I – Field Sampling Plan, Cannon Air Force Base, New Mexico.

SITE SAFETY AND HEALTH PLAN

SUPPLEMENTAL ASSESSMENT
AOC A, B, & C
CANNON AIR FORCE BASE,
NEW MEXICO

January 2005

Prepared for:

U.S. Department of the Army
Corps of Engineers – Omaha District
Omaha, Nebraska

Contract No. W9128F-04-0001
Task Order 17

Prepared by:

URS
12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154

16169716

SUPPLEMENTAL ASSESSMENT SITE SAFETY AND HEALTH PLAN

AREAS OF CONCERN A, B, & C – CANNON AIR FORCE BASE

APPROVALS:

(for) 1/10/05

Steve Cox, URS Project Manager (PM) — Date

1/10/05

Jeff Hopkins, URS Project Health and Safety Manager — Date

1/10/05

Dennis Day, Certified Industrial Hygienist (CIH), URS Regional Health and Safety Manager (RHSM) — Date

1/10/05

Mike Sonderman, URS Field Team Leader (FTL) & URS Site Safety Officer (SSO) — Date

This supplemental assessment (SA) site safety and health plan (SSHP) is valid for Hazardous and/or Toxic Waste (HTW) activities completed by URS and its subcontractors at Areas of Concern (AOCs) A, B, and C at Cannon Air Force Base. This SA SSHP must be used in conjunction with any subsequent SA-related SSHP Addenda. Each SA-related SSHP Addendum must include an approval page signed and dated by the URS Project Manager and Certified Industrial Hygienist. **A copy of this plan and any SA-related SSHP Addenda are to be maintained at the site at all times during fieldwork.**

TABLE OF CONTENTS

Section 1 **Introduction** **1-1**
1.1 Site Descriptions 1-1
1.1.1 AOC A 1-1
1.1.2 AOC B 1-1
1.1.3 AOC C 1-1
1.2 Purpose and Scope of Work 1-2
1.3 Applicability 1-2
1.4 USACE Safety and Health Requirements Manual EM 385-1-1 1-2
1.5 Changes to the SA SSHP 1-3

Section 2 **Responsibilities** **2-1**
2.1 On-Site Personnel 2-1
2.2 Project Manager 2-1
2.3 Site Safety Officer 2-2
2.4 Project Health and Safety Manager & Regional Health and Safety Manager 2-3

Section 3 **Job Hazard Analysis** **3-1**
3.1 Chemical Hazards 3-1
3.1.1 Site Constituents 3-1
3.1.2 Hazard Communication Materials 3-1
3.2 Physical Hazards 3-2
3.2.1 Hand Safety 3-2
3.2.2 Heat Stress Recognition and Control 3-2
3.2.3 Cold Stress Recognition and Control 3-5
3.2.4 Noise Hazards 3-5
3.2.5 Slip/Trip/Fall Hazards 3-6
3.2.6 Lifting Hazards 3-6
3.2.7 Heavy Equipment 3-6
3.2.8 Underground and Aboveground Utilities 3-7
3.3 Biological Hazards 3-8
3.3.1 Insects and Arachnids 3-8
3.3.2 Reptiles 3-8
3.3.3 Other Animals 3-8
3.3.4 Plants 3-8
3.3.5 Blood-Borne Pathogens 3-9
3.4 Radiological Hazards 3-9

Section 4 **Exposure Monitoring Plan** **4-1**
4.1 Action Levels 4-1
4.1.1 Personal Monitoring 4-1
4.1.2 Background Readings 4-1
4.1.3 Data Logging and Instrument Calibration 4-2
4.2 Chemical Exposure Monitoring 4-2
4.2.1 Air Monitoring Instrumentation 4-2

TABLE OF CONTENTS

4.2.2 Air Monitoring Procedures 4-2
4.3 Dust Control 4-3

Section 5 Personal Protective Equipment 5-1
5.1 Personal Protective Equipment 5-1
5.2 Protective Equipment Description 5-1
5.2.1 Level C (Not Anticipated) 5-1
5.2.2 Modified Level D(Not Anticipated) 5-2
5.2.3 Level D 5-2
5.2.4 Anticipated PPE Levels 5-3
5.2.5 Limitations of Protective Clothing 5-3
5.3 Respiratory Protection 5-3
5.3.1 Respirator Selection 5-3
5.3.2 Medical Screening 5-4
5.3.3 Fit Testing 5-4
5.3.4 Respirator Use Instructions 5-5
5.3.5 Respirator Inspection 5-5
5.3.6 Cleaning of Respirators 5-6
5.3.7 Maintenance of Respirators 5-6
5.3.8 Storage of Respirators 5-7

Section 6 Site Control 6-1
6.1 Site Access 6-1
6.2 Sanitation 6-1
6.3 Site Rules and Responsibilities 6-1
6.4 Sampling Practices 6-2
6.5 Sample Shipment and Hazardous Material Shipment 6-3

Section 7 Decontamination Procedures 7-1
7.1 Personal Decontamination 7-1
7.2 Decontamination – Medical Emergencies 7-1
7.3 Equipment Decontamination 7-1
7.3.1 Equipment Needs 7-1
7.3.2 Procedures for Drilling Equipment 7-2
7.3.3 Procedures for Subsurface/Surface Soil Sampling Equipment 7-2

Section 8 Emergency Response Plan 8-1
8.1 Emergency Information 8-1
8.1.1 Emergency Telephone Numbers 8-1
8.1.2 Hospital Directions 8-1
8.2 Places of Refuge 8-2
8.3 Fire 8-2
8.4 Communication 8-2
8.5 Emergency Response Procedures 8-3
8.5.1 Emergency Response Team 8-3

8.6 Medical Emergencies Response Plan 8-3
8.7 Incident Reporting 8-4
8.8 Injury Management 8-4
8.9 Operation Shutdown 8-4
8.10 Spill or Hazardous Material Release 8-4

Section 9 Training, Medical Surveillance, and Site Inspections 9-1
9.1 Training and Medical Surveillance 9-1

Section 10 Recordkeeping 10-1

Section 11 References 11-1

List of Figures

Figure 8-1 Hospital Route Map

List of Attachments

Attachment A Safety Plan Compliance Agreement Form, Daily Tailgate Safety Briefing and Analysis Worksheet Form
Attachment B Activity Hazard Analysis
Attachment C Safety Management Standards
Attachment D USACE Accident Reporting Forms: NOW Form 1880 and ENG Form 3394
Attachment E Material Safety Data Sheets

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
AOC	Area of Concern
carcinogen	a substance that can cause cancer
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
Contractor	USACE Contractor
CRZ	contamination reduction zone
DA	Department of the Army
eV	electron volt
EZ	exclusion zone
FTL	Field Team Leader
HEPA	High Efficiency Particulate Air
HTW	Hazardous and/or Toxic Waste
IDW	Investigation Derived Waste
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
OBZ	operator's breathing zone
OSHA	Occupational Safety and Health Administration
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
RHSM	Regional Health and Safety Manager
SA	supplemental assessment
SCBA	self-contained breathing apparatus
SSHP	Site Safety and Health Plan
SSO	Site Safety Officer
SSR	Subcontractor's Safety Representative
SVOC	semivolatile organic compound
USACE	United States Army Corps of Engineers
VOC	volatile organic compound
°F	degrees Fahrenheit

This document presents the site safety and health plan (SSHP) for the supplemental assessment (SA) at Areas of Concern (AOCs) A, B, and C at Cannon Air Force Base (AFB), New Mexico.

1.1 SITE DESCRIPTIONS

1.1.1 AOC A

AOC A is the site of two spills of motor gasoline (MOGAS) from overturned fuel trucks. The site measures approximately 400 by 200 feet. Both spills occurred in the early 1960s at the present location of Argentia Avenue, across from the refueling area of Facility No.379, and southeast of the gymnasium (Building 444). The total quantity of MOGAS spilled is estimated to be 2,000 to 3,000 gallons during each event (4,000 to 6,000 gallons total). The physical features of the site were changed in 1977 during the construction of Building 444; a portion of the spill site is now under Argentia Avenue (Radian 1986).

Visually impacted soils were segregated, and samples of impacted soil were analyzed for volatile organic compounds (VOCs), benzene, toluene, ethylbenze, and xylenes (BTEX), total petroleum hydrocarbons (TPH), and a full Toxicity Characteristic Leaching Procedure (TCLP) suite. In these analyses, barium was the only chemical detected above the laboratory detection limits, and the detected concentration, 1.7 mg/L was well below the RCRA TCLP regulatory limit for hazardous waste (100 mg/L).

1.1.2 AOC B

AOC B is the site of a JP-4 spill from an aircraft fuel tank onto a concrete parking apron as a result of a broken fuel line coupling. The spill occurred in 1980 in the west-central portion of the Base. The total quantity of JP-4 spilled is estimated to be 400 gallons. The site was located on the south parking apron, southwest of Building 120. Since the time of the spill, Building 120 has been moved to a new location and a new facility has been constructed over the site (CH2M Hill 1983).

1.1.3 AOC C

AOC C is the site where three pole-mounted electrical capacitors ruptured. The incident occurred in 1978 when lightning struck the pole, which housed a total of six capacitors. The site is located in the northwest portion of the Base. Approximately 6 gallons of dielectric oil, believed to contain PCBs, spilled onto the ground.

Approximately 100 cubic yards of soil were excavated and drummed immediately following the incident. The contaminated soil was excavated, placed in 55-gallon drums, and sent off site for disposal by the Defense Property Disposal Office (DPDO). The drummed soil was disposed of off Base in a permitted disposal facility. No visible evidence of the spill was observed during an April 1992 site visit.

1.2 PURPOSE AND SCOPE OF WORK

The purpose of this SA SSHP is to provide safety procedures that will be used by the USACE and URS for all non-munitions SA activities at AOCs A, B, and C.

This SA SSHP was developed specifically for SA operations at Cannon AFB to assign responsibilities, establish personal protection standards and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted at the site. This plan complies with, but does not replace, Federal Health and Safety Regulations as set forth in 29 Code of Federal Regulations (CFR) 1910 and 1926, guidance provided in the most recent USACE Safety and Health Requirements Manual EM 385-1-1 (currently 3 November 2003), and applicable state regulations. This plan is to be used by the USACE and URS personnel as a supplement to such rules, regulations, and guidance. This SA SSHP is required to be available on site during all SA activities.

1.3 APPLICABILITY

The provisions of the SA SSHP are applicable to all on-site personnel engaged in SA field activities associated with this project, which may involve health and safety hazards.

This plan will be provided to any subcontractors that are utilized in order to fulfill Contractor obligations, under 29 CFR 1910.120(b), to inform all Subcontractors of site hazards. Every Subcontractor will be required to comply with this SA SSHP. Additionally, Subcontractors may be required to develop SA-related SSHP Addenda to comply with 29 CFR 1910.120 by addressing those project activities specific to the Subcontractor personnel.

1.4 USACE SAFETY AND HEALTH REQUIREMENTS MANUAL EM 385-1-1

The USACE and URS will follow the USACE safety and health requirements at a minimum. Below is a list of all referenced sections from the most recent USACE EM 385-1-1.

USACE SAFETY AND HEALTH REQUIREMENTS MANUAL EM-385-1-1 TOPICS AND ASSOCIATED SECTIONS IN THIS SA SSHP

EM 385-1-1 Section	Topic	SSHP Section
01.C	Physical Qualifications of Employees	5.3.2
01.D	Accident Reporting and Recordkeeping	9.6, 10.1
05	Personal Protective and Safety Equipment	5.1
05.C	Hearing Protection and Noise Control	3.2.8
05.E	Respiratory Protection	5.3
06.D	Harmful Plants, Animals, and Insects	3.3
06.J	Inclement Weather and Environmental Hazards	3.2.6
13	Hand and Power Tools	3.2.13

EM 385-1-1 Section	Topic	SSHP Section
14	Material Handling, Storage, and Disposal	3.1, 3.2
16	Machinery and Mechanized Equipment	3.2.11
28	HAZWOPER	
Appendix A	Minimum Basic Outline for Accident Prevention Plan	1.5

1.5 CHANGES TO THE SA SSHP

Changing and/or unanticipated site conditions may require modifications to this SA SSHP in order to maintain a safe and healthful work environment. Any proposed changes to this plan after it has been finalized would be addressed in a SSHP Addendum. The SSHP Addendum would require the review and approval of the USACE prior to its implementation. If this is not feasible, the site/project manager may modify the plan and record all changes in the field logbook; under no circumstances will modifications to this plan conflict with Federal, state, or other governmental health and safety regulations.

URS will have site safety and health oversight and coordination responsibilities for all on-site URS personnel, as well as any subcontractors, or support personnel who may enter the site.

The USACE and URS will strictly adhere to the provisions of this SA SSHP and applicable regulations issued by governmental entities. The following responsibilities are general, any changes or exceptions to them, following final acceptance of this SA SSHP, would be addressed in a SSHP Addendum.

2.1 ON-SITE PERSONNEL

Project personnel involved in on-site investigations and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow personnel.
2. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the Site Safety Officer (SSO) or the Project Manager (PM).
3. Implementing the procedures set forth in the SA SSHP, and reporting any deviations from the described procedures to the SSO or PM for action.
4. Notifying the PM and SSO of any special medical problems (i.e., allergies) and seeing that all on-site personnel are aware of such problems.
5. Reviewing the SA SSHP and signing Safety Plan Compliance Agreement (Attachment A).

2.2 PROJECT MANAGER

The PM will direct all on-site operations of URS personnel. The PM may delegate all or part of these duties to a properly qualified individual who has been designated as the Field Team Leader (FTL). At the site, the PM, assisted by the SSO, has primary responsibility for:

1. Ensuring that appropriate personal protective equipment (PPE) and monitoring equipment is available and properly utilized by all on-site personnel.
2. Ensuring that all on-site personnel are aware of the provisions of this SA SSHP, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies.
3. Verifying that all on-site personnel have completed a minimum of 40 hours of health and safety training as well as a current 8-hour refresher course, and have appropriate medical clearance as required by 29 CFR 1910.120.
4. Ensuring that all on-site personnel are aware of the potential hazards associated with site operations.
5. Monitoring the safety performance of all on-site personnel to see that the required work practices are employed.

6. Correcting any work practices or conditions that may result in injury or exposure to hazardous substances.
7. Ensuring the completion of Safety Plan Compliance Agreements by all on-site personnel (see Attachment A).
8. Halting site operations, if necessary, in the event of an emergency or to correct unsafe work practices.
9. Ensuring that utility clearances are obtained prior to the commencement of work.
10. Ensuring that this SA SSHP is available on site.

2.3 SITE SAFETY OFFICER

The SSO's duties may be carried out by the PM, the FTL or other qualified and designated personnel. The SSO is responsible for:

1. Implementing the SA SSHP and reporting any deviations from the anticipated conditions described in the plan to the PM, and, if necessary, the Regional Health and Safety Manager (RHSM).
2. Determining that monitoring equipment is used properly by all on-site personnel and is calibrated in accordance with manufacturer's instructions or other standards, and those results are properly recorded and filed.
3. Ensuring all on-site personnel have current medical clearance and training.
4. Assuming any other duties as directed by the PM or RHSM.
5. Coordinating with the RHSM to identify all on-site personnel for whom special PPE, exposure monitoring, or work restrictions may be required (not applicable to USACE).
6. Conducting Daily Tailgate Safety Briefings for all on-site personnel
7. Documenting Daily Tailgate Safety Briefing using the form included in Attachment A.
8. Completing the Activity Hazard Analyses (AHA) for each definable work activity (included in Attachment B).
9. Providing ongoing reviews of the PPE levels needed as project work is performed, and informing the PM of the need to upgrade/downgrade protection levels as appropriate.
10. Ensuring that all on-site personnel follow decontamination procedures.
11. Establishing monitoring operations for all on-site personnel and recording results of exposure evaluations.
12. Halting site operations, if necessary, in the event of an emergency or to correct unsafe work practices.
13. Maintaining the visitor log.
14. Maintaining MSDSs.
15. Investigating accidents/incidents and preparing all accident/incident reports for URS activities.

2.4 PROJECT HEALTH AND SAFETY MANAGER & REGIONAL HEALTH AND SAFETY MANAGER

The Project Health And Safety Manager and the RHSM are responsible for:

1. Determining the need for periodic audits of the operation to evaluate compliance with this plan.
2. Providing health and safety support as requested by the SSO and PM.
3. The Project Health and Safety Manager and the RHSM shall, review, approve, and sign any SSHP Addenda.
4. Processing accident reports.
5. The RHSM shall have a minimum of 5 years of experience working on HTW sites, and be a Certified Industrial Hygienist (CIH).

This section describes in general the Chemical, Physical and Biological Hazards anticipated during the work planned at Cannon AFB. To address activity-specific hazards, URS has completed an AHA for each work activity to be completed on site during the SA. The completed AHA forms are included in Attachment B.

3.1 CHEMICAL HAZARDS

There are two categories of chemical hazards associated with site activities:

- Site Constituents
- Chemicals used to conduct the site work

Site constituents are those that exist at the site and are the cause for conducting site activities. The chemicals that are brought on site in order to conduct the work may be hazardous and subject to regulation under the Occupational Safety and Health Administrations (OSHA's) Hazard Communication Standard (29 CFR 1910.1200). Additional information regarding work at this potential hazardous waste site is contained in SMS 017 – Hazardous Waste Operations, included in Attachment C. Information related to health and safety training requirements is presented in SMS 055 – Health and Safety Training, also included in Attachment C.

3.1.1 Site Constituents

From an occupational health standpoint, given that any potential exposure to site personnel will be only for a short period of time (intermittent for several days), the levels of contaminants that have been, or could be, encountered during site activities should not represent a significant concern if the provisions of this SA SSHP are appropriately implemented. However, because the sites are being assessed, the potential for exposure to elevated levels of unknown contaminants may exist.

Skin contact with potentially contaminated materials will be minimized through the use of personal protective clothing. The use of engineering controls will minimize inhalation of vapors or particulates during the site activities. Ingestion of contaminated materials will be minimized through the use of appropriate personal hygiene procedures during decontamination (i.e., thoroughly washing face and hands with soap and water after leaving the work area, and prior to eating or drinking).

3.1.2 Hazard Communication Materials

Materials considered hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200) may be brought on site for use during this project. In accordance with the URS Hazard Communication Program, Material Safety Data Sheets (MSDSs) will be provided for any hazardous materials used by field personnel during this course of this project. The SSO will make copies of MSDSs available to any URS, USACE, Air Force, or Subcontractor personnel upon request. Additional information regarding the Hazard Communication Program is contained in SMS 002 – Worker Right-to-Know (Hazard Communication), included in Attachment C.

3.2 PHYSICAL HAZARDS

Physical hazards at this work site may include:

- Heat stress and cold stress;
- Noise from the operation of site equipment;
- Slip/trip/fall accidents;
- Confined Space;
- Back injuries due to improper lifting;
- Being caught in or struck by moving equipment;

3.2.1 Hand Safety

Information on recognizing conditions that may require PPE or specific work practices to reduce hand injury risk is presented in SMS 064 – Hand Safety, included in Attachment C.

3.2.2 Heat Stress Recognition and Control

Procedures designed to protect on-site project personnel from the effects of heat related illness are presented in SMS 018 – Heat Stress, developed in accordance with guidance provided by the American Conference of Governmental Industrial Hygienists (ACGIH) *Threshold Limit Values and Biological Exposure Indices*, and other references applicable to protecting personnel exposed to temperature extremes. This SMS is included in Attachment C.

Heat stress monitoring will commence when personnel are wearing PPE, and the ambient temperature exceeds 70°F. If standard work garments (e.g., cotton coveralls) are worn, monitoring will commence at 85°F.

3.2.2.1 Heat Stress Information and Precautions

Heat stress is one of the most common (and potentially serious) illnesses that can affect hazardous waste site workers. The most common cause of heat stress during site activities is the effect that PPE has on the body's natural cooling mechanism. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Factors that may predispose a worker to heat stress include lack of physical fitness, lack of acclimatization to hot environments, degree of hydration, level of obesity, current health status (having an infection, chronic disease, diarrhea, etc.), alcohol or drug use, and the worker's age and sex. For the remainder of this section, references to "liquids" will indicate water or an electrolyte replacement solution – not tea, coffee, or soft drinks.

Heat Rash. Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

- **Symptoms:** Mild red rash, especially in areas of the body that sweat heavily.

- **Treatment:** Decrease amount of time in protective gear and provide powder such as corn starch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

Heat Cramps. Heat cramps are caused by a rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat-related cramps is often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

- **Symptoms:** Acute, painful spasms of voluntary muscles such as the back, abdomen, and extremities.
- **Treatment:** Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have patient drink one to two cups of liquids immediately and every 20 minutes thereafter. Consult with physician if condition does not improve. If available, an electrolyte replacement solution should be administered along with water. Consumption of soft drinks may aggravate the condition.

Heat Exhaustion. Heat exhaustion includes several clinical disorders having symptoms which may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt.

- **Symptoms:** Sweating and extreme weakness or fatigue, giddiness, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.
- **Treatment:** Remove victim to a cool area cool place and administer plenty of liquids. Patients with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days.

Heat Stroke. Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. Heat Stroke occurs when the body's system of temperature regulation fails and the body temperature rises to critical levels. When this occurs, the body core temperature rises very rapidly to a point where brain damage and death will result if the person is not cooled quickly.

- **Symptoms:** A heat stroke victim's skin is hot, usually dry, red or spotted. Body temperature is usually 105°F or higher, and the victim is mentally confused, delirious, perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.
- **Treatment:** Any person with signs or symptoms of heat stroke requires immediate hospitalization. However, first aid should be immediately administered. This includes removing the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment at a medical facility should include the continuation of the cooling process and the monitoring of complications that often accompany the heat stroke. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

3.2.2.2 Heat Stress Prevention

Preventive Measures. In hot environments, drinking water shall be made available to workers and workers shall be encouraged to frequently drink small amounts (e.g., one cup every 15 to 20 minutes); the water shall be kept reasonably cool. In situations where heat stress may impact worker safety and health, work-rest regimens shall be established.

Minimal Preventive Measures. In order to avoid heat-related illnesses, proper preventive measures will be implemented whenever environmental conditions dictate the need. Heat stress monitoring will begin at 70°F. The preventive measures listed in this paragraph represent the minimal steps to be taken and will include the following procedures:

- The SSO will examine each site worker prior to the start of daily operations in order to determine the individual's susceptibility to heat stress. Workers exhibiting factors that make them more susceptible to heat stress will be closely monitored by the SSO.
- Site workers will be trained to recognize and treat heat-related illnesses. This training will include the signs, symptoms, and treatment of heat stress disorders.
- Workers will be encouraged to drink a minimum of 16 ounces of liquids prior to start of work in the morning, after lunch, and prior to leaving the site at the conclusion of the day's activities. Acceptable liquids will include water and an electrolyte replacement solution, with the intake of each being equally divided. Liquids containing caffeine are to be avoided.
- When ambient conditions and site workload requirements dictate, as determined by the SSO, workers will be required to drink a minimum of 16 to 32 ounces of liquids during each rest cycle.
- A shelter or shaded area will be provided where workers may be protected from direct sunlight during rest periods.
- Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat-induced stress.
- Site workers should be given time to acclimatize to working in hot environments. Acclimatization usually takes 2 to 6 days and allows the worker's body to become adjusted to working in hot environments.

Additional Preventive Measures. When possible and/or feasible, the following measures will also be implemented to aid in prevention or reduce the affects of heat-induced stress:

- Designated rest areas will be out of the direct sun and the number and frequency of breaks increased.
- Depending on the severity of the heat exposure some form of artificial cooling may be required to ensure protection of the workers.
- Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have

less physiological strain, a lower heart rate and body temperature, and a more efficient sweating mechanism.

3.2.3 Cold Stress Recognition and Control

Protection against cold stress should be initiated when temperatures drop below 45°F. Cold stress guidance is provided below.

Exposure to cold working conditions can result in cold stress (including hypothermia) and/or injury (including frostbite) to hands, feet, and head. Hypothermia can result when the core body temperature drops below 36°C (96.8°F). Lower body temperature will likely result in dizziness, drowsiness, disorientation, slurred speech, or loss of consciousness, with possible fatal consequences. Pain in the extremities may be the first warning of danger to cold stress. Shivering develops when the body temperature has fallen to 35°C (95°F).

Hypothermia can be brought on by exposure to cold air, immersion in cold water, or a combination of both. Wind chill factor, the cooling power of moving air, is a critical factor in cold stress.

Workers must wear adequately insulated clothing if work is performed in temperatures below 4°C (40°F). At temperatures of 2°C (35.6°F or less), workers whose clothing becomes wet should be immediately provided with a change of clothing, and if necessary, treated for hypothermia. Treatment includes warming the victim with skin-to-skin contact, or by providing warm blankets or other coverings, and drinking warm liquids. Skin exposure should not be permitted at temperatures of -32°C (-25°F) or below.

If fine work is to be performed with bare hands for more than 10-20 minutes at temperatures below 16°C (60°F), provisions should be made for keeping the workers' hands warm. If equivalent chill temperatures fall below 40°F and fine manual dexterity is not required, then gloves should be worn. Metal handles of tools should be covered with insulating material at air temperatures below -1°C (30°F).

If work is to be performed continuously in the cold when the wind chill factor is at or below -7°C (19°F), heated warming shelters (tents, trailers, vehicle cabs) should be made available nearby.

3.2.4 Noise Hazards

Previous surveys indicate that heavy equipment such as drilling equipment may produce continuous and impact noise at or above the action level of 85 dBA. All on-site personnel within 25 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, will wear hearing protective devices (either earmuffs or earplugs). Personnel will wash their hands with soap and water prior to inserting earplugs to avoid initiating ear infections. Information regarding hearing conservation information is presented in SMS 026 – Noise and Hearing Conservation, included in Attachment C

3.2.5 Slip/Trip/Fall Hazards

Workers should exercise caution when walking around the site to avoid slip/trip/fall hazards. If there are holes or uneven terrain in the work area that could cause site personnel to slip, trip, or fall, they must be covered, flagged or marked to warn workers. Workers should exercise caution around open excavations, such as test pits, and avoid getting closer than two feet to the edge of an unsloped excavation unless a guardrail or fall protection is provided. If conditions become slippery, workers should take small steps with their feet pointed slightly outward to decrease the probability of slipping. Gravel or sand should be spread in muddy areas to reduce slipperiness. Workers should watch where they are walking and walk only in areas of good stability.

3.2.6 Lifting Hazards

The following guidelines will be followed whenever lifting equipment, any other objects that are of odd size or shape, or that weigh over 40 pounds. Safe lifting procedures are described below.

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

Additional information on reducing the risk of injuries to the back from lifting is presented in SMS 045 – Back Injury Prevention, included in Attachment C.

3.2.7 Heavy Equipment

Operation of heavy equipment during site activities presents potential physical hazards to personnel.

The following precautions must be observed whenever heavy equipment is in use:

- Personal protective equipment (PPE) such as steel-toed shoes, safety glasses or goggles, and hard hats must be worn whenever such equipment is present.
- Personnel must at all times be aware of the location and operation of heavy equipment, and take precautions to avoid getting in the way of its operation. Never assume that the equipment operator sees you; make eye contact and use hand signals to inform the operator of your intent, particularly if you intend to work near or approach the equipment.

- Traffic safety vests **ARE REQUIRED** for all on-site personnel working near mobile heavy equipment, such as backhoes and other excavators.
- Never walk directly in back of or to the side of, heavy equipment without the operator's acknowledgment.
- When an equipment operator must operate in tight quarters, the equipment should provide a person to assist in guiding the operator's movements.
- Keep all non-essential personnel out of the work area.
- Any heavy equipment that is used in the exclusion zone (EZ) should remain in that zone until its task is completed. The equipment Subcontractor should completely decontaminate such equipment in the designated equipment decontamination area as required prior to moving the equipment outside of the EZ/contamination reduction zone (CRZ).
- All heavy equipment will be equipped with back-up alarms.

3.2.8 Underground and Aboveground Utilities

The PM is responsible for ensuring that underground utilities are identified and marked prior to the commencement of any subsurface (greater than 0.3 meters [1 foot]) activities. Resources include site plans, utility companies, and regional utility locating services. The proper utility company personnel will certify in writing to the PM the deactivation of underground utilities, and the certification retained in the project files.

Excavation, drilling, crane, or similar operations adjacent to overhead lines will not be initiated until operations have been coordinated with the utility officials. Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:

- Power has been shut off and positive means (e.g., lockout/tagout) have been taken to prevent lines from being energized. Wherever possible, the SSHO will observe power shutoff and place a lock and tag on the switch. In all cases utility company personnel will certify in writing to the PM the deactivation of overhead utilities, and the certification retained in the project files. The PM must also attempt to verify power shut off by checking that power is no longer available to the affected building or equipment.
- Equipment, or any part of the equipment, cannot come within the following minimum clearance from energized overhead lines:

Power Lines Nominal System (kV)	Minimum Required Clearance
0 – 50	10 feet
51 – 200	15 feet
201 – 300	20 feet
301 – 500	25 feet
501 – 750	35 feet
751 – 1000	45 feet

3.3 BIOLOGICAL HAZARDS

The following sections provide guidance on identification and avoidance of biological hazards. Procedures designed to eliminate or reduce illnesses or injuries transmitted by plants, insects or animals are presented in SMS 047 – Biological Hazards, included in Attachment C.

3.3.1 Insects and Arachnids

During fieldwork at this site, personnel may encounter a wide variety of insects and arachnids with defensive mechanisms including bees, mosquitoes, ticks, and spiders. Field personnel are encouraged to use insect repellent as necessary.

Stings of bees and wasps may cause serious allergic reactions in certain individuals. The SSO should identify all personnel with known insect allergies or sensitivities before fieldwork begins. If an allergic reaction occurs, a physician's advice should be sought. Personnel with known allergies should carry appropriate medication.

Spider bites can be extremely serious, e.g., those of the black widow or brown recluse. Others are unpleasant or uncomfortable, resulting in rashes, itching, and possible infection. The possibility of allergies greatly increases the danger since people are not usually aware of such allergies until they have been bitten. Therefore, spiders should be regarded as a serious potential hazard. Care should be taken when lifting or entering possible habitats of spiders, including debris and cover.

Ticks are parasites that feed on the blood of an animal/human host and may carry severe diseases, the least of these bringing several days of fever and pain, and the worst causing brain damage.

3.3.2 Reptiles

Poisonous snakes may be encountered on site. Personnel should check for snakes before walking through grassy or debris-strewn areas. Care should be taken when lifting possible habitats of snakes such as debris and cover.

3.3.3 Other Animals

Rodents and other mammals have been known to harbor fleas carrying bubonic plague. Their bites can also transmit rabies and other infections. Rodents pose a special problem if people to try to feed them or pet them; the increased contact brings a greater possibility of danger. Avoid wildlife when possible.

3.3.4 Plants

Poisonous plants including poison ivy, poison oak, and poison hemlock, as well as a variety of euphorbs and nettles, may be encountered during field activities. Contact with these plants may cause skin irritation and should be avoided. If field personnel come into contact with a

poisonous plant, the affected skin area should be washed thoroughly with soap and water. If an allergic reaction occurs, a physician's advice should be sought.

3.3.5 Blood-Borne Pathogens

It is possible that employees could incur exposure to another person's blood or other potentially infectious body fluids as a result of performing their assigned job duties. For example, designated first aid responders may be exposed while treating someone with an open wound.

In the event that an employee is exposed to blood or body fluids, they should immediately flush the affected area with copious amounts of water. A confidential medical evaluation and follow-up with an occupational physician should be arranged for the employee as soon as possible following the report of an exposure incident, preferably within 1 to 2 hours after the exposure incident has occurred.

The following exposure control methods will be used to reduce potential exposures to blood-borne pathogens:

- All employees will utilize universal precautions, an approach to infection control where all human blood and body fluids are treated as potentially infectious.
- Engineering and work practice controls (e.g., sharps disposal containers, splash prevention) will be used to eliminate or minimize exposure to employees.
- PPE (e.g. disposable gloves, face masks with eye protection, liquid impermeable gowns, CPR pocket masks) will be provided and used in order to place a barrier between the employee and the blood or body fluids.
- Hands will be washed immediately with soap and water after removing gloves or performing any work with blood or body fluids.
- Work surfaces will be decontaminated with EPA-registered germicides or a bleach solution diluted 1:10 with water as needed to maintain a safe working environment.
- Regulated biohazardous waste (contaminated sharps or items that are capable of releasing blood or body fluids through employee handling) will be disposed of in special waste receptacles lined with red bags and incinerated per federal and state regulations. This does not include small amounts of waste from a minor wound that can be sealed in a plastic bag and disposed of as regular trash.

3.4 RADIOLOGICAL HAZARDS

Based on the historical uses of AOCs A, B, and C, it is not anticipated that radioactive materials will be encountered. Therefore, radiation screening will not be required unless document reviews and/or interviews indicate possible radiological hazards.

Heat and/or cold stress, noise, and chemical exposures may be encountered at this site. Heat and cold stress monitoring and prevention are addressed in Sections 3.2.4 and 3.2.5, respectively. Noise levels will not be monitored; instead all on-site personnel will wear hearing protection as described in Section 3.2.6.

4.1 ACTION LEVELS

The following table summarizes the initial action levels.

VOC Action Level Table

Analyzer Reading*	Location	Duration	Action	Personal Protective Equipment
< 5 ppm	Point of Operations/Release Source point	-----	Continued periodic monitoring	Minimum Site Ensemble
> 5 ppm (1st Action Level)	Point of Operations/Release Source point	> 1 minute	Monitor OBZ; establish work zones as described in Section 6.3	Minimum Site Ensemble
< 5 ppm	OBZ	----	No respirators required	Minimum Site Ensemble
> 5 ppm (2nd Action Level)	OBZ	> 1 minute	Stop Work and move upwind, or Provide respiratory protection; establish decontamination area as described in Section 6.3. Contact the SSHO to perform personal monitoring as described in Section 4.1.1.	Add half-face respirators with organic vapor cartridges

*above background readings (OBZ = Operator's Breathing Zone)

4.1.1 Personal Monitoring

URS is responsible for determining the need for personal monitoring. Personal monitoring will be in accordance with OSHA 29 CFR 1910.

4.1.2 Background Readings

All direct-reading instrument readings will be evaluated relative to background readings, not "meter zero." Prior to the start of work at each shift, and whenever there is a significant shift in wind direction, instrument readings will be obtained upwind of the site exclusion zone in order to determine the level of "background" readings from local vehicle traffic, emissions from nearby operations unrelated to the site, etc. Site readings will be evaluated against these background readings (i.e., if an action level is listed as 5 parts per million (ppm), it is evaluated as 5 ppm

above background). The SSHO should consult with the SSO regarding the potential health hazards associated with background readings above 5 ppm.

4.1.3 Data Logging and Instrument Calibration

All monitoring data, including background readings, will be logged in the field logbook. The results of daily instrument calibrations will also be recorded in the field logbook. All monitoring instruments will be calibrated in accordance with the manufacturer's instructions prior to the start of each shift. Calibration should also be performed when inconsistent or erratic readings are obtained. **IF AN INSTRUMENT CANNOT BE CALIBRATED TO SPECIFICATION, OR BECOMES OTHERWISE INOPERABLE, ALL INVASIVE SITE WORK (I.E., DRILLING, EXCAVATING) WILL CEASE UNTIL THE INSTRUMENT IS APPROPRIATELY REPAIRED OR REPLACED;** the PM or SSO must be contacted for further guidance.

4.2 CHEMICAL EXPOSURE MONITORING

The field instrumentation described in this SA SSHP has been selected for the volatile organic compounds (VOCs) that may be encountered at Cannon AFB. Selection factors include anticipated airborne concentrations, potential interference, ionization potentials, instrument sensitivity, and occupational exposure limits.

4.2.1 Air Monitoring Instrumentation

An organic vapor monitor equipped with a 10.2 electron volt (eV) or greater photoionization detector (PID) will be used to monitor organic vapors at the point of operation and/or in the operator's breathing zone (OBZ). The PID will be calibrated to 100 ppm using 100 ppm isobutylene. Other air monitoring instrumentation may be required depending on specific task requirements. Any additional air monitoring instrumentation requirements will be described in a SSHP Addendum.

4.2.2 Air Monitoring Procedures

The monitoring equipment specified above will be used on a regular basis to evaluate the potential for exposure to airborne contaminants, typically every five to ten minutes. Monitoring will be conducted in the immediate vicinity of the contaminant source point or work area (e.g., at the borehole, monitoring well, or sampling location). If readings exceed the first action level (greater than 5 ppm above background for more than one minute in the immediate vicinity of the contaminant source point or work area), monitoring in the OBZ of the person working nearest the point of operations/contaminant source will start immediately, and site personnel will don protective clothing.

A reading above the second action level (greater than 5 ppm above background for more than one minute in the OBZ) will require either:

- The use of half-face respirators with appropriate cartridges, or
- Work to stop, and workers to move upwind while the airborne contaminants dissipate.

If levels remain elevated for more than five minutes, the source of the airborne contamination will be covered with clean soil, plastic sheeting, or foam (or otherwise controlled in an appropriate manner), and the SSO or PM will be contacted for further guidance.

4.3 DUST CONTROL

High winds and site operations can cause airborne dust hazards. If site operations generate sustained visible dust, a water mist will be applied to reduce dust generation. If the mist is not effective in reducing dust generation, personnel will don respirators (either half-face or full-face as appropriate for analyzer readings) equipped with particulate filter cartridges.

5.1 PERSONAL PROTECTIVE EQUIPMENT

The minimum PPE for site personnel includes:

- Hardhat (when overhead hazards exist)
- Safety glasses with side shields (or impact resistant goggles)
- Steel-toed boots
- Ear protection in vicinity of noisy equipment
- Work gloves and/or chemical-resistant gloves

As the various monitoring action levels specified in Section 4.1 are reached, additional PPE is required. Section 5.2 provides the description of the incremental PPE requirements relative to specific action levels, as well as the specific kinds of PPE to be used. Procedures for use and selection of PPE are located in EM 385-1-1, Section 05, and in 29 CFR 1910.132(d).

URS will conduct a PPE Hazard Assessment to determine PPE requirements for site- and activity-specific tasks in accordance with 29 CFR 1910.132(d).

5.2 PROTECTIVE EQUIPMENT DESCRIPTION

The level of PPE is categorized as Level A, B, C, Modified Level D, or Level D, based upon the degree of protection required. The following is a brief summary of the levels that may be used at Cannon AFB, in order of most to least protective.

5.2.1 Level C (Not Anticipated)

Level C protection is used when the concentration(s) and type(s) of airborne substance(s) are known and the criteria for using air-purifying respirators are met. The following constitute Level C equipment:

- NIOSH-approved, full-face air purifying respirator with organic vapor cartridges and P100 particulate filters
- Chemical-resistant clothing
- Coveralls (optional)
- Gloves, outer, chemical-resistant (neoprene)
- Gloves, inner, chemical-resistant (nitrile or latex)
- Boots, outer, chemical-resistant, with steel toe and shank or equivalent
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Hard hat (Class B)
- Face shield and safety glasses when not wearing a full face respirator

- Tape wrists and ankle joints
- Hearing protection when working in areas with noise hazards

5.2.2 Modified Level D(Not Anticipated)

Modified Level D protection is used when the concentration(s) and type(s) of airborne substance(s) are known, the criteria for not using air-purifying respirators are met, and a level of skin protection above Level D is required. The following constitute Modified Level D equipment:

- Tyvek® or equivalent disposable chemical resistant coveralls (optional)
- Coveralls (optional)
- Gloves, outer, chemical-resistant (neoprene)
- Gloves, inner, chemical-resistant (nitrile or latex)
- Boots, outer, chemical-resistant, with steel toe and shank or equivalent
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Face shield and/or safety glasses
- Hearing protection when working in areas with noise hazards

5.2.3 Level D

Level D protection is used when a work uniform affording minimal protection, used, for nuisance contamination only. The following constitute Level D equipment:

- Short- or long-sleeve shirt
- Gloves (neoprene or leather, depending on activity)
- Boots, leather, steel toe and shank
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Safety glasses or chemical splash goggles
- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Escape mask (optional)
- Face shield when not wearing other eye protection.
- Hearing protection when working in areas with noise hazards

5.2.4 Anticipated PPE Levels

Information on recognizing conditions that may require the use of PPE as well as selecting the appropriate PPE is presented in SMS 029 – Personal Protective Equipment, included in Attachment C. The minimum PPE required for on-site URS personnel during fieldwork for this project includes:

Task:	Soil Sampling Activities	Mobilization/Demobilization
PPE:	Level D	Level D
Minimum Requirements:	• Gloves (leather) – as needed • Boots, leather, steel toe and shank or equivalent • Safety glasses or chemical splash goggles – as needed • Hearing protection when working in areas with noise hazards	• Gloves (leather) – as needed • Boots, leather, steel toe and shank or equivalent • Safety glasses or chemical splash goggles – as needed • Hearing protection when working in areas with noise hazards

5.2.5 Limitations of Protective Clothing

The protective equipment ensembles selected for this project are anticipated to provide protection against the types and concentrations of hazardous materials that may potentially be encountered during field operations. However, no protective garment, glove or boot is resistant to all chemicals at any concentration; in fact, chemicals may continue to permeate or degrade a garment even after the source of the contamination is removed.

In order to obtain optimum usage from PPE, all on-site personnel are required to inspect all clothing, gloves and boots both prior to and during use for:

- Imperfect seams
- Non-uniform coatings
- Tears
- Poorly functioning closures

5.3 RESPIRATORY PROTECTION

Based on site conditions and the types of fieldwork planned for the SA, respiratory protection most likely will not be required. The drilling subcontractor will provide a copy of their Written Respiratory Protection Program.

5.3.1 Respirator Selection

Engineering controls and safe work practices (e.g., elimination of the source of contamination, ventilation equipment, working upwind, limiting exposure time, etc.) must always be the primary control for air contaminants. Respirators will be used if engineering or work practice controls

are not feasible for controlling airborne exposures below acceptable concentrations and as an interim control measure while engineering or work practice controls are implemented.

Once the need for respirators has been established, the respirators will be selected on the basis of the hazards to which the worker is exposed. Only NIOSH-approved respirators will be used. Selection criteria established in 29 CFR 1910.134 will be followed in determining respirator requirements for this specific project.

The forms of the airborne contaminants will be evaluated based upon the suspected chemicals of concern for each specific project. Evaluation of the concentration of the airborne chemical hazard will be performed using direct reading instruments to determine what type respirator will be used. Airborne readings will be compared to action levels in the table in Section 4.1 to determine respirator requirements. Air purifying respirators equipped with appropriate cartridges will be used if the second action level defined in Section 4.1 is exceeded. Each SSHP Addendum will provide appropriate cartridge information for each site where respiratory protection is required.

5.3.2 Medical Screening

All on-site personnel are required to be enrolled in a Medical Surveillance Program and to be medically evaluated in compliance with the requirements of 29 CFR 1910.134(a)(10). All Contractor and Subcontractor personnel involved in intrusive activities must also be medically evaluated in compliance with the requirements of 29 CFR 1910.134(a)(10). Employees not medically cleared to wear respirators will not be assigned to this project.

5.3.3 Fit Testing

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

No individual will enter an area where the use of respiratory protective equipment is required unless the person has been fit tested within the last year. Fit testing will be performed in accordance OSHA 29 CFR 1910.134.

Records of fit testing will be maintained on site or by the personnel's office and/or corporate medical surveillance program.

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

holding one's breath for 10 seconds. The respirator mask should remain collapsed on the face without noticeable leakage.

5.3.4 Respirator Use Instructions

Only those personnel who have been properly trained and qualified on the specific type of respirator to be worn may use that specific type of respirator. No individual will enter an area where the use of respiratory protective equipment is required unless the person has been trained.

All personnel whose job assignment requires the use of respirators will have had training in accordance with 29 CFR 1910.134 during initial 40-hour and annual refresher training for hazardous waste operations prior to beginning work at Cannon AFB.

Hands-on training on inspecting and donning a respirator, including user seal checks, must also be provided at the time of fit testing. Retraining must be performed annually on each type of respirator worn by an individual. In addition, site-specific respirator training will be provided during Tailgate Safety Briefings conducted by the SSHO.

Particulate respirator cartridges should be changed out when the wearer has difficulty breathing through the cartridges. Chemical gas or vapor respirator cartridges will be changed out at least daily.

The fit of a chemical gas or vapor respirator should be rechecked and the cartridges changed if the wearer detects chemical odor or feels chemical irritation on the skin, both indicators of leakage or cartridge breakthrough.

5.3.5 Respirator Inspection

The user will inspect respirators before and after each day's use. The inspection procedures for air purifying respirators, including full-face piece and half-face piece cartridge respirators, will include the following:

- Examine the face piece for:
  - Excessive dirt
  - Cracks, tears, holes, or distortion from improper storage
  - Inflexibility
  - Cracked or badly scratched lenses (full-face only)
  - Incorrectly mounted eyeglass lenses or broken or missing mounting clips (full-face only)
  - Cracked or broken air purifying element holder, badly worn threads, or missing gaskets
- Examine the head straps or head harness for:
  - Breaks or cracks

  - Broken or malfunctioning buckles
  - Excessively worn serration on the headstraps, which may permit slippage
- Examine the inhalation valves (2) and exhalation valve for:
  - Foreign material (e.g., hairs, particles, etc.)
  - Improper insertion of the valve body in the face piece
  - Cracks, tears, or chips in the valve body, particularly in the sealing surface
  - Missing or defective exhalation valve covers
- Examine the air-purifying cartridge for:
  - Missing or worn cartridge holder gasket
  - Incorrect cartridge/canister for the hazard
  - Incorrect cartridge installation, loose connections, or cross threading in the holder
  - Cracks or dents in the outside case or threads of filter or cartridge/canister

5.3.6 Cleaning of Respirators

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

Respirator Cleaning Procedure:

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

5.3.7 Maintenance of Respirators

Routine respirator maintenance such as replacing missing valves, gaskets, nose cups etc., must only be performed by trained respirator users or a respirator manufacturer's representative. Only

approved replacement parts must be used. Substitution of parts from a different brand or type of respirator is generally not possible, invalidates the technical approval of the respirator, and is not permitted. Any respirator suspected of being defective must be removed from service and replaced.

5.3.8 Storage of Respirators

When not in use, respirators must be stored to protect them from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. Respirators must be stored in sealable (e.g., Ziploc® or twist-tie), reusable plastic bags between shifts.

The respirator storage environment must be clean, dry, and away from direct sunlight. On-site cabinets or cases are suggested. Storing bagged respirators in vehicles is discouraged due to the potential for damage from other material or equipment.

6.1 SITE ACCESS

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

The SSO will provide site hazard and emergency action information to all site visitors before they enter the site. This may be accomplished by providing the visitor with access to a copy of this SA SSHP.

6.2 SANITATION

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

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

Washing facilities will be provided on site, and will be located in the decontamination area or the support area. Soap, clean water, wash basins and single-use towels will be available for personnel use.

6.3 SITE RULES AND RESPONSIBILITIES

1. Eating, drinking, chewing gum or tobacco, and smoking are prohibited in the contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.
2. All personnel will enter designated work areas only through the CRZ. All personnel leaving an EZ must exit through the CRZ and pass through decontamination.
3. Personnel will wash their hands and face thoroughly with soap and water prior to eating, drinking or smoking.
4. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling, leaning or sitting on contaminated surfaces. Do not place monitoring equipment on potentially contaminated surfaces, such as the ground.
5. All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved (e.g., the presence of strong, irritating or nauseating odors).

6. Only those vehicles and equipment required to complete work tasks should be permitted within the EZ (drill rigs, excavators, and similar items). All non-essential vehicles should remain within the support zone.
7. Containers, such as drums, will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport.
8. Field survey instruments, such as PIDs, should be covered with plastic or similar covering to minimize the potential for contamination.
9. No matches or lighters will be permitted in the EZ or CRZ.
10. Contaminated protective equipment, such as respirators, hoses, boots, and disposable protective clothing, will not be removed from the EZ or CRZ until it has been cleaned, or properly packaged and labeled.
11. Prevent, to the extent possible, spills. In the event that a spill occurs, contain liquid if possible.
12. Prevent splashing of the contaminated materials.
13. The number of personnel and equipment in the EZ should be minimized but only to the extent consistent with workforce requirements of safe site operations.
14. Field crewmembers will be familiar with the physical characteristics of the site operations including:
    - Wind direction in relation to the contaminated area
    - Accessibility to equipment and vehicles
    - Areas of known or suspected contamination
    - Site access
    - Nearest water sources
15. All wastes generated by field activities at the site will be disposed of as directed by the FTL.
16. All PPE will be used as specified and required.
17. The buddy system will be used at all times when performing sampling for hazardous material when the first action level criterion has been exceeded or when working in remote areas.

6.4 SAMPLING PRACTICES

For all sampling activities, the following standard safety procedures will be employed:

1. All sampling equipment should be cleaned before proceeding to the site.
2. At the sampling site, sampling equipment should be cleaned after each use.
3. Work in "cleaner" areas should be conducted first where practical.
4. All unauthorized personnel will remain outside the EZ at all times.

6.5 SAMPLE SHIPMENT AND HAZARDOUS MATERIAL SHIPMENT

If samples to be collected during the course of this project fall under the criteria that defines them as hazardous materials under DOT regulations 49 CFR Parts 171-177, then they must be shipped in accordance with DOT regulations.

7.1 PERSONAL DECONTAMINATION

The following steps will be followed whenever personnel leave the EZ:

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

Each worker will be responsible for cleaning, sanitizing and storing their own respirator in accordance with manufacturer's guidance. All spent decontamination fluids (rinse waters, etc.) will be handled in accordance with relevant regulations.

7.2 DECONTAMINATION – MEDICAL EMERGENCIES

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

7.3 EQUIPMENT DECONTAMINATION

Specific procedures for equipment decontamination are presented in SOP No. A12 in the Field Sampling Plan, which is also included below.

7.3.1 Equipment Needs

- Plastic sheeting
- Wash and rinse tubs/troughs
- Liquinox®
- Tap water
- Deionized water
- Scrub brushes
- Paper towels
- Squirt bottles
- Disposable nitrile gloves/Disposal latex gloves

7.3.2 Procedures for Drilling Equipment

Prior to arrival on-site, all drilling equipment will be steam-cleaned. The drill rig and all support equipment will be free from grease, oils, or caked-on soils from previous work. Equipment that leaks fuel, coolant, or lubricants will be removed from the site and repaired prior to use. Decontaminated drilling equipment (excluding the drill rig) not immediately utilized will be placed on plastic sheeting. Decontamination activities will be performed at a convenient location at least 20 feet downwind from any soil sampling locations. Drilling equipment will be decontaminated before any drilling begins at the site, between each hole, and upon completion of sampling at Cannon AFB.

The drill rig auger initially will be cleaned by scraping off caked soils onto the plastic sheeting used for cuttings disposal. The auger then will be positioned over a tub or trough underlain by plastic sheeting to collect over-spray. All decontamination tubs and troughs used to decontaminate the drill augers will be placed on plastic sheets while in use.

7.3.3 Procedures for Subsurface/Surface Soil Sampling Equipment

Split spoon sampling equipment, soil core barrels, shallow hand soil augers, and other hand sampling and mixing equipment will be decontaminated between sample locations and sample intervals using the following procedure:

1. Remove all soil and solids from sampling equipment and place on plastic used for investigation derived waste (IDW),
2. Scrub all sampling equipment with a Liquinox® and tap water wash,
3. Rinse equipment in tap water, and
4. Double rinse equipment with deionized water.

Deionized water will be stored in labeled plastic pump sprayers.

Decontaminated equipment will be kept on plastic sheeting until required for the next sampling event. If equipment is to be stored or transported, it will be wrapped completely with aluminum foil, shiny side out, to prevent contamination. No rinsate samples will be collected or analyzed for soil sampling devices.

Equipment cleaning will take place in an area away from sampling locations. Personnel will wear latex or nitrile gloves during all decontamination procedures.

This section provides emergency information and outlines the procedures to be followed by all on-site personnel in the event of a site emergency. These procedures are to be reviewed during the Daily Tailgate Safety Briefings conducted by the SSO.

8.1 EMERGENCY INFORMATION

8.1.1 Emergency Telephone Numbers

Fire:	Cannon AFB	(505) 784-2578
Police:	Cannon AFB	(505) 784-2353
Hospital:	Plains Regional Medical Center	(505) 769-2141
Steve Cox	URS Project Manager	(402) 952-2502
Jeff Hopkins	URS Project Health and Safety Manager	(402) 952-2531
Dennis Day, Certified Industrial Hygienist (CIH)	URS Regional Health and Safety Manager	(402) 952-2525
Mike Sonderman	URS Field Team Leader & Site Safety Officer	(402) 952-2537

8.1.2 Hospital Directions

Traveling to:

Plains Regional Medical Center
2100 N. Dr. Martin Luther King Jr. Blvd., Clovis, NM 88101

Traveling from:

Cannon AFB, Main Gate

1. Turn **RIGHT** on **N. TORCH BLVD.** – go **0.6** mile
2. **N. TORCH BLVD.** becomes **US-84 SOUTH** – go **0.2** mile
3. Continue on **US-84 SOUTH** – go **3.9** mi
4. Turn **LEFT** on **W. 7TH ST.** – go **0.9** mi
5. Turn **LEFT** on **N. THOMAS ST.** – go **1.0** mi
6. Turn **RIGHT** on **W. 21ST ST.** – go less than **0.1** mi
7. Arrive at **2100 N. DR. MARTIN LUTHER KING JR. BLVD., CLOVIS,** on the **LEFT**

A Route to Hospital map is included as Figure 8-1.

8.2 PLACES OF REFUGE

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

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

8.3 FIRE

To protect against fires, no flame- or spark-producing devices (including matches and lighters) may be used on site. The local fire department will be summoned in the event of any fire on site.

8.4 COMMUNICATION

A communication network must be established to alert on-site personnel of emergencies and to summon outside emergency assistance. Where voice communication is not feasible, cell phones or radios will be used to alert personnel of emergencies. Cell phones will be used to communicate with outside agencies. Emergency phone numbers must always be readily available for all site workers. The SSO is responsible for ensuring the communication network is working prior to the start of work, and for explaining the procedures to all site personnel during the site safety briefing.

In the event of an emergency, personnel will use the following hand signals where voice communications are not feasible:

Signal	Definition
Hands clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm alright/I understand
Thumbs down	No/negative
Arms waving upright	Send back support
Grip partner's wrist	Exit area immediately

8.5 EMERGENCY RESPONSE PROCEDURES

8.5.1 Emergency Response Team

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

- Emergency Care Provider(s):

  Provide first aid/CPR as needed.

- Communicator:

  The role of the communicator is to maintain contact with appropriate emergency services, providing as much information as possible, such as the number injured, the type and extent of injuries, and the exact location of the accident scene. The communicator should be located as close to the scene as possible in order to transmit to the emergency care providers any additional instructions that may be given by emergency services personnel in route.

- SSO:

  The SSO should survey and assess existing and potential hazards, evacuate personnel as needed, and contain the hazard. Follow up responsibilities include replacing or repairing damaged equipment, documenting the incident, and notifying appropriate personnel/agencies described under incident reporting. It also includes reviewing the SA SSHP.

8.6 MEDICAL EMERGENCIES RESPONSE PLAN

At least two on-site field personnel will hold a current certificate in American Red Cross or equivalent Standard First Aid and CPR. If a medical emergency exists, consult the emergency phone number list and request an ambulance immediately. Perform First Aid/CPR as necessary, stabilize the injured, decontaminate if necessary, and extricate **ONLY** if the environment they are in is dangerous or unsafe and **ONLY** if the rescuers are appropriately protected for potential hazards they may encounter during the rescue. When emergency services personnel arrive, communicate all first aid activities that have occurred. Transfer responsibility for care of the injured/ill to the emergency service personnel.

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

- First Aid Kit and Infection Control Kit;
- Eyewash – A 15 minute eyewash (required if corrosives are present) or an appropriate amount of portable sterile eyewash bottles will be available on site for flushing foreign particles or contaminants out of eyes. The SSO will demonstrate the proper operation of the unit(s) prior to the start of work;
- Emergency Phone Numbers List; and

- Portable radios for emergency communications in remote areas.

Drugs, inhalants, or medications will not be included in the First Aid Kit.

Supplies should be re-ordered as they are used. A monthly inventory must be done on the first aid kit and infection control kit contents and supplies re-ordered that have been used and not reported.

8.7 INCIDENT REPORTING

All site injuries and illnesses must be reported to the SSO and PM immediately following first-aid treatment. Work is to be stopped until the PM or SSO and RHSM have determined the cause of the incident and have taken the appropriate action to prevent a reoccurrence. Any injury or illness, regardless of severity, is to be reported as specified in SMS 049 – Injury/Illness/Incident Reporting and Notifications, included in Attachment C, and in EM 385-1-1, Section 01.D. Additionally, USACE NWO Form 1880 and ENG Form 3394 included in Attachment D must also be completed and submitted to the USACE PM within 24 hours of the incident/accident.

8.8 INJURY MANAGEMENT

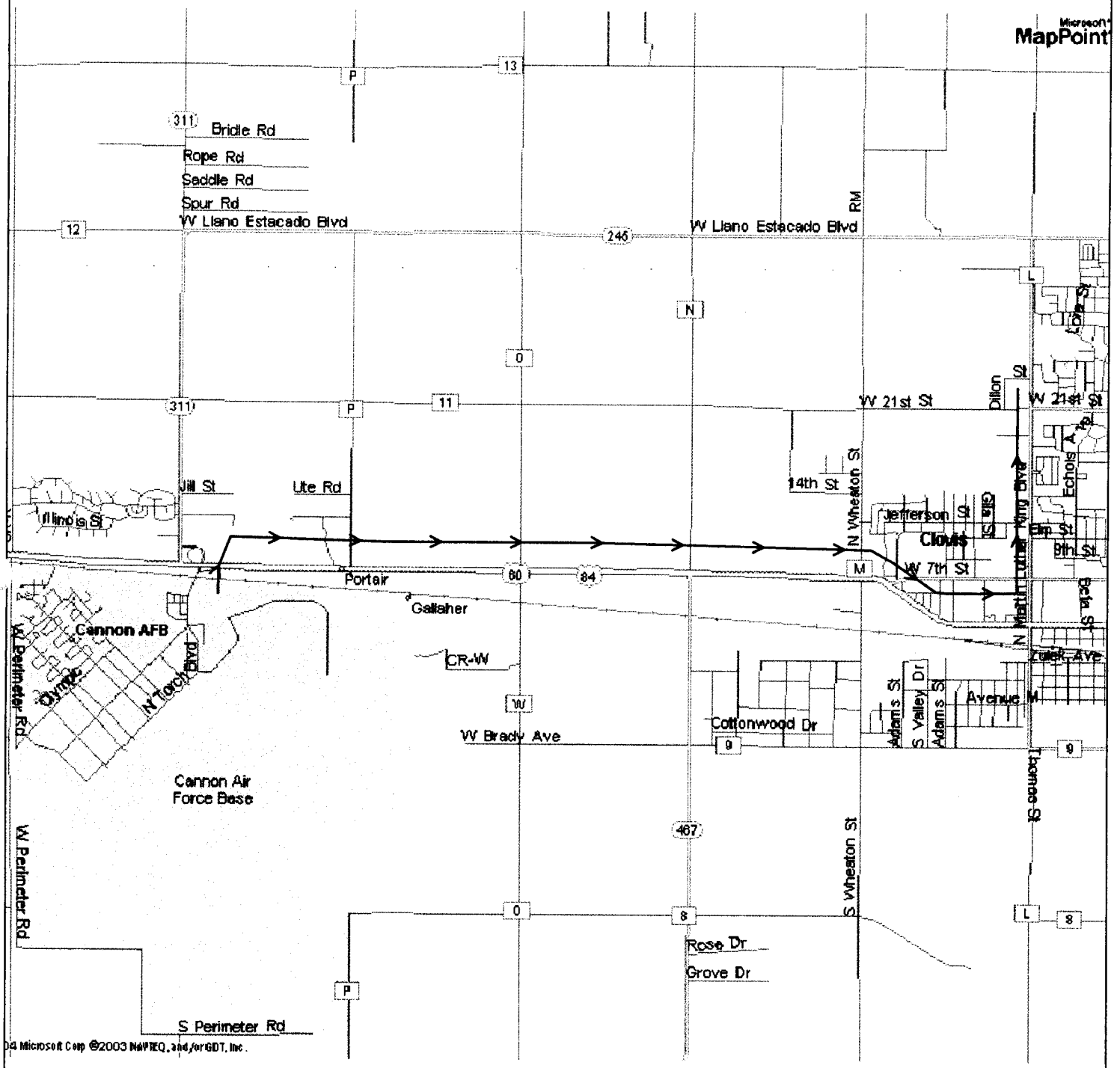
The URS Injury Management Program is designed to ensure that employees receive appropriate, immediate, and high quality medical services that will minimize disability, promote rapid recovery, and save lives.

8.9 OPERATION SHUTDOWN

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

8.10 SPILL OR HAZARDOUS MATERIAL RELEASE

Small spills are immediately reported to the SSO and are dealt with according to the chemical manufacturers recommended procedures found on the MSDS. Steps will be taken to contain and/or collect small spills for approved storage and disposal.



ROUTE TO HOSPITAL
CANNON AIR FORCE BASE
CLOVIS, NEW MEXICO

DRN. BY: DPG	DATE: 01/10/05	PROJECT NO.	FIG. NO.
CHK'D. BY:	REVISION: 0	16169869	8-1

January 10, 2005 1:53:26 p.m.
Drawing: T:\CANNON\16169869\2\8-1.dwg

9.1 TRAINING AND MEDICAL SURVEILLANCE

All URS on-site personnel will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent;
- Eight hours of annual refresher training for all personnel (as required);
- Eight hours of supervisor training for personnel serving as SSO;
- Three days of work activity under the supervision of a trained and experienced supervisor

All URS on-site personnel participate in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Detailed information regarding medical screening and surveillance is contained in SMS 024 – Medical Screening and Surveillance, included in Attachment C.

The local URS office maintains current copies of training certificates and statements of medical program participation for all URS personnel. Copies of all applicable training certificates and medical program participation for all URS personnel, subcontractors and visitors will be presented to the SSO during the initial Daily Tailgate Safety Briefing and documented in the Safety Plan Compliance Agreement Form included in Attachment A. URS personnel, subcontractors and site visitors will not be allowed to enter the site without this documentation.

In addition, all URS on-site personnel will review this SA SSHP and sign a copy of the Safety Plan Compliance Agreement, which is included in Attachment A. The PM will maintain these agreements at the site, and place them in the project file at the conclusion of the operation.

Prior to the start of operations at the site, the SSO will conduct an initial Daily Tailgate Safety Briefing, which will include all personnel involved in site operations. At this meeting, the SSO will discuss:

- Contents of this SA SSHP
- Types of hazards at the site and means for minimizing exposure to them
- The type of monitoring that will be performed
- Action levels for upgrade and downgrade of PPE
- PPE that will be used
- Decontamination protocol
- Site control measures, including safe operating practices and communication
- Location and use of emergency equipment
- Evacuation signals and procedures

All URS on-site personnel, including subcontractor personnel, are to attend the briefings and sign the Safety Compliance Agreement Form and the Daily Tailgate Safety Briefing and Analysis Worksheet Form included in Attachment A.

Daily Tailgate Safety Briefings will be conducted each morning, or whenever there is a change in task or significant change in task location. Whenever new personnel report to the site, briefings will be conducted and the new personnel will be required to sign the forms included in Attachment A.

The PM and SSO are responsible for site recordkeeping. Prior to the start of work, they will review the SA SSHP; if there are no changes to be made, the they will both sign the approval form.

All on-site personnel will review the SA SSHP and sign the Safety Plan Compliance Agreement included in Attachment A, or its equivalent. Copies of the completed forms will be maintained in the project file.

The SSO will conduct Daily Tailgate Safety Briefing in accordance with Section 9.1 and have all attendees sign the form or its equivalent; an example is included in Attachment A. Copies of the completed form will be maintained in the project file.

Incidents and exposure incidents will be investigated by the PM and the SSO and ENG Form 3394 and NWO Form 1880 will be completed and forwarded to the USACE. Additional URS requirements are listed in SMS 049 – Incident Reporting, included in Attachment C.

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

URS Radian (URS). 2000. Seymour Johnson Base Range Inventory Report. Prepared for HQ ACC/CEVR. September.

URS. 2004. Final Work Plan. Preliminary Assessment, OT-28, Dare County Bombing Range, Seymour Johnson Air Force Base, North Carolina. Prepared for the U.S. Army Corps of Engineers, Omaha District. June.

USACE. 2003. Safety and Health Requirements Manual. EM 385-1-1. November.

SAFETY PLAN COMPLIANCE AGREEMENT AND DOCUMENTATION OF SITE SAFETY BRIEFING

DATE _____ TIME _____

SITE LOCATION _____ PROJECT NUMBER _____

SITE SAFETY OFFICER _____ PROJECT MANAGER _____

TOPICS COVERED DURING BRIEFING:

__ EXTENT AND CONCENTRATION OF CHEMICAL HAZARDS ON SITE
__ HEALTH EFFECTS OF CHEMICALS HAZARDS
__ PHYSICAL HAZARDS ON SITE
__ LEVELS OF PROTECTION REQUIRED
__ LOCATION OF EMERGENCY EQUIPMENT (FIRST AID, FIRE FIGHTING EQUIPMENT, ETC.)
__ VERIFICATION THAT HEALTH AND SAFETY PLAN HAS BEEN RECEIVED AND READ
__ MONITORING PROCEDURES
__ ACTION LEVELS
__ DECONTAMINATION PROCEDURES
__ LOCATION OF EMERGENCY NUMBERS
__ ROUTE TO THE HOSPITAL
__TASK SPECIFIC ACTIVITY HAZARD ANALYSIS

I, the undersigned, have received a copy of the Preliminary Assessment SSHP (Site Safety and Health Plan) for the Dare County Bombing Range (OT-28). I have read the plan, understand it, and agree to comply with all of the health and safety requirements. I understand that I may be prohibited from working on the project for violating any of the requirements. In addition, I have been verbally briefed on the topics noted above.

DOCUMENTATION (SSHO MUST SEE VERIFICATION BEFORE INITIALING COLUMN)

ATTENDEES:

NAME	COMPANY	40 HR	FIT	MEDICAL
1.(print) _____ (signature) _____				
2.(print) _____ (signature) _____				
3.(print) _____ (signature) _____				

SAFETY PLAN COMPLIANCE AGREEMENT AND DOCUMENTATION OF SITE SAFETY BRIEFING

Page 2

I, the undersigned, have received a copy of the Preliminary Assessment SSHP (Site Safety and Health Plan) for the Dare County Bombing Range (OT-28). I have read the plan, understand it, and agree to comply with all of the health and safety requirements. I understand that I may be prohibited from working on the project for violating any of the requirements. In addition, I have been verbally briefed on the topics noted above.

ATTENDEES: NAME	COMPANY	DOCUMENTATION (SSHO MUST SEE VERIFICATION BEFORE INITIALING COLUMN) 40 HR	FIT	MEDICAL
4.(print) _____ (signature) _____				
5.(print) _____ (signature) _____				
6.(print) _____ (signature) _____				
7.(print) _____ (signature) _____				
8.(print) _____ (signature) _____				
9.(print) _____ (signature) _____				
10.(print) _____ (signature) _____				
11.(print) _____ (signature) _____				
12.(print) _____ (signature) _____				

DAILY TAILGATE SAFETY BRIEFING AND ANALYSIS WORKSHEET

TASK _____ **DATE** _____
WORK AREA(s) _____

The Site Safety Officer (SSO) must discuss the principal steps of each planned task and associated hazards (see applicable Activity Hazard Analysis [AHAs] forms). The SSO is responsible for conducting a site inspection to identify additional or unanticipated hazards not identified in the applicable AHAs. Additional hazards identified during the site inspection must be added to table below. The SSO certifies that the applicable AHAs have been discussed at the Safety Briefing.

Principal Steps of Task	Recognized/Unanticipated Safety/Health Hazards	Recommended Controls

The SSHO must check the following items discussed during the Daily Tailgate Safety Briefing:

__ CHEMICAL HAZARDS ON SITE
__ HEALTH EFFECTS OF CHEMICALS HAZARDS
__ PHYSICAL HAZARDS ON SITE
__ LEVELS OF PROTECTION REQUIRED
__ LOCATION OF EMERGENCY EQUIPMENT
__ MONITORING PROCEDURES
__ ACTION LEVELS
__ DECONTAMINATION PROCEDURES
__ LOCATION OF EMERGENCY NUMBERS
__ ROUTE TO THE HOSPITAL
__ DESCRIBE OTHER ITEMS DISCUSSED: _____

TEAM MEMBERS SIGNATURES

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

SSHO SIGNATURE **DATE** _____

AHAs:

- Soil Boring
- Blank

ACTIVITY HAZARD ANALYSIS FORM

Work Activity: Soil Boring		
Principal Steps	**Potential Safety/Health Hazards**	**Recommended Controls**
Raise mast	Rig stability	• Situate the rig on a flat surface • Use outriggers as necessary • Never move the rig with the mast up
	Overhead utilities	• If overhead utilities are present in work areas, place warning signs at ground level • Always check for overhead utilities before raising the mast • Maintain at least one mast length or 20 feet (whichever is greater) from all power lines • Contact the RHSM if high voltage lines are present • Refer to SMS 34, *Utility Clearance and Isolation*
Attach/detach rod and augers	Lifting	• Use the winch to lift auger flights
	Hand tools	• Inspect tools prior to use • Use tools for their intended use only • Don't use damaged tools • Push, don't pull wrenches
	Pinch points	• Never place your hand or other body parts under auger
Advance the boring	Rotating equipment	• All team members should know the location of the kill switch • At least two persons must be present when advancing the auger • Stand clear if possible • Do not wear loose clothing, jewelry, hair, or equipment near the auger • Remove cuttings with a shovel, not your hand or foot
	Underground utilities	• Complete utility locates prior to drilling (One Call: (800) 321-ALERT and/or coordinate with site personnel) • Mark locations in white • Field verify utility locations • Document all utility locates • Observe the area for indications of utilities • Refer to SMS 34, *Utility Clearance and Isolation*
	Environmental Contamination (if applicable)	• Contain cuttings in drums or plastic sheeting • Wear proper PPE and minimize contact with soil, sediment, groundwater, etc. • Work upwind of the boring • If unusual soil discoloration or odors are encountered, stop work, evacuate area and contact HSM; approach will need to be re-evaluated and Level C PPE may be required • Follow all provisions of this Health and Safety Plan
	Dust (respirable silica)	• Minimize generation of dust • Stay out of visible dust clouds • Wet soil if necessary to eliminate visible dust
	Noise	• Wear hearing protection when operating or working near the rig • Refer to SMS 26, *Hearing Conservation*
Rig Maintenance	Falls	• Fall protection is required when working at heights of greater than 6 feet (e.g., guard rails or a personal fall arrest system);

ACTIVITY HAZARD ANALYSIS FORM

Work Activity: Soil Boring		
		refer to SMS 40, *Fall Protection* • Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible
	Equipment energization	• Lockout and tagout is required if accidental energization of the rig could cause injury • Refer to SMS 23, *Lockout and Tagout Safety*
	Hot work	• Clear all combustibles away from the work area • A fire extinguisher must be available • Notify the site superintendent of all hot work • Observe work areas for 30 minutes after hot work ("fire watch") • Refer to SMS 20, *Hot Work*
	Hand Tools	• See above
	Chemical Hazards	• Review material safety data sheets • Follow manufacturer's instructions for use, handling and storage • Use recommended protective equipment • Label all containers
All		• Wear proper PPE: Hardhat, safety glasses with side shields, and steel-toed boots as a minimum. • Refer to URS SMS 56, Drilling Safety Guidelines

Work Activity: Soil Boring		
Equipment to Be Used	**Inspections Required**	**Training Requirements**
Drill rig	Perform a pre-shift inspection of all equipment	Follow requirements of the Site Safety and Health Plan.
Personal Protective Equipment:		
Follow requirements defined in the Site Safety and Health Plan		
Daily Tailgate Safety Meeting:		
Field staff must review Site -Safety and Health and Plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work dayAlso consider weather conditions (heat, cold, rain, lightning).		

Analyzed By/Date: Jeff Voelker / 12/20/04
Reviewed By/Date: Dennis Day CIH, CSP / 12/23/04

ACTIVITY HAZARD ANALYSIS FORM

Work Activity:		
Principal Steps	Potential Safety/Health Hazards	Recommended Controls

Work Activity:		
Equipment to Be Used	Inspections Required	Training Requirements

Personal Protective Equipment:

Daily Tailgate Safety Meeting:

Analyzed By/Date:
Reviewed By/Date:

Copies of the following Safety Management Standards (SMSs) are included in this Attachment:

SMS 002	Worker Right-to-Know (Hazard Communication)
SMS 017	Hazardous Waste Operations
SMS 018	Heat Stress
SMS 024	Medical Screening & Surveillance
SMS 026	Noise and Hearing Conservation
SMS 029	Personal Protective Equipment
SMS 045	Back Injury Prevention
SMS 047	Biological Hazards
SMS 049	Injury / Illness / Incident Reporting & Notifications
SMS 055	Health and Safety Training
SMS 064	Hand Safety

SAFETY MANAGEMENT STANDARD
Worker Right-to-Know (Hazard Communication)

1. Applicability

This procedure applies to both office and field operations.

2. Purpose and Scope

The worker right-to-know program provides personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace. This procedure describes how chemical safety hazards are communicated to personnel working in offices and at field site locations, and how information is to be provided to employees of other employers working at the location. The requirements include steps to acquire this information, maintain it, and train everyone to use it.

3. Implementation

Office Locations: Implementation of this program is the responsibility of the Office Manager.

Field Activities: Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Hazardous Material Inventory

1. Maintain a hazardous material inventory that lists all of the hazardous materials used at each workplace (i.e., office/field location). Use chemical names consistent with the applicable MSDS's.
2. File a copy of the chemical inventory with the Project Safety Plan or with the Health and Safety Representative.

B. Material Safety Data Sheets (MSDS's)

1. Obtain a MSDS for each chemical before it is used.
2. Review each MSDS when it is received to evaluate whether the information is complete and to determine if existing protective measures are adequate.
3. Maintain a collection of all applicable and relevant MSDS's where they are accessible at all times.

SAFETY MANAGEMENT STANDARD
Worker Right-to-Know (Hazard Communication)

4. Replace MSDS sheets when updated sheets are received. Communicate any significant changes to those who work with the chemical.
5. MSDS's are required for all hazardous materials used on site by project personnel.

C. Labels

Unless each container has appropriate labeling, label all chemical containers with:

1. Identity of the hazardous chemical(s),
2. Appropriate hazard warnings, and
3. Name and address of the chemical manufacturer, importer, or other responsible party.

D. Hazardous Nonroutine Tasks

Periodically, employees are required to perform hazardous non-routine tasks. Prior to starting work on such projects, provide each employee with information about hazards to which they may be exposed during such an activity.

This information will include:

1. Specific chemical hazards.
2. Protective/safety measures which must be utilized.
3. Measures that have been taken to lessen the hazards including ventilation, respirators, presence of another employee and emergency procedures.

E. Informing Contractors/Subcontractors

Provide contractors/subcontractors the following information on chemicals used by or provided to personnel:

1. Names of hazardous chemicals to which they may be exposed while on the jobsite.

2. Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures.

3. Location of MSDS's and written chemical inventory.

F. Training

1. Conduct training of all employees potentially exposed to hazardous materials on the following schedule:

   a. Before new employees begin their jobs.

   b. Whenever new chemicals are introduced into the workplace, or

   c. Annually thereafter.

2. This training will include:

   a. Applicable regulatory requirements.

   b. Names of those responsible for implementing this program.

   c. Location of the program, inventory and MSDS 's.

   d. Chemicals used, and their hazards (chemical, physical and health).

   e. How to detect the presence or release of chemicals.

   f. Safe work practices.

   g. How to read an MSDS.

3. Document the training.

5. Documentation Summary

A. File these records with the office Health and Safety Representative:

1. Chemical Inventory.

2. Location of the MSDS inventory.

3. Training records.

4. Contractor/Subcontractor notifications.

B. File these records in the Project Safety File.

1. Chemical Inventory.

2. Location of the MSDS inventory.

3. Training records.

4. Contractor/Subcontractor notifications.

6. Resources

A. U.S. OSHA Technical Links - Hazard Communication

B. U.K. - Control of Substance Hazardous to Health - Regulations

SAFETY MANAGEMENT STANDARD
Hazardous Waste Operations

1. Applicability

This standard applies to field operations involving the investigation or remediation of sites impacted with hazardous wastes or hazardous materials including those associated with underground storage tanks.

Investigation projects for real estate transactions conducted to confirm that a site is "clean" are not covered under this standard. Reference related Safety Management Standards for such operations.

2. Purpose and Scope

The purpose of this standard is to provide guidance designed to minimize hazardous chemical exposures to personnel while conducting hazardous waste field operations.

Investigation techniques included under this standard include, but are not limited to, hand auger, soil gas evaluation, test pits, and all types of power drilling, including direct push. Remediation techniques included under this standard include, but are not limited to, excavation, groundwater treatment, soil gas treatment, containment, and landfarming and similar insitu methods.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager or Superintendent.

4. Requirements

A. Project Evaluation

Assess the technical and field aspects of every hazardous waste site project to evaluate:

1. Risk of exposure to hazardous chemicals, with particular attention to suspected or known human carcinogens.
2. Personal protective equipment requirements.
3. Air monitoring requirements.
4. Emergency services requirements.
5. Hazards addressed by other Safety Management Standards

SAFETY MANAGEMENT STANDARD
Hazardous Waste Operations

6. Logistical considerations, such as access, distance from population centers.
7. Other safety and health hazards associated with site operations.

B. Client/Contract Evaluation

1. Review contract documents to determine whether the client has any special internal or regulatory requirements for hazardous waste site operations.
2. Implement client requirements in addition to those of this standard. Those requirements that are the most protective (e.g., most stringent) will be used.

C. Site-specific Health and Safety Plan

1. Prepare a site-specific Health and Safety Plan (HSP) for every project under this standard.
2. HSPs must be written or reviewed by a Health and Safety Regional Health and Safety Manager (RHSM) or a safety professional specifically approved by the RHSM.
3. Evaluate client and agency requirements prior to preparing the HSP, particularly if the client or an agency will approve the HSP prior to implementation.

D. Training

Verify that each assigned employee has completed required training. In general, the following are required for operations within North America:

1. 40-hours of initial training from an approved training provider.
2. 3-days of on-the-job training.
3. 8-hours of refresher training completed within 12 months of the initial or subsequent refresher training.
4. 8-hours of Site Safety Officer (Supervisor) training for directing the activities of any other employee.
5. Additional training for the Site Safety Officer as described below.

E. Site Safety Officer

1. Appoint a Site Safety Officer (SSO) with appropriate qualifications for the specific hazardous waste project.
2. Assure that the SSO for complex projects, such as those with complicated remediation activities, has no duties other than site safety and health.
3. Verify that the SSO has completed basic supervisor training, and has additional required training and experience as applicable:
   a. Advanced respiratory protection training is required for projects where supplied air respirators may be used.
   b. Heavy equipment/construction safety.
   c. Personal air monitoring.

F. Exposure Monitoring

Require that exposure monitoring is conducted in accordance with the HSP on all hazardous waste projects.

G. Project Equipment

1. Provide all health and safety equipment as described by the project Health and Safety Plan.
2. Provide all personal protective equipment as described by the project Health and Safety Plan.

H. Medical Surveillance

Verify that each employee assigned to the project meets the minimum requirements of the Medical Surveillance Program. This typically includes:

1. Baseline examination.
2. Annual examination.
3. Appropriate clearance for respirator use.

5. Documentation Summary

In the Project Safety File:

A. Completed Health and Safety Plan.

B. Completed and signed HSP approval form.

C. Signed HSP acceptance form.

D. Completed H&S field forms that are included in each HSP.

E. Training and Medical Surveillance Clearance documentation for project personnel.

6. Resources

A. U.S. OSHA Technical Links - Hazardous Waste Operations

The following documents are PDF files which must be read with Adobe Reader:

B. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities - NIOSH 85-115

C. USACE EM 385-1-1 - Hazardous, Toxic and Radioactive Waste

1. Applicability

This procedure applies to field projects where ambient (not adjusted) temperatures exceed 70°F (21°C) for personnel wearing chemical protective clothing, including Tyvek coveralls, and 90°F (32°C) for personnel wearing normal work clothes.

2. Purpose and Scope

The purpose of this procedure is to protect project personnel from the effects of heat related illnesses.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Monitor ambient temperatures and conduct Heat Stress Monitoring when threshold temperatures (see Section 1) are reached.

B. Conduct initial monitoring to determine first rest break.

1. Measure the air temperature with a standard thermometer with the bulb shielded from radiant heat; this yields T (actual).

2. Estimate the fraction of sunshine by judging what percent time the sun is not shielded by clouds that are thick enough to produce a shadow. 100 percent sunshine - no cloud cover = 1.0; 50 percent sunshine - 50 percent cloud cover = 0.5; 0 percent sunshine - full cloud cover = 0.0.

3. Plug these variables into the following equation to determine the adjusted temperature:

T (adjusted) = T (actual) + (13 x fraction sunshine)

C. Body Temperature Monitoring

1. Monitor oral body temperature to determine if employees are adequately dissipating heat buildup. Ear probe thermometers which are adjusted to oral temperature are convenient and the

preferred method of measurement. Determine work/rest regimen as follows:

a. Measure (oral adjusted) temperature at the end of the work period.

b. If temperature exceeds 99.6 °F (37.5°C)., shorten the following work period by 1/3 without changing the rest period.

c. If temperature still exceeds 99.6 °F (37.5°C), shorten the following work period by 1/3.

d. Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6 °F (38.1°C).

2. Oral temperatures are to be obtained prior to the employee drinking water or other fluids.

D. Pulse Rate Monitoring

1. Take the radial (wrist) pulse as early as possible in the rest period.

a. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third.

b. If the heart rate still exceeds 110 beats per minute at the next rest cycle, shorten the following work cycle by an additional one-third.

E. Record monitoring results on Heat Stress Monitoring Form (Attachment 18-2).

F. Investigate the use of auxiliary cooling devices in extreme heat conditions.

G. Conduct briefings for employees regarding health hazards and control measures associated with heat stress whenever conditions require the implementation of heat stress monitoring. Review the information provided in Attachment 18-3.

H. Provide water and electrolyte replacement drinks fluids as described in Attachment 18-3.

I. Allow employees who are not accustomed to working in hot environments appropriate time for acclimatization (see Attachment 18-3).

J. Provide break areas as described in Attachment 18-3.

5. Documentation Summary

File these records in the Project Safety File.

A. Heat Stress Monitoring Forms.

B. Employee Safety Briefing Verification Forms.

6. Resources

A. NIOSH - "Working in Hot Environments"

B. AFL-CIO Building Trades Division - "Heat Stress in Construction"

The following documents are PDF Files that must be read with Adobe Reader.

C. Attachment 18-1 - Initial Work Monitoring Cycles

D. Attachment 18-2 - Heat Stress Monitoring Record

E. Attachment 18-3 -Informational Supplement

INITIAL WORK / MONITORING CYCLES

Adjusted Temperature	Normal Work Clothes	Protective Clothing
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F - 90°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°F – 87.5°F (28.1°C – 30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°F – 82.5°F (25.3°C – 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°F – 77.5°F (22.5°C – 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Health & Safety Program
EMPLOYEE HEAT STRESS EXPOSURE MONITORING RECORD

DATE: _____ SAFETY REPRESENTATIVE: _____

WORKER'S NAME: _____ SUBCONTRACTOR: _____

WORK ACTIVITY: _____

Time (24 hour)	*Oral Temp (°F)*	*Pulse (BPM)*	*Comments*

DATE: _____ SAFETY REPRESENTATIVE: _____

WORKER'S NAME: _____ SUBCONTRACTOR: _____

WORK ACTIVITY: _____

Time (24 hour)	*Oral Temp (°F)*	*Pulse (BPM)*	*Comments*

DATE: _____ SAFETY REPRESENTATIVE: _____

WORKER'S NAME: _____ SUBCONTRACTOR: _____

WORK ACTIVITY: _____

Time (24 hour)	*Oral Temp (°F)*	*Pulse (BPM)*	*Comments*

HEAT RASH

Heat rash (prickly heat) may result from continuous exposure to heat or humid air. It appears as red papules (elevated skin lesion), usually in areas where the clothing is restrictive, and gives rise to a prickly sensation, particularly as sweating increases. It occurs in skin that is persistently wetted by unevaporated sweat. The papules may become infected unless treated.

> **First Aid for Heat Rash** - to prevent heat rash: shower after work, dry off thoroughly, and put on clean, dry underwear and clothes. Try to stay in a cool place after work. If, in spite of this, you develop heat rash, see your physician.

HEAT CRAMPS

Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:

- Muscle spasms.
- Pain in the hands, feet and abdomen.

> **First Aid for Heat Cramps** - leave the work area, and rest in a cool, shaded place. Drink one or two glasses of electrolyte replacement drink, and try to gently massage the cramped muscle. Once the spasms disappear, you may return to work; taking adequate breaks and drinking electrolyte replacement drink should prevent the cramps from returning.

HEAT EXHAUSTION

Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:

- Pale, cool, moist skin.
- Heavy sweating.
- Dizziness.
- Nausea.
- Fainting.

The key here is that the victim is still sweating, so the cooling system is still working; it's just under severe stress. The body core temperature may be elevated. It is important to

recognize and treat these symptoms as soon as possible, as the transition from heat exhaustion to the very hazardous heat stroke can be quite rapid.

First Aid for Heat Exhaustion - leave the work area immediately, go through decon and remove all chemical protective clothing. Rest in a cool, shaded place and open your clothing to allow air circulation; lay flat except when taking fluids. Drink plenty of cooled electrolyte replacement drinks. Your work is over for the day; do not attempt to return. Medical assistance in severe cases may be warranted.

HEAT STROKE

Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occurs. Competent medical help must be obtained. Signs and symptoms are:

- Red, hot, usually dry skin.
- Lack of or reduced perspiration (lack of perspiration may be masked for those wearing chemical protective clothing since perspiration from earlier in the day will be present).
- Nausea.
- Dizziness and confusion.
- Strong, rapid pulse.
- Coma.

First Aid for Heat Stroke - THIS IS A MEDICAL EMERGENCY! SUMMON MEDICAL ASSISTANCE IMMEDIATELY! Remove the victim from the work area, perform a gross decon, and remove all PPE. Have the victim lie down in a cool, shady area. Attempt to bring the victim's temperature down by increasing air movement (electric fan) or placing wetted sheets or towels on them. Place an ice bag on the victim's head. The victim must not be sent home or left unattended without a physician's specific order.

HEAT STRESS PREVENTION

The best approach to avoiding heat-related illnesses is through preventative heat stress management. The site manager and site safety officer are responsible for implementing this program.

Rest areas - a relatively cool, shaded area must be provided for breaks when ambient temperatures exceed 70° F and workers are wearing chemical protective clothing (including uncoated Tyvek), or if temperatures exceed 90° F and workers are wearing "Level D"

coveralls or work clothes. A car or van is an oven, not a rest area. For Hazardous Waste Sites, the rest area should be located in the support zone adjacent to the contamination reduction zone, situated so that part of it is in the decon area so workers can take breaks without going through full decon. If shade is not available, build some: use a plastic "dining canopy", which can be obtained at sporting goods stores. This same type of canopy can be set up to shade personnel performing various types of work in hot weather.

Liquids - encourage employees to drink plenty of cool plain water and electrolyte replacement drinks. Supplementing water with cool electrolyte replacement drinks, such as Gatorade, Squench or Quik-kick (drink) is helpful to employees who tend to sweat a lot. Do not use "community cups"; use paper cups. Have workers drink 16 ounces of drink before beginning work, such as in the morning and after lunch. At each break, workers should take 8-16 ounces of drink. Don't wait until you are thirsty to drink.

Discourage the use of alcohol during non-working hours, and discourage the intake of coffee during work hours, as these make heat stress control more difficult.

Acclimatization - this is the process by which your body "gets used to" hot work environments. This is achieved by slowly increasing workloads. Start at 50 percent capacity on day one, and increase by 10 percent per day; on day six, you'll be at 100 percent. You don't lose acclimatization over a weekend, but it'll start to decrease after three to four days. If you don't do hot work for a week, it is gone. You don't have to do full shift hot work to achieve or retain acclimatization; a minimum of 100 minutes of continuous hot work exposure per day is adequate.

Auxiliary Cooling - auxiliary cooling is usually obtained by providing workers with a specially-designed vest, which is worn under the protective clothing, but over any underclothing. These vests typically provide cooling via one of two methods: the use of ice or other frozen media, or the use of a vortex cooler. Each method has its advantages and disadvantages.

The frozen media vest requires a means for freezing the media, and the media (usually water or "blue ice") will melt, requiring replacement.

The vortex cooler tends to cool more uniformly. Instead of frozen media, this vest uses the expansion of compressed air to cool the wearer. The drawback is the compressed air requirement, but this is negated when the wearer is already using an airline respirator supplied by a compressor. A vortex cooler should not be supplied from air cylinders, as this will draw down the cylinders rapidly.

Auxiliary cooling should be considered when the following conditions exist:

- Ambient temperature over 80° F
- Workers wearing impermeable garments (PE Tyvek, Saranex, Chemrel, etc.)
- It is desirable to have long work shifts with minimum interruption

1. Applicability

This program applies to employees assigned to work environments where there is a potential for exposure to chemical, biological, and/or physical hazards. Individuals will be selected for medical screening based on regulatory standards, project health and safety plan assessments, the expected use of personal protective equipment, and client contract requirements.

2. Purpose and Scope

The overall goal of this program is to prevent occupational illness and injury by early identification of exposure-related health effects before they result in disease. Medical examinations will be performed in order to determine if employees are capable of safely performing assigned tasks, to verify protective equipment and controls are effectively providing protection, and to comply with governmental regulations. Included are provisions for emergency medical consultation and treatment.

3. Implementation

Office/laboratory locations – Implementation is the responsibility of the Office Manager.

Field activities – Implementation is the responsibility of the Project Manager.

Program Administration – The Occupational Health Specialist (OHS) is responsible for development and administration of this program in coordination with the Medical Service Provider (MSP). The OHS will maintain current injury and illness data and participate with Corporate Health & Safety Managers in evaluation of this program. The MSP will provide board certified occupational medicine oversight for the program and will approve medical surveillance protocols.

The United States and Canada locations will follow all requirements of this program.

International locations will follow sections B.1,2,3,5,6,7,8; G.3; and H.1 of this program.

4. Requirements

A. Selection of program participants.

1. The Medical Surveillance Evaluation (MSE) form provides the primary guidance for determining whether medical screening is required for an employee and the frequency of periodic exams. The MSE is to be completed by the employee and their supervisor at time of hire for any employee who may work outside an office environment and is to be reviewed for accuracy at each annual performance review. Other reviews are required whenever there is a change in job tasks.

2. Additional site/project specific biological monitoring or toxicological screening may be required in addition to this program's core exam schedule. These medical tests will be specified by the project-specific health and safety plan and will be authorized by the MSP on the exam appointment protocol. Note: See section D.2 if employee will have an initial assignment at a HAZWOPER site.

B. Types of medical screening and surveillance exams

1. A baseline or preassignment baseline exam will be conducted prior to the start of work assignments requiring medical surveillance.

2. Periodic exam schedules are established by the MSP using the following criteria:

   a. Employees performing the following types of work will receive annual exams: construction activities in the exclusion zone of HAZWOPER sites, field work activities in the exclusion zone of HAZWOPER sites for 30 or more days per year, projects involving exposure to OSHA-regulated materials at or above established action levels.

   b. Employees performing the following types of work will receive biennial exams: field work activities at HAZWOPER sites less than 30 days per year; waste disposal activities; non-HAZWOPER environmental sampling; chemistry laboratory, pilot plant projects, or bench scale operations for 30 or more days per year.

3. Employees currently participating in an examination program will receive exit exams when they leave their work assignment as identified in the Exit Exam Determination. In the event an employee declines the exit exam, the employee will be requested to sign a Waiver of Exit Medical Surveillance Exam.

4. Department of Transportation (DOT) exams will be conducted biennially when an employee is assigned to drive a vehicle with a gross weight rating of more than 10,000 pounds or when driving a placarded vehicle of any size used to transport hazardous chemicals. DOT exam certification can be added to a routine baseline or periodic exam protocol when scheduling with the MSP.

5. When noise levels in the employee's work environment equal or exceed an 8-hour time-weighted average of 85 decibels as measured on the A-scale (dBA), annual audiograms will be performed. For employees involved in construction activities or management of construction, enrollment in this program will be required if more than 50% of their time is spent in an active construction area.

6. Individual radiation dose monitoring will be conducted as required by the site-specific health and safety plan with approval by a Radiation Safety Officer. Personal dosimetry (film badges) are typically required, however, depending on the specific radiation hazard, additional excretory monitoring or thyroid scans may be required.

7. In order to determine an employee's ability to wear a respirator, a medical evaluation will be performed before an employee is fit tested or assigned to wear a respirator.

8. Employees assigned to work environments with airborne concentrations of asbestos fibers at or above the established action level will receive asbestos-specific baseline and annual exams. Exit exams will be performed if an exam has not been performed within the past 6 month period or if an employee has medical complaints related to asbestos exposure.

C. Exam protocols

1. The Medical Screening & Surveillance Exam Protocol identifies the medical exam components of this program.

D. Scheduling of exams

1. The Office or Project Manager, usually with assistance of the local H&S Representative, is responsible for contacting the MSP when baseline, exit, and project specific exams are required. The MSP maintains an employee scheduling database for tracking periodic

exams and will contact the employee for scheduling the month their exam is due. These steps are detailed in the Medical Surveillance Exam Process.

2. Construction Services Division employees hired with an initial assignment to work at a OSHA HAZWOPER site whose work duties require passing a physical exam or who have an essential job function of wearing a respirator, will receive a job offer contingent upon passing a preassignment baseline exam. See HAZWOPER & Respirator Preassignment Baseline Exam Process. In the event of an urgent business necessity a temporary clearance to begin work the day of the exam, issued by the local physician and good for 14 days until the MSP physician final clearance is received, may be requested at the time a baseline exam is scheduled through the MSP.

3. If an exam becomes due during an employee's pregnancy, it is advised to defer the exam until after delivery and the employee returns to work from family/medical leave status.

E. Exam Follow Up

1. Following each exam, the MSP will issue a physician's written opinion (Health Status Medical Report) to the site Health & Safety Representative which will include any medical restrictions and address the employee's ability to use personal protective equipment. See Exam Follow Up Procedures.

2. The MSP will mail the exam invoice to the site H&SR who will approve the charge and forward the invoice to the accounts payable department for payment.

3. The MSP will mail an exam results letter that is confidentially addressed to the employee at their home address within 30 days of the exam date.

F. Emergency Medical Care

1. Preplanning is essential to a prompt and proper response to a medical emergency. Site specific emergency procedures will be provided in the site Health & Safety Plan. See Field First Aid Kit Supply List for recommended supplies. The contents of the first aid kit shall be checked prior to being sent out to each site/project and periodically thereafter to ensure the expended items are replaced.

2. A MSP occupational physician should be available 24 hours a day for phone consultation.

3. A workers' compensation claim should be filed by the Human Resource Representative
for an injured employee who receives professional medical care or who is disabled from working beyond the initial date of injury.

4. In order to comply with OSHA reporting regulations, immediately notify the OHS or a Division Health & Safety Manager if there is a work-related hospitalization or death.

G. Medical Records

1. Medical records are maintained and preserved in confidential, locked files in the custody of the MSP for at least the duration of employment plus 30 years. Only information regarding the employee's ability to perform the job assignment will be provided to company representatives.

2. Upon request, each employee (or designated representative) will have access to the employee's medical record. Prior to the release of health information to the employee (or designated representative), a specific written consent must be signed by the employee.

3. International records (excluding the United States and Canada) will be maintained in country at the local clinic.

H. Program evaluation

1. The OHS and Division Health & Safety Managers will evaluate this program annually and as needed. Issues to review include program efficacy and efficiency, employee satisfaction, and cost effectiveness.

2. The MSP will prepare an Annual Medical Trending Report specifying the number and types of exams performed and anonymous statistical exam results in group data format.

3. Each employee is mailed a Post-Exam Evaluation by the MSP. Employee feedback regarding the clinic, medical staff, and exam

procedures are reviewed and corrective actions are identified and acted upon as needed.

5. Documentation Summary

The H&SR will file the Medical Surveillance Evaluation and the Health Status Medical Report in the site health & safety records.

6. Resources

A. U.S. OSHA Technical Links - Medical Screening/Surveillance

B. U.S. OSHA Publication 3162 (1999) Screening and Surveillance: A Guide to OSHA Standards

C. Attachment 24-1 Medical History Questionnaire

D. Attachment 24-2 Medical Surveillance Evaluation

E. Attachment 24-3 Medical Screening & Surveillance Exam Protocol

F. Attachment 24-4 Medical Surveillance Exam Process

G. Attachment 24-5 HAZWOPER/Respirator Preassignment Baseline Exam Process

H. Attachment 24-6 Exit Exam Determination

I. Attachment 24-7 Waiver of Exit Medical Surveillance Exam

J. Attachment 24-8 Exam Follow Up Procedures

K. Attachment 24-9 Field First Aid Kit Supply List

L. SMS 8 Asbestos Survey and Oversight Operations

M. SMS 17 Hazardous Waste Operations

N. SMS 42 Respiratory Protection

Medical History Questionnaire

☐ Baseline ☐ Annual/Biennial
☐ Exit ☐ Other _____

Company Name: _____
Office: _____
Date: _____

Attachment 24-1

Example
Medical History Questionnaire

The exam will be at: *Please see Appointment Protocol.*

- Please have your Supervisor or Health & Safety Professional complete the Job Profile on the inside flap of this page if you do not know the responses.
- See your Health & Safety Professional for directions to the clinic. Please bring the completed exam packet and your Authorization.
- Do not eat for 8 hours prior to exam.
  (Water and unsweetened juice or black decaffeinated coffee are allowed)
  (Dry toast if you have an afternoon appointment)
- Avoid all alcohol consumption for 24 hours prior to the exam.
- Avoid loud noise exposure for 14 to 16 hours before the exam.
- If you wear contact lenses, please do not insert them on the day of the exam. Bring a pair of glasses.
- If you use hearing aids, please bring them to the clinic.
- If you have questions, do not read or understand please contact (800) 455-6155.
- The cost of this exam will be borne by your employer. It is important to be on time for your appointment. If you cannot attend your appointment, call (800) 455-6155 to cancel, or your employer may be charged.

Please answer all the questions in this booklet.

Copyright WorkCare™ © 2000 All Rights Reserved.

I INSTRUCTIONS

Your supervisor must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisors must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the healthcare professional who will review it.

Has your employer told you how to contact the healthcare professional who will review this questionnaire? Yes ☐ No ☐

This questionaire is used to gather information about your health and physical condition, both now and in the past. This information will be used to determine if you can safely perform the duties of your job. This exam is not intended to substitute for care provided by a personal physician. Results of the exam will be sent to your home address. The results of the examination are kept confidential.

I. 1. Print the following information:

Last Name: _____ First Name: _____

Home mailing address: _____

_____
(city) (state) (zip)

Social Security Number: _____ Date of Birth: _____ Age: _____

Sex	Position	Site Location	Date Employed
[ ] Male [ ] Female			

Home Phone	Work Phone	Emergency Contact/Phone #
( )	( )	( )

What is the phone number at which you can be reached by the healthcare professional who reviews this questionnaire (include area code:) (____) _____

What is the best time to reach you? From: _____ AM/PM To: _____ AM/PM

E-mail: _____

2. **Read and sign this Consent for Release of Medical Records:**
I hereby authorize the provider to release in confidence to _____(company) and/or its subsidiaries medical information, including but not limited to the results of medical evaluations, physical examinations or medical testing, as it specifically pertains to my medical qualification to perform the stated Job Duty consistent with the requirements of OSHA, MSHA.
I further authorize the examining physician and/or clinic to release to the provider any medical information related to my medical or physical condition. You have a right to receive a copy of this authorization.

Signature: _____ Date: _____

Job Profile

II THIS SECTION IS TO BE COMPLETED

If you have questions about the job, these need to be discussed with the employer.

JOB DUTY / TITLE What is the main job duty (present or proposed) for this individual?
(Example: Driller, Water Treatment, Ground Water Sampling, Engineer, Environmental Scientist, Lab Tech, Heavy Equipment Operator, Maintenance Worker, etc.)

_____

_____

WORK SCHEDULE _____ % Field _____ % Office _____ % Travel

PHYSICAL REQUIREMENTS

Are there any specific physical demands of the job that are important? (example: lifting, carrying) Yes ☐ No ☐
If yes, please specify:

_____

PROTECTIVE EQUIPMENT

Is clearance for the use of respiratory protective equipment needed? Yes ☐ No ☐

Escape only (no rescue) ☐ Emergency rescue only ☐

Is there specific safety equipment (beyond hard hat, gloves, boots, and appropriate clothing) that are used in the safe performance on the job? If yes please specify: Yes ☐ No ☐

_____

1. **THIS EMPLOYEE USES THE FOLLOWING TYPES OF RESPIRATORY PROTECTIVE EQUIPMENT:**

✓		DURATION	FREQUENCY	TEMPERATURE EXTREMES	HUMIDITY
	HALF FACE PIECE AIR PURIFYING RESPIRATOR				
	FULL FACE PIECE AIR PUIRFYING RESPIRATOR				
	POWERED AIR PURIFYING REPIRATOR				
	SELF-CONTAINED BREATHING APPARATUS				
	AIR LINE RESPIRATOR				

	Yes	No
2. Is it possible that this individual will be required to wear Level A protection at any time? [SCBA, fully encapsulated suit, chemical resistant gloves & boots.]	☐	☐
3. Is it possible that this individual will be required to wear Level B protection at any time? [SCBA, chemical resistant clothing, chemical resistant gloves & boots.]	☐	☐

4. List potential chemical exposures

_____

	Yes	No
5. Will you be working under hot conditions (temperatures exceeding 77°F)?	☐	☐
Will you be working under humid conditions?	☐	☐
Will you be working at high altitudes?	☐	☐

Describe the work you'll be doing while you're using your respirator(s). _____

_____

6. Describe any special or hazardous conditions you might encounter when you're using your respirator(s) (For example, confined spaces, life-threatening gases): _____

_____

7. During the period you are using the respirator(s), is your work effort:
   a. Light (less than 200 kcal per hour) Yes ☐ No ☐ How long_____hrs per shift
   b. Moderate (200 to 359 kcal per hour) Yes ☐ No ☐ How long_____hrs per shift
   Examples: sitting while mailing or filing; driving a truck or trasferring a moderate load (about 35 lbs) at trunk level; walking on a level surface about 2 mph
   c. Heavy (above 350 kcal per hour) Yes ☐ No ☐ How long_____hrs per shift
   Examples: lifting a heavy load (about 50 lbs.) from the floor to your waist; working on a loading dock; shoveling; standing while bricklaying; climbing stairs with a heavy load (about 50 lbs.)
8. Describe any special responsibilities you'll have while using your respirator(s) that may affect the safety and well-being of other (e.g. rescue, security): _____

_____

9. Are there any substances which you can not work with? List: _____

III REVIEW OF SYSTEMS

ANSWER YES IF YOU CURRENTLY HAVE THE SYMPTOM OR HAVE HAD SIGNIFICANTLY IN THE PAST

		YES	NO	DATE
1.	A. Fever			
	B. Chills			
	C. Weight Loss			
	D. Loss of energy/fatigue			
2.	A. Poor Vision			
	B. Color Blindness			
	C. Double vision			
	D. Injury to eye			
	E. Cataract			
	F. Glaucoma			
	G. Do you wear glasses or contacts?			
3.	A. Ear infection			
	B. Mastoid surgery			
	C. Loss of hearing			
	D. Sore throat			
	E. Frequent hoarseness			
	F. Dental problems			
4.	A. Allergies			
	B. Sinus trouble			
	C. Hay fever			
5.	A. Tuberculosis			
	B. Asthma & breathing difficulties			
	C. Lung collapse			
	D. Pneumonia			
	E. Shortness of breath			
	F. Persistent or severe colds			
	G. Persistent or severe coughs			
	H. Chest surgery			
	I. Wheezing			
	J. Emphysema			
	K. Bronchitis			
6.	A. High blood pressure			
	B. Heart murmur			
	C. Enlarged heart			
	D. Heart disease/failure			
	E. Rheumatic fever			
	F. Heart palpitations			
	G. Irregular heart beat			
	H. Heart attack			
	I. Chest pain			
7.	A. Varicose veins			
	B. Stroke			
	C. Leg ulcers			
	D. Swelling of ankles			
	E. Leg pain on walking			
8.	A. Anemia			
	B. Leukemia			
	C. Sickle Cell Disease			
	D. Other blood disease			
9.	A. Diabetes			
	B. Thyroid problems			
	C. Cancer or tumors			
	D. Heart related illness			
10.	A. Rash/dermatitis			
	B. Bruise easily			
	C. Psoriasis			
	D. Wart/mole change			
	E. Eczema/Acne			

		YES	NO	DATE
11.	A. Headaches			
	B. Head injury			
	C. Neck injury			
12.	A. Birth defect			
	B. Frequent backaches			
	C. Back surgery			
	D. Disc disease			
	E. Back injury or strain			
	F. Back x-rays			
	G. Chiropractic treatments			
	H. Arthritis/Rheumatism			
	I. Knee problems			
	J. Swollen joints			
	K. Amputation			
	L. Broken Bones			
	Type:			
	M. Dislocations			
	N. Carpal Tunnel Syndrome			
	O. Repetitive Strain Extremities			
13.	A. Ulcers			
	B. Colitis			
	C. Diarrhea (frequent)			
	D. Stomach problems			
	E. Vomiting			
	F. Bloody bowel movements			
	G. Hepatitis/Abnormal liver enzymes			
	H. Cirrhosis			
	I. Yellow Jaundice			
	J. Gallbladder trouble			
14.	A. Epilepsy/seizures			
	B. Fainting spells			
	C. Loss of consciousness			
	D. Dizziness or vertigo			
	E. Frequent exhaustion			
	F. Trouble with nerves			
	G. Frequent worry/depression			
15.	A. Kidney trouble/stones			
	B. Bladder trouble			
	C. Kidney/bladder surgery			
	D. Blood in urine			
	E. Difficulty urinating			
16.	A. Venereal disease			
	B. Infertility/difficulty conceiving			
	C. Children with birth defects			
17. Female	A. Irregular period/painful menstruation			
	B. Hysterectomy			
	C. Are you pregnant?			
	D. Have you difficulty becoming pregnant?			
	E. Date of last menstrual period			
	F. Date of past pelvic/pap smear			
	G. Date of last mammogram			
	H. Breast lumps			
	I. Breast discharge			
	J. Repeated miscarriages			
18. Male	A. Inability to have an erection			
	B. Discharge or bleeding from the penis			
	C. Abnormal testicular self examination			
	D. Prostate problems			

Describe fully any "Yes" responses by number: _____

_____

Are you currently unable to perform any type of activity? Yes ☐ No ☐ List: _____

_____

IV SOCIAL HISTORY

	YES	NO
1. Do you now or in the past month smoke cigarettes?	☐	☐
2. Have you ever smoked cigarettes in the past?	☐	☐

3. If you now smoke or smoked in the past, how many years total have you smoked? (Write in number)_____

4. If you now smoke or have smoked in the past, how many packs per day do/did you smoke on the average? (Choose the closest number)

☐ Less than one-half(½) ☐ One (1) ☐ One and one-half(1½)
☐ Two (2) ☐ Two and one-half (2½) ☐ Three (3)
☐ More than three

	YES	NO
5. Do you use any one of the following tobacco products?	☐	☐

☐ Pipe Tobacco ☐ Cigars ☐ Snuff ☐ Smokeless Tobacco

	YES	NO
6. Do you regularly drink alchoholic beverages?	☐	☐

FOR QUESTIONS 7-9, CHOOSE THE ANSWER WHICH BEST FITS YOU.

7. If yes, how many drinks, beers or glasses of wine do you drink daily?
☐ Less than 1 ☐ 1-2 ☐ 3-4
☐ 5-6 ☐ 7-8 ☐ More than 8

8. Do you have strenuous exercise for at least 45 min.?
☐ Daily ☐ 3 times a week ☐ 1 time a week
☐ Rarely ☐ Never

9. Do you feel frustated, stressed or uptight?
☐ Daily ☐ 3 times a week ☐ 1 time a week
☐ Rarely ☐ Never

10. Do you eat greasy or fatty foods?
☐ Daily ☐ 3 times a week ☐ 1 time a week
☐ Rarely ☐ Never

11. Do you use street drugs? ☐ Yes ☐ No

V PAST MEDICAL HISTORY

For Annual or Exit Exam - Indicate Change Since Last Exam

1. Are you currently being treated for illness or injury? ☐ Yes ☐ No
2. Have you been treated for persistent illness or injury? ☐ Yes ☐ No
3. Describe fully any "Yes" responses. _____

4. Please list HOSPITAL ADMISSIONS: ☐ If none, check here

YEAR	REASON FOR HOSPITALIZATION
19____	_____
19____	_____
19____	_____

5. Please list allergies to any medication, food, clothing, bee stings or other substances:
_____
_____
_____

	YES	NO
6. How many days of work did you miss in the last 12 months due to your health? _____		
7. Have you ever pursued a compensation claim or received disability payment for occupational injury or disease?	☐	☐
8. Have you ever been turned down for life insurance?	☐	☐
9. Have you had injuries from an auto accident?	☐	☐

VI CURRENT MEDICINES

When was the last year you received a tetanus immunization booster? _____ / _____ / _____ (mo. day yr.)

Do you currently have presciptions for drugs or medications? ☐ Yes ☐ No Please specify:_____

Have you ever been addicted to or consistently used drugs? ☐ Yes ☐ No Please specify:_____

Do you take any of the following medications on a daily basis.

Heart Medicine	☐ Yes	☐ No	Aspirin	☐ Yes	☐ No
Thyroid medicine	☐ Yes	☐ No	Blood pressure medicine	☐ Yes	☐ No
Oral medicine for Diabetes	☐ Yes	☐ No	Diuretic (Water pill)	☐ Yes	☐ No
Insulin for diabetes	☐ Yes	☐ No	Medicine for seizures	☐ Yes	☐ No
Nerve or sleeping pills	☐ Yes	☐ No	Allergy/Asthma medications	☐ Yes	☐ No
Blood thinner	☐ Yes	☐ No	Other: _____		

VII FAMILY HISTORY

Father:	☐ Living	List Diseases _____	If dead, cause of death _____
Mother:	☐ Living	List Diseases _____	If dead, cause of death _____
Brothers:	☐ Living	List Diseases _____	If dead, cause of death _____
Sisters:	☐ Living	List Diseases _____	If dead, cause of death _____

Has any member of the family had any of the following:

Cancer	☐ Yes	☐ No	Diabetes	☐ Yes	☐ No	Nervousness	☐ Yes	☐ No
Insanity	☐ Yes	☐ No	Tuberculosis	☐ Yes	☐ No	Rheumatism	☐ Yes	☐ No
Kidney Disease	☐ Yes	☐ No	Heart Disease	☐ Yes	☐ No			

FOR INITIAL EXAMS ONLY

THIS PAGE IS TO BE COMPLETED ONLY AS INITIAL OR PRE-JOB EXAMS

VIII PAST JOB HISTORY

LIST ALL JOBS EVER HELD STARTING WITH YOUR FIRST - INCLUDE PART TIME AND VOLUNTEER WORK

NAME OF EMPLOYER	FROM MO/YR	TO MO/YR	# HRS WORKED PER WEEK/SHIFT	DESCRIPTION OF WORK	POTENTIAL HAZARDS (DUST, FUMES, CHEMICALS, HEAT, NOISE, PHYSICAL AGENTS, METALS, RADIATION)

IX TOXIC EXPOSURE HISTORY

At work or at home have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g. gases, fumes, dust) or have you come into skin contact with hazardous chemicals?

List _____

Have you worked with any of the materials, or under any of the conditions, listed below:

	YES	NO
Asbestos	☐	☐
Silica (e.g. sandblasting)	☐	☐
Coal (e.g. mining)	☐	☐
Grinding	☐	☐
Welding	☐	☐
Aerosols	☐	☐
Asphalt, pitch or tar	☐	☐
Beryllium	☐	☐
Cadmium	☐	☐
Cotton Dust	☐	☐
Pesticides	☐	☐
Fuel Specify:	☐	☐
Oils	☐	☐
Lead	☐	☐
Nickel/Chrome	☐	☐
Paint	☐	☐
Microwave/Radio Frequency	☐	☐
Nuclear Radiation/X-Ray	☐	☐
Fiberglass	☐	☐
Plastics	☐	☐
Solvents	☐	☐
Compressed Gases	☐	☐
Aluminum	☐	☐
Iron	☐	☐
Tin	☐	☐
Dusty Environments	☐	☐
Have you ever worked around excessive **noise?** Where? _____	☐	☐
Have you ever worked in an excessively **hot or cold environment?** Where? _____	☐	☐

	YES	NO
Have you ever worked around **vibration** or with **vibrating tools?**	☐	☐
Have you ever worked in a doctor's office, clinic or hospital where you might have had exposure to **biohazardous materials?**	☐	☐
Have you ever performed a **site assesment** on any of the above industry groups or materials? List: _____	☐	☐
Any other hazardous exposures if "yes," describe these exposures: _____	☐	☐

	YES	NO
Have you ever lived near large industrial plants or areas of air pollution?	☐	☐
Have you ever received hazardous duty or environmental pay?	☐	☐
Have you ever been in the military service?	☐	☐
If "yes" were you exposed to biological or chemical agents (either in training or combat?)	☐	☐
Have you ever worked on a HAZMAT team?	☐	☐

List any second jobs or side businesses you have:
_____
_____

List your current and previous hobbies:
_____
_____

RESPIRATOR USERS ONLY

THE FOLLOWING 2 PAGES ONLY NEED TO BE COMPLETED BY THOSE ASSIGNED TO USE REPIRATORS. IF UNCERTAIN ABOUT RESPIRATOR USE, PLEASE COMPLETE

RESPIRATOR USE

	YES	NO
1. Have you ever worn a respirator in the past?	☐	☐

2. What type of respirator did you wear? (mark all that apply) If no go to question 4
   - ☐ Disposable particulate filter mask (non-cartridge dust mask)
   - ☐ Half face cartridge respirator
   - ☐ Full face cartridge respirator
   - ☐ Powered air purifying respirator
   - ☐ Supplied air (airline) respirator
   - ☐ Self contained breathing apparatus (SCBA)
   - ☐ Escape only respirator

3. If you've ever used a respirator, have you ever had any of the following problems?	YES	NO
Eye irritation	☐	☐
Skin allergies or rashes	☐	☐
Anxiety	☐	☐
General weakness or fatigue	☐	☐
Any other problem or difficulty that interfered with your use of a respirator	☐	☐

_____

_____

HEART, LUNGS, AND OTHER BODY SYSTEMS (CONT.)

	YES	NO
4. Have you ever had an abnormal EKG (Electrocardiogram)	☐	☐

Explain: _____

5. Have you ever had any of the following cardiovascular or heart problems?	YES	NO
Heart attack	☐	☐
Stroke	☐	☐
Angina (chest pain)	☐	☐
Heart failure	☐	☐
High blood pressure	☐	☐
Swelling in your legs or feet (not caused by standing or walking)	☐	☐
Heart arrhythmia	☐	☐
Any other heart problem that you have been told about	☐	☐

6. Have you ever had surgery of the arteries, coronary bypass or angioplasty (to correct blocked artery or aneurysm)? (mark only 1 answer)		
Yes, within the past year	☐	☐
Yes, more than 1 year ago	☐	☐
No	☐	☐

6. Have you ever had any of the following pulmonary or lung problems?		
Asbestosis	☐	☐

HEART, LUNGS, AND OTHER BODY SYSTEMS (CONT.)

	YES	NO
Asthma	☐	☐
Chronic bronchitis	☐	☐
Emphysema	☐	☐
Pneumonia	☐	☐
Tuberculosis	☐	☐
Silicosis	☐	☐
Lung cancer	☐	☐
Broken ribs	☐	☐
Pneumothorax (collapsed lung)	☐	☐
Any chest injuries or surgeries	☐	☐
8. Have you ever had seizures (fits)?	☐	☐
9. Have you ever been told you had diabetes (sugar disease)?	☐	☐
10. Have you ever had allergic reactions that interfere with your breathing?	☐	☐
11. Have you ever experienced claustrophobia (fear of closed-in places)?	☐	☐
12. Have you ever had trouble smelling odors?	☐	☐
13. Have you ever had any of the following pulmonary, cadiovascular, lung or heart symptoms?		
Shortness of breath	☐	☐
Shortness of breath when walking fast on level ground or walking up a slight hill or incline	☐	☐
Shortness of breath when walking with other people at an ordinary pace on level ground	☐	☐
Have to stop for breath when walking at your own pace on level ground	☐	☐
Shortness of breath when washing or dressing yourself	☐	☐
Shortness of breath that interferes with your job	☐	☐
14. Do you currently take medication for any of the following problems?		
Breathing	☐	☐
Heart trouble	☐	☐
Blood pressure	☐	☐
Seizure (fits)	☐	☐
15. Have you within the past had any of the the following symptoms of lung illness?		
Coughing that produces phlegm (thick sputum)	☐	☐

HEART, LUNGS, AND OTHER BODY SYSTEMS (CONT.)

	YES	NO
Coughing that occurs mostly when you are lying down	☐	☐
Coughing up blood in the last month	☐	☐
Wheezing	☐	☐
Wheezing that interferes with your job	☐	☐
Chest pain when you breath deeply	☐	☐
Coughing that wakes you early in the morning	☐	☐
Any other symtoms that you think may be related to lung problems	☐	☐
16. Have you ever had any of the following cardiovascular or heart symtoms?		
Frequent pain or tightness in your chest	☐	☐
Pain or tightness in your chest during physical activity	☐	☐
Pain or tightness in your chest that interferes with your job	☐	☐
In the past two years, have you noticed your heart skipping or missing a beat?	☐	☐
Heartburn or indigestion that is not related to eating	☐	☐
Any other symtoms that you think might be related to heart or circulation problems	☐	☐

FULL FACE OR SCBA REPIRATOR USER ONLY

The following questions must be answered by every employee who has been selected to use either a full-face piece respirator or Air Supply Respirator (Self-Contained Breathing Apparatus [SCBA] or air line).

	YES	NO
17. Have you ever lost vision in either eye (temporarily or permanently)?	☐	☐
18. Do you currently have any of the following vision problems?		
Wear contact lenses	☐	☐
Wear glasses	☐	☐
Color blind	☐	☐
Any other eye or vision problem	☐	☐

FULL FACE OR SCBA REPIRATOR USER ONLY (CONT.)

	YES	NO
19. Have you ever had an injury to your ears, including a broken ear drum?	☐	☐
20. Do you currently have any of the following hearing problems?		
Diffculty hearing	☐	☐
Wear a hearing aid	☐	☐
Any other hearing or ear problem	☐	☐

Explain: _____

_____

_____

_____

21. Have you ever had a back injury?	☐	☐
22. Do you currently have any of the following muscle or skeletal problems?		
Weakness in any of your arms, hands, legs or feet	☐	☐
Back pain	☐	☐
Difficulty fully moving your arms and legs	☐	☐
Pain or stiffness when you lean forward or backward at the waist	☐	☐
Difficulty fully moving your head up and down	☐	☐
Difficulty fully moving your head side to side	☐	☐
Difficulty bending at your knees	☐	☐
Difficulty squatting to the ground	☐	☐
Difficulty climbing a flight of stairs or a ladder carrying more than 25 lbs.	☐	☐
Any other muscle or skeletal problems that might interfere with using a respirator	☐	☐

Explain: _____

_____

_____

_____

X FOR YEARLY / EXIT EXAMINATIONS ONLY

1. a. Approximately how many days of hazardous field work have you performed since your last examination? _____
   b. Approximately how many days in Level C (using an air-purifying respirator)? _____
   c. Approximately how many days in Level B (self-contained breathing apparatus or air line)? _____
2. Approximately how many different hazardous material sites have you worked on since your last examination? _____
3. What were the chemical or other hazards of concern to which you have potential exposure since your last examination? (e.g. gasoline, arsenic, trichlorethylene, radiation, asbestos)

Chemicals of Concern	Approximate # of Days	Exposure Frequency			Exposure Duration		
		Daily	Weekly	Monthly	< 1 Hr.	1-8 Hrs.	> 8 Hrs.

4. **Since your last exam,** have you had difficulty doing your job because of:

a.	Sensitivity to chemicals, dust, sunlight, etc.? (circle one)	**Yes**	**No**	**Don't Know**
b.	Inability to perform certain motions? (circle one)	**Yes**	**No**	**Don't Know**
c.	Inability to assume certain positions? (circle one)	**Yes**	**No**	**Don't Know**
d.	Heat Stress? (circle one)	**Yes**	**No**	**Don't Know**
e.	Other medical reasons? (circle one)	**Yes**	**No**	**Don't Know**

5. Have you experienced any health symptoms that may be related to exposures to hazardous materials since your last examination? If so, please describe:

6. **Since your last examination,** have you had any type of illness that resulted in more than 3 consecutive days lost time from work? Yes No List: _____

7. Do you feel that you have and/or had exposure to ticks? [ ] No [ ] Yes When _____
   If "Yes", how would you quantify your potential exposure?
   [ ] Very significant [ ] Significant [ ] Insignificant [ ] None [ ] Unknown
   Have you ever had any symptoms or signs (e.g. rash) which you attribute to tick bites? [ ] No [ ] Yes
   If "Yes", please describe:

8. a. How would you rate the effectiveness of the health and safety procedures used for work?
   Check One [ ] Poor [ ] Fair [ ] Good [ ]Excellent
   b. Comments: _____

	YES	NO
9. Have you ever had an illness, condition or symptom which:		
Occurred only during work?	☐	☐
Occurred only after work, in evening?	☐	☐
Occurred when you begin work after a weekend or holiday?	☐	☐
Disappeared during vacations or weekends?	☐	☐

	YES	NO
10. Have you ever developed illness or symptoms which you think were related to your work?	☐	☐
11. Have you ever worked with a substance which made your nose, chest, or sinuses congested?	☐	☐
12. Have you ever worked with substances that irritated your skin or caused a rash?	☐	☐

13. Would you like to talk to the healthcare professional who will review this questionnaire about your answers to this questionnaire? YES ☐ NO ☐

STOP!: PHYSICIANS COMPLETE THE REMAINING SECTIONS.

PHYSICAL EXAMINATION AND SUPPORTING STUDIES

(Please initial on Authorization Form when completed)

HEIGHT _____inches **WEIGHT** _____lbs. **TEMP.** _____°F **BLOOD PRESSURE** _____/_____

PULSE (Resting) _____ /min.

For D.O.T. only: Pulse immediately after 2/min. exercise: _____

VISION Visual acuity (if applicant wears glasses, test and record both with and without glasses.)

NEAR	Left	Right	Both
Corrected	20/_____	20/_____	20/_____
Uncorrected	20/_____	20/_____	20/_____
FAR	Left	Right	Both
Corrected	20/_____	20/_____	20/_____
Uncorrected	20/_____	20/_____	20/_____

COLOR VISION
Normal ☐
Abnormal ☐
Can recognize Red & Green ☐

PERIPHERAL VISION
Normal ☐
Abnormal ☐

URINALYSIS

Specified Gravity ____ Albumin____ Female: LMP ____
Sugar ____ Blood ____

AUDIOGRAM (If marked YES on Exam Checklist):

	500	1000	2000	3000	4000	6000	8000
Right	_____	_____	_____	_____	_____	_____	_____
Left	_____	_____	_____	_____	_____	_____	_____

Note: Testing documentation must be forwarded to the provider

SPIROMETRY (If marked YES on Exam Checklist):

FVC _____ Observed Vol. FEV_1 _____ Observed Vol. $\frac{FEV_1}{FVC}$ _____%
FVC _____ Predicted %_____ FEV_1 _____ Predicted %_____

Note: Testing documentation must be forwarded to the provider

EKG (If marked YES on Exam Checklist);

☐ Normal ☐ Abnormal

Note: All EKG strips must be forwarded to the provider

CHEST X-RAY (If marked YES on Exam Checklist):

☐ Normal ☐ Abnormal

Comments: _____

SPECIMEN COLLECTION PER EXAM CHECKLIST

All laboratory specimens must be shipped by the day of the exam! If this is a Friday exam, mark Airbill for Saturday delivery. Exam data should be included for shipment in the box with the laboratory specimens.

MEDICAL EXAMINATION

CHECK LIST	NORMAL	ABNORMAL	DETAILED DESCRIPTION OF ABNORMAL FINDINGS
HANDS/SKIN			
HAIR	☐	☐	
SKIN COLOR/TEXTURE	☐	☐	
NAILS	☐	☐	
HEAD/EYES/EARS/NOSE/THROAT/MOUTH			
CONFIGURATION	☐	☐	
LIDS/CONJ/SCLERA	☐	☐	
PUPILS/FUNDI/EOM	☐	☐	
PINNA/CANALS/TM	☐	☐	
NASAL SEPTUM/MUCOSA	☐	☐	
TEETH/GUMS/TONGUE/PALATE	☐	☐	
NERVOUS SYSTEM			
CENTRAL	☐	☐	
MOTOR	☐	☐	
SENSORY	☐	☐	
CEREBELLAR	☐	☐	
REFLEXES	☐	☐	
NECK/NODES			
BRUIT	☐	☐	
ROM	☐	☐	
MUSCLE STRENGTH	☐	☐	
THYROID	☐	☐	
CERVICAL NODES	☐	☐	
INGUINAL/AXILLARY NODES	☐	☐	
CHEST/LUNGS			
SHAPES/SYMMETRY	☐	☐	
DIAPHRAGMATIC EXCURSION	☐	☐	
PERCUSSION	☐	☐	
AUSCULTATION	☐	☐	
CARDIOVASCULAR			
CAROTIDS	☐	☐	
NECK VEINS/PULSES	☐	☐	
HEART SOUNDS (MURMURS)	☐	☐	
HEART SIZE	☐	☐	
GASTRO/INTESTINAL			
LIVER	☐	☐	
SPLEEN	☐	☐	
MASSES	☐	☐	
TENDERNESS	☐	☐	
SCARS	☐	☐	
HERNIA	☐	☐	
MUSCULOSKELETAL/EXTREMITIES			
SPINAL ALIGNMENT	☐	☐	
EXTREMITIES	☐	☐	
(EDEMA, VARICOSITIES)	☐	☐	
JOINTS	☐	☐	
ROM	☐	☐	

COMMENTS.

EXAMINING PHYSICIAN (PRINT)	PHYSICIAN SIGNATURE	DATE

SUMMARY OF FINDINGS AND COMMENTS RELEVANT TO ABNORMAL CONDITIONS

_____

_____

_____

_____

_____

_____

_____

Signature of Licensed Examining Physician: _____

Printed Name: _____

Phone: (_____) _____

INSTRUCTION FOR PHYSICIAN/CLINICIAN

1. The results of the required testing should be recorded on page 10.
2. Please be sure to note EKG and chest x-ray readings on NORMAL or ABNORMAL on page 10 if **required for this exam.**
3. Please review any YES answers ONLY for questions on pages 4, 5, 7, 8 and 9 of this booklet.

   You are not required to review the other history questions.
4. Your physical examination findings should be recorded on page 11.
5. The booklet and any specimens must be shipped to our laboratory **THE DAY OF THE EXAM.**

W

	Health and Safety Program **MEDICAL SURVEILLANCE EVALUATION**	Attachment 24-2 Revision: 09/01/01

This information will be used to determine routine medical screening exams for employees who work outside of an office setting. In addition, Site Health and Safety Plans may specify project related medical surveillance for regulated substances.

Please answer each question.

Date _____

Name _____

Phone _____ SSN _____ Employee # _____

Job Title _____

Location _____ Supervisor _____

Health & Safety Representative _____

Division _____ Region/ Business Unit _____

Choose One: ❑ New Employee ❑ Current employee w/ job change
❑ Transfer from _____office

The following questions assess federally mandated medical screenings and surveillance requirements:

	Yes	No	
Respirator	❑	❑	Does your job require you to wear a respirator or be certified for respirator use? If yes, how many days per year? ❑ 1-29 ❑ 30+
Hearing	❑	❑	Does your job require you to wear hearing protection because you: a) Work in an environment where noise levels equal or exceed an 8-hour time-weighted average of 85 decibels? b) Perform construction activities or construction management around heavy equipment on a construction project more than 50 percent of the time?
Asbestos	❑	❑	Do you perform intrusive work with asbestos? (i.e., sampling, demolition, etc.)
Lead	❑	❑	Are you currently performing construction work where you may be exposed to lead above the OSHA action level or are you currently in a job that required you to be in a medical surveillance

URS	Health and Safety Program **MEDICAL SURVEILLANCE EVALUATION**	Attachment 24-2 Revision: 09/01/01

	Yes	No	
			program for lead> (i.e. removal of lead based paint or other demolition activities)
Radiation	❑	❑	Are you classified as a radiation worker?
DOT Driver	❑	❑	Do you drive a truck with a gross vehicle weight rating of 10,000 pounds or more during company trips?
Biohazard	❑	❑	Does you job require work with bloodborne pathogens?
Remediation	❑	❑	Do you perform heavy remediation construction activities, field CONSTRUCTION sampling or supervision activities at hazardous waste sites or HAZWASTE treatment, storage, or disposal (TSD) facilities which could expose you to hazardous substances above permissible exposure levels? (i.e. exclusion zone). If yes, how many days per year? ❑ 1-29 ❑ 30+
Field and Lab	❑	❑	Answer Yes if you do ANY of the following: a) Work at HAZWOPER sites 1 to 29 days per year b) Perform waste disposal activities c) Perform non-HAZWOPER environmental sampling d) Work in a chemistry laboratory 30 or more days per year e) Work on a pilot plant project 30 or more days per year f) Conduct bench scale operations 30 or more days per year
Other	❑	❑	Site/Project specific biological monitoring or toxicological screening as specified by the project-specific health and safety plan.

Distribution:

❑ Supervisor,
❑ Site Health and Safety Representative,
❑ Medical Service Provider

_____ _____
Employee Signature Date

_____ _____
Supervisor Signature Date

SAFETY MANAGEMENT STANDARD

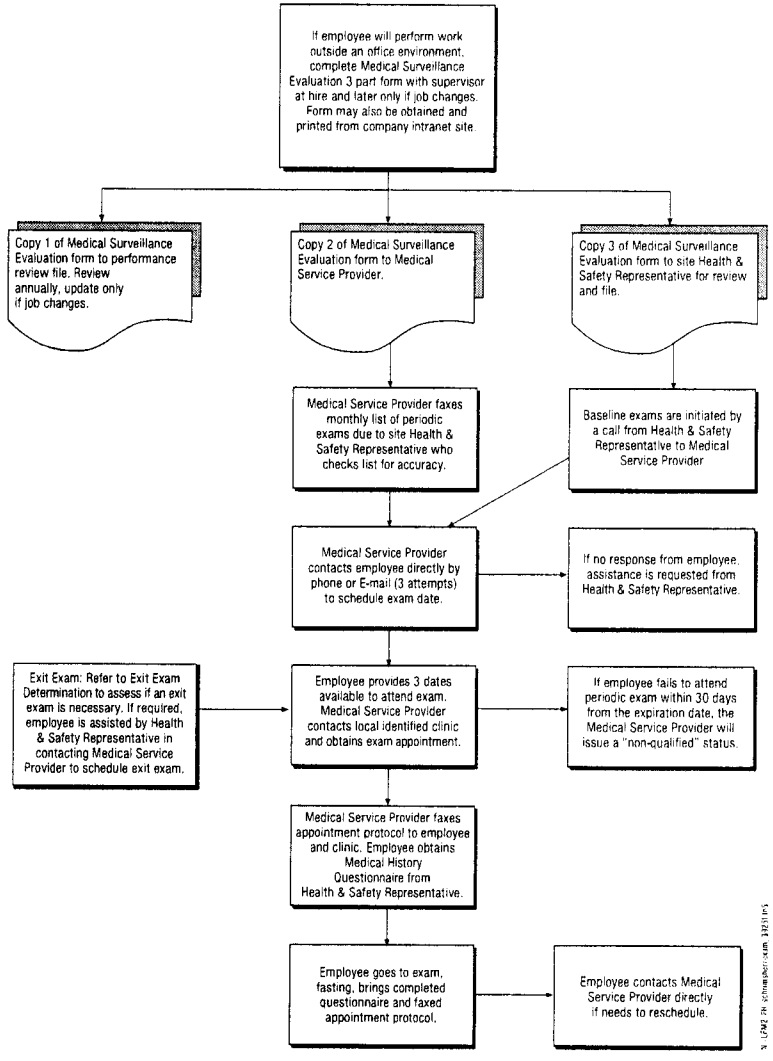
Medical Screening & Surveillance Exam Protocol

PROTOCOL	HAZWOPER Baseline or Preassignment Baseline	HAZWOPER Annual or Biennial	HAZWOPER Exit	DOT Driver Certification (Baseline and Biennial)	ASBESTOS (Baseline, Annual and Exit)	MINI-RESPIRATOR (Baseline and Biennial)
Medical History & Respiratory Questionnaire	X	X	X	X	X	X
OSHA Asbestos Questionnaire (Initial or Periodic)					X	
Medical Exam	X	X	X	X	X	If indicated by questionnaire
Physical Exam (height, weight, pulse, oral temperature, blood pressure)	X	X	X	X	X	
Non-resting pulse				X		
Vision	X	X	X	X	X	
Urinalysis	X	X	X	X		
Audiogram (hearing test)	X	X	X	X	(If indicated by project noise levels)	
Spirometry (pulmonary function test)	X	X	X		X	X
Electro-cardiogram (EKG)						
EKG Age < = 40	X	Every 3 years for annual, every 4 years for biennial				
EKG Age 41-55	X	Every 2 years				
EKG Age 56	X	Every year for annual, every 2 years for biennial				
Chest x-ray (one view)						
Age < or = 40	X	Every 4 years	If symptomatic or due on periodic		Baseline and every 5 years per OSHA 1910.1001	
Age 41-50	X	Every 3 years for annual, every 4 years for biennial	If symptomatic or due on periodic		Baseline and every 2-5 years per OSHA 1910.1001	
Age 51-54	X	Every 2 years	If symptomatic or due on periodic		Baseline and every 2-5 years per OSHA 1910.1001	
Age 55 >	X	Every year for annual, every 2 years for biennial	If symptomatic or due on periodic		Baseline and every 1-5 years per OSHA 1910.1001	
B-reader					X	
Complete Blood Count with White Cell Differential	X	X	X			
Blood Chemistry Panel	X	X	X			

*Note: Additional entry, periodic, and exit biological monitoring or toxicological screening may be indicated in the project-specific health & safety plan. Examples include: blood lead/ZPP, serum/RBC cholinesterase, urine heavy metals (arsenic, cadmium, mercury, chromium, or beryllium), urine radiation (thorium, uranium), biological vaccinations (hepatitis B, hepatitis A), blood benzene, blood beryllium LPT, etc.

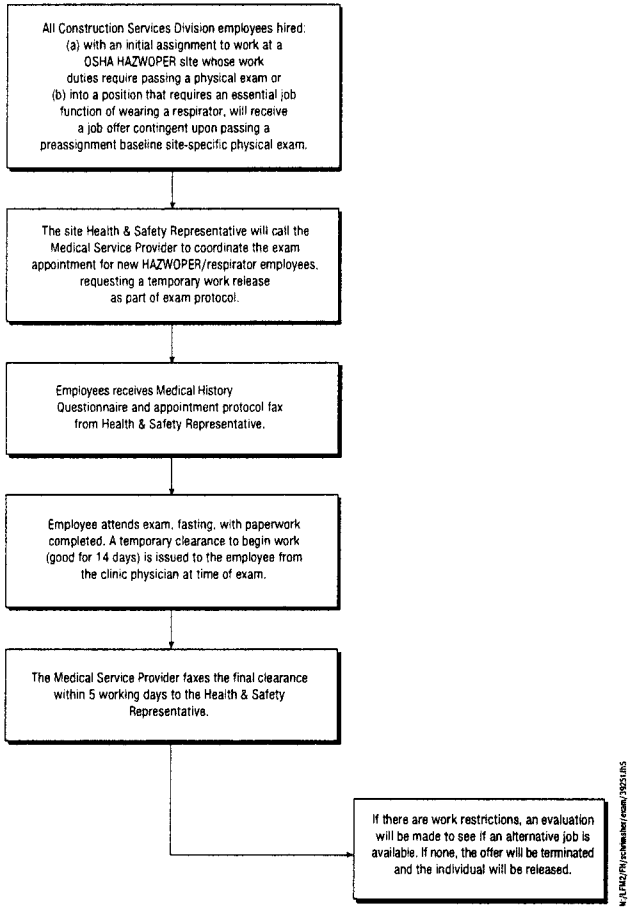
Attachment 24-4

Medical Surveillance Exam Process



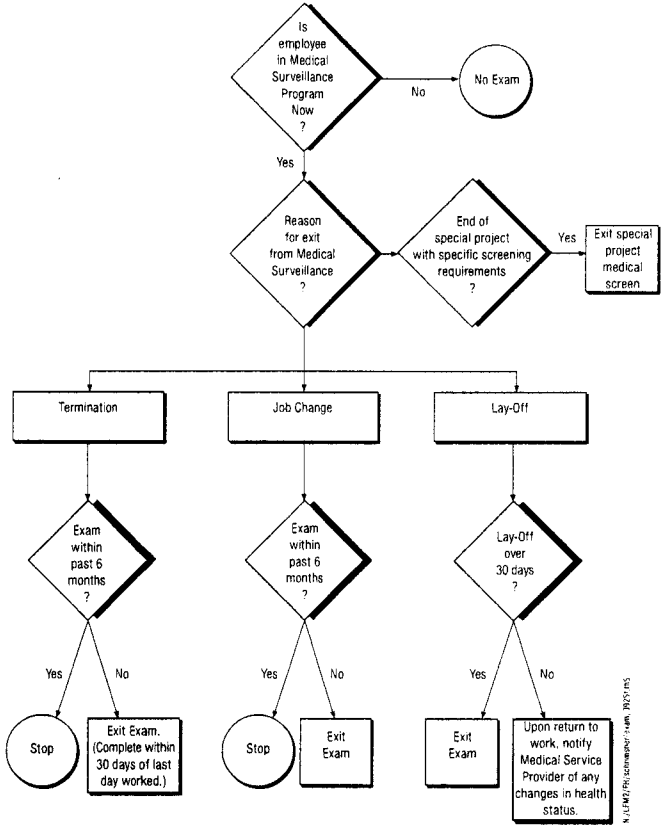
Attachment 24-5

Construction Services Division
HAZWOPER & Respirator Preassignment Baseline Exam Process



Attachment 24-6

Exit Exam Determination



Note:

Exit exams from Medical Service Provider or previous employer may be used for review as a baseline exam if completed within the past 3 months. A Medical History Questionnaire is completed by the employee and submitted with a copy of the previous exam for physician review and approval.

	Health and Safety Program **WAIVER OF EXIT MEDICAL SURVEILLANCE EXAM**	Attachment 24-7

I have been a participant in the Medical Screening & Surveillance Program which entitles me to an exit medical screening exam upon reassignment to a position that does not require medical clearance or termination of my employment. I understand that employees are encouraged to schedule and complete an exit medical exam, however, I voluntarily relinquish the opportunity to have an exit medical exam.

Name _____

Employee Number _____

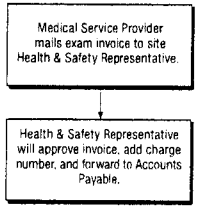
Date _____

Employee Signature:_____

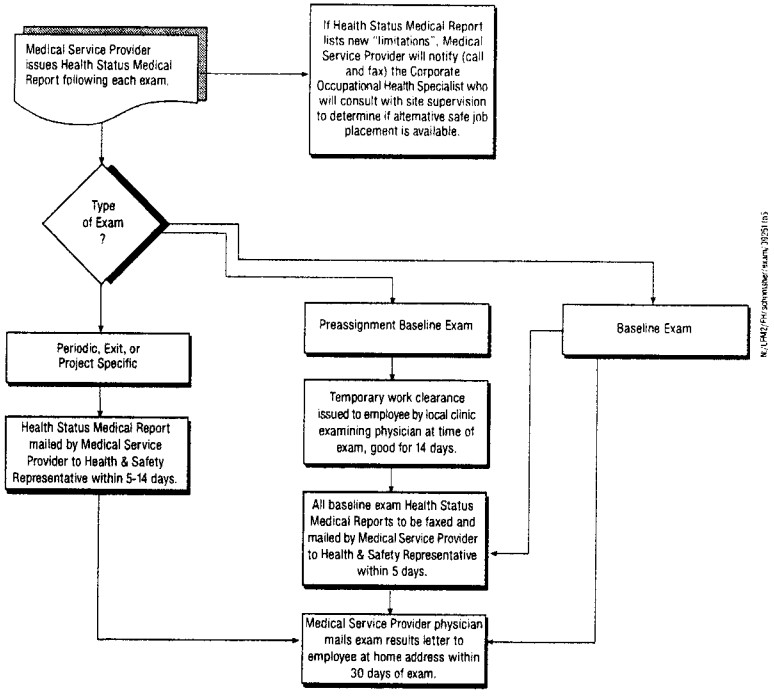
Attachment 24-8

Exam Follow Up Procedures

Billing



Medical Surveillance Exam Clearances



	Health and Safety Program **FIELD FIRST AID KIT SUPPLY LIST**	Attachment 24-9

- Portable, plastic or metal, water resistance first aid kit, with handle
- Bloodborne pathogens personal protective equipment kit (minimum requirements are latex gloves and CPR shield)
- First aid manual
- Ace bandage 3"
- Assorted band aids
- Sterile gauze pads 4" x 4"
- Sterile non-stick gauze pads 2" x 3"
- Paper tape (hypo-allergenic)
- Burn ointment (for minor burns, use after cold water soak)
- Antibiotic ointment (Neosporin or generic)
- Alcohol prep pads
- Iodine prep pads (if not allergic to iodine, use after soap and water wash for bloodborne exposure)
- Ice pack
- Gauze roll 2"
- Butterfly strips (wound closure)
- Tweezers (one use, disposable)
- Temperature strips
- Flashlight
- Triangular bandage
- Bandage scissors
- Sterile normal saline eye wash, 4 ounce bottle
- Ammonia inhalant ampoules
- Insect sting relief wipes or spray

SAFETY MANAGEMENT STANDARD
Noise and Hearing Conservation

1. Applicability

This procedure applies to facilities and field operations where personnel may encounter noise exposures that may exceed 85 dBA as an 8 hour Time Weighted Average.

2. Purpose and Scope

The purpose of this procedure is to protect employees from hazardous noise exposures and to prevent hearing loss.

3. Implementation

Office/Lab locations: High noise is unlikely to be encountered at offices, however, if applicable, the implementation of this program is the responsibility of the Office Manager.

Field Activities: Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. General

The use of hearing protectors in any location where powered or motorized equipment or any other noise source could reasonably be expected to exceed 85 dBA. Use of hearing protectors may only be discontinued when noise levels are verified to be less than 85 dBA through a properly conducted noise survey. Whenever information indicates that any employee's exposure may equal or exceed an 8-hour time-weighted average of 85 decibels, the project manager or location manager will be responsible to enforce the proper use of hearing protectors.

B. Hearing Protectors

1. Require that at least two (2) types of hearing protectors are available to employees free of charge, preferably a plug and a muff type.

2. Minimum Noise Reduction Ratings (NRR)

Hearing protectors issued must have the following minimum NRR:

Ear Plug	Muffs
29 dBA	27 dBA

SAFETY MANAGEMENT STANDARD
Noise and Hearing Conservation

3. Require that hearing protectors are used and thus effectively protect hearing.

C. Noise Surveys

1. Noise surveys must be conducted in a manner that reasonably reflects the exposure of the affected employees. Surveys must be conducted under the supervision of a Safety Program Representative.

2. Sound level meters and audio dosimeters used to determine employee exposure to noise sources must be Type II (accurate to within +/- 2 dBA), operated in "slow" response, on the "A" scale, and be calibrated to factory guidelines (including periodic factory recalibration).

D. Noise Controls

Eliminate noise sources to the extent possible. Examples of controls that must be considered follow:

1. Addition or replacement of mufflers on motorized equipment.

2. Addition of mufflers to air exhausts on pneumatic equipment.

3. Following equipment maintenance procedures to lubricate dry bearings.

4. Isolation of loud equipment with newer and quieter models.

E. Audiometric Exams

1. Tests

Details on the medical surveillance program (including audiometric testing) are included in SMS 24.

Audiometric tests shall be performed by a person meeting OSHA's 1910.95 (g)(3)'s definition. Within 6 months of an employee's first exposure at or above the action level, a valid baseline audiogram shall be established against which subsequent audiograms can be compared. Testing to establish a baseline audiogram shall be preceded by 14 hours without exposure to noise. Hearing protectors may be used as a substitute for the requirement that

baseline audiogram shall be preceded by 14 hours without exposure to workplace noise. The medical surveillance provider shall notify employees of the need to avoid high levels of non-occupational noise exposure during the 14-hour period immediately preceding the audiometric examination. For multi-year projects, an annual audiogram shall be obtained for each employee exposed at or above an 8-hour time-weighted average of 85 decibels.

Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if the audiogram is valid and if there is a standard threshold shift (STS). If the annual audiogram shows that an employee has suffered a standard threshold shift, the employer will obtain a retest within 30 days and consider the results in assessing an STS as the annual audiogram. The audiologist, otolaryngologist, or physician shall review problem audiograms and shall determine whether there is a need for further evaluation. If an STS has occurred, the medical surveillance provider will notify the employee within 21 days of the determination.

2. Standard Threshold Shifts

   If an employee's test results show a confirmed STS, their hearing protection will be evaluated and refitted, and a medical evaluation may be required.

F. Training

Verify that each employee who must work in a noisy environment is current on the required Hearing Conservation Training. Training must include the following topics:

1. The effects of noise on hearing.
2. The purpose of hearing protectors.
3. The advantages and disadvantages of various types of hearing protectors.
4. The attenuation of various types of hearing protection.
5. The selection, fitting, care, and use of hearing protectors.
6. The purpose of audiometric testing.

7. An explanation of the audiometric testing procedure.

5. Documentation Summary

A. File these records in the Office Safety Filing System:

1. Noise surveys, when applicable.
2. Training Records.

B. File noise surveys, when applicable, in the Project Safety File:

6. Resources

A. U.S. OSHA Standard – Occupational noise exposure – 29 CFR 1910.95

B. U.S. OSHA Construction Standard – Occupational noise exposure – 29 CFR 1926.52

C. U.S. OSHA Technical Links - Noise and Hearing Conservation

D. American Industrial Hygiene Association: The Occupational Environment – Its Evaluation and Control, Chapter 20. Fairfax, VA: 1997

E. National Hearing Conservation Association web site

F. SMS 24 Medical Screening and Surveillance

Safety Management Standard
Personal Protective Equipment

1. Applicability

This program applies to laboratory and field operations where the use of Personal Protective equipment (PPE) is warranted. Refer to SMS 42, "Respiratory Protection", for respiratory hazards. Hearing Protection issues are additionally addressed in SMS 26, "Noise and Hearing Conservation."

2. Purpose and Scope

This procedure provides information on recognizing those conditions that require personal protective equipment as will as selecting personal protective equipment for hazardous activities.

3. Implementation

Shop/Lab Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Perform hazard assessments for those work activities that are likely to require the use of PPE.

1. Use Attachment 29-1 to perform the assessment.
2. Reevaluate completed hazard assessments when the job changes.

B. Eliminate the hazards identified in Attachment 29-1, if possible, through engineering or administrative controls.

C. Select PPE that will protect employees if hazards cannot be eliminated.

1. See Attachment 29-1 for recommended PPE.
2. Review Material Safety Data Sheets for chemicals used for PPE recommendations.
3. If needed, consult with the Health and Safety Representative for assistance in selecting PPE.

Safety Management Standard
Personal Protective Equipment

D. Provide required PPE to employees free of charge (excluding in some instances components of standard work attire such as steel-toed boots), assuring that it fits properly giving them a choice if more than one type is available.

E. Whenever a hazard is recognized, and PPE is required, the employees will be provided with the appropriate PPE. However, when a PPE is not required, and the employee selects to wear his or her own PPE, the project manager shall ensure that the employee is properly trained in the fitting, donning, doffing, cleaning, and maintenance of his or her employee owned equipment.

F. Conduct and document employee training.

1. Train all employees who are required to wear PPE.
2. Require that training includes:
   a. When PPE is necessary to be worn.
   b. What PPE is necessary.
   c. How to properly don, doff, adjust and wear PPE.
   d. Limitations of PPE
   e. Proper care, maintenance, useful life and disposal of PPE.
3. Training must be conducted before PPE is assigned.
4. Refresher training is needed when:
   a. New types of PPE are assigned to the worker.
   b. Worker cannot demonstrate competency in PPE use.
5. Keep written records of the employees trained and type of training provided, including the date of training.

G. Maintain Protective Equipment

1. Check personal protective equipment for damage, cracks, and wear prior to each use. Replace or repair equipment not found in good condition.

2. Wash off contaminated protective equipment with water and mild soap, if necessary, to prevent degradation of the equipment.

H. Periodically inspect worksites where employees are using personal protective equipment, using Attachment 29-2.

1. Field activities – inspect work sites at least monthly.
2. Office locations – inspect work sites semi-annually.

5.0 Documentation Summary

A. Records required in the Project Safety File:

1. Completed Hazard Assessment Certification Forms (Attachment 29-1)
2. Completed Personal Protective Equipment Inspection Sheet (Attachment 29-2)
3. Documentation of employee training.

B. Records required in the Laboratory Safety Filing System:

1. Completed Hazard Assessment Certification Forms (Attachment 29-1)
2. Completed Personal Protective Equipment Inspection Sheet (Attachment 29-2)
3. Documentation of employee training.

6.0 Resources

A. U.S. OSHA Standards - Personal Protective Equipment -29CFR 1910 Subpart I (http://www.osha-slc.gov/SLTC/lead/index.html)

B. U.S. OSHA Construction Standard - Personal Protective Equipment –29 CFR 1926 Subpart E (http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1926_SUBPART_E.html)

C. U.S. OSHA Technical Links - Personal Protective Equipment (http://www.osha-slc.gov/SLTC/personalprotectiveequipment/index.html)

D. Australian Standards SAA HB9-1994 - Occupational Personal Protection

E. American National Standards Institute, ANSI Z89.1-1986, Protective Headwear (http://www.ansi.org/cat_top.html)

F. American National Standards Institute, ANSI Z87.1 - 1989, Eye and Face Protection (http://www.ansi.org/cat_top.html)

G. American National Standards Institute, ANSI Z41.1 - 1991, Foot Protection (http://www.ansi.org/cat_top.html)

H. SMS 40 - Fall Protection

I. Attachment 29-1 Hazard Assessment Form

J. Attachment 29-2 PPE Inspection Form

Health & Safety Program
HAZARD ASSESSMENT CERTIFICATION FORM

Location:_____ **Job No:**_____

Date : _____ **Assessment Conducted by:** _____

Specific tasks performed at this location: _____

	Are any of the following present during the task?	No	Yes (Hazard Present)	Eliminate Hazard or Use Following PPE
	Overhead Hazards			
1.	Suspended loads that could fall			Hard hat, ANSI Class A, B
2.	Overhead beams or load that could strike head			Hard hat, ANSI Class A, B
3.	Energized wires or equipment that could strike head			Hard hat, ANSI Class B
4.	Employees working above at an elevated site who could drop objects on others below			Hard hat, ANSI Class A, B
5.	Sharp objects or corners at head level			Hard hat, ANSI Class A, B or C
	Eye Hazards			
6.	Chemical splashes or irritating mists			Chemical protective goggles See Attachment 29-3
7.	Excessive dust			Safety glasses or impact goggles
8.	Smoke & fumes			Chemical protective goggles
9.	Welding operations			See Attachment 29-3 and 29 T-1
10.	Lasers/optical radiation			See Attachment 29-3 and Reference F
11.	Projectiles			See Attachment 29-3
12.	Sawing, cutting, chipping, grinding			See Attachment 29-3
	Face Hazards			
13.	Chemical splashes or irritating mists			Face shield if chemical is irritating to the skin or is corrosive. See Attachment 29-3
14.	Welding operations			See Attachment 29-3 and 29-T1
15.	Projectiles			See Attachment 29-3 and face shield
	Hand Hazards			
16.	Chemical exposure			Use resistant gloves as recommended by manufacturer - See Best Chemrest Guide
17.	Sharp edges, splinters, etc.			Leather gloves

Location :_____ **Job No:**_____

	Are any of the following present during the task?	No	Yes (Hazard Present)	Eliminate Hazard or Use Following PPE
18.	Temperature extremes - heat			Leather gloves; hot mill gloves; Kevlar gloves, welders' gloves
19.	Temperature extremes - cold			Leather gloves; insulated gloves
20.	Blood, fungus			Nitrile gloves
21.	Exposure to live electrical current			Electrical gloves - See Reference H
22.	Sharp tools, machine parts, etc.			Leather gloves, kevlar gloves
23.	Material handling			Leather gloves
	Foot Hazards			
24.	Heavy materials (greater than 50 pounds) handled by employees			Safety shoes or boots
25.	Potential to crush whole foot			Safety shoes or boots with metatarsal guard
26.	Sharp edges or points - puncture risk			Safety shoes or boots
27.	Exposure to electrical wires			Safety shoes or boots with electrical protection
28.	Unusually slippery conditions			Rubber soled boots or grips
29.	Chemical contamination			Rubber, nitrile boots or boot covers
30.	Wet conditions			Rubber boots or boot covers
31.	Construction/demolition			Safety shoes or boots with metatarsal guard if who foot crushing hazard exists.
	Fall Hazards			
32.	Elevations above 6 feet without guardrails			Full body harness, ANSI A-10.14 - 1991 - See Reference G
33.	Suspended scaffolds, boatswain's chairs, float scaffolds, suspended staging.			ANSI Type II - full body harness - See Reference G
34.	Working in trees			ANSI Type I full body harness - See Reference G
35.	Working in vehicle mounted, elevating work platforms (bucket trucks, pin-on platforms, etc.)			ANSI Type II full body harness - see Reference G
	Water Hazards			
36.	Working on or above water where drowning hazards exist			U.S. Coast Guard approved personal flotation device, Type I, II, or III PFD
	Excessive Heat or Flame			
37.	Full body chemical protective clothing in temperatures greater than 80 degrees			Cooling vest
38.	Work around molten metal or flame			Nomex or kevlar clothing

Location :_____ Job No:_____

	Are any of the following present during the task?	No	Yes (Hazard Present)	Eliminate Hazard or Use Following PPE
39.	Welding activities			Welding leathers for those areas that are exposed to flame, spark or molten metal
	Respiratory Hazards			
40.	See SMS for RESPIRATORY PROTECTION for selection guidance			
	Excessive Noise			
41.	Exposure to noise			Ear plugs or muffs
	Body and Leg Protection			
42.	Chemical exposure			Have local DMG H&S representative assist you in proper selection
43.	Using chainsaw, cutting brush			Chainsaw chaps

I certify that the above inspection was performed to the best of my knowledge and ability, based on the hazards present on _____.

_____
Signature

	Health and Safety Program PERSONAL PROTECTIVE EQUIPMENT INSPECTION SHEET	Attachment 29-2

Name of Inspector _____ **Date Inspected** _____

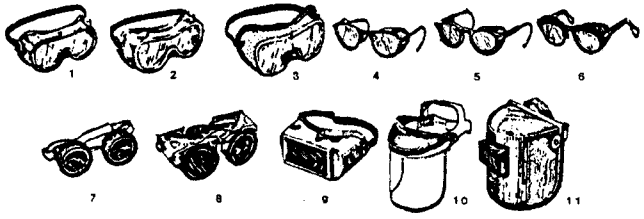
		True	False (= Hazard - Needs to be fixed)
	Hard Hats		
1.	The brim or shell does not show signs of exposure and excessive wear, loss of surface gloss, chalking or flaking.		
2.	Suspension system in hard hat does not show signs of deterioration including cracking, tearing or fraying.		
3.	The brim or shell is not cracked, perforated or deformed.		
4.	Employees use hard hats in marked areas.		
5.	Hard hat areas are marked.		
	Safety Shoes		
6.	Safety shoes used by employees do not show signs of excessive wear.		
7.	Safety shoe required areas are marked.		
	Work Gloves		
8.	Gloves are worn when needed.		
9.	Gloves do not show signs of excessive wear such as cracks, scrapes, or lacerations, thinning or discoloration or break through to the skin.		
	Protective Clothing		
10.	Protective clothing is worn by employees when required.		
	Hearing Protection		
11.	Noise hazardous areas are marked.		
12.	Employees are using earplugs or muffs when using noise hazardous equipment or working in noise hazardous areas.		
	Safety Glasses		
13.	Eye hazardous areas are marked or posted.		
14.	Employees use safety glasses when working in eye hazardous areas or working with eye hazardous equipment.		

REMARKS

_____
_____
_____
_____
_____

Health & Safety Program

EYE AND FACE PROTECTOR SELECTION GUIDE



1. **GOGGLES,** Flexible Fitting, Regular Ventilation
2. **GOGGLES,** Flexible Fitting, Hooded Ventilation
3. **GOGGLES,** Cushioned Fitting, Rigid Body
*4. **SPECTACLES,** Metal Frame, with Sideshields
*5. **SPECTACLES,** Plastic Frame, with Sideshields
*6. **SPECTACLES** , Metal-Plastic Frame, with Sideshields
*7. **WELDING GOGGLES,** Eyecup Type, Tinted Lenses (Illustrated)
7A. **CHIPPING GOGGLES,** Eyecup Type, Clear Safety Lenses (Not Illustrated)
*8. **WELDING GOGGLES,** Coverspec Type, Tinted Lenses (Illustrated)
8A. **CHIPPING GOGGLES,** Coverspec Type, Clear Safety Lenses (Not Illustrated)
*9. **WELDING GOGGLES,** Coverspec Type, Tinted Glass Plate Lens
10. **FACE SHIELD,** (Available with Plastic or Mesh Window)
11. **WELDING HELMETS**

APPLICATIONS		
OPERATION	HAZARDS	RECOMMENDED PROTECTORS Bold Type Numbers Slightly Preferred Protection
ACETYLENE-BURNING ACETYLENE-CUTTING ACETYLENE-WELDING	SPARKS, HARMFUL RAYS MOLTEN METAL, FLYING PARTICLES	**7,8,9**
CHEMICAL HANDLING	SPLASH, ACID BURNS, FUMES	**2,10** (For severe exposure add 10 over 2)
CHIPPING	FLYING PARTICLES	**1,3,4,5,6,7A,8A**
ELECTRIC (ARC) WELDING	SPARKS, INTENSE RAYS, MOLTEN METAL	**9,11** (11 in combination with 4,5,6 in tinted lenses, advisable)
FURNACE OPERATIONS	GLARE, HEAT, MOLTEN METAL	**7,8,9** (For severe exposure add 10)
GRINDING-LIGHT	FLYING PARTICLES	**1,3,4,5,6,10**
GRINDING -HEAVY	FLYING PARTICLES	**1,3,7A,8A** (For severe exposure add 10)
LABORATORY	CHEMICAL SPLASH, GLASS BREAKAGE	**2** (10 when in combination with 4,5,6)
MACHINING	FLYING PARTICLES	**1,3,4,5,6,10**
MOLTEN METALS	HEAT, GLARE, SPARKS, SPLASH	**7,8** (10 in combination with 4,5,6 in tinted lenses)
SPOT WELDING	FLYING PARTICLES, SPARKS	**1,3,4,5,6,10**

*Non-side shield spectacles are available for limited hazard use requiring only frontal protection.

SAFETY MANAGEMENT STANDARD
Back Injury Prevention

1. Applicability

This procedure applies to operations where personnel perform manual lifting.

2. Purpose and Scope

The purpose of this procedure is to prevent back injuries to personnel.

3. Implementation

Office Locations - Implementation of this procedure is the responsibility of the Office Manager.

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Safe Lifting Practices in the Office

1. Require that personnel receive the training described in (C) below.
2. Evaluate all assignments that involve lifting, such as moving boxes of files and paper, computer equipment, and the like to see that the task can be completed without risk of back injury to assigned personnel.
3. Provide material handling devices, such as carts and dollies, to assist in the safe moving of materials.
4. Obtain outside assistance, such as contract movers, if the job cannot be safely accomplished by personnel.
5. Require that heavier items are stored on lower shelving units.

B. Safe Lifting Practices in the Field

1. Recognize that field assignments tend to be lifting-intensive, and that has a duty to provide the means by which personnel can perform lifting duties without risk of injury.
2. Require that personnel receive the training described in (C) below.

SAFETY MANAGEMENT STANDARD
Back Injury Prevention

3. Evaluate all field assignments that involve lifting to see that the tasks can be completed without risk of back injury to assigned personnel.
4. Provide material handling devices, such as carts, dollies, trucks with lift gates, to assist in the safe moving of materials. If required, assign additional personnel to the task.
5. Direct field personnel not to assist in lifting tasks that are normally undertaken by subcontractor personnel.
6. Contact a Health and Safety Program Representative when assistance is necessary to evaluate a lifting task that may pose a back injury risk to assigned personnel.

C. Training

1. Require that personnel who may have lifting as part of their duties receive training that includes the following topics:
   a. Showing personnel how to avoid unnecessary physical stress and strain.
   b. Teaching personnel to become aware of what they can comfortably handle without undue strain.
   c. Instructing personnel on the proper use of equipment.
   d. Teaching personnel to recognize potential hazards and how to prevent or correct them.
2. This training must be completed prior to an employee being assigned to a task that involves lifting.

D. Office Moves and Relocations

1. Utilize professional movers (who are appropriately insured) to move office furniture such as desks, file cabinets, and bookcases, even if such a move is only between offices or cubicles at a particular location (on-site move).
2. Utilize professional movers for intensive moving of file boxes and other heavy materials.

E. Material Packaging

1. Use only smaller size (<18") file ("Banker") boxes for file storage, as the larger (>18") boxes are awkward and readily overloaded.

2. Use only smaller coolers for field samples, as the larger coolers are awkward and readily overloaded.

5. Documentation Summary

File the following documents in the Office Health and Safety File

- Training rosters

File the following documents in the Project Health and Safety File

- Training rosters

6. Resources

A. Work Practices Guide for Manual Lifting, NIOSH

1. Applicability

This program applies to job activities performed primarily in outdoor environments.

2. Purpose and Scope

The primary goal of this program is to eliminate or reduce illnesses and injuries transmitted by plants, insects, and animals. Although there are many animals and insects that are potentially harmful to humans (i.e. bees, spiders, bears, and rodents), this safety management standard focuses on four common biological hazards: ticks, poison plants, mosquitoes, and snakes.

3. Implementation

The Project Manager, with support from the H&S Regional Managers and Occupational Health Specialist, will be responsible for implementation of this program.

4. Requirements

A. Ticks

1. Precautionary Measures

Background information: Ticks do not jump, crawl, or fall onto a person. They are picked up when clothing or hair brushes a leaf or other object the tick is on. Ticks are generally found within three feet of the ground. Once picked up, they will crawl until they find a likely site to feed. Often they will find a spot at the back of the knee, near the hairline, behind the ears, or at pressure points where clothing presses against the skin (underwear elastic, belts, neckline). The best way to prevent tick borne diseases is not to be bitten by a tick. Ticks can carry a number of diseases including:

- Lyme Disease is an infection caused by the corkscrew-shaped bacteria *Borrelia burgdorferi* that is transmitted by the bite of deer tick (ixodes) and western black-legged ticks. The disease occurs in the forested areas of North America, Europe, and Asia. Symptoms which occur 3-30 days following a tick bite include: a spreading 'bulls-eye" rash, fever, fatigue, headache, and joint and muscle aches. Prompt treatment with antibiotics is essential in order to prevent more serious complications that may occur if left untreated.

- Rocky Mountain Spotted Fever is an infection caused by the bacteria *Rickettsia rickettsii*. The disease occurs in North, Central, and South America. Other Rickettsia organisms cause disease worldwide (Mediterranean, Japan, Africa, North Asia). Symptoms which occur 2-6 days following a tick bite include: fever, nausea, vomiting, diarrhea, rash, muscle and joint pain. The disease is treated with antibiotics.

- Babesiosis is caused by hemoprotozoan parasites of the genus *Babesia*. It is transmitted by the ixodid tick. The geographic distribution is worldwide. Symptoms include fever, chills, fatigue, muscle aches, and an enlarged spleen and liver. The disease is treated with anti-protozoan drugs.

- Ehrlichiosis is caused by several bacteria of the genus *Ehrlichiae*. The geographic distribution is global, primarily in temperate regions. Symptoms which occur 5-10 days following a tick bite include fever, headache, fatigue, muscle aches, nausea, vomiting, diarrhea, confusion, and occasionally a rash. The disease is treated with antibiotics.

a. Avoidance of tick habitats

Whenever possible, persons should avoid entering areas that are likely to be infested with ticks, particularly in spring and summer when nymphal ticks feed. Ticks favor a moist, shaded environment, especially that provided by leaf litter and low-lying vegetation in wooded, brushy, or overgrown grassy habitat. Both deer and rodent hosts must be abundant to maintain the life cycle of the tick.

b. Personal Protective Equipment

1. Wear light colored clothing or white Tyvek® to allow you to see ticks that are crawling on your clothing.

2. Tuck your pant legs into your socks or boots, wear high rubber boots, or use tape to close the opening where they meet so that ticks cannot crawl up the inside of your pant legs.

3. Wear a hat, tie back long hair.

4. Apply repellents to discourage tick attachment. Repellents containing permethrin can be sprayed on boots and clothing and will last for several days. Repellents containing DEET (n,n-diethyl-

m-toluamide) can be applied to the skin, but will last only a few hours before reapplication is necessary. Apply according to Environmental Protection Agency guidelines to reduce the possibility of toxicity.

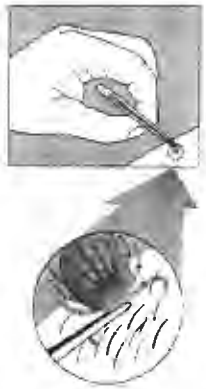
c. Tick Check

1. Change clothes when you return from an area where ticks may be located.
2. Shower to wash off any loose ticks.
3. Check your entire body for ticks. Use a hand held or full-length mirror to view all parts of your body.
4. Place clothing worn in tick infested areas into the dryer for at least 30 minutes in order to kill any ticks.

2. Tick Removal

Because it takes several hours of attachment before microorganisms are transmitted from the tick to the host, prompt removal of attached or crawling ticks is an important method of preventing disease. Remember, folklore remedies of tick removal to do not work! Methods such as the use of petroleum jelly or hot matches may actually make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting disease.

The best method to remove an attached tick is with a set of fine tipped tweezers.



a. Use fine-tipped tweezers. When possible, avoid removing ticks with bare hands.

b. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers.

c. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms.

d. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

e. Disinfect the tweezers.

f. Save the tick for identification in case you become ill. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip lock bag and put it in the freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.

3. Medical Follow-Up

In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, individuals who are bitten by a tick

- should seek medical attention if any signs and symptoms of tick borne disease develop over the weeks following the tick bite.

B. Poisonous Plants

1. Background Information

Poison ivy and poison oak plants are the most common cause of allergic contact dermatitis in North America. These poisonous plants can be a hazard for many various outdoor activities at work, home, and play. Skin contact with the oleoresins (urushiol) from these plants can cause an itchy, red, oozing, blistered rash in sensitive individuals. Oil content in the plants is highest in the spring and summer, however the plants are even hazardous in the winter when they have dropped their leaves. There are three types of exposure:

- Direct contact: An initial skin exposure in necessary to "sensitize" the individual. Subsequent contact in a sensitized person will result in a rash appearing within 4 to 48 hours. Approximately 50-70 % of the population is sensitized. Poison plant dermatitis is usually characterized by areas of linear or streaked patches where branches of the plant brushed the skin.

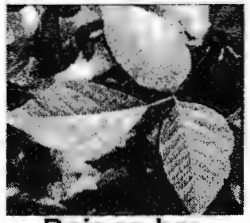
- Indirect contact: Skin exposure can happen indirectly. Clothing, shoes, tools, personal protective equipment and other items can be contaminated with the oils and maintain potency for months.

- Airborne smoke contact: Never burn poison plants. Droplets of oil can be carried by smoke and enter the respiratory system causing a severe internal outbreak.

Poison plant rash is not contagious. Skin contact with blister fluid from an affected individual will not cause dermatitis in another sensitized person. Scratching the rash can only spread it to other parts of your body if the oil is still on your skin. After the oil has been washed off or absorbed by the skin, scratching will not spread the rash.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each and are green in the summer and red in the fall. Both plants also have greenish-white flowers and berries that grow in clusters. All parts of these plants are toxic.

Poison Ivy grows as a small plant, vine, and as a shrub. Leaves always consist of three glossy leaflets.



Poison Ivy

Poison Oak grows as a shrub or vine. It has three leaflets that resemble oak leaves.

Eastern Poison Oak

Poison Sumac grows as a woody shrub or small tree from 5 to 25 feet tall. It has 7 to 13 leaves that grow opposite each other with a leaflet at the tip.

Poison Sumac

1. Precautionary Measures

- The best approach is to learn to identify the plants and avoid them.

- Wear long pants and long sleeves, boots and gloves.

- Barrier skin creams may offer some protection if applied before contact.

- Avoid indirect contact from tools, clothing or other objects that have come into contact with a crushed or broken plant. Don't forget to wash contaminated clothing and clean up contaminated equipment.

- If you can wash exposed skin areas within 3-5 minutes with cold running water, you may keep the urushiol from penetrating your skin. Proper washing may not be practical in remote areas, but a small wash-up kit with pre-packaged alcohol-based cleansing tissues can be effective.

2. Medical Follow-Up

Home treatment: Calamine lotion and an oatmeal (one cup to a tub full of water) bath can help relieve itching. To prevent secondary skin infection, scratching is not helpful and the finger nails should be cut to avoid damage to the skin. Over-the-counter hydrocortisone cream can decrease inflammation and itching, however read the label and use according to directions.

When to see the doctor: Severe cases may require further treatment. A physician should be seen if the rash appears infected, is on the face or other sensitive body areas, or is too extensive to be easily treated at home.

C. Mosquito Borne Diseases

1. Background Information

a. Arboviral encephalitis is a viral illness causing inflammation of the brain and is transmitted to humans by the bite of infected mosquitoes. Globally there are several strains including: Eastern equine, Japanese, La Crosse, St. Louis, West Nile, and Western equine encephalitis. Some of the strains have a vaccine. Symptoms of infection are nonspecific and flu-like: fever, headache, and tiredness. Fortunately, only a small proportion of infected people progress to encephalitis. Treatment is supportive, antibiotics are not effective.

b. Malaria is a serious but preventable disease spread by the bite of an infected anopheline mosquito. It is caused by four species of the parasite *Plasmodium (P. falciparum, P. vivax, P. ovale, and P malariae)*. Malaria-risk areas include primarily tropical areas of Central and South America, Africa, India, Southeast Asia, and the Middle East. Symptoms of malaria which occur 8 days to 1 year after infection

include fever, shaking chills, headache, muscle ache, tiredness, jaundice, nausea, vomiting, and diarrhea. Malaria can be cured with prescription drugs.

c. Dengue Fever is a potentially life-threatening viral illness transmitted by the bite of the Aedes mosquito, found primarily in urban areas. The disease is found in most of tropical Asia, the Pacific Islands, Central and South America, and Africa. There are four dengue virus serotypes. Symptoms include sudden onset, high fever, severe headache, joint and muscle pain, rash, nausea and vomiting. There is no specific treatment and no vaccine.

d. Yellow Fever is a viral disease transmitted between humans by mosquitoes. It occurs only in Africa and South America. There is a vaccine that confers immunity lasting 10 years or more. Symptoms begin 3-6 days after the mosquito bite and include fever, nausea, vomiting, headache, slow pulse, muscle aches, and restlessness. Treatment is symptomatic.

2. Precautionary Measures

- Insect Repellent – Use insect repellants that contain DEET. The effect should last about 4 hours. Always use according to label directions. Use only when outdoors and wash skin after coming indoors. Do not breathe in, swallow, or get into the eyes. Do not put on wounds or broken skin.

- Protective Clothing – wear long sleeved shirts and long pants, especially from dusk to dawn. Or avoid going outdoors during these hours.

- Mosquito netting – Travelers who will not be staying in well-screened or air conditioned rooms should use a pyrethroid containing flying insect spray in living and sleeping areas during evening and nighttime hours. Sleep under mosquito netting (bed nets) that have been sprayed with permethrin.

- Malaria prophylaxis medications may be prescribed, however they do not provide complete protection. The type of medication given depends on the area of travel.

D. Poisonous Snakes

1. Background Information

No single characteristic distinguishes a poisonous snake from a harmless one except the presence of poison fangs and glands. Only in dead specimens can you determine the presence of these fangs and glands without danger. Most poisonous snakes have both neurotoxic and hemotoxic venom, however, one type is dominant and the other is weak.

a. Hemotoxic venom. The folded-fang snakes (fangs can raise to an erect position) have venoms that affect the circulatory system, destroying blood cells, damaging skin tissues, and causing internal hemorrhaging.

b. Neurotoxic venom. The fixed-fang snakes (permanently erect fangs) have venoms that affect the nervous system, making the victim unable to breathe.

c. Poisonous snakes in the Americas: copperhead, coral snake, cottonmouth, and rattlesnake.

d. Poisonous snakes in Europe: adder, viper.

e. Poisonous snakes of Africa and Asia: viper, cobra, adder, green mamba.

f. Poisonous snakes in Australia: copperhead, adder, taipan, tiger snake.

2. Precautionary Measures

Bites occur when you don't hear or see the snake, when you step on them, or when you walk too close to them. Follow these simple rules to reduce the chance of accidental snakebite:

- Don't put your hands into dark places, such as rock crevices, heavy brush, or hollow logs, without first investigating.
- Don't step over a fallen tree. Step on the log and look to see if there is a snake resting on the other side.
- Don't walk through heavy brush or tall grass without looking down. Look where you are walking.

- Do not pick up any live snake. If you encounter a snake, walk around the snake, giving it plenty of room. A snake can strike half its length.
- Don't pick up freshly killed snakes without first severing the head. The nervous system may still be active and a dead snake can deliver a bite.

3. Medical Follow-up

If you are bitten by a snake, the primary goal is to get to a hospital as soon as possible to receive professional medical evaluation and possible treatment with antivenom if warranted. Initial first aid should include: Wash the bite with soap and water. Immobilize the bitten area and keep it lower than the heart. Try to remain calm. If you are unable to reach a hospital within 30 minutes, a bandage, wrapped two to four inches above the bite, may help slow the venom. The bandage should not cut off blood flow from a vein or artery, make sure the band is loose enough that a finger can slip under it. A suction device from a commercial snakebite kit may be placed over the bite to help draw venom out of the wound.

Research has shown the following to be potentially harmful, DO NOT: apply ice, use a tourniquet, or make incisions into the wound.

5. Documentation Summary

Complete and distribute a Incident Report form 49-1 for all work-related biological exposure incidents.

6. Resources

Centers for Disease Control
http://www.cdc.gov

U. S. Occupational Safety and Health Administration
http://www.osha.gov

U.S. Food and Drug Administration
Treating and Preventing Venomous Snake Bites

SAFETY MANAGEMENT STANDARD
Injury / Illness / Incident Reporting & Notifications

1. Applicability

This procedure applies to both office and field operations.

2. Purpose and Scope

The purpose of this procedure is to provide guidance for the timely reporting of work related injuries, illness, and incidents. This procedure also defines incident notification procedures for employees. Note – For incidents involving motor vehicles, the reporting and notification requirements of SMS 057 – Vehicle Safety Program may also apply.

3. Implementation

Office Locations - Implementation of this program is the responsibility of the employee's Supervisor.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Reporting: All employees shall immediately notify their appropriate level of management (line, project, and/or office) of a reportable incident. A reportable incident includes the following:

1. An injury or illness to any employee or subcontractor, even if the injury does not require medical attention;
2. An injury to a member of the public, including clients, occurring on a controlled work site;
3. Illness resulting from suspected chemical exposure;
4. Chronic or re-occurring conditions such as back pain or cumulative trauma disorders (example: carpal tunnel syndrome);
5. Fire, explosion, or flash;
6. Any vehicle accidents occurring on site, while traveling to or from client locations, or with any company-owned, rented, or leased vehicle (including personal vehicles used for company business);
7. Property damage resulting from any activity or subcontractor activity;
8. Structural collapse or potential structural hazards;

SAFETY MANAGEMENT STANDARD
Injury / Illness / Incident Reporting & Notifications

9. Unexpected release or imminent release of a hazardous material;
10. Unexpected chemical exposures to workers or the public;
11. A safety related complaint from the public regarding site activities.
12. Incidents that could result in adverse public media interest concerning a project.
13. Any incident that could result in, or any actual investigation by, OSHA, DOT, EPA, or State, Federal, or local law enforcement agency.
14. Any other significant occurrence that could impact safety – including a near-miss.

Note: A near-miss is defined as an incident having the potential to cause significant injury or property damage as listed above – but did not. Examples of a near-miss include:

- A worker steps off a ledge and falls three feet (1 meter) to the floor – and is uninjured.
- A crane drops a 1,000-pound (454 kg) beam during a lift – and nobody is hurt, no equipment is damaged.
- A work crew is conducting a survey along the highway. A vehicle leaves the roadway (driver asleep) and the vehicle enters the survey area at 50 mph (80 kph). The vehicle misses an employee by 3-feet (1 meter), the driver recovers control of the vehicle and leaves the area.

B. Actions: The following actions will be taken following a reportable incident:

1. Employees:

a. If necessary, suspend operations and secure and/or evacuate the area;

b. Immediately notify your supervisor and/or project manager

c. Record information pertaining to the incident (e.g., time, date, location, name and company of person(s) involved witnesses, description of event, and actions taken) and initiate either an Incident Report (49-1) or Near-Miss Report (49-2);

d. Assist with incident investigation as directed by management;

e. Implement corrective actions as directed by management;

f. *Do not* discuss the incident with members of the news media or legal representatives (except in-house legal counsel or your personal legal advisor) unless directed to do so by management;

g. *Do not* make statements pertaining to guilt, fault, or liability.

2. Line/Project Management:

a. For instances involving serious accidents, injuries, or other significant consequences, verbally notify the H&S Management Team as soon as possible at the following numbers:

- In the U.S., Canada, and Mexico: (866) 326-7321
  Fax +1 (512) 419 6413
- In Europe: +44-1291-621768
  Fax +44 1291 621768
- In Asia/Pacific: +61 (2) 8925 5693
  Fax +61 (2) 8925 5555

Notification should in no case occur later than the end of the work shift. Follow-up notification by faxing an SMS 49-1 Incident Report Form within 24 hours to the Occupational Health Manager (OHM) at +1-512.419.6413. Also, assure copies of the report are distributed as outlined on the form.

Corporate H&S Management will make notification to Federal and State authorities as appropriate.

b. For minor incidents involving only first aid treatment, minor damage to vehicle of equipment, etc., make notifications to the above number as soon as reasonable during normal business hours and fax the SMS 49-1 Incident Report Form to the OHM within 24 hours at +1-512.419.6413. Also, assure copies of the report are distributed as outlined on the form.

c. For a near-miss incident, complete the Near-Miss Report Form (49-2) and give it to the Office or Project Health and Safety

Representative. Also, assure copies of the report are distributed as outlined on the form.

d. Review circumstances (i.e., who, what, when, where, and how) of the incident with applicable employee(s) to determine apparent causes and to develop recommended corrective actions;

e. Discuss with department or project staff the circumstances surrounding the incident and corrective actions taken.

3. Local Office or Project Health And Safety Representative

a. Assist with incident evaluation;

b. With management, identify cause(s) of incident and identify corrective actions needed to avoid recurrence;

c. Review injury/incident report or the near-miss report for completeness and accuracy. Assure the reports are distributed properly.

d. Assure notifications are made in a timely manner.

e. Assure that the injured employee is properly counseled/advised as directed by SMS 65 - Injury Management. Communicate with the OHM at (866) 326-7321.

4. Occupational Health Manager

a. Report work-related injuries and illness to workers' compensation carrier.

b. Assure that the employee's injury is managed in accordance with SMS 065. Provide guidance for the affected Office or Project Health and Safety Representative.

c. Periodically disseminate near-miss reporting summary information to the Regional and Corporate H&S Managers.

5. Corporate Health and Safety Management

a. Notify management of any significant occurrence including lost-time injuries, deaths, or other serious result or circumstance.

b. The Occupational Health Manager (OHM) will review all reported incidents to determine OSHA reporting and recording requirements with input from the appropriate Corporate Health and Safety Manager. For a determination of recordability in those infrequent instances where there is not a clear answer, the Director of Health and Safety shall make the final determination. All decisions will be based strictly on current Federal OSHA guidelines. The Corporate H&S Manager will make notifications to Corporate Legal and Management as required.

c. Official records (including required reports and logs for all reported incidents) will be maintained at one central location by the OHM.

d. The OHM will send each office any required government report (i.e. OSHA 300 log) for their operation following receipt of an incident report.

e. Each January the OHM will prepare and distribute, to each establishment, the appropriate government injury/illness reports. These reports will summarize all required government information for incidents that occurred during the preceding calendar year.

5. Documentation Summary

A. File these records in the Office Safety File:

1. Attachment 49-1 - Incident Report Form
2. Attachment 49-2 – Near-Miss report
3. Maintain OSHA 300 Log.

B. File these records in the Project Health and Safety File

1. Attachment 49-1 - Incident Report Form
2. Attachment 49-2 – Near-Miss report
3. Maintain OSHA 300 Log if applicable for Project.

	Health and Safety Program	Attachment 49-1
	INCIDENT REPORT FORM	Revision 1: Feb 2003

ADMINISTRATIVE INFORMATION:

Division/Company: _____

Project or Office: _____

Project Number: _____

Date/Time of Incident: _____ _____

Location/Client Name: _____ _____

TYPE OF INCIDENT
(Check all applicable items)

☐ Illness	☐ Injury	☐ Fire, Explosion, Flash	☐ Unexpected Exposure
☐ Property Damage	☐ Vehicular Accident	☐ Other (describe):	

FOR INJURIES/ILLNESS ONLY

Name of Injured Employee _____ Phone No. _____

Describe Injury _____

Medical Treatment / First Aid _____

EMPLOYEES' DESCRIPTION OF INCIDENT: (Describe the facts contributing to the incident. Identify individuals involved, witnesses, and their affiliations. Attach additional sheets, drawings, or photographs as needed.)

_____

_____

_____

_____

_____

_____

_____

_____

Employee Name _____

Employee Signature _____ Date _____

	Health and Safety Program **INCIDENT REPORT FORM**	Attachment 49-1 Revision 1: Feb 2003

SUPERVISORS' DESCRIPTION OF INCIDENT: (Provide any additional/different details than provided by employee. Attach additional sheets, drawings, or photographs as needed.) Use additional sheets if necessary.

_____

_____

_____

_____

_____

CORRECTIVE ACTIONS (*For Internal Use Only*):

_____

_____

_____

_____

_____

REVIEWED BY:

Supervisor or Project Manager _____ Date _____

Office Manager _____ Date _____

Health and Safety Representative _____ Date _____

Supervisor must deliver this report to the office or project health and safety representative within 24 hours of the reported incident.

DISTRIBUTION: The Office or Project Health and Safety Representative distributes to:

- Office Manager
- Project Manager
- Project / Office file
- Regional Health and Safety Manager
- Occupational Health Manager

  Fax: 512.419.6413

  Phone: 866.326.7321

(For Asia/Pacific and Europe Operations – distribute this form in accordance with the directions in SMS 49.)

Note: The Regional Health and Safety Manager will distribute this Incident Report to other appropriate line managers as appropriate.

	Health and Safety Program **NEAR-MISS REPORT**	Attachment 49-2 Issue Date: Feb. 2003

Division/Company: _____

Project /Location _____

Date/Time of Near-miss: _____

Name of Preparer: _____ Date: _____

The following is an account of what happened:

_____

_____

_____

I believe this could have resulted in injury and/or damage to: (Check all that pertain)

❑ **Personnel** ❑ **Property** ❑ **Equipment**

If these circumstances occurred:

_____

_____

I recommend the following actions to prevent this from occurring in the future:

_____

_____

_____

_____

REVIEWED BY:

Project Manager _____ Date _____

Health and Safety Representative _____ Date _____

DISTRIBUTION:

- **Regional H&S Manager**
- **Project / Office file**
- **Occupational Health Manager**

SAFETY MANAGEMENT STANDARD

Health and Safety Training

1. Applicability

This SMS applies to all personnel. These are the minimum Environmental, Health and Safety (EHS) compliance training requirements and tracking procedures. Specific geographic entities, business units, and projects may require additional training. These requirements may be dictated by federal/national, state/provincial or local agencies or by the activities of a specific work group or project team. Each location or project manager is responsible for ensuring documentation and informing employees of these additional requirements.

2. Purpose and Scope

This SMS was developed to assist employees and managers in the identification of training requirements and to define the procedures for tracking/documenting this training. It covers environmental, hazardous materials, and health and safety training only. The goals of this program are to ensure regulatory compliance and to provide employees with the information/training they need to accomplish their work assignments safely, prevent injuries to themselves, coworkers, surrounding communities and clients, and to protect company property and the environment.

3. Implementation

Location — Location Manager is responsible for ensuring compliance with this program and any additional requirements necessary because of the physical location of the facility, and/or the business units in operation at that facility (e.g., laboratories).

Projects — Project Manager is responsible for ensuring project-related compliance (e.g., compliance of project staff members) with this program and any additional training necessary because of specific project activities.

Corporate HS Training Coordinator (CTC) — The CTC is responsible for maintaining the corporate training calendar, filing original records/tests, issuing certificates, maintaining and issuing corporate training materials, helping to develop materials that meet requirements, adding approved courses and course information to the corporate training database, updating the intranet site with course information.

4. Requirements

Employee training requirements are dictated by the work each employee performs (or are expected to perform) and the geographic area(s) where they perform these activities. In most cases there is a regulatory driver for specific training. Attachment 55-1 shows a decision tree designed to help employees and managers determine training requirements.

A. Health & Safety Orientation: All employees must be informed as to existence of and basic content of the Health and Safety Program. Locations will have the option of selecting the appropriate method of delivery but the content of this orientation must include at a minimum:

SAFETY MANAGEMENT STANDARD

Health and Safety Training

1. Review of the EHS policy statement
2. The Management System
3. The H&S Organization
4. Overview of the Safety Management Standards and Hazard Assessment Process
5. Incident Reporting (SMS 049)

Based on job assignment, additional training covered during this orientation:

6. Office Ergonomics (SMS 054)
7. Hazard Communication (US) or WHMIS (Canada)
8. Emergency Procedures (emergency action plans, evacuation plans, fire alarms, gathering points, emergency communications)

B. Table 1 contains a list of the most common courses that may be required, their frequency, and expected participants. This table will be updated as regulatory and company requirements change.

TABLE 1

Course Title	Regulatory Requirement	Frequency	Audience	Comments
Hazardous Waste Operations (40-Hrs - U.S.) (24-Hrs- non U.S.)	Y	Once	Anyone performing work or expected to perform at hazardous waste sites or treatment, storage, and disposal facilities	
Hazardous Waste Operations – Refresher (8 Hrs - U.S.) (4 Hrs - non-U.S.))	Y	Annually	(See above)	
Hazardous Waste Operations – Supervisor (8 Hrs)	Y	Once	Required for anyone serving as the site supervisor at a hazardous waste site.	
Field Safety (4 Hrs)	N	Biennially	Required for all non-craft employees performing field work that are not in hazardous waste training program.	Specific content will depend on the office and the employees' expected work.
Health & Safety Orientation	Y	Once	Required for all employees.	Specific content will depend on the office and the employees' expected work
Respiratory Protection[1]	Y	Annually	Required for any employee who may be required to wear a respirator.	Initial training is approximately 1 hr. Annually refresher training and fit testing is approximately .5 hrs.

Course Title	Regulatory Requirement	Frequency	Audience	Comments
Hazardous Materials Shipping[1]	Y	Biennially	Required for anyone who packages, labels, transports, completes paperwork for, or offers for shipment, hazardous materials/dangerous goods	
Bloodborne Pathogens[1]	Y	Annually	Required for anyone designated as a first aid responder or others who have a potential bloodborne pathogen exposure.	
First Aid	N	Biennially	Required for Hazardous Waste Site Safety Officers and personnel at remote sites (e.g., no local emergency medical response).	
Hazard Communication[1]	Y	Initially and if hazards change	Required for anyone who is potentially exposed to/works with hazardous chemicals	Training must occur before any work with hazardous chemicals. Included (as needed) in H&S Orientation. After the initial training, required updates will typically be handled as part of project specific H&S training.

[1]This material is covered in the Hazardous Waste Operations initial and annually refresher courses, however individuals who are not Hazardous Waste Operations staff may be required to take one or more of these courses based on their work activities and as required by federal regulations.

C. Attachment 55-1 is a tool used to identify *additional* training requirements. These requirements may be necessary due to the individual's project or office activities, or the location of the facility. The responses to this simple questionnaire dictate what training an individual needs above and beyond the basic courses. Each employee, once these requirements have been identified, is expected to complete the required training as soon as possible and to track his/her progress.

D. Training requirements should be re-evaluated at least annually and more frequently if an employee's assigned duties change significantly.

E. To ensure consistency in content and duration and in meeting regulatory and company requirements, corporate training materials should be used as the base materials whenever they are available. Trainers may always elect to supplement the base corporate training materials for these courses with project/office/geographic unit specifics.

F. For training requiring certifications (regulatory or corporate) trainers must be regional or divisional H&S Managers or be approved by the Corporate Health and Safety Director. This training includes but is not limited to, Hazardous Waste Health and Safety courses and Field Safety Training.

G. Training is offered in a variety of formats including classroom instruction, computer-based training (CBT), and on-the-job (OTJ) training. To ensure consistency and that all requirements are being met, external courses (e.g., 40 Hour HAZOPWER) including classroom instruction and CBT should be evaluated and approved by the Corporate Health and Safety Director or a designee (e.g., Divisional or Regional H&S

Manager). Local, regional or divisional H&S staff will be able to assist in identifying qualified external vendors when the need arises.

H. Internal training course schedules will be posted on the Health and Safety intranet site at http://healthandsafety.com/ .

I. Staff is expected to be familiar with applicable training requirements. In addition to the corporate training tracking. Staff members are expected to track their own progress toward meeting those requirements.

5. Documentation Summary

A. Those courses shown in Table 1 will be tracked in a corporate training database. These courses were selected for a variety of reasons including:

1. Audits/compliance checking
2. Written certification requirements
3. Easy access to qualified individuals for project/office staffing purposes

B. All training must be documented using Training Attendance form (Attachment 55-2) and Course Agenda. Minimum course agenda requirements include:

- Type of course
- Course date
- Course location
- Topics covered
- Length of time covered for each topic
- Course duration (start / end times)
- Instructor(s) name

C. For client/vendor provided training, training documentation must include:

- Copy of the attendee's course certificate
- Course agenda

D. Divisional H&S Managers will ensure the course agenda meet regulatory/company requirements. The Corporate H&S Training Coordinator will then enter attendance records in the corporate training database.

E. Original attendance sheets, agendas, and any completed tests will be sent to the Corporate H&S Training Coordinator. These should be filed by course then by date for easy access/auditing.

F. Locations/projects will maintain records on any project or location specific training requirements such as fire extinguisher training, project H&S plan training, and chemical hygiene program (laboratory safety) training. They may optionally elect to maintain copies of attendance records for courses also being tracked corporately.

G. For courses requiring certification, certificates will be issued by the Corporate Health and Safety Director, unless the certificate is issued by a vendor or client. Under those conditions a copy of the certificate must be provided to the Corporate H&S Training Coordinator (along with course content information and sign in sheets).

H. Managers (local, regional, project) can access the information for staffing and compliance purposes through the Divisional H&S Managers or Corporate H&S Training Coordinator. Divisional H&S Managers will have "read only" access to the corporate training database.

6. References

The following are sites that provide additional information to assist you in identifying training requirements.

A. OSHA website training section (U.S. Regulatory Requirements)
http://www.osha-slc.gov/Training/

B. National Occupational Health and Safety Commission (Australia)
http://www.nohsc.gov.au/work/education/index.htm

C. European Agency for Safety and Health at Work
http://europe.osha.eu.int/training/

D. Additional Training Requirements Evaluation - Attachment 55-1

E. Training Attendance Form - Attachment 55-2

Name _____ Location _____ Date _____

Course Title	Regulatory	Frequency	Should You Attend?	Check If Required ✓	Comments
Asbestos Inspector	Y	Annual	You perform asbestos sampling tasks.		Not offered in-house
Asbestos Planner	Y	Annual	You serve as the project asbestos planner.		Not offered in-house
Confined Space Entry	Y	Once	You perform confined space entry/authorizer/attendant duties (including anyone performing non-entry rescue activities).		Tracked in corporate database.
Confined Space Refresher	N	As needed	Recommended if you perform entry activities.		
Confined Space Rescuer	Y	Once	You may have to enter a confined space to perform a rescue		Not offered in-house. Tracked in corporate database.
Construction Safety OSHA 500		Once	Recommended if you are a Supervisor and/or Safety Officers at Construction Sites		Tracked in corporate database.
Emergency Action Plan	Y	Once	You are assigned to and at least occasionally work at a fixed facility in the US. This should be covered in EHS Orientation.		For field/site personnel this will be covered in project/site safety training.
Excavations/Trenching Awareness	Y	Once	You work at sites where excavation/trenching tasks are performed.		Covered in HAZWOPER and Field Safety
Excavations/Trenching Competent Person	Y	Once	You are or may be designated as a competent person (educational background and experience may allow for grand-fathering)		Tracked in corporate database.
Fall Prevention/Protection	Y	Once	You supervise tasks or perform tasks at heights (on roofs, scaffolding, ladders, unfinished flooring).		Tracked in corporate database.
Fire Extinguisher	Y	Annual	You may be expected to use fire extinguishers (fixed facilities and project sites)		
Powered Industrial Trucks (Forklifts)	Y	Once	Your job assignments includes operating a powered industrial truck (forklift)		Required more frequently if required assessments indicate the need.
General Industry Safety	N	Once			See Field Safety

Course Title	Regulatory	Frequency	Should You Attend?	Check if Required ✓	Comments
H&S Issue for Project Managers	N	Once	Required if you manage projects with field work.		Will be offered as part of PM Training
Hazard Communication	Y	Once	You work with or around hazardous materials in a US facility (includes facilities and client facilities)		Tracked in corporate database. Typically included in H&S Orientation.
HAZWOPER HazMat Team	Y	Once	Emergency Response Team Members (First Responders Operations Level, HazMat Technicians and Incident Commanders)		Tracked in the corporate training database.
Hearing Conservation	Y	Annual	Employees exposed to noise at or above 85 decibels averaged over an 8 hour day.		Covered in HAZWOPER Refresher and Field Safety
Injury/Illness Prevention	Y	Once	You are assigned to CA offices		Covered in CA office H&S Orientation.
Laboratory Safety	Y	Once	You work in a fixed or mobile wet chemistry lab.		
Lead Inspector	Y		You are a project lead inspector.		Not offered in house.
Lead Planner	Y		You are a project lead planner.		Not offered in house.
Lockout/Tagout	Y	Once	You work with and around equipment that may need to be locked out/tagged out. (You are not responsible for applying tags/locks)		General awareness covered in HAZWOPER and Field Safety
Nuclear Density Gauge Operator	Y	Once	You operate nuclear density gauges		
Radiation Safety Officer	Y	Once	You are designated as a Radiation Safety Officer		
SCBA/Cascade Systems	Y	Once	Required for any employee required to wear SCBAs or to operate a supplied air system.		Part of Project H&S training as needed.
Shipping Specialist	Y	Once	You are designated as a Shipping Specialist and/or are a Regional H&S Manager.		Updates are required as regulations change. Tracked in the corporate training database.
Substance Specific	Y	Once	Any employee potentially exposed to a substance covered by the 29 CFR substance specific regulations. SMS 050.		Includes lead, asbestos, benzene, etc.
Waste Awareness	Y	Annual	You generate, handle or manage hazardous waste at a fixed facility or		Updates/refreshers can be part of Project H&S

Health and Safety Program
ADDITIONAL H&S TRAINING EVALUATION
Attachment 55-1

Course Title	Regulatory	Frequency	Should You Attend?	Check if Required ✓	Comments
			field project.		training.
Waste Specialist	Y	Once with Annual Refresher	You are responsible for waste management at a small or large quantity generator facility.		
Welding/Brazing/ Cutting	Y		You job duties include these activities		
WHMIS	Y		You are assigned to a Canadian facility and work with or around hazardous materials.		Canadian "HazCom"

	Health and Safety Program EXAMPLE TRAINING ATTENDANCE FORM	Attachment 55-2

OCCUPATIONAL SAFETY AND HEALTH TRAINING

ATTENDANCE RECORD

DATE: _____ PAGE_____OF_____

LOCATION: _____

TYPE OF COURSE: _____

INSTRUCTOR SIGNATURE: _____

Name (print legibly)	Signature	Company/Location	Social Security Number

(SSN - Social Security Number requested for training database use only. Information will be kept confidential.)

SAFETY MANAGEMENT STANDARD
HAND SAFETY

1. Applicability

This program applies to both office and field operations where hand safety is a concern.

2. Purpose and Scope

This procedure is intended to protect employees from activities that might or could expose them to injury. This procedure provides information on recognizing those conditions that require personal protective equipment or specific work practices to reduce hand injury risk.

3. Implementation

Office locations: The implementation of this program is the Office Manager's responsibility, with support from the Local Health and Safety Representative.

Field Activities: Implementation of this program is the Project Manager(s)' responsibility.

4. Requirements

A. Personal Protective Equipment

1. Perform hazard assessments for those work activities likely to require PPE.

   a. Use SMS 29-1 (PPE Hazard Assessment Certification Form) to perform the assessment. The Hazard Assessment Certification Form shall accompany field personnel at job sites for use in the event of a job or task change.

   b. Reevaluate completed hazard assessments when the job or task changes.

2. If possible, eliminate the hazards identified through engineering or administrative controls. Examples of controls are: chemical substitution, machine guarding, and use of different tools.

3. Select PPE that will protect employees if hazards cannot be eliminated.

   a. Review Material Safety Data Sheets for project or task-specific chemicals to determine appropriate PPE. If needed, consult with the Health and Safety Representative for assistance.

SAFETY MANAGEMENT STANDARD
HAND SAFETY

   b. Review glove manufacturer recommendations for both physical and chemical protection.

   c. Obtain gloves of the correct size for project field staff

   d. When both chemical and physical protection are of concern, the chemical protection gloves (e.g. nitrile) shall be worn inside the physical protection gloves (e.g. leather, Kevlar®).

   e. Latex gloves are not recommended for chemical protection.

B. Guidelines for Working With and Around Equipment (Hand Tools, Portable Equipment)

1. General

   a. Keep hand and power tools in good repair and used only for the task for which they were designed.

   b. Remove damaged or defective tools from service.

   c. Do not remove or bypass a guarding device for any reason.

   d. Keep surfaces and handles clean and free of excess oil to prevent slipping.

   e. Wear proper PPE, including gloves, as necessary.

   f. Do not carry sharp tools in pockets.

   g. Clean tools and return to the toolbox or storage area upon completion of a job.

   h. Wrenches must have a good bite before pressure is applied.

      i. Brace yourself by placing your body in the proper position so that in case the tool slips you will not fall.

      ii. Make sure hands and fingers have sufficient clearance in the event the tool slips.

      iii. Always pull on a wrench, never push.

   i. When working with tools overhead, place tools in a holding receptacle when not in use.

j. Do not throw tools from place to place, from person to person, or drop from heights.

k. Inspect all tools prior to start-up or use to identify any defects.

l. Powered hand tools should not be capable of being locked in the on position.

m. Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.

n. Do not allow loose clothing, long hair, loose jewelry, rings and chains to be worn while working with power tools.

o. Do not use cheater pipes.

p. Make provisions to prevent machines from restarting through proper lockout/tagout (refer to SMS 023 – Lockout and Tagout Safety).

2. Cutting Tools

a. Hand cutting tools such as knives, scissors, paper cutters, etc. should be used with care and in the manner intended by the manufacturer.

b. Personnel when utilizing cutting tools should observe the following precautions to the fullest extent possible:

i. Use the correct tool and correct size tool for the job,

ii. Cut in a direction away from yourself and not towards other workers in the area,

iii. Maintain the non-cutting hand and arm towards the body and out of the direction of cutting tool if it were to slip out of the material being cut.

iv. Ensure that the tool is sharp and clean; dirty and dull tools typically cause poor cuts and more hazard than a sharp clean cutting tool

v. Store these tools correctly with covers in-place or blades retracted as provided by the manufacturer.

vi. On tasks where cutting may be very frequent or an all day task (e.g., liner samples), Kevlar® gloves should be considered in the PPE evaluation for the project.

vii. Do not remove guards on paper cutters.

3. Moving/Rotating Equipment

a. General Requirements for Drilling

i. Require a meeting at project start-up regarding the drill rig operator responsibility for rig safety and any site and equipment specific safety requirements. The significant potential for hand injuries (including finger amputation) in drilling operations requires proper work practices and well-maintained equipment.

ii. Set up any sample tables and general work areas for the field staff to the side of the drill rig (preferably 10 meters away) and not directly behind the rig.

iii. Engineers, technician, and geologists shall not assist drillers with the drilling equipment or supplies and shall not at any time operate the drill rig controls.

iv. Do not wear loose clothing or jewelry while working near rotating equipment.

b. Safe Use of Augers (Drilling work)

i. When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.

ii. Move auger cuttings away from the auger with a long-handled shovel or spade; never use hands.

iii. Never clean an auger attached to the drill rig unless the transmission is in neutral or the engine is off, and the auger has stopped rotating.

c. Other Rotating Equipment (feed augers, chippers, conveyors, etc.)

i. Never place hands, fingers, extremities near hoppers and operational areas of machinery.

ii. When the equipment is rotating, stay clear of the rotating components and only operate equipment with proper machine guarding in place.

iii. Never clean a jammed piece of equipment unless the transmission is in neutral and the power source or the engine is off, and the moving parts of the equipment have stopped rotating. Refer to SMS 23, Lockout and Tagout Safety.

4. Power Saws

   a. Require that circular saws are fitted with blade guards.

   b. Remove damaged, bent or cracked saw blades from service immediately.

   c. Require that table saws be fitted with blade guards and a splitter to prevent the work from squeezing the blade and kicking back on the operator.

   d. Require guards that cover the blade to the depth of the teeth on hand held circular saws. The guard should freely return to the fully closed position when withdrawn from the work surface.

5. Pneumatic Tools and Equipment

   a. Require that pneumatic tools have:

      i. Tool retainers to prevent the tool from being ejected from the barrel during use.

      ii. Safety clip or tie wire to secure connections between tool/hose/compressor if they are of the quick connection (Chicago fittings) type.

   b. Never use compressed air to blow dirt from hands, face or clothing.

   c. Compressed air exhausted through a chip-guarded nozzle shall be reduced to less than 30 psi. Proper respiratory, hand, eye and ear protection must be worn.

   d. Never raise or lower a tool by the air hose.

6. Chain Saws

   a. Inspect the saw prior to each use and periodically during daily use. Refer to the manufacturer's manual for an inspection checklist.

   b. Operate the chain saw with both hands at all times.

   c. Never cut above chest height.

   d. Require that the idle is correctly adjusted on the chain saw. The chain should not move when the saw is in the idle mode.

   e. Start cutting only after a clear escape path has been made.

   f. Shut the saw off when carrying through brush or on slippery surfaces. The saw may be carried no more than 50 feet (15 meters) while idling.

   g. Require applicable protective gear.

      i. Loggers safety hat.

      ii. Safety glasses.

      iii. Steel-toed boots.

      iv. Protective leggings.

      v. Hearing protection.

   h. Inspect saws to ensure that they are fitted with an inertia break and hand guard.

   i. Never operate a chain saw when fatigued.

   j. Do not allow others in the area when chain saws are operated.

   k. Make sure there are no nails, wire or other imbedded material that can cause flying particles.

   l. Do not operate a chain saw that is damaged, improperly adjusted, or is not completely and securely assembled. Always keep the teeth sharp and the chain tight. Worn chains should immediately be replaced.

   m. Keep all parts of your body away from the saw chain when engine is running.

7. Hand Operated Pressure Equipment

   a. High-pressure water/steam sprayers or cleaners should be used and handled as directed by the manufacturer. Hands should not be cleaned utilizing this equipment.

b. Pressure equipment such as grease guns, paint and garden sprayers shall be directed away from the body and other personnel in the area.

c. Never allow the nozzle of a pressurized tool to come in contact with any body parts while operating. There is potential for injection of a chemical directly into the user's body, resulting in severe injury or death.

8. Physical Hazards – Non-tool

a. Activities such as drum handling, fencing, work near razor-wire, manhole cover removal and demolition also pose hazards to hands

b. The SMS 29 - Personnel Protective Equipment should be utilized to determine what type of PPE will be needed for a job.

c. Plan work to avoid pinch points for hands when moving drums, moving man-hole covers back in to position, and handling other heavy objects.

d. Work handling scrap metal or other sharp edges requires proper hand PPE (Kevlar® or leather gloves).

C. Ergonomics - Hand & Wrist Care

1. Keep your wrist in neutral. Avoid using your wrist in a bent (flexed), extended, or twisted position for long periods of time. Instead try to maintain a neutral (straight) wrist position. Ergonomic tools may be needed for long-term work.

2. Watch your grip. Gripping, grasping, or lifting with the thumb and index finger can put stress on your wrist. When practical, use the whole hand and all the fingers to grasp an object.

3. Minimizing repetition. Even simple, light tasks may eventually cause injury. If possible, avoid repetitive movements or holding an object in the same way for extended periods of time.

4. Reduce speed and force. Reducing the speed with which you do a forceful, repetitive movement gives your wrist time to recover from the effort. Using power tools helps reduce the force.

5. Rest your hands. Periodically give your hands a break by letting them rest briefly. Or you may be able to alternate easy and hard tasks, switch hands, or rotate work activities.

D. Biological Impacts

1. Poisonous Plants

a. Personnel in regions where potential contact with poisonous plants should be aware of the hazard.

i. Avoid contact

ii. Wear appropriate PPE

iii. Thorough hand cleaning after impact prior to further work tasks

2. Further information can be obtained from the SMS 47 - Biological Hazards

E. Cleaning Hands

1. Avoid contamination of hands by proper use of gloves when contact with physical, chemical, or biological hazards is possible.

2. Use soap and water for normal hand cleaning. Do not use solvents for cleaning as they remove essential oils in the skin and may cause dermatitis. Do not use pressure washers for hand cleaning.

3. If the hands contact a corrosive (e.g. nitric acid), wash the area with water for fifteen minutes and then seek medical attention.

4. Use antibiotic ointment and skin protection on minor breaks/scratches of the skin.

5. Resources

A. SMS 16 - Hand Tools and Portable Equipment

B. SMS 29 - Personal Protective Equipment

C. SMS 54 - Office Ergonomics

D. SMS 56 - Drilling Safety Guidelines

USACE Accident Reporting Forms:

- NWO Form 1880
- ENG Form 3394

NOTIFICATION OF ACCIDENT - FIRST REPORT

1. Name of Caller	2. Telephone Number of Caller
3. Office Reporting	4. Office Symbol

5. Date and Time of Accident

( ) Injury ( ) Property ( ) DA Civilian ( ) Contractor
( ) Fatality ( ) Public

7. Nature of Individual	7a. Age	7b. ( ) Male ( ) Female

8.Accident Location

9.Estimated Dollar Loss of Property Damage

10. Alcohol Involved? ( ) Yes ( ) No	11. Was alcohol a Contributing Factor? ( ) Yes ( ) No
12. Were Seat Belts Used? ( ) Yes ( ) No ( ) N/A	13. Personal Flotation Devices Used? ( ) Yes ( ) No ( ) N/A

14. Brief Narrative of Accident

15. Name of Prime Contractor

16. Name of Subcontractor

17. Contract #

18. Forms Forthcoming: ( ) ENG Form 3394 ( ) Police Reports ( ) Emergency Room Notes
( ) SF 91 ( ) CA-1 ( ) Photos

Upon notification of a "Fatality, Lost-Time Injury, or Property Damage ($2,000 or more), provide a copy of this form to the Omaha District Safety and Occupational Health Office (SOHO) not later than close of business the next duty day.

Fatalities must be reported immediately by calling the SOHO at (402-)221-4051, plus fax a copy of this form to (402-)221-7770

omputerized Copy of NWO Form 1880, dated 1 Aug 98

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE
f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT ☐ ON DUTY ☐ TDY ☐ OFF DUTY	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT ☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*		

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:
e. CONTRACT NUMBER ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*		f. TYPE OF CONTRACT ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	g. HAZARDOUS/TOXIC WASTE ACTIVITY ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

SEVERITY OF ILLNESS/INJURY	(CODE) #	B. ESTIMATED DAYS LOST	C. ESTIMATED DAYS HOSPITALIZED	D. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY	#	TYPE	#
SECONDARY	#	SOURCE	#
f. NATURE OF ILLNESS / INJURY	#		

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE) #	b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐ PICKUP/VAN ☐ AUTOMOBILE ☐ TRUCK ☐ OTHER *(Specify)*	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	B. OWNERSHIP	C. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT	(CODE) #	b. TYPE OF COLLISION/MISHAP	(CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

See attached page.

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)

	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*

	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

See attached page.

b. INDIRECT CAUSE(S)

See attached page.

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

See attached page.

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL
CORPS _____ CONTRACTOR _____			

16. MANAGEMENT REVIEW *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL

COMMENTS

MMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE:

10. ACCIDENT DESCRIPTION *(Continuation)*

3a. DIRECT CAUSE *(Continuation)*

13b.	INDIRECT CAUSES *(Continuation)*

14.	ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident (excluding uninjured personnel and witnesses). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the descretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 - ACCIDENT CLASSIFICATION

(Mark All Boxes That Are Applicable)

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (injury), CA-2 (illness) or CA-6 (fatality) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to government property (including motor vehicles).

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to contractor property (including motor vehicles).

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in public fatality or permanent total disability. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).

(2) VOID SPACE - Make no entry.

(3) VEHICLE INVOLVED - Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) VOID SPACE - Make no entry.

INSTRUCTIONS FOR SECTION 2 - PERSONAL DATA

a. NAME - (MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.

b. AGE - Enter age.

c. SEX - Mark appropriate box.

d. SOCIAL SECURITY NUMBER - (FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).

e. GRADE - (FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: 0-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE - For government civilian employees enter the pay plan, full series number, and job title, e.g., GS-O810/Civil Engineer. For military personnel enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. DUTY STATUS - Mark the appropriate box.

(1) ON DUTY - Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) TDY - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) OFF DUTY - Person was not on official business at time of accident.

h. EMPLOYMENT STATUS - (FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 - GENERAL INFORMATION

a. DATE OF ACCIDENT - Enter the month, day, and year of accident.

b. TIME OF ACCIDENT - Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).

c. EXACT LOCATION OF ACCIDENT - Enter facts needed to locate the accident scene, (installation/project name, building number, street, direction and distance from closest landmark, etc.).

d. CONTRACTOR NAME

(1) PRIME - Enter the exact name (title of firm) of the prime contractor.

(2) SUBCONTRACTOR - Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER - Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW) - Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration rogram (IRP) HTW activities include accidents that occurred uring inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 - CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY - Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. MOBILIZATION
2. SITE PREPARATION
3. EXCAVATION/TRENCHING
4. GRADING (EARTHWORK)
5. PIPING/UTILITIES
6. FOUNDATION
7. FORMING
8. CONCRETE PLACEMENT
9. STEEL ERECTION
10. ROOFING
11. FRAMING
12. MASONRY
13. CARPENTRY
14. ELECTRICAL
15. SCAFFOLDING/ACCESS
16. MECHANICAL
17. PAINTING
18. EQUIPMENT/MAINTENANCE
19. TUNNELING
20. WAREHOUSING/STORAGE
21. PAVING
22. FENCING
23. SIGNING
24. LANDSCAPING/IRRIGATION
25. INSULATION
26. DEMOLITION

b. TYPE OF CONSTRUCTION EQUIPMENT - Select the equipment olved in the accident from the list below. Enter the name and ce the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE (ON VESSEL/BARGE)
4. CRANE (TRACKED)
5. CRANE (RUBBER TIRE)
6. CRANE (VEHICLE MOUNTED)
7. CRANE (TOWER)
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK (CONCRETE)
11. TRUCK (CONCRETE/TRANSIT MIXER)
12. DUMP TRUCK (HIGHWAY)
13. DUMP TRUCK (OFF HIGHWAY)
14. TRUCK (OTHER)
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR (UTILITY)
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5 - INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY/ILLNESS - Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

NOI	NO INJURY
FAT	FATALITY
PTL	PERMANENT TOTAL DISABILITY
PPR	ERMANENT PARTIAL DISABILITY
VD	LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW	RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA	RECORDABLE FIRST AID CASE

b. ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED - Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER

GENERAL BODY AREA	CODE	BODY PART NAME
HEAD, EXTERNAL	H1	EYES EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCK	LB	BOTH LEGS/HIPS/ ANKLES/BUTTOCKS
	LS	SINGLE LEG/HIP ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM (BREAST BONE)
	RV	VERTEBRAE (SPINE; DISC)
	RZ	TRUNK BONES OTHER
ULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.

*** The injury or condition selected below must be caused by a specific incident or event <u>which occurred during a single work day or shift.</u>**

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN
	TC	CONTUSION; ABRASION
ISE;	TD	DISLOCATION
	TF	FRACTURE
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER, STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY - OTHER (EXCEPT DISEASE, ILLNESS)

** A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and <u>repeated exposures to conditions of the work environment over a long period of time</u>. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER
DISABILITY, OCCU-PATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME	CODE
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)	
ENVIRON-	DE	EFFECT OF	
		MENTAL CONDITION	0310
	DH	HEARING LOSS	0320
	DK	HEART CONDITION	0330
	DM	MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS	
CONDITION			0410
			0420
	DR	RADIATION	0430
	DS	STRAIN, MULTIPLE	0440
	DU	ULCER	
	DV	OTHER VASCULAR CONDITIONS	0510
	D9	DISABILITY, OTHER	
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL	0520
	SC	CHEMICAL	
	S9	DERMATITIS, UNCLASSIFIED	0610

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples:

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface).

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.
TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle.
TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
0210	FELL, SLIPPED, TRIPPED
0220	FELL ON SAME LEVEL
0230	FELL ON DIFFERENT LEVEL
	SLIPPED, TRIPPED (NO FALL)
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
	EXERTED
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
	BUILDING OR WORKING AREA
0100	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC.)
0110	STAIRS, STEPS
0120	LADDER
0130	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0140	BOILER, PRESSURE VESSEL
0150	EQUIPMENT LAYOUT (ERGONOMIC)
0160	WINDOWS, DOORS
0170	ELECTRICITY
0180	
0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME (INDOOR)
0220	WEATHER (ICE, RAIN, HEAT, ETC.)
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS (EMOTIONAL)
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL (POWERED; SAW, GRINDER, ETC.)
0320	HAND TOOL (NONPOWERED)
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD (FIXED, MOVEABLE,

CODE	TYPE OF INJURY NAME
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)
0440	AIRCRAFT (NOT COMMERCIAL)
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST (SILICA, COAL, ETC.)
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES (UNIDENTIFIED)
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL - CORROSIVE
0712	DRY CHEMICAL - TOXIC
0713	DRY CHEMICAL - EXPLOSIVE
0714	DRY CHEMICAL FLAMMABLE
0721	LIQUID CHEMICAL - CORROSIVE
0722	LIQUID CHEMICAL - TOXIC
0723	LIQUID CHEMICAL - EXPLOSIVE
0724	LIQUID CHEMICAL - FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INAMINATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS

CODE	SOURCE OF INJURY NAME
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN (VIOLENCE)
0950	HUMAN (COMMUNICABLE DISEASE)
0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 - PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT - Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating-powered
3. Boating-unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities (skin diving, scuba, etc.)
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing (general)
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer (baseball, football, etc.)
24. Sports/winter (skiing, sledding, snowmobiling etc.)
25. Cycling (bicycle, motorcycle, scooter)
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts (fights, riots, vandalism, etc.)
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED - If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

'STRUCTIONS FOR SECTION 7 - MOTOR VEHICLE .CCIDENT

a. TYPE OF VEHICLE - Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION - Mark appropriate box.

c. SEAT BELT - Mark appropriate box.

INSTRUCTIONS FOR SECTION 8 - PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM - Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. OWNERSHIP - Enter ownership for each item listed. (Enter one of the following: USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE)

c. $ AMOUNT OF DAMAGE - Enter the total estimated dollar amount of damage (parts and labor), if any.

INSTRUCTIONS FOR SECTION 9 - VESSEL/ FLOATING PLANT ACCIDENT

TYPE OF VESSEL/FLOATING PLANT - Select the most ropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. COLLISION/MISHAP - Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING UP
10. SWEPT DOWN ON DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10 - ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT - Fully describe the accident. Give the ·ience of events that describe what happened leading up to and uding the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11 - CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE - Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION - Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES - Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES - Were any of the provisions of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS - Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS - Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.,), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, byproducts of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) **OFFICE FACTORS** - Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less 'perience and training in performing tasks such as lifting ice furniture. Did physical hazards within the office environment contribute to the hazard?

(10) **SUPPORT FACTORS** - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) **PERSONAL PROTECTIVE EQUIPMENT** - Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) **DRUGS/ALCOHOL** - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. **WRITTEN JOB/ACTIVITY HAZARD ANALYSIS** - Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. If one was performed, attach a copy of the analysis to the report.

;TRUCTIONS FOR SECTION 12 - TRAINING

a. **WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?** - For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.

b. **TYPE OF TRAINING** - Mark the appropriate box that best indicates the type of training; (classroom or on-the-job) that the injured person received before the accident happened.

c. **DATE OF MOST RECENT TRAINING** - Enter the month, day, and year of the last formal training completed that covered the activity task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13 - CAUSES

a. **DIRECT CAUSES** - The direct cause is that single factor which most directly lead to the accident. See examples below.

b. **INDIRECT CAUSES** - Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.

Direct cause: failure to provide fall protection at elevation.
'ndirect causes: failure to enforce USACE safety requirements; nproper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (Note: USACE vehicle was in proper/safe working condition).

Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14 - ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION - Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 - DATES FOR ACTION

a. **BEGIN DATE** - Enter the date when the corrective action(s) identified in section 14 will begin.

b. **COMPLETE DATE** - Enter the date when the corrective action(s) identified in section 14 will be completed.

c. **TITLE AND SIGNATURE** - Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for mangement review as indicated in section 16.

d. **DATE SIGNED** - Enter the month, day, and year that the report was signed by the responsible supervisor.

e. **ORGANIZATION NAME** - For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

f. **OFFICE SYMBOL** - Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16 - MANAGEMENT REVIEW (1st)

1ST REVIEW - Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17 - MANAGEMENT REVIEW (2nd)

'D REVIEW - The FOA Staff Chief (i.e., FOA Chief of Construction, erations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18 - SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW - The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19 - COMMAND APPROVAL

4TH REVIEW - The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

Material Safety Data Sheets (MSDSs):

- 100 ppm Isobutylene Calibration Gas
- Alconox

LIQUID AIR CORP -- ISOBUTYLENE IN AIR,0.01 %,DC 102573,101-350-N -- 6665-01-214-8247

==========

MSDS Safety Information

==========

FSC: 6665
NIIN: 01-214-8247
M Date: 01/01/1992
MSDS Num: CFKHB
Tech Review: 09/19/1997
Product ID: ISOBUTYLENE IN AIR,0.01 %,DC 102573,101-350-N
Responsible Party
Cage: 18197
Name: LIQUID AIR CORP
Address: 2700 POST OAK BLVD 18TH FLOOR
City: HOUSTON TX 77056 US
Info Phone Number: 713-624-8000
Emergency Phone Number: 800-231-1366/800-424-9300(CHEMTREC)

==========

Contractor Summary

==========

Cage: 24274
Name: AIR LIQUID AMERICA CORP
Address: 2700 POST OAK DR
City: HOUSTON TX 77056-8229 US
Phone: 716-868-0440
Cage: 57631
Name: HNU SYSTEMS INC
Address: 160 CHARLEMONT ST
City: NEWTON HIGHLANDS MA 02161 US
Phone: 617/964-6690
Cage: 18197
Name: LIQUID AIR CORP
Address: 2121 N CALIFORNIA BLVD, STE 296
City WALNUT CREEK CA 94596 US
Phone: 415-977-6500

==========

Item Description Information

==========

Item Manager: S9G
Item Name: CALIBRATION GAS CYL
Specification Number: NONE
Type/Grade/Class: NONE
Unit of Issue: EA
UI Container Qty: 1
Type of Container: CYLINDER

==========

Ingredients

==========

RTECS #: AX5275000
Name: AIR
% by Wt: 100
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED

Cas: 115-11-7
RTECS #: UD0890000
Name: ISOBUTYLENE (DDRV PROVIDED % FOR ISOBUTYLENE)
% by Wt: 0.01
Other REC Limits: NONE RECOMMENDED
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Ozone Depleting Chemical: N

==========

Health Hazards Data
==========
LD50 LC50 Mixture: NOT RELEVANT
Route Of Entry Inds - Inhalation: YES
Skin: NO
Ir tion: NO
C nogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: TARGET ORGANS:NONE. ACUTE AND CHRONIC- NONE. THESE MIXTURES SHOULD BE CONSIDERED SIMILAR TO AIR AND WOULD THEREFORE CAUSE NO SYMPTOMS OF EXPOSURE.
Explanation Of Carcinogenicity: NONE
Signs And Symptions Of Overexposure: NONE
Medical Cond Aggravated By Exposure: NONE.
First Aid: NONE NEEDED.
==========
Handling and Disposal
==========
Spill Release Procedures: NOT RELEVANT
Neutralizing Agent: NOT RELEVANT
Waste Disposal Methods: NOT RELEVANT
Handling And Storage Precautions: STORE CYLINDERS SECURE, IN COOL, DRY, VENTILATED AREA BELOW 125F. PROTECT CYLINDERS FROM PHYSICAL DAMAGE. FULL & EMPTY CYLINDERS SHOULD BE SEGREGATED.
Other Precautions: VENTING OF AIR FROM CYLINDER MUST BE ACCOMPLISHED SLOWLY. USE A "FIRST IN-FIRST OUT" INVENTORY SYSTEM. CLOSE VALVE AFTER EACH USE AND WHEN EMPTY.
==========
Fire and Explosion Hazard Information
==========
Flash Point Text: NONE
Lo Limits: NOT RELEVANT
Up Limits: NOT RELEVANT
Extinguishing Media: USE WATER FOG, CARBON DIOXIDE, FOAM, OR DRY CHEMICAL FOR SURROUNDING FIRE. KEEP FIRE-EXPOSED CYLINDERS COOL WITH WATER.
Fire Fighting Procedures: AS WITH ANY FIRE, WEAR PROTECTIVE CLOTHING AND NIOSH-APPROVED SELF-CONTAINED BREATHING APPARATUS IF NEEDED.
Unusual Fire/Explosion Hazard: AIR AT HIGH PRESSURES WILL ACCELERATE THE BURNING OF MATERIALS TO A GREATER RATE THAN THEY BURN AT ATMOSPHERIC PRESSURE.
==========
Control Measures
==========
Respiratory Protection: NONE NEEDED.
Ventilation: NONE
Protective Gloves: LEATHER WHEN HANDLING CYLINDERS
Eye Protection: GOGGLES RECOMMENDED
Other Protective Equipment: EAR PROTECTION WHEN VENTING AIR
Work Hygienic Practices: OBSERVE GOOD INDUSTRIAL HYGIENE PRACTICES AND RECOMMENDED PROCEDURES.
==========
Physical/Chemical Properties
==========
HCC: G3
NRC/State LIC No: NOT RELEVANT
B.P. Text: -318F (AIR)
Vapor Density: 1
Spec Gravity: NOT RELEVANT
Vis sity: NOT RELEVANT
Ev ation Rate & Reference: NOT RELEVANT (GAS)
Solubility in Water: SLIGHTLY
Appearance and Odor: COLORLESS, ODORLESS GAS
Percent Volatiles by Volume: 100

==========
Reactivity Data
==========
Stability Indicator: YES
Stability Condition To Avoid: HEATING CYLINDER
Materials To Avoid: NONE
Hazardous Decomposition Products: NONE
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT
==========
Toxicological Information
==========
==========
Ecological Information
==========
==========
MSDS Transport Information
==========
==========
Regulatory Information
==========
==========
Other Information
==========
==========
Transportation Information
==========
Responsible Party Cage: 18197
Trans ID NO: 115758
Product ID: ISOBUTYLENE IN AIR,0.01 %,DC 102573,101-350-N
MSDS Prepared Date: 01/01/1992
Review Date: 07/13/1998
Article W/O MSDS: N
Text Entry NOS Shipping Nm: 0.01% ISOBUTYLENE IN AIR.
Net Unit Weight: 0.6 LB
Multiple KIT Number: 0
Unit Of Issue: EA
Container QTY: 1
Type Of Container: CYLINDER
==========
Detail DOT Information
==========
DOT PSN Code: DQQ
Symbols: G
DOT Proper Shipping Name: COMPRESSED GASES, N.O.S.
Hazard Class: 2.2
UN ID Num: UN1956
Label: NONFLAMMABLE GAS
Special Provision: B13
Non Bulk Pack: 302,305
Bulk Pack: 314,315
Max Qty Pass: 75 KG
Max Qty Cargo: 150 KG
Vessel Stow Req: A
==========
Detail IMO Information
==========
IMO PSN Code: EQH
IMO Proper Shipping Name: COMPRESSED GAS, N.O.S. o
IMDG Page Number: 2124
UN Number: 1956
UN Hazard Class: 2(2.2)
IMO Packaging Group: -
Subsidiary Risk Label: -

EMS Number: 2-04
MED First Aid Guide NUM: 620

==========

Detail IATA Information

==========

IATA PSN Code: HDO
IATA UN ID Num: 1956
IATA Proper Shipping Name: COMPRESSED GAS, N.O.S. *
IATA UN Class: 2.2
IATA Label: NON-FLAMMABLE GAS
Packing Note Passenger: 200
Max Quant Pass: 75KG
Max Quant Cargo: 150KG
Packaging Note Cargo: 200

==========

Detail AFI Information

==========

AFI PSN Code: HDO
AFI Symbols: *
AFI Proper Shipping Name: COMPRESSED GAS, N.O.S.
AFI Hazard Class: 2.2
AFI UN ID NUM: UN1956
Special Provisions: P5
Back Pack Reference: A6.3, A6.5,A6.6

==========

HAZCOM Label

==========

Product ID: ISOBUTYLENE IN AIR,0.01 %,DC 102573,101-350-N
Cage: 18197
Company Name: LIQUID AIR CORP
Street: 2121 N CALIFORNIA BLVD, STE 296
City: WALNUT CREEK CA
Zip Code: 94596 US
Health Emergency Phone: 800-231-1366/800-424-9300(CHEMTREC)
Label Required IND: N
Date Of Label Review: 09/19/1997
Label Date: 09/19/1997

==========

Disclaimer (provided with this information by the compiling agencies):
This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department of Defense or other government situation.

ALCONOX

Section 1: MANUFACTURER INFORMATION

Product name: Alconox

Supplier: Same as manufacturer.

Manufacturer: Alconox, Inc.
30 Glenn St. Suite 309
White Plains, NY 10603.

Manufacturer emergency phone number: 800-255-3924
813-248-0573 (outside of the United States)

Manufacturer: Alconox, Inc.
30 Glenn St. Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2003/10/08

D.O.T. Classification:

Not regulated.

Section 2: INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	TLV	LD/50	LC/50
25155-30-0	10-30	SODIUM DODECYLBENZENESULFONATE	NOT AVAILABLE	438 MG/KG RAT ORAL 1330 MG/KG MOUSE ORAL	NOT AVAILABLE
497-19-8	7-13	SODIUM CARBONATE	NOT AVAILABLE	4090 MG/KG RAT ORAL 6600 MG/KG MOUSE ORAL	2300 MG/M3/2H RAT INHALATION 1200 MG/M3/2H MOUSE INHALATION
7722-88-5	10-30	TETRASODIUM PYROPHOSPHATE	5 MG/M3	4000 MG/KG RAT ORAL 2980 MG/KG MOUSE ORAL	NOT AVAILABLE
7758-29-4	10-30	SODIUM PHOSPHATE	NOT AVAILABLE	3120 MG/KG RAT ORAL 3100 MG/KG MOUSE ORAL >4640 MG/KG RABBIT DERMAL	NOT AVAILABLE

Section 2A - ADDITIONAL INGREDIENT INFORMATION

Note: (supplier).
CAS# 497−19−8: LD50 4020 mg/kg − rat oral.
CAS# 7758−29−4: LD50 3100 mg/kg − rat oral.

Section 3 - PHYSICAL / CHEMICAL CHARACTERISTICS

Physical state: Solid

Appearance & odor: Almost odourless.
White granular powder.

Odor threshold (ppm): Not available.

Vapour pressure (mmHg): Not applicable.

Vapour density (air=1): Not applicable.

By weight: Not available.

Evaporation rate (butyl acetate = 1): Not applicable.

Boiling point (°C): Not applicable.

Freezing point (°C): Not applicable.

pH: (1% aqueous solution).
9.5

Specific gravity @ 20 °C: (water = 1).
0.85 − 1.10

Solubility in water (%): 100 -> 10% w/w

Coefficient of water\oil dist.: Not available.

VOC: None

Section 4 - FIRE AND EXPLOSION HAZARD

Flammability: Not flammable.

Conditions of flammability: Surrounding fire.

Extinguishing media: Carbon dioxide, dry chemical, foam.
Water
Water fog.

Special procedures: Self-contained breathing apparatus required.
Firefighters should wear the usual protective gear.

Auto−ignition temperature: Not available.

Flash point (°C), method: None

Lower flammability limit (% vol): Not applicable.

Upper flammability limit (% vol): Not applicable.

Not available.

Sensitivity to mechanical impact:	Not applicable.
Hazardous combustion products:	Oxides of carbon (COx). Hydrocarbons.
Rate of burning:	Not available.
Explosive power:	None

Section 5 - REACTIVITY DATA

Chemical stability:	Stable under normal conditions.
Conditions of instability:	None known.
Hazardous polymerization:	Will not occur.
Incompatible substances:	Strong acids. Strong oxidizers.
Hazardous decomposition products:	See hazardous combustion products.

Section 6 - HEALTH HAZARD DATA

Route of entry:	Skin contact, eye contact, inhalation and ingestion.
Effects of Acute Exposure	
Eye contact:	May cause irritation.
Skin contact:	Prolonged contact may cause irritation.
Inhalation:	Airborne particles may cause irritation.
Ingestion:	May cause vomiting and diarrhea. May cause abdominal pain. May cause gastric distress.
Effects of chronic exposure:	Contains an ingredient which may be corrosive.
LD50 of product, species & route:	> 5000 mg/kg - rat oral.
LC50 of product, species & route:	Not available for mixture, see the ingredients section.
Exposure limit of material:	Not available for mixture, see the ingredients section.
Sensitization to product:	Not available.
Carcinogenic effects:	Not listed as a carcinogen.
Reproductive effects:	Not available.
Teratogenicity:	Not available.
Mutagenicity:	Not available.
Synergistic materials:	Not available.
Medical conditions aggravated by exposure:	Not available.
First Aid	
Skin contact:	Remove contaminated clothing. Wash thoroughly with soap and water. Seek medical attention if irritation persists.

Eye contact: Check for and remove contact lenses.
Flush eyes with clear, running water for 15 minutes while holding eyelids open; if irritation persists, consult a physician.

Inhalation: Remove victim to fresh air.
Seek medical attention if symptoms persist.

Ingestion: Dilute with two glasses of water.
Never give anything by mouth to an unconscious person.
Do not induce vomiting, seek immediate medical attention.

Section 7: PRECAUTIONS FOR SAFE HANDLING AND USE

Leak/Spill: Contain the spill.
Recover uncontaminated material for re–use.
Wear appropriate protective equipment.
Contaminated material should be swept or shoveled into appropriate waste container for disposal.

Waste disposal: In accordance with municipal, provincial and federal regulations.

Handling procedures and equipment: Protect against physical damage.
Avoid breathing dust.
Wash thoroughly after handling.
Keep out of reach of children.
Avoid contact with skin, eyes and clothing.
Launder contaminated clothing prior to reuse.

Storage requirements: Keep containers closed when not in use.
Store away from strong acids or oxidizers.
Store in a cool, dry and well ventilated area.

Section 8: EXPOSURE CONTROLS

Precautionary Measures

Gloves/Type:

Neoprene or rubber gloves.

Respiratory/Type:

If exposure limit is exceeded, wear a NIOSH approved respirator.

Eye/Type:

Safety glasses with side–shields.

Footwear/Type: Safety shoes per local regulations.

Clothing/Type: As required to prevent skin contact.

Other/Type: Eye wash facility should be in close proximity.
Emergency shower should be in close proximity.

Ventilation requirements: Local exhaust at points of emission.

SOP No. 4	Subsurface Drilling and Soil Sampling
SOP No. 11	Equipment Decontamination
SOP No. 13	Sample Handling, Documentation, and Tracking
SOP No. 15	Headspace Analysis
SOP No. 16	Boring Abandonment
SOP No. 17	Permits and Clearances
SOP No. 19	EnCore® Sampling Method

4.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for subsurface drilling and collection of soil samples at Cannon Air Force Base (AFB). These procedures give descriptions of equipment, field procedures, and Quality Assurance/Quality Control (QA/QC) procedures implemented for the collection of subsurface soil samples. Specific sample locations and frequency of collection are presented in the project-specific Work Plan (WP).

These procedures are intended to be used together with the WP and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the Site Safety and Health Plan (SSHP). Applicable SOPs are listed below:

- SOP No. 11 - Equipment Decontamination
- SOP No. 13 - Sample Handling, Documentation, and Tracking
- SOP No. 15 - Headspace Analysis
- SOP No. 16 - Boring Abandonment
- SOP No. 17 - Permits and Clearances
- SOP No. 19 – En Core® Sampling Method

Reference Standards

Wherever an ASTM designation is cited in this document, it shall mean the American Society for Testing and Materials Standard Specification of that designation appearing in the "1994 Annual Book of ASTM Standards," published by the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania. "EM 1110-2-1906" refers to United States Department of the Army, "Engineering and Design, Laboratory Soil Testing," 30 December 1970.

4.2 PROCEDURES FOR SOIL SAMPLING

Subsurface soil samples will be collected using a stainless-steel hand auger or stainless-steel split-spoon samplers when using a drill rig. Surface soil samples will be collected from the 0- to 0.5-foot depth interval, except soil for volatile organic compound (VOC) analysis. Soil for VOC analysis will be collected from the 0.5- to 1.0-foot depth interval. Subsurface soil samples for VOC analysis will be collected using the EnCore® sampling method (SOP No. 19).

4.2.1 Equipment List

Equipment for Subsurface Soil Sampling with a Hand Auger

- Stainless-steel hand auger and sample bucket
- En Core® soil sampling equipment
- Weighted tape measure with 0.1-foot increments

- Surveyor's stakes and flags
- Ruler marked in 0.1-foot increments
- Field books/field sheets
- Stainless-steel knife, bowl and spoon
- Sample bottles provided by the laboratory
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Camera and film
- Waterproof and permanent marking pens
- Plastic sheeting
- Plastic bags
- Appropriate health and safety equipment, as specified in the SSHP
- Appropriate decontamination supplies, as specified in SOP No. 11
- Ice chest with ice

Equipment for Subsurface Soil Sampling with Split Spoon

- Drill rig with appropriate drilling and sampling tools (stainless-steel split spoons)
- En Core® soil sampling equipment
- Weighted tape measure with 0.1-foot increments
- Surveyor's stakes and flags
- Aluminum foil
- Field books/field sheets
- Stainless-steel knife, bowl and spoon
- Sample bottles provided by the laboratory
- Sample bottle labels
- Label tape (clear)
- Paper towels
- Camera and film
- Waterproof and permanent marking pens
- Plastic sheeting

- Plastic bags
- Appropriate health and safety equipment, as specified in the SSHP
- Appropriate decontamination supplies, as specified in SOP No. 11
- Ice chest with ice

4.2.2 Decontamination

Before drilling or sampling begins, the drilling and sampling equipment will be decontaminated according to the procedures contained in SOP No. 11. Drilling and sampling equipment will be decontaminated between boring and sampling locations. Sampling equipment will also be decontaminated between collection of samples from different depths at the same location.

4.2.3 Drilling and Subsurface Soil Sampling Procedures

4.2.3.1 Subsurface Soil Sampling Using a Hand Auger

This method of soil sample collection is to be used at Cannon AFB in situations where the sampling depth makes it impractical to use hand utensils, or site conditions limit the accessibility of heavier drilling equipment. Hand auger borings will be completed in accordance with ASTM D 1452. Hand auger samples will be collected at the specified depth using a stainless-steel hand auger with a minimum 4-inch outside diameter (OD) bucket. The soil cuttings will be treated as IDW. The following step-by-step procedure should be used to collect shallow soil sampling using a hand auger:

- Decontaminate sampling equipment according to SOP No. 11.
- Record the sample location on a site map and in the field logbook.
- Obtain PID background (BG) readings at the sampling location, readings just above the soil and in the breathing zone.
- Don a clean pair of nitrile gloves.
- Clear and remove vegetation and any surface debris such as rocks, as necessary.
- Using a decontaminated hand auger handle and sampling bucket, advance a borehole to the specified sampling depth. Removed soil should be placed on plastic sheeting.
- Collect the VOC sample using the En Core® sampling method.
- Collect soil for the remaining parameters from the specified depth using a decontaminated stainless-steel sampling bucket. If more soil is necessary to fill the sample jars, the sampling area is to be expanded with an additional borehole without increasing the depth.
- Composite the remaining soil by thoroughly mixing the soil from the sampling bucket in a decontaminated stainless-steel bowl with a decontaminated stainless-steel spoon. Fill the semivolatile organic compound (SVOC) jars completely full with soil from the sampling spoon immediately after compositing the soil. Then fill the remaining bottles with the

composited soil for the specified analysis. The required analyses and appropriate containers are stated in the WP.

- Label, store, and document sample according to SOP No. 13.
- Record applicable information on the Sample Collection Field Sheet (attached).
- If no other samples are to be collected from this sampling location, abandon sampling hole according to SOP No. 16.
- Identify the location for future reference using surveying stakes and flags.

4.2.3.2 Subsurface Soil Sampling Using a Drilling Rig

The process of drilling and of soil sample collection with a split spoon sampler is to be used at Cannon AFB in situations where the sampling depth makes it impractical to use hand utensils or hand augers, and site conditions are appropriate for the use of heavy drilling equipment. Split spoon soil sampling will begin by auger drilling a boring, using machine-driven hollow stem augers (HSA) with flights and a 4-1/4-inch minimum inside diameter to accommodate a 3-inch outside diameter stainless-steel split-spoon sampler. Auger borings will be completed in accordance with ASTM D 1452. A HSA finger plug installed in the bit will be used to prevent soil material coming into the interior of the hollow stem augers. The soil cuttings will be handled as IDW.

Soil samples will be obtained according to the WP specifications and the resistance to soil penetration will be measured using a split-spoon sampler in accordance with ASTM D 1586. Penetration resistance (blow counts) for each sampling depth will be recorded on the field boring log (attached). The coupling head for the split-spoon sampler will be provided with a ball check valve and will have open vents. Where necessary for sample recovery, the sampler will also be equipped with a spring-type sample retainer or an equivalent retainer. The procedure for collecting, labeling, storing, and transporting subsurface soil samples collected from machine-driven HSAs is described below:

- Record the boring location on a site map and in the field logbook.
- Decontaminate the drilling and sampling equipment according to SOP No. 11.
- Collect the soil samples using the drilling rig and split spoon sampler at the depths specified in the WP.
- Samples from each discrete 2-foot sample interval will be collected and stored per SOP No. 13 until all samples from a boring are collected. Samples will then be identified for laboratory analysis per the WP, based on headspace analysis (SOP No. 15) and visual contamination. The remaining samples will be disposed of as investigation-derived waste (IDW).
- Don a clean pair of nitrile gloves.
- Open the split-spoon sampler or soil core barrel, scan the length of the sample with the OVA and record the readings, measure the recovery, and scrape off any soil smear zone from the recovered sample with a stainless-steel knife. If the soil is not cohesive or if the smear zone

cannot be easily removed, an attempt will be made to remove soil from the portion of the sample that has not come in contact with the sampler.

- Determine and identify the use of the recovered sample. This will always be for soil classification and stratigraphic logging and may be for chemical or headspace analysis.
- The sample must be handled quickly, especially if it is loose or crumbling, to avoid losing volatile contaminants.
- Collect any required volatile organic compound (VOC) sample immediately using the En Core® sampler (SOP No. 19). This should be done immediately upon opening the split spoon.
- Composite the remaining soil by thoroughly mixing the soil from the split spoon sampler in a clean stainless-steel bowl with a stainless-steel spoon. Once the soil has been composited, fill the appropriate containers for semivolatile organic compounds (SVOCs). The remaining bottles will then be filled with the composited soil for any remaining parameters. The required analyses and appropriate volume of containers of soil are presented in the WP.
- Complete the lithologic description of the recovered sample according to the Unified Soil Classification System.
- Label, store, transport, and document the samples (depending on the use of the sample) according to SOP No. 13.
- If no other samples will be collected, the boring will be abandoned using hydrated bentonite chips or a cement/bentonite mixture according to SOP No. 16.

4.2.4 Field Quality Assurance/Quality Control Procedures and Samples

Field QA/QC samples are designed to help identify potential sources of external sample contamination and to evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analyses.

4.2.4.1 Field Blanks and Trip Blanks

Field blanks are QC samples that check for potential external contamination of samples. A trip blank serves as a check on sample contamination originating from the container or sample transport. For Cannon AFB field investigations, field blanks and trip blanks are not required for soil sampling activities.

4.2.4.2 Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the soil sampling, a duplicate sample will be collected at the same time as the initial sample. The initial sample bottles for a particular parameter or set of parameters will be filled first, then the duplicate sample bottles for the same parameter(s), and so on until all necessary sample bottles for both the initial sample and the duplicate sample have been filled. The duplicate soil sample will be handled in the same manner as the primary sample. The duplicate sample will be assigned a QA/QC

identification number, stored in an iced cooler, and shipped to the laboratory on the day it is collected. Duplicate samples will be collected for all parameters. Following collection of VOA samples, the remaining soil in the split spoon will be divided evenly and then homogenized separately and containerized for nonvolatile analyses. Duplicate samples will be blind to the laboratory.

4.2.4.3 Matrix Spikes and Matrix Spike Duplicates

Matrix spikes (MS) and matrix spike duplicates (MSD) are used to assess the potential for matrix effects. Samples will be designated for MS/MSD analysis on the chain-of-custody form and on the bottles. It may be necessary to increase the sample volume for samples where this designation is to be made.

4.2.5 Sample Identification, Handling, and Documentation

Samples will be identified, handled and recorded as described in this SOP and SOP No. 13. The parameters for analysis and preservation are specified in the WP.

4.2.6 Documentation

Each field activity must be properly documented to facilitate a timely and accurate reconstruction of events in the field (see SOP No. 13). Sample Collection Field Sheets (attached) will be completed for all soil samples submitted for chemical analysis.

4.2.6.1 Field Logbook

The most important aspect of documentation is thorough, organized, and accurate record keeping. All information pertinent to the investigation and not documented on the boring log will be recorded in a bound logbook with consecutively numbered pages. All entries in logbooks will be made in waterproof ink and corrections will consist of line-out deletions that are initialed and dated. Entries in the logbook will include the following, as applicable:

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number, location, and depth
- Sampling method
- Observations at the sampling site
- Unusual conditions
- Information concerning drilling decisions
- Decontamination observations
- Weather conditions

- Names and addresses of field contacts
- Names and responsibilities of field crew members
- Names and titles of any site visitors
- Location, description, and log of photographs (if taken)
- References for all maps and photographs
- Information concerning sampling changes, scheduling modifications, and change orders
- Summary of daily tasks (including costs) and documentation on any cost or scope of work changes required by field conditions
- Signature and date by personnel responsible for observations

Field investigation situations vary widely. No general rules can include each type of information that must be entered in a logbook for a particular site. A project-specific logging procedure will be developed to include sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks will be kept in the field team member's possession or in a secure place during the investigation. Following the investigation, the logbooks will become a part of the final project file.

4.2.6.2 Boring Logs

Boring logs will be completed for each boring by qualified personnel (geologist, geological engineer, or geotechnical engineer). The boring log form is attached.

Boring logs will include the following information:

- Boring location
- Boring identification
- Drilling agency
- Drilling equipment and method
- Date started and completed
- Completion depth
- Logger
- Description of lithologies by depth including soil or rock type, moisture content, color, and Unified Soil Classification
- Blow counts (if appropriate)
- Samples collected for laboratory analysis by depth of sample below surface, sample type and identification number, and sample interval
- Sample recovery
- Field screening results for soil headspace, breathing zone, and borehole with PID

- Origin of the lithologies (fill, loess, glacial till, glacial outwash, alluvium or colluvium, etc.)
- Other remarks or observations

SOIL SAMPLE COLLECTION FIELD SHEET

GENERAL INFORMATION

SITE NAME: _____ PROJECT NO. _____

SAMPLE NO. _____ BORING NO. _____

DATE/TIME COLLECTED: PERSONNEL:

SAMPLE METHOD / DEPTH: _____ _____

SAMPLE MEDIA: SOIL

SAMPLE QA SPLIT: YES NO SPLIT SAMPLE NO. _____

SAMPLE QC DUPLICATE: YES NO DUPLICATE SAMPLE NO. _____

MS/MSD REQUESTED: YES NO

SAMPLE CONTAINERS, PRESERVATIVES, ANALYSIS

Sample Container	Preservative	Analysis Requested

HNU MEASUREMENTS

Background _____

Breathing zone _____

Boring _____

Headspace _____

SAMPLE DESCRIPTION

DEPTH: _____ DESCRIPTION: _____

_____ _____

_____ _____

GENERAL COMMENTS

_____

_____

_____

FIGURE 1

URS

HTRW DRILLING LOG

	DISTRICT	HOLE
1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET SHEETS OF

3. PROJECT	4.LOCATION
5. NAME OF DRILLER	6. MANUFACTURE'S DESIGNATION OF DRILL
7. SIZES AND TYPES OF DRILLING AND SAMPLING	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED / 11. DATE
12. OVERBURDEN	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS SCALE:

PROJECT	HOLE

FIGURE 2

ENG FORM 5056-R, AUG 94

(Proponent: CECW-EG) URS

HTRW DRILLING LOG (CONTINUATION SHEET)

PROJECT	INSPECTOR	HOLE NO.
		SHEET OF SHEETS

ELEV a.	DEPTH b.	DESCRIPTION OF MATERIALS c.	FIELD SCREENING RESULTS d.	GEOTECH SAMPLE OR CORE BOX NO. e.	ANALYTICAL SAMPLE NO. f.	BLOW COUNTS g.	REMARKS h.

PROJECT	HOLE

FIGURE 2

URS

11.1 INTRODUCTION AND TYPES OF CONTAMINATION

This document defines the Standard Operating Procedure (SOP) for decontamination at Cannon Air Force Base (AFB). This procedure is intended to be used together with the project-specific Work Plan (WP) and the other SOPs. Applicable SOPs are listed below:

- No. 4 – Subsurface Drilling and Soil Sampling
- No. 19 – En Core® Sampling Method

Site and/or Sample Cross-Contamination

The overall objective of multimedia sampling programs is to obtain samples that accurately depict the chemical, physical, and/or biological conditions at the sampling site. Extraneous contaminants can be brought onto the sampling location and/or introduced into the medium of interest during the sampling program (e.g. using sampling equipment that is not properly or fully decontaminated). Trace quantities of contaminants can consequently be captured in a sample and lead to false positive analytical results and, ultimately, to an incorrect assessment of the contaminant conditions associated with the site. Decontamination of sampling equipment (e.g., all non-disposable equipment that will come in direct contact with samples) and field support equipment (e.g., drill rigs, vehicles) is, therefore, required prior to, between, and after uses at Cannon AFB to ensure that sampling cross-contamination is prevented, and that on-site contaminants are not carried off-site.

11.2 EQUIPMENT DECONTAMINATION PROCEDURES

11.2.1 Equipment List

The following is a list of equipment that may be needed to perform decontamination:

- Brushes
- Wash tubs
- Buckets
- Scrapers, flat bladed
- Hot water - high-pressure sprayer
- Sponges or paper towels
- Alconox detergent (or equivalent)
- Potable tap water
- Laboratory-grade de-ionized water
- Garden-type water sprayers
- Appropriate Health and Safety equipment (i.e. nitrile gloves, safety glasses, etc.)
- Appropriate investigation-derived waste (IDW) containers

11.2.2 Decontamination

11.2.2.1 Personnel

A temporary personnel decontamination line will be set up around each exclusion zone. If contamination is not encountered, a dry decontamination station may be established which consists of discarding of disposable personal protective equipment (PPE).

If real-time monitoring instruments indicate that contamination has been encountered, (i.e. action levels requiring an upgrade from initial PPE levels are exceeded), a personnel decontamination station will be established.

The temporary decontamination line should provide space to wash and rinse boots, gloves, and all sampling or measuring equipment prior to placing the equipment into a vehicle. A container should be available to dispose of used disposable items such as gloves, tape or Tyvek® (if used).

The decontamination procedure for field personnel will include:

1. Glove and boot wash in an Alconox (or equivalent) solution
2. Glove and boot rinse
3. Duct tape removal
4. Outer glove removal
5. Coverall removal
6. Respirator removal (if used)
7. Inner glove removal

11.2.2.2 Sampling Equipment

The following steps will be used to decontaminate sampling equipment:

- Personnel will dress in suitable safety equipment to reduce personal exposure as required by the Site Safety and Health Plan (SSHP).
- Gross contamination on equipment will be scraped off at the sampling or construction site.
- Equipment that cannot be damaged by water will be placed in a washtub containing Alconox or low-sudsing non-phosphate detergent along with potable water and scrubbed with a bristle brush or similar utensil. Equipment will be rinsed with tap water in a second washtub followed by a de-ionized water rinse.
- Equipment that may be damaged by water will be carefully wiped clean using a sponge and detergent water and rinsed with de-ionized water. Care will be taken to prevent equipment damage.

Following decontamination, equipment will be placed in a clean area or on clean plastic sheeting to prevent contact with contaminated soil. If the equipment is not used immediately after decontamination, the equipment will be covered or wrapped in plastic sheeting, foil, or heavy-duty trash bags to minimize potential contact with contaminants.

11.2.2.3 Drilling and Heavy Equipment

Drilling rigs and excavating equipment will be decontaminated at the decontamination station located near the staging area. Mobile decontamination trailers may be used to decontaminate heavy equipment at each site. The following steps will be used to decontaminate drilling and heavy equipment:

- Personnel will dress in suitable PPE to reduce personal exposure as required by the SSHP.
- Equipment showing gross contamination or having caked-on drill cuttings will be scraped with a flat-bladed scraper at the sampling or construction site.
- Equipment that cannot be damaged by water, such as drill rigs, augers, drill bits, and shovels, will be washed with a hot water, high-pressure sprayer then rinsed with potable water. Care will be taken to adequately clean the insides of the hollow-stem augers and backhoe buckets.

Following decontamination, drilling equipment will be placed on the clean drill rig and moved to a clean area. If the equipment is not used immediately, it will be stored in a clean area.

11.2.2.4 Equipment Leaving the Site

Vehicles used for activities in non-contaminated areas shall be cleaned on an as-needed basis, as determined by the Site Safety Officer, using soap and water on the outside and vacuuming the inside. On-site cleaning will be required for very dirty vehicles leaving the area. Construction equipment such as trucks, drilling rigs, backhoes, trailers, etc., will be pressure washed before the equipment is removed from the site to limit exposure of off-site personnel to potential contaminants.

11.2.2.5 Wastewater

Unless otherwise specified, liquid wastewater from decontamination will be containerized, labeled, and stored for later disposal.

11.2.3 Documentation

Sampling personnel will be responsible for documenting the decontamination of sampling and drilling equipment. The documentation will be recorded with waterproof ink in the sampler's field notebook with consecutively numbered pages. The information entered in the field book concerning decontamination should include the following:

- Decontamination personnel
- Date and start and end times
- Decontamination observations
- Weather conditions
- IDW handling

13.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for sample handling, documentation, and tracking at Cannon Air Force Base (AFB). This procedure is intended to be used together with the project-specific Work Plan (WP) and other SOPs. Applicable SOPs are listed below:

- No. 4 - Subsurface Drilling and Soil Sampling

13.2 SAMPLE IDENTIFICATION

Samples collected during site activities shall have discrete sample identification numbers. These numbers are necessary to identify and track each of the many samples collected for analysis during the life of this project. In addition, the sample identification numbers will be used in the database to identify and retrieve the analytical results received from the laboratory.

Each sample is identified by a unique code that indicates the site number, sample location number, sample method and matrix identifier, and sample depth. For project-specific details, refer to the WP.

The sampling locations, sample type, and sample sequence identifiers will be established prior to field activities for each sample to be collected. On-site personnel will obtain assistance in defining any special sampling requirements from the Project Manager.

13.3 SAMPLE LABELING

Prior to beginning field-sampling activities each day, a designated member of the sampling team will fill out sample labels as completely as possible. The date, time, sampler's signature, and the last field of the sample identification number should not be completed until the time of sample collection. All sample labels shall be filled out using waterproof ink. At a minimum, each label shall contain the following information:

- Sampler's company affiliation
- Site location
- Sample identification code (i.e., CAB - SB02 - 018)
- Date and time of sample collection
- Analyses required
- Method of preservation (if any) used
- Sample matrix (i.e., soil, groundwater, surface water)
- Sampler's signature or initials

An example of a completed sample label is attached.

13.4 SAMPLE HANDLING

This section discusses proper sample containers, preservatives, and handling and shipping procedures. The WP summarizes the information contained in this section and also includes the sample holding times for each analyte.

13.4.1 Sample Containers

Certified, commercially clean sample containers shall be obtained from the contract analytical lab. The contract laboratory shall label the bottles to indicate the type of sample to be collected. Required preservatives shall be prepared and placed in the bottles at the laboratory prior to shipment to the site.

Appropriate sample containers for the specific analyses required are listed in the project-specific WP.

13.4.2 Sample Preservation

Sample preservation efforts shall commence at the time of sample collection and will continue until analyses are performed. Samples will be stored on ice at 4°C in coolers immediately following collection. The ice will be double bagged in Zipper-Lock-type storage bags. Additional sample preservation requirements are given in the WP. Chemical preservatives, if necessary, shall be added to the sample containers by the laboratory prior to shipment to the field, unless otherwise specified in the WP.

13.4.3 Sample Handling and Shipping

After collection, sample labels will be completed as described in Section 1.2 and samples stored on ice at 4°C in an insulated cooler. The ice will be double bagged in Zipper-Lock-type storage bags.

The sample containers will be placed in reclosable Zipper-Lock-type plastic storage bags and wrapped in protective packing material (bubble wrap). Samples will then be placed right side up in a cooler with ice (double bagged using plastic bags), taped with a custody seal for delivery to the laboratory. Samples will be hand delivered or shipped by overnight express carrier for delivery to the analytical laboratory. All samples must be shipped for laboratory receipt and analyses within specific holding times. This may require daily shipment of samples with short holding times. A chain-of-custody (COC) form will accompany each cooler. The temperature of all coolers will be measured upon receipt at the laboratory.

13.4.4 Holding Times and Analyses

The holding time is specified as the maximum allowable time between sample collection and analysis and/or extraction, based on the analyte of interest and stability factors, and preservative (if any) used. Allowable holding times will be listed in the WP. Samples should be sent to the

laboratory as soon as possible after collection by overnight courier service to minimize the possibility of exceeding holding times.

Chemical constituents that will be analyzed and other parameters to be measured during field investigations at Cannon AFB are identified in the WP.

13.5 SAMPLE DOCUMENTATION AND TRACKING

This section describes documentation required in the field notes and on the sample Chain-of-Custody forms.

13.5.1 Field Notes

Documentation of observations and data acquired in the field will provide information on the acquisition of samples and also provide a permanent record of field activities. The observations and data will be recorded using pens with permanent waterproof ink in a permanently bound weatherproof field log book containing consecutively numbered pages or on field sampling data sheets.

The information in the field logbook or on the data sheets will include the following as a minimum. Additional information is included in the specific SOPs regarding the data sheets.

- Project name
- Location of sample
- Sampler's printed name and signature
- Date and time of sample collection
- Sample identification code
- Description of samples (matrix sampled)
- Sample depth (if applicable)
- Number and volume of samples
- Sampling methods or reference to the appropriate SOP
- Sample handling, including filtration and preservation, as appropriate for separate sample aliquots
- Analytes of interest
- Field observations
- Results of any field measurements, such as depth to water, pH, temperature, and conductivity
- Personnel present
- Level of PPE used during sampling

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

Each page in the field books will be signed by the person making the entry at the end of the day, as well as on the bottom of each page. Anyone making entries in another person's field book will sign and date those entries.

13.5.2 Sample Chain-Of-Custody

During field sampling activities, traceability of the sample must be maintained from the time that the samples are collected until laboratory data are issued. Initial information concerning collection of the samples will be recorded in the field logbook as described above. Information on the custody, transfer, handling, and shipping of samples will be recorded on a COC form. An example COC form is attached. The COC is a three-part carbonless form.

The sampler will be responsible for initiating and filling out the COC form. The sampler will sign the COC when the sampler relinquishes the samples to anyone else. One COC form will be completed for each cooler of samples collected daily. The COC will contain the following information:

- Sampler's signature and affiliation
- Project number
- Date and time of collection
- Sample identification number
- Sample type
- Analyses requested
- Number of containers
- Signature of persons relinquishing custody, dates, and times
- Signature of persons accepting custody, dates, and times
- Method of shipment
- Shipping air bill number (if appropriate)

The person responsible for delivery of the samples to the laboratory will sign the COC form, retain the last copy of the three-part COC form, document the method of shipment, and send the original and the second copy of the COC form with the samples. Upon receipt at the laboratory, the person receiving the samples will sign the COC form and return the second copy to the Project Manager. Copies of the COC forms documenting custody changes and all custody documentation will be received and kept in the central files. The original COC forms will remain with the samples until final disposition of the samples by the laboratory. The analytical laboratory will dispose of the samples in an appropriate manner 60 to 90 days after data

reporting. After sample disposal, a copy of the original COC will be sent to the Project Manager by the analytical laboratory to be incorporated into the central files.

URS

12120 Shamrock Plaza, Suite 300
Omaha, NE 68154

Phone: (402) 334-8181
Fax: (402) 334-1984

Project:	**Supplemental Assessment AOCs A, B, & C**		
Sample ID:	**CAB-SB02-018**		
Analysis:	**VOCs**		
Preservative	**4°C**	Date:	**0-0-00**
Samplers:	**JV, UG**	Time:	**1300**

DAILY QUALITY CONTROL REPORT

Supplemental Assessment AOCs A, B, & C
Cannon AFB

Date _____

Day	S	M	T	W	TH	F	S

USACE Project Manager _____
Project _____
Project No. _____
Contract No. _____

Weather	Bright Sun	Clear	Overcast	Rain	Snow
Temp	To 32	32-50	50-70	70-85	85 up
Wind	Still	Moderate	High	**Report No.**	
Humidit	Dry	Moderate	Humid		

Subcontractors on Site:

Equipment on Site:

Visitors on Site:

URS Personnel on Site:

Field Work Performed (including sampling):

Quality Control Activities (including field calibration):

Health and Safety and Activities:

Observations/Problems Encountered/Corrective Action Taken:

By **Title**

FIGURE 2

URS Corporation

12120 Shamrock Plaza Suite 300, Omaha, NE 68154 (402) 334-8181 Fax (402) 334-1984

CHAIN OF CUSTODY RECORD

Page ____ of ____

Project Name	Project No.
Project Location	Project Manager
Sampler(s)	

Sample		Type		Sample Identification	Matrix	Containers		Analytical Parameters										Remarks
Date	Time	Comp.	Grab			No.	Type											

Signatures	Date	Time	Shipping Details	Special Instructions
Relinquished by:			Method of Shipment	
Received by:			Airbill No.	
Relinquished by:			Lab Address	
Received for Laboratory by:				

Custody.frm/jdg 3-09-92

White copy - Laboratory Yellow copy - Laboratory Pink copy - WCC

116917

FIGURE 3

15.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for performing headspace analysis of soil and water samples in the field at Cannon Air Force Base (AFB) and gives the description of equipment and procedures for field screening of soil and water samples. Sample locations and frequency of collection will be presented in the project-specific Work Plan (WP).

Applicable SOPs are listed below:

- SOP No. 4 – Subsurface Drilling and Soil Sampling

15.2 HEADSPACE ANALYSIS

15.2.1 Equipment List

The following equipment is required for headspace analysis:

- Clean glass sample containers with lids
- Paper towels
- Aluminum foil
- Organic vapor analyzer equipped with a photoionization detector (PID)
- Field book
- Waterproof and permanent marking pens

15.2.2 Field Screening Procedures

A portion of each shallow surface soil sample and each subsurface soil sample collected for lithologic logging purposes will be placed in the appropriate glass container for headspace analysis. The container should be filled approximately one-half full. The mouth of the container will be covered with aluminum foil, tightly capped, and the sample matrix will be allowed to equilibrate with the headspace for 30 minutes. Care must be taken in the selection of soils with respect to consistency and sample placement in the container in order to achieve comparability and consistency in the results. The disposition of the sample in the container will be recorded in the field logbook.

The sample headspace in the container shall be analyzed with an organic vapor analyzer by removing the lid and inserting the instrument probe through the foil liner. Care must be taken in the selection of appropriate foil, placement of the foil on the container, and removal of the lid so as not to compromise the integrity of the seal. If the seal has been compromised, this will be recorded appropriately or a new sample taken if possible.

15.2.3 Organic Vapor Analyzer Selection

The selection of the appropriate organic vapor analyzer equipped with either a PID shall be based on contaminants of concern and/or ambient conditions at the respective site. The lamp selected for the PID, where applicable, will be based on the relative ionization potentials of the expected volatile contaminants. The selected instrument will be recorded on the Daily Quality Control Report (DQCR) and in the field logbook. It is anticipated that a PID detector will be used for most or all of the work at Cannon AFB.

15.2.4 Calibration

The instrument(s) selected for use in accordance with data quality objectives and site requirements will be calibrated according to the manufacturer's recommendations and specifications. These requirements include a calibration gas of isobutylene (100ppm) to be applied to the PID on a daily basis, to check accuracy of the instrument.

15.2.5 Documentation

All procedures and field conditions shall be recorded on the sample collection field sheet (SCFS) and in the field logbook. The record shall include a description of the material being screened as well as site conditions such as humidity and the equilibration time and temperature.

16.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for abandoning borings at Cannon Air Force Base (AFB) and gives descriptions of equipment and field procedures necessary to abandon borings. Applicable SOPs are listed below:

Applicable SOPs are listed below:

- SOP No. 4 - Subsurface Drilling and Soil Sampling

16.2 BORING ABANDONMENT PROCEDURES

16.2.1 Equipment List

The following is an equipment list for boring abandonment:

- Portland cement (type I or II) and powdered bentonite for grouting
- Bentonite chips
- Potable water
- Drill rig or portable grout station
- Logbook
- Boring log sheets
- Waterproof and permanent marking pens
- Tremie pipe
- Appropriate health and safety equipment

16.2.2 Abandonment Procedures

Following completion of the borings each boring must be abandoned and plugged to provide a low-permeability zone that would retard movement of water through the boring backfill.

Where water was not encountered and the boring sidewalls are stable the boring may be backfilled using hydrated bentonite chips. The dry bentonite chips are poured into the boring from the ground surface filling the boring in 1-foot lifts. Hydration of the bentonite chips with 1 gallon of water is necessary for each lift of bentonite chips.

Where water was encountered in the boring and where the boring sidewalls are unstable the boring must be backfilled with a fluid cement/bentonite grout pumped into the boring. The grout mixture will consist of type 1 or type 2 Portland cement with not more than 8% by weight bentonite powder added to not more than 7 gallons of potable water. The grout will be prepared in an aboveground rigid container by first thoroughly mixing the cement and water before adding the bentonite powder. Pump the grout mixture into the base of the boring using drill rods or tremie pipe placed through the center of the augers. Initially place the tremie pipe 1 foot above

the bottom of the boring. Pump grout into the boring maintaining a positive head of grout within the central core of the augers at all times. Pull the augers and tremie pipe incrementally until the boring is grouted to the ground surface. After the grout has set for 24 hours check the boring for settlement. Add grout as required to refill the boring.

16.2.3 Pavement Repair

Where borings penetrate surface pavements, walkways or sidewalks, it will be necessary to patch the pavement surface following backfilling. Concrete pavements should be filled with low slump (less than 4 inches) concrete mix. Asphaltic concrete pavements should be filled with asphaltic concrete patch mix and thoroughly compacted by ramming. The surface of any patch should be screeded level upon completion. In freezing weather the concrete mix must be protected from freezing for 48 hours after placement.

16.2.4 Documentation

Observations and data acquired in the field during boring abandonment will be recorded to provide a permanent record. These observations will be recorded with waterproof black ink in a bound weatherproof field book with consecutively numbered pages.

A boring log will be completed for each boring with the observations recorded in the field book. A note shall be placed on the boring log that the boring was abandoned and backfilled with hydrated bentonite chips or grouted with a cement/bentonite mixture to the ground surface or the pavement subgrade. The type of material used to patch the pavement surface will also be noted on the boring log and the field book.

17.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for obtaining permits and clearances at Cannon Air Force Base (AFB). Permits and clearances are required for underground utilities (drilling, hand augering, excavating, etc.), for plant security, and for use of hot equipment such as welders and steam cleaners.

17.2 CONTRACTORS BADGES, VEHICLE PASSES, AND CAMERA PASSES

17.2.1 Contractor Identification

Prior to the initiation of each field investigation, URS personnel and all subcontractors onsite will be identified to appropriate personnel within the 27th Civil Engineer Squadron's Environmental Flight (27 CES/CEV). 27 CES/CEV will make all arrangements to notify Base personnel and security of the pending field investigation. It is likely that onsite URS personnel and subcontractors will be issued Base visitor passes, which they will be required to have with them at all times while on Base. In addition, all URS personnel and URS subcontractors may be required to attend a safety briefing provided by the Base.

17.2.2 Vehicle Passes

All vehicles that enter the Base must be registered at the Main Gate, and obtain and display a vehicle permit tag from security the Base. The vehicle registration applicant will need to furnish proof of insurance, rental agreement (if applicable), a valid drivers license, and the contract number to register a vehicle. The tag shall be displayed in the lower driver's side corner of the windshield.

17.2.3 Hot Work Permit

Cannon AFB may require "Hot Work" permits for operating equipment such as drill rigs, pavement-coring devices, welding devices, steam cleaners, etc. These permits will be obtained and recorded as required.

17.3 UTILITY CLEARANCES

Digging permits will be obtained for all subsurface drilling activities prior to initiating the work. Digging permits will be obtained through the appropriate U.S. Air Force representative. When any intrusive work is being performed in the vicinity of utility and/or communication cables/lines, Civil Engineering and/or Communication monitoring personnel, as required, will be present. No mechanical digging shall be performed within five feet on each side of utilities and/or communication line(s) until they are physically exposed by hand digging. If a utility and/or communication line is damaged, the designated representative of the U.S. Air Force shall be notified immediately for further directions.

Notice will be given to the monitoring personnel no later than 24 hours prior to work. No work shall start if the required monitoring personnel are not present.

19.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for collecting soil samples at Cannon Air Force Base (AFB) using the EnCore® sampling method. This SOP describes the equipment, field procedures, and Quality Assurance/ Quality Control (QA/QC) procedures implemented for the using the EnCore® Sampler.

This SOP is intended to be used together with the project-specific Work Plan (WP) and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the project Site Safety and Health Plan (SSHP). Applicable SOPs are listed below:

- SOP No. 4 – Subsurface Drilling and Soil Sampling
- SOP No. 11 – Equipment Decontamination

19.2 PROCEDURES FOR SAMPLING USING THE EN CORE® SAMPLER

The EnCore® Sampler is a single use device and cannot be cleaned and/or reused. The EnCore® sampler is designed to store soil. Do not use the EnCore® sampler to store solvent or free product. The samplers to be used are 5-gram samplers.

To ensure sufficient sample volume, three 5-gram EnCore® samplers will be collected from each sampling interval. If the sample from a given interval will undergo laboratory analysis, all three samplers from that interval will be sent to the laboratory. Otherwise, if the sample will not undergo laboratory analysis, all three samplers from that interval will be disposed of as investigation-derived waste.

19.2.1 Equipment List

The following list of equipment will be need to collect soil samples for VOC analysis using the EnCore® Sampler:

- Disposable 5-gram EnCore® samplers in zipper bags
- T-handle Sampler
- Zipper lock-type storage bags
- Sampler label
- Cooler with ice
- Field logbook

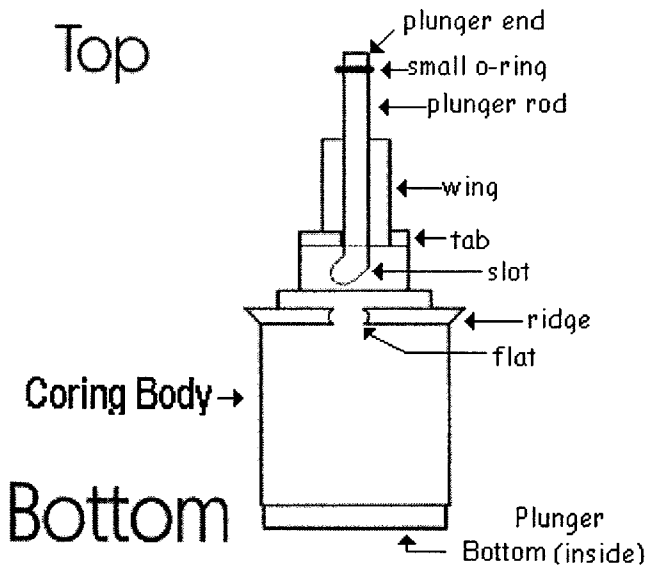
19.2.2 Decontamination

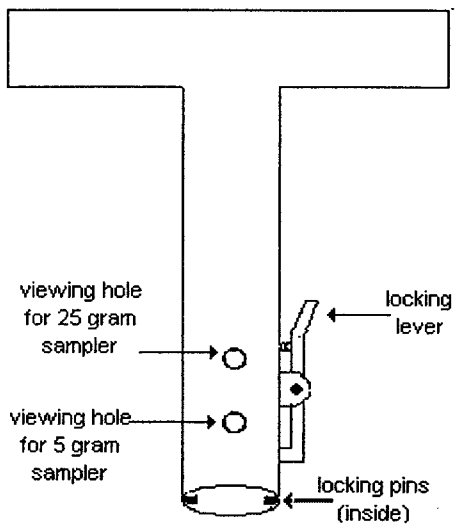
Before sampling begins, the T-handle and any extensions will be decontaminated according to procedures contained in SOP No. 11, Equipment Decontamination. Sampling equipment

(T-handle and extension rods) will also be decontaminated between each sample collected. The plastic EnCore® samplers are intended for single use only and cannot be decontaminated.

19.2.3 Sampling Procedures for Clay Soils

Diagrams showing an EnCore® sampler and the T-handle sampling tool are shown below:

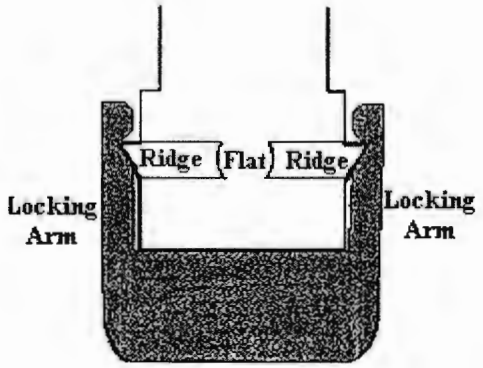




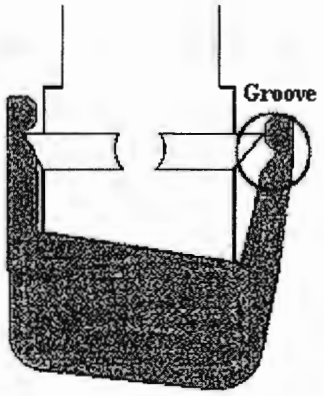
To collect a soil sample using the EnCore® sampler, follow the steps listed below:

- Hold the coring body and push the plunger rod down until the small o-ring rests against the tabs. This will assure that the plunger moves freely.
- Depress the locking lever on the EnCore® T-handle. Place the coring body, plunger end first, into the open end of the T-handle, aligning the two slots on the coring body with the two locking pins in the T-handle. Twist the coring body clockwise to lock the pins in the slots. Check to ensure the sampler is locked in place. The sampler is now ready for use.
- Turn the T-handle with T-up and the coring body down. This positions the plunger bottom flush with the bottom of the coring body (make sure the plunger bottom is in position). Using the T-handle, push the sampler into the soil until the coring body is completely full. When full, the small o-ring will be centered in T-handle viewing hole (see T-handle diagram). Remove the sampler from the soil and wipe excess soil from the coring body exterior.
- Cap the coring body while it is still on the T-handle by pushing the cap the over flat area of the ridge. Push and twist the cap to lock the arm in place. The cap must be seated to seal the sampler (see diagrams below).

Sampler Correctly Capped: Locking arm grooves are seated over coring body.



Sampler Incorrectly Capped: Cap appears crooked; the locking arm grooves are not fully seated over coring body ridge



- Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
- Lock the plunger by rotating the extended plunger rod fully counter-clockwise until the wings rest firmly against the tabs (see the diagram below).

- Attach a completed label (from the EnCore® sampler bag) to the cap on the coring body.
- Return the full EnCore® sampler to zipper bag. Seal the bag, place it inside a Ziploc®-type storage bag, seal the second bag, and place it on ice in the sample cooler.
- Record all appropriate information on the chain-of-custody form and in sample collection field sheet and field logbook.
- Repeat these procedures until three 5-gram samplers have been filled for a given sample.

19.2.4 Sampling Procedures for Sand

The EnCore® sampler cannot be used to directly sample sand. Sand samples must be collected using another sampling method, such as a split-spoon, hand auger or stainless steel spoon. Sand material is then pressed into the EnCore® sampler and capped.

19.3 SAMPLE HOLDING TIMES

The holding time for EnCore® samplers is 48 hours from the time of sample collection to extraction. Therefore, all samples collected using this method must be shipped priority overnight on the same day as collected to ensure meeting the required holding time. Once the samples are properly preserved at the laboratory there is a 14 day holding time until analysis must be completed.

This appendix presents Table A-1 and A-2 from

New Mexico Environment Department

Hazardous Waste Bureau

Groundwater Quality Bureau

and

Voluntary Remediation Program

Technical Background Document for Development of Soil Screening Levels

Revision 2.0

February 2004

NMED Soil Screening Levels

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Acenaphthene	4.69E+03	nc	3.48E+04	nc	1.44E+04	nc	X	3.99E+00	7.98E+01
Acetaldehyde	9.43E+01	nc	3.42E+02	nc	3.08E+02	nc	X	3.32E-04	6.63E-03
Acetone	7.04E+04	nc	1.00E+05	sat	1.00E+05	sat	X	1.03E-01	2.06E+00
Acrylonitrile	3.96E+00	ca	1.15E+01	ca	5.22E+01	nc	X	6.61E-06	1.32E-04
Acetophenone	1.31E+03	sat	1.31E+03	sat	1.31E+03	sat	X		
Acrolein	1.84E-01	nc	6.70E-01	nc	6.01E-01	nc	X	8.39E-06	1.68E-04
Aldrin	2.84E-01	ca	1.12E+00	ca	6.99E+00	nc		1.47E-02	2.94E-01
Aluminum	7.78E+04	nc	1.00E+05	max	1.44E+04	nc		7.50E+03	1.50E+05
Anthracene	2.35E+04	nc	2.64E+05	nc	8.53E+04	nc	X	8.00E+01	1.60E+03
Antimony	3.13E+01	nc	4.54E+02	nc	1.24E+02	nc		2.71E-01	5.42E+00
Arsenic	3.90E+00	ca	1.77E+01	ca	8.52E+01	nc		2.92E+00	5.83E+01
Barium	5.45E+03	nc	7.83E+04	nc	1.44E+03	nc		4.12E+01	8.23E+02
Benzene	2.70E+01	ca	7.36E+01	ca	1.57E+02	nc	X	1.41E-03	2.83E-02
Benzidine	2.11E-02	ca	8.33E-02	ca	7.09E-01	ca			
Benzo(a)anthracene	6.21E+00	ca	2.34E+01	ca	2.14E+02	ca		5.49E-02	1.10E+00
Benzo(a)pyrene	6.21E-01	ca	2.34E+00	ca	2.14E+01	ca		3.06E-01	6.12E+00
Benzo(b)fluoranthene	6.21E+00	ca	2.34E+01	ca	2.14E+02	ca		1.70E-01	3.40E+00
Benzo(k)fluoranthene	6.21E+01	ca	2.34E+02	ca	2.14E+03	ca		1.70E+00	3.40E+01
Beryllium	1.56E+02	nc	2.25E+03	nc	5.62E+01	nc		3.16E+00	6.32E+01
α-BHC	9.02E-01	ca	3.99E+00	ca	3.00E+01	ca		2.21E-05	4.43E-04
β-BHC	3.16E+00	ca	1.40E+01	ca	5.39E+01	nc		7.61E-05	1.52E-03
γ-BHC	4.37E+00	ca	1.93E+01	ca	8.09E+01	nc		3.55E-04	7.09E-03
1,1-Biphenyl	8.90E+01	sat	8.90E+01	sat	8.90E+01	sat	X	3.56E+00	7.12E+01
Bis(2-chloroethyl) ether	2.04E+00	ca	5.95E+00	ca	9.09E+01	ca	X	1.87E-06	3.75E-05
Bis(2-chloroisopropyl) ether	3.13E+03	nc	6.19E+03	nc	4.24E+03	nc	X	7.04E-05	1.41E-03
Bis(2-ethylhexyl) phthalate	3.47E+02	ca	1.37E+03	ca	4.66E+03	nc		1.09E+02	2.17E+03
Bis(chloromethyl) ether	4.26E-03	ca	1.10E-02	ca	2.11E-01	ca	X	8.87E-09	1.77E-07
Boron	5.50E+03	nc	6.16E+04	nc	2.14E+04	nc			

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Bromobenzene	3.32E+01	nc	1.22E+02	nc	1.09E+02	nc	X	1.03E-02	2.06E-01
Bromodichloromethane	1.03E+02	ca	5.13E+02	ca	1.05E+03	nc	X	4.64E-05	9.28E-04
Bromomethane	7.62E+00	nc	2.92E+01	nc	2.52E+01	nc	X	1.84E-03	3.67E-02
1,3-Butadiene	8.91E-01	ca	2.13E+00	ca	4.11E+00	nc	X	1.32E-05	2.63E-04
2-Butanone (MEK)	5.73E+02	nc	2.10E+03	nc	1.88E+03	nc	X	3.32E-01	6.63E+00
tert-Butyl methyl ether (MTBE)	9.80E+02	ca	3.18E+03	ca	4.07E+04	ca	X	2.33E-03	4.67E-02
n-Butylbenzene	6.20E+01	sat	6.20E+01	sat	6.20E+01	sat	X	1.06E+00	2.13E+01
sec-Butylbenzene	6.05E+01	sat	6.05E+01	sat	6.05E+01	sat	X	8.54E-01	1.71E+01
tert-Butylbenzene	1.06E+02	sat	1.06E+02	sat	1.06E+02	sat	X	8.47E-01	1.69E+01
Cadmium[a]	7.41E+01	nc	8.60E+03	nc	4.74E-03	nc		3.76E-01	7.52E+00
Carbon disulfide	3.76E+03	nc	2.14E+04	nc	1.34E+04	nc	X	3.76E-01	7.52E+00
Carbon tetrachloride	3.13E+00	ca	7.75E+00	ca	9.06E+00	nc	X	2.87E-03	5.74E-02
Chlordane	1.62E+01	ca	7.19E+01	ca	1.30E+02	nc		3.61E-01	7.21E+00
2-Chloroacetophenone	4.07E-02	nc	1.48E-01	nc	1.33E-01	nc	X	4.35E-05	8.70E-04
2-Chloro-1,3-butadiene	5.64E+00	nc	2.05E+01	nc	1.84E+01	nc	X	5.51E-03	1.10E-01
1-Chloro-1,1-difluoroethane	2.05E+02	sat	1.00E+05	sat	1.00E+05	sat	X	6.36E+01	1.27E+03
Chlorobenzene	1.76E+02	nc	2.42E+02	sat	2.42E+02	sat	X	5.14E-02	1.03E+00
1-Chlorobutane	2.91E+02	sat	2.91E+02	sat	2.91E+02	sat	X	9.45E-01	1.89E+01
Chlorodifluoromethane	2.05E+02	sat	1.00E+05	sat	1.00E+05	sat	X	6.21E+01	1.24E+03
Chloroethane	1.38E+03	sat	1.38E+03	sat	1.38E+03	sat	X	1.12E-03	2.23E-02
Chloroform	3.56E+00	ca	8.52E+00	ca	1.88E+01	nc	X	2.45E-02	4.90E-01
Chloromethane	1.95E+01	ca	4.77E+01	ca	2.53E+02	nc	X	5.01E-04	1.00E-02
β-Chloronaphthalene	6.26E+03	nc	2.58E+04	nc	1.40E+04	nc	X	1.26E+00	2.52E+01
o-Chloronitrobenzene	1.69E+00	nc	6.23E+00	nc	5.54E+00	nc	X	3.98E-05	7.96E-04
p-Chloronitrobenzene	1.24E+01	nc	5.09E+01	nc	4.15E+01	nc	X	3.18E-04	6.37E-03
2-Chlorophenol	3.91E+02	nc	8.07E+02	nc	5.47E+02	nc	X	2.31E-02	4.62E-01
2-Chloropropane	2.87E+02	nc	6.89E+02	sat	6.89E+02	sat	X	4.34E-02	8.68E-01
o-Chlorotoluene	1.56E+03	nc	7.74E+02	nc	6.46E+02	nc	X	5.09E-02	1.02E+00
Chromium III	1.00E+05	max	1.00E+05	max	1.00E+05	max		9.90E+06	1.98E+08
Chromium VI	2.34E+02	nc	3.40E+03	nc	1.80E+02	ca		9.58E-01	1.92E+01
Chrysene	6.21E+02	ca	2.34E+03	ca	2.14E+04	ca	X	5.49E+00	1.10E+02

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Cobalt	1.52E+03	nc	2.05E+04	nc	6.10E+01	nc		2.26E+00	4.52E+01
Copper	3.13E+03	nc	4.54E+04	nc	1.24E+04	nc		3.52E+01	7.03E+02
Crotonaldehyde	3.37E+00	ca	1.67E+01	ca	5.18E+01	sat	X	1.53E-05	3.06E-04
Cumene (isopropylbenzene)	7.00E+02	nc	2.73E+03	nc	2.32E+03	nc	X	3.65E-01	7.29E+00
Cyanide	1.56E+03	nc	2.27E+04	nc	6.19E+03	nc		3.88E-02	7.75E-01
Cyanogen	3.13E+03	nc	8.22E+02	nc	7.11E+02	nc	X	5.55E-02	1.11E+00
Cyanogen bromide	7.04E+03	nc	1.85E+03	nc	1.60E+03	nc	X	1.27E-01	2.54E+00
Cyanogen chloride	3.91E+03	nc	1.03E+03	nc	8.88E+02	nc	X	6.93E-02	1.39E+00
DDD	2.44E+01	ca	1.11E+02	ca	8.29E+02	ca		4.20E-01	8.40E+00
DDE	1.72E+01	ca	7.81E+01	ca	5.85E+02	ca		1.34E+00	2.68E+01
DDT	1.72E+01	ca	7.81E+01	ca	1.38E+02	nc		7.89E-01	1.58E+01
Dibenz(a,h)anthracene	6.21E-01	ca	2.34E+00	ca	2.14E+01	ca		5.24E-02	1.05E+00
Dibenzofuran	3.13E+02	nc	3.17E+03	nc	1.09E+03	nc	X	2.85E-01	5.70E+00
1,2-Dibromo-3-chloropropane	3.64E+00	nc	1.32E+01	nc	1.19E+01	nc	X	1.01E-05	2.02E-04
Dibromochloromethane	7.62E+01	ca	3.79E+02	ca	1.39E+03	nc	X	1.14E-04	2.28E-03
1,2-Dibromoethane	7.14E-02	ca	3.36E-01	ca	2.47E+00	ca	X	2.11E-05	4.23E-04
1,4-Dichloro-2-butene	1.33E-01	ca	3.17E-01	ca	7.14E+00	ca	X	2.89E-07	5.78E-06
1,2-Dichlorobenzene	1.16E+02	sat	1.16E+02	sat	1.16E+02	sat	X	4.46E-01	8.93E+00
1,3-Dichlorobenzene	7.04E+01	nc	7.39E+01	nc	5.70E+01	nc	X	6.09E-03	1.22E-01
1,4-Dichlorobenzene	3.60E+01	ca	8.14E+01	sat	8.14E+01	sat	X	8.27E-02	1.65E+00
3,3-Dichlorobenzidine	1.08E+01	ca	4.26E+01	ca	3.71E+02	ca		1.88E-04	3.76E-03
Dichlorodifluoromethane	1.44E+02	nc	2.05E+02	sat	2.05E+02	sat	X	2.85E-01	5.70E+00
1,1-Dichloroethane	8.20E+02	nc	1.22E+03	sat	1.22E+03	sat	X	6.05E-03	1.21E-01
1,2-Dichloroethane	5.07E+00	ca	1.26E+01	ca	5.33E+01	nc	X	9.92E-04	1.98E-02
cis-1,2-Dichloroethene	7.82E+02	nc	2.67E+02	nc	2.28E+02	nc	X	1.68E-02	3.37E-01
trans-1,2-Dichloroethene	1.56E+03	nc	3.98E+02	nc	3.44E+02	nc	X	2.91E-02	5.82E-01
1,1-Dichloroethene	1.82E+02	nc	6.86E+02	nc	6.01E+02	nc	X	1.92E-03	3.84E-02
2,4-Dichlorophenol	1.80E+02	nc	2.05E+03	nc	6.99E+02	nc		1.22E-02	2.45E-01
1,2-Dichloropropane	1.00E+01	nc	3.64E+01	nc	3.28E+01	nc	X	3.94E-05	7.89E-04
1,3-Dichloropropene	1.13E+01	ca	2.98E+01	ca	8.38E+01	nc	X	1.28E-04	2.56E-03
Dicyclopentadiene	2.35E+03	nc	2.13E+00	nc	1.92E+00	nc	X	4.51E-04	9.02E-03

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Dieldrin	3.04E-01	ca	1.20E+00	ca	1.02E+01	ca		1.36E-04	2.71E-03
Diethyl phthalate	4.80E+04	nc	1.00E+05	max	1.00E+05	max		1.74E+01	3.48E+02
Dimethyl phthalate	1.00E+05	max	1.00E+05	max	1.00E+05	max		1.66E+02	3.31E+03
Di-n-butyl phthalate	6.00E+03	nc	6.84E+04	nc	2.33E+04	nc		1.84E+02	3.67E+03
2,4-Dimethylphenol	1.20E+03	nc	1.37E+04	nc	4.66E+03	nc		4.27E-02	8.54E-01
2,4-Dinitrotoluene	1.20E+02	nc	1.37E+03	nc	4.66E+02	nc		2.27E-02	4.54E-01
1,2-Diphenylhydrazine	6.08E+00	ca	2.39E+01	ca	2.04E+02	ca		9.73E-05	1.95E-03
Endosulfan	3.60E+02	nc	4.10E+03	nc	1.40E+03	nc		7.43E-01	1.49E+01
Endrin	1.80E+01	nc	2.05E+02	nc	6.99E+01	nc		3.72E-02	7.45E-01
Epichlorohydrin	1.51E+01	nc	5.90E+01	nc	5.01E+01	nc	X	3.46E-04	6.93E-03
Ethyl acetate	7.04E+04	nc	1.00E+05	sat	2.06E+04	sat	X	1.41E+00	2.83E+01
Ethyl acrylate	5.13E+01	sat	6.62E+02	ca	4.52E+03	ca	X	5.90E-04	1.18E-02
Ethyl chloride	1.38E+03	sat	1.38E+03	sat	7.48E+04	ca	X	1.12E-03	2.23E-02
Ethyl ether	1.89E+03	sat	1.89E+03	sat	1.89E+03	sat	X	2.27E-01	4.53E+00
Ethyl methacrylate	5.18E+01	sat	5.18E+01	sat	5.18E+01	sat	X	1.42E+00	2.85E+01
Ethylbenzene	1.06E+04	ca	2.54E+04	ca	5.71E+05	ca	X	5.25E-01	1.05E+01
Ethylene oxide	2.47E+00	ca	7.39E+00	ca	1.08E+02	ca	X	4.11E-06	8.23E-05
Fluoranthene	2.25E+03	nc	2.44E+04	nc	8.73E+03	nc		2.41E+02	4.82E+03
Fluorene	3.13E+03	nc	2.94E+04	nc	1.06E+04	nc	X	5.01E+00	1.00E+02
Furan	7.82E+01	nc	1.88E+01	nc	1.63E+01	nc	X	1.29E-03	2.58E-02
Heptachlor	1.08E+00	ca	4.26E+00	ca	3.63E+01	ca			
Hexachlorobenzene	3.04E+00	ca	1.20E+01	ca	1.02E+02	ca		8.27E-02	1.65E+00
Hexachloro-1,3-butadiene	1.20E+01	nc	1.37E+02	nc	4.66E+01	nc		8.08E-02	1.62E+00
Hexachlorocyclopentadiene	1.25E+02	nc	4.10E+03	nc	4.31E+02	nc		1.50E+01	3.00E+02
Hexachloroethane	6.00E+01	nc	6.84E+02	nc	2.33E+02	nc		1.37E-02	2.74E-01
n-Hexane	3.80E+01	sat	3.80E+01	sat	3.80E+01	sat	X	7.29E-01	1.46E+01
HMX	3.00E+03	nc	3.42E+04	nc	1.17E+04	nc			
Hydrogen cyanide	1.99E+01	nc	7.31E+01	nc	6.53E+01	nc	X	1.20E-03	2.40E-02
Indeno(1,2,3-c,d)pyrene	6.21E+00	ca	2.34E+01	ca	2.14E+02	ca		4.79E-01	9.58E+00
Iron	2.35E+04	nc	1.00E+05	max	9.29E+04	nc		3.27E+00	6.54E+01
Isobutanol	2.22E+04	sat	2.22E+04	sat	2.22E+04	sat	X	4.69E-01	9.39E+00

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Isophorone	5.12E+03	ca	2.02E+04	ca	4.66E+04	nc		1.69E-02	3.38E-01
Lead	4.00E+02		7.50E+02	nc	7.50E+02	nc		4.58E-01	9.17E+00
Lead (tetraethyl-)	6.11E-03	nc	6.84E-02	nc	2.38E-02	nc			
Maleic hydrazide	1.57E+03	sat	1.57E+03	sat	1.57E+03	sat	X	7.86E-01	1.57E+01
Manganese	1.55E+03	nc	2.18E+04	nc	1.48E+02	nc		5.24E-02	1.05E+00
Mercury (elemental)	2.35E+01	nc	3.41E+02	nc	8.44E+01	nc			
Mercury (methyl)	6.11E+00	nc	6.84E+01	nc	2.38E+01	nc			
Methacrylonitrile	3.61E+00	nc	2.00E+01	nc	1.28E+01	nc	X	1.69E-04	3.39E-03
Methomyl	1.96E+03	nc	2.83E+02	nc	2.49E+02	nc	X	5.64E-02	1.13E+00
Methyl acetate	7.82E+04	nc	1.00E+05	sat	1.00E+05	nc	X	1.03E+02	2.06E+03
Methyl acrylate	2.35E+03	nc	3.12E+02	nc	2.75E+02	nc	X	4.62E-01	9.24E+00
Methyl isobutyl ketone	5.43E+03	nc	6.90E+03	sat	6.90E+03	sat	X	5.81E-02	1.16E+00
Methyl methacrylate	2.83E+03	sat	2.83E+03	sat	2.83E+03	sat	X	2.64E-01	5.29E+00
Methyl styrene (alpha)	2.16E+02	sat	2.16E+02	sat	2.16E+02	sat	X	3.09E-01	6.18E+00
Methyl styrene (mixture)	1.28E+02	nc	2.16E+02	sat	2.16E+02	sat	X	4.31E-02	8.62E-01
Methylcyclohexane	2.10E+03	nc	7.63E+03	nc	6.87E+03	nc	X	1.35E+01	2.69E+02
Methylene bromide	1.12E+02	nc	4.54E+02	nc	3.74E+02	nc	X	1.28E-02	2.56E-01
Methylene chloride	1.65E+02	ca	4.40E+02	ca	2.55E+03	sat	X	8.44E-04	1.69E-02
Molybdenum	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc		2.02E+01	4.03E+02
Naphthalene	7.19E+01	nc	9.83E+01	sat	9.83E+01	sat	X	1.97E-02	3.93E-01
Nickel	1.56E+03	nc	2.25E+04	nc	5.61E+02	nc		1.30E+01	2.61E+02
Nitrate	1.00E+05	max	1.00E+05	max	1.00E+05	max			
Nitrite	7.82E+03	nc	1.00E+05	max	3.10E+04	nc			
Nitrobenzene	2.18E+01	nc	1.36E+02	nc	7.89E+01	nc	X	9.00E-04	1.80E-02
Nitroglycerin	3.47E+02	ca	1.37E+03	ca	1.19E+04	ca			
N-Nitrosodiethylamine	3.24E-02	ca	1.28E-01	ca	1.09E+00	ca			
N-Nitrosodimethylamine	9.54E-02	ca	3.76E-01	ca	3.20E+00	ca		1.15E-06	2.31E-05
N-Nitrosodi-*n*-butylamine	2.48E-01	ca	6.67E-01	ca	1.16E+01	ca	X	1.12E-06	2.24E-05
N-Nitrosodiphenylamine	9.93E+02	ca	3.91E+03	ca	3.40E+04	ca		2.94E-02	5.89E-01
N-Nitrosopyrrolidine	2.32E+00	ca	9.12E+00	ca	7.77E+01	ca			
m-Nitrotoluene	4.10E+02	nc	5.57E+02	sat	5.57E+02	sat	X	1.62E-02	3.24E-01

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
o-Nitrotoluene	4.10E+02	nc	5.57E+02	sat	5.57E+02	sat	X	1.62E-02	3.24E-01
p-Nitrotoluene	4.10E+02	nc	5.57E+02	sat	5.57E+02	sat	X	1.62E-02	3.24E-01
Pentachlorobenzene	4.80E+01	nc	5.47E+02	nc	1.86E+02	nc		1.00E+00	2.00E+01
Pentachlorophenol	2.98E+01	ca	1.00E+02	ca	1.03E+03	ca		1.06E-03	2.11E-02
Phenanthrene	1.80E+03	nc	2.05E+04	nc	6.99E+03	nc		3.81E+00	7.62E+01
Phenol	1.80E+04	nc	1.00E+05	max	6.99E+04	nc		1.05E-03	2.11E-02
Polychlorinatedbiphenyls		ca		ca		ca			
Aroclor 1016	2.22E+00	ca	8.26E+00	ca	1.50E+01	nc			
Aroclor 1221	2.22E+00	ca	8.26E+00	ca	7.61E+01	ca			
Aroclor 1232	2.22E+00	ca	8.26E+00	ca	7.61E+01	ca			
Aroclor 1242	2.22E+00	ca	8.26E+00	ca	7.61E+01	ca			
Aroclor 1248	2.22E+00	ca	8.26E+00	ca	7.61E+01	ca			
Aroclor 1254	1.11E+00	nc	8.26E+00	ca	4.28E+00	nc			
Aroclor 1260	2.22E+00	ca	8.26E+00	ca	7.61E+01	ca			
n-Propylbenzene	5.32E+01	sat	5.32E+01	sat	5.32E+01	sat	X	1.06E+00	2.13E+01
Propylene oxide	2.17E+01	ca	9.01E+01	ca	7.91E+02	ca	X	4.52E-05	9.05E-04
Pyrene	2.30E+03	nc	3.13E+04	nc	9.05E+03	nc	X	2.84E+01	5.68E+02
RDX	4.42E+01	ca	1.74E+02	ca	6.99E+02	nc			
Selenium	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc		2.58E-01	5.17E+00
Silver	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc		4.23E-01	8.47E+00
Strontium	4.69E+04	nc	1.00E+05	max	1.00E+05	max		2.03E+02	4.06E+03
Styrene	4.19E+02	sat	4.19E+02	sat	4.19E+02	sat	X	1.35E-01	2.70E+00
1,2,4,5-Tetrachlorobenzene	1.80E+01	nc	2.05E+02	nc	6.99E+01	nc			
1,1,1,2-Tetrachloroethane	3.93E+01	ca	1.03E+02	ca	8.55E+02	sat	X	1.33E-04	2.66E-03
1,1,2,2-Tetrachloroethane	5.20E+00	ca	1.36E+01	ca	2.56E+02	ca	X	1.70E-05	3.40E-04
Tetrachloroethene	9.83E+00	ca	2.46E+01	ca	9.76E+01	sat	X	3.22E-04	6.44E-03
Thallium	5.16E+00	nc	7.49E+01	nc	2.04E+01	nc		1.42E-01	2.85E+00
Toluene	2.48E+02	sat	2.48E+02	sat	2.48E+02	sat	X	3.40E-01	6.80E+00
Toxaphene	4.42E+00	ca	1.74E+01	ca	1.48E+02	ca		2.35E-02	4.71E-01
Tribromomethane	8.11E+02	ca	4.02E+03	ca	6.02E+03	nc		3.01E-02	6.02E-01
1,1,2-Trichloro-1,2,2-trifluoroethane	3.18E+03	max	1.00E+05	max	1.00E+05	max	X		

Chemical	Residential Soil (mg/kg)	Endpoint	Industrial/ Occupational Soil (mg/kg)	Endpoint	Construction Worker Soil (mg/kg)	Endpoint	VOC	DAF 1 (mg/kg)	DAF 20 (mg/kg)
1,2,4-Trichlorobenzene	6.51E+02	nc	8.53E+02	sat	8.53E+02	sat	X	1.99E-01	3.98E+00
1,1,1-Trichloroethane	5.51E+02	sat	5.51E+02	sat	5.51E+02	sat	X	2.49E-02	4.98E-01
1,1,2-Trichloroethane	1.07E+01	ca	2.70E+01	ca	1.75E+02	nc	X	1.24E-03	2.47E-02
Trichloroethene	6.48E-01	ca	1.59E+00	ca	3.41E+01	ca	X	2.33E-03	4.66E-02
Trichlorofluoromethane	5.28E+02	nc	9.59E+02	sat	9.59E+02	sat	X	1.13E+00	2.27E+01
2,4,5-Trichlorophenol	6.00E+03	nc	6.84E+04	nc	2.33E+04	nc		9.24E+00	1.85E+02
2,4,6-Trichlorophenol	6.00E+00	nc	6.84E+01	nc	2.33E+01	nc		2.66E-03	5.32E-02
1,1,2-Trichloropropane	2.27E+01	nc	8.61E+01	nc	7.49E+01	nc	X	1.15E-02	2.30E-01
1,2,3-Trichloropropane	3.20E+00	ca	1.59E+01	ca	1.69E+01	nc	X	2.08E-06	4.17E-05
1,2,3-Trichloropropene	1.78E+01	nc	6.67E+01	nc	5.85E+01	nc	X	1.12E-02	2.23E-01
Triethylamine	6.36E+01	nc	2.31E+02	nc	2.08E+02	nc	X	2.06E-03	4.12E-02
1,2,4-Trimethylbenzene	5.22E+01	nc	1.91E+02	nc	1.71E+02	nc	X	6.89E-02	1.38E+00
1,3,5-Trimethylbenzene	2.23E+01	nc	6.89E+01	sat	6.89E+01	sat	X	1.72E-02	3.44E-01
2,4,6-Trinitrotoluene	3.00E+01	nc	3.42E+02	nc	1.17E+02	nc			
Vanadium	5.48E+02	nc	7.95E+03	nc	2.17E+03	nc		4.03E+01	8.07E+02
Vinyl acetate	9.53E+02	nc	3.49E+03	nc	3.12E+03	nc	X	7.30E-02	1.46E+00
Vinyl bromide	5.67E+00	nc	2.06E+01	nc	1.85E+01	nc	X	3.93E-05	7.86E-04
Vinyl chloride (Child)	3.49E-01	ca							
Vinyl chloride (adult)			1.30E+01	ca	1.74E+02	ca	X	3.25E-04	6.49E-03
m-Xylene	8.00E+01	sat	8.00E+01	sat	8.00E+01	sat	X	8.13E+00	1.63E+02
o-Xylene	9.86E+01	sat	9.86E+01	sat	9.86E+01	sat	X	7.37E+00	1.47E+02
p-Xylene	1.24E+02	sat	1.24E+02	sat	1.24E+02	sat	X	7.88E+00	1.58E+02
Xylenes	1.32E+02	sat	1.32E+02	sat	1.32E+02	sat	X	5.07E-01	1.01E+01
Zinc	2.35E+04	nc	1.00E+05	max	9.29E+04	nc		6.22E+02	1.24E+04

Notes: [a] - An oral absorption efficiency of 5% was assumed for the dermal route.
ca – carcinogenic effect basis
nc – noncarcinogenic effect basis
sat – soil saturation limit basis
max – low toxicity maximum, health based SSL exceeds 10^5 mg/kg
Compounds solid at ambient temperature will present a risk-based level over the soil saturation level (USEPA 2001a)

Default Exposure Factors			
Symbol	**Definition (units)**	**Default**	**Reference**
CSF_o	Cancer slope factor oral $(mg/kg\text{-}day)^{-1}$	Chem.-spec.	IRIS, HEAST, or NCEA
CSF_i	Cancer slope factor inhaled $(mg/kg\text{-}day)^{-1}$	Chem.-spec.	IRIS, HEAST, or NCEA
RfD_o	Reference dose oral (mg/kg-day)	Chem.-spec.	IRIS, HEAST, or NCEA
RfD_i	Reference dose inhaled (mg/kg-day)	Chem.-spec.	IRIS, HEAST, or NCEA
TR	Target cancer risk	1E-05	NMED-specific value
THQ	Target hazard quotient	1	US EPA, 1989
BW	Body weight (kg)		
	-- adult	70	US EPA, 1989
	-- child	15	US EPA, 1991
AT	Averaging time (days)		
	-- carcinogens	25550	US EPA, 1989
	-- noncarcinogens	ED*365	
SA	Exposed surface area for soil/dust (cm^2/day)		US EPA, 1989
	– adult resident	5700	US EPA, 1996a
	– adult worker	3300	US EPA, 1996a
	-- child	2800	US EPA, 1989
AF	Adherence factor, soils (mg/cm^2)		US EPA, 1989
	– adult resident	0.07	US EPA, 1996a
	– adult worker	0.2	US EPA, 1996a
	-- child resident	0.2	US EPA, 1989
	– construction worker	0.3	NMED-specific value
ABS	Skin absorption defaults (unitless):		
	– semi-volatile organics	0.1	US EPA, 1989
	– volatile organics	na	US EPA, 2003a
	– inorganics	na	US EPA, 2000s
IRA	Inhalation rate (m^3/day)		
	-- adult resident	20	US EPA, 1991
	– adult worker	20	US EPA, 2001a
	-- child resident	10	Exposure Factors, (US EPA, 1997)
IRW	Drinking water ingestion rate (L/day)		
	-- adult	2.4	US EPA, 1997
	-- child	1.5	US EPA, 1997
IRS	Soil ingestion (mg/day)		
	-- adult residenti	100	US EPA, 1991
	-- child resident	200	US EPA, 1991
	-- commercial/industrial worker	100	US EPA, 2001a
	construction worker	330	US EPA, 1991
EF	Exposure frequency (days/yr)		
	-- residential	350	US EPA, 1991
	-- commercial/industrial	225	US EPA, 2001a
	– construction worker	250	NMED-specific value
ED	Exposure duration (years)		
	-- residential	30[a]	US EPA, 1991)
	-- child	6	(US EPA, 1991)
	-- commercial/industrial	25	(US EPA, 1999)
	– construction worker	1	NMED-specific value
	Age-adjusted factors for carcinogens		
IFSadj	Ingestion factor, soils ([mg-yr]/[kg-day])	114	US EPA, 2001a
SFSadj	Dermal factor, soils ([mg-yr]/[kg-day])	360	US EPA, 2001a
InhFadj	Inhalation factor, air ([m^3-yr]/[kg-day])	11	By analogy to RAGS: Part B, (US EPA, 1991)
IFWadj	Ingestion factor, water ([L-yr]/[kg-day])	1.1	By analogy to RAGS: Part B, (US EPA, 1991)
PEF	Particulate emission factor (m^3/kg)	Chem.-spec.	US EPA, 2001a
VFs	Volatilization factor for soil (m^3/kg)	Chem.-spec.	US EPA, 2001a
Csat	Soil saturation concentration (mg/kg)	Chem.-spec.	US EPA, 2001a

[a]Exposure duration for lifetime residents is assumed to be 30 years total. For carcinogens, exposures are combined for children (6 years) and adults (24 years).
Chem.-spec.- Chemical-specific value
na - not applicable
RAGS – Risk Assessment Guidance for Superfund
IRIS – Integrated Risk Information System, USEPA, 2003b
HEAST – Health Effects Assessment Summary Tables, USEPA, 1997
NCEA – National Center for Environmental Assessment, Office of Research and Development (USEPA, 2003c)
NMED – New Mexico Environment Department