ENTERED

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

JUL 2009

JUL 16 2009

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

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

Dear Ms. Stewart

Cannon Air Force Base, NM is forwarding two hardbound and two electronic copies of the Final, Playa Lake (SWMU 103) Corrective Measures Study Work Plan, Cannon Air Force Base, New Mexico, July 2009 for your review and approval.

If you have any questions, please contact Mr. Hugh G. Hanson, Asset Management Flight, at 575-784-6031 (temporary).

Sincerely

Ronald A. Lancaster, YC-03

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

Air Commandos

F I N A L

PLAYA LAKE (SWMU 103)
CORRECTIVE MEASURES STUDY WORK PLAN

CANNON AIR FORCE BASE
NEW MEXICO

July 2009

Prepared for:

Air Force Special Operations Command

27th Special Operations Wing

Under contract to:

U.S. Army Corps of Engineers
Omaha District

URS
12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154

THIS PAGE INTENTIONALLY BLANK

FINAL
PLAYA LAKE (SWMU 103)
CORRECTIVE MEASURES STUDY WORK PLAN
CANNON AIR FORCE BASE, NEW MEXICO

July 2009

Prepared by:

United States Army Corps of Engineers
Omaha District
and
URS Group, Inc.
12120 Shamrock Plaza
Omaha, Nebraska 68154

Contract Number W9128F-04-D-0001
Task Order 0071
Modification 01

THIS PAGE INTENTIONALLY BLANK

TABLE OF CONTENTS

Section 1 Introduction 1-1
1.1 Purpose and Scope 1-1
1.2 Project Work Authority 1-1
1.3 Regulatory Framework 1-1
1.4 Schedule 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
2.6.1 Cannon AFB Vicinity 2-5
2.6.2 Background Metals Concentrations in Soil 2-6
2.7 Biological Resources 2-6
2.7.1 Plant Resources 2-6
2.7.2 Wildlife Resources 2-7

Section 3 SWMU 103 Site Background 3-1
3.1 Site Description 3-1
3.2 Site History 3-1
3.3 Current Use 3-1
3.4 Previous Investigations 3-1
3.4.1 Phase I RFI 3-1
3.4.2 Phase II RFI 3-2
3.4.3 Human Health and Ecological Risk Re-evaluations 3-4
3.4.3.1 Human Health Risk Re-evaluation 3-4
3.4.3.2 Ecological Risk Re-evaluation 3-4

Section 4 CMS Objectives and Approach CMS Objectives and Approach 4-1
4.1 Corrective Measures Study Objectives 4-1
4.2 Corrective Measures Study Approach 4-1
4.2.1 Sediment 4-2
4.2.2 Surface water 4-2
4.2.3 Corrective Measures Alternatives Guidelines 4-2
4.3 Evaluation of Corrective Measures Alternative(s) 4-2
4.4 Preliminary Development of Site Conceptual Exposure Models (SCEMs) 4-4
4.5 Evaluation of Background Concentrations 4-5
4.6 Human Health Risk Evaluation Methodology 4-5
4.6.1 Derivation of NMED SSLs 4-6
4.7 Screening-Level Ecological Risk Evaluation Methodology 4-7
4.8 Corrective Measures Study Report 4-7

TABLE OF CONTENTS

Section 5 Field Sampling Plan 5-1
5.1 Standard Operating Procedures 5-1
5.2 Mobilization 5-1
5.2.1 Base Passes 5-1
5.2.2 Utility Locates and Digging Permits 5-1
5.3 Surveying 5-2
5.4 Data Collection 5-2
5.4.1 Surface Water Sampling 5-2
5.4.2 Sediment Sampling 5-2
5.5 Analytical Parameters and Sample Quantities 5-3
5.6 Sample Identification, Handling, and Documentation 5-3
5.6.1 Sample Identification 5-3
5.6.2 Field Documentation 5-4
5.7 Quality Assurance/Quality Control Samples 5-6
5.8 Decontamination and Investigation-Derived Waste 5-6

Section 6 References 6-1

TABLE OF CONTENTS

List of Tables (Tables are included at the end of each section.)

Table 2-1 Summary of Background Elemental Concentrations in Soil Samples

Table 2-2 Federal – and State-Protected Animals Potentially Occurring in the Vicinity of Cannon AFB

Table 5-1 Surface Water and Sediment Sampling Summary for Corrective Measures Study

List of Figures (Figures are included at the end of each section.)

Figure 1-1 Playa Lake (SWMU 103) – Location Map

Figure 1-2 Playa Lake (SWMU 103) – Site Map

Figure 2-1 Generalized Geologic Strata at Cannon Air Force Base

Figure 2-2 Elevation and Configuration of the Water Table in the Region of Cannon Air Force Base

Figure 2-3 Water Well Locations On and Near Cannon Air Force Base

Figure 2-4 Distribution of Soils by Type at Cannon Air Force Base

Figure 5-1 Playa Lake (SWMU 103) – Planned CMI Sample Locations Map

List of Appendices

Appendix A Site Safety and Health Plan

Appendix B Quality Assurance Project Plan

Appendix C Standard Operating Procedures

Appendix D New Mexico Environment Department (NMED) Soil Screening Levels (SSLs)

Appendix E Human Health Risk Evaluation

Appendix F Ecological Risk Assessment

TABLE OF CONTENTS

List of Acronyms

AFB	Air Force Base
AFSOC	Air Force Special Operations Command
APPL	Agriculture and Priority Pollutants Laboratories, Inc.
B.P.	before present
BRA	Baseline Risk Assessment
°C	Degrees Celsius
CEC	cation exchange capacities
CES	Civil Engineering Squadron
CFR	Code of Federal Regulations
cm	centimeters
cm/sec	centimeters per second
cm/yr	centimeters per year
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	chemicals of concern
CoC	chain of custody form
COPC	chemicals of potential concern
DQCR	daily quality control report
DQO	data quality objective
EMAX	EMAX Laboratories, Inc.
°F	Degrees Fahrenheit
FIPs	Federal Information Processing Standard
FSP	Field Sampling Plan
gal/ft	gallon per foot
HQ	hazard quotient
IDW	investigation derived waste
in/yr	inches per year
IRP	Installation Restoration Program

km/hr	kilometers per hour
L/min	liters per minute
m	meters
MCL	Maximum Contaminant Level
mm	millimeter
m^3/m	cubic meters per meter
mph	miles per hour
msl	mean sea level
m/yr	meters per year
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NMAC	New Mexico Administrative Code
NMED	New Mexico Environmental Department
NWR	National Wildlife Refugees
PCB	Polychlorinated Biphenyl
pH	hydrion ion exponent
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
RBC	Risk Based Concentrations
RBCA	Risk Based Corrective Action
RCRA	Resource Conservation & Recovery Act
RFI	RCRA Facility Investigation
RfD	reference dose
SCEM	Site Conceptual Exposure Model
SCFS	sample collection field sheet
SHSP	Site Health and Safety Plan
SOP	standard operating procedure
SSL	soil screening levels

SSTL	site-specific target levels
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
T&E	threatened & endangered
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
URS	URS Group, Inc.
U.S.	United States
USACE	United States Army Corps of Engineers
USCS	United Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UTLs	Upper Tolerance Limits
VOC	volatile organic compound
W-C	Woodward and Clyde
WP	work plan
WWTP	Waste Water Treatment Plant

1.1 PURPOSE AND SCOPE

This Corrective Measures Study Work Plan (CMS WP) describes the activities to be completed at Solid Waste Management Unit (SWMU) 103, Playa Lake, at Cannon Air Force Base (AFB) near Clovis, New Mexico.

This CMS WP for the Playa Lake (SWMU 103) is a living document. A living document is one that can be modified, as necessary, in order to best achieve the goals and objectives stated within. Based on field observations, site conditions, and other unforeseen circumstances or conditions, the sampling designs, sampling locations, and sampling numbers stated in this document may be modified in order to best achieve the objectives of the CMS.

The purpose of the CMS is to develop and evaluate Corrective Measures Alternatives and to recommend the selected final Corrective Measure(s) for Playa Lake (SWMU 103). A regional map showing the location of Cannon AFB is shown on **Figure 1-1**. A map of Cannon AFB and the location of Playa Lake (SWMU 103) is shown on **Figure 1-2**.

Section 2 of the CMS WP provides a facility description of Cannon AFB. **Section 3** discusses the site background of Playa Lake (SWMU 103). **Section 4** describes the CMS objectives, approach, and decision process. In addition to the CMS WP, the documents required to complete the CMS for Playa Lake (SWMU 103) include: the Field Sampling Plan (FSP), Site Health and Safety Plan (SHSP) [**Appendix A**], Quality Assurance Project Plan (QAPP) [**Appendix B**]. **Appendix C** contains the standard operating procedures (SOPs). The New Mexico Environment Department (NMED) Soil Screening Levels (SSLs) are presented in **Appendix D** (NMED 2006a & b). **Appendix E** contains the Human Health Risk Evaluation and **Appendix F** contains the Ecological Risk Assessment.

1.2 PROJECT WORK AUTHORITY

This CMS project for Playa Lake (SWMU 103) is being completed by URS Group, Inc. (URS) under United States (U.S.) Army Corps of Engineers (USACE) Omaha District Contract W9128F-04-D-0001, Task Order 0071, Modification 01 to support Cannon AFB.

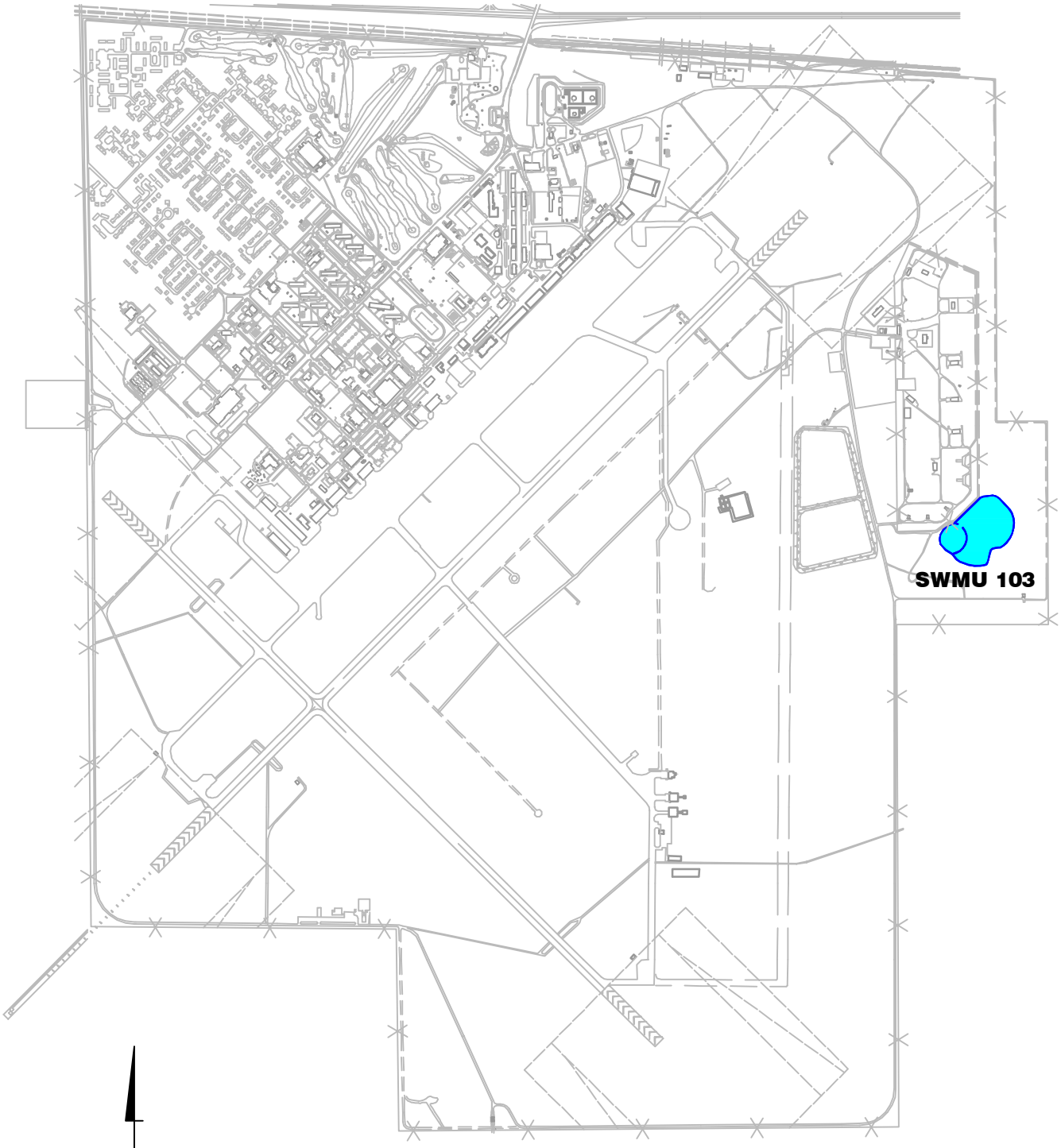
1.3 REGULATORY FRAMEWORK

Playa Lake (SWMU 103) is identified as an Appendix III SWMU in Cannon's Resource Conservation & Recovery Act (RCRA) permit. The CMS WP follows the general requirements of Cannon's RCRA permit and 40 CFR Part 264, Subpart S, Corrective Action for Solid Waste Management Units.

1.4 SCHEDULE

The schedule for activities associated with the CMS to be completed at Playa Lake (SWMU 103) at Cannon AFB is presented below.

Tasks	Duration
CMS Work Plan	
• Prepare Draft Corrective Measures Study Work Plan	85 Days
• USACE and Cannon AFB Review and Comment	30 Days
• Prepare Final CMS Work Plan	5 Days
• NMED Review and Comment	270 Days
• Prepare Final CMS Work Plan, Revision 1	18 Days
CMS Field Investigation	
• Collect Samples	5 Days
• Receive Analytical Results	5 Days
• Validate and Review Analytical Data	5 Days
• Screen New Data	5 Days
Site Closure Report	
• Prepare Draft Site Closure Report	25 Days
• USACE and Cannon AFB Review and Comment	30 Days
• Prepare Final Site Closure Report	10 Days
• NMED Review and Comment	480 Days
• Prepare Final CMS Work Plan, Revision 1	18 Days



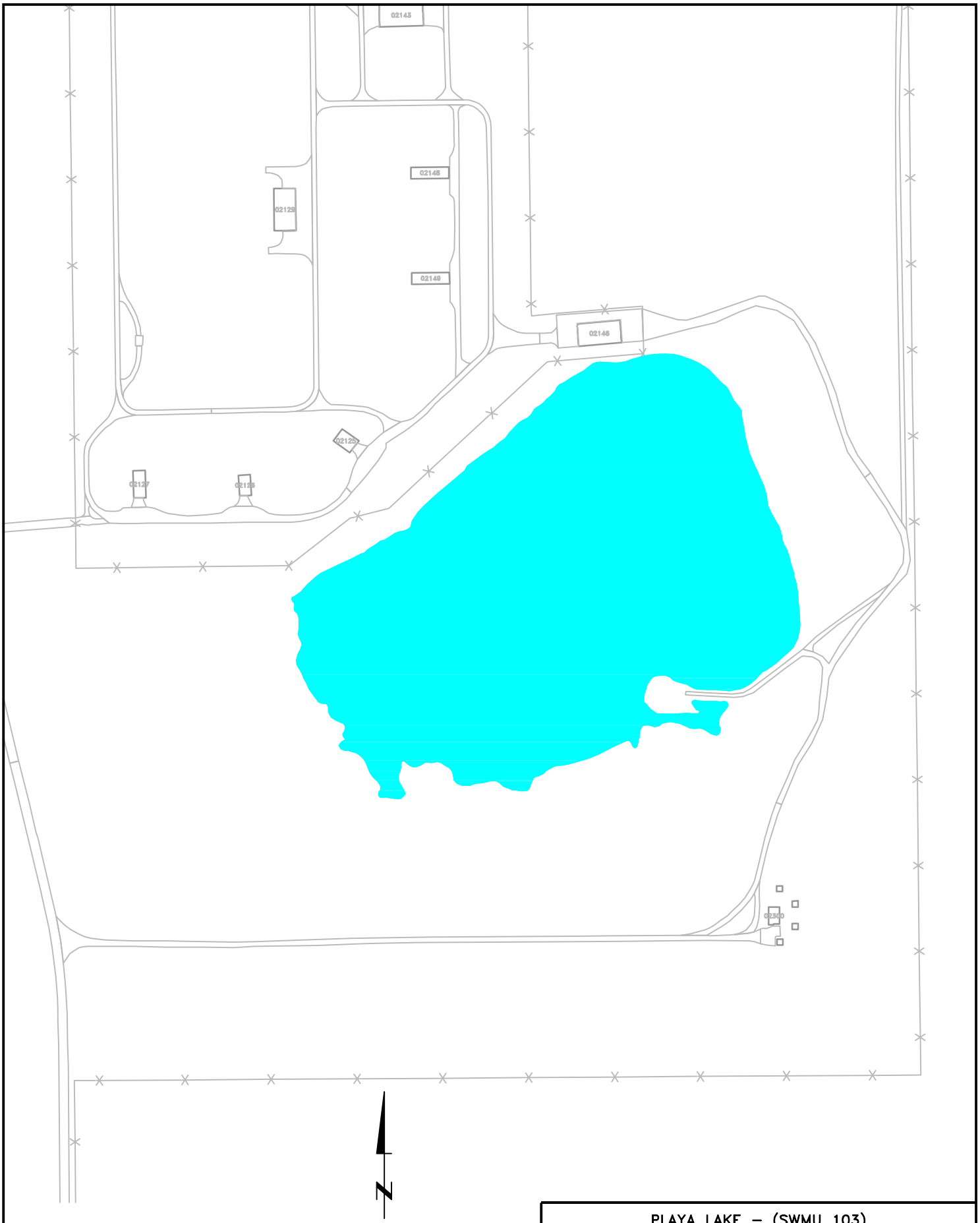
2000 1000 0 2000

SCALE IN FEET

May 27, 2009 1:57:08 p.m.
Drawing: T:\CANNON\16170402\200\1-1.dwg

PLAYA LAKE – (SWMU 103)
LOCATION MAP
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 05/08/09	PROJECT NO. 16170402	FIG. NO. 1-1
CHK'D. BY: .	REVISION: 0		



May 27, 2009 1:56:33 p.m.
Drawing: T:\CANNON\16170402\200\1-2.dwg

PLAYA LAKE – (SWMU 103)
SITE MAP
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 04/23/09	PROJECT NO. 16170402	FIG. NO. 1-2
CHK'D. BY: .	REVISION: 0		

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 to the south. Relict dunes are not found on or near Cannon AFB.

Blowouts are broad, shallow depressions that 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 Cannon AFB, and several more are found to the north and east of Cannon AFB.

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 west of the City of Clovis, New Mexico and just south of U.S. Highway 60-84 in a farming and ranching area. 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" (W-C 1991). There were 33,063 people living in Clovis in 2004 according to U.S. Census data, while the Cannon AFB population was estimated to be 2,600 in 2008 with a significant increase planned as part of the Air Force Special Operations Command (AFSOC) beddown.

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 degrees Celsius (°C) (39 degrees Fahrenheit [°F]) to a July high of 26°C (78°F). Extreme daily temperatures range from –24°C (-11°F) to 41°C (106°F) (Lee Wan 1990). Average monthly precipitation ranges from 1 centimeter (cm) (0.4 inch) in winter to 6.9 cm (2.7 inches) in July. The maximum-recorded 24-hour rainfall was 12.2 cm (4.8 inches), which occurred in the

month of August. Rainfall occurs on eight or more days per month during the summer precipitation maximum. Mean annual precipitation is approximately 41 cm (16 inches). The mean annual evapotranspiration rate is 181.4 centimeters per year (cm/yr) (71.4 inches per year [in/yr]) (Lee Wan 1990). Prevailing winds are from the west at an average of 5 kilometers per hour (km/hr) (3.1 miles per hour [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 (m) in the morning to 4,000 m in the afternoon. The afternoon mixing heights are typically greater during the spring and fall. The morning mixing heights are usually low due to nighttime heat loss from the ground, producing surface-based temperature inversions. After sunrise, these inversions break up, and solar heating of the earth's surface causes vertical mixing in the atmosphere.

Dust is frequently entrained into the atmosphere in this region of the country because of gusty winds and the semi-arid climate. The Texas Panhandle-eastern New Mexico area is considered the worst area in the United States for windblown dust. Occasionally, this windblown dust is of sufficient quantity to restrict visibility. Most of the seasonal dust storms occur in March and April, when the wind speeds are typically high (i.e., average 5 km/hr [3.1 mph]) (W-C 1991).

2.4 GEOLOGY

A generalized geologic section at Cannon AFB is shown in **Figure 2-1**. 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.

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 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. According to Lee Wan (1990), 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 Formation 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 Formation dips gently and monoclinally to the southeast in the vicinity of Cannon AFB. As reported by Lee Wan (1990), data suggest that some quaternary 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 Formation internal stratigraphy varies vertically and horizontally over short distances.

Except where strongly cemented by calcium carbonate (caliche), the sediments of the Ogallala Formation are loose and friable. Authigenic and allogenic clays are found as a trace to abundant matrix mineral (Lee Wan 1990). As reported by Lee Wan (1990), five zones have been distinguished within the Ogallala Formation 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. 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 by Lee Wan (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 Formation 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 millimeters [mm] in diameter) (Lee Wan 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 Formation, and is locally termed “caprock.” The climax caliche is typically 3 to 5 feet thick. Caliches that

occur lower in the Ogallala Formation 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 that serve as the basal confining layer. The Ogallala aquifer is a water table, or unconfined, aquifer (Lee Wan 1990). The Ogallala aquifer has a southeasterly regional gradient of about 17 feet per mile (ft/mi) (0.0032 meters per meter [m/m]) (see **Figure 2-2**). Well yields vary from less than 1 gallon per minute (gpm) in thin silts and sands and up to 1,600 gpm in thick sands and gravels (Lee Wan 1990). Water quality is generally good, with hardness and fluorides being somewhat high (Lee Wan 1990).

Beneath the eastern portion of Cannon AFB, the depth to groundwater has been measured between 270 and 300 feet bgs. Saturated thickness of the Ogallala aquifer 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 ft/mi (Lee Wan 1990). Yields in tests of Cannon AFB water wells have ranged from 776 liters per minute (L/min) (205 gpm) to 4,353 L/min (1,150 gpm). Specific capacities range from 0.14 cubic meters per meter (m^3/m) (11.4 gallons per foot [gal/ft]) to 0.35 m^3/m (27.9 gal/ft) (Lee Wan 1990).

Very rough estimates of hydraulic conductivity were made from well pump tests in water wells 5 and 9 (**Figure 2-3**) 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 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} centimeters per second (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 Consultants, Inc. (W-C) in February 1995 (W-C 1995). 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 by Lee Wan (1990), a groundwater flow velocity of about 45 meters per year (m/yr) (150 feet per year [ft/yr]) has been estimated. This calculates out to a hydraulic conductivity of approximately 1.4×10^{-4} 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 Installation Restoration Program (IRP)

projects and published reports (Lee Wan 1990) indicated that interstitial and interstratified clays are abundant in the Ogallala Formation.

Recharge to the Ogallala aquifer is primarily through precipitation. A recharge rate of 0.5 in/yr was calculated using the Theis equation, and the recharge rate may be as much as 1.0 in/yr (Lee Wan 1990). 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 rain waters, and is leached over time to form percolation pathways.

Discharge from the Ogallala aquifer occurs through well pumping and springs along the eroded margins of the formation. Spring discharge does not occur on or near Cannon AFB. However, domestic and irrigation water wells are common on and around Cannon AFB. The rate of discharge exceeds the rate of recharge. Water levels in the Ogallala aquifer 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 (1990), states "the largest area of water level decline exceeding 100 feet occurs south of the Canadian River extending from Curry County, New Mexico to Crosby County, 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 2-3**).

The Ogallala aquifer 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

2.6.1 Cannon AFB Vicinity

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 by Lee Wan (1990).

The most common soil type on Cannon AFB is Amarillo fine sandy loam, 0- to 2-percent slope phase (map symbol Ab on **Figure 2-4**). 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 Cannon AFB 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 1990).

2.6.2 Background Metals Concentrations in Soil

Soils in the vicinity of Cannon AFB are generally alkaline and naturally contain higher concentrations of metals. Elevated concentrations of aluminum, calcium, iron, magnesium, manganese, and potassium have been found to naturally occur in this area.

A summary of background elemental concentrations in soil samples at Cannon AFB is presented in **Table 2-1**. Data for this table were initially presented in the final report "Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon Air Force Base, New Mexico" (W-C 1997a). Additional information regarding historical background soil data is available in this report.

2.7 BIOLOGICAL RESOURCES

Land adjacent to Cannon AFB is primarily used for agriculture, and there is little natural vegetation remaining in the area. There are a few playa lakes in the area; these are used by upland game for cover, by waterfowl for resting and feeding, and by wildlife in general for drinking. Nearby riverbeds also provide water sources during rainy seasons. During periods of low rainfall, the riverbeds are dry (W-C 1991).

2.7.1 Plant Resources

The undisturbed natural vegetation is mostly shortgrass prairie, including blue grama grassland and mixed grama grassland vegetation types, which have moderately fast recovery rates. Woodlands composed of large shrubs and small trees are confined to riparian areas and playa lakes in the vicinity (W-C 1991).

The following plants are candidate species for the Federal List of Endangered and Threatened Wildlife and Plants and are found within a 50-mile radius of Cannon AFB: chatterbox orchid (*Epipactus gigantea*), spiny aster (*Aster harridus*), Whittmans milkvetch (*Asragalus witmanii*), dune unicorn plant (*Proboscidea sabulosa*), and the tall plains spruce (*Eupjorbia strictior*). The

dune unicorn plant is also on the state endangered plant species list. No federally protected endangered plants are known to be present on the Base (Lee Wan 1990).

2.7.2 Wildlife Resources

The eastern New Mexico area contains many nongame wildlife species that are typical of the High Plains. Most of these species are distributed widely throughout the western United States. Species diversity is low in most habitats because of the low vegetation diversity. Most amphibian species are associated with riparian habitats and playa lakes. Reptiles are found in all terrestrial habitat types, but are most abundant in scrub/grasslands. Nocturnal rodents are the most abundant members of the small mammal community.

Grasslands on the High Plains support a variety of seed-eating sparrows and other ground-dwelling birds, both as residents and migrants. Raptors (hawks and owls) are relatively abundant in all habitats in the region. Insectivorous and tree-nesting species are most abundant in riparian areas. Shorebirds and waterfowl utilize the rivers, playa lakes, and reservoirs of the region.

Two National Wildlife Refuges (NWRs) are located in the region surrounding Cannon AFB area. The Grulla and Muleshoe NWRs are within 30 miles of the Base. These areas provide high-quality habitat for waterfowl.

Big-game species in the area include mule deer, white-tailed deer, pronghorn, and barbary sheep. Pronghorn are the most abundant game animal in the area. Several species of upland game, such as quail, ring-necked pheasant, and turkey are common in the area. Reservoirs (Ute Lake, Conchas Lake, and Clayton Lake) and playa lakes are important waterfowl habitats in the region. Numerous species of native and introduced fish inhabit the rivers and perennial streams, and the reservoirs support recreational fishing of warm-water species such as walleye, crappie, channel catfish, largemouth bass, and bluegill.

As determined by the regional office of the U.S. Fish and Wildlife Service, two federally listed endangered animal species, the bald eagle and peregrine falcon, are known to inhabit the area within a 50-mile radius of Cannon AFB. The New Mexico Department of Game and Fish also indicated that the state endangered Mississippi kite, Baird's sparrow, and the black-footed ferret may also occur in the vicinity of the Base. The federal- and state-protected species are listed in **Table 2-2**.

Within Curry County, the only state-protected bird that is expected to occur is the Mississippi Kite. In New Mexico, since the early 1960s, this kite summers regularly and breeds in the Clovis region. The birds frequent the golf course at Cannon AFB. Two other state-protected birds that may occur within Curry County are the McCown's longspur and Baird's sparrow. These two species have not been sighted regularly in recent years. No information is available on the McCown's longspur in New Mexico; however, Baird's sparrow occurs mainly in autumn during migration in the eastern plains and southern lowlands. Migratory birds appear as early as the first week of August and move further south by November. The species seems to have declined in abundance throughout its range in the Southwest due to the loss of shrubby shortgrass habitats.

State-protected birds known to occur infrequently are the bald eagle and the peregrine falcon. The bald eagle migrates and winters from the northern border of New Mexico to the Gila, lower Rio Grande, middle Pecos, and Canadian valleys. It is seen occasionally in summer and as a breeding bird, with nests reported in the extreme northern and western parts of the state. Winter and migrant populations appear to have increased with reservoir construction. The peregrine falcon is widely distributed but population numbers are low. The American subspecies breeds statewide in New Mexico, but mainly west of the eastern plains (Draft EIS 1990).

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 of Background Concentrations (UTLs)	
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 sample 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.

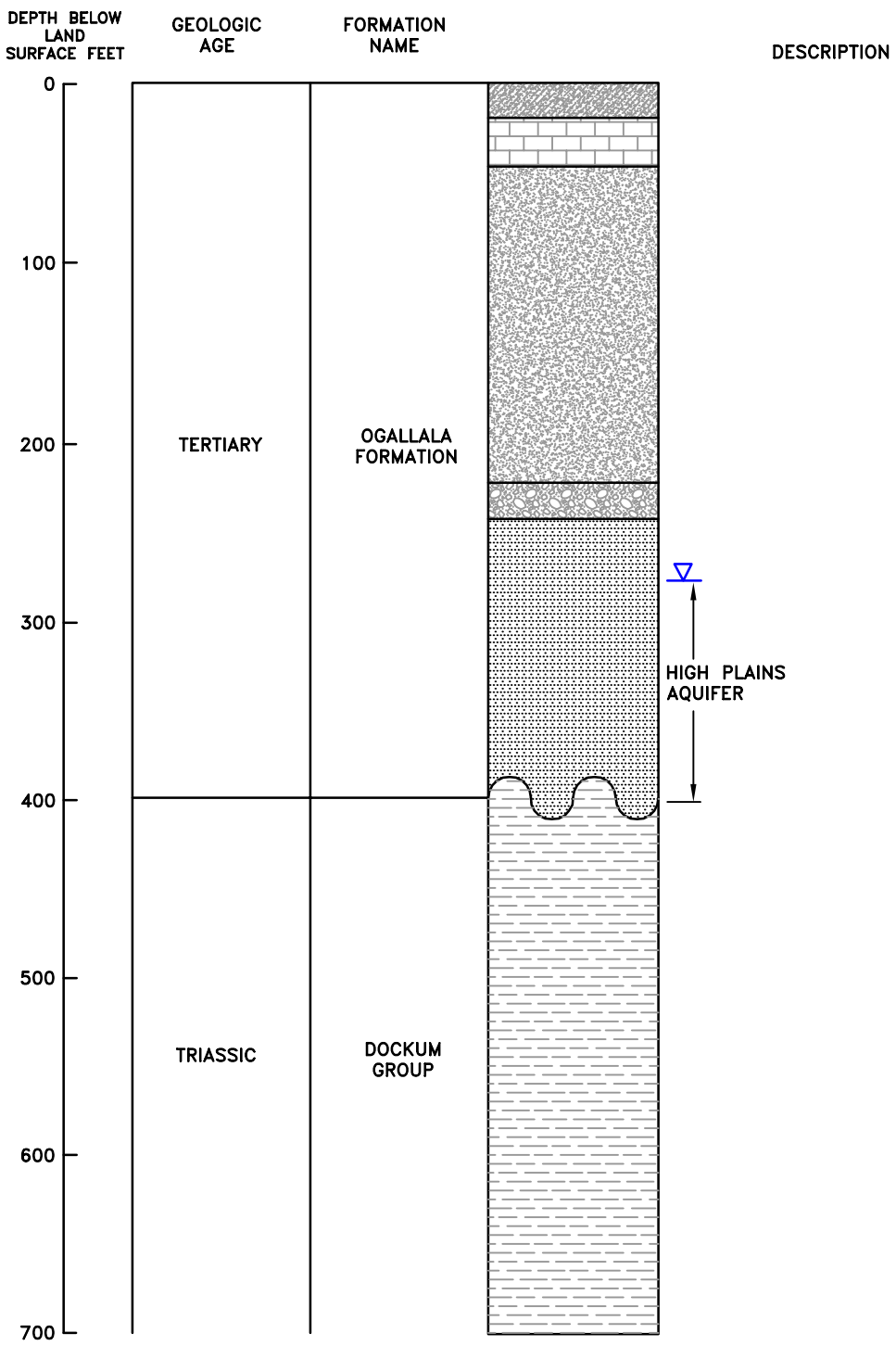
(4) Values determined from a data set including one-half of the reporting limits for nondetects.

(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.

TABLE 2-2
FEDERAL- AND STATE-PROTECTED ANIMALS POTENTIALLY OCCURRING IN THE VICINITY OF CANNON AFB (CURRY COUNTY)

Common Name	Scientific Name	Federal Status	State Status
Birds			
Eagle, Bald	Haliaeetus leucocephalus alascanus (NM)		Threatened
Falcon, Peregrine	Falco peregrinus		Threatened
Falcon, Peregrine, Arctic	Falco peregrinus tundrius		Threatened
Tern, Least	Sterna antillarum athalassos	Endangered	Endangered

Source: New Mexico Game and Fish Department, Bison-M 2009



LEGEND

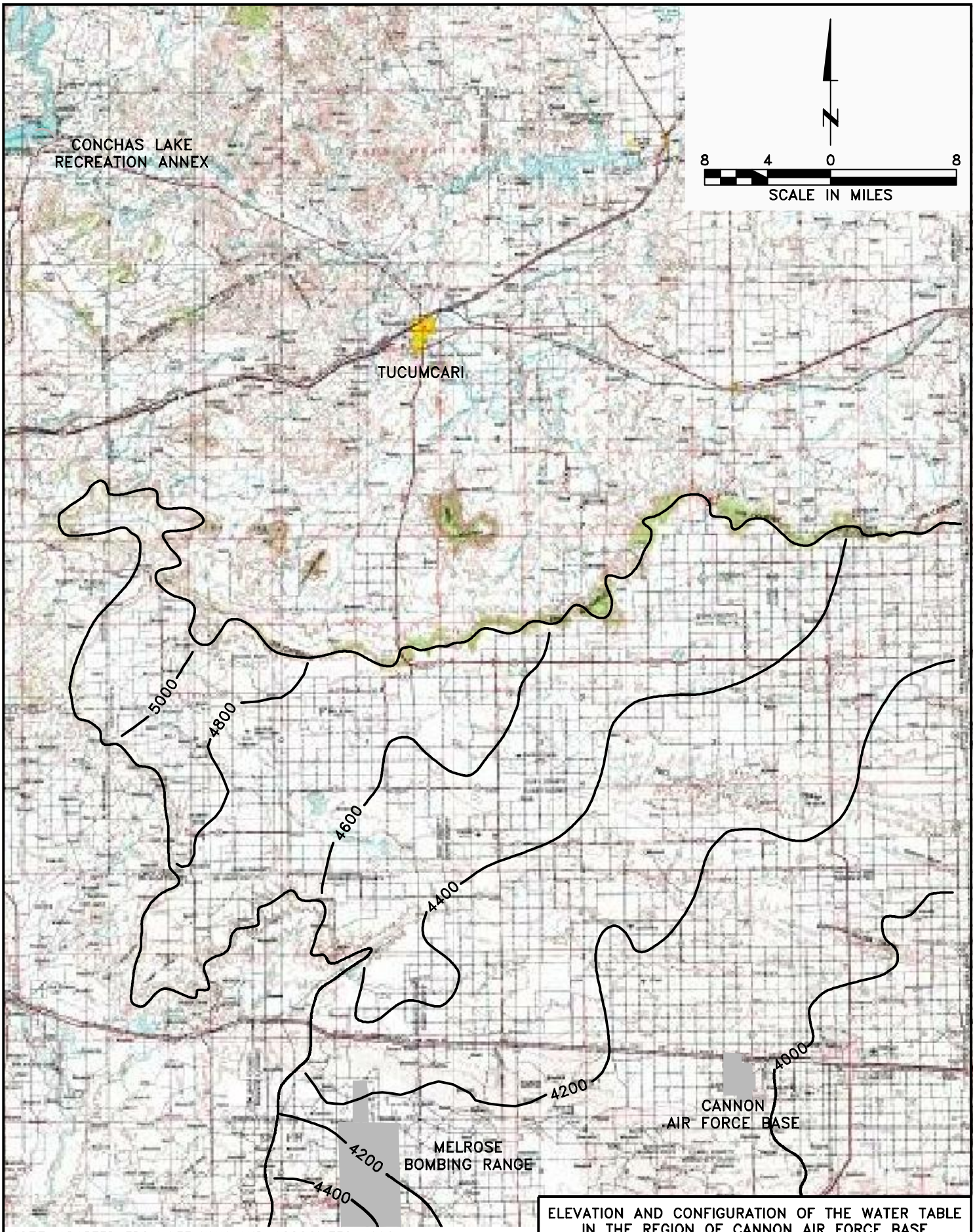
- SILTY SAND WITH CALICHE
- CALICHE
- SAND AND SILTY SAND
- SANDY GRAVEL
- SAND
- SANDSTONE (RED BEDS)
- LITHOLOGIC CONTACT
- EROSIONAL UNCONFORMITY
- WATER LEVEL

SOURCE: MODIFIED FROM GUTENTAG ET.AL., 1984

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

DRN. BY: DPG	DATE: 05/08/09	PROJECT NO. 16170402	FIG. NO. 2-1
CHK'D. BY: JLV	DATE: 05/08/09		

May 27, 2009 1:56:16 p.m.
Drawing: T:\CANNON\16170402\200\2-1.dwg

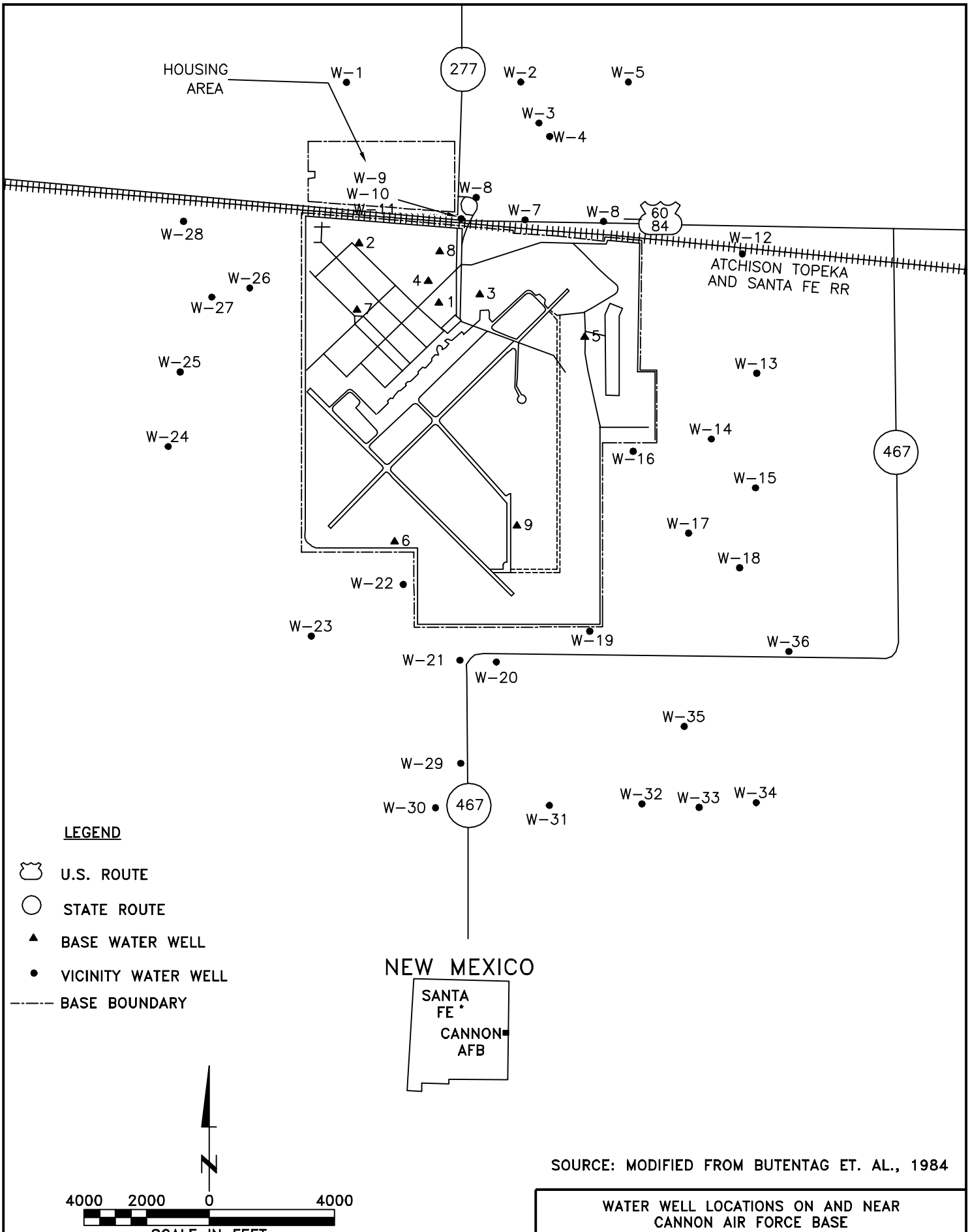


NOTE: ADAPTED FROM LEE WAN AND ASSOCIATES 1990
ORIGINAL SOURCE: USGS

May 27, 2009 1:56:02 p.m.
Drawing: T:\CANNON\16170402\200\2-2.dwg

ELEVATION AND CONFIGURATION OF THE WATER TABLE
IN THE REGION OF CANNON AIR FORCE BASE
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 05/08/09	PROJECT NO. 16170402	FIG. NO. 2-2
CHK'D. BY: JLV	REVISION: 0		

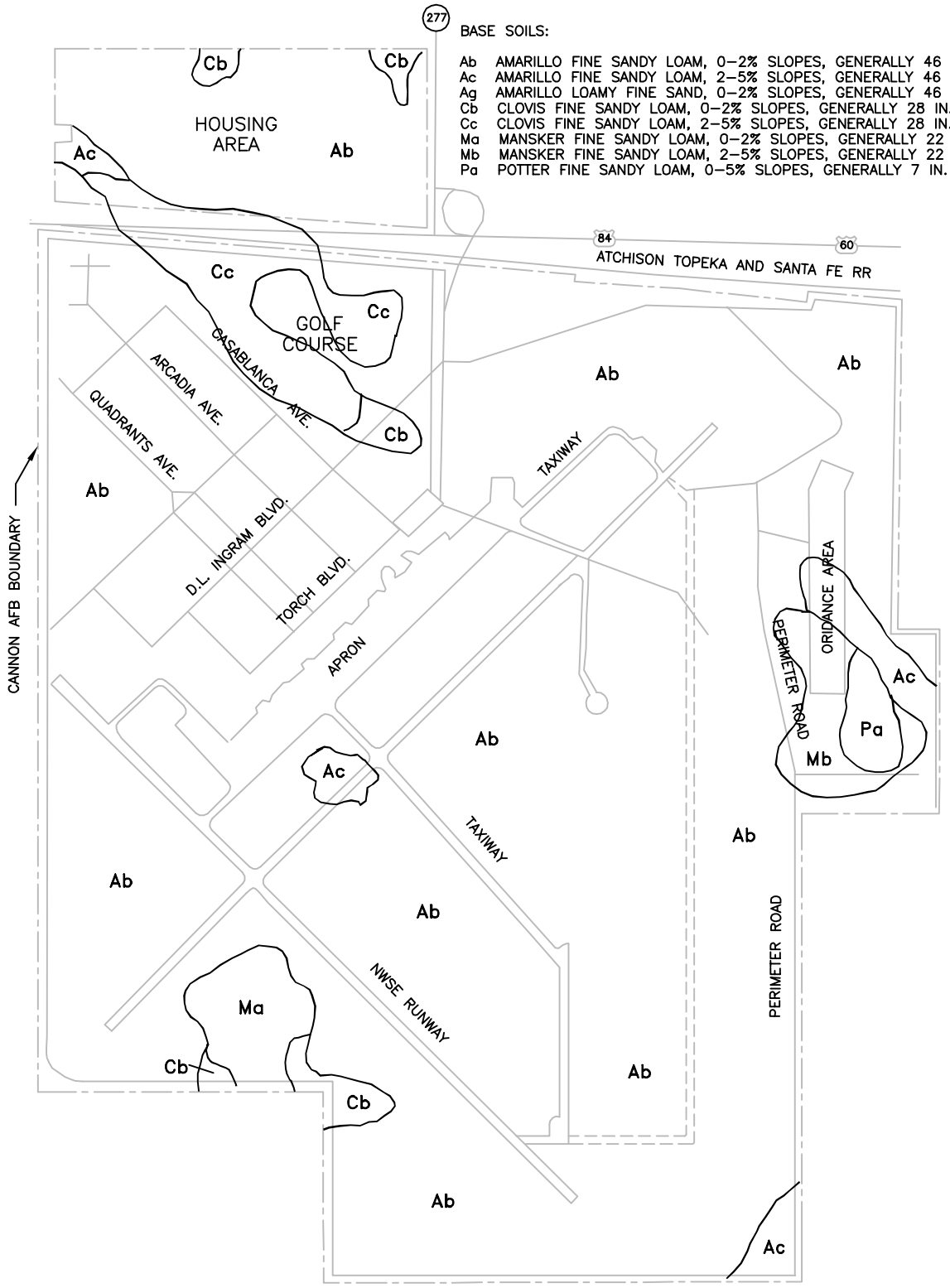


SOURCE: MODIFIED FROM BUTENTAG ET. AL., 1984

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

DRN. BY: DPG	DATE: 05/08/09	PROJECT NO. 16170402	FIG. NO. 2-3
CHK'D. BY: JLV	DATE: 05/08/09		

May 27, 2009 1:55:49 p.m.
Drawing: T:\CANNON\16170402\200\2-3.dwg



BASE SOILS:

Ab AMARILLO FINE SANDY LOAM, 0–2% SLOPES, GENERALLY 46 IN. THICK
Ac AMARILLO FINE SANDY LOAM, 2–5% SLOPES, GENERALLY 46 IN. THICK
Ag AMARILLO LOAMY FINE SAND, 0–2% SLOPES, GENERALLY 46 IN. THICK
Cb CLOVIS FINE SANDY LOAM, 0–2% SLOPES, GENERALLY 28 IN. THICK
Cc CLOVIS FINE SANDY LOAM, 2–5% SLOPES, GENERALLY 28 IN. THICK
Ma MANSKER FINE SANDY LOAM, 0–2% SLOPES, GENERALLY 22 IN. THICK
Mb MANSKER FINE SANDY LOAM, 2–5% SLOPES, GENERALLY 22 IN. THICK
Pa POTTER FINE SANDY LOAM, 0–5% SLOPES, GENERALLY 7 IN. THICK

N

2000 1000 0 2000
SCALE IN FEET

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

DISTRIBUTION OF SOILS BY TYPE AT
CANNON AIR FORCE BASE
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 05/08/09	PROJECT NO. 16170402	FIG. NO. 2–4
CHK'D. BY: JLV	DATE: 05/08/09		

May 27, 2009 1:55:34 p.m.
Drawing: T:\CANNON\16170402\200\2-4.dwg

3.1 SITE DESCRIPTION

Playa Lake (SWMU 103) occupies approximately 13 acres within Cannon AFB near the ordnance area at the east-central edge of the Base (**Figure 1-1**). This shallow pond is maintained at capacity by inflow from the wastewater treatment plant located to the west. The lake is approximately 1,000 feet across at the widest part of the lake and is estimated to be a maximum of five feet deep with a gradual sloping bottom.

3.2 SITE HISTORY

Playa Lake (SWMU 103) received all of Cannon AFB sanitary and industrial wastewater from 1943 to 1966; a portion of the wastewater was treated with an Imhoff unit prior to discharge to the Playa Lake. In 1966, a lagoon system was placed in operation that provided aeration treatment of the wastewater prior to discharge of treated effluent to Playa Lake (SWMU 103). The lake received treated sanitary and industrial wastewater effluent from the wastewater treatment lagoons from 1966 to 1998; the lagoons were decommissioned in 2003. A new Waste Water Treatment Plant (WWTP) was built and put into commission in 1998. A portion of the treated effluent is discharged to a golf course pond where it is used for irrigation. The remainder of the effluent is discharged to Playa Lake. The WWTP is regulated by a National Pollution Discharge Elimination System permit issued by the USEPA and a New Mexico Ground Water Discharge Permit. The WWTP consistently meets its discharge requirements. In 2006 and 2007 it was awarded the New Mexico Water and Wastewater Association's Good Housekeeping Award for best overall operations and maintenance practices.

3.3 CURRENT USE

Playa Lake (SWMU 103) continues to receive treated effluent directly from the wastewater treatment plant. There are no streams or water bodies entering or exiting the lake. Water exits the lake via evaporation and possibly via infiltration. Very little vegetation surrounds the lake; weeds and annuals are found seasonally in the wet zones of the shoreline. A few individual elms and hybrid poplars are also located along the shoreline.

3.4 PREVIOUS INVESTIGATIONS

Play Lake (SWMU 103) has been the subject of a Phase I RFI, a Phase II RFI, as well as Human Health and Ecological Risk Evaluations.

3.4.1 Phase I RFI

The Phase I RFI for Playa Lake (SWMU 103) included sample collection and screening-level risk evaluation (W-C 1994). As part of the Phase I RFI, surface water samples were collected from three locations and sediment samples were collected from four locations within Playa Lake (SWMU 103). The water samples were described as algae-rich with an olive-green hue. The sediment samples were described as black silt with a strong sulfurous odor. All surface water

and sediment samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, total petroleum hydrocarbons (TPH), pesticides/polychlorinated biphenyls (PCBs), and herbicides.

As a conservative risk-screening approach, maximum detected chemical concentrations from the Phase I RFI were screened against highly conservative USEPA Region III Risk Based Concentrations (RBCs) in accordance with RCRA Subpart S guidance. Other screening criteria included the State of New Mexico's TPH clean-up level of 1,000 mg/kg (New Mexico Environmental Improvement Board 1993), USEPA's recommended soil lead level of 500 mg/kg (USEPA 1990), and Federal Maximum Contaminant Levels (MCLs) for some surface water analytes. Prior to risk screening, metals analytes were first screened against upper tolerance limit (UTL) background concentrations. If metals concentrations exceeded background, then they too were screened against applicable criteria.

The results of the Phase I risk screening concluded that no surface water screening results exceeded screening criteria, and surface water was not evaluated further. Sediment screening results indicated that three metals (beryllium, silver, vanadium) along with TPH exceeded applicable screening criteria. A Phase I Baseline Risk Assessment (BRA) was completed for these four analytes to evaluate potential sediment exposures.

The Phase I BRA identified occupational workers, hypothetical construction workers, hypothetical trespassers, and farm workers as potential sediment receptors through ingestion or dermal contact. The Phase I BRA results indicated that no adverse human health risks were anticipated from potential exposure to concentrations of beryllium, silver, vanadium, or TPH in sediment even with prolonged exposure. The Phase I RFI report indicated that no significant human health risks were expected due to chemical exposure from Playa Lake (SWMU 103) water or sediment. However, because this lake has been historically utilized for wastewater storage, the Phase I RFI report suggested further investigation of subsurface soil in and around the lake to evaluate a potential groundwater pathway.

3.4.2 Phase II RFI

The Phase II RFI investigation for Playa Lake (SWMU 103) (W-C 1997) included the collection of soil samples and subsurface sediment samples to further assess the vertical and horizontal extent of potential site contamination at Playa Lake (SWMU 103). Six soil borings (four samples per boring from 0 to 20 feet) and five subsurface sediment borings (two samples per boring at 2 to 3 feet and 4 to 5 feet) were collected during the Phase II investigation in November and December 1994. All samples were analyzed for VOCs, SVOCs, metals, total recoverable petroleum hydrocarbons (TRPH), chlorinated herbicides, pesticides, and PCBs. Whenever applicable, maximum Phase II chemical concentrations were compared with Phase I maximum chemical concentrations. Next, Phase II maximum chemical concentrations that exceeded Phase I maximums were screened to evaluate the nature and extent of any contamination and to assess any risks associated with potential exposure to chemicals of concern (COCs).

Phase II analytical data confirmed low levels of VOCs, SVOCs, and pesticides in subsurface sediments (i.e., 2 to 5 feet), and identified low concentrations of VOCs, SVOCs, pesticides, and the PCB (Aroclor-1248) in shallow subsurface soils. TRPH was only detected in surface soils from the soil borings, and only bis(2-ethylhexyl) phthalate (a common laboratory contaminant) was reported in a single subsurface soil sample collected at 20 feet bgs.

The human health routes and receptors addressed by the Phase II risk assessment for soil and sediment were the same as those addressed during Phase I. The higher of the maximum concentrations detected during Phase I and Phase II were screened against USEPA Region III RBCs. Of the Phase II maximum chemical concentrations, only Aroclor-1248, manganese, and beryllium exceeded residential and industrial RBCs. However, the maximum detected beryllium concentration was within typical regional background concentrations. The estimated risk associated with Aroclor-1248 fell within USEPA's target risk range of 10^{-6} to 10^{-4}. An estimated hazard quotient for manganese (2.3) exceeded the recommended hazard quotient of 1.0. However, the maximum manganese concentration was detected in a sample collected beneath Playa Lake (SWMU 103) where the potential for a residential exposure scenario is unlikely.

A maximum TRPH concentration of 734 mg/kg was detected and compared to the New Mexico Action Level of 100 mg/kg (USEPA had not established a toxicity factor for the combined chemicals, so an appropriate RBC could not be calculated). However, only a small fraction of TRPH constituents are known to be toxic, (e.g., benzene, naphthalene, pyrene, and toluene), these chemicals were analyzed for individually during both the Phase I and II, and all results indicated low concentrations below applicable screening levels. Therefore, it is not likely that TRPH constituents would contribute significantly to risk at Playa Lake (SWMU 103).

The Phase II RFI included an evaluation of the groundwater pathway. The results from the deepest sediment samples (5 feet bgs) collected during the Phase II RFI were compared to surface sediment samples collected during the Phase I. The deepest sediment results were also compared to applicable residential soil RBCs to evaluate any potential current or historical transport of contaminants to groundwater. VOCs and pesticides were detected in the deepest sediment samples (5 feet bgs), but all were at levels below residential screening RBCs. Results of the subsurface sediment analysis showed that only beryllium and manganese were detected at concentrations greater than residential RBCs. Beryllium and manganese are both naturally occurring and are not typically mobile in soil or groundwater. Groundwater at Cannon AFB ranges from 240 to 280 feet bgs, and was not likely to be impacted by these relatively immobile COCs. Therefore, Corrective Action Complete was recommended with regard to groundwater beneath Playa Lake (SWMU 103).

Phase II RFI data were screened against Phase I results, background levels, and RBCs (residential and industrial). The results of the screening indicated that no unacceptable human health risks due to detected chemicals were expected from Playa Lake (SWMU 103). Therefore, the results of the Phase I BRA were supported by the Phase II RFI data, and NFA was recommended for lake sediments and surrounding soil.

3.4.3 Human Health and Ecological Risk Re-evaluations

The Draft Summary of Risk Evaluation at the Playa Lake (SWMU 103) (URS 1998) reviewed all field and analytical activities that have occurred and summarized all subsequent risk evaluations that have been completed for Playa Lake (SWMU 103).

To facilitate the implementation of a Corrective Measures Study at Playa Lake (SWMU 103), the data collected during the Phase I and II RFIs has been re-evaluated for risk to humans and the Playa Lake (SWMU 103) environment using updated human health and ecological risk screening values and information.

In summary, recent human health and ecological risk reassessments have identified sediment and surface water as the media of concern for the Corrective Measures Study that will be conducted at Playa Lake (SWMU 103). Sediment will be analyzed for TPH (as waste oil), arsenic, vanadium, silver, and selenium while surface water will be analyzed for lead, silver, and selenium. To validate a conclusive ecological assessment of the data, both the total and dissolved fractions of the surface water analytes will be evaluated.

3.4.3.1 Human Health Risk Re-evaluation

Maximum detected soil and sediment data from the RFIs completed at Playa Lake (SWMU 103), have been re-evaluated and compared to State of New Mexico Soil Screening Levels (SSLs) to determine if any risk to human health exists. For this data re-evaluation, maximum soil and sediment concentrations were compared to NDEM soil screening levels (SSLs) (NMED 2006a). Using maximum chemical concentrations to evaluate risk is a conservative way to estimate risk. The human health risk assessment is also a highly conservative estimate of risk from sediment concentrations because exposure to the sediments underlying Playa Lake (SWMU 103) is limited by five feet of water typically present in the lake. Therefore, using residential screening levels to reevaluate the RFI data was a highly conservative approach. The results of this human health risk evaluation are presented in **Appendix E**. In summary, the results indicate that the maximum TPH concentration detected in sediment (5,890 mg/kg) exceeds the residential screening guideline for waste oil (2,500 mg/kg) (NMED 2006b). The maximum arsenic (10.8 mg/kg) and vanadium (130 mg/kg) concentrations also exceed corresponding residential SSLs (4.3 mg/kg and 32.8 mg/kg, respectively). These are the only chemicals detected in sediment at Playa Lake (SWMU 103) that exceed current residential SSLs. All three of these maximum concentrations were associated with a single sediment sample (CAN103-1032) collected within the bermed area of the Playa Lake (SWMU 103) as part of the Phase I RFI (W-C 1994).

3.4.3.2 Ecological Risk Re-evaluation

The Draft Summary of Risk Evaluations at the Playa Lake (W-C 1998) was written to address specific comments and concerns posed by NMED regarding potential deficiencies in the historical data collection, analyses, and associated risk assessments, especially the ecological risk assessment. The ecological risk evaluation identified elevated sulfide and selenium concentrations as potential ecological concerns, but concluded that based on typical

concentrations of sulfides and selenium associated with natural sources and the intrinsic conservatism applied during the ecological risk assessment that Corrective Action Complete was warranted for ecological concerns at the Playa Lake (SWMU 103). It does not appear, however, that this document was ever submitted for regulatory review. Therefore, an updated ecological risk screening evaluation using current methodologies, screening levels, and literature has been performed in 2009 for the data collected during the Phase I and II RFI in order to further facilitate the development of a Corrective Measures Study. This ecological risk assessment is included as **Appendix F**. In summary, the results of this evaluation indicated that risks to terrestrial receptors from exposure to soils around Playa Lake were not indicated. No further sampling or evaluation of soils is recommended.

Additional surface sediment and surface water samples, however, should be collected in the areas where lead, silver, and selenium were elevated in the 1993 sampling (specifically in the bermed area) to determine current concentrations of these elements in sediment and surface water. Surface water should be evaluated for both total (unfiltered) and dissolved (filtered) fractions.

THIS PAGE INTENTIONALLY BLANK

4.1 CORRECTIVE MEASURES STUDY OBJECTIVES

The overall purpose of a Corrective Measures Study is to develop and evaluate Corrective Measures Alternatives and to recommend the selected Final Corrective Measure(s) based on technical criteria, including performance, reliability, implementability, and safety, as well as human health criteria, environmental criteria, and cost.

The preliminary corrective action objective for Playa Lake (SWMU 103) is to implement a risk-based corrective action process to streamline the decision process for a corrective action that is protective of human health and the environment. This risk-based process will integrate site assessment, remedial action selection, and monitoring with NMED-recommended risk evaluation practices.

The specific objectives for Playa Lake (SWMU 103) are:

- Further evaluate the extent and degree of contamination levels in sediment and surface water at Playa Lake (SWMU 103)
- Further assess the potential for contaminant migration in the surrounding and subsurface environment
- Further identify public health and environmental risks of contaminants relative to applicable regulatory standards
- Based on the results of the risk-screening process, evaluate and justify the Corrective Action Complete alternative or appropriate RBCA alternative

4.2 CORRECTIVE MEASURES STUDY APPROACH

The following decision process has been used to assess the data needs and approach for the CMS at Playa Lake (SWMU 103). The Data Quality Objective (DQO) evaluation process is designed to provide data of sufficient quality and quantity to evaluate whether a release has occurred that could pose a risk to human health or the environment and to evaluate the need for further action, such as corrective measures implementation (CMI).

The decision process is designed to identify appropriate actions based on three alternative recommendations: Corrective Action Complete (with or without controls), further evaluation, or corrective measures implementation. The recommendation for the selection of alternative action will depend upon whether chemicals of potential concern (COPCs) are detected in Playa Lake (SWMU 103), sediment and/or surface water at levels that may pose an unacceptable risk to human health or the environment. The initial steps in the decision process involve compiling all historical information and analytical data and any new information and/or data for Playa Lake (SWMU 103). Additional fieldwork is being completed at Playa Lake (SWMU 103) to further evaluate the extent and degree of sediment and surface water contamination. The data collected during the corrective measures investigation will be used to determine sediment and/or surface water COPCs for Playa Lake (SWMU 103) and, if possible, identify any potential sites of chemical release.

4.2.1 Sediment

Sediment metals data will be compared to the established Cannon AFB background levels (W-C 1997). If NMED human health Soil Screening Levels (SSLs) for residential exposure (NMED 2006). In addition, total petroleum hydrocarbons data will be compared to NMED TPH Screening guideline for waste oil. If any sediment COPC exceeds background and its corresponding human health SSL or guideline, then a more site-specific risk evaluation will be completed which may include the generation of site-specific target levels (SSTLs). An updated qualitative screening-level ecological risk evaluation will also be completed using the corrective measures investigation data for sediment and surface water. This risk evaluation process is discussed in more detail in Sections 4.5, 4.6, and 4.7. This evaluation will provide a focused assessment of potential risks to human health and the environment at Playa Lake (SWMU 103).

4.2.2 Surface water

Surface water COPCs will be compared to New Mexico Administrative Code (NMAC) surface water screening levels (NMAC 2009). If any surface water COPC exceeds its corresponding human health screening level, then a more site-specific risk evaluation will be completed which may include the generation of SSTLs.

4.2.3 Corrective Measures Alternatives Guidelines

The results of the risk evaluation process will be used to help evaluate the corrective measures alternatives for Playa Lake (SWMU 103). Recommendations regarding the alternatives will be made on the following basis:

- If the extent of contamination has been defined, no threat to human or ecological health exists based on the risk evaluation process or the qualitative ecological risk screen, and no potential threat to the environment is apparent, then Corrective Measures Complete will be recommended.
- If the extent has not been defined and there is a potential significant threat to human or ecological health based on the risk evaluation process or the qualitative ecological risk screen, further evaluation will be recommended for the site.
- If the extent of contamination has been defined and an unacceptable threat to human health or the environment exists, additional corrective measure alternatives will be reviewed, and the appropriate measure(s) will be recommended for implementation.

4.3 EVALUATION OF CORRECTIVE MEASURES ALTERNATIVE(S)

Once extent and degree of contamination has been defined, then corrective measures alternatives will be evaluated. Those alternatives include:

- Corrective Action Complete
- Treatment (which may include the use of a binding agent)

- Excavation and removal
- Capping

The corrective measures will be evaluated and the final measure(s) selected based on the following criteria.

1. Technical

    - Performance - Corrective measures which are most effective at performing their intended functions and maintaining the performance over extended periods of time will be given preference.
    - Reliability - Corrective measures which do not require frequent or complex operation and maintenance activities and have proven effective under waste and facility conditions similar to those anticipated will be given preference.
    - Implementability - Corrective measures which can be constructed and operated to reduce levels of contamination to attain or exceed applicable standards in the shortest period of time will be preferred.
    - Safety - Corrective measures which pose the least threat to the safety of nearby residents and environments as well as workers during implementation will be preferred.

2. Human Health

The corrective measures must comply with existing USEPA and NMED criteria, standards, or regulations for the protection of human health. Corrective measures which provide the minimum level of exposure to contaminants and the maximum reduction in exposure are preferred. Human health risk evaluations will be completed per the methodology described in Section 4.6.

3. Environment

The corrective measures posing the least adverse impact (or greatest improvement) on the environment over the shortest period of time will be favored. Ecological risk evaluations will be completed per the methodology described in Section 4.7.

4. Cost

If contaminants are identified in sediment or surface water, at concentrations that may pose a risk to human or ecological receptors, the CMS report will justify and recommend a corrective measure alternative using technical, human health, environmental, and cost criteria. This will include summary tables which allow the alternative or alternatives to be understood easily. Trade-offs among health risks, environmental affects, costs, and other pertinent factors will be highlighted.

4.4 PRELIMINARY 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 at 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 of all chemicals of concern for sediment and surface water.

The SCEM presents chemical release sources and transport media, potential human or ecological 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 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., sediment or surface water)
- A point of potential human or ecological exposure to transported chemicals (e.g., a domestic drinking water well)
- A human or ecological 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 primary source is generally waste (e.g., fuels, oils, and solvents) that may have been discharged to Playa Lake (SWMU 103). Chemicals from the primary source may be transported away from the primary source area, affecting other media that may in turn act as secondary sources. Percolation and leaching of the wastes to the subsurface sediment are shown as secondary chemical release mechanisms. However it is unlikely that COPCs in sediments would

leach or percolate through the subsurface and be released to groundwater since the depth to groundwater is greater than 200 feet.

Other release mechanisms, such as direct contact (soil ingestion and dermal contact), surface runoff, or volatilization to the atmosphere are also depicted in the CSM.

4.5 EVALUATION OF BACKGROUND CONCENTRATIONS

A comparison of Playa Lake (SWMU 103) sediment sample concentrations to background soil concentrations (see **Table 2-1**) will be used to determine whether metals detected in sediment samples are site related. The following sections describe the approaches used for each.

Sediments are derived from parent geologic materials as a result of physical, chemical, and biological processes as well as the hydrologic processes that have occurred in Playa Lake. The sediment system is a highly heterogeneous matrix of inorganic and organic components. The relative proportions of these components are dependent upon factors such as topography, climate, deposition, and time (Sposito and Page 1984). Total concentrations of metals in sediments may vary depending upon location; for example, surface sediments can be influenced by leaching, runoff, atmospheric deposition, and biotic uptake, as well as any anthropogenic activity. The ranges of naturally occurring or "background" concentrations of metals in sediments can be variable due to the composition of parent material. Therefore, care must be taken in the interpretation of metals data generated during an investigation.

Metals concentrations in Playa Lake (SWMU 103) sediments 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 1997a). The approach will compare the maximum concentrations detected in Playa Lake (SWMU 103) sediment samples to the 95 percent upper tolerance limit (UTL) of the background concentrations. Using this technique, individual samples at the site with high concentrations relative to background levels (i.e., which could represent a site-related release) can be identified.

4.6 HUMAN HEALTH RISK EVALUATION METHODOLOGY

This section provides a description of the approach that will be used in the health risk evaluation for the Playa Lake (SWMU 103). Sediment COPCs will be compared to NMED human health SSLs for residential exposure (NMED 2006a). In addition, total petroleum hydrocarbons data will be compared to NMED TPH Screening guideline for waste oil. Surface water COPCs will be compared to New Mexico Administrative Code (NMAC) surface water screening levels (NMAC 2009). If any sediment or surface water COPC exceeds background and its corresponding human health screening level or guideline, then a more site-specific risk evaluation will be completed which may include the generation of SSTLs.

4.6.1 Derivation of NMED SSLs

The SSLs will be taken from the NMED table which is provided in **Appendix D** (NMED 2006a). The latest available version will be used. These SSLs are based on 1 x 10^{-5} excess cancer risk or a hazard quotient equal to 1, assuming residential ingestion, dermal, and inhalation exposures. A maximum chemical concentration that exceeds a screening-level SSLs 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 SSLs is the concentration of a chemical in soil/sediment that is estimated to result in an excess cancer risk of 1 x 10^{-5} (1 in 100,000) for Class A and B carcinogens or 1 x 10^{-4} for Class C carcinogens, assuming long-term (30-year) daily exposures. A range of 1 x 10^{-6} to 1 x 10^{-4} (1 in 1,000,000 to 1 in 10,000) is USEPA's target excess cancer risk range for cleanup under Superfund and RCRA (USEPA 1991). Therefore, SSLs based on target risks of 1 x 10^{-5} and 1 x 10^{-4} are conservative (protective) values, and exceedances of these SSLs do not necessarily mean that a health risk is present. Exceedance of 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/sediment 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 an established reference dose (RfD) that is considered safe for a lifetime of daily exposure. A hazard quotient of 1 means that no toxic effects are likely to occur even to sensitive individuals exposed for a lifetime. A hazard quotient 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 the values for noncarcinogens do not account for chemical mixtures. If more than one noncarcinogen detection is observed in the CMS data, then the noncarcinogenic SSL should be divided by 10.

NMED SSLs for soil/sediment exposures are based on the ingestion, inhalation, and dermal exposure routes. Soil/sediment SSLs are available for industrial and residential scenarios. Playa Lake (SWMU 103) is located in an industrialized area of the Base. For the initial assessment of corrective measures investigation data, residential SSLs will be used. If a secondary assessment is required, the site-specific exposure parameters will be refined and site-specific exposure scenario SSTLs will be calculated. Maximum detected concentrations (or UCL if adequate data are available) will then be compared to the site-specific industrial SSTLs.

It is important to note that SSLs are not cleanup goals. Cleanup goals are determined on a site-specific basis. Rather, comparing CMS sediment concentrations to screening-level SSLs, is adopted as a means of screening whether the chemicals in sediments could pose a threat to human health. If the screening-level SSLs are not exceeded, Corrective Action Complete will be recommended. If the screening-level SSLs are exceeded, further evaluation of potential risks will be completed.

4.7 SCREENING-LEVEL ECOLOGICAL RISK EVALUATION METHODOLOGY

The corrective measures investigation data will be screened in accordance with the procedures and methodology described in **Appendix F**, Ecological Risk Assessment.

4.8 CORRECTIVE MEASURES STUDY REPORT

At a minimum, the CMS report will include:

- Description of Cannon AFB and Playa Lake (SWMU 103)
- Summary of previous investigations
- Results of the corrective measures investigation, including data review and validation
- Description of nature and extent of contamination
- Description of the risk evaluation process
- Discussion of the risk evaluation results
- Remedy selection, if applicable
- Justification of the risk evaluation decision or remedy selection, if applicable
- Remedy cost estimate, if applicable
- Remedy schedule, if applicable

THIS PAGE INTENTIONALLY BLANK

The following sections describe the general investigative approach and protocols that will be followed during the CMS Investigation at Playa Lake (SWMU 103). This section also identifies specific sampling locations and supporting rationale.

5.1 STANDARD OPERATING PROCEDURES

The following is a list of applicable SOPs developed for use at Cannon AFB. These SOPs will be used during the Playa Lake (SWMU 103) CMS investigation and will provide the foundation for all fieldwork execution.

- SOP No. 1 Permits and Clearances
- SOP No. 2 Surveying and Description of Sampling Locations
- SOP No. 3 Sediment Sampling
- SOP No. 4 Surface Water Sampling
- SOP No. 5 Equipment Decontamination
- SOP No. 6 Sample Handling, Documentation and Tracking

SOPs are presented in **Appendix C**.

5.2 MOBILIZATION

Mobilization of equipment and personnel will be completed prior to the start of field activities. The mobilization activities will include, but are not limited to, obtaining base passes for site personnel, locating utilities in areas where intrusive sampling will occur, and subsequently obtaining an AF 103 form to document USAF approval for intrusive sampling at designated and cleared locations.

5.2.1 Base Passes

All on-site field personnel and subcontractors will coordinate with the Cannon AFB PM to acquire passes that will allow entry onto Cannon AFB. Base passes will be obtained, available, and updated to last the entire duration of planned activities at Cannon AFB.

5.2.2 Utility Locates and Digging Permits

URS will obtain all required utility clearances prior to the start of any intrusive activities at Cannon AFB. Utility locates will be coordinated with the Cannon AFB PM. The utility clearances will be requested sufficiently in advance of all intrusive field activities. The utility locates will be completed by 27th Fighter Wing, Civil Engineering Squadron (27 CES). All underground utilities identified will be marked with flagging, stakes, and/or paint. No intrusive work using heavy equipment will be completed within five feet of an active utility. All utility location tasks will be documented in the field logbook to aid in subsequent fieldwork and

reporting. Furthermore, in order to properly document utility location activities, a USAF Form 103 Dig Permit will be obtained and kept on-site prior to any intrusive fieldwork or sampling. Clearances and permits will be obtained in accordance with SOP No. 1 in **Appendix C**.

5.3 SURVEYING

In most situations, a hand held GPS unit will be utilized to locate and record sampling coordinates and elevations for this investigation. The horizontal and vertical coordinates for the sample location will be collected to sub-meter accuracy and reference to the appropriate North American Datum of 1983 (NAD83) State Plane Coordinate System (i.e., New Mexico East, Federal Information Processing Standard [FIPS] 3001 [feet]). Elevations will be referenced to the North American Vertical Datum of 1988 (NAVD88). The time stamp registered for each GPS location will be recorded in the field logbook. Prior to the start of fieldwork, the GPS unit will be calibrated to a known reference point. The results of this calibration will be recorded in the field logbook.

5.4 DATA COLLECTION

Samples collected for the CMS field investigation will be completed to supplement samples previously collected from Playa Lake (SWMU 103) during a Phase I screening-level RI and Phase II RFI investigation. To date, during the previous Phase I and Phase II investigations, three surface water samples, four surface sediment samples, ten subsurface sediment samples (2 to 5 feet), six surface soil samples, and 18 subsurface soil samples (5 to 20 feet) have been collected, analyzed, and evaluated for the Playa Lake (SWMU 103) site. All samples from each media type were analyzed for VOCs, SVOCs, metals, TPH/TRPH, herbicides, and pesticides/PCBs.

This CMS investigation will collect and analyze additional surface water and sediment samples (see **Figure 5-1**) to further define the nature and extent of potential selenium and silver contamination that could be harmful to ecological receptors.

5.4.1 Surface Water Sampling

Surface water samples will be collected using dippers or bailers in accordance with the procedures outlined in SOP No. 4. The collection device will be carefully lowered into the water without disturbing the surface sediments at the bottom of the lake. The projected number of surface water samples to be collected from Playa Lake (SWMU 103) and the associated analytes for each sample, are detailed in **Table 5-1.**

5.4.2 Sediment Sampling

Sediment samples will be collected using a stainless-steel sludge sampler or similar sampling device with extension rods as required based on site conditions. Subsurface sediment samples will be collected in accordance with the procedures outlined in SOP No. 3. The projected

number of surface and subsurface soil samples to be collected from Playa Lake (SWMU 103) and the associated analytes for each sample are detailed in **Table 5-1**.

5.5 ANALYTICAL PARAMETERS AND SAMPLE QUANTITIES

Samples collected from each location will be analyzed for specific parameters. The analytical parameters specific to each media type and location are presented in **Table 5-1**. Agriculture and Priority Pollutants Laboratories Inc. (APPL) in Clovis, California will complete the chemical analysis of all samples and all QC duplicates. EMAX Laboratories, Inc. (EMAX) of Torrance, California will complete QA sample analyses.

Surface water and sediment samples collected as part of the Playa Lake (SWMU 103) CMS field investigation will be shipped to the laboratory and analyzed on an accelerated turn-around time basis. Sediment samples collected from Playa Lake (SWMU 103) will be analyzed for TPH-DRO, TPH-ORO, TPH-GRO and project specific metals (arsenic, selenium, silver and vanadium); surface water samples will be analyzed for lead, selenium and silver.

Initially, six surface water and sediment samples will be collected. If sediment analytical results indicate that horizontal expansion of the sampling area is warranted (i.e., the horizontal extent of contamination is not clearly defined), then additional sediment samples will be collected in accordance with this section of the CMS Work Plan.

5.6 SAMPLE IDENTIFICATION, HANDLING, AND DOCUMENTATION

Proper sample identification, sample preservation, documentation, shipping and handling procedures are all necessary to obtain acceptable and representative data. Collected samples will be transferred to appropriate sample containers and immediately placed into coolers containing ice for preservation. **Table 5-1** of the QAPP summarizes the appropriate sample containers, preservation, and holding times for the planned samples to be analyzed by the designated laboratory. The following sections briefly describe sample management procedures to be used for the work described in this plan. These procedures are discussed in detail in SOP No. 6 of **Appendix C**.

5.6.1 Sample Identification

Samples collected during field activities will be assigned discrete sample identification numbers. These numbers are necessary to identify and track each of the samples collected for analysis during this project. In addition, the sample identification numbers will be used to identify and retrieve analytical results from the laboratory.

Each sample will be identified by a unique code that indicates the site, sampling location, sample type, and either the sampling event or depth. The sample designation for each analytical and QA/QC sample will be a defined three-character code for Playa Lake (SWMU 103) samples, followed by a four-character code and ending with another three character code (i.e., 103-

YYYY-ZZZ). "103" is the facility/site identifier for samples collected at Cannon AFB's Playa Lake (SWMU 103).

The next four characters (YYYY) identify the sampling method and specific sampled locations. The first two characters will present the method of sampling. "SD" will be used as the first two characters for a sediment sample. The last two characters will identify the sample location. Samples from the second sediment sample location would be identified as "103-SD02-."

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

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

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

The following is an example of an identification number:

Sediment location no. 2 — Approximate depth of the sample in feet bgs

C103 - SD02 - 00

Cannon AFB, SWMU 103

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

5.6.2 Field Documentation

Thorough documentation of observations and data acquired in the field will be of sufficient detail that provides specific details on sample acquisition and produces a permanent record of all field activities. Documentation of all data collection activities will be recorded using waterproof ink in a permanently bound, weatherproof field logbook with consecutively numbered pages and/or on sample collection field sheets (SCFSs).

Field Logbook Modifications and Signatures

Sufficient information will be recorded in the field logbook to ensure that, if necessary, the sampling event could be reconstructed without relying on the sampler's memory. The person making logbook entries will sign each page of the book at the end of each day. Changes or deletions in the field logbook will be lined out with a single strike mark and will remain legible.

Changes/entries made in another person's logbook will be sign and dated by the person who made the entry.

Sample Collection Field Sheets

As part of the field documentation process, SCFSs will be generated in addition to logbook entries. Each SCFS will summarize the sample media type, collection details (e.g., depth and location), identification number, time and date collected, container type(s), QA/QC analyses being requested, physical descriptions, name(s) of the sampler(s), and any other significant facts, details, or limitations regarding the sample collected.

Sample Labeling

Sample labels will be filled out using waterproof ink, and each label will contain, at a minimum, the following information: samplers' initials, project name, sample identification number, date and time of sample collection, method of preservation used, and the sample matrix. Samples will be thoroughly homogenized (except in the case of TPH-GRO analysis) and transferred to appropriate sample containers in accordance with the QAPP. The analytical laboratory will provide all appropriate commercially cleaned containers with preservatives, as required.

Sample Chain-of-Custody

During field sampling activities, sample tracking will be maintained from the time that samples are collected until laboratory data are issued. Initial information concerning the collection of a sample will be recorded in a field logbook and on a SCFS as described above. Specific sample custody information concerning the transfer, handling, and shipping of the sample to an off-site laboratory will be recorded on a chain-of-custody (CoC) form. A copy of the CoC is presented in **Appendix C**.

The sampler will be responsible for initiating and filling out the CoC form. The person responsible for packaging samples for delivery to the off-site laboratory will sign the CoC form. That person will retain the last copy of the three-part form, document the method of shipment, and send the original and second copy, sealed inside the cooler, along with the samples. Each sample cooler sent will have its own CoC documenting only those samples contained in that cooler. A custody seal will be placed on each sample cooler prior to transfer of the cooler to the delivery company (e.g., Federal Express) or a laboratory. Upon receipt at the off-site laboratory, the person receiving the samples will confirm that the custody seal has not been compromised and will sign the CoC form and return the second copy to URS.

Daily Quality Control Reports

To supplement the information reported in the field logbook, daily quality control reports (DQCRs) will be completed for each day of fieldwork activity. A copy of the DQCR that will be used to summarize and update all field activities is presented in **Appendix C.**

5.7 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

QA/QC samples will be collected according to the following schedule, as presented in the project QAPP:

QC blind field duplicates will be collected at a typical frequency of about five percent of the total field samples collected. These samples will be submitted to the contract laboratory.

Matrix spike/matrix spike duplicate (MS/MSD) field samples will also be collected at a typical frequency of about five percent and will be submitted to the contract laboratory.

The anticipated distribution of the QA/QC samples to be collected is listed in **Table 5-1**.

5.8 DECONTAMINATION AND INVESTIGATION-DERIVED WASTE

All sampling equipment will be decontaminated before starting work and between sample intervals. Small tool decontamination will be done at the site. Auger decontamination, and drum staging will be completed at locations identified by the 27 CES, Environmental Flight (27 CES/CEV) personnel. Specific decontamination procedures are described in SOP No. 5.

IDW is expected to include waste sediment, decontamination fluids, and personal protective equipment (PPE). In general, sediment will be containerized and properly disposed of on the base, as long as the analytical results demonstrate the waste is non-hazardous by applying the "20 Times Rule" (i.e., none of the total analytical results exceed the corresponding Toxicity Characteristic Leaching Procedure [TCLP] limit by more than 20 times). Decontamination fluids will be field-screened and discharged either to the ground or to the sanitary sewer system. PPE will be disposed of on the base as a solid waste. Specific procedures for handling IDW are outlined in SOP No. 5.

All decontamination and all investigation-derived waste (IDW) will be handled in accordance with SOP No. 5.

TABLE 5-1
SURFACE WATER AND SEDIMENT SAMPLING SUMMARY FOR CORRECTIVE MEASURES STUDY
CANNON AFB, NEW MEXICO

Parameter (Analytical/Preparation Method)	Field Samples	Field Duplicates	MS/MSD Samples	Total Samples
Sediment				
TPH - DRO (8015B/3540C)	6	1	1	8
TPH - ORO (8015B/3540C)	6	1	1	8
TPH - GRO (8015B/5030B/5035)	6	1	1	8
Metals (6010B/3050B)	6	1	1	8
Surface Water				
Metals (6010B/3010A)	6	1	1	8

Notes:
MS - Matrix Spike
MSD - Matrix Spike Duplicate
TPH - Total Petroleum Hydrocarbons
DRO - Diesel Range Organics
GRO - Gasoline Range Organics
ORO - Oil Range Organics

THIS PAGE INTENTIONALLY BLANK

LEGEND

▲ PLANNED CMS SURFACE WATER/SEDIMENT SAMPLE LOCATION

N

200 100 0 200

SCALE IN FEET

May 27, 2009 1:54:11 p.m.
Drawing: T:\CANNON\16170402\200\5-1.dwg

PLAYA LAKE – (SWMU 103)
PLANNED CMI SAMPLE LOCATIONS MAP
CANNON AIR FORCE BASE, NEW MEXICO

DRN. BY: DPG	DATE: 04/23/09	PROJECT NO.	FIG. NO.
CHK'D. BY: .	REVISION: 0	16170402	5-1

Cannon AFB. 1990. Draft Environmental Impact Statement.

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

Lee Wan and Associates, Inc. (Lee Wan). 1990. RCRA Facility Investigation Field Sampling Plan. Cannon AFB, New Mexico. June.

NMAC. 2009. Title 20 Environmental Protection, Chapter 6 Water Quality, Part 2 Ground and Surface Water Protection, Section 20.6.2.3103, Subsections A, B, and C.

New Mexico Environmental Department (NMED). 2006a. Technical Background Document for Development of Soil Screening Levels, Revision 4.0. June.

NMED. 2006b. New Mexico Environment Department TPH Screening Guidelines. October.

New Mexico Environmental Improvement Board. 1993. State of New Mexico TPH clean-up level.

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 Environmental Protection Agency (USEPA). 1990. Supplement to Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites. OSWER Directive 9355. 4-02.

USEPA. 1991. Memorandum from Don R. Clay. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. April.

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

URS Corporation (URS). 1998. Summary of Risk Evaluations at the Playa Lake (SWMU 103), Cannon Air Force Base, New Mexico. URS Corporation, Omaha, NE. Prepared for: U.S. Army Corps of Engineers, Omaha District.

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

W-C. 1994. RCRA Facility Investigation Activities Phase II to Appendix I (Old Entomology Rinse Area Boring). Supplemental RFI Report (19 SWMU Boundary Survey). Final. Cannon Air Force Base, New Mexico. September.

W-C. 1995. RCRA Facility Investigation Activities Phase II to Appendix I Solid Waste Management Units Supplemental RFI Report. Final (Revised). Cannon Air Force Base, New Mexico. January.

W-C. 1997. RCRA Facility Investigation, Appendix II SWMUs – Phase II. Cannon Air Force Base, New Mexico. Final RFI Report. November.

W-C. 1997a. Naturally Occurring Concentrations of Inorganics and Background Concentrations of Pesticides at Cannon air Force Base, Clovis, New Mexico. Final Report. September.

THIS PAGE INTENTIONALLY BLANK

SITE SAFETY AND HEALTH PLAN

CMS
CANNON AIR FORCE BASE
NEW MEXICO
May 2009

Prepared for:

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

Contract No. W9128F-04-0001
Task Order 0071, Modification 01

Prepared by:

URS
12120 Shamrock Plaza, Suite 300
Omaha, Nebraska 68154
16170402

THIS PAGE INTENTIONALLY BLANK

SITE SAFETY AND HEALTH PLAN

CMS – CANNON AIR FORCE BASE

APPROVALS:

Jeff Voelker, URS Project Manager (PM)	5/20/09 Date
Tony Host, URS Project Health and Safety Manager	5/20/09 Date
Dennis Day, Certified Industrial Hygienist (CIH), URS Regional Health and Safety Manager (RHSM)	5/20/09 Date
TBD, URS Field Team Leader (FTL) & URS Site Safety Officer (SSHO)	Date

This site safety and health plan (SSHP) for the Corrective Measures Study (CMS) – Cannon Air Force Base (AFB) is valid for Hazardous and/or Toxic Waste (HTW) activities completed by URS and its subcontractors at Cannon AFB. **A copy of this plan is to be maintained at the site at all times during fieldwork.**

Disclaimer:

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

TABLE OF CONTENTS

Section 1 Introduction 1-1
1.1 Site Descriptions 1-1
1.1.1 SWMU 103 – Playa Lake 1-1
1.2 Purpose and Scope of Work 1-1
1.3 Applicability 1-1
1.4 USACE Safety and Health Requirements Manual EM 385-1-1 1-2
1.5 Applicable URS SMSs 1-2
1.6 Changes To This 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 and Health Officer 2-2
2.4 Project Health and Safety Manager and Regional Health and Safety Manager 2-3

Section 3 Hazard Analysis 3-1
3.1 Project Hazard Analysis 3-1
3.1.1 Activity Hazard Analysis 3-1
3.1.2 Accident Prevention Plan 3-2
3.2 Chemical Hazards 3-2
3.2.1 Site Constituents 3-3
3.2.2 Chemicals Used to Conduct Site Work 3-3
3.2.3 Hazard Communication Materials 3-3
3.3 Physical Hazards 3-3
3.3.1 Hand Safety 3-4
3.3.2 Heat Stress Recognition and Control 3-4
3.3.3 Cold Stress Recognition and Control 3-4
3.3.4 Noise Hazards 3-5
3.3.5 Slip/Trip/Fall Hazards 3-5
3.3.6 Lifting Hazards 3-6
3.3.7 Field Equipment 3-6
3.3.8 Underground and Aboveground Utilities 3-7
3.3.9 Electrical Safety 3-8
3.4 Biological Hazards 3-8
3.4.1 Insects and Arachnids 3-8
3.4.2 Reptiles 3-9
3.4.3 Other Animals 3-9
3.4.4 Plants 3-9
3.4.5 Blood-Borne Pathogens 3-9

Section 4 Exposure Monitoring Plan 4-1
4.1 Chemical Exposure Monitoring 4-1
4.1.1 Air Monitoring Instrumentation 4-1
4.2 Dust Control 4-1

TABLE OF CONTENTS

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 5-2
5.2.3 Level D 5-2
5.2.4 Anticipated PPE Levels 5-2
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 5-7
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 Sediment/Surface water 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

TABLE OF CONTENTS

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
9.1.1 Initial Site Safety Briefing 9-1
9.2 HAZWOPER 9-2
9.3 Behavior Based Safety 9-2

Section 10 Recordkeeping 10-1

Section 11 References 11-1

List of Figures

Figure 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, Accident Prevention Plan Outline, Hazard Assessment Certification Form and Field Change Request Form
Attachment C Safety Management Standards
Attachment D USACE Accident Reporting Forms: Appendix B of OM 385-1-1 (includes NWO Form 1880) and ENG Form 3394
Attachment E Material Safety Data Sheets

°F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AFB	Air Force Base
AHA	Activity Hazard Analysis
Base	Cannon Air Force Base
CENWO	US Army Corps of Engineers, Omaha District
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
Contractor	USACE Contractor
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
DA	Department of the Army
dB	decibels
DOT	Department of Transportation
EM	Engineering Manual
ENG	Engineering
EPA	Environmental Protection Agency
eV	electron volt
EZ	exclusion zone
FM	Field Manager
HAZWOPER	Hazardous Waste & Emergency Response
HTW	Hazardous and/or Toxic Waste
IDW	Investigation Derived Waste
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NWO	North West Omaha
OBZ	operator's breathing zone
OSHA	Occupational Safety and Health Administration
OWS	Oil/Water Seperator
PID	photoionization detector
PM	Project Manager
POL	Petroleum, Oil, and Lubricants
PPE	personal protective equipment
ppm	parts per million

RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RHSM	Regional Health and Safety Manager
SA	supplemental assessment
SHM	Safety and Health Manager
SMS	Safety Management Standard
SSHP	Site Health and Safety Plan
SOP	Standard Operating Procedure
SSHO	Site Safety Officer
SVOC	semivolatile organic compound
SWMU	Solid waste management unit
URS	URS Corporation, Inc.
USACE	United States Army Corps of Engineers
UST	Underground Storage Tank
VOC	volatile organic compound
WP	Work Plan

THIS PAGE INTENTIONALLY BLANK

This document presents the Site and Safety Health Plan (SSHP) for the Corrective Measures Study (CMS) at Cannon Air Force Base (AFB), New Mexico.

1.1 SITE DESCRIPTIONS

The CMS Work Plan describes the field sampling requirements to complete additional sampling at Solid Waste Management Unit (SWMU) 103, Playa Lake at Cannon AFB, New Mexico. The description of SWMU 103, Playa Lake is included below.

1.1.1 SWMU 103 – Playa Lake

SWMU 103, Playa Lake occupies approximately 13 acres within Cannon AFB near the ordnance area at the east central edge of the Base. This shallow pond is maintained at approximately total capacity by inflow from the wastewater treatment plant located to the west. The lake is an estimated 1,000 feet across the widest part and an estimated 5 feet deep at the deepest area with a gradually sloping bottom.

Additional sampling will be completed at SWMU 103, Playa Lake for lead, selenium and silver in surface water and arsenic, selenium, silver, vanadium and total petroleum hydrocarbons (TPH) in sediment.

1.2 PURPOSE AND SCOPE OF WORK

The purpose of this SSHP is to provide safety procedures that will be used by the URS Corporation, Inc. (URS) for all CMS activities at SWMU 103, Playa Lake.

This SSHP was developed specifically for CMS field 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 Engineering 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 SSHP is required to be available on site during all CMS field activities.

1.3 APPLICABILITY

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

This plan will be provided to any subcontractors if they 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 SSHP. Additionally, subcontractors may be

required to develop CMS-related SSHP Addenda to comply with 29 CFR 1910.120 by addressing those project activities specific to 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 SSHP		
EM 385-1-1 Section	Topic	SSHP Section
01.C	Physical Qualifications of Employees	5.3.2
01.D	Accident Reporting and Recordkeeping	8.7, 10
05	Personal Protective and Safety Equipment	5
05.C	Hearing Protection and Noise Control	3.3.4
05.E	Respiratory Protection	5.3
06.D	Harmful Plants, Animals, and Insects	3.4
13	Hand and Power Tools	3.3.1
14	Material Handling, Storage, and Disposal	6.5, 8.10
28	Hazardous Waste & Emergency Response (HAZWOPER)	9.2
Appendix A	Minimum Basic Outline for Accident Prevention Plan	3.1.2

1.5 APPLICABLE URS SMSs

This SSHP is augmented by the URS Health and Safety Program and Management System and relevant safety and management standards (SMS), which are required to be available on site during all activities. Relevant SMSs are presented in the table below.

SAFETY MANAGEMENT STANDARDS		
SMS	Topic	SSHP Section
2	Worker Right to Know	3.2
9	Corrosive and Reactive Materials	3.2.3
16	Hand Tools and Portable Equipment	3.3.1
17	Hazardous Waste Operations	3.2, 9.2
18	Heat Stress	3.3.2
21	Housekeeping	3.3.1
24	Medical Screening	9.1
27	Work Over Water	3.3.7
29	Personal Protective Equipment	5
30	Sanitation	6.2
34	Utility Clearances	3.3.8
42	Respiratory Protection	5.3

SAFETY MANAGEMENT STANDARDS		
SMS	Topic	SSHP Section
47	Biological Hazards	3.4
49	Injury/Illness/Incident Reporting and Notifications	8.7, 10
50	Specific Chemical Hazards	3.2
51	Blood Borne Pathogens	3.4.5
55	Health & Safety Training	3.2
59	Cold Stress	3.3.3
64	Hand Safety	3.3.1
65	Injury Management	8.8
69	Back Injury Prevention	3.3.6
72	Behavior Based Safety	9.3

Copies of the SMSs referenced by this SSHP are to be maintained on site and are included in **Attachment C**.

1.6 CHANGES TO THIS SSHP

Changing and/or unanticipated site conditions may require modification of this APP/SSHP in order to maintain a safe and healthful work environment. The SSHO will be responsible for initiating, completing and submitting a Field Change Request (FCR) form (Attachment B) to the PM. The PM will determine if the change is minor or major. Minor changes are defined as those that would not adversely affect the quality of the data, objectives of the data, field schedule, and the rationale for the field procedure. Major changes are those that will adversely affect the data quality, data objectives, cause a significant change in project scope, or will cause significant schedule delays. Major changes will require client approval. Under no circumstances will modifications to this plan conflict with federal, state, or other governmental health and safety regulations.

If the PM accepts the change, the change will also require approval of the either the RHSM. If the PM, the RHSM and the Client (if required) approves the FCR, the PM will be responsible for final disposition. Final disposition includes incorporation of the change(s) in the field and office copies of the SSHP, and to record the change on the Revision History Record.

THIS PAGE INTENTIONALLY BLANK

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 personnel will strictly adhere to the provisions of this SSHP and applicable regulations issued by governmental entities. The following responsibilities are general. Any changes or exceptions to them, following final acceptance of this 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 and Health Officer (SSHO) or the Project Manager (PM).
3. Implementing the procedures set forth in the SSHP, and reporting any deviations from the described procedures to the SSHO or PM for action.
4. Notifying the PM and SSHO of any special medical problems (i.e., allergies) and seeing that all on site personnel are aware of such problems.
5. Reviewing the 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 Manager (FM). At the site, the PM, assisted by the SSHO, has primary responsibility for:

1. Ensuring that appropriate personal protective equipment (PPE) and monitoring equipment (if applicable) are available and properly utilized by all on site personnel.
2. Ensuring that all on site personnel are aware of the provisions of this 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 SSHP is available on site.
11. Preparing any accident/incident reports for URS activities, ENG 3394, and URS SMS 49-1 (**Attachments C and D**)
12. Completing the Field Change Request process as described in Section 1.6 for any changes in the SSHP.

2.3 SITE SAFETY AND HEALTH OFFICER

The URS SSHO reports directly to the URS RHSM. The URS SSHO administratively reports to the PM to coordinate schedules and activity with the PM and FM. Depending on the size and complexity of the project the PM, the FM may be designated as the SSHO's. The SSHO is responsible for:

1. Implementing the 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 (if applicable) is used properly by all on site personnel and is calibrated in accordance with manufacturer's instructions or other standards, and that those results are properly recorded and filed.
3. Ensuring that 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 Material Safety Data Sheets (MSDSs).
15. Investigating accidents/incidents and preparing all accident/incident reports for URS activities.
16. Prior to initiating work for each day, performing a Daily Safety Task Analysis, recording the results on the Daily Safety Task Analysis Worksheet.

Should any unforeseen hazard become evident during the performance of work, the SSHO will bring such hazard information to the attention of the RHSM and the PM (both verbally and in writing) for resolution as soon as possible. The PM will notify the appropriate government representative (verbally and in writing). In the interim, necessary action will be taken to reestablish and maintain safe working conditions.

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

The RHSM is the Safety and Health Manager (SHM) as defined by EM 385-1-1. The duties of the RHSM may be delegated to the Project Health and Safety Manager. The RHSM will have a minimum of 5 years of experience working on HTRW sites, and be a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP). The RHSM is responsible for:

1. Developing, maintaining, and overseeing implementation of the SSHP
2. Providing health and safety support to the SSHO and PM.
3. Reviewing, approving, and signing the SSHP and all changes to the SSHP.
4. Processing accident reports.
5. Evaluating occupational exposure monitoring/air sampling data and adjusting SSHP requirements as necessary.
6. Determining the need for periodic audits of the operation to evaluate compliance with the SSHP.
7. Visiting the project as needed to audit the effectiveness of the SSHP.

THIS PAGE INTENTIONALLY BLANK

This section describes in the chemical, physical and biological hazards anticipated during the work planned at Cannon AFB.

3.1 PROJECT HAZARD ANALYSIS

Aspects of the field investigation contain certain innate risks. The table below shows the Project Hazard Analysis for work that will be conducted as part of the field investigations. Additional general chemical, physical and biological hazards are discussed in the following sections.

Project Hazard Analysis

Task	Chemical Hazard	Biological Hazards	Noise Hazard	Slip/Trip/Fall Hazard	Lifting Hazard	Mechanical Hazard	Electrical Hazard
1. Mobilization and Site Access	Low	Med	Low	High	Med	Low	Low
1. Surveying and Site Inspection	Low	Med	Low	High	Med	Low	Low
2. Surface Water Sampling	Med	Med	Low	High	Low	Low	Low
3. Sediment Sampling	Med	Med	Low	High	Low	Low	Low
4. Equipment Decontamination	Med	Med	Low	High	Med	Low	Low
6. Demobilization	Low	Med	Low	High	Med	Low	Low

Notes:
Low = Exposure likely less than 10% of the time
Med = Exposure likely 10 to 50% of the time
High = Exposure likely more than 50% of the time
N/A = Exposure not anticipated

3.1.1 Activity Hazard Analysis

An Activity Hazard Analysis (AHA) has been developed for every operation involving a type of work presenting hazards. The AHAs define the activity being performed, sequence of work, specific safety and health hazards anticipated, control measures, equipment, inspection requirements, training requirements, and the competent person in charge of that phase of work. The following AHAs are included as Appendix B.

1. Mobilization and Site Access
2. Surveying and Site Inspection
3. Surface Water Sampling
4. Sediment Sampling

5. Equipment Decontamination
6. Demobilization

3.1.2 Accident Prevention Plan

An Accident Prevention Plan Outline is provided in Appendix B with references to demonstrate that each element of the Accident Prevention Plan as required by EM 381-1-1 has been considered and addressed when applicable to this project.

3.2 CHEMICAL HAZARDS

The URS Hazard Communication Program provides personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace. The following Safety Management Standards (SMSs) related to hazard communication are included in **Appendix E**.

- SMS 002 Worker Right to Know (Hazard Communication)
- SMS 017 Hazardous Waste Operations

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

The greatest risk of chemical exposure is likely to occur during sediment and surface water sampling activities. The potential routes of exposure include dermal contact, and ingestion. Dermal contact is expected to be the significant exposure route, and appropriate PPE will be used to help minimize the exposure through these routes. The potential for exposure by ingestion is expected to be low. Personnel will be expected to use good personal hygiene practices and appropriate PPE to minimize the potential for incidental ingestion of environmental media and associated chemicals. 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 potentially 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**.

3.2.1 Site Constituents

Site constituents have been thoroughly characterized. However, based on past site activities, site constituents will include metals (lead, selenium and silver in water) in surface water and metals (arsenic, selenium, silver and vanadium) and Total Petroleum Hydrocarbons (TPH) TPH-Diesel Range Organics (DRO), TPH-Gasoline Range Organics (GRO) and TPH-Oil Range Organics (ORO) in sediment.

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 SSHP are appropriately implemented. However, because the site is 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).

3.2.2 Chemicals Used to Conduct Site Work

A variety of chemicals and products may be brought on site to be used during field activities. These chemicals and products may include, but are not limited to, items such as Alconox, nitric acid, compressed gasses, fuel (gasoline). If corrosive or reactive materials will be present on site, refer to SMS 09 in **Attachment C** and the nitric acid MSDS in **Attachment E**.

3.2.3 Hazard Communication Materials

Materials which are considered hazardous materials under the OSHA Hazard Communication Standard (29 CFR 1910.1200) may be used during activities covered by this SSHP. In accordance with the URS Hazard Communication Program, the MSDSs for the hazardous materials brought on site will be included in **Attachment E** of this SSHP. The URS written Hazard Communication program is located in SMS 2 and Specific Chemical Hazards is located in SMS 50. Both SMSs are in **Attachment C**, a copy of which will be maintained on site when field activities are being done.

3.3 PHYSICAL HAZARDS

Physical hazards at this work site may include:

- Hand Safety
- Heat stress and cold stress

- Noise from the operation of on site equipment
- Slip/trip/fall accidents
- Back injuries due to improper lifting
- Being caught in or struck by moving equipment
- Utility line clearance
- Electrical Safety
- Water to a depth of at least five feet

3.3.1 Hand Safety

Personnel will be using a variety of hand-operated tools during the course of field activities, including hand augers. Personnel should consult SMS 16 on Hand Tools and Portable Equipment, SMS 21 on Housekeeping, and SMS 64 on Hand Safety in **Attachment C**, a copy of which will be maintained on-site when field activities are being done.

3.3.2 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 90°F. Both heart rate monitoring and body temperature monitoring will be conducted and the results recorded as specified in SMS 18.

3.3.3 Cold Stress Recognition and Control

Cold stress can result when temperatures drop below 45°F and workers are not wearing appropriate personal protective equipment. Cold stress can result in frostbite, body temperature depression, and hypothermia. In extreme cases, cold stress can result in death when not treated properly. Cold stress guidance is provided in SMS 59 in **Attachment C**, a copy of which will be maintained on-site when field activities are being done.

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 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.

3.3.4 Noise Hazards

Although the use of equipment causing high noise levels it is not anticipated for the CMS, previous surveys indicate that equipment used on environmental investigation sites may produce continuous and impact noise at or above the action level of 85 decibels (dB). 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**.

3.3.5 Slip/Trip/Fall Hazards

Workers will be working in a variety of terrains and weather conditions, which could lead to physical harm, such as sprained or strained muscles and twisted ankles. More severe injuries, such as broken bones and back injuries, could result from extreme accidents. Slipping accidents may potentially occur during and after rainfall, on steep inclines, on rocky areas and in marshy areas. Tripping may occur due to roots and rugged terrain, as well as via improperly marked or staged extension cords. Falls can occur when working on or near elevated areas, including stairs. Workers will be exposed to a variety of slip/trip/fall hazards during the course of the work. While URS cannot anticipate every possible scenario, URS can mitigate likely accidents by following the Safe Management Standards (SMS) 40: Slip Trip Fall Prevention.

Workers should exercise caution when walking around the site to avoid fall and trip hazards. If there are holes, uneven or rocky terrain in the work area that could cause site personnel to fall or trip, the hazard 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 un-sloped excavation, unless guardrails or fall protection are 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.

Engineering controls:

1. Flags marking hazardous areas
2. Gravel, sand, or boards placed over slippery terrain

3.3.6 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 (if applicable) 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 069 – Back Injury Prevention, included in **Attachment C**.

3.3.7 Field Equipment

The use of heavy equipment such as drill rigs or direct push rigs are, not anticipated for the CMS. However, equipment used during site activities may include a belly boat that presents potential physical hazards to personnel. Issues associated with work over water and marine safety and boat operations are addressed in SMS 27 and SMS 53, respectively. All Safety Management Standards are located in **Attachment C**, a copy of which is to be maintained on site.

The following precautions must be observed whenever a belly boat is in use:

- Personal protective equipment (PPE) such as chest waders, safety glasses or goggles, and life vest must be worn whenever such equipment is present.
- Personnel must at all times be aware of the location and operation of the belly boat, 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.
- Keep all non-essential personnel out of the work area.

- If a belly boat is used in the exclusion zone (EZ) it 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).
- Life vests should be worn by all personnel in the belly boat.
- A life preserver or equivalent should be present in or near the belly boat at all times.

3.3.8 Underground and Aboveground Utilities

Excavation, drilling, crane, or similar operations are not anticipated during the CMS. Procedures for activities proximal to utility locations are located in SMS 34 in **Attachment C**, a copy of which will be maintained on-site when field activities are being done. Procedures will be in accordance with EM 385-1-1.

The PM is responsible for ensuring that underground utilities are identified and marked prior to the commencement of any subsurface (> 0.5 bgs) activities.) 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 are not anticipated during the CMS. 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

3.3.9 Electrical Safety

During work activities, the potential for exposure to electrical hazards exists. The primary hazards associated with electrical hazards are shock, burns, arc-blast, fire, and explosion. The procedure to reduce worker risk to electrical hazards is presented in SMS 012. Lockout/tagout procedures (SMS 023) must be used when working on any electrical equipment that has the potential to be energized. SMSs are located in **Attachment C.**

All motor housings will be guarded, and motors that emit sparks will not be used.

If live panel electrical work is required, either in the installation of temporary power or the repair of equipment, only a licensed electrician will be used to do this work. Licensure will be attached to this SSHP and will be available on-site during all such electrical work. The electrician will comply with National Fire Protection Association (NFPA) 70E-2000 Part II 2-3.1.5, which requires a hazard/risk evaluation procedure as part of an electrical safety program. This evaluation includes determination of the shock approach boundaries, flash hazard analysis as required by NFPA 70E-2000 Part II 2-1.3.3, and equipment labeling for equipment that must remain energized while being serviced. Work areas determined to contain an arc flash hazard will be entered only by a licensed electrician, and these areas will be marked with signage and barricade tape to prohibit all other entry.

3.4 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**.

3.4.1 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 containing DEET as necessary.

Stings of bees and wasps may cause serious allergic reactions in certain individuals. The SSHO 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. Personnel are encouraged to wear protective clothing if ticks are suspected to be present.

3.4.2 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.

3.4.3 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 try to feed them or pet them; the increased contact brings a greater possibility of danger. Avoid wildlife when possible.

3.4.4 Plants

Poisonous plants including poison ivy, poison oak, poison hemlock, 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.

3.4.5 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. Guidance on blood borne pathogens is located in SMS 51.

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, and cardiopulmonary resuscitation [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 the Environmental Protection Agency (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.

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 CHEMICAL EXPOSURE MONITORING

The chemical exposures that may be encountered at Cannon AFB include metals and TPH constituents in sediment and surface water; therefore chemical monitoring is not applicable to this CMS.

4.1.1 Air Monitoring Instrumentation

Sediment and surface water samples will be collected as part of CMS, therefore; air monitoring is not applicable to this CMS.

4.2 DUST CONTROL

Sediment and surface water samples will be collected as part of CMS, therefore; dust control is not applicable to this CMS.

THIS PAGE INTENTIONALLY BLANK

5.1 PERSONAL PROTECTIVE EQUIPMENT

The minimum PPE for site personnel includes:

- Safety glasses with side shields (or impact resistant goggles)
- Work gloves and/or chemical-resistant gloves
- Life vest
- Life preserver
- Chest waders

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) and SMS 29. Attachment 029-1 NA, will be utilized to document the PPE Hazard Assessment.

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 from 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:

- National Institute for Occupational Safety and Health (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

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 is 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:	Sediment/Surface water Sampling Activities	Mobilization/Demobilization, Site Inspection and Surveying
PPE:	Level D	Level D
Minimum Requirements:	• Rubber or nitrile gloves • Chest waders • Safety glasses or chemical splash goggles – as needed • Hearing protection when working in areas with noise hazards • Life vest and preserver	• 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 CMS, respiratory protection is not anticipated and will not be required. Although respiratory protection is not anticipated, if fieldwork conditions are encountered that warrant the use of respiratory protection, they will be used as described below.

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. Personnel not medically cleared to wear respirators will not be assigned to the 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).

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 assignments require 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 the respirator 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 (110ºF 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.

THIS PAGE INTENTIONALLY BLANK

6.1 SITE ACCESS

The SSHO 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 SSHP.

The SSHO 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 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 the 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 GPS units, 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 (if used), 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 FM.
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 Department of Transportation (DOT) regulations.

THIS PAGE INTENTIONALLY BLANK

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 decontaminate 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. Remove life vest.
3. Scrub boots with a stiff bristle brush and water.
4. Remove outer gloves (and boot covers, if used).
5. Remove hardhat (if used) and eye protection.
6. Remove respirator (if used).
7. Remove inner gloves.
8. 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 Standard Operating Procedure (SOP) No. 6 in the Field Sampling Plan, which is also included below.

7.3.1 Equipment Needs

- Plastic sheeting
- Wash and rinse tubs/troughs
- Alconox
- Tap water
- Deionized water
- Scrub brushes
- Paper towels

- Squirt bottles
- Disposable nitrile gloves/Disposal latex gloves

7.3.2 Procedures for Drilling Equipment

The use of drilling equipment is not anticipated during CMS fieldwork, however if one is deemed to be required, 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 Sediment/Surface water Soil Sampling Equipment

Shallow hand soil augers, other hand sampling and mixing equipment and stainless steel dipper (if used) 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 an Alconox 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 SSHO.

8.1 EMERGENCY INFORMATION

8.1.1 Emergency Telephone Numbers

Fire:	Cannon AFB	911 or (505) 784-2578
Police:	Cannon AFB	911 or (505) 784-2353
Hospital:	Plains Regional Medical Center	(505) 769-2141
Jeff Voelker	URS Project Manager	(402) 952-2558
Tony Host	URS Project Health and Safety Manager	(402) 952-2567
Dennis Day, Certified Industrial Hygienist (CIH)	URS Regional Health and Safety Manager	(402) 952-2525
TBD	URS Field Team Leader & Site Safety Officer	TBD

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 1.

8.2 PLACES OF REFUGE

In the event of a site emergency that requires evacuation, all on site personnel will evacuate to a pre-designated area located a safe distance from any health or safety hazard. The SSHO 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 SSHO in the event of an emergency where the area of influence affects the primary assembly area. Once assembled, the SSHO will take a head count. The SSHO will evaluate the assembly area to determine if the area is outside the influence of the situation; if not, the SSHO 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 SSHO 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 SSHO 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 en route.

- SSHO:

  The SSHO 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 SSHP.

8.6 MEDICAL EMERGENCIES RESPONSE PLAN

All 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 from potential hazards they may encounter during the rescue. When emergency services personnel arrive, communicate all first aid activities that have occurred. Transfer responsibility for care of the injured/ill to the emergency 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 SSHO 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 SSHO and PM immediately following first-aid treatment. Work is to be stopped until the PM or SSHO 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, the USACE North West Omaha (NWO) Form 1880 and engineering (ENG) Form 3394 must be completed and submitted to the USACE PM within 24 hours of the incident/accident. Refer to Appendix B of OM 385-1-1 (CENWO 2002) for instructions regarding the use of NWO Form 1880 and for a copy of the form itself. Appendix B of OM 385-1-1 and ENG Form 3394 are both included in Attachment D of this SSHP.

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. URS's guidance on Injury Management can be found in SMS 65 in **Attachment C**, a copy of which will be maintained on-site when field activities are being done.

8.9 OPERATION SHUTDOWN

Under certain extreme hazardous situations the SSHO 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 SSHO, 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 SSHO 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.

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 SSHO;
- 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 SSHO 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 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.

9.1.1 Initial Site Safety Briefing

Prior to the start of operations at the site, and for every new employee assigned to perform work at the site, the SSO will conduct a site safety briefing, which will include all personnel involved in site operations. At this meeting, the SSO will discuss:

1. Contents of this HSP
2. Types of physical and chemical hazards (extent and concentrations) at the site and means for minimizing exposure to hazards
3. Health effects of chemicals hazards
4. The type of monitoring that will be performed
5. Action levels for upgrade and downgrade of personal protective equipment
6. Personal protective equipment that will be used
7. Site-specific respiratory protection requirements
8. Decontamination protocol
9. Site control measures, including safe operating practices and communication
10. Location and use of emergency equipment (first aid kit, fire extinguishers)

11. Evacuation signals and procedures
12. Verification that the health and safety plan has been reviewed
13. Emergency Contacts
14. Route to the hospital

All site personnel, including subcontractor personnel, are to attend the briefing, review the SSHP and sign the Safety Plan Compliance Agreement Form in Appendix A; copies of these forms will be maintained in the project file.

Daily Tailgate Safety Briefings will be conducted each morning, and whenever there is a change in task or significant change in task location. All personnel will be required to sign the Daily Safety Task Analysis form included in Attachment A for each day they are on site.

All visitors will sign the Visitor Log form included in Attachment A.

9.2 HAZWOPER

All site personnel engaged in HTRW work are required to abide by the HAZWOPER requirements of 29 CFR 1910.120(e). URS's policy on Hazardous Waste Operations can be found in SMS 17 in **Attachment C**, a copy of will be maintained on-site when field activities are being done.

9.3 BEHAVIOR BASED SAFETY

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

The SHSO will maintain Safety Observation Checklists 72-1 or similar form modified for task specific operations. Safety Observations will be performed by employees and subcontractor at the rate of 1 per 200 hours worked and a minimum of 1 per week of field work conducted. Each employee working on the project is to complete a minimum of one Safety Observation. Details for SMS 072 may be found in **Attachment C**.

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

All on site personnel will review the 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 SSHO 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 SSHO 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 SSHP will be recorded in the field log.

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

1. Fit test records (if respirators are used)
2. Safety Compliance Agreement
3. Daily Safety Tasks Analysis forms
4. Safety training records
5. Medical clearance records
6. Field First Aid Kit Supply List (SMS 24-9 – monthly inspection documentation)
7. Visitor Log
8. Copies of Behavior Based Safety Observations (SMS 72-1)
9. Field Change Request Forms

THIS PAGE INTENTIONALLY BLANK

CENWO. 2002. Safety and Occupational Health Program. OM 385-1-1. November.

URS. 2005. Final Work Plan. Supplemental Assessment of Areas of Concern A, B, and C, Cannon AFB, New Mexico. Prepared for the U.S. Army Corps of Engineers, Omaha District. February.

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

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

DAILY SAFETY TASK ANALYSIS FORMS

Daily Safety Task Analysis

JOB/TASK _____ **DATE** _____

Work Area _____ **Permits(s) Required and attached** ☐ **YES** ☐ **NO**

Major Steps of Task:	Recognized/Unanticipated Hazards:	Safe Plan:	Tools *Required* to do the job safely:

Other Items discussed during the Safety Briefing:

_____

_____

_____

_____

Adjacent Work/Processes and/or co-occupancy ☐ **Yes** ☐ **No** ☐ **Other workers adjacent, above, below**
☐ **Notified them of our presence** ☐ **Coordinated with adjacent work supervisor/customer operator** ☐ **Can work safely**

TEAM MEMBERS SIGNATURES

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

The signature of the Supervisor certifies the completion of the Hazard Assessment and Safe Plan of Action by the crew.

Supervisor's Signature: _____ Date _____

Instructions: 1. Write the name of the job or task in the space provided. 2. Conduct a walk-through survey of work area. 3. Write the steps of the task in a safe sequence. 4. List all possible hazards involved in each step as well as reaction to failure. 5. In the Safe Plan column, provide the corrective actions that will be taken to keep the hazard from becoming an accident or injury. 6. In Tools column list tools needed to do the job, additional safety equipment, etc. 7. Have each team member that helped develop and will use this STA sign in the spaces provided at the bottom. 8. Review the STA at the end of the task for improvements. ***(NOTE:*** *THE WORK SHALL STOP IF CONDITIONS CHANGE, JOB CHANGES, OR DEFICIENCY IN PLAN IS NOTED.)*

Safe Plan of Action Checklist (Check the items that apply)

Permits/Clearances	Hazards	Safe Plan	
☐ Utility Clearance Obtained			
☐ Confined Space	☐ Overhead Utilities	☐ Power de-energization required	☐ Insulation blankets required ☐ Wire watcher required
☐ Critical Lift		☐ Required clearance distance = _____ ft.	☐ Safe work zone marked
☐ Hoisting & Rigging Safety Review	☐ Crane or other Lifting Equipment	☐ Signalman assigned ☐ Tag lines in use	☐ Area around crane barricaded
☐ Boom Assembly and Breakdown		☐ Lifting equipment inspected	☐ Personnel protected from overhead load
☐ Boom Proximity	☐ Underground Utilities	☐ Reviewed as-builts	☐ Subsurface surveys ☐ Received dig permit
☐ Concrete Structure Penetration		☐ Required clearance distance = _____ ft.	☐ Safe work zone marked
☐ Soil Excavation	☐ Electrical	☐ Lock Out/Tag Out/Try Out?	☐ Permit required ☐ Confirm that equipment is de-energized
☐ Pneumatic Test		☐ Reviewed electrical safety procedures	☐ Additional info below
☐ Hot Work	☐ Excavations	☐ Permits ☐ Inspected prior to entering	☐ Proper sloping/shoring
☐ Scaffolding Erection Plan		☐ Barricades provided ☐ Access/egress provided	☐ Protection from accumulated water
☐ Steel Erection/Decking/Flooring/ Grating Checklist	☐ Fire Hazard	☐ Permit ☐ Fire Extinguishers	☐ Fire watch ☐ Adjacent area protected
☐ Request for Shutdown		☐ Unnecessary flammable material removed	☐ Additional info below
☐ Electrically Hazardous Work	☐ Vehicular Traffic or Heavy Equipment	☐ Traffic Barricades ☐ Cones ☐ Signs	☐ Flagmen ☐ Lane closure
☐ Radiation Work Permit for Visitors		☐ Communication with equipment operator	☐ Additional information below
Required PPE	☐ Noise > 85 dB	Hearing protection is required: ☐ Ear plugs ☐ Ear muffs	☐ Both ☐ Additional info below
☐ Hard Hat	☐ Hand & Power Tools:	☐ Inspect general condition ☐ GFCI in use	☐ Identified PEP required for each tool
☐ Ear Plugs/Ear Muffs		☐ Reviewed safety requirements in operators manual(s)	☐ Guarding OK ☐ Additional info below
Eye Protection	☐ Hand Hazards	☐ List sharp tools, material, equipment	
☐ Safety Glasses			
☐ Face Shield		☐ PPE gloves, etc. ☐ Protected sharp edges as necessary	☐ Additional info below
☐ Chemical Goggles	☐ Manual Lifting	☐ Reviewed proper lifting tech.	☐ Identified material requiring lifting equipment
☐ Welding Hood		☐ Hand protection required ☐ Back support belts	☐ Additional information below
Hand Protection	☐ Ladders	☐ Inspect general condition before use	☐ Ladder inspected within last quarter
☐ Cut Resistant Gloves		☐ Ladder tied off ☐ Proper angle and placement	☐ Reviewed ladder safety
☐ Welders Gloves	☐ Scaffolds	☐ Inspect general condition before use	☐ Tags in place ☐ Properly secured
☐ Nitrile Gloves		☐ Toe boards used ☐ Footings adequate	☐ Materials properly stored on scaffold
☐ Surgical Gloves	☐ Slips, Trips, Falls	☐ Inspect for trip hazards ☐ Hazards marked	☐ Tools & material properly stored
☐ Rubber Gloves		☐ Extension cords properly secured ☐ Work zone free of debris	☐ Additional information below
☐ Electrical Insulated Gloves	☐ Pinch Points	List potential pinch points:	
☐ Arm Sleeves			
Foot Protection		☐ Working near operating equipment ☐ Hand/Body positioning	☐ Additional information below
☐ Safety Toe Boots	☐ Working w/Chemicals	☐ The task creates potential for direct contact with hazardous chemicals.	
☐ Rubber Boots		☐ Reviewed MSDS hazards and precautions	☐ Have proper containers and labels
☐ Rubber Boot Covers		☐ Have identified proper PPE (respirators, clothing, gloves, etc.	
☐ Dielectric Footware	☐ Heat Stress Potential	☐ Heat stress monitoring (>85º F; 29.4º C) ☐ Liquids available	☐ Cool down periods
Respiratory Protection		☐ Sun Screen ☐ Reviewed Heat Stress symptoms	☐ Additional info below
☐ Dust Mask (NIOSH)	☐ Cold Stress Potential	☐ Proper clothing (i.e., gloves, coat, coveralls)	☐ Wind chill (<32º F; 0º C)
☐ Air Purifying Respirator		☐ Reviewed Cold Stress symptoms ☐ Warm up periods	☐ Additional information below
☐ Supplied Air Respirator	☐ Environmental	☐ Air emissions ☐ Water discharge	☐ Hazardous wastes ☐ Other wastes
☐ SCBA		☐ Pollution prevention	☐ Waste minimization
☐ Emergency Escape Respirator	☐ Natural or Site Hazards	☐ Weather ☐ Terrain	☐ Adjacent operations or processes ☐ Biological hazards
Special Clothing		☐ Animals/reptiles/insects hazards	
☐ Tyvek®	☐ Overhead Work	☐ Caution barricade tape required	☐ Danger barricade tape required
☐ Poly Coated Tyvek®		☐ Rigid railing required ☐ Covers over opening	☐ Warming signs required
☐ NOMEX®	**Additional Information**		
☐ Rain Suit			
Fall Protection			
☐ Harness			
☐ Double Lanyard Required			
☐ Anchorage Point Available			

THIS PAGE INTENTIONALLY BLANK

SAFETY 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...)
__ VERICATION THAT HEALTH AND SAFETY PLAN HAS BEEN RECEIVED AND READ
__ MONITORING PROCEDURES
__ ACTION LEVELS
__ DECONTAMINATION PROCEDURES
__ LOCATION OF EMERGENCY NUMBERS
__ ROUTE TO THE HOSPITAL

I, the undersigned, have received a copy of the safety plan for the referenced project. 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
1.(print) _____	
(signature) _____	
2.(print) _____	
(signature) _____	
3.(print) _____	
(signature) _____	

SAFETY COMPLIANCE AGREEMENT AND DOCUMENTION OF SITE SAFETY BRIEFING - Page 2

I, the undersigned, have received a copy of the safety plan for the referenced project. 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
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) _____	

Visitor Log

LOCATION:

Name (print legibly)	Company	Date/Time IN	Date Time Out

AHAs:

Mobilization / Demobilization

Survey and Site Inspection

Sediment / Surface water sampling

Field Sampling IDW, Management and Disposal

Equipment Decontamination

Hazard Assessment Certification Form

THIS PAGE INTENTIONALLY BLANK

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Cannon AFB Job: Mobilization/Demobilization Risk Assessment Code (RAC): **L**

Prepared By: Tony Sedlacek: Reviewed By: Dennis Day

Minimum Protective Clothing and Equipment:
PPE Level D (outside exclusion zone): General work clothes, safety glasses, steel-toed boots

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Field engineering (survey of preliminary conditions) Driving to and from Air Force base from hotel Loading and unloading work vehicle at work site	Driving/vehicle movement (including trucks)	1. Obey traffic rules. 2. 15 miles per hour is the maximum speed allowed in the work area. 3. Use caution when entering roadways. 4. Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). 5. Do not use cell phones when operating vehicles. 6. Secure all loads, including equipment within the cab, containerize small equipment and secure container. 7. Wear seat belts. 8. Use caution and wear orange vests if working near active roads 9. Leave enough time to get to your destination without hurrying. 10. For pick-ups or SUVs with obstructed rear view, use a spotter when backing up. 11. Refer to SMS 57, Vehicle Safety Program.	16.A/18.A 16.B/18.B 08.B 16.B.08/18.B.03 16.B.01/18.B.03 16.B.02 16.B/18.B 16.M
	Overhead/underground utilities	1. If overhead utilities are present in work areas, place warning signs at ground level. 2. Always check for overhead utilities before using extendable equipment. 3. Maintain at least one mast length or 20 feet (whichever is greater) from all power lines. 4. Contact the RHSM if high voltage lines are present. 5. Complete utility locates prior to intrusive work in areas where utilities have not been cleared through institutional knowledge by calling One Call: (800) 321-ALERT and/or coordinating with site personnel. 6. Observe the area for indications of utilities.	16.M.03 16.M.07/11.E 16.M.07 11.I

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Cannon AFB Job: Mobilization/Demobilization Risk Assessment Code (RAC): L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Dust	1. Minimize generation of dust. 2. Stay out of visible dust clouds. 3. Wet soil if necessary to eliminate visible dust.	06.A.04
	Noise	1. Wear hearing protection when operating or working near heavy equipment. 2. Refer to SMS 26, Hearing Conservation.	05.C.01
	Slips, trips, and falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Inspect areas daily and findings and recorded on daily inspection reports.	14.C
	Hand tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Don't use damaged tools. 4. Push, don't pull wrenches.	13.A.02 13.A.02 13.A.02
	Biological hazards	1. Use repellents and proper clothing for protection against insects including ticks and mosquitoes. 2. Wear protective clothing in areas where poison oak and poison ivy are present. 3. Wear protective clothing, including long pants and sturdy boots for protection against snakes and spiders. 4. See SMS 047.	06.D.01 06.D.02 06.D.01
	Material handling	1. Use safe lifting techniques, bending at the knees and lifting with the legs. 2. Use caution and do not twist the back when carrying a load. 3. Use mechanical devices to move loads when possible. 4. Wear protective gloves when handling materials. 5. See SMS 069.	14.A.01 14.A.01 14.A.04 05.A
	Cold stress	1. Wear cold weather clothing and provide shelter as needed based on site conditions. 2. Conduct temperature monitoring when temperatures fall below 45°F. 3. See SMS 059.	06.J.10 06.J.11
	Heat stress	1. Make drinking water available to all workers and encourage workers to drink small amounts of water frequently. 2. Adjust work/rest regimens during hot weather. 3. See SMS 018.	06.J.03 06.J.04

MOBILIZATION/DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Cannon AFB Job: Mobilization/Demobilization Risk Assessment Code (RAC): L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Extreme weather	1. When there are warnings or indications of severe weather, monitor conditions and take precautions to protect personnel.	06.J.01
	Fire	1. Provide portable fire extinguishers in all equipment. 2. Inspect fire extinguishers monthly.	09.E 09.E
	On-Site Vehicle	1. Provide type II 16-unit first aid kits and make these kits accessible at the site.	03.B

THIS PAGE INTENTIONALLY BLANK

SURVEY AND SITE INSPECTION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Cannon AFB Job: Survey and Site Inspection Risk Assessment Code (RAC): **L**

Prepared By: Tony Sedlacek: Reviewed By: Dennis Day

Minimum Protective Clothing and Equipment:
PPE Level D: General work clothes, safety glasses, hard hat, steel-toed boots, chemically resistant gloves (when handling potentially contaminated materials)

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Land surveying (GPS) and site inspections	Ergonomics	1. Do not strain when collecting the sample. 2. Use arms and shoulders; do not twist your back.	16.M.09 16.M.09
	Hand tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Do not use damaged tools.	13.A.02 13.A.02 13.A.02

THIS PAGE INTENTIONALLY BLANK

SURFACE WATER AND SEDIMENT SAMPLING
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Cannon AFB Job: Surface Water and Sediment Sampling Risk Assessment Code (RAC): L

Prepared By: Dennis Day: Reviewed By:

Minimum Protective Clothing and Equipment:
PPE Level D: General work clothes, safety glasses, chemically resistant gloves - nitrile (when handling potentially contaminated materials), deconable rubber boots, chest waders, personal floatation device

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Surface water and Sediment sampling	Ergonomics	1. Do not strain when collecting sample. 2. Use you arms, do not twist your back.	16.M.09 16.M.09
	Hand tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Don't use damaged tools.	13.A.02 13.A.02 13.A.02
	Working in or near water	1. Personal floatation devices are required if working over water or adjacent to fast flowing water. 2. Where chest waders with a life vest if wading in water. 3. Use a belly boat floatation device to aid in the collection of samples.	
	Environmental contamination (if applicable)	1. Contain cuttings in drums or plastic sheeting. 2. Wear proper PPE and minimize contact with soil, sediment, groundwater, etc. 3. Work upwind of the boring. 4. If unusual soil discoloration or odors are encountered, stop work, evacuate the area, and contact the SSO. The approach will need to be reevaluated, and Level C PPE may be required.	28.A.02
	Chemical hazards	1. Review MSDSs. 2. Follow manufacturer's instructions for use, handling, and storage. 3. Use recommended protective equipment. 4. Label all containers.	01.B.06

THIS PAGE INTENTIONALLY BLANK

FIELD SAMPLING IDW, MANAGEMENT AND DISPOSAL
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Vance AFB

Job: Field Sampling IDW Management and Disposal

Risk Assessment Code (RAC): **L**

Prepared By: Jeff Hopkins:

Reviewed By:

Minimum Protective Clothing and Equipment:
PPE Level D (outside exclusion zone): General work clothes, safety glasses, hard hat, steel-toed boots, work gloves, respiratory protection (EM 385-1-1 Section 05.A,B,C,D))

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Field Screening – Head Space Analysis with PID	Material Handling	1. Use safe lifting techniques, bending at the knees and lifting with the legs 2. Use cution and do not twist the back when carrying a load 3. Use mechanical devices to move loads whtn possible 4. Wear protective gloves when handing materials 5. See SMS 069	14.A.01 14.A.01 14.A.04 05.A
	Slips, trips, and falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Work areas should be inspected daily and findings will be recorded on daily inspection reports.	14.C
	Biological hazards	1. Repellents and proper clothing should be used for protection against insects including ticks and mosquitoes. 2. Protective clothing should be used in areas where poison oak and poison ivy are present. 3. Protective clothing, including long pants and sturdy boots, should be used for protection against snakes and spiders. 4. See SMS 047.	06.D.01 06.D.02 06.D.01
	Cold stress	1. Cold weather clothing and shelter should be provided as needed based on site conditions. 2. Air temperature monitoring should be done when temperatures fall below 45°F. 3. See SMS 059.	06.J.10 06.J.11

FIELD SAMPLING IDW, MANAGEMENT AND DISPOSAL
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Apr-08

Project: Vance AFB Job: Field Sampling IDW Management and Disposal Risk Assessment Code (RAC): L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Heat stress	1. Drinking water should be made available to all workers and workers should be encouraged to drink small amounts frequently. 2. Work/rest regimens will be adjusted during hot weather. 3. See SMS 018.	06.J.03 06.J.04
	Extreme weather	1. When there are warnings or indications of severe weather, conditions should be monitored and precautions taken to protect personnel.	06.J.01

EQUIPMENT DECONTAMINATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Dec-08

Project: Vance AFB Job: Equipment Decontamination Risk Assessment Code (RAC): L

Prepared By: Tony Sedlacek: Reviewed By:

Recommended Protective Clothing and Equipment:
PPE Level D (outside exclusion zone): General work clothes, safety glasses, hard hat, steel-toed boots, work gloves, hearing protection

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

SEVERITY	PROBABILITY: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
Scrape gross materials from sampling equipment Wash sampling equipment in Liquinox and water mix Rinse sampling equipment in clean rinse water Triple rinse sampling equipment with deionized water	Eye and hand safety	1. Wear safety glasses or goggles. 2. Use hand with protective glove or approved hand tools to remove gross material 3. Change protective gloves often	
	Dust	1. Minimize generation of dust. 2. Stay out of visible dust clouds. 3. Wet soil if necessary to eliminate visible dust.	06.A.04
	Noise	1. Wear hearing protection when operating or working near heavy equipment. 2. Refer to SMS 26, Hearing Conservation.	05.C.01

EQUIPMENT DECONTAMINATION
ACTIVITY HAZARD ANALYSIS

Date Prepared: 24-Dec-08

Project: Vance AFB Job: Equipment Decontamination Risk Assessment Code (RAC): L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)
	Slips, trips, and falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Inspect work areas daily and record findings on daily inspection reports.	14.C
	Biological hazards	1. Use insect repellents and proper clothing for protection against insects including ticks and mosquitoes. 2. Use protective clothing in areas where poison oak and poison ivy are present. 3. Use protective clothing, including long pants and sturdy boots, for protection against snakes and spiders. 4. See SMS 047.	06.D.01 06.D.02 06.D.01
	Material handling	1. Use safe lifting techniques, bending at the knees and lifting with the legs. 2. Use caution and do not twist the back when carrying a load. 3. Wear protective gloves when handling materials. 4. See SMS 069.	14.A.01 14.A.04 05.A
	Cold stress	1. Provide cold weather clothing and shelter as needed based on site conditions. 2. Monitor air temperature monitoring when temperatures fall below 45°F. 3. See SMS 059.	06.J.10 06.J.11
	Heat stress	1. Make drinking water available to all workers and worker. Encourage workers to drink small amounts frequently. 2. Adjust work/rest regimens during hot weather. 3. See SMS 018.	06.J.03 06.J.04
	Extreme weather	1. When there are warnings or indications of severe weather, monitor weather conditions and take precautions to protect personnel.	06.J.01

Safety Management Standards (SMSs):

2 Worker Right to Know
9 Corrosive and Reactive Materials
16 Hand Tools and Portable Equipment
17 Hazardous Waste Operations
18 Heat Stress
21 Housekeeping
24 Medical Screening
27 Work Over Water
29 Personal Protective Equipment
30 Sanitation
34 Utility Clearances
42 Respiratory Protection
47 Biological Hazards
49 Injury/Illness/Incident Reporting and Notifications
50 Specific Chemical Hazards
51 Blood Borne Pathogens
53 Marine Safety and Boat Operations
55 Health & Safety Training
59 Cold Stress
64 Hand Safety
65 Injury Management
69 Back Injury Prevention
72 Behavior Based Safety

THIS PAGE INTENTIONALLY BLANK

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies.

This standard is not applicable to chemical laboratory operations that are covered under 29 Code of Federal Regulations (CFR) 1910.1450 (Occupational Exposure to Chemicals in Laboratories).

2. Purpose and Scope

The purpose of this Hazard Communication standard (also know as worker right-to-know program) is to provide URS personnel with information and training about safety and health hazards associated with the chemicals they may encounter in the workplace. This procedure describes how chemical safety hazards are communicated to URS personnel and how information is to be provided to employees of other companies working at the location. The requirements include steps to acquire this information, maintain the information, and train personnel in the hazard communication program.

3. Implementation

Implementation of this standard is the responsibility of the URS manager who directs activities at the facility, site, or project location. For office locations and large projects, this program may be incorporated into the general site orientation and training program or administered by project management.

4. Requirements

A. Hazardous Material Inventory

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 material safety data sheet (MSDS).

B. Site-Specific Written Program

A site-specific written program may be prepared as a stand-alone document or included within a site-specific health and safety plan. The program must cover hazardous materials in all physical forms (liquids, solids, gases, vapors, fumes, and mists); regardless of whether they are “contained.”

C. Material Safety Data Sheets (MSDSs)

1. The safety representative will obtain an MSDS for each chemical before it is used. MSDSs will generally be received by the person ordering the product. MSDSs for products frequently used should be kept on file because additional copies may not be included in repeat shipments.

2. The safety representative will review each MSDS when it is received to evaluate whether the information is complete and to determine whether existing protective measures are adequate.

3. Each office or project location will assign a responsible person or department to maintain a collection of all applicable and relevant MSDSs in an area that is accessible by all employees at all times. An electronic database is an acceptable method of maintaining the MSDSs.

4. The assigned person or department will replace MSDSs when updated sheets are received and will communicate any significant changes to those who work with the chemical.

5. MSDSs are required for all hazardous materials brought on site by project personnel.

6. General household products to be used for their specific purpose, as well as food, drugs, and cosmetics brought into the workplace for employee consumption, are exempt, as are supplies in the first aid kit, such as isopropyl alcohol and antibacterial wipes.

7. Subcontractors bringing hazardous materials on to a site or project must submit MSDSs to the safety representative. The safety representative may restrict the use of certain hazardous materials on a site or project due to occupational health risk, hazardous physical properties of the material, or potential employee sensitivity to odor or irritating properties of the material.

D. Labels

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

1. Product name and identity of the hazardous chemical(s).

2. Appropriate hazard warnings.

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

Labels on incoming containers of hazardous materials will not be removed or defaced.

Labels are also required when a hazardous substance is transferred from a primary container to a secondary container. Labels on secondary containers must indicate the product name or the names of the hazardous substances contained therein, as well as related physical and health hazards and their associated target organs.

E. Hazardous Nonroutine Tasks

Periodically, employees are required to perform hazardous nonroutine tasks. Prior to starting work on such projects, each employee must be provided with information about hazards to which they may be exposed, as follows:

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

F. Informing Contractors/Subcontractors

Provide other contractors/subcontractors working in the same area with the following information on chemicals used by or provided to URS 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, such as ventilation or isolation of the work. In some cases, as an administrative control measure, a task may be delayed to a time when a minimal number of employees are present in the area.
3. Location of MSDSs.

G. Training

1. Provide training to all employees who have the potential to be exposed to hazardous materials, on the following schedule:
   a. At the time of the initial task assignment, or
   b. Whenever new chemicals are introduced into the workplace.
2. This training will include the following:
   a. Applicable regulatory requirements.
   b. Location of the program, inventory, and MSDS.
   c. Chemicals used and their hazards (chemical, physical, and health).
   d. How to detect the presence or release of chemicals.
   e. Safe work practices and methods employees can take to protect themselves from chemical hazards.
   f. How to read an MSDS.
   g. Site- or project-specific information on hazard warnings and labels in use at the location, if applicable.
3. Document the training.
4. Where non–English-speaking workers are employed, arrange provisions for training in the appropriate language. International Chemical Safety Cards (see Section 6, ILO) may be used in conjunction with MSDS information to provide non–English-language information. MSDSs are required to be on site, but there is no requirement for the MSDSs to be in a language other than English.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Chemical Inventory.

B. MSDSs.

C. Training records.

D. Contractor/Subcontractor notifications.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) General Industry Standards – Hazard Communication – 29 Code of Federal Regulations (CFR) 1910.1200

B. U.S. OSHA General Industry Standards – Occupational Exposure to Hazardous Chemicals in Laboratories – 29 CFR 1910.1450

C. U.S. OSHA Construction Standards – Hazard Communication – 29 CFR 1926.59

D. Mine Safety and Health Administration – Hazard Communication – 30 CFR 47

E. OSHA Administration Technical Links – Hazard Communication

F. National Paint and Coatings Association (NPCA) – Hazardous Materials Identification System (HMIS) Version III

G. National Fire Protection Association (NFPA) Standard 704 – Standard System for the Identification of Hazardous Materials for Emergency Response

H. International Labour Organization (ILO) – International Chemical Safety Cards (information about 1613 chemicals in 18 languages). http://www.ilo.org/public/english/protection/safework/cis/products/icsc/index.htm

I. Agency for Toxic Substances and Disease Registry (ATSDR) – Tox FAQs and Tox FAQs en Espanol, 2003. http://www.atsdr.cdc.gov/toxfaq.html

7. Supplemental Information

A. Hazard Communication Program – Template

B. Hazard Communication Employee Training Program

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies where corrosive and/or reactive materials are used or stored.

2. Purpose and Scope

The purpose of this standard is to protect employees from the hazards of corrosive and reactive materials. This procedure considers a corrosive material as one that has a pH less than 2.0 (acid), or greater than 12.5 (base). A reactive material is a chemical that may be sensitive to shock, or may react with air or water depending upon its makeup.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Appoint a responsible person who will:

1. Inspect storage areas periodically.
2. Monitor the quantity of corrosive and reactive materials on site, as well as that of incoming materials.
3. Review work practices that involve corrosive and reactive materials.

B. Require that all employees working with corrosive or reactive materials, or who may be exposed to such materials, are trained in accordance with SMS 002 – Hazard Communication.

C. Control the use of corrosive and reactive materials by URS personnel.

1. Order only those materials and quantities that are needed to complete a job.
2. Check incoming corrosive and reactive materials for proper labeling in accordance with SMS 002 – Hazard Communication.

a. Label materials, if needed, as they arrive on site.

b. Mark reactive materials containers with the date of receipt of the chemical.

3. Check incoming corrosive and reactive materials for material safety data sheets (MSDS). If MSDSs are not provided or are already on file, order them from the manufacturer, distributor, or vendor.

4. Add incoming corrosive and reactive chemicals to the hazardous materials inventory, if not already present, following procedures set forth in SMS 002 – Hazard Communication.

5. Do not store any quantity of corrosive or reactive materials in an office (with the exception of limited quantities of consumer products). These materials are to be stored off site, or at an on-site laboratory or storage area.

D. Store corrosive and reactive materials as indicted in the MSDS:

1. In a cool, dry environment, free from extremes of temperature and humidity.

2. In a manner that separates them from other materials (including flammables and oxidizers) and from each other.

   a. Separate acids and bases.

   b. Separate reactive materials from acids and bases, and protect from contact with water.

3. On materials that are acid-resistant (Teflon-coated, plastic, etc.) for small containers.

4. Covered, not stacked on one another, on acid-resistant material for carboys (approximately 5 gallons/22 liters).

5. On individual racks or securely blocked on skids, with closure (plug) facing upward to prevent leakage from drums.

E. Require that labeling and signage are in place.

1. Label containers with the appropriate warning word to indicate the hazard, such as: DANGER; WARNING; CAUTION; CORROSIVE; OXIDIZER.

F. Use corrosive and reactive materials appropriately.

1. Prior to use and in accordance with MSDS, safe-handling procedures must be developed for each operation, and type and

concentration of the chemical. In all cases, review the MSDS and product information before use.

2. Follow SMS 029 – Personal Protective Equipment when working with or around corrosive and reactive materials. Review the MSDS for the chemical used to determine the specific type of PPE needed, to include at a minimum:

   a. Chemical-splash goggles

   b. Chemical-resistant gloves

   c. Chemical-resistant apron

3. Obtain medical care immediately in the event of:

   a. Skin or eye exposure (e.g., splash) to corrosive liquids

   b. Inhalation of vapors of corrosive liquids that cause respiratory discomfort.

4. Require an eyewash station to be located in all areas where acids or bases are used. Safety showers must be near by if significant acid or base quantities are involved.

   a. Place emergency eyewashes and showers in accessible locations that require no more than 10 seconds to reach, and are in a travel distance no greater than 25 feet (7.5 meters) from the hazard.

   b. Keep the areas surrounding eyewashes and safety showers free of stored materials or debris at all times.

   c. Mark emergency eyewashes and showers with a highly visible sign.

   d. Require the area around emergency eyewashes and showers to be well lighted and visible.

   e. Where portable eyewash units are used, a process must be in place to change the water and clean the unit, as required by the manufacturer's instructions.

   f. Require emergency showers and shower/eyewash combinations connected to a self-contained water supply to

deliver a minimum 20 gallons (85 liters) per minute for 15 minutes.

g. Require emergency showers and shower/eyewash combinations permanently connected to a potable water supply to deliver at least 30 gallons (127.5 liters) per minute continuously.

h. Require emergency eyewashes to be capable of delivering to the eyes not less than 0.4 gallon (1.5 liters) per minute for 15 minutes.

G. Be prepared to clean up spills of corrosive and reactive materials.

1. Have a written spill response plan in place before materials are stored on site.

2. Have commercial spill kits available for cleanup of small quantities of materials. At a minimum, kits should contain appropriate protective clothing (including full-body suits, gloves, and boots) and spill control equipment (including absorbents, pillows, shovels, containers, etc.).

3. Where necessary, ensure that appropriate respiratory protection equipment is provided to spill responders. For additional information, see SMS 042 – Respiratory Protection.

4. Clean up or respond to spills promptly.

5. Ensure that personnel responding to a spill have been trained in the hazards associated with the spilled material, as well as use of the spill control equipment, including PPE required for the task.

6. Do not use combustible organic materials such as sawdust, excelsior, wood chips and shavings, paper, rags, or burlap bags to absorb or clean up spills.

H. Develop a waste management plan and procedures, including procedures for collection, storage, labeling, pick-up and transport, and final disposal.

I. Dispose of corrosive and reactive materials appropriately.

1. Segregate organic acids, inorganic acids, and basic wastes.

2. Contract hazardous waste disposal services should be obtained, as necessary, to dispose of waste materials. All waste must be appropriately packaged for off-site transportation, if applicable.

3. Wastes must be marked, labeled, and shipped in accordance with regulatory requirements. For additional information, see SMS 048 – Hazardous Materials/Dangerous Good Shipping.

J. Inspect corrosive and reactive storage and use areas periodically.

1. Inspect office, laboratory, and project settings quarterly.

2. Use the inspection sheet provided as Attachment 009-1 NA to inspect sites.

5. Documentation Summary

The following information will be maintained in the project file:

A. Completed Corrosive and Reactive Material Inspection Sheets.

B. Worker Right-to-Know training documentation.

C. Written Spill Response Plan.

D. Waste Management Plan.

E. Documentation of training for spill response personnel.

F. Documentation of hazard communication training for personnel exposed to corrosive and/or reactive materials.

6. Resources

A. ANSI Z358.1-2004 – American National Standard for Emergency Eyewash and Shower Equipment

B. U.S. Occupational Safety and Health Administration (OSHA) Technical Links – Personal Protective Equipment

C. U.S. OSHA Technical Links – Hazard Communication

D. Australian Standards AS 3780 – 1994. The Storage and Handling of Corrosive Substances

E. SMS 002 – Hazard Communication

F. SMS 029 – Personal Protective Equipment

G. SMS 042 – Respiratory Protection

H. SMS 048 – Hazardous Materials/Dangerous Goods Shipping

I. Attachment 009-1 NA – Corrosive and Reactive Materials Inspection Sheet

URS	Health, Safety and Environment **CORROSIVE AND REACTVE MATERIALS INSPECTION SHEET**	Attachment 009-1 NA Issue Date: June 1999 Revision 3: February 2009

Location: _____

Name of Inspector: _____ **Date Inspected:** _____

Labeling

1. Original containers are labeled with: ☐ Yes ☐ No ☐ NA
   - Name of chemical
   - Signal word (e.g., DANGER; WARNING; CAUTION, etc.)
   - Manufacturer

Pre-Job Activities

2. Corrosives and reactives are stored in a cool, dry environment, free from temperature extremes ☐ Yes ☐ No ☐ NA
3. Corrosives and reactives are stored in their properly labeled original containers, cushioned against shock, and stored to prevent leaks ☐ Yes ☐ No ☐ NA
4. Corrosives are not stored in the vicinity of oxidizers ☐ Yes ☐ No ☐ NA
5. Hydrofluoric acid is stored only in acid-proof polyethylene- or ceresin-lined containers ☐ Yes ☐ No ☐ NA
6. Corrosives are stored on acid-resistant material ☐ Yes ☐ No ☐ NA
7. Chromic acid, nitric acid, perchloric acid, and potassium permanganate (all oxidizers) are stored separately from other corrosives and flammables ☐ Yes ☐ No ☐ NA

Handling

8. The following minimum required PPE is used when working with corrosives: ☐ Yes ☐ No ☐ NA
   - Chemical splash goggles
   - Chemical resistant gloves
   - Chemical resistant apron
9. Bottles or carboys are opened slowly to guard from splashes. ☐ Yes ☐ No ☐ NA
10. The outside of the container is washed off with water after use to clean off any droplets of material. ☐ Yes ☐ No ☐ NA
11. An eyewash is located in all areas where corrosives are used. ☐ Yes ☐ No ☐ NA
12. An eyewash is:
    - Within 25 feet (7.62 meters) or 10 seconds of travel ☐ Yes ☐ No ☐ NA
    - Marked with a highly visible sign ☐ Yes ☐ No ☐ NA
    - Well lit and visible ☐ Yes ☐ No ☐ NA
    - Working and delivering a minimum of 1.5 liters of water per minute for 15 minutes ☐ Yes ☐ No ☐ NA
13. Where substantial quantities of corrosives and/or reactives are stored, access to an emergency shower is available. ☐ Yes ☐ No ☐ NA
14. Spill control materials compatible with chemicals are available for emergency use. ☐ Yes ☐ No ☐ NA

Waste Disposal

15. Organic acid, inorganic acid, and basic waste are kept segregated. ☐ Yes ☐ No ☐ NA
16. Corrosive waste is disposed in accordance with regulatory and client requirements. ☐ Yes ☐ No ☐ NA
17. A waste management plan or procedure is in place. ☐ Yes ☐ No ☐ NA
18. Arrangements for waste collection, transport, and disposal are in place. ☐ Yes ☐ No ☐ NA

Comments:

_____

_____

1. Applicability

This standard applies to URS Corporation and its subsidiary companies in which hand tools and/or portable powered equipment, including chain saws; brush cutters, powder-actuated tools, and similar high-hazard implements are used.

2. Purpose and Scope

The purpose of this standard is to provide procedures for the safe use and handling of hand tools and portable powered equipment. SMS 064 – Hand Safety provides additional information on the safe use of hand tools.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site or project location.

4. Requirements

A. General

1. Keep hand and power tools in good repair and use them only for the task for which they were designed. Use tools only in accordance with the manufacturer's recommendations.

2. Remove damaged or defective tools from service. Affix a "Do Not Use" tag (or similar) to the tool until repairs are made or the tool is destroyed.

3. Provide employees using hand tools or portable powered equipment with personal protective equipment (PPE) and train employees in the use of PPE required for the operation being undertaken.

4. Keep surfaces and handles clean and free of excess oil and grease to prevent slipping.

5. Do not carry sharp tools in pockets; this practice may cause puncture wounds.

6. Clean tools and return to a suitable toolbox, room, rack, or other storage area upon completion of a job.

7. Before applying pressure, ensure that wrenches have a good bite.

a. Brace yourself by placing your body in the proper position so that that you will not fall in case the tool slips.

b. Make sure hands and fingers have sufficient clearance in the event the tool slips.

c. Always pull on a wrench, never push.

8. When working with tools overhead, place tools in a holding receptacle or secure when not in use to prevent them from falling.

9. Do not leave tools in or on passageways, access ways, walkways, ramps, platforms, stairways, or scaffolds where they can create a tripping hazard.

10. Do not throw tools from place to place or from person to person, or drop tools from heights.

11. Use nonsparking tools in atmospheres with fire or explosive characteristics.

12. Inspect all tools prior to start-up or use to identify any defects.

13. Powered hand tools should not be capable of being locked in the ON position, except as noted elsewhere in this standard.

14. Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.

15. Ensure that all portable powered tools designed to accommodate guards are equipped with such when in use.

16. Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools.

17. Do not use cheater pipes.

18. Make provisions to prevent machines from automatically restarting upon restoration of power (see SMS 023 – Lockout and Tagout Safety).

19. Where URS issues tools to its employees, the supervisor is responsible for the safe condition of tools and equipment.

20. Where workers furnish their own tools, their tools must conform to the requirements demanded for safety and efficiency. The supervisor has the responsibility to regularly inspect these tools for defects.

B. Electrical Power Tools

1. Electric-power–operated tools will be either of the approved double-insulated type or grounded in accordance with the National Electric Code.
2. The use of the electric cord for hoisting or lowering electric tools is an unsafe practice and will not be permitted.
3. All handheld powered drills, tappers, fastener drivers, horizontal, vertical, and angle grinders with wheels greater than 2 inches (5.1 centimeters) in diameter, disc sanders, belt sanders, reciprocating saws, saber saws, and other similar operating powered tools will be equipped with a momentary contact ON/OFF control and may have a lock-on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.
4. All other handheld powered tools such as circular saws, chain saws, and percussion tools without positive accessory holding means will be equipped with a constant pressure switch that will shut off the power when the pressure is released (i.e., “dead man” switch).

C. Grinding Tools

1. Inspect work rests and tongue guards for grinders.
   a. Work rest gaps should not exceed ⅛ inch (3 mm).
   b. Tongue guard gaps should not exceed ¼ inch (6 mm).
2. Do not adjust work, guards, or tool rests while the grinding wheel is moving.
3. Inspect the grinding wheel for cracks, chips, defects, or excessive wear. Remove from service if any defects are found.
4. Wear goggles when grinding. A clear full face shield may be worn with the goggles.

5. Do not use the side of a grinding wheel unless the wheel is designed for side grinding.
6. Always stand to the side of the blade, never directly behind it.
7. Use grinding wheels only at their rated speed.
8. Grinding aluminum is prohibited.
9. For operations in the United Kingdom:
   a. No grinding wheels exceeding 55 mm are to be used.
   b. All wheels are to be marked with their safe maximum speed.
   c. Abrasive wheels will be operated only by personnel who have been specifically trained and specified competent by URS.
   d. Abrasive wheels will be operated only by persons specified as competent, under the abrasive wheel regulations.
   e. Abrasive wheels must be operated only if the manufacturer's guard is fitted and they are in good working order.

D. Power Saws

1. Require that circular saws are fitted with blade guards.
2. Inspect each day prior to use. Remove damaged, bent, or cracked saw blades from service immediately.
3. Require that table saws are fitted with blade guards and a splitter to prevent the work from squeezing the blade and kicking back on the operator.
4. 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.

E. Woodworking Machinery

1. Do not leave woodworking tools running when unattended.
2. Keep the operating table and surrounding area clear of debris.
3. Do not use compressed air to remove dust and chips from woodworking machinery.
4. Locate the ON/OFF switch to prevent accidental start-up. The operator must be able to shut off the machine without leaving the workstation. Safety goggles and kickback aprons should be provided for and worn by operators. Respirators or local exhaust ventilation may also be necessary based on the type of material being cut or sanded.
5. Guard planers and joiners to prevent contact with the blades throughout the full length of the cutting area.
6. Ensure that band saw blades are fully enclosed except at the point of operation.
7. Require that swing cut-off saws have a guard completely covering the upper half of the saw.
8. Require that circular cross-cut and rip saws are provided with a hood guard, splitter, and anti-kickback device. The hood should adjust itself automatically to the thickness of and remain in contact with the material being cut. All circular saws will be provided with a hood guard.
9. Ensure that exposed parts of the saw blade under the table are properly guarded.
10. Equip all swing cutoff and radial saws that are drawn across a table with limit stops to prevent the saw from traveling beyond the edge of the table.
11. Hold the material being cut firmly against a back guide or fence and cut with a single, steady pass.
12. Cut green or wet material slowly and with caution. Check all material being cut for nails, hard knots, etc.
13. Use a push stick when:

   a. The cutting operation requires the hands of the operator to come close to the blade.
   b. Small pieces are being machined.
14. When cutting long stock, provide extension tables and a helper to assist the operator.
15. Adjust saw blades so they clear only the top of the cut.
16. Automatic feed devices should be used whenever feasible.
17. When drills are used:
   a. Take care to prevent clothing from being wound around the drill. Wear sleeves buttoned at the wrist or short-sleeved shirts.
   b. Clamp or hold down material being drilled to prevent spinning with the drill.
   c. If the bit is long enough to pass through the material, provide against damage and injury.
   d. Secure magnetic drills with a chain or rope to prevent falling. Label cord connections to prevent unplugging.
18. When sanders are used:
   a. Move sanders away from the body.
   b. Because dust may create an explosion hazard, guard against open flames and sparks.

F. Pneumatic Tools and Equipment

1. Require that pneumatic tools have:
   a. Tool retainers to prevent the tool from being ejected from the barrel during use.
   b. Safety clips, chains, tie wires, or other retaining devices to secure connections between tool/hose/compressor to prevent whipping in case of disconnection or failure.

2. Do not lay hose in walkways, on ladders, or in any manner that presents a tripping hazard.

3. Never use compressed air to blow dirt from hands, face, or clothing.

4. Do not use compressed air for cleaning purposes unless the pressure is reduced to 30 pounds per square inch (psi) or less. This rule does not apply for concrete form, mill scale, green cutting, and similar cleaning operations. Proper respiratory, hand, eye, and ear protection must be worn.

5. Never raise or lower a tool by the air hose.

6. Shut off the pressure and exhaust from the line before disconnecting the line from any tool or connection.

G. Powder-Actuated Fastener Tools

1. Use powder-actuated tools that comply with the requirements of the American National Standards Institute (ANSI)/American Society of Safety Engineers (ASSE) Standard A10.3 – 2006 – Powder-Actuated Fastening Systems.

2. Assess local and state regulations governing the use of these tools to ensure compliance.

3. Use only individuals who have been trained by a manufacturer's representative and possess the proper license to operate, repair, service, and handle powder-actuated tools.

4. With each tool, the manufacturer or supplier should furnish a detailed instruction manual covering the application, operation, and maintenance of the tool. The manufacturer's recommendation for size of charge, stud unit, or pin, and for specific application must be followed explicitly by the operator.

5. Keep cartridges or shells in the original containers, in separate metal containers, or in the carrying case provided with the tool, and then stored in locked containers. Keep cartridges of varied charges or forces segregated from each other.

6. Take precaution, as defined by the manufacturer, in the event of a misfire.

7. Provide information from the manufacturer on the safe use, testing, and maintenance of each type of tool in each tool kit.

8. Never use a powder-actuated tool in a flammable or explosive atmosphere.

9. Require the use of goggles or a full face shield as well as safety glasses during operation of powder-actuated tools.

10. Use only tools that are provided with a shield or muzzle guard. This shield or guard should be of a size, design, and material that will effectively confine flying particles and prevent escape of ricocheting studs and pins.

11. Ensure that powder-actuated tools are not able to be fired unless the tool is pressed against the work surface.

12. Always handle powder-actuated tools like firearms, with hands clear of the muzzle and barrel pointed away from all persons, especially when the tool is being closed or assembled after loading.

13. Ensure that the tool is not able to fire if the tool is dropped when loaded.

14. Ensure that firing the tool requires two separate operations, with the firing movement being separate from the motion of bringing the tool to the firing position.

15. Provide signs and barricades when shooting into walls or floors with personnel working on the other side.

16. Never fire into easily pierced or soft substrates or into materials of unknown resistance to piercing. In these situations, there is potential for the fastener to penetrate and pass through, creating a flying projectile hazard. If penetration of these materials is required, the material should be backed with a box of wood or sand al least four inches (10 cm) thick and of adequate area.

17. Do not use powder-actuated tools in reinforced concrete if there is the possibility of striking the rebar.

18. Do not use powder-actuated tools on cast iron, high carbon, heat treated steel, or armor plate, thin slate, marble, glass, live rock, glazed brick or tile, terra cotta, or other brittle substances, or where the composition is unknown.

19. Do not fire studs closer than three inches (7.5 cm) from the edge or corner when being used on brick or concrete. Do not fire studs closer than ½ inches (1.25 cm) from the edge when being used on steel.

20. Never load and leave a powder-actuated tool unattended. It should be loaded only prior to its intended firing. Use only studs or pins specifically designed for the tool.

21. Test tools each day prior to loading by testing safety devices according to the manufacturer's recommended procedure.

22. Inspect, clean, and store powder-actuated tools in a safe place at the end of each day. No tool will be stored loaded. Store tools with the barrels removed or breech open.

23. At the manufacturer's recommended intervals, the tool will be completely dismantled and carefully inspected for wear on the safety devices by a qualified person familiar with the tool. Worn parts will be replaced before the tool is used again. It is recommended that factory-authorized service representatives be utilized for inspection, repair, and parts replacement, where possible.

H. Chain Saws

1. Approval by the HSE manager is required for all use of chain saws.

2. Inspect the saw prior to each use and periodically during daily use.

3. Never cut above chest height.

4. Require that the idle is correctly adjusted on the chain saw. The chain should not move when the saw is in the idle mode.

5. Start cutting only after a clear escape path has been made.

6. 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.

7. Require applicable protective gear. This will include, but is not limited to:

   a. Logger's safety hat.

   b. Safety glasses and face shield.

   c. Steel-toed boots.

   d. Protective leggings.

   e. Hearing protection.

   f. Work gloves.

8. Inspect saws to ensure that they are fitted with an inertia break and hand guard.

9. *Never* operate a chain saw when fatigued.

10. Do not allow others in the area when chain saws are operated.

11. Make sure there are no nails, wire, or other imbedded material that can cause flying particles.

12. Do not operate a chain saw that is damaged or improperly adjusted, or is not completely and securely assembled. Always keep the teeth sharp and the chain tight. Worn chains should be replaced immediately.

13. Keep all parts of your body away from the saw chain when the engine is running.

14. For all operations, only personnel specifically trained and certified as competent by URS may operate chain saws.

I. Hand-Operated Pressure Equipment

1. Direct pressure equipment such as grease guns, and paint and garden sprayers away from the body and other personnel in the area. The person operating any equipment

such as this, which has a potential for eye injury, must wear protective goggles.

2. The noise produced when using certain types of pressure equipment may require the use of hearing protection.

3. 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.

J. Gasoline-Powered Tools

1. Never pour gasoline on hot surfaces.

2. Never fuel around an open flame or while smoking.

3. Shut down the engine before fueling.

4. Provide adequate ventilation when using in enclosed spaces.

5. Use only Underwriters Laboratories (UL) - or FM-approved safety cans to transport flammable liquids. The use of unapproved containers for gasoline is strictly prohibited.

6. Label gasoline containers in compliance with Hazard Communication requirements, indicating the chemical and physical hazards of the product.

K. Inspection

Inspect all hand tools on a regular basis. Immediately remove defective tools from service, and tag or destroy them to prevent further use.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Site briefings regarding tool use.

B. Records of tools removed from service.

C. Copies of powder-actuated tool licenses (as applicable).

D. Tool inspection documentation.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Standard – Hand and Portable Power Tools – 29 Code of Federal Regulations (CFR) 1910, Subpart P

B. U.S. OSHA Standard – Construction Tools – Hand and Power – 29 CFR 1926, Subpart I

C. American National Standards Institute (ANSI)/American Society of Safety Engineers (ASSE) Standard A10.3 – 2006 – Powder-Actuated Fastening Systems

D. National Association of Demolition Contractors

E. United Kingdom – 'Provision and Use of Work Equipment' Regulations 1998

F. Australia/New Zealand Standards – Powder-Actuated Handheld Fastening Tools - AS/NZS 1873.1:2003Australian/New Zealand Standards – Hand-held Motor-operated Electric Tools – AS/NZS 60745.1:2003

G. SMS 023 – Lockout and Tagout Safety

H. SMS 064 – Hand Safety

1. Applicability

This standard applies to all operations of URS Corporation and its subsidiary companies involving the investigation or remediation of sites impacted with hazardous wastes or hazardous materials, including those associated with underground storage tanks.

Normally, investigation projects for real estate transactions conducted to confirm that a site is "clean" are not covered under this standard. If the Project Manager reasonably expects that there is the potential for a “clean” site to actually have some level of contamination, it should initially be treated as contaminated, and be subject to this standard.

2. Purpose and Scope

The purpose of this standard is to minimize the risks to URS personnel and subcontractors while conducting hazardous waste field operations.

Investigation techniques discussed in this standard include, but are not limited to, hand augering, soil gas evaluation, groundwater monitoring, test pits, and all types of power drilling, including direct-push. Remediation techniques discussed under this standard include, but are not limited to, excavation, groundwater treatment, soil gas treatment, containment, and landfarming.

The applicability of the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard to URS activities is primarily in the areas of site investigation and remediation. URS relies on outside vendors or clients to provide emergency response teams (HazMat Teams) at our project sites and locations. On a project-specific basis, if the need arises for URS to provide an emergency response team, then the HAZWOPER requirements specific to that activity will be developed and incorporated into the project health and safety plan (HASP). This includes specific chemical protective clothing, equipment, and post-emergency response operations.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

The URS Safety Management System and Safety Management Standards were designed to help employees to identify, evaluate, and control safety and health hazards and to provide for emergency response. Site/project hazards and scope

of work dictate the specifics, which are covered in Facility Emergency Action Plans and Project HASPs.

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 URS Safety Management Standards (e.g., SMS 010 – Confined Space Entry).
6. Hazardous materials shipping and disposal responsibilities.
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 HASP for every project under this standard.
2. HASPs must be written or approved by the appropriate Health, Safety, and Environment (HSE) Manager, or a safety professional specifically approved by the HSE Manager, and by the project manager.
3. Evaluate client and agency requirements prior to preparing the HASP, particularly if the client or an agency will approve the HASP prior to implementation.

4. On a site-/project-specific basis, conduct a hazard assessment and identify appropriate engineering controls, work practices, and personal protective equipment (PPE) requirements. This assessment and the mitigations and controls are documented in site-/project-specific HASPs that are provided to clients by the project manager for their review and approval prior to the initiation of field activities.

5. On a site-/project-specific basis, conduct a hazard assessment for potential physical and chemical exposures and identify monitoring equipment, frequency, action levels, and actions. These are incorporated into project-/site-specific HASPs, which are reviewed and approved by clients prior to the initiation of field activities. Guidance on monitoring is provided in SMS 043 – Personal Monitoring/Industrial Hygiene.

6. On a site-/project-specific basis and based on the potential chemical exposures and work activities, develop specific decontamination procedures that include instructions on materials, decontamination steps, and location of decontamination. The purpose of these procedures will be to ensure personnel leaving contaminated areas are appropriately decontaminated, and all equipment is disposed or decontaminated.

7. PPE selection, use, and maintenance are presented in SMS 029 – Personal Protective Equipment. This information is documented on a site/project specific basis in the site/project HASP. Remove any non-impermeable PPE clothing that becomes contaminated with hazardous substances in accordance with the decontamination procedures noted above.

8. Provide regular showers, change rooms, and sanitation facilities for employees, as necessary.

D. Training – Remediation and Investigation Activities

Verify that each assigned URS employee has completed the following required training.

1. 40-hour initial training from an approved training provider, (24 hours of initial training for operations outside of North America).

2. 3 days of on-the-job training (1 day is required for operations outside of the United States).

3. 8-hour refresher training completed within 12 months of the initial or subsequent refresher training.

4. 8-hour Site Safety Officer (Supervisor) training for directing the activities of any other URS employee or subcontractor.

5. Additional training for the Site Safety Officer as described below.

E. Training – Emergency Response

The HAZWOPER standard is primarily applicable to URS operations involving remediation and investigations at hazardous waste sites or sampling at Treatment, Storage, and/or Disposal Facilities (TSDFs). URS typically contracts emergency response or relies on client or local emergency response teams. On an as-needed basis, if a project requires URS to provide a HAZMAT emergency response team, the following training requirements must be met.

1. Operations Level – a minimum of 8 hours of initial and refresher training for those responsible for acting defensively in the case of a release, attempting to contain the release from a safe distance.

2. HAZMAT Technician – at least 24 hours of initial training and 8 hours of refresher training. They will participate in operations-level training and know how to implement the emergency response plan for the facility/site/project location.

3. HAZMAT Specialist – at least 24 hours of initial training and 8 hours of refresher training. They will be trained in the same content as the HAZMAT Technician, as well as in how to develop a site safety and control plan.

4. Incident Commander – will have at least 40 hours of training covering the Operations Level training and techniques for implementing the emergency response plan and directing the incident. They will be knowledgeable in relevant regulations.

F. 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. Additional respiratory protection training is required for projects where supplied air respirators may be used.

    b. Heavy equipment/construction safety.

    c. Personal air monitoring.

4. The SSO will monitor decontamination and other site activities for effectiveness.

G. Exposure Monitoring

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

H. Project Equipment

1. Provide all health and safety equipment as described by the project HASP.

2. Provide all personal protective equipment as described by the project HASP.

I. Medical Surveillance

Verify that each URS employee assigned to the project meets the minimum requirements of the URS Medical Surveillance Program (refer to SMS 024 – Medical Screening and Surveillance). This typically includes:

1. Baseline examination

2. Annual examination

3. Appropriate clearance for respirator use.

J. Compliance Assurance

SMS 068 – Compliance Assurance is a tool for use in determining the effectiveness and compliance of a waste site operation.

5. Documentation Summary

The following information will be maintained in the project file:

A. Completed Health and Safety Plan

B. Completed and signed HASP approval form

C. Signed HASP acceptance form

D. Completed Health and Safety (H&S) field forms that are included in each HASP

E. Training and Medical Surveillance Clearance documentation for project personnel

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) – Hazardous Waste Operations

B. European Agency for Safety and Health at Work, Dangerous Substances http://europe.osha.eu.int/good_practice/risks/dangerous_substances/

C. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities – National Institute for Occupational Safety and Health (NIOSH) 85-115

D. SMS 010 – Confined Space Entry

E. SMS 024 – Medical Screening & Surveillance

F. SMS 043 – Personal Monitoring

G. SMS 029 – Personal Protective Equipment

H. SMS 068 – Compliance Assurance

1. Applicability

This standard applies to URS Corporation and its subsidiary companies on projects where ambient (not adjusted) temperatures exceed 70 degrees Fahrenheit (°F) (21 degrees Celsius [°C]) for personnel wearing chemical-protective clothing, including semi-permeable or impermeable protective clothing such as Tyvek or Saranex coveralls, and 90°F (32°C) for personnel wearing normal permeable work clothes. Permeable clothing refers to clothes of standard cotton or synthetic materials.

2. Purpose and Scope

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

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. The project Health and Safety Plan will address heat stress control when temperatures identified in Section 1 of this standard are anticipated. For employees wearing chemical-protective clothing, physiological monitoring (Section J) is the most effective approach, because evaporative cooling capability is limited.

B. Heat stress is influenced by air temperature, radiant heat, and humidity. The Wet Bulb Globe Temperature (WBGT) is a useful index of the environmental contribution to heat stress. Because WBGT is only an index of the environment, the contributions of work demands, clothing, and state of acclimatization must also be accounted for, as described in the following steps.

1. Monitor ambient temperatures and conduct heat stress monitoring in accordance with the project Health and Safety Plan. Revise the heat stress monitoring and controls if there are any reports of discomfort due to heat stress.

2. Monitor temperatures in each unique environment in which workers perform work (e.g., take WBGT measurements inside truck cabs for truck drivers, and take separate WBGT measurements in the outdoor area where field employees work, etc.).

3. Determine if individual workers are acclimatized or un-acclimatized. Full heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, or when there is a sustained increase in temperatures of 10 °F (5.6 °C) or more, and a noticeable loss occurs after 4 days. A worker can be considered acclimatized for the purpose of this procedure when they have been exposed to the site conditions (including level of activity) for 5 of the last 7 days.

4. Determine the approximate workload of each worker or group of workers. The following examples can be used for comparison:

Table 1
Examples of Activities within Workload Categories

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on level at 6 Km/hr while carrying 3 Kg weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

5. Determine the approximate proportion of work within an hour during a typical shift. Typically, the initial work schedule will be 60 minutes of work per hour (100 percent work) with a small break in the morning and afternoon, as appropriate, and a 30-minute lunch break mid-day.

6. Compare the WBGT values measured in 4.B.1 to the screening criteria values in the following table, using the determinations made in 4.B.3 through 4.B.5.

Table 2
SCREENING CRITERIA FOR HEAT STRESS EXPOSURE
(WBGT Values in ºF /ºC)

Work Cycle	Acclimatized				Unacclimatized			
	Light Work	Mod. Work	Heavy Work	Very Heavy Work	Light Work	Mod. Work	Heavy Work	Very Heavy Work
100% Work (60 min/ hour)	85.1/ 29.5	81.5/ 27.5	78.8/ 26.0	N/A	81.5/ 27.5	77.0/ 25.0	72.5/ 22.5	N/A

a. If the measured WBGT is *less than* the table value, there is little risk of excessive exposure to heat stress, and work can continue. Continue to monitor ambient conditions with the WBGT. However, if there are reports of the symptoms of heat-related disorders, then the analysis of little risk should be reconsidered.

b. If the measured WBGT is *greater than* the table value, institute heat stress controls, including a work-rest cycle, and perform physiological monitoring as described elsewhere in this standard.

c. Because of the physiological strain associated with very heavy work among less fit workers regardless of WBGT, values are not provided in Table 1 for continuous work. Physiological monitoring should always be implemented under these conditions.

d. For workers wearing semi-permeable or impermeable clothing, such as Tyvek or Saranex, the WBGT procedures cannot be used. For these situations, workers should begin physiological monitoring as soon as the temperature in the work area exceeds 70ºF (21°C).

C. Physiological Monitoring

Physiological monitoring provides a means to assess the effectiveness of the heat stress controls (training, hydration, work-rest cycles, etc.) that are in place. Based on the results of physiological monitoring and self-assessment, work-rest cycles can be adjusted to more effectively control heat stress by shortening the work period, or to allow for longer work periods if workers are recovering adequately during rest breaks.

1. Perform physiological monitoring as soon as the employee stops working and begins their break (rest). Perform *physiological monitoring at least every hour. Base rest breaks* on the results of the monitoring, workers' self-assessment, and professional judgment.

a. Example 1: If the WBGT is 85°F (29.4°C) or less for acclimatized, light-duty workers, they can work 60 minutes per hour (100 percent work), and they need only take their regularly scheduled breaks.

b. Example 2: If the WBGT is greater than 85°F (29.4°C) for acclimatized, light-duty workers, physiological monitoring must be performed, and workers' work-rest cycles must be adjusted as described below.

2. Have workers assess themselves and their body's reaction to the heat and work conditions (self-assessment), and report any signs or symptoms of heat illness. These can include nausea or dizziness, heat cramps, extreme thirst, or very dark urine.

3. Based on the results of the physiological monitoring and on the workers' self-assessments, the work period may be adjusted as follows:

   a. The work period may be *increased* (generally, by 5- to 10-minutes intervals, up to a maximum of 4 hours) if the results of the first 2 hours of the physiological monitoring and the workers' self-assessments indicate that workers *are* recovering adequately (see below), and on the judgment of the Health and Safety Technician.

   b. The work period *must be decreased* if the results of the physiological monitoring and the workers' self-assessment indicate that workers are NOT recovering adequately (see below).

4. Perform physiological monitoring

   a. The worker or the Health and Safety Technician must measure and record body temperature and pulse rate as described below. Use SMS 018-1 NA – Heat Stress Monitoring Record as a tool.

5. Body Temperature Monitoring

   a. Monitor body temperature to determine if employees are adequately dissipating heat buildup. Ear probe thermometers which are adjusted to oral temperature (aural temperature) are convenient and the preferred method of measurement. Determine work/rest regimen as follows:

      i. Measure oral body temperature at the end of the work period. Oral body temperatures are to be obtained prior to the employee drinking water or other fluids.

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

iii. If, at the next rest period, temperature still exceeds 99.6°F (37.5°C), the worker should not be allowed to continue work until repeated temperature measurements are in the acceptable range (i.e., less than 99.6°F). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.

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

b. Have employees assess themselves and their body's reaction to the heat and work conditions, and report any signs or symptoms of heat stress, including, but not limited to, feeling nauseous or dizzy, skin rash or skin irritation, muscle cramps, weakness or fatigue, extreme thirst, dizziness, blurred vision, headache, or very dark urine.

6. Pulse Rate Monitoring

a. Take the radial (wrist) pulse as early as possible in the rest period and determine the worker's heart rate in beats per minute. The heart rate is determined by counting the pulse for ten seconds and multiplying the number by 6 to get the beats per minute. Record this as P1.

b. Wait 2 minutes and repeat the pulse measurement. Record this as P2.

c. If P1 is greater than or equal to 110 beats per minute (bpm) and if (P1 – P2) is less than or equal to 10 bpm (indicating that workers are not recovering adequately), shorten the next work cycle by 1/3 without changing the rest period.

d. At the next rest period, if P1 is still equal to or greater than 110 bpm, and if (P1 – P2) is still less than or equal to 10 bpm, shorten the following work cycle by 1/3 without changing the rest period.

e. At the third rest period, if P1 is still equal to or greater than 110 bpm and (P1 – P2) is still less than or equal to 10 bpm, the worker should not be allowed to continue work until repeated pulse measurements are in the acceptable range (i.e., P1 is less than 110 bpm and (P1 – P2) is greater than 10 bpm). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.

D. Record monitoring results and worker's self-assessments on Attachment 018-1 NA – Heat Stress Monitoring Record.

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

F. 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 Supplemental Information A.

G. Provide cool water and electrolyte replacement drinks as described in Supplemental Information A.

H. Allow employees who are not accustomed to working in hot environments appropriate time for acclimatization, as described in Supplemental Information A.

I. Provide break areas as described in Supplemental Information A.

5. Documentation Summary

The following information will be maintained in the project file:

A. Heat Stress Monitoring Records

B. Employee Safety Briefing Verification Forms

6. Resources

A. NIOSH – Working in Hot Environments (Publication No. 86-112), 1986

B. NIOSH – Criteria for a Recommended Standard for Occupational Exposures to Hot Environments (Publication No. 86-113), 1986

C. ACGIH – Documentation of the Threshold Limit Values and Biological Indices, 2003

D. AFL-CIO Building Trades Division – Heat Stress in Construction

E. Attachment 018-1 NA – Heat Stress Monitoring Record

7. Supplemental Information

A. Heat Stress Informational Supplement

URS	Health, Safety and Environment HEAT STRESS MONITORING RECORD	Attachment 018-1 NA Issue Date: May 2001 Revision 5: February 2009

Date: _____ Safety Representative: _____

Worker's Name: _____ Subcontractor: _____

Work Activity/Equipment: _____

Time	Work-Rest Cycle	Aural Temp (ºF/°C)	Pulse (BPM)			Comments
			P_1	P_2	P_1-P_2	

URS SAFETY MANAGEMENT STANDARD

Housekeeping

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies.

2. Purpose and Scope

The purpose of this standard is to ensure proper housekeeping in office locations, on construction sites, and fixed work facilities to prevent cross contamination of hazardous materials, fires, and injuries resulting from slips, trips and falls.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility or site.

4. Requirements

A. General

1. Require tools, materials, extension cords, hoses, and other equipment to be stowed at the end of the day. These materials must not be strewn about the site in a manner that may cause tripping or other hazards while in use.

2. Clear general waste, scraps, debris, and rubbish from work areas, passageways, and stairs in and around the facility on a daily basis. Do not throw or drop materials from upper levels to lower levels or to the ground unless disposal areas are provided and the area below is barricaded or secured.

3. Provide metal or other approved containers in adequate numbers to handle waste and rubbish disposal.

4. Garbage (including solid or liquid wastes), refuse, and hazardous waste such as caustics, acids, and toxic materials must be stored in approved and covered containers. Containers must be appropriately labeled as to contents. SMS 009 – Corrosive and Reactive Materials and SMS 017 – Hazardous Waste Operations, provide additional information on hazardous materials.

5. Store supplies in locations away from walkways and in a manner that will not trip workers. Maintain stored materials in safe, neat stockpiles for ease of access and to prevent collapse or falling.

6. Keep weeds and vegetation away from stockpiled materials and walkways.

7. Maintain flooring, stairways, gangways, access ways, and walkways in a clean, dry, and smooth condition.

8. Ensure that oil, grease, water, ice, or other hazardous materials that may cause slipping or fire hazards are removed promptly.

B. Regularly inspect the work area for slip and trip hazards.

1. Office and trailer locations – Inspect work areas at least quarterly. Use the inspection sheet provided as Attachment 021-1 NA.

2. Field sites – Inspect sites at least biweekly. Use the inspection sheet provided as Attachment 021-1 NA.

3. Field sites performing aircraft and vehicle maintenance – Inspect the sites weekly if sanding, drilling, grinding, and/or painting operations are conducted. Use the inspection sheet provided as Attachment 021-2 NA.

4. For European operations, the Workplace Inspection Checklist - Attachment 021-3 NA must be completed monthly.

C. Thoroughly investigate all injuries resulting from slips, trips, and falls on site. Correct those housekeeping conditions contributing to injuries.

D. For operations involving work with hazardous materials (including metals associated with aviation maintenance activities), the manager directing activities of the facility or site will assure that:

1. Eating, drinking, and smoking areas are removed from the work areas. Hand washing stations shall be available nearby for employees entering the eating and smoking areas.

2. Resting, eating and smoking areas will be kept clean.

3. Work areas will be cleaned to remove accumulated contaminants. Working surfaces, including workbenches, desks, and other lateral working surfaces, will be wiped down daily with an appropriate cleaner (soap, solvent, or oxidizing agent). Walking surfaces will be cleaned to remove accumulated contaminants weekly or more often.

5. Documentation Summary

The following information will be maintained in the project file:

A. Completed Inspection Sheets.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Standard – Sanitation – 29 Code of Federal Regulations (CFR) 1910.141

B. U.S. OSHA Standard – Walking and Working Surfaces – 29 CFR 1910.22.

E. SMS 009 – Corrosive and Reactive Materials

F. SMS 017 – Hazardous Waste Operations

G. Attachment 021-1 NA – Housekeeping Inspection Sheet

H. Attachment 021-2 NA – Special Housekeeping Inspection Sheet - Sanding, Drilling, Grinding, and Painting

I. Attachment 021-3 NA – Workplace Inspection Checklist

URS	Health, Safety and Environment HOUSEKEEPING INSPECTION SHEET	Attachment 021-1 NA Issue Date: June 1999 Revision 4: February 2009

Building or Location: _____

Inspection Conducted by: _____ **Date:** _____

Check Yes, No, or NA for Not Applicable.

General Site Housekeeping

1. Do not block exits or emergency equipment. ☐ Yes ☐ No ☐ NA
2. Do not leave equipment or materials lying on the ground. ☐ Yes ☐ No ☐ NA
3. Keep storage areas free from the accumulation of materials that constitute trip hazards. ☐ Yes ☐ No ☐ NA
4. Remove scrap materials and other debris from work area. ☐ Yes ☐ No ☐ NA
5. Remove combustible scrap and debris by safe means at regular intervals. ☐ Yes ☐ No ☐ NA
6. Store oily rags in metal cans with tight fitting lids. Remove oily rags at the end of the day. ☐ Yes ☐ No ☐ NA

Visibility

7. Ensure that halls, stairways and walkways are well lit. ☐ Yes ☐ No ☐ NA
8. Ensure that well designed light switches are present in areas where walkways are not always lighted. ☐ Yes ☐ No ☐ NA
9. Ensure that dust, smoke or steam does not create poor visibility. ☐ Yes ☐ No ☐ NA
10. Ensure that glare from floodlights or windows does not create poor visibility in work areas. ☐ Yes ☐ No ☐ NA

Stairs

11. Ensure that handrails are tight and at the proper level. ☐ Yes ☐ No ☐ NA
12. Ensure that handrails extend past the top and bottom step. ☐ Yes ☐ No ☐ NA
13. Ensure that white or yellow strips are painted on the first and last step for better visibility. (Not an OSHA requirement – recommendation only). ☐ Yes ☐ No ☐ NA
14. Ensure that steps are not rough or defective. ☐ Yes ☐ No ☐ NA
15. Ensure that stair treads are wide enough and risers consistently spaced. ☐ Yes ☐ No ☐ NA
16. Ensure that stairs are free of obstructions. ☐ Yes ☐ No ☐ NA

Floor Conditions

17. Ensure that floors of every workroom are clean, and so far as possible, in a dry condition. ☐ Yes ☐ No ☐ NA
18. Ensure that floors are not oily, overly waxed, or polished. ☐ Yes ☐ No ☐ NA
19. Where wet floors or processes are present, provide proper drainage and false floors, mats, or other dry standing places. ☐ Yes ☐ No ☐ NA
20. Finish floor surfaces with non-slip coatings where spills are likely. ☐ Yes ☐ No ☐ NA
21. Ensure that floors and passageways are free from protruding nails, splinters, holes, or loose boards. ☐ Yes ☐ No ☐ NA
22. Ensure that floors are free of holes and depressions. ☐ Yes ☐ No ☐ NA
23. Ensure that aisles or pathways are wide enough for easy passage and for carrying objects (48 inches is recommended). ☐ Yes ☐ No ☐ NA

URS	Health, Safety and Environment HOUSEKEEPING INSPECTION SHEET	Attachment 021-1 NA Issue Date: June 1999 Revision 4: February 2009

24. Ensure that ramps are covered with non-slip surfaces or matting. ☐ Yes ☐ No ☐ NA
25. Keep carpets or rugs free from loose or frayed edges that may catch boots or shoes. ☐ Yes ☐ No ☐ NA
26. Keep walkways free from extension cords, air hoses and cables. ☐ Yes ☐ No ☐ NA
27. Keep pathways free from boxes, containers, machine parts, or other tripping hazards. ☐ Yes ☐ No ☐ NA

Ground Conditions

28. Ensure that trip hazards are not present. ☐ Yes ☐ No ☐ NA
29. Ensure that fall hazards are not present. ☐ Yes ☐ No ☐ NA
30. Ensure that holes or changes in ground elevation are either filled or guarded. ☐ Yes ☐ No ☐ NA
31. Ensure that muddy walkways are filled with gravel to reduce slipping. ☐ Yes ☐ No ☐ NA
32. Ensure that all employees who work in wet or greasy conditions wear slip resistant footwear. ☐ Yes ☐ No ☐ NA

Equipment

33. Ensure that vehicle steps are of adequate size, surface placement for safe dismounting. ☐ Yes ☐ No ☐ NA
34. Ensure that hand grips or ladders are adequate for getting into and out of equipment. ☐ Yes ☐ No ☐ NA
35. Ensure that ladders have been checked for damage and removed from service if found unsafe. ☐ Yes ☐ No ☐ NA

Identify areas that need attention and describe the corrective actions to be implemented:

_____

_____

_____

_____

_____

I certify that the above inspection was performed to the best of my knowledge and ability, based on the conditions present on: _____

_____
Signature

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies for 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 (HASP), assessments, the expected use of personal protective equipment (PPE), and client contract requirements.

2. Purpose and Scope

The purpose of this standard 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 to determine whether employees are capable of safely performing assigned tasks, to verify that protective equipment and controls are effectively providing protection, and to comply with government regulations. Included are provisions for emergency medical consultation and treatment.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

The Occupational Health Manager (OHM) is responsible for development and administration of this program in coordination with the URS Medical Service Provider (MSP). The OHM will maintain current injury and illness data, and participate with corporate, division, regional, country, or strategic business unit Health, Safety, and Environment (HSE) Managers in evaluation of this program. The MSP will provide occupational medicine oversight for the program and will approve medical surveillance protocols.

Locations in the United States and Canada will follow all requirements of this program.

International locations will follow sections B.1, 2, 3, 5, 6, 7, and 8; G.3; and H.1 of this program.

4. Requirements

A. Selection of program participants

1. The Medical Surveillance Evaluation (MSE) form – Attachment 024-2 NA 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 his or her supervisor at the time of hire for any employee who may work outside an office environment. At each annual performance review, the MSE is to be reviewed for accuracy. Other reviews are required whenever there is a change in job tasks.

2. Additional site- or project-specific biological monitoring or toxicological screening may be required in addition to this program's scheduled core exams. These medical tests will be specified by the project-specific HASP and will be authorized by the MSP on the exam appointment protocol. Note: See Section D.2 if the 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; or projects involving exposure to materials regulated by the Occupational Safety and Health Administration (OSHA) or Mine Safety and Health Administration (MSHA) 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; or 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 – Attachment 024-6 NA. In the event an employee declines the exit exam, the employee will be requested to sign a Waiver of Exit Medical Surveillance Exam – Attachment 024-7 NA.

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 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 construction management, enrollment in this program will be required if more than 50% of their time is spent in an active construction area and working in an area with posted noise hazards.

6. Individual radiation dose monitoring will be conducted as required by the site-specific HASP with approval by a Radiation Safety Officer. Personal dosimetry (film badges) is typically required; however, depending on the specific radiation hazard, additional monitoring or scans may be required.

7. 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 in environments with airborne concentrations of asbestos fibers at or above the established action level (OSHA, MSHA, state, or other applicable regulations) will receive asbestos-specific baseline and annual exams. Exit exams will be performed if an exam has not been performed within the previous 6 months or if an employee has medical complaints related to potential asbestos exposure.

9. Blood sampling and monitoring for lead and other heavy metals will be conducted every 6 months until two consecutive blood

samples/analyses are acceptable. An employee with elevated heavy metal blood levels should be temporarily assigned to a task with minimal exposure, pending medical clearance. Sampling and monitoring will be performed every 2 weeks during the reassignment period. Employees will be notified of results within 5 days when levels are not acceptable. Medical Removal Protection benefits may apply in this situation.

10. Urine samples may be collected for some heavy metal exposures such as cadmium and mercury. Samples must be collected within 30 days of assignment to any task with potential for exposure to cadmium or other heavy metals. Medical monitoring results will be used to assess worker exposure and exposure control methods.

11. Medical monitoring will also be required to assess potential worker health risk to other chemical hazards, including polyaromatic hydrocarbons (PAHs), pesticides, benzene, chlorinated solvents, crystalline silica, and other chemical hazards as identified in prejob hazard analysis. The MSP will be consulted to determine necessary testing protocols and acceptance levels. The physician's opinion letter will be used to determine the worker's ability to perform the specified task and to wear PPE necessary to accomplish the task in a safe manner.

12. Skin exposures to hazardous chemicals with "Skin" notation will be evaluated case by case in consultation with the MSP. Allergic and hyper-sensitivity symptoms will be evaluated by the MSP as required.

C. Exam protocols

1. The Medical Screening and Surveillance Exam Protocol – Attachment 024-3 NA identifies the medical exam components of this program.

2. Evaluation will be confidential and provided during normal hours. Employees will be offered the opportunity to discuss the results of the evaluation with the MSP. All exam results are considered personal and confidential information, and will not be stored in any unsecured records not transmitted without the employee's permission.

D. Scheduling of exams

1. The Office or Project Manager, usually with assistance from the local HSE 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 during the month the exam is due. These steps are detailed in the Medical Surveillance Exam Process – Attachment 024-4 NA.

2. Employees hired with an initial assignment to work at a 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 and Respirator Preassignment Baseline Exam Protocol – Attachment 024-5 NA.

3. In the event of an urgent business need, a temporary clearance to begin work the day of the exam may be requested at the time a baseline exam is scheduled through the MSP. The temporary clearance will be issued by the local physician and will be good for up to 14 days or until the MSP physician's final clearance is received, whichever comes first.

4. 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), which will include any medical restrictions and address the employee's ability to use personal protective equipment, to the HSE Representative. See Exam Follow-Up Procedures – Attachment 024-8 NA.

2. The MSP will mail the exam invoice to the Local Office HSE Representative, who will either approve the charge and forward the invoice to the accounts payable department for payment or forward the charge to the manager responsible for the employee for charge assignment and payment. (Medical exams that are part of this program are provided to URS employees at no cost to the employee.)

3. The MSP will mail a confidential letter detailing the results of the exam to the employee at his or her home address within 30 days of the exam date.

F. Emergency Medical Care

1. Preplanning is essential for a prompt and proper response to a medical emergency. Site-specific emergency procedures will be provided in the site HASP. Suggested preplanning actions are provided in SMS 065 – Injury Management. See Field First Aid Kit Supply List – Attachment 024-9 NA for recommended supplies. The contents of the first aid kit will be checked prior to being sent out to each site/project and periodically thereafter to ensure that the expended items are replaced.

2. A MSP occupational physician can be reached 24 hours a day for phone consultation at WorkCare™ (1-800-455-6155).

3. A workers' compensation claim should be filed by URS Occupational Health Nurses with Sedgwick CMS (1-866-566-1915) for an injured employee who receives professional medical care or who is disabled from working beyond the initial date of injury.

4. To comply with OSHA reporting regulations, the OHM or the applicable corporate, regional, country, or SBU HSE Manager should be notified immediately 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.

4. Projects that use local clinics or employer/client clinics may store records at that site, but at the termination of the project, all employee medical records must be transferred to long-term records retention or forwarded to WorkCare™.

5. Subcontractors and vendors are expected to maintain their own employee records and reports, but the employee physician's opinion letters will be available for inspection and verification of compliance.

H. Program evaluation

1. The OHM and corporate, regional, country, or SBU HSE 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 taken as needed.

5. Documentation Summary

The following documentation will be maintained in the office / project file:

A. Medical Surveillance Evaluation.

B. Health Status Medical Report.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Technical Links – Medical Screening/Surveillance

B. U.S. OSHA Publication 3162 – Screening and Surveillance: A Guide to OSHA Standards, 1999

C. SMS 065 – Injury Management

D. Attachment 024-1 NA – WorkCare™ Medical History Questionnaire

E. Attachment 024-2 NA – Medical Surveillance Evaluation

F. Attachment 024-3 NA – Medical Screening and Surveillance Exam Protocol

G. Attachment 024-4 NA – Medical Surveillance Exam Process

H. Attachment 024-5 NA – HAZWOPER and Respirator Preassignment Baseline Exam Protocol

I. Attachment 024-6 NA – Exit Exam Determination

J. Attachment 024-7 NA – Waiver of Exit Medical Surveillance Exam

K. Attachment 024-8 NA – Exam Follow-Up Procedures

L. Attachment 024-9 NA – Field First Aid Kit Supply List

URS	Health, Safety and Environment **FIELD FIRST AID KIT SUPPLY LIST**	Attachment 024-9 NA Issue Date: February 2001 Revision 5: February 2009

- Portable, plastic or metal, water-resistant first aid kit, with handle
- Bloodborne pathogens personal protective equipment kit (minimum requirements are nitrile gloves [2 pairs] and CPR shield)
- First aid manual
- Flashlight/batteries
- Bandage scissors
- Red bag for biohazard waste disposal

Individually wrapped items

- Compress bandages: four 2" x 36", two 3" x 60", and one 4" x 72"
- Assorted adhesive bandages, (at least 16)
- Sterile gauze compress pads 4" x 4"
- Sterile nonstick gauze pads 3" x 3", minimum of 4 packages
- Paper tape (hypoallergenic), at least 5 yards of 3/8" wide
- Water-soluble burn dressing with gel pad (for minor burns, use after cold water soak), at least 6
- Antiseptic (alcohol prep pads, towelette, or swab), at least 10 individual-use packages (must meet Food and Drug Administration Code of Federal Regulations 333 requirements)
- Iodine prep pads (if not allergic to iodine, use after soap and water wash for bloodborne exposure)
- Ice pack or cold pack
- Gauze roller bandages: two 2" x 6 yards and one 4" x 6 yards
- Butterfly strips (wound closure)
- Tweezers (one use, disposable)
- Temperature strips
- Triangular bandage: 40" x 40" x 56"
- Sterile normal saline eye wash, 4-ounce bottle
- Eye covering, at least 2
- Antibiotic – individual use packages only, at least 6
- Insect sting relief wipes or spray, if required by health and safety plan

Other items may be added only with the approval of an authorized health care professional.

Automated external defibrillator (AED) units may be co-located with first aid kits with the approval of an authorized medical provider or occupational physician.

URS SAFETY MANAGEMENT STANDARD

Work Over Water

1. Applicability

This standard applies to URS Corporation and its subsidiary companies a where personnel will work above, immediately adjacent to, or within 6 feet of water that is more than 3 feet deep, or water where a drowning hazard exists (e.g., fast-moving stream, water body with soft bottom creating entrapment hazard). Refer to SMS 053 – Marine Safety and Boat Operations and SMS 095 – Barge Operations, for more information on marine-related hazards.

2. Purpose and Scope

The purpose of this standard is to protect employees from drowning while working above or adjacent to water.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Review the project in the planning phase to determine if any work will occur above or immediately adjacent to water where a drowning hazard exists. In general, a risk of drowning is present when:

1. Employees perform work on or under bridges without constant protection from falling into the water; or

2. Employees work on the banks of rivers, lakes, canals, or other waterways that slope so steeply that an employee could slip or fall into the water when no portable protection (like roping off) is used.

   NOTE: Employees working on or under bridges who are constantly protected by guardrail systems, nets, or body harness systems are deemed to be adequately protected from the danger of drowning, and are not required to wear life jackets or buoyant work vests.

B. If site activities pose a risk of drowning:

1. Provide employees with a U.S. Coast Guard (USCG)-approved (for U.S. operations) personal flotation device (PFD). This must include either a Type II buoyant vest or a Type III flotation aid. The use of a Type V PFD (e.g., flotation jacket or mustang suit) may also be appropriate in colder temperatures. For work at night, Type II, III, or V PFD should have a chemical light, or other appropriate survival

light attached to facilitate rescue. All PFDs must have reflective tape on them to facilitate visibility at night. Employees must inspect PFDs daily before use for defects. Do not use defective PFDs.

2. Post USCG-approved Type IV throwable devices (e.g., ring buoys) with at least 90 feet (27 meters) of the line next to the work area. If the work area is large, post extra buoys 200 feet (60 meters) or less from each other. During night operations, ring buoys must have a water light attached.

3. Provide at least one life-saving skiff immediately available at locations where employees are working over or adjacent to water. Require that the skiff is in the water, is capable of being launched by one person, and is equipped with both motor and oars.

4. Designate at least one employee on site to respond to water emergencies and operate the skiff at times when there are employees above water.

    a. If the designated skiff operator is not within visual range of the water, provide him or her with a radio or provide some form of communication to inform them of an emergency.

5. Require that at least one employee trained in CPR and first aid is on site during work activities.

5. Documentation Summary

The following information will be maintained in the project file:

A. Copy of the fall protection plan designed for work activities (as necessary; refer to SMS 040 – Fall Protection).

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Standard - Working Over or Near Water – 29 Code of Federal Regulations (CFR) 1926.106

B. SMS 040 – Fall Protection

C. SMS 053 – Marine Safety and Boat Operations

D. SMS 095 – Barge Operations

1. Applicability

This standard applies to all operations of URS Corporation and its subsidiary companies where the use of personal protective equipment (PPE) is anticipated.

2. Purpose and Scope

The purpose of this standard is to provide information on recognizing those conditions that require PPE. PPE is designed to protect the employee from health and safety hazards that cannot be practically removed from the work environment.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Perform hazard assessments for those work activities that are likely to require the use of PPE.

    1. Use Attachment 029-1 NA to perform the assessment.

    2. Reevaluate completed hazard assessments when job conditions or duties change.

B. Eliminate the hazards identified in Attachment 029-1 NA, if possible, through engineering or administrative controls.

C. Select PPE that will protect employees if hazards cannot be controlled or eliminated.

    1. See Attachment 029-1 NA for recommended PPE.

    2. Review Material Safety Data Sheets for chemicals used for PPE recommendations.

    3. If needed, consult with the applicable safety representative for assistance in selecting PPE.

D. Provide required PPE to employees free of charge (excluding, in some instances, components of standard work attire such as steel-toed boots and prescription safety glasses), assuring proper fit and providing a choice

if more than one type of PPE is available. Where applicable, the local policy (office or project) regarding reimbursement for PPE will prevail.

E. Provide the employees with the appropriate PPE whenever a hazard is recognized and PPE is required. However, when PPE is not required and the employee elects to wear his or her own PPE, the manager directing activities must ensure that the employee is properly trained in the fitting, donning, doffing, cleaning, and maintenance of his or her employee-owned equipment.

F. Make employees of aware that they are responsible for PPE maintenance, care, and proper use. Employees must inform their supervisors when a need arises to use PPE for which the employee has not received training, or when a condition exists where adequate PPE is not available.

G. Conduct and document employee training.

1. Train all employees who are required to wear PPE.
2. Require that training includes:
   a. When PPE is to be worn.
   b. The type of PPE necessary for the task to be completed.
   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. Conduct training before PPE is assigned.
4. Provide refresher training when:
   a. The workplace changes, rendering previous PPE and training obsolete.
   b. New types of PPE are assigned to the worker.
   c. The 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.

H. PPE Specific Information

1. Head Protection

   a. Use hard hats in areas where there is the possible danger of head injury from the impact of falling or flying objects, striking against objects, electrical shock and/or burns, or any combination of these hazards. Hard hats will be worn when required by site safety procedures, client/site requirements, or when posted as an entry requirement.

   b. Adjust the hard hat suspension to fit the wearer and to keep the shell a minimum of 1.25 inches (3.2 cm) above the wearer's head. Do not store materials in the suspension. Cold weather liners and perspiration control bands may be utilized within the hart hat unless specifically excluded by the manufacturer.

   c. Wear hard hats in the forward position unless written verification and instructions from the hard hat manufacturer indicate your hard hat model has been tested and found to be compliant when worn backwards.

   d. Type 1 helmets are designed to protect the employee from impact and penetration caused by objects hitting the top of the head; Type II helmets extend this protection to the sides of the head as well.

   e. Class G (General) helmets provide protection against impact, penetration, and limited electrical hazards up to 2,200 volts. Class E (Electrical) helmets meet the same criteria, but electrical protection is increased to 20,000 volts. Class C (Conductive) helmets only provide impact and penetration protection.

   f. Do not use bump caps as protection against head injury.

   g. Do not alter hard hats in a way that will downgrade their efficiency. Typical prohibited alterations include painting, drilling holes in shell, application of metal jewelry, etc. Replace hats with these alterations or with excessive scratches.

   h. Wear integral chinstraps when working in high-wind conditions or near helicopters.

i. Inspect hard hats before use and remove from service if any of the following are observed: cracking, tearing, fraying, chalking, and flaking.

j. Remove hard hats and their components from service and replace as recommended by the manufacturer. Hard hats must be replaced after no more than 5 years.

2. Hearing Protection

a. Provide hearing protection in any location where powered or motorized equipment or any other noise source could reasonably be expected to exceed 85 dBA. Each task in the work area will be evaluated for potential worker noise exposure as required.

b. Review SMS 026 – Noise and Hearing Conservation – for additional information.

3. Eye and Face Protection

a. Use eye and/or face protection when machines or operations create the risk of eye and/or face injuries due to physical, chemical, and/or radiation sources. Safety glasses will be worn when required by site safety procedures, client/site requirements, or when posted as an entry requirement.

b. Provide safety glasses that can be worn over corrective spectacles for employees whose vision requires the use of corrective lenses. Employees will consult with the applicable Division safety representative or project managers for policies on reimbursement for prescription safety glasses.

c. Do not use of sunglasses in place of required safety glasses. Heavily tinted safety glasses will only be used in outdoor areas with suitable lighting. Colored or lightly tinted or gradient lenses may be used indoors as appropriate to the work conditions.

d. Tasks requiring grinding, cutting, power washing, or handling corrosive chemicals will require face shields over safety glasses. For welding tasks, refer to Supplemental Information B for lens selection criteria.

e. Consult Supplemental Information A for additional information on types of eye and face protection and their various uses.

4. Hand Protection

a. Wear gloves when the hands are exposed to hazards such as, but not limited to, chemical absorption, cuts or lacerations, abrasions, punctures, chemical burns, thermal burns, vibration, or temperature extremes.

b. Gloves must always be provided to workers for tasks with potential hand hazards.

c. Identify hand hazards during job or task hazard analysis. A supply of appropriate gloves in various sizes must be provided to workers assigned to work on that task.

d. Inspect chemical gloves for degradation or tears prior to use. Do not remove chemical gloves from the work area if it is visibly contaminated. Chemical gloves may be decontaminated or disposed of according to specified procedures. In some cases, inner disposable chemical gloves (e.g., nitrile) will be required for protection of hands during removal of contaminated gloves.

e. Select chemical-resistant gloves using manufacturer's hazard-based selection programs or other published guides that identify compatibility of glove material with chemical hazards. Selection must also consider physical requirements of the task with regard to puncture resistance and need for flexibility and dexterity in performing the task.

f. Review SMS 064 – Hand Safety – for additional information.

5. Foot Protection

a. Wear appropriate specialized protective footwear in the following environments:

i. Using harmful corrosive substances or processes.

ii. Having a high probability of puncture or crushing injuries.

iii. Performing regular assembly or disassembly of heavy system components.

iv. Working in wet conditions.

v. Working in extreme cold.

vi. Working around exposed electrical wires or connections.

vii. When using hand-operated compactors, snow blowers, pressure washers, or steam cleaners.

viii. Other activities or areas as designated by supervisors or safety personnel.

b. Employees assigned to field projects who are not required to wear specified protective footwear (e.g., steel-toed boots, metatarsal protection, rubber boots, insulated boots, etc.) will wear substantial leather, high-sided work boots. Shoes (leather, canvas, tennis, deck, or other types of material), sandals, high-heeled shoes, etc., are not allowed on field project sites.

I. Maintain Protective Equipment

1. Check PPE for damage, cracks, and wear prior to each use. Replace or repair equipment not found in good condition.

2. Decontaminate non-disposable PPE with appropriate cleaner, as necessary, to prevent degradation of the equipment. Staff will remove any non-impermeable PPE/clothing that becomes contaminated with hazardous substances. These instructions are reiterated in the emergency decontamination procedures in the Health and Safety Plans.

J. Periodically inspect worksites where employees are using PPE using Attachment 029-2 NA. Regularity of inspections should be determined by the project manager and/or site safety representative.

5. Documentation Summary

The following information will be maintained in the project file:

A. Completed Hazard Assessment Certification Forms (Attachment 029-1 NA).

B. Completed Personal Protective Equipment Inspection Sheet (Attachment 029-2 NA).

C. Documentation of employee training.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Standards – Personal Protective Equipment – 29 Code of Federal Regulations (CFR)1910, Subpart I

B. U.S. OSHA Construction Standard - Personal Protective Equipment – 29 CFR 1926 Subpart E

C. U.S. OSHA Technical Links – Personal Protective Equipment

D. American National Standards Institute – ANSI Z89.1-2003, Protective Headwear

E. American National Standards Institute – ANSI Z87.1 - 1989 – Eye and Face Protection

F. American National Standards Institute /International Safety Equipment Association, ANSI/ISEA 107 - 2004 – Standard for High-Visibility Safety Apparel

G. American Society for Testing and Materials, ASTM F13-WK4519, Specification for Personal Protective Footwear

H. *Quick Selection Guide to Chemical Protective Clothing,* K Forsberg and S.Z. Mansdorf, Wiley Interscience, 2002

I. Best Manufacturing Co. http://www.bestglove.com/. Information on chemical resistant gloves.

J. SMS 040 – Fall Protection

K. SMS 026 – Noise and Hearing Conservation

L. SMS 064 – Hand Safety

M. Attachment 029-1 NA – Hazard Assessment Form

N. Attachment 029-2 NA – Personal Protective Equipment Inspection Form

7. Supplemental Information

A. Eye and Face Protector Selection Guide

B. Welding Lens Selector

C. Traffic Control Class Guidelines and Scenarios

URS	Health, Safety and Environment **HAZARD ASSESSMENT CERTIFICATION FORM**	Attachment 029-1 NA Issue Date: July 2000 Revision 5: February 2009

Location: _____ **Job No.:** _____

Date: _____ **Assessment conducted by:** _____

Specific tasks performed at this location: _____

If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.

Overhead Hazards

1.	Suspended/elevated loads, beams, or objects that could fall or strike head	☐ **Yes**	☐ **No**	Hard hat, ANSI Z89, Class G, E or C
2.	Flying objects that could strike head	☐ **Yes**	☐ **No**	Hard hat, ANSI Z89, Class G, E or C
3.	Energized wires or equipment that could strike head	☐ **Yes**	☐ **No**	Hard hat, ANZI Z89, Class G or E (dependent on potential voltage)
4.	Sharp objects or corners at head level	☐ **Yes**	☐ **No**	Hard hat, ANSI Z89, Class G, E or C

Eye Hazards

5.	Chemical splashes or irritating mists	☐ **Yes**	☐ **No**	See Supplemental Information A for additional information
6.	Excessive dust	☐ **Yes**	☐ **No**	Safety glasses or goggles
7.	Smoke and/or fumes	☐ **Yes**	☐ **No**	Safety goggles
8.	Welding operations	☐ **Yes**	☐ **No**	Welding goggles; See Supplemental Information A and B for additional information
9.	Lasers/optical radiation	☐ **Yes**	☐ **No**	Have URS HSE Representative assist you in proper selection
10.	Projectiles	☐ **Yes**	☐ **No**	Safety glasses or goggles plus face shield
11.	Sawing, cutting, chipping, and/or grinding	☐ **Yes**	☐ **No**	Safety glasses or goggles plus face shield; See Supplemental Information A for additional information

Face Hazards

12.	Chemical splashes or irritating mists	☐ **Yes**	☐ **No**	Safety goggles; See Supplemental Information A for more information; add face shield if irritating or corrosive
13.	Welding operations	☐ **Yes**	☐ **No**	Welding goggles or welding helmet; see Supplemental Information A and B for additional information
14.	Projectiles	☐ **Yes**	☐ **No**	Safety glasses or goggles plus face shield

Hand Hazards

15.	Chemical exposure	☐ **Yes**	☐ **No**	Use chemical-resistant gloves specific to hazard; consult MSDS, chemical hazard guide, or HSE Representative
16.	Sharp edges, splinters, etc.	☐ **Yes**	☐ **No**	Leather or Kevlar gloves
17.	Temperature extremes – heat	☐ **Yes**	☐ **No**	Leather gloves, welder's gloves, hot mill gloves

If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.

18.	Temperature extremes – cold	☐ **Yes**	☐ **No**	Insulated gloves
19.	Blood, fungus, biological agents	☐ **Yes**	☐ **No**	Nitrile gloves
20.	Exposure to live electrical currents	☐ **Yes**	☐ **No**	Electrical gloves; consult HSE representative
21.	Sharp tools, machine parts, etc.	☐ **Yes**	☐ **No**	Leather or Kevlar gloves
22.	Material handling	☐ **Yes**	☐ **No**	Leather gloves

Foot Hazards

23.	Heavy materials (greater than 50 pounds) handled by employees	☐ **Yes**	☐ **No**	Safety shoes or boots
24.	Potential to crush whole foot	☐ **Yes**	☐ **No**	Safety shoes or boots with metatarsal guard
25.	Sharp edges or points (puncture risk)	☐ **Yes**	☐ **No**	Safety shoes or boots
26.	Exposure to electrical wires	☐ **Yes**	☐ **No**	Safety shoes or boots with electrically non-conductive soles
27.	Slippery conditions	☐ **Yes**	☐ **No**	Rubber-soled boots or grips
28.	Chemical contamination	☐ **Yes**	☐ **No**	Rubber, PVC, or polyurethane boots or boot covers with puncture and protective toe if task required
29.	Wet conditions	☐ **Yes**	☐ **No**	Rubber boots or boot covers
30.	Construction/demolition	☐ **Yes**	☐ **No**	Safety boots with metatarsal guard if foot-crushing hazard exists

Fall Hazards

31.	Elevations above 4 feet (general industry) or 6 feet (construction) without guardrails	☐ **Yes**	☐ **No**	ANSI A-10.14 Type 1 full-body harness
32.	Suspended scaffolds, boatswain's chairs, float scaffolds, or suspended staging	☐ **Yes**	☐ **No**	ANSI A-10.14 Type 1 full-body harness
33.	Working in trees	☐ **Yes**	☐ **No**	ANSI A-10.14 Type 1 full-body harness
34.	Working in vehicle-mounted elevating work platforms (e.g., bucket trucks, aerial lifts)	☐ **Yes**	☐ **No**	ANSI A-10.14 Type 1 full-body harness

Water Hazards

35.	Working on or above water where a risk of drowning exist	☐ **Yes**	☐ **No**	U.S. Coast Guard approved personal floatation device; Type I, II, or III

Excessive Heat or Flame

36.	Full body chemical protective clothing in temperatures greater than 80 °F	☐ **Yes**	☐ **No**	Cooling vest
37.	Work around molten metal or flame	☐ **Yes**	☐ **No**	Nomex or heat reflective clothing
38.	Welding activities	☐ **Yes**	☐ **No**	Welding leathers for those areas that are exposed to flame, spark, or molten metal

Respiratory Hazards

39.	Airborne particulates, gases, vapors, or mists in excess of established exposure limits	☐ **Yes**	☐ **No**	Refer to SMS 042 or URS HSE Representative for respirator selection guidance

URS	Health, Safety and Environment **HAZARD ASSESSMENT CERTIFICATION FORM**	Attachment 029-1 NA Issue Date: July 2000 Revision 5: February 2009

If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.

Excessive Noise

40.	Exposure to noise	☐ **Yes**	☐ **No**	Ear plugs, muffs or both

Body and Leg Protection

41.	Chemical exposure	☐ **Yes**	☐ **No**	Contact URS HSE Representative for assistance in proper selection
42.	Using chainsaw, cutting brush	☐ **Yes**	☐ **No**	Chainsaw chaps
43.	Exposure to snakes	☐ **Yes**	☐ **No**	Snake chaps
44.	Exposure to vehicle traffic or heavy equipment	☐ **Yes**	☐ **No**	See SMS 032 and SMS 029 NA – Supplemental Information C for additional guidance

I certify that the above inspection was performed to the best of my knowledge and ability, based on the hazards present on: _____

Name _____ Signature _____

URS	Health, Safety and Environment **PERSONAL PROTECTIVE EQUIPMENT INSPECTION SHEET**	Attachment 029-2 NA Issue Date: July 2000 Revision 5: February 2009

Name of Inspector _____ **Date Inspected** _____

Hard Hats	
1. The brim or shell does not show signs of exposure and excessive wear, loss of surface gloss, chalking, or flaking.	☐ **Yes** ☐ **No**
2. Suspension system in hard hat does not show signs of deterioration, including cracking, tearing, or fraying.	☐ **Yes** ☐ **No**
3. The brim or shell is not cracked, perforated, or deformed.	☐ **Yes** ☐ **No**
4. Employees use hard hats in marked areas.	☐ **Yes** ☐ **No**
5. Areas requiring hard hat usage are marked.	☐ **Yes** ☐ **No**
Safety Shoes	
6. Safety shoes used by employees do not show signs of excessive wear.	☐ **Yes** ☐ **No**
7. Areas requiring safety shoes are marked.	☐ **Yes** ☐ **No**
Work Gloves	
8. Gloves are available and worn when needed.	☐ **Yes** ☐ **No**
9. Gloves are appropriate for the task.	☐ **Yes** ☐ **No**
10. Gloves do not show signs of excessive wear such as cracks, scrapes, or lacerations, thinning or discoloration, or break-through to the skin.	☐ **Yes** ☐ **No**
Protective Clothing	
11. Protective clothing (including traffic control apparel) is worn by employees when required.	☐ **Yes** ☐ **No**
Hearing Protection	
12. Noise hazard areas are posted.	☐ **Yes** ☐ **No**
13. Employees are using earplugs or muffs when using noise producing equipment or working in posted noise hazard areas.	☐ **Yes** ☐ **No**
Safety Glasses	
14. Eye hazard areas are marked or posted.	☐ **Yes** ☐ **No**
15. Employees use safety glasses when working in eye hazard areas or working with equipment that produces an eye hazard.	☐ **Yes** ☐ **No**
16. Face shields are used when required and worn over safety glasses.	☐ **Yes** ☐ **No**

REMARKS ***(All "No" answers indicate a hazard which needs to be fixed.)***

_____

_____

_____

_____

_____

URS SAFETY MANAGEMENT STANDARD

Sanitation

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies.

2. Purpose and Scope

The purpose of this standard is to provide employees with appropriate personal hygiene facilities, including toilets, wash rooms, and eating facilities, to protect employees from unsanitary conditions.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility or site.

4. Requirements

A. Prior to the start of site activities, ensure the availability of adequate toilet and wash facilities. Note: Mobile crews having transportation readily available (within 5 minute travel time) to nearby toilet facilities need not be provided with facilities.

1. Flush toilets will be used where available.
2. For job sites without flush toilets readily available, one of the following must be provided:
   a. Chemical toilets.
   b. Combustion toilets.
   c. Recirculation toilets.
3. Other than construction sites, toilets will be provided for employees of each sex at sites according to the following ratio:

Number of Employees	Minimum # of toilets (1)
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	(2)

Notes:
(1) Where toilet facilities will not be used by women, urinals may be provided instead of the minimum specified.
(2) One (1) additional fixture for each additional 40 employees.

B. A means for washing hands must be provided next to or near toilet areas.

C. For facilities under URS control:

1. Maintain toilets and toilet area in good repair and in a clean and sanitary condition. Refer to SMS 021 – Housekeeping.
2. Provide paper towels and soap or other suitable sanitizing material for washing hands.
3. Construct toilets so that the interior is lighted, by artificial or natural light, adequate ventilation is provided, and all windows and vents are screened.

D. Maintain availability and cleanliness of drinking (potable) water.

1. Use backflow prevention devices, testing, and administrative controls for all potable water supply branches. Maintain backflow prevention devices in a sanitary condition.
2. Keep water coolers and water dispensers in a sanitary condition and filled only with potable water. Clearly mark potable drinking water containers as “Drinking Water.”
3. Clean and sanitize water containers daily. Tightly close, seal, date, and mark containers as to the contents. Provide containers with a tap, and refill daily.
4. Provide fountain-type dispensers or one-use cups at each water dispenser. Provide a waste receptacle where disposable cups are used.
5. Do not use common drinking cups.
6. Conspicuously post outlets for non-potable water such as water for industrial or firefighting purposes (e.g., Danger – Water Unfit for Drinking, Washing, or Cooking).
7. Laboratory-test drinking water obtained from streams, wells, or other temporary sources in accordance with federal, state, or local regulations, or often enough to ensure it is suitable for consumption. Maintain records of testing reports and results.

E. Eating Facilities

1. Operate and maintain food dispensing facilities established by URS in compliance with applicable health and sanitation regulations.
2. Ensure that buildings housing these facilities are floored completely, painted, well lighted, heated, ventilated, fly proof, and sanitary. Equip doors and windows with screens.
3. Use microwave ovens for food only.
4. Use refrigerators designated for food storage for food only (i.e., no chemical or samples storage).
5. Prohibit workers from eating or storing foods in areas where there is a potential for contamination.
6. Take positive control measures for protection against vermin, insects, and rodents.
7. Provide an ample supply of hot and cold water at all times in mess halls.
8. Clean break rooms /lunchrooms periodically. Refer to SMS 021 – Housekeeping.

F. Washing Facilities

1. Maintained each washing facility in a sanitary condition, and provide adequate water, soap, individual towels of cloth or paper, and covered receptacles for disposal of waste.
2. Provide emergency showers and eyewash facilities as required. Refer to SMS 065 – Injury Management.
3. Provide at least one shower for each 30 employees in construction camps. The use of a common towel is prohibited.

G. Waste Management:

1. Release sanitary sewage into sanitary sewer lines or to other proper disposal channels.
2. Do not dispose of garbage, refuse, or sewage in lakes, reservoirs, rivers, streams, or ditches.

3. Do not discharge hazardous waste into the sanitary sewer or storm sewer system.

4. Collect garbage and trash daily.

   a. Provide lids for garbage containers located outside buildings, and keep them closed. Transport garbage offsite at least weekly.

   b. Remove garbage from the site daily at remote field sites where wild animals are a hazard. Do not let garbage remain on site overnight.

H. Change Rooms

Provide heated and ventilated change rooms for changing, hanging, and/or drying clothing for operations subjecting workers to prolonged wetting or contact with hazardous materials.

I. Sleeping Facilities

1. Keep temporary sleeping quarters heated, ventilated, lighted, and clean. Screen all doors and windows.

2. Keep clean and sanitary, and periodically disinfect bunkhouses, bedding, and furniture.

J. Notify property manager of sanitation issues for sites not under URS control.

K. Personal Hygiene

Wash hands and face before eating, drinking, smoking, and using facilities.

L. Inspect work sites periodically in accordance with Attachment 030-1 NA.

5. Documentation Summary

The following information will be maintained in the project file:

A. Completed inspection sheets.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Construction Standard – Sanitation – 29 Code of Federal Regulations (CFR) 1926.51

B. U.S. OSHA General Industry Standard – Sanitation – 29 CFR 1910.141

C. SMS 021 - Housekeeping

D. SMS 065 – Injury Management

E. Attachment 030-1 NA - Sanitation Inspection Sheet

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies.

2. Purpose and Scope

The purpose of this standard is to provide employees with appropriate personal hygiene facilities, including toilets, wash rooms, and eating facilities, to protect employees from unsanitary conditions.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility or site.

4. Requirements

A. Prior to the start of site activities, ensure the availability of adequate toilet and wash facilities. Note: Mobile crews having transportation readily available (within 5 minute travel time) to nearby toilet facilities need not be provided with facilities.

1. Flush toilets will be used where available.
2. For job sites without flush toilets readily available, one of the following must be provided:
   a. Chemical toilets.
   b. Combustion toilets.
   c. Recirculation toilets.
3. Other than construction sites, toilets will be provided for employees of each sex at sites according to the following ratio:

Number of Employees	Minimum # of toilets (1)
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	(2)

Notes:
(1) Where toilet facilities will not be used by women, urinals may be provided instead of the minimum specified.
(2) One (1) additional fixture for each additional 40 employees.

B. A means for washing hands must be provided next to or near toilet areas.

C. For facilities under URS control:

1. Maintain toilets and toilet area in good repair and in a clean and sanitary condition. Refer to SMS 021 – Housekeeping.
2. Provide paper towels and soap or other suitable sanitizing material for washing hands.
3. Construct toilets so that the interior is lighted, by artificial or natural light, adequate ventilation is provided, and all windows and vents are screened.

D. Maintain availability and cleanliness of drinking (potable) water.

1. Use backflow prevention devices, testing, and administrative controls for all potable water supply branches. Maintain backflow prevention devices in a sanitary condition.
2. Keep water coolers and water dispensers in a sanitary condition and filled only with potable water. Clearly mark potable drinking water containers as “Drinking Water.”
3. Clean and sanitize water containers daily. Tightly close, seal, date, and mark containers as to the contents. Provide containers with a tap, and refill daily.
4. Provide fountain-type dispensers or one-use cups at each water dispenser. Provide a waste receptacle where disposable cups are used.
5. Do not use common drinking cups.
6. Conspicuously post outlets for non-potable water such as water for industrial or firefighting purposes (e.g., Danger – Water Unfit for Drinking, Washing, or Cooking).
7. Laboratory-test drinking water obtained from streams, wells, or other temporary sources in accordance with federal, state, or local regulations, or often enough to ensure it is suitable for consumption. Maintain records of testing reports and results.

E. Eating Facilities

1. Operate and maintain food dispensing facilities established by URS in compliance with applicable health and sanitation regulations.
2. Ensure that buildings housing these facilities are floored completely, painted, well lighted, heated, ventilated, fly proof, and sanitary. Equip doors and windows with screens.
3. Use microwave ovens for food only.
4. Use refrigerators designated for food storage for food only (i.e., no chemical or samples storage).
5. Prohibit workers from eating or storing foods in areas where there is a potential for contamination.
6. Take positive control measures for protection against vermin, insects, and rodents.
7. Provide an ample supply of hot and cold water at all times in mess halls.
8. Clean break rooms /lunchrooms periodically. Refer to SMS 021 – Housekeeping.

F. Washing Facilities

1. Maintained each washing facility in a sanitary condition, and provide adequate water, soap, individual towels of cloth or paper, and covered receptacles for disposal of waste.
2. Provide emergency showers and eyewash facilities as required. Refer to SMS 065 – Injury Management.
3. Provide at least one shower for each 30 employees in construction camps. The use of a common towel is prohibited.

G. Waste Management:

1. Release sanitary sewage into sanitary sewer lines or to other proper disposal channels.
2. Do not dispose of garbage, refuse, or sewage in lakes, reservoirs, rivers, streams, or ditches.

3. Do not discharge hazardous waste into the sanitary sewer or storm sewer system.
4. Collect garbage and trash daily.
   a. Provide lids for garbage containers located outside buildings, and keep them closed. Transport garbage offsite at least weekly.
   b. Remove garbage from the site daily at remote field sites where wild animals are a hazard. Do not let garbage remain on site overnight.

H. Change Rooms

Provide heated and ventilated change rooms for changing, hanging, and/or drying clothing for operations subjecting workers to prolonged wetting or contact with hazardous materials.

I. Sleeping Facilities

1. Keep temporary sleeping quarters heated, ventilated, lighted, and clean. Screen all doors and windows.
2. Keep clean and sanitary, and periodically disinfect bunkhouses, bedding, and furniture.

J. Notify property manager of sanitation issues for sites not under URS control.

K. Personal Hygiene

Wash hands and face before eating, drinking, smoking, and using facilities.

L. Inspect work sites periodically in accordance with Attachment 030-1 NA.

5. Documentation Summary

The following information will be maintained in the project file:

A. Completed inspection sheets.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Construction Standard – Sanitation – 29 Code of Federal Regulations (CFR) 1926.51

B. U.S. OSHA General Industry Standard – Sanitation – 29 CFR 1910.141

C. SMS 021 - Housekeeping

D. SMS 065 – Injury Management

E. Attachment 030-1 NA - Sanitation Inspection Sheet

URS	Health, Safety and Environment **SANITATION INSPECTION SHEET**	Attachment 030-1 NA Issue Date: June 1999 Revision 3: February 2009

Location: _____ **Job No:** _____

Date Inspected: _____ **Name of Inspector:** _____

Toilets

1. Are there an adequate number of toilets on site? ☐ Yes ☐ No ☐ NA
   - 1 to 15 employees = 1 toilet
   - 16 to 35 employees = 2 toilets
   - 36 to 55 employees = 3 toilets
   - 56 to 80 employees = 4 toilets
   - 81 to 110 employees = 5 toilets
2. Toilets are in clean condition. ☐ Yes ☐ No ☐ NA
3. Toilet paper is provided. ☐ Yes ☐ No ☐ NA
4. Toilet areas are clean and sanitary. ☐ Yes ☐ No ☐ NA

Hand Washing Facilities

5. Hand washing facilities are provided near toilets. ☐ Yes ☐ No ☐ NA
6. Paper towels and soap are provided. ☐ Yes ☐ No ☐ NA

Drinking Water

7. Drinking water is provided on site. ☐ Yes ☐ No ☐ NA
8. Disposable cups are provided or fountain-type dispenser is provided. ☐ Yes ☐ No ☐ NA
9. Drinking water containers are kept clean and tightly closed or covered. ☐ Yes ☐ No ☐ NA

Break Rooms

10. Break rooms or eating areas are kept clean. ☐ Yes ☐ No ☐ NA
11. Microwaves are used for food only. ☐ Yes ☐ No ☐ NA
12. Microwave ovens are kept clean. ☐ Yes ☐ No ☐ NA
13. Refrigerators are kept clean. ☐ Yes ☐ No ☐ NA
14. Refrigerators are used to store food only. ☐ Yes ☐ No ☐ NA

Vermin

15. Rats, mice, and other vermin are not living within buildings. ☐ Yes ☐ No ☐ NA
16. Cockroaches and fleas are not thriving within buildings. ☐ Yes ☐ No ☐ NA

Employee Compliance

17. Employees only eat/drink in areas free from contamination. ☐ Yes ☐ No ☐ NA
18. Employees wash hands/face prior to eating, drinking, smoking. ☐ Yes ☐ No ☐ NA

REMARKS:

_____

_____

_____

1. Applicability

This standard applies to URS Corporation and its subsidiary companies where personnel may encounter subsurface or overhead utilities.

2. Purpose and Scope

Many field activities are conducted near aboveground and underground utilities. The primary purpose of this standard is to establish operating requirements that will permit employees to work safely in the vicinity of electrical, natural gas, fuel, water, and other utility systems and installations. The secondary purpose is to prevent economic damage to utility systems from operations associated with project-related activities.

The term *utility clearance* includes the following:

A. The positive locating of utility systems in or near the work area.

B. A signed statement by an appropriate representative attesting to the location of underground utilities and/or the positive de-energizing (including lockout) and testing of electrical utilities.

In some cases, utility representatives may deem it appropriate or necessary to use insulating blankets to isolate a power line. This is an acceptable alternative to positive de-energizing; however, only utility representatives can make the determination.

"Contact" with overhead power lines is considered to occur when equipment is closer to power lines than permitted by the criteria in the table in Section 4.C.2.b. (See note for operations in the United Kingdom).

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Time for Completion

Complete utility clearances prior to the start of any work in the area of the utility that could feasibly result in contact with or damage to that utility.

B. Local Regulations

Research local and state codes and regulations regarding utility locating and isolation requirements. Utility companies and locating services are among the appropriate resources.

C. Overhead Power Lines

1. Proximity to Power Lines

No work is to be conducted within 50 feet (15 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15 meters) of overhead power lines without first making this determination.

2. Operations adjacent to overhead power lines are *prohibited* unless one of the following conditions is satisfied:

a. Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.

b. The minimum clearance from energized overhead lines is presented in the following table, or the equipment will be repositioned and blocked so that no part, including cables, can come within the minimum clearances listed in the table.

Minimum Distances from Power Lines

Nominal System (kilovolt, kV)	Minimum Required Distance
0–50	10 feet (3 meters)
51–100	12 feet (3.6 meters)
101–200	15 feet (4.6 meters)
201–300	20 feet (6.1 meters)
301–500	25 feet (7.6 meters)
501–750	35 feet (10.7 meters)
751–1000	45 feet (13.7 meters)

Note: For operations in the United Kingdom, the specific safe distance is determined by the utility company.

c. The power line(s) has been isolated through the use of insulating blankets, which have been properly placed by the utility. If insulating blankets are used, the utility will

determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.

3. All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the appropriate URS representative prior to the start of the task that may impact the utility.

D. Underground Utilities

1. Do not begin subsurface work (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted. The use of as-built drawings must be confirmed with additional geophysical or other surveys.

2. Contact utility companies or the state/regional utility protection service at least two (2) working days prior to excavation activities to advise them of the proposed work and to ask them to establish the location of the underground utility installations prior to the start of actual excavation. One Call utility location service is available throughout the United States by calling 811. Where these services are unavailable (e.g., private properties), contract with an independent utility locating service to perform an evaluation of subsurface utilities.

3. Obtain utility clearances for subsurface work on both public and private property. Clearances are to be in writing and signed by the party conducting the clearance.

4. Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the URS representative must notify the utility company, utility protection service, or the utility locating service to inform them that the markings have been destroyed.

5. Do not conduct mechanical-assisted subsurface work (e.g., work using a powered drill rig, mechanical excavator, etc.) within five (5) feet (1.5 meters) of a confirmed or suspected utility or other subsurface structure. Confirm minimum distances for mechanical-assisted subsurface work with the utility owner, as distances beyond this five-foot minimum may be required.

6. Nondestructive clearance techniques (e.g., vacuum extraction or other hand clearing means) are required prior to drilling/excavating in higher risk locations, including chemical plants, retail service stations, or other locations with complex underground utility systems.

7. Subsurface work within five feet (1.5 meters) of a confirmed or suspected utility or other subsurface structure must be done by nondestructive clearing techniques to the point where the obstruction is visually located and exposed. Once the obstruction location is confirmed in this manner, mechanical-assisted work may begin.

8. Reference SMS 013 – Excavation Safety for additional information regarding subsurface operations.

E. Training

Conduct a briefing for site employees regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Documents requesting utility clearance.

B. Documents confirming utility clearance.

C. Training/briefing documentation of each isolation.

6. Resources

A. Utility Locating Services (typically under "Utility" in the Yellow Pages)

B. National Institute for Occupational Safety and Health (NIOSH) Alert – Preventing Electrocutions from Contact Between Cranes and Power Lines

C. One Call Utility Locating List

D. National Utility Locating Contractor's Association

E. United Kingdom – Health and Safety Executive GS6

F. SMS 013 – Excavation Safety

1. Applicability

This standard applies to URS Corporation and its subsidiary companies that may require the use of respiratory protection, including Immediately Dangerous to Life and Health (IDLH) and emergency conditions. This program also addresses the voluntary use of respirators.

2. Purpose and Scope

The purpose of this standard is to protect those employees performing operations for which exposures cannot be controlled by use of conventional engineering or administrative controls, and prior to establishing a negative air exposure assessment, and to require that respiratory protective equipment is selected, used, maintained, and stored in accordance with acceptable practices. This procedure establishes the minimum standard for respirator training, selection, and use during the performance of all work requiring such protection.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Before assigning hazardous jobs to employees, determine if respirators are required.

1. If the potential for respiratory hazards exists for any portion of a job, complete Attachment 042-1 NA – Identifying When A Respirator Is Needed.

2. Contact a Division Health, Safety, and Environment (HSE) Manager, Regional or Strategic Business Unit (RBU/SBU) Manager, or URS Certified Industrial Hygienist (CIH) if any of the questions in Attachment 042-1 are checked "yes."

3. Follow instructions in Attachment 042-2 NA – Voluntary Use or Respirators – for employees who wish to voluntarily use dust masks.

4. Follow all the requirements of this standard for employees who wish to voluntarily use tight-fitting (e.g., air purifying) respirators.

5. Required respirators will be paid for by URS and will be provided without cost to the employee.

6. Control worker's exposure to air contaminants, where practicable, by engineering or administrative controls, or by substitution of process materials with less-toxic substances. Use respirators only when engineering or administrative controls are not feasible or completely effective.

B. Select the proper respirator for the job.

1. Contact the appropriate HSE Manager or CIH for assistance in respirator selection for those jobs identified in Attachment 042-1 NA.

2. Contact the appropriate HSE Manager for follow up if there are any problems implementing the recommendations made.

C. Require employees who will use respirators to be medically qualified by a project medical consultant (PMC) before fit-testing and assigning them a respirator. The PMC should preferably be an occupational physician; however, the Occupational Safety and Health Administration (OSHA) allows any physician or licensed health care professional (PLHCP) to conduct evaluations of respiratory protection medical forms. The PMC, where required, will determine the physiological and psychological status that is relevant to wearing different types of respirators. The PMC will review all questionnaires and test results and verify in writing that workers are physically and psychologically able to perform work while using respiratory protective devices. These determinations will be made using guidelines established by the PMC.

1. For program details, refer to SMS 024 – Medical Screening and Surveillance.

2. Require that employees have a current and accurate Medical Surveillance form (Attachment 024-2).

3. Obtain a copy of the employee's Health Status Medical Report from the Office Health and Safety Representative. The consulting occupational physician of the medical service provider following each work-related examination issues the Health Status Medical Report. Employees cannot be assigned respirators unless they are medically cleared for respirator use.

D. Require respirator users to receive appropriate training.

1. All respirator users must be trained:

a. Before they are assigned a respirator.

b. Annually thereafter.

c. Whenever a new hazard or job is introduced.

d. Whenever employees fail to demonstrate proper use or knowledge.

2. Document training in accordance with the requirements of SMS 055 – Training.

3. Training must address, at a minimum, the following:

a. Why the respirator is necessary, and what conditions can make the respirator ineffective.

b. What the limitations and capabilities of the respirators are.

c. How to inspect, put on and remove, and check the seals of the respirator.

d. What the respirator maintenance and storage procedures are.

e. How to recognize medical signs and symptoms that may limit or prevent effective use of the respirator.

f. The engineering and administrative controls being used and the need for respirators.

g. The hazards and consequences of improper respirator use.

h. How to recognize and handle emergency situations.

E. Require respirator users to be fit tested.

1. Any employee who has been assigned a reusable respirator must be fit tested on an annual basis (no more than 1 year may elapse between fit tests), or when the employee is assigned a respirator of a different make, type, or size from that previously tested.

2. Qualitative or quantitative fit testing can be performed by contract or in-house personnel.

3. Obtain a signed, written copy of the fit-test results. The fit-test results should include:

a. Employee's name and employee identification number.

b. Respirator brand, model, and size fitted for.

c. Date fit tested.

d. Method of fit testing used.

e. Name and signature of fit tester.

f. Manufacturer and serial number of fit-testing apparatus (if used).

A fit test results form is available as Attachment 042-3 NA.

F. A person assigned the task of issuing respirators to persons who must wear respirators for protection against harmful atmospheres should be given adequate training to ensure that the correct respirator is issued for each application. This training should include, but not necessarily be limited to, the following:

1. Establishment of a working knowledge of the specific types of respirators to be issued, their limitations, and the importance of issuing only the respirators for which each user is specifically approved.

2. Familiarization with the respirator maintenance and repair program in order to be able to identify any respirator that is improperly cleaned or needs repair.

3. Familiarization with the procedures for respirator issue. Only persons trained to ensure that proper respirators are issued will be permitted to issue respirators to persons needing them.

G. Provide qualified employees with respirator(s) and adequate amounts of parts and cartridges.

1. Assign employees whose duties require respirators their own respirator for which they have been fit tested.

2. Provide special eyeglass inserts designed for the respirator if an employee must wear eyeglasses with a full-facepiece respirator. Contact lenses may be worn when wearing a full-facepiece respirator.

3. Respirators and cartridges must be approved by the National Institute for Occupational Safety and Health (NIOSH). Military-issue respirators are approved under Military Standard AR 11-34.

H. Require respirators to be used properly.

1. Prohibit facial hair where the respirator-sealing surface meets the wearer's face.
2. Require employees to perform a positive and negative fit check every time the respirator is put on.
3. Employees will leave the area where respirators are being used:
   a. Before removing the facepiece for any reason.
   b. To correct any respirator malfunction.
   c. To change the respirator and/or respirator cartridges.
   d. The employee becomes ill (dizziness, nausea, etc.).
   e. If any of the following is detected:
      1. Vapor or gas breakthrough
      2. Leakage around the facepiece
      3. Increased breathing resistance.
4. Use cartridges with End-of-Service-Life indicators, or determine the respirator cartridge change-out schedule. See Supplemental Information A for guidance.

I. Require respirators to be cleaned and stored properly.

1. Clean and disinfect respirators after each use.
2. Store respirators in a plastic bag or case and in a clean location.
3. Inspect respirators before use and after each cleaning.

J. Address issues associated with special-use respirators (self-contained breathing apparatus; air-supply respirators; emergency-use respirators).

1. Self-Contained Breathing Apparatus

   Inspect self-contained breathing apparatus and other emergency-use respirators monthly and after each use in accordance with manufacturer's instructions.

2. Air-Supplied Respirators

   a. Air used for atmosphere-supplying respirators must meet or exceed the requirements for Type 1 – Grade D breathing air. Never use oxygen.
      1. A certificate of analysis must accompany bottled air.
      2. Compressors used to supply breathing air must:
         i. Prevent entry of contaminated air into the air supply.
         ii. Minimize moisture content.
         iii. Have suitable in-line sorbent beds and filter to provide appropriate air quality.
         iv. Have a high–carbon-monoxide alarm that sounds at 10 part per million (ppm).
   b. Couplings on air-hose lines must be incompatible with other gas systems.

K. Require follow-up training and medical surveillance to be provided as directed.

1. Provide follow-up physical examinations as directed by the SMS 024-3 NA – Medical Screening and Surveillance Exam Protocol table.
2. Provide follow-up physicals as directed by the Occupational Health Manager.
3. Provide annual refresher training.
4. Provide annual fit testing.

5. Documentation Summary

All Respiratory Protection Program documentation must be protected by the Privacy Act of 1974 (PL-93-579), and confidential medical information not required by OSHA may be protected under the Health Insurance Portability Accountability Act of 2003 (HIPAA).

The following information will be maintained in the office/project file:

1. Identifying When A Respirator Is Needed – Attachment 042-1 NA.
2. Voluntary Use of Respirators – Attachment 042-2 NA.
3. Fit Test Record – Attachment 042-3 NA.

4. Employee Health Status Medical Report, including clearance for respirator use.

5. Employee Respirator Training Records.

6. Resources

A. U.S. OSHA Standard - Respiratory Protection – 29 Code of Federal Regulations (CFR) 1910.134

B. U.S OSHA Technical Links – Respiratory Protection

C. ANSI Z88.6-2006 – Respirator Use – Physical Qualifications for Personnel

D. AIHA, The Occupational Environment – Its Evaluation and Control

E. NIOSH Respirator Decision Logic

F. NIOSH Guide to Industrial Respiratory Protection

G. SMS 024 – Medical Screening and Surveillance Program

H. SMS 055 – Health and Safety Training

I. Attachment 042-1 NA – Identifying When a Respirator is Needed

J. Attachment 042-2 NA – Voluntary Use of Respirators

K. Attachment 042-3 NA – Fit Test Record

L. Attachment 042-4 NA – Respirator Standard Operating Procedure

7. Supplemental Information

A. Respirator Cartridge Change Schedule

B. Hazard Analysis for Respirator Use

C. Fit Testing Guidance

D. Respirator Selection Guidance

E. Inspection, Cleaning, and Storage Guidance

1. Applicability

This standard applies to URS Corporation and its subsidiary companies where job activities are performed primarily in outdoor environments.

2. Purpose and Scope

The purpose of this standard is to provide information that will help eliminate or reduce illnesses and injuries transmitted by plants, insects, animals, and pathogenic agents. Although there are many animals and insects that are potentially harmful to humans (e.g., bees, spiders, bears, and rodents), this standard focuses on six common biological hazards: ticks, poison plants, mosquitoes, snakes, Valley Fever, and water-borne pathogenic agents. Refer to SMS 051 – Bloodborne Pathogens for additional information.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Ticks

1. Precautionary Measures

a. 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 3 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 the following:

i. *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 that occur within 3 to 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.

ii. *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.

iii. *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.

iv. *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.

b. 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.

c. Personal Protective Equipment

i. Wear light colored clothing or white Tyvek® to allow you to see ticks that are crawling on your clothing.

ii. 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.

iii. Wear a hat, and tie back long hair.

iv. 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.

d. Tick Check

i. Change clothes when you return from an area where ticks may be located.

ii. Shower to wash off any loose ticks.

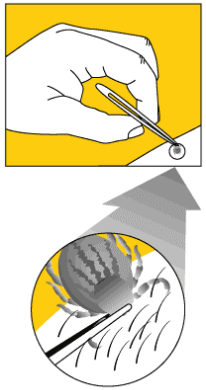
iii. Check your entire body for ticks. Use a hand held or full-length mirror to view all parts of your body.

iv. 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:

a. Direct contact: An initial skin exposure is necessary to “sensitize” the individual. Subsequent contact in a sensitized person will result in a rash appearing within 4 to 48 hours. Approximately 50 to 70 percent 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.

b. 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.

c. 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

2. Precautionary Measures

   a. The best approach is to learn to identify the plants and avoid them.

   b. Wear long pants and long sleeves, boots, and gloves.

   c. Barrier skin creams may offer some protection if applied before contact.

   d. Avoid indirect contact with 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.

   e. If you can wash exposed skin areas within 3 to 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.

3. Medical Follow-Up

   Home treatment: Calamine lotion and an oatmeal (1 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 to 6 days after the mosquito bite, and include fever, nausea, vomiting, headache, slow pulse, muscle aches, and restlessness. Treatment is symptomatic.

e. West Nile virus is a viral disease transmitted by mosquitoes. It occurs in North America, Europe, Africa, west and central Asia, and the Middle East. There is no vaccine for West Nile virus. Symptoms include nausea, vomiting, and diarrhea.

2. Precautionary Measures

a. 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.

b. Protective Clothing: Wear long-sleeved shirts and long pants, especially from dusk to dawn. Avoid going outdoors during these hours.

c. 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 has been sprayed with permethrin.

d. 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 in 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:

a. Don't put your hands into dark places, such as rock crevices, heavy brush, or hollow logs, without first investigating.

b. 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.

c. Don't walk through heavy brush or tall grass without looking down. Look where you are walking.

d. 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.

e. 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 anti-venom if warranted. Initial first aid should include: Washing the bite with soap and water; immobilizing the bitten area and keeping it lower than the heart. Try to remain calm. If you are unable to reach a hospital within 30 minutes, a bandage, wrapped 2 to 4 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 bandage is loose enough that a finger can slip under it.

Research has shown the following to be potentially harmful: DO NOT apply ice, use a tourniquet, or make incisions into the wound.

E. Valley Fever

1. Background Information

Valley Fever is an illness that results from exposure to a fungal spore (*Coccidioides immitis*). It is endemic to the San Joaquin Valley in California, as well as areas of the Southwestern U.S., Mexico, and Central and South America, although it has been found in many other areas. It is particularly associated with arid soils that are not cultivated. Exposure is generally by inhalation of spores, though it may also enter through broken skin. Approximately 2 weeks after inhalation exposure, severe weakness and flu-like symptoms develop; severe pneumonia may occur. It may also affect the brain, bones, and joints causing disability, spinal meningitis, or death. Dermal forms of the infection can form disfiguring fungal lesions.

2. Precautionary Measures

Because it is associated with arid soils, personnel should avoid locations and activities that create dust. Persons at risk of exposure include geologists, surveyors, excavators, archaeologists, etc. Dust suppression methods should be employed and the use of particulate respirators should be considered for areas known to harbor the fungus. At one phase of the fungus' life cycle, cottony, spider-web–like growths may be seen on the soil surface. If observed, these growths must not be disturbed, and work should be relocated if possible.

3. Medical Follow-up

Approximately 60 percent of exposed persons will not have symptoms. Persons that have been in areas associated with Valley Fever should be alert to the development of flu-like symptoms, fatigue, or skin rashes 2 to 4 weeks later. Valley Fever can be treated with anti-fungal medication. Early treatment is critical, as disseminated forms of the disease can result in chronic disease or death.

F. Pathogenic organisms

1. Background Information

Employees who perform certain activities, such as disaster response, may be in areas where water-borne pathogens may be present. A partial list of agents includes: E. coli, Hepatitis A, typhoid, and cholera. Chemical hazards and molds and fungus may also be present. Refer to SMS 051–Bloodborne Pathogens for additional information.

2. Precautionary Measures

All work must be performed within the scope of either a Health and Safety Plan or Safe Work Plan that identifies the task hazards, and specifies appropriate controls. A medical exam and/or inoculations may be required. See SMS 024 – Medical Screening and Surveillance, or contact the Occupational Health Manager for assistance.

Where contact with water or wet materials may occur, personnel must use protection such as impervious coveralls, boots/waders, faceshields, etc, as specified in the project Health and Safety Plan or Safe Work Plan. Personnel must protect any areas of broken skin, eyes, nose, and mouth from contact with potentially infectious materials, and practice good personal hygiene before eating, drinking, etc.

3. Medical Follow-up

Medical evaluation and/or an inoculation schedule may be required prior to beginning work. Because early evaluation and treatment is more successful, personnel should be alert to signs and symptoms of possible pathogenic organisms and seek prompt medical evaluation if illness develops or is suspected.

G. Natural disaster relief efforts

1. Natural disaster relief efforts present a variety of hazards, including biological hazards. Biological hazards potentially encountered during relief efforts include mold, sewage-contaminated water, various building materials that may puncture the skin and create various types of infections, and displaced animals and insects. Before work begins, each disaster relief site should be evaluated for the various types of biological hazards that may be encountered. Control measured must be developed to address the biological hazards.

5. Documentation Summary

Complete and distribute a URS Incident Report form 049-1 for all work-related biological exposure incidents.

6. Resources

A. Centers for Disease Control http://www.cdc.gov

B. U. S. Occupational Safety and Health Administration http://www.osha.gov

C. U.S. Food and Drug Administration - Treating and Preventing Venomous Snake Bites
http://www.fda.gov/fdac/features/995_snakes.html

D. ENature – Identify plant and animals hazards in a specific area.
http://enature.com/zipguides/index.asp?choice=poisonous

E. SMS 051 – Bloodborne Pathogens

F. SMS 024 – Medical Screening and Surveillance

G. SMS 049 – Injury / Illness / Incident Reporting & Notifications

7. Supplemental Information

A. Influenza Management Plan

1. Applicability

This standard applies to the operations of URS and EG&G Divisions of URS Corporation (URS) and its subsidiary companies.

2. Purpose and Scope

The purpose of this standard is to provide guidance for the timely reporting of work-related injuries, illness, and incidents. This procedure also defines incident notification procedures for URS employees. For incidents involving motor vehicles, the reporting and notification requirements of SMS 057 – Vehicle Safety Program – may also apply.

For significant incidents (e.g., fatality, serious injury, injury to members of the public), SMS 066 – Incident Investigation – is also required.

Note that this standard will also be used for investigation of critical injuries as defined by Canadian provincial regulations. See Supplemental Information A for definitions of critical injuries.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Reporting: All employees must 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 URS employee or subcontractor, even if the injury does not require medical attention.
2. An injury to a member of the public, or clients, occurring on a URS-controlled work site.
3. Illness resulting from suspected chemical exposure.
4. Chronic or re-occurring conditions such as back pain or cumulative trauma disorders (e.g., 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 URS or subcontractor activity.
8. Structural collapse or potential structural hazards.
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 URS activities.
12. Incidents that could result in adverse public media interest concerning URS or a URS project.
13. Any incident that could or does result in an actual investigation by state, federal, provincial, or local regulatory or law enforcement agencies.
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. A worker steps off a ledge, falls 3 feet (1 meter) to the floor, and is uninjured.
    b. A crane drops a 1,000-pound (454-kilogram) beam during a lift. Nobody is hurt, and no equipment is damaged.
    c. 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 miles per hour (80 kilometers per hour). 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. Contact appropriate emergency services and obtain appropriate medical attention, as required or directed by your supervisor. For additional information, refer to SMS 065 – Injury and Claims Management.
    d. 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 Attachment 049-1 NA – Incident / Near Miss Report. (Note: The international operations of URS Division will complete an on-line Incident Report instead, using the appropriate Health, Safety, and Environment (HSE) and Quality Improvement database).
    e. Submit this information to your supervisor and/or Project Manager within 24 hours of the incident.
    f. Assist with incident investigation as directed by management.
    g. Implement corrective actions as directed by management.
    h. *Do not* discuss the incident with members of the news media or legal representatives (except URS legal counsel or your personal legal advisor) unless directed to do so by URS management.
    i. *Do not* make statements pertaining to guilt, fault, or liability.

2. Line/Project Management Responsibilities (U.S. and Mexico Operations)

    a. For instances involving employee or subcontractor death or hospitalization, or equipment damage to Company or customer equipment valued at more than $100,000 (USD), immediately notify by telephone or other direct means URS/EG&G Operations and the HSE team in the order listed below. If any level of contact is unsuccessful, continue down the list in sequence. After notification has been made, a detailed follow-up, via email, is required.

        i. Appropriate corporate leadership for the affected program up to the Regional Business Unit (RBU) or

Strategic Business Unit (SBU) Vice President for the affected Operations.

ii. The URS Occupational Health Manager (OHM).

iii. Appropriate RBU and SBU HSE Manager for the affected Operation.

Follow-up notification should be made by forwarding Attachment 049-1 NA to the OHM within 24 hours. See Attachment 049-1 NA for methods of distribution. Also, assure copies of the report are distributed as outlined on the form. For the international operations of URS Division, this follow-up notification is not required.

URS/EG&G Division HSE Management will make notification to federal and state authorities as appropriate.

b. For minor incidents involving only first aid treatment, minor damage to vehicle or equipment, etc., make notifications to a supervisor and OHM immediately and submit Attachment 049-1 NA to the OHM. See Attachment 049-1 NA for methods of distribution. Also, assure copies of the report are distributed as outlined on the form.

c. For a near-miss incident, complete Attachment 049-1 NA and submit to the OHM as soon as reasonable. Also, ensure 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. Line/Project Management Responsibilities (Canadian Operations)

a. If notified of an incident that is a critical injury (see Supplemental Information A for definition), serious accident, or other significant consequence:

i. Immediately contact URS Canada Human Resources at (905) 882-4401.

ii. 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.

iii. Follow up notification by completing, signing, and delivering/faxing Attachment 049-1 NA to URS Canada Human Resources within 24 hours.

iv. URS Canada Human Resources will make notification to provincial authorities as appropriate.

b. If notified of an incident that is not a critical injury, nor a serious accident or other significant consequence:

i. 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.

ii. Complete, sign, and deliver/fax Attachment 049-1 NA to URS Canada Human Resources within 24 hours.

iii. URS Canada Human Resources will make notification to provincial authorities as appropriate.

c. If notified of a near-miss incident:

i. 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.

ii. Complete, sign, and deliver/fax Attachment 049-1 NA to URS Canada Human Resources as soon as practicable.

d. Discuss with department or project staff the circumstances surrounding the incident and corrective actions taken.

4. Local Office, Project, and/or Certified HSE 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. Ensure the reports are distributed properly.

d. Ensure notifications are made in a timely manner.

e. Ensure that the injured employee is properly counseled/advised as directed by SMS 065 – Injury and Claims Management. Communicate with the OHM.

f. Note that "Certified" HSE Representatives are those who have received special training in occupational safety and health and have been certified by the Ontario Workplace Safety and Insurance Board. Certified HSE Representatives should be used at larger Canadian project sites where joint worker/employer safety committees are developed.

5. Occupational Health Manager

a. Report work-related injuries and illness to workers' compensation carrier.

b. Ensure that the employee's injury is managed in accordance with SMS 065 – Injury and Claims Management. Provide guidance for the affected office, project, and/or Certified HSE Representative.

c. Periodically disseminate near-miss reporting summary information to the Regional, RBU/SBU, and Division HSE Managers.

6. URS Human Resources (Canadian Operations Only)

a. Receive incident notifications from staff.

b. For incidents involving critical injuries, serious accidents, or other significant consequences:

i. Verbally notify the Office Manager immediately, via cell phone if necessary.

ii. Notify the Certified HSE Representatives (management and worker) as soon as possible (where necessary).

iii. Notify the OHM as soon as possible. Notification to the OHM should in no case occur later than the end of the work shift.

iv. Follow up notification by receiving from staff and forwarding Attachment 049-1 NA to the OHM within 24 hours. Also, assure copies of the report are distributed as outlined on the form.

c. For minor incidents involving only first aid treatment, minor damage to vehicle of equipment, etc.:

i. Notify the OHM as soon as reasonable during normal business hours.

ii. Receive from staff and forward Attachment 049-1 NA to the OHM within 24 hours.

Ensure copies of the report are distributed as outlined on the form.

d. Report work-related injuries and illness to the Workplace Safety and Insurance Board or appropriate workers' compensation carrier and other provincial or federal authorities as appropriate.

e. Ensure, in conjunction with the Office HSE Representative, that the employee's injury is managed in accordance with SMS 065 – Injury and Claims Management. Provide guidance for the affected Certified or Project HSE Representative.

f. Periodically disseminate near-miss reporting summary information to the Regional and Division HSE Managers.

7. Division HSE Management

a. Notify URS management of any significant occurrence, including lost-time injuries, deaths, or other serious result or circumstance.

b. The OHM will review all reported incidents to determine OSHA reporting and recording requirements with input from the appropriate Division HSE Manager. For a determination of recordability in those infrequent instances where there is not a clear answer, the Vice President of HSE will make the final determination. All decisions will be based strictly on current U.S. Occupational Safety and Health Administration (OSHA) regulations.

c. Official records (including required reports and logs for all reported incidents) will be maintained at one central location by the OHM.

d. Each January, the OHM will prepare and distribute the appropriate government injury/illness reports to each URS and EG&G establishment. These reports will summarize all required government information for incidents that occurred during the preceding calendar year.

5. Documentation Summary

File Attachment 049-1 NA in the appropriate safety files. Note that the international operations of URS Division will use the appropriate HSE and Quality Improvement database.

6. Resources

A. Occupational Health Managers (OHMs)

URS Division	EG&G Division
Jeanette Schrimsher, RN COHN-S (866) 326-7321 (Toll Free-U.S.) (512) 656-0203 (Cell) (512) 419-6413 (Confidential Fax)	**BJ (Johnson) Heinrich, RN, BSN, COHN-S** (866) 344-1415 (Toll Free-U.S.) (877) 878-9525 (Toll Free-International) (512) 656-8502 (Cell) (512) 419-5252 (Confidential Fax)

B. SMS 057 – Vehicle Safety Program

C. SMS 065 – Injury and Claims Management

D. SMS 066 – Incident Investigation

E. Attachment 049-1 NA – Injury/Near Miss Report Form

URS	Health, Safety and Environment **INCIDENT / NEAR MISS REPORT FORM**	Attachment 049-1 NA Issue Date: May 2001 Revision 7: February 2009

ADMINISTRATIVE INFORMATION

Database Office ID:

☐ URS Division	☐ EG&G Division
RBU:	SBU:
Region:	SBE Director:
Client Sector:	Program:

NOTIFICATION / LOCATION DATA

Site or Office:		Customer/Client Name:
Date of Event:	Time of Event:	Time Employee Started Work:
Date Supervisor Notified:	Time Supervisor Notified:	Name of Employee Submitting Report:
Client Notification Completed (if required)? ☐ Yes ☐ No		Project/Order Number:

TYPE OF EVENT (Check all applicable items)

Illness (Check one)
☐ Employee
☐ Subcontractor
☐ Other

Injury (Check one)
☐ Employee
☐ Subcontractor
☐ Other

NAME of Injured/Ill Employee: _____

Near Miss (Check the potential consequences):
☐ Injury
☐ Equipment Damage
☐ Property Damage
☐ Environmental release
☐ Other (describe)

Property Damage (Check one)
☐ Company (owned, leased, rented)
☐ Client/Customer
☐ Other

Vehicular Accident (Check one)
☐ Company (owned, leased, rented)
☐ Client/Customer
☐ Other

☐ Fire
☐ Explosion
☐ Flash
☐ Other (describe): _____

EVENT SUMMARY

Briefly state the facts contributing to the event. Attach additional pages and supporting information, as necessary. Avoid use of employees' names. *If this is an injury or illness, supply additional information as required on Page 2.*

ROOT CAUSE DETERMINATION

Root Cause (State the root or primary cause, then select the most appropriate cause category from Page 4):

CONTRIBUTING FACTORS

Contributing Causes (Describe any contributing causes, then select the applicable cause categories from Page 4):

CORRECTIVE ACTIONS

List methods of preventing/avoiding this type of incident/near miss in the future. There must be one or more corrective actions for each root cause.

NOTE: If this is a near miss report, no further information is required. Submit only the first page of the form. The preferred method of distribution of near miss reports is by e-mail attachment either in Word, or scanned to PDF. Forward URS near miss reports to incidentreport@urscorp.com. Alternatively, reports may be faxed to 512.419.6413.

Additional Distribution: ☐ Office/Site Manager ☐ Regional/SBE/SBU HSE Manager ☐ Office/Site HSE Representative

FOR INJURIES/ILLNESS ONLY

Employee Information

What was the employee's location when the injury/illness occurred (include city and state)?

What was the employee doing when the injury/illness occurred? Describe the activity as well as the tools, equipment, or material you were using.

What happened? Describe how the injury/illness occurred.

What was the injury or illness? Describe the part of the body that was affected and how it was affected. Use the Incident pick lists on Page 4 to aid in your description.

What level of medical treatment was received? ☐ First Aid ☐ Clinic/Physician ☐ Emergency Room ☐ Refused/None

List witnesses and/or other employees involved. Attach statements where applicable.

Do you feel URS/EG&G provided you with the proper safety instructions (including PPE usage) for the task you were performing at the time of the incident? ☐ Yes ☐ No (Explain below)

How do you think this type of incident could be prevented or avoided in the future?

Mark all PPE being used when the incident occurred:

☐ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Safety Shoes
☐ Half-face Respirator	☐ Full-face Respirator	☐ Protective Gloves	☐ Chemical Gloves
☐ Hard Hat	☐ Hearing Protection	☐ Other (describe):	

Injured/Ill Employee Signature: _____ Date: _____

Name of Injured/Ill Employee (Please print clearly): _____

Employee Number: Contact Phone Number:

Additional Sheets Attached? ☐ Yes ☐ No (Include photos, maps, and/or diagrams when possible.)

URS | Health, Safety and Environment | Attachment 049-1 NA
INCIDENT / NEAR MISS REPORT FORM | Issue Date: May 2001 Revision 7: February 2009

Supervisor Information

Describe any additional/different details other than those provided on the previous page. Avoid use of employees' names, where possible. Attach additional sheets, drawings, or photos, as needed.

Were the required tools available at the time of the injury? ☐ Yes ☐ No (Explain below)

At the time of the injury, was the employee using the correct tools for the task? ☐ Yes ☐ No (Explain below)

Was the employee sent for substance screening? ☐ Yes ☐ No (Explain below)

How do you think this type of incident could be prevented or avoided in the future?

Supervisor Signature: _____ Date: _____

Supervisor Name (Please print clearly):

HSE Representative Comments

Signature: _____ Date: _____

Supervisor Name (Please print clearly):

Site/Office Manager Comments

Signature: _____ Date: _____

Supervisor Name (Please print clearly): ____

DISTRIBUTION

NOTE: *The preferred method of distribution of this report is by e-mail attachment either in Word, or scanned to PDF. Forward URS injury/illness reports to incidentreport@urscorp.com. Alternatively, reports may be faxed to 512.419.6413. Initial reports must be delivered within 24 hours of incident. More detailed follow-up reports may be submitted later.*

Additional Distribution: ☐ Program/Client Sector Manager ☐ Regional/SBE/SBU HSE Manager ☐ Office HSE Representative

URS	Health, Safety and Environment INCIDENT / NEAR MISS REPORT FORM	Attachment 049-1 NA Issue Date: May 2001 Revision 7: February 2009

ROOT CAUSE CATEGORIES

Check all cause categories that apply to the incident/near miss, then choose the root cause (or causes) category from the boxes checked. Enter where indicated on Page 1.

PHYSICAL/ENVIRONMENT

- ☐ Extreme cold/ice
- ☐ Extreme heat
- ☐ Working/walking surface unfavorable
- ☐ Inadequate lighting
- ☐ Excessive noise
- ☐ Chemical exposure
- ☐ Biological hazards (animal/plant)
- ☐ Other weather
- ☐ Other

SYSTEMS

- ☐ Inadequate training/instruction
- ☐ Inadequate management system
- ☐ Missing or incorrect procedures or planning
- ☐ Inadequate management emphasis on safety
- ☐ Corporate/operations procedures not communicated
- ☐ Other

PHYSICAL/EQUIPMENT, TOOLS, and PPE

- ☐ Failure due to improper maintenance
- ☐ Failure due to improper design
- ☐ Other

HUMAN

- ☐ Failure to adequately recognize hazards
- ☐ Failure to follow procedures
- ☐ Failure to recognize condition change
- ☐ Impaired state (drug, alcohol, other)
- ☐ Physical/psychological limitation for task
- ☐ Inadequate communications (i.e., supervisor/employee)
- ☐ Carelessness by affected person(s)
- ☐ Carelessness by other person(s)
- ☐ Improper selection of equipment/tool/PPE
- ☐ Improper use of equipment/tool/PPE
- ☐ Other

INCIDENT PICK LIST

NATURE OF INJURY/ILLNESS	BODY PART	DIRECT CAUSE
☐ Amputation	☐ Ankle/Foot	☐ Animal/Insect Contact
☐ Burn	☐ Arm/Elbow	☐ Biological Agent
☐ Concussion	☐ Back	☐ Caught Between
☐ Contusion/Abrasion	☐ Eyes	☐ Ergonomics/Repetitive Trauma
☐ Corneal Abrasion	☐ Head	☐ Exposure To
☐ Dental	☐ Hip/Groin	☐ Miscellaneous
☐ Dermatitis	☐ Internal Organs/Blood	☐ Motor Vehicle Wreck
☐ Fatality	☐ Leg/Knee	☐ Overexertion
☐ Fracture	☐ Multiple Body Parts	☐ Poisonous Plant
☐ Hearing Loss	☐ Neck/Cervical	☐ Slips/Trips/Falls
☐ Heat-Related Illness	☐ Respiratory	☐ Struck Against
☐ Hernia	☐ Shoulder	☐ Struck By
☐ Insect Bite	☐ Trunk	
☐ Laceration/Puncture	☐ Wrist/Hand	
☐ Other		
☐ Respiratory Disorder		
☐ Sprain/Strain		

URS SAFETY MANAGEMENT STANDARD

Toxic and Hazardous Substances

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies where employees may be exposed to concentrations of specific chemical hazards potentially exceeding permissible exposure limits.

2. Purpose and Scope

The purpose of this standard is to provide guidance in controlling potential employee exposures to toxic and hazardous substances specifically regulated by the U.S. Occupational Safety and Health Administration (OSHA). These substances include the following:

Acrylonitrile	**13 Carcinogens:**
Asbestos	4-Nitrobiphenyl
Benzene	alpha-Napthylamine
Cadmium	Methyl chloromethyl ether
Chromium (VI)	3,3'-Dichlorobenzidine
Coke Oven Emissions	bis-Chloromethyl ether
Cotton Dust	beta-Napthylamine
Ethylene Oxide	Benzidine
Formaldehyde	4-Aminodiphenyl
Hydrogen Sulfide	Ethyleneimine
Inorganic Arsenic	beta-Propiolactone
Lead	2-Acetylaminofluorene
Methylene Chloride	4-Dimethylaminoazobenzene
Methylenedianiline	N-Nitrosodimethylamine
Vinyl Chloride	
1,2-dibromo-3-chloropropane	
1,3-Butadiene	

Note: Hexavalent Chromium is covered in SMS 083.
Lead in construction activities is covered in SMS 022.
Bloodborne pathogens is covered in SMS 051.
Ionizing radiation is covered in SMS 052.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Identification of Hazardous Substances

1. Determine whether there is potential for exposure to any of the hazardous substances (identified in Section 2 of this SMS) in the work area prior to performing any work that may involve handling of one or more of the chemicals, or may result in exposure through production, research, or process activities or through activities such as drilling, excavation, demolition, alteration, salvage, repair, restoration, welding, brazing, grinding, or other surface-disturbing activities.

2. Determination may include the evaluation of material safety data sheets (MSDSs) where any hazardous substance(s) are part of a mixture.

B. Determine the Potential for Employee Exposure to the Hazardous Substance

1. If any of the substances are identified, conduct an exposure assessment based on the type of work to be performed to determine whether employees have the potential to be exposed above any action level identified in the substance-specific regulations. This assessment must be reviewed and approved by a Certified Industrial Hygienist (CIH) approved by a Health, Safety, and Environment (HSE) Manager.

2. Include the results of the initial exposure assessment in the facility or site health and safety plan and/or facility or site health and safety file.

C. Controlling Potential Employee Exposures

1. Where the initial exposure assessment identifies the potential for employee exposures above an established action level or permissible exposure limit, develop a facility or site-specific program to address all required regulatory concerns for that substance(s). Completed programs and/or guidance documents are to be included in the facility or site-specific health and safety plans.

2. Toxic and Hazardous Substance Checklist – Attachment 050-1 NA provides a general checklist to be used in conjunction with the substance-specific standard and to ensure that the program covers all required areas of concern.

D. Compliance Programs

When compliance programs are required by a specific standard, the following outline will be used unless otherwise directed by the standard:

1. Description of work activities that expose personnel.

2. Engineering controls and personal protective equipment to be used and procedures to be followed during exposure activities.

3. Employee job responsibility and crew size during exposure activities.

4. Work practice program (e.g., protective work clothing and equipment, housekeeping, change areas, hygiene practices).

5. Maintenance and decontamination practices to be followed for servicing and cleaning equipment and disposing of waste.

6. Specific instructions on how to set up engineering controls (e.g., ventilation, containment).

7. Procedures to be followed in regulated areas where the chemical hazards are present (e.g., restricted access, signage and instruction, contamination control, emergency procedures).

8. Exposure monitoring data from the initial assessment.

9. Exposure monitoring data from ongoing monitoring as required by the specific standard.

10. Medical surveillance program requirements. Refer to SMS 024 – Medical Screening and Surveillance for additional information.

11. A detailed work schedule for implementation.

12. Recordkeeping requirements.

13. A description of arrangements made among contractors on multicontractor sites with respect to informing affected employees of potential exposure.

14. Name of competent person who will be responsible for performing regular inspections of the job site, materials, and equipment during the job.

A HSE Manager must approve all compliance programs.

E. Training Requirements

1. All employees with potential exposure to the substances covered by this SMS must receive appropriate training prior to performing activities that could result in exposure. This training must be performed initially, upon any substantial changes to the operation covered, and annually. In general, the training should cover the following topics unless otherwise indicated by the specific standard:

a. Basic Employee Training

- Regulated areas: authorizations, entrance restrictions.
- Signs and warnings.
- Container contents identification.
- Nature of the specific hazards, including local and systemic toxicity.
- Specific nature of the operations that could result in exposure.
- Medical surveillance program and, as appropriate, methods for self-examination.
- Personal protective equipment and procedures.
- Engineering controls.
- Hygiene practices and procedures.
- Decontamination practices.
- Respiratory protection requirements and program, if applicable.
- Emergency practices and procedures.

- Employee's specific role in emergency procedures.
- Recognition and evaluation of potential hazardous situations.
- Employee's specific duties and responsibilities.
- Employee's rights to access records.
- First aid procedures and practices.

b. Supervisor Training (in addition to basic employee training)

- Operations reports required.
- Incident reports required.
- Medical surveillance program.
- Medical examinations.
- Recordkeeping.
- Training program and outline.

2. All training performed as part of this SMS will be documented and tracked in accordance with SMS 055 – Health and Safety Training.

3. These training records will be maintained for a minimum of 5 years.

4. Staff potentially exposed to lead at or above 30 ug/m^3 time-weighted average (TWA) for more than one year will attend refresher training each year this potential exposure exists. After a lapse of more than one year, staff will be retrained prior to working on sites with the potential to exceed 30 ug/m^3 TWA.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Hazardous substance list.

B. Approved exposure assessment(s).

C. Completed Toxic and Hazardous Substance Checklist – Attachment 050-1 NA, along with any required guidelines and/or programs.

D. Approved Compliance Program.

E. Training Records.

6. Resources

A. 13 Carcinogens – 29 Code of Federal Regulations (CFR) 1910.1003 and 29 CFR 1926.1004-1016

B. Acrylonitrile – 29 CFR 1910.1045 and 29 CFR 1926.1145

C. Asbestos – 29 CFR 1910.1001 and 29 CFR 1926.1101

D. Benzene – 29 CFR 1910.1028 and 29 CFR 1926.1128

E. Cadmium – 29 CFR 1910.1027 and 29 CFR 1926.1127

F. Chromium (VI) – 29 CFR 1910.1026 and 29 CFR 1926.1126

G. Coke Oven Emissions – 29 CFR 1910.1029

H. Cotton Dust – 29 CFR 1910.1043

I. Ethylene Oxide – 29 CFR 1910.1047 and 29 CFR 1926.1147

J. Formaldehyde – 29 CFR 1910.1048 and 29 CFR 1926.1148

K. Hydrogen Sulfide – Sampling and Analytical Methods

L. Inorganic Arsenic – 29 CFR 1910.1018 and 29 CFR 1926.1118

M. Lead – 29 CFR 1910.1025 and 29 CFR 1926.62

N. Methylene Chloride – 29 CFR 1910.1052 and 29 CFR 1926.1152

O. Methylenedianiline – 29 CFR 1910.1050

P. Vinyl Chloride – 29 CFR 1910.1017 and 29 CFR 1926.1117

Q. 1,2-dibromo-3-chloropropane – 29 CFR 1910.1044 and 29 CFR 1926.1144

R. 1,3-Butadiene – 29 CFR 1910.1051

S. SMS 008 – Asbestos Operations

T. SMS 022 – Lead in Construction

U. SMS 024 – Medical Screening and Surveillance

V. SMS 043 – Personal Monitoring (Industrial Hygiene)

W. SMS 055 – Health and Safety Training

X. SMS 083 – Chromium (VI) Inhalation Exposure Protection

Y. Attachment 050-1 NA – Toxic and Hazardous Substance Checklist

7. Supplemental Information

A. Benzene Handling Policy and Procedure

URS	Health, Safety, and Environment **TOXIC AND HAZARDOUS SUBSTANCE CHECKLIST**	Attachment 050-1 NA Issue Date: November 2000 Revision 4: February 2009

1.	Have hazardous substances present in the workplace been identified?	☐ Yes	☐ No	☐ NA
2.	Is there a potential for employee exposure above an established action level?	☐ Yes	☐ No	☐ NA
3.	List hazardous substances identified: _____ _____ _____ _____			
4.	If the response to Question 2 is "Yes," have you completed a program or developed guidelines to address the following compliance concerns, where applicable, for each identified hazardous substance?			
•	Permissible Exposure Limits	☐ Yes	☐ No	☐ NA
•	Exposure Monitoring	☐ Yes	☐ No	☐ NA
•	Regulated Areas/Signs	☐ Yes	☐ No	☐ NA
•	Compliance Program	☐ Yes	☐ No	☐ NA
•	Respiratory Protection	☐ Yes	☐ No	☐ NA
•	Protective Clothing	☐ Yes	☐ No	☐ NA
•	Hygiene	☐ Yes	☐ No	☐ NA
•	Hazard Communication	☐ Yes	☐ No	☐ NA
•	Training Program	☐ Yes	☐ No	☐ NA
•	Housekeeping	☐ Yes	☐ No	☐ NA
•	Medical Surveillance	☐ Yes	☐ No	☐ NA
•	Medical Removal	☐ Yes	☐ No	☐ NA
•	Recordkeeping	☐ Yes	☐ No	☐ NA
•	Reporting	☐ Yes	☐ No	☐ NA
•	Standard Operating Procedures	☐ Yes	☐ No	☐ NA
•	Contamination/Waste disposal	☐ Yes	☐ No	☐ NA
•	Emergency Response	☐ Yes	☐ No	☐ NA
•	Engineering Controls	☐ Yes	☐ No	☐ NA

Attach all program and/or guidance material for items checked "Yes" to this checklist (or indicate where the information can be found in the facility or site health and safety plan).

Prepared by: _____ Date: _____

Reviewed by: _____ Date: _____

Approved by: _____ Date: _____

URS SAFETY MANAGEMENT STANDARD

Bloodborne Pathogens

1. Applicability

This standard applies to all operations of URS Corporation and its subsidiary companies, and to all employees who may incur exposure to blood or other potentially infectious body fluids as a result of performing their assigned job duties. Examples include: designated first aid and emergency responders, work assignment at a medical laboratory site, or janitorial work involving removal of red bag waste or sharps from medical facilities or clinics.

Sewage work does not typically involve exposure to bloodborne pathogens as covered under the Occupational Safety and Health Administration (OSHA) standard, even though other biological hazards may be present, and should be addressed in the task/job hazard analysis.

Employees serving on safety committees or who volunteer as first-aid–trained employees do not fall under the OSHA requirements for vaccination, but should have training on bloodborne pathogens as part of the curriculum of their first aid training.

2. Purpose and Scope

The purpose of this standard is to identify jobs and tasks where occupational exposure to bloodborne pathogens (e.g., Human Immunodeficiency Virus, that will eliminate or significantly reduce the risk of infectious bloodborne diseases in accordance with the OSHA Bloodborne Pathogen Standard (29 Code of Federal Regulations [CFR] 1910.1030). This standard also includes provisions for affected employees to receive personal protective equipment; Hepatitis B vaccinations; training; and if necessary, confidential medical evaluations and follow up.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

A. Program Administration – The Occupational Health Manager (OHM) and Vice President of Health, Safety, and Environment (or equivalent) of the Division is responsible for implementation and annual evaluation of the Exposure Control Plan (ECP) – Attachment 051-1 NA. The OHM will ensure that all medical actions required are performed, and that the appropriate employee health and OSHA records are maintained. The Vice President of Health, Safety, and Environment will oversee provisions of necessary personal protective equipment and supplies, training, documentation of training, and will make the written ECP available to employees and OSHA representatives.

4. Requirements

A. Risk Identification

1. The facility or site manager, with assistance from the site safety representative, will perform an exposure determination concerning which employee may or may not have exposure to bloodborne pathogens. Employees will be classified into two categories:

   a. Employees formally designated as part of their job to perform tasks that may involve direct contact with blood or potentially infectious body fluids.

      i. Requires initial and annual training

      ii. Hepatitis B vaccination series will be offered

      iii. Requires procedures be followed in ECP.

   b. Employees not assigned to jobs or tasks that involve exposure to blood or potentially infectious body fluids, but who could in extraordinary situations, voluntarily assist injured or ill individuals, and therefore could have exposure to bloodborne pathogens.

      i. Requires post-exposure procedures outlined in ECP.

2. The ECP will be reviewed and updated at least annually, and whenever necessary to include new or modified tasks and procedures. The ECP will be reviewed by non-managerial employees responsible for direct patient care who are potentially exposed to injuries from contaminated sharps. These employees will be trained in the identification, evaluation, and selection of effective engineering and work practice controls.

B. Exposure Control Methods

1. All employees will use universal precautions—an approach to infection control where all human blood and body fluids are treated as potentially infectious.

2. Use engineering and work practice controls (e.g., sharps disposal containers, perform procedures to prevent splashing) to eliminate or minimize exposure to employees.

3. Provide personal protective equipment (e.g. disposable gloves, face masks with eye protection, liquid impermeable gowns, CPR

pocket masks) and ensure use in order to place a barrier between the employee and the blood or body fluids.

4. Wash hands immediately with soap and water after removing gloves or performing any work with blood or body fluids.

5. Perform housekeeping and decontamination of work surfaces with U.S. Environmental Protection Agency (U.S. EPA)-registered germicides, or a bleach solution diluted 1:10 with water, as needed, to maintain a safe working environment.

6. Dispose of regulated biohazardous waste (contaminated sharps or items that are capable of releasing blood or body fluids through employee handling) in special waste receptacles lined with red bags, and incinerate per federal and state regulations. This does not include small amounts of waste from a minor wound, which can be sealed in a plastic bag and disposed of in a solid waste receptacle.

C. Provide the Hepatitis B Vaccination series to all employees who have been designated to perform tasks that involve direct exposure to bloodborne pathogens. Further, make this vaccination series immediately available to employees who have had an occupational bloodborne exposure incident, whether as a result of their assigned tasks, or occurring as a result of incidental contact.

   An employee who declines the vaccination must sign the wavier form located at the end of Attachment 051-1.

D. 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. Arrange a confidential medical evaluation and follow-up with an occupational physician 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.

E. Hazard Communication

1. Use orange-red biohazard warning labels to identify lab areas or disposal containers with blood or other potentially infectious materials present.

2. Conduct initial and annual training classes for all employees assigned to tasks where occupational exposure may occur.

F. Exposure Incident Investigation

The OHM and HSE Manager will review the circumstances of each exposure incident to determine if the appropriate work procedures were being followed at the time of the incident, and to assess and implement any necessary corrective actions, including changes required in the ECP.

5. Documentation Summary

A. Post-exposure medical records from consulting physician and exposure incident reports will be retained in employee's confidential medical record

B. Initial and annual training records

C. Regulated infectious medical waste manifest records will be stored by the site safety representative

6. Resources

A. U.S. OSHA 29 CFR 1910.1030 Occupational Exposure to Bloodborne Pathogens Standard, current revision.

B. Centers for Disease Control Morbidity and Mortality Weekly Report: "Public Health Service Guidelines for the Management of Health-Care Worker Exposure to HIV and Recommendations for Post-exposure Prophylaxis"

C. Centers for Disease Control Morbidity and Mortality Weekly Report: "Immunization of Health-Care Workers: Recommendations" December 26, 1997; Vol. 46, No. RR-18.

D. Centers for Disease Control Morbidity and Mortality Weekly Report: "Recommendations for Prevention and Control of Hepatitis C Virus (HCV) Infection and HCV-Related Chronic Disease" October 16, 1998; Vol. 47, No. RR-19.

E. Bloodborne pathogens standard and the construction industry (OSHA letter of interpretation 01-26-93)

F. Clarification on first aid requirements for hazardous waste sites (OSHA letter of interpretation 04-20-93)

G. SMS 024 – Medical Screening and Surveillance

H. Attachment 051-1 NA – Bloodborne Pathogens Exposure Control Plan

1. Applicability

This standard applies to all operations of URS Corporation and its subsidiary companies where personnel may be required to work on or over water. Refer to SMS 095 – Barge Operations for information regarding work activities associated with marine transportation; and SMS 027 – Work Over Water for working over or near water.

2. Purpose and Scope

The purpose of this standard is to protect employees from the hazards associated with working on, in, or over water. Maritime work has the same risks associated with landside activities, with the additional risks of drowning, hypothermia, and the energy of wave action. It is an inherently dangerous environment that must be treated with respect. This SMS delineates personal protective equipment requirements to address these hazards. In addition, this section specifies watercraft operating restrictions for URS activities.

The operation of watercraft by company employees will be an infrequent event, but may be a necessary part of a project. Where possible, subcontractors who specialize in the operation of watercraft will be contracted to provide work platforms. In most countries, a contractor hired to carry passengers aboard a small craft is required to be licensed by the national maritime authority or coast guard. Similarly, any vessel carrying more than 12 passengers (6 passengers in the U.S.) must carry a certificate of safe carriage of passengers.

When it is not possible to hire an appropriate contractor to provide a safe work platform or vessel, URS personnel may operate work boats in accordance with the guidance of this standard.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing the activities of the facility, site, or project location.

4. Requirements

A. Personal Floatation Devices

There are five types of Personal Flotation Devices (PFDs):

1. Type I PFD is an offshore lifejacket.

   a. This device will right an unconscious wearer, and will usually keep the wearer's face out of the water.

   b. This device is bulky, and uncomfortable to wear for long periods of time.

2. Type II PFD is a near-shore buoyancy vest.

   a. This device will right an unconscious wearer, and will usually keep the wearer's face out of the water.

   b. This device is bulky, and uncomfortable to wear for long periods of time.

3. Type III PFD is a floatation aid.

   a. This device is generally the most comfortable PFD, and has at least 15.5 pounds of buoyancy in the adult size.

   b. This device provides adequate buoyancy, but will not turn the wearer face-up in the water.

   c. This device is comfortable to wear, and is designed to be worn as work attire.

   d. Common Type III devices are work vests and harnesses with built-in pneumatic floatation.

4. Type IV PFD is a throwable device.

   a. This device includes the horseshoe collar, ring buoy, and seat cushion.

   b. This device has at least 16.5 pounds of buoyancy, and must offer immediate access.

5. Type V PFD is a hybrid inflatable or special-use device.

   a. This device is for special-purpose floatation.

   b. This device is a full-body insulating floatation suit suitable for work in cold weather.

   c. This device is designed to survive high-speed impacts (like water-skiing vests and jet-ski vests).

   d. Some Type V PFDs are water-activated, and are very low profile until inflated. A further subset of these devices activate (inflate) automatically when submerged.

B. General Marine Safety

In general, the two additional hazards that maritime work involves are drowning and hypothermia. All other hazards are generally similar to those for landside activities, and the personal protective equipment requirements are identical (hardhat, safety glasses, hearing protection, steel-toed safety shoes, etc.).

Wearing a personal floatation device mitigates the risk of drowning. Company employees are required to wear a Type III PFD anytime they are aboard a small craft and are outside of an enclosed cabin. The PFD must be readily accessible for each person inside a cabin. If employees are working aboard a larger vessel (greater than 26 feet [7.9 meters] in length), a PFD must be readily accessible, but need not be worn unless engaged in activities on an open deck or at the rail.

The risk of hypothermia is mitigated by wearing appropriate insulated floating outerwear when cold weather or cold water is a threat. A Type V PFD, usually referred to as a "mustang suit," is a full-body PFD that has excellent insulation qualities and will extend the wearer's survivability in the event of immersion or dowsing with spray when in cold weather. It is required to wear these PFDs when the air temperature and the water temperature combined are less than 100 degrees Fahrenheit (°F) (38 degrees Celsius [°C]), and when the craft is less than 26 feet (7.9 meters) in length. When the working platform is larger than 26 feet (7.9 meters), the wearing of a mustang suit is at the discretion of the boat captain, the site supervisor, or the URS employee.

C. Operation of Small Boats

1. Limitations

   a. URS personnel may perform work from a small boat (less than 26 feet, or 7.9 meters long) under the following conditions:

      i. The boat used for the work must be appropriate to the type of work, and suitable for safe carriage of the workers necessary for the task.

ii. The work site must be located in a bay, sound, lake, or similar body of water that is protected from open-sea weather conditions.

iii. The work site must be within sight of land, and in no case more than 2 miles (3.2 kilometers) from shore.

iv. All operations will be completed in daylight hours under reasonable weather conditions with good visibility.

v. The operator of the boat must have sufficient experience and knowledge to be competent in the operation of the boat at the work site location.

vi. There must be at least two people in the boat any time the boat is under way.

vii. The boat and personnel must be properly equipped, as specified below.

viii. The boat operator must be intimately familiar with all aspects of the boat, its intended use, the local area, and expected weather conditions.

ix. The boat must be monitored from the shore, either directly with a supervisor or team member; or by filing a "float plan" (Attachment 053-1 NA) with the Project Manager or other responsible person before getting under way.

b. Prior to departing the dock, the boat should be checked for:

i. Watertight integrity;

ii. Operation of machinery (ahead and astern, throttle, ignition cut-off);

iii. Appropriate safety gear (see section 6.B below);

iv. Proper loading of the boat (personnel and equipment) such that vessel stability is not jeopardized;

v. Sufficient fuel for the duration of the trip and site work; and

vi. All electrical and electronic equipment in good working order (lights, radios, horns, etc.).

c. While operating, the boat operator will:

i. Maintain a communication schedule with shore support as specified in the float plan.

ii. Periodically monitor the weather on the VHF radio (or equivalent).

d. When moored, the boat operator will close-out the float plan (if one was required).

2. Boat Safety Equipment (for URS-Operated Small Boats)

a. All persons on the boat will wear a U. S. Coast Guard-approved Type III PFD device (or equivalent if located outside the U.S.).

b. At least one throwable Type IV device will be readily available for use.

c. At least one B-II U. S. Coast Guard-approved (or equivalent) hand-held portable fire extinguisher will be on the boat, readily available for use.

d. Visual Distress Signal Flares (check expiration date) and a battery-operated light will be in good working order and readily available on the boat.

e. A sound-producing distress signal, in the form of a bell, whistle, or horn, will be in good working order and readily available on the boat.

f. A first aid kit will be available on the boat.

g. All boat fuel (gasoline or diesel) will be contained in fuel tanks or approved (manufacturer, Underwriters Laboratories, or equivalent) containers that supply fuel to the engine via approved fuel lines. No fuel transfers between containers are to be conducted aboard the boat.

h. A secondary means of propulsion will be available on the boat (multiple engines, oars, or paddles for smaller vessels).

i. A boat hook, anchors, and proper mooring lines will be available on the boat.

j. A VHF radio (or equivalent) is required for any boat working more than 1 mile offshore, or at any site where there is no shore-side support for the boat crew. The radio may have to be licensed by

the Federal Communications Commission or equivalent regulatory agency depending upon transmission strength and installation. When operating less than 1 mile (1.6 kilometers) from shore, a citizens band radio, cellular telephone, or a UHF radio may be used to provide positive communication with shore-side support.

3. Safe Operations

a. All boats will be properly registered for use in waterways of local, state, or federal jurisdictions as required by law.

b. All boat trailers and towing vehicles will be properly licensed and in good working order.

c. The boat must be operated by experienced personnel. The U. S. Coast Guard Auxiliary and other equivalent volunteer organizations regularly sponsor boating safety courses. In addition to basic boating safety, the courses cover navigation regulations and emergency procedures. The training is recommended even for experienced boat operators.

d. The boat will be operated in a safe manner, and all waterway regulations will be obeyed.

e. No alcoholic beverages are permitted on the boat.

f. No recreational equipment for fishing, hunting, water skiing, or SCUBA diving will be allowed on the boat unless specifically authorized as part of the work-related equipment.

D. Boating Incidents

Federal and state regulations may require incident reports if property damage or significant injuries occur. Examples of situations requiring reporting include standing or grounding, material damage affecting the seaworthiness or efficiency of the vessel, significant injuries, or loss of life. The definition of a reportable incident varies between state and federal authorities. The vessel operator must be familiar with accident reporting requirements (usually available in the U. S. through the US Coast Guard for commercial vessels, or a state's Department of Motor Vehicles for small craft). Any incident or accident should also be reported in accordance with SMS 049 – Injury/Illness/Incident Reporting and Notifications.

E. Float Plan

A float plan is required to be completed any time small craft (less than 26 feet [7.9 meters]) will be operating beyond the confines of a shore-supported work site. The float plan (Attachment 053-1 NA) should be completed and given to a shore supervisor, who will know what actions to take in the event the vessel is overdue.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Float Plan (Attachment 053-1 NA)

6. Resources

A. SMS 027 – Work Over Water

B. SMS 049 – Incident/Illness/Incident Reporting and Notifications

C. SMS 095 – Barge Operations

D. Attachment 053-1 NA – Float Plan

1. Applicability

This standard applies to the operations of URS Corporation and its subsidiary companies. These are the minimum Health, Safety, and Environment (HSE) 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.

2. Purpose and Scope

This standard was developed to assist employees and managers in the identification of training requirements and to define the URS procedures for tracking/documenting this training. It covers environmental, hazardous materials, and health and safety training only. The goals of this standard 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 customers; and protect company and/or customer property and the environment.

3. Implementation

A. The assigned Site/Office Manager is responsible for ensuring compliance with this standard 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).

B. The Program/Project Manager is responsible for ensuring project or program-related compliance (e.g., compliance of project/program staff members) with this standard and any additional training necessary because of specific project/program activities.

C. The Division HSE Training Coordinator (DHTC) is responsible for maintaining a divisional training calendar, filing original records/tests, issuing certificates for division-sponsored training, maintaining and issuing training materials, adding approved courses and course information to the divisional training database, and updating the URS HSE intranet site with course information.

4. Requirements

A. Employee training requirements are dictated by the work each employee performs (or is expected to perform) and the geographic area(s) where the employee performs these activities. In most cases, there is a regulatory driver for specific training.

B. All new URS employees must be provided an orientation on the URS HSE Program. Details on orientation requirements are provided in SMS 025 – New Employee Health, Safety and Environment Orientation and SMS 078 – Short Service Employee.

C. HSE Training Evaluation – Attachment 055-1 NA is 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. These requirements may be necessary due to the individual's project, site, or office activities, or the location of the facility. The responses to this simple questionnaire dictate what training an individual needs in addition to the basic URS courses. Once these requirements have been identified, each employee is expected to complete the required training as soon as possible and to track his/her progress.

D. Attachment 055-2 NA lists the most common courses currently being provided within URS' European operations. This table will be updated as regulatory and company requirements change.

E. Training requirements should be re-evaluated at least annually and more frequently if an employee's assigned duties change significantly.

F. To ensure consistency in content and duration and in meeting regulatory and company requirements, URS training materials should be used as the basis for training whenever they are available. Trainers may always elect to supplement the base training materials for these courses with specifics for the program, project, customer, office, or geographic unit.

G. For training requiring certification (regulatory or URS-driven), trainers must be Divisional, Country, Group, Regional Business Unit (RBU), or Strategic Business Unit (SBU) HSE Managers or approved by the Divisional, Country, Group, RBU, or SBU HSE Manager.

H. Training is offered in a variety of formats, including classroom instruction, computer based training (CBT), and on-the-job (OTJ) training. To ensure that training is consistent 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 Division, Country, Group, RBU, or SBU HSE Manager. Local HSE staff will be able to assist in identifying qualified external vendors as necessary.

I. Schedules for internally developed training courses will be posted on the URS HSE website.

J. URS staff is expected to be familiar with applicable training requirements. Staff members are expected to track their own progress toward meeting those requirements.

K. Supervisors and office/location managers are expected to be familiar with the training requirements of staff that report to them.

L. A sample safety training flow chart is available in Supplemental Information A.

5. Documentation Summary

A. Those courses so denoted in Attachment 055-1 NA or Commonly Required Training – European Operations – Attachment 055-2 NA will be tracked in a division training database.

B. All training must be documented using a training Attendance Record – Attachment 055-3 NA and Course Agenda. This attendance form requires participants to acknowledge by their signature that they received the training.

C. Minimum course agenda requirements are as follows:

- Type of course.
- Course date.
- Course location.
- Topics covered.
- Length of time covered for each topic.
- Course duration (start/end times).
- Instructor(s) name.

D. For training provided by customers/vendors, training documentation must include the following:

- Copy of the attendee's course certificate.
- Course agenda.

In some cases, objective evidence of comprehension is required. This information must be tracked in addition to the course certificate and agenda.

E. Group, RBU, and SBU HSE Managers will ensure that the course agenda meets regulatory/company requirements. Attendance records will be entered into the Divisional HSE training database.

F. For corporately tracked courses, original attendance sheets, agendas, course evaluations, and any completed tests will be sent to the DHTC. These should be filed by course then by date for easy access/auditing.

G. Locations/projects/programs will maintain records on any project, program, or location- or site-specific training requirements such as fire extinguisher training, project health and safety plan training, and chemical hygiene program (laboratory safety) training. HSE Representatives will also maintain copies of attendance records for courses being tracked corporately.

H. For courses requiring Divisional certification, the Vice President of HSE (or designee) or customer/vendor will issue certificates. A copy of the certificate must be provided to the DHTC, along with course content information and sign-in sheets (see Item 5.D). For EG&G Division employees, a copy of the certificate is to be provided to the appropriate Human Resources Manager for inclusion into the personnel record (Human Resources Management System or HRMS).

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA), Training Requirements in OSHA Standards and Training Guidelines

B. Australian Government, Australia Safety and Compensation Council

C. European Agency for Safety and Health at Work

D. SMS 025 – New Employee Health, Safety and Environment Orientation

E. SMS 078 – Short Service Employee

F. Attachment 055-1 NA – HSE Training Evaluation

G. Attachment 055-2 NA – Commonly Required Training – European Operations

H. Attachment 055-3 NA – Attendance Record

1. Applicability

This standard applies to URS Corporation and its subsidiary companies where field crews are working outdoors in damp and cool (below 50 degrees Fahrenheit [°F] or 10 degrees Celsius [°C]) conditions or anytime temperatures are below 32°F or 0°C.

2. Purpose and Scope

The purpose of this standard is to protect project personnel from hypothermia and frostbite.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Carefully plan work anticipated to be performed in cool or cold conditions. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.

B. Monitor weather forecasts immediately prior to entering the field. If possible, schedule heavy work during the warmer parts of the day. Implement a work-warming regimen by taking breaks out of the cold.

C. Observe and monitor weather conditions such as ambient temperature, wind speed, and precipitation while in the field. If needed, use Supplemental Information B to determine wind chill.

D. Wearing the right clothing is the most important way to avoid cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. Adequate insulating dry clothing will be required in air or wind chill temperatures below 40 °F (4.4 °C).

1. Wear at least 3 layers of clothing to help prevent cold stress. It is important to preserve the air space between the body and the outer layer of clothing to retain body heat.

2. Wear an outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon).

3. Wear a middle layer of down, wool, or similar materials to provide insulation.

4. Wear an inner layer of cotton or synthetic weave to allow ventilation.

5. Wear a hat or hardhat liner. Up to 40 percent of body heat can be lost when the head is left exposed.

6. Wear insulated boots or other insulated footwear, and insulated gloves to help reduce the chance of frostbite.

7. Keep a change of dry clothing available in case work clothes become wet.

8. Do not wear tight clothing. Loose clothing allows better ventilation.

9. Skin should not be left exposed on a continuous basis when air temperature or chill factors are below -17°F (-27°C).

10. Drink plenty of liquids, avoiding caffeine and alcohol, which are vasoconstrictors. It is easy to become dehydrated in cold weather.

E. Use the following work practices:

1. Use Supplemental Information C to establish work/rest cycles in cold weather.

2. Drink plenty of warm liquids. It is easy to become dehydrated in cold weather.

3. Avoiding caffeine and alcohol. Alcohol will accelerate loss of body heat.

4. Eat high calorie snacks to help maintain body metabolism.

5. If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold.

6. Work in pairs to keep an eye on each other and watch for signs of cold stress.

7. NEVER IGNORE SHIVERING. Persistent or violent shivering is a clear warning that you are on the verge of hypothermia.

8. Avoid exhaustion.

F. When possible, use the following engineering controls:

1. Provide shelter to escape cold, wind, and precipitation
2. Provide a source of heat (such as warm packs or portable heaters).
3. Use insulating materials on equipment handles when temperatures drop below 30°F (-1°C).

G. Watch for symptoms and signs of hypothermia. Work in pairs to keep an eye on each other and watch for signs of cold stress.

H. Treat cold stress illness as follows:

1. Hypothermia: Prompt treatment of hypothermia is essential. Once the body temperature drops below 95°F (35°C), the loss of temperature control occurs, and the body can no longer rewarm itself. Initial treatment includes reducing heat loss by moving the individual out of the wind and cold, removing wet clothing, applying external heat (such as a pre-warmed sleeping bag, electric blanket, or body-heat from other workers), and obtaining follow-up medical attention.
2. Frost Bite: The initial treatment for frostbite includes bringing the individual to a warm location, removing clothing in the affected area, and, **if help is delayed**, placing the affected parts in warm (100° to104°F or 38° to 40°C) water. Do not massage or rub the frostbite area. After the initial treatment, wrap the affected area loosely in sterile gauze and seek medical attention.

For further discussion on Cold Stress treatment, please refer to Supplemental Information A.

I. Hypothermia in Water:

Loss of body heat to the water is a major cause of deaths in boating and working near water incidents. Often the cause of death is listed as drowning; however, the primary cause is often hypothermia. It should also be noted that alcohol lowers the body temperature around 2 to 3 degrees by dilating the blood vessels. Do not drink alcohol around cold water. The following table shows the effects of hypothermia in water:

WATER TEMPERATURE	EXHAUSTION	SURVIVAL TIME
32.5°F (0°C)	Under 15 minutes	Under 15 to 45 minutes
32.5 to 40°F (0 to 4°C)	15 to 30 minutes	30 to 90 minutes
40 to 50°F (4 to 10°C)	30 to 60 minutes	1 to 3 hours
50 to 60°F (10 to 16°C)	1 to 2 hours	1 to 6 hours
60 to 70°F (16 to 21°C)	2 to 7 hours	2 to 40 hours
60 to 70°F (16 to 21°C)	3 to 12 hours	3 hours to indefinite
Over 80°F (27°C)	Indefinite	Indefinite

SOME POINTS TO REMEMBER:

1. Wear your PFD. Review SMS 027 – Work Over Water, SMS 053 – Marine Safety and Boat Operations and SMS 095 – Barge Operations.
2. If the water is less than 50°F (10°C), wear a wet suit or dry suit for work in water (e.g., wading), or if a significant potential to fall in water exists.
3. While in the water, do not attempt to swim unless to reach nearby safety. Unnecessary swimming increases the rate of body heat loss. Keep your head out of the water. This will increase your survival time.
4. Keep a positive attitude about your rescue. This will increase your chances of survival.
5. If there is more than one person in the water, huddling is recommended.

J. Training

Workers at risk of developing hypothermia or cold-related injury will be trained in:

1. Recognition of the signs and symptoms of cold injury or impending hypothermia;

2. Proper re-warming procedures and appropriate first aid treatment;
3. Proper use of clothing;
4. Proper eating and drinking practices; and
5. Safe work practices appropriate to the work that is to be performed.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Cold stress training records.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) Fact Sheets – "Protecting Workers in Cold Environments"

B. OSHA Publication 3156 – Quick Reference Card

C. SMS 027 – Work Over Water

D. SMS 053 – Marine Safety and Boat Operations

E. SMS 095 – Barge Operations

7. Supplemental Information

A. Signs of, and Treatment for, Cold Stress-Related Illnesses

B. Wind Chill Index (units in °F and miles/hour, and units in °C and Kilometers/hour)

C. Work/Warm-up Schedule for Outside Workers based on a Four-Hour Shift

1. Applicability

This standard applies to URS Corporation and its subsidiary companies where the potential for hand injuries is present.

Appropriate gloves must be worn when persons work with materials or equipment that presents the potential for hand injury due to sharp edges, corrosives, flammable and irritating materials, extreme temperatures, splinters, etc.

2. Purpose and Scope

This standard is intended to protect employees from activities that may expose them to injury. This standard provides information on recognizing those conditions that require personal protective equipment (PPE) or specific work practices to reduce the risk of hand injury.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Hazard Assessment

1. Perform hazard assessments for those work activities likely to require PPE.

   a. Use the PPE Hazard Assessment Certification Form – Attachment 029-1 NA to perform the assessment. The Hazard Assessment Certification Form will accompany URS personnel at jobsites 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 a URS safety representative for assistance.

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 is of concern, wear the chemical protection gloves (e.g., nitrile) inside the physical protection gloves (e.g., leather, Kevlar®).

e. Latex gloves are not recommended for chemical protection.

f. Do not wear metal or metal-reinforced gloves when working with electrical equipment or on electrical services. Proper leather and/or rubber gloves designed and tested for this purpose should be used.

4. Follow glove requirements in the project-specific safety plan.

B. Guidelines for Working With and Around Equipment (Hand Tools, Portable Powered Equipment)

1. General

a. Employees should be trained in the use of all tools.

b. Keep hand and power tools in good repair and use them only for the task for which they were designed.

c. Inspect tools before use and remove damaged or defective tools from service.

d. Operate tools in accordance with manufacturer's instructions.

e. Do not remove or bypass a guarding device for any reason.

f. Keep surfaces and handles clean and free of excess oil to prevent slipping.

g. Wear proper PPE, including gloves, as necessary.

h. Do not carry sharp tools in pockets.

i. Clean tools and return to the toolbox or storage area upon completion of a job.

j. Before applying pressure, ensure that wrenches have a good bite.

i. Brace yourself by placing your body in the proper position so you will not fall if the tool slips.

ii. Make sure hands and fingers have sufficient clearance in the event the tool slips.

iii. Always pull on a wrench, never push.

k. When working with tools overhead, place tools in a holding receptacle when not in use.

l. Do not throw tools from place to place or from person to person, or drop tools from heights.

m. Inspect all tools prior to start-up or use to identify any defects.

n. Powered hand tools should not be capable of being locked in the ON position.

o. Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.

p. Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools.

q. Do not use cheater pipes.

r. Make provisions to prevent machines from restarting through proper lockout/tagout (refer to SMS 023 – Lockout and Tagout Safety).

2. Cutting Tools

a. Always use the specific tool for the task. Tubing cutters, snips, self-retracting knives, concealed blade cutters, and related tools are task specific and minimize the risk of hand injury. For more information about cutting tools, see Supplemental Information A.

b. Fixed open-blade knives (FOBK) are prohibited from use. Examples of fixed open-blade knives include pocket knives, multitools, hunting knives, and standard utility knives.

c. When utilizing cutting tools, personnel will 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 toward other workers in the area.

iii. Maintain the noncutting hand and arm toward the body and out of the direction of the 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 last all day (e.g., liner samples), consider Kevlar® gloves in the PPE evaluation for the project.

vii. Do not remove guards on paper cutters.

3. Moving/Rotating Equipment

a. General Requirements for Rotating Equipment (feed augers, chippers, conveyors, etc.)

i. Never place hands, fingers, or 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 023 – Lockout and Tagout Safety.

4. Other Physical Hazards

a. Activities such as drum handling, fencing, work near razor wire, manhole cover removal, and demolition also pose hazards to hands.

b. Plan work to avoid pinch points for hands when moving drums, moving manhole covers into position, and handling other heavy objects.

c. Work handling scrap metal or other sharp edges requires proper hand PPE (Kevlar® or leather gloves).

C. Ergonomics – Hand and 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. Minimize 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 there is the potential for contact with poisonous plants should be aware of the hazard.

i. Avoid contact with poisonous plants.

ii. Wear appropriate PPE.

iii. Clean hands thoroughly after contact before performing additional work tasks.

2. Further information can be obtained from SMS 047 – 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. Documentation Summary

The following documentation will be maintained in the project file:

A. Hand tool training records, as applicable.

6. Resources

A. U.S. OSHA Regulation - 29 Code of Federal Regulations (CFR) 1910.138 – Hand Protection

B. Chemical resistant glove selection: http://www.bestglove.com/

C. SMS 016 – Hand Tools and Portable Equipment

D. SMS 023 – Lockout and Tagout Safety

E. SMS 029 – Personal Protective Equipment

F. SMS 047 – Biological Hazards

G. SMS 054 – Office Ergonomics

H. SMS 056 – Drilling Safety Guidelines

7. Supplemental Information

A. Safer Alternative Tools

1. Applicability

This standard applies to all operations of URS Corporation and its subsidiary companies.

2. Purpose and Scope

This standard is designed to ensure that employees receive appropriate, immediate, and high-quality health care services that will minimize disability, promote rapid recovery, and save lives.

3. Implementation

Implementation of this procedure is the responsibility of the manager directing activities of the facility, site, or project location.

4. Requirements

A. Pre-Injury Management

The following proactive plans and procedures will be in place before an injury or illness occurs.

1. Work Site Evaluation

Project and office locations will evaluate their location for first aid and medical requirements. The following factors should be considered:

a. Types of accidents that could reasonably occur.

b. Location of local clinics and hospitals.

c. Response time for external emergency services.

d. If corrosive or hazardous materials are in use.

e. Any industry specific requirements.

f. Types of training for employees and first aid responders.

g. What first aid supplies should be available.

2. First Aid Services

a. First Aid Responders

There will be a sufficient number (but not less than one) of employees on each shift trained in first aid to provide adequate first response medical care available at the work site if either of these conditions exist:

i. If life-threatening injuries can reasonably be expected, trained personnel must be available within 3 to 4 minutes. This generally means that community emergency medical services cannot be relied on since their response time is usually greater than 3 minutes.

ii. If no life-threatening injuries can reasonably be expected, the response time for trained personnel is extended to 15 minutes.

The trained first aid responders should be designated so that the other employees know who they are and how to contact them. The trained responders must have a current first aid certificate and be trained in Bloodborne Pathogens (see SMS 051 – Bloodborne Pathogens).

For certain long-term, heavily staffed, or high hazard projects, URS may opt to establish a first aid station on site. It should be staffed with a person who is a nurse, Emergency Medical Technician (EMT), or Emergency Medical Technician Paramedic (EMT-P) who may practice limited treatment under the direction of a physician.

Where clients provide the services of a first aid station, the project manager will determine the specific services provided and the administrative procedures involved. Employees requiring first aid treatment by a client-provided facility must obtain prior approval from the project manager.

b. First Aid Kits

i. Each site will maintain a first aid kit in accordance with Attachment 024-9 NA – Field First Aid Kit Supply List.

ii. First aid kits will be maintained in readily accessible locations on each job site. For mobile or vehicle-based operations in remote locations, first aid kits may be necessary in vehicles.

iii. Kits will be inspected prior to being sent to a work location and weekly while in use. Any items not approved for the kit will be removed during inspection.

iv. At no time will over-the-counter medications such as antacids, aspirin, cold or cough drops, or other sundry items be stored in the kits without the written approval of the URS Occupational Health Nurse or a URS-approved health care professional.

c. Emergency Services

The project Health, Safety, and Environment (HSE) Representative, in conjunction with the project manager, will identify emergency service providers, including ambulance and hospital services. Each location will post a current list of emergency telephone numbers and maps to access local medical emergency providers (SMS 003 – Emergency Preparedness Plans). Advance contact with ambulance services to ensure they are familiar with location, access routes, and hospital locations is advised.

d. Eyewash and Safety Shower Facilities

A corrosive material is a highly reactive substance that causes obvious damage to living tissue. Corrosives act either directly by chemically destroying the part (oxidation) or indirectly by causing inflammation. A hazardous material is any substance or compound (including corrosives) that has the capability of producing adverse effects on the health and safety of humans. Review material safety data sheets for the health effects of compounds being used at the site to determine whether they meet the criteria defined previously.

If corrosive or otherwise hazardous materials are used, eyewash and body flush facilities must be provided. Where possible, these facilities should provide large quantities of clean water. The water source must be pressure controlled and clearly identified. Portable eyewash stations must contain a minimum of 1 gallon of potable water. See Supplemental Information A for additional guidance on eyewash and shower facilities.

e. Identification of Medical Facilities

The field and office location will identify a suitable local clinic, preferably specializing in occupational medicine, to treat nonemergency injuries and illnesses. In addition, a local hospital

emergency room will be identified for treatment of life-threatening or after hours injuries. The URS Occupational Health Nurse, the Workers' Compensation Administrator, or the workers' compensation insurance carrier representative should be contacted to provide a listing of recommended medical facilities.

The project HSE Representative should visit the medical facility and meet with the medical provider to establish expectations. Clinics should be conveniently located, clean, professionally staffed, offer multiple services, and be supportive of early return to work practices.

Field/construction projects will make appropriate arrangements with local ambulance/emergency service providers prior to the start of work activities to ensure that appropriate transportation can be provided in the event of an emergency. These arrangements include establishment of an identifiable project address and emergency access point (i.e., location to meet emergency personnel).

The project HSE Representative will communicate the following with the designated hospitals/clinics:

i. Physical requirements for each trade.

ii. Policies regarding availability of suitable work for partially disabled employees.

iii. Procedures for reporting of treatment diagnosis and treatment plans to the company and its workers' compensation insurance carrier.

iv. Requirements for alcohol and substance abuse testing per company and/or client-required substance abuse policies (as needed).

B. Post-Injury Management

1. Transportation

When employees require urgent medical attention as the result of a work-related injury/illness, transportation will be provided to the doctor's office, clinic, or hospital. Employees should not be permitted to drive unless it is safe to do so.

2. Emergency Injury/Illness Treatment

In all cases, critical injuries must be immediately referred for professional medical attention. The manner in which the referral is accomplished, and the person responsible for the referral, should be clearly defined in either a project safety plan and/or an office Emergency Preparedness Plan (SMS 003). Critical injuries/illnesses include, but may not be limited to, the following:

a. Loss of consciousness.

b. Unexplained chest pain.

c. Breathing difficulty.

d. Uncontrolled bleeding.

e. Fractured bones.

f. Suspected internal injuries.

g. Suspected exposure to chemical/biological hazard.

h. Second or third degree thermal or chemical burns (i.e., blistering).

i. Electrocution.

j. Unexplained change in mental state following an injury (may indicate shock or other internal injuries).

3. Nonemergency Injury/Illness Treatment

When a work-related incident results in a noncritical injury/illness, the primary objective is to provide appropriate medical services to diagnose and treat the injury/illness. Options available to the employee and project/office management in these situations include the following:

a. First aid treatment and/or review by a qualified first aid responder.

b. First aid treatment and/or review by a qualified first aid responder followed by a referral to an occupational health clinic.

Additional support for the employee and managers in these situations can also be obtained from a URS HSE professional.

Attachment 065-1 NA – Injury Management Procedures Flow Chart provides a flow chart to assist employees and managers in determining the most appropriate option for obtaining medical services for nonemergency injuries/illnesses.

Note: Some states allow injured workers to choose their own initial medical provider. Employees are to be cautioned that not all medical providers accept workers' compensation insurance and coverage should be verified prior to treatment if an employee lives in a state that permits him/her to elect to see their personal doctor rather than the URS-recommended physician.

C. Workers' Compensation Case Management

1. Health and Safety

a. Occupational Health Nurse/Workers' Compensation Administrator will

i. Evaluate and file workers' compensation claims for cases covered by the URS insurance program. Evaluate and provide consultation for injuries occurring in monopolistic states (Ohio, Washington, North Dakota, and Wyoming). Within Washington Division, workers' compensation claims are filed by site personnel.

ii. Provide date of injury support to employees and supervisors, including monopolistic state claims.

iii. Coordinate regular follow-up of all cases, including monopolistic state claims, to ensure effective case management.

iv. Offer pre-injury consultation for offices and project sites.

v. Provide training and communication regarding the workers' compensation process.

b. The HSE Representatives will assist with the early return to work program by interfacing with the supervisor and employee to evaluate whether appropriate and safe temporary transitional work is available.

c. HSE Representatives will

i. Provide support to ensure that the requirements of this SMS are in place.

ii. Provide training on this SMS.

iii. Ensure proper reporting of incidents in accordance with SMS 049 – Injury/Illness/Incident Reporting and Notification.

iv. Ensure that requirements of this SMS are incorporated into all project health and safety plans.

2. Human Resources

The HR Representatives will forward any external communication (e.g., clinic bills, monopolistic state forms) to the Occupational Health Nurse or Workers' Compensation Administrator upon receipt.

3. Supervisor

The Supervisor (or HR or HSE Representative) will

a. Sign the Medical Treatment Referral form (Attachment 065-2 NA) prior to the employee leaving the site for medical treatment (this will not be necessary in an emergency). The employee will also be given the Medical Authorization Form (Attachment 065-3 NA) to be signed with copy provided to the employee, health care provider, and Occupational Health Nurse or Workers' Compensation Administrator.

b. Provide transitional job assignments, with consultation and approval of the office manager, whenever possible to enable an injured worker to return to work (Return to Work Policy Attachment 065-4 NA). Transitional employment is defined as temporary modified or light duty work that covers the time from the injury until the release to full duty from the doctor. The return to work hierarchy includes the following:

i. Return to own job.

ii. Return to own job with accommodations/modifications.

iii. Return to another job at URS with or without accommodations/modifications.

iv. Placement in alternate jobs through telecommuting or other job assignments determined case by case.

c. Provide, when requested by the treating physician or insurance carrier, the Description of Employee's Job Duties form (Attachment 065-5 NA).

d. Maintain regular contact with employees who are temporarily disabled (contact at least weekly by phone or email).

4. Employee

The employees will

a. Report injuries immediately to their supervisors. Employees are encouraged to contact their supervisor and/or the Occupational Health Nurse or Workers' Compensation Administrator prior to seeking any medical services for nonemergency injuries and illnesses.

b. Provide the Medical Treatment Referral form to the treating physician. If employees are unable to obtain the form prior to being treated (i.e., onset of symptoms during nonwork hours, work in remote locations), they must notify their supervisor as soon as possible on the next scheduled workday.

c. Provide their supervisor with written return to work and follow-up paperwork from the treating physician immediately following each doctor appointment.

D. URS will follow the recordability requirements of U.S. Occupational Safety and Health Administration (OSHA) (29 CFR 1904 and 1952) for both U.S. and international operations.

1. For URS Division and EG&G Division, the Occupational Health Nurse will maintain OSHA 300 logs for U.S. locations. For Washington Division, the Business Group HSE Managers will maintain OSHA 300 logs for U.S. locations. The OSHA 300 logs (with employee names deleted) will be distributed to the U.S. locations each January and posted from February 1 to April 30.

2. Sites working under the U.S. Mine Safety and Health Administration (MSHA) recordkeeping requirements will meet MSHA requirements, as well as track injuries using OSHA criteria for use in company HSE statistics.

3. For URS Division and EG&G Division, the Occupational Health Nurse will make the initial decision on recordability of an injury/illness. For Washington Division, the Business Group HSE Manager will make the decision on recordability of an injury/illness.

4. For URS Division, a recordability review committee will be appointed by the Vice President HSE to review the recordable cases on a monthly

basis. The review committee (based on OSHA regulations and information regarding the case) will make the final decision on recordability.

5. The injury/illness statistics (e.g., Total Recordable Incident Rate) will be calculated monthly and reported to URS management.

5. Documentation

A. The following documents will be maintained in the office/project safety file:

1. Posting of medical services providers and emergency phone numbers.

2. List of qualified first aid providers.

3. Documentation of coordination between URS and emergency service providers for field/construction projects.

4. Completed Injury/Illness/Incident Report Form (Attachment 049-1).

5. Description of Employee's Job Duties form.

6. Medical Treatment Referral form.

7. Medical Authorization Form.

B. The following documents will be maintained by the HR Representative and copied to the Occupational Health Nurse or Workers' Compensation Administrator.

1. Physician's First Report of Injury and follow-up reports.

2. Medical Treatment Referral form.

3. Medical Authorization Form.

4. Description of Employee's Job Duties form.

6. Resources

A. U.S. Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.151 – Medical Services and First Aid

B. OSHA 29 CFR 1910.1030 – Bloodborne Pathogens

C. OSHA 29 CFR 1926.50 – Medical Services and First Aid

D. OSHA 29 CFR 1904 – Recording and Reporting Occupational Injuries and Illnesses

E. OSHA 29 CFR 1952 – Approved State Plans for Enforcement of State Standards

F. American National Standards Institute (ANSI) Z358.1-2004 – Emergency Eyewash and Shower Equipment

G. OSHA Instruction CPL 2-2.53 – Guidelines for First Aid Programs

H. OSHA Safety and Health Topics: Medical and First Aid

I. Red Cross Health and Safety Services – www.redcross.org/services/hss/

J. SMS 003 – Emergency Preparedness Plans

K. SMS 024 – Medical Screening and Surveillance

L. SMS 049 – Injury/Illness/Incident Reporting and Notifications

M. SMS 051 – Bloodborne Pathogens

N. Medical Services Provider – WorkCare™ 1-800-455-6155

O. Contacts

URS Division	EG&G Division	Washington Division
Occupational Health Nurse	Senior Occupational Health Nurse	Workers' Compensation Administrator
Jeanette Schrimsher, RN COHN-S (866) 326-7321 (Toll Free-U.S.) (512) 656-0203 (Cell) (512) 419-6413 (Confidential Fax)	**BJ (Johnston) Heinrich, RN, BSN, COHN-S** (866) 344-1415 (Toll Free-U.S.) (877) 878-9525 (Toll Free-International) (512) 656-8502 (Cell) (512) 419-5252 (Confidential Fax)	**Terry Sower, CPCU, AIC, CWCP** (208) 386-6038 (Office) (208) 890-3843 (Cell) (208) 386-5462 (Confidential Fax)

P. Attachment 065-1 NA – Injury Management Procedures Flow Chart

Q. Attachment 065-2 NA – Medical Treatment Referral form

R. Attachment 065-3 NA – Medical Authorization Form

S. Attachment 065-4 NA – Return to Work Policy

T. Attachment 065-5 NA – Description of Employee's Job Duties

7. Supplemental Information

A. Emergency Eyewash and Shower Equipment

1. Applicability

This standard applies to URS Corporation and its subsidiary companies where personnel perform manual handling of materials. For this procedure, manual material handling (MMH) is defined as the movement of items by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

2. Purpose and Scope

The purpose of this standard is to prevent common injuries caused by the practice of MMH. Immediate or short-term effects include lacerations, bruises, and muscle fatigue. Long-term effects include chronic pain, frequently in the lower back but also in limb joints and ligaments.

3. Implementation

Implementation of this standard is the responsibility of the URS manager directing activities of the facility, site, or project.

4. Requirements

A. General

1. Prior to lifting, lowering, pushing, pulling, carrying, holding, or restraining an object of any significant size or weight, employees must evaluate the object and the required task to determine whether they can handle the object safely.
2. If the employee has any doubt about whether he or she can safely move the object alone, the employee should obtain additional manual or mechanical help.
3. Healthy employees with no physician-imposed restrictions should be able to lift and carry a maximum of 50 pounds (23 kilograms) using proper lifting and carrying techniques. Physical and workplace factors may reduce this recommended weight limit (RWL) significantly and should be considered prior to attempting lifts of this magnitude. Examples of physical and workplace factors may include the following:
   a. Physical size of an object.
   b. Slippery container surface or poor grip ability.
   c. Sharp edges.
   d. Slippery floors or obstacles on the floor.
   e. Cold or hot objects surfaces.
   f. Distance and route of travel.

4. An employee's personal "safe" MMH capability is defined as the employee's personal capability to manually lift, carry, push, or pull an object alone. This "safe" limit must consider the employee's past experience and training with MMH, health status, and any other personal or environmental characteristics affecting the employee's ability to perform these tasks. An employee's "safe" MMH capability is typically at or below the calculated RWL. In some cases, a trained and physically conditioned employee may exceed the MMH capability limit, but only after a complete hazard review of the task has determined an acceptable risk for minimizing injury.
5. An MMH task that exceeds an employee's personal "safe" MMH capability or RWL should be brought to the attention of the applicable manager or safety supervisor for the project.
6. If, due to a medical or health condition, the employee's physician or the employee has set a personal "safe" MMH capability, then appropriate medical documentation must be provided to the applicable manager to define these limits. The manager and appropriate safety supervisor should evaluate the tasks to which that employee is assigned and recommend a specific course of action to limit the potential for injury. This should include periodic monitoring of the employee and his/her work environment.
7. A recommended RWL can be calculated using the factors described in Supplemental Information A. The weight limit derived from these calculations is considered to be a load that over 99% of men and over 75% of women can safely handle without application of engineering or administrative controls. **Implementation of the calculations in Supplemental Information A should be attempted only with the assistance of a safety professional knowledgeable in the application of these factors. The calculations are intended to determine RWLs for repetitive lifting scenarios rather than occasional lifts.**
8. Prior to any manual lift, it is suggested that the employee warm up his or her muscles and joints using a combination of stretching and flexing.

B. Preplanning

1. Where MMH will be a necessary function of the task, the manager and/or safety supervisor should perform a thorough evaluation of the activities to determine ergonomic solutions to reduce or eliminate conditions that can cause or contribute to MMH injuries.

2. If a heavy object is to be moved to another location, the safest transport route should be determined prior to the activity.
3. The area around the object and the route over which it will be transported should be checked for slip, trip, and fall hazards. Hazards should be removed prior to initiation of the task.
4. The object to be moved should be inspected for grasping or handling hazards, such as slivers, sharp edges, grease, water, etc. Eliminate or abate any identified hazards where possible. Safe grasping or handling points on the object should be determined. Whenever possible, containers with carrying handles should be used for objects because they increase the manual grip strength for holding the object, thus providing better control and reduced muscle fatigue.
5. The distance to be traveled and the length of time that a grip on the object must be maintained should be considered before moving objects. If the travel distance is greater than 10 feet (3 meters) at maximum RWL, the employee should consider using an alternative method, rather than manually carrying the object.

C. Lifting/Lowering Guidelines

1. Reduce or eliminate manual lifting and lowering tasks where possible. Determine whether there are ways to abate the safety and ergonomic hazards associated with manual lifting.
2. The recommended technique for two-handed manual lifting/lowering involves five maneuvers:
   a. Get a firm footing. Keep your feet apart for a stable base. Put one foot slightly in front of the other.
   b. Bend your knees. Do not bend at the waist. When grasping the object, a firm grip should be obtained before lifting/lowering.
   c. Lift/lower with your legs. Lift/lower the load slowly and in a straight line, avoiding sudden movements.
   d. Keep the load close to the body. Generally, the closer the load is to the body, the less force it exerts on your back.
   e. Keep your back straight, your head and shoulders up, and your stomach muscles tights. Do not add the weight of your body to the load. Avoid twisting.

3. When a turn or change of direction is necessary, the object should be lifted or lowered into a carrying position, then the whole body should be turned with the feet, avoiding any trunk twisting motion.
4. Objects to be lifted to shoulder height should first be lifted to waist height, then rested on a level surface so the grasping position can be changed prior to lifting to a higher level.
5. Employees should never lift a load above their head.

D. Carrying/Holding Guidelines

1. Manual carrying is an inefficient way of transporting materials in the work place. Where possible, reduce or eliminate manual carrying tasks.
2. Never carry a load above the head.
3. Carry an object close to the body using both hands. One-handed carries are awkward and tend to unbalance the employee.
4. Do not carry objects that are so large they will obstruct visibility.
5. Do not change grips on an object while carrying or holding an object. Rest the object on a secure surface prior to changing grip.
6. If an object is of a size, shape, or mass that it requires two people to carry, use two people of similar size and physique. Two-person lifts should be planned and coordinated before performing the lift. Lift the item in unison.
7. Avoid carrying objects on stairs, particularly where the line of sight may be obstructed or the object can interfere with leg movement. All travel on stairs requires use of a handrail at all times, so only carry objects that can be safely handled with one hand. Always maintain handrail contact when carrying an object up or down stairs.

E. Pushing/Pulling Guidelines

1. Check the condition of the floor, ground, or other surface prior to pushing or pulling an object across it.
2. Be aware of the “break out” force of the object; this is the force at which a push or pull overcomes the frictional force between the surface and object. Adjust posture to avoid losing balance when this point is reached.
3. Get assistance when moving or guiding a large load.
4. Where possible, always push rather than pull a load.

5. Never load the cart or load-carrying device in such a manner that visibility is obstructed in the path of travel.
6. When pushing or pulling an object on an inclined surface, be certain that you can control the load and direction of travel before proceeding. Obtain additional support to control the load if necessary.
7. Never leave carts or loads in an area that will present a hazard to other workers. Make sure carts or transport devices are secured in position before leaving them unattended.

F. Workplace Design

1. Store heavy or bulky materials at heights between the knee and shoulder to avoid the need to stretch or bend. Use step stools to access objects above shoulder height.
2. Pack or arrange items to be lifted to avoid shifting of weight in the package. If a box has hand cutouts (e.g., file archive boxes) do not load the box so full that the handles cannot be used for carrying the box.
3. Design work areas to avoid the need to lift, carry, push, or pull heavy or bulky materials for extended distances.
4. Design workplaces with the following in mind:
   a. Lifts from the floor should be avoided.
   b. The torso should never twist while handling loads.
   c. Asymmetrical or unbalanced one-handed lifts should be avoided.
   d. Loads should not be lifted with sudden movements.
   e. Loads should not be lifted over obstacles.
   f. Loads should not be lifted at extended forward or sideway reaches.
   g. Uncomfortable or static postures should not be necessary throughout the work cycle.
   h. Environmental factors (e.g., task lighting, dry work surfaces, heat or cold stress) should be considered.

G. Training

1. Personnel who may have MMH as part of their duties are required to receive training that includes the following topics:

   a. Showing personnel how to avoid unnecessary physical stress and strain during MMH operations.
   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 MMH activities.
3. Assistance with training or training materials is available through the HSE staff.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Training rosters.

B. Other proof of completion of MMH training.

6. Resources

A. National Institute for Occupational Safety and Health (NIOSH) – Work Practices Guide for Manual Lifting http://www.cdc.gov/niosh

B. Canadian Centre for Occupational Health and Safety http://www.ccohs.ca/oshanswers/ergonomics/

C. Oregon OSHA – Ergonomics of Manual Materials Handling http://www.cbs.state.or.us/external/osha/pdf/workshops/206w.pdf

D. North Carolina Department of Labor – A Guide to Manual Materials Handling and Back Safety http://www.nclabor.com/osha/etta/indguide/ig26.pdf

7. Supplemental Information

A. Recommended Weight Limit (RWL) Calculations

1. Applicability

This standard applies to all operations of URS Corporation and its subsidiary companies.

2. Purpose and Scope

The purpose of this standard is to describe the URS approach to implementing our behavior-based safety program.

Behavior-based safety is a process that provides a higher level of safety excellence by promoting proactive involvement, building ownership, and fostering communication that relates to employee safety. A primary concept is that most accidents are due to at-risk behavior, and behavioral changes may be made that significantly reduce accident potential.

3. Implementation

Implementation of this procedure is the responsibility of the URS manager directing activities of the facility, site, or project location.

4. Requirements

A. Definitions

1. At-Risk Behavior: Individual actions that increase the chance of injury, despite knowledge of the hazard. An example is excessive speed while driving.

2. Activators: Items that are intended to produce desired behaviors. URS activators for safety include, but are not limited to, policy statements, safety management standards (SMS), training, safety slogans, posters and signs, health and safety plans, safe work plans, safety meetings, and rules and regulations.

3. Behaviors: Visible actions on the part of individuals and can be characterized as safe (following health and safety plans, using work practices that minimize risk, coaching others on safe behavior, having safety as a priority over speed and convenience, etc.), or at-risk.

4. Consequences: Result of safe and at-risk behaviors, and can therefore be positive or negative. Examples of consequences include self-approval, reprimand, peer approval, penalty, feedback, inconvenience, and comfort. The most effective consequences are positive, immediate, and certain.

B. Values of Behavior-Based Safety

1. Employees hold safety as a core value.

2. Each employee feels responsible for the safety of their coworkers as well as themselves, and takes action accordingly.

3. Each employee is willing and able to “go beyond the call of duty” on behalf of the safety of others.

C. Roles for Safe Behavior

1. Supervisor’s Role:

a. Provide clearly defined safety expectations and encourage/reinforce the implementation of safety observations using the SMS 072-1 NA checklist or equivalent.

b. Provide consequences for observed behaviors throughout the course of the work shift.

2. Co-Worker Role

a. Intervene when observing at-risk behavior.

b. Provide positive feedback for safe behavior.

c. Volunteer to be observed.

C. Identification of At-Risk Behaviors

Observations and review of incident and near miss data will be used by URS Safety Officers to help identify at-risk behavior.

1. Employee observations.

a. Observation checklists, either project-specific or Attachment 072-1 NA, will be used as a tool to help identify safe and at-risk behaviors and why the behavior(s) occurred.

b. Employees will be instructed on using the checklists.

c. Checklists will be included in the site-specific health and safety plan or the safe work plan.

d. The checklists will include the expected safe behaviors.

e. Peers will complete the checklist for applicable work tasks.

f. Checklists may change throughout the project to include additional behaviors.

E. Feedback to Employees

1. Observers will immediately provide one-on-one feedback to the observed, noting both safe and at-risk behaviors.
2. Observer and observee will discuss the identified barriers to safe behavior, and potential solutions.
3. Near-Miss and Incident Reports will be reviewed to identify at-risk behaviors and corrective actions.
4. Management and Health, Safety, and Environment staff will verify compliance with this standard.

F. Feedback Follow-up

1. Observation checklists will be collected and discussed at periodic safety meetings.
2. The manager will review the trends for at-risk and safe behavior, and report the trends to the employees.
3. Project-specific trends are analyzed and areas of additional action are identified.

5. Documentation Summary

The following documentation will be maintained in the project file:

A. Behavior-Based Safety Checklists.

6. Resources

Attachment 072-1 NA – Behavior-Based Safety Checklist

URS	Health, Safety and Environment **BEHAVIOR BASED SAFETY CHECKLIST**	Attachment 072-1 NA Issue Date: September 2003 Revision 2: February 2009

Job Location: _____ Date: _____

Task/Work Observed: _____ Observer: _____

	Safe	Unsafe	Comments *
Personal Protective Equipment			
Head	☐	☐	
Hand	☐	☐	
Feet	☐	☐	
Eyes/Face	☐	☐	
Skin	☐	☐	
Hearing	☐	☐	
Fall Protection	☐	☐	
Equipment / Tools			
Proper tool for the job	☐	☐	
Condition	☐	☐	
Proper Use	☐	☐	
Body Use / Position			
Lifting	☐	☐	
Pinch Point	☐	☐	
Ladder / stairs	☐	☐	
Hand placement	☐	☐	
Travel path / speed	☐	☐	
Body position	☐	☐	
Work Practices			
Follow Safety Plan / Procedures	☐	☐	
Housekeeping	☐	☐	
Other			
	☐	☐	
	☐	☐	
	☐	☐	

* Use comment column when unsafe behavior / conditions were observed. Describe what was observed and why this occurred.

USACE Accident Reporting Forms:

Appendix B of OM 385-1-1 (NWO Form 1880)

ENG Form 3394

THIS PAGE INTENTIONALLY BLANK

Appendix B of OM 385-1-1 (NWO Form 1880)

THIS PAGE INTENTIONALLY BLANK

APPENDIX B

ACCIDENT INVESTIGATION AND REPORTING

IMMEDIATE NOTIFICATION TO DISTRICT COMMANDER

Incidents that should be reported directly to the Commander by telephone include all Class A and Class B accidents and accidents that may generate inquiries at the District, Division, or HQUSACE.

IMMEDIATE NOTIFICATION TO SOHO

1. Fatalities (Government and contractor).

2. Lost workday cases for very serious injury (may result in permanent disability) or multiple injuries (three or more) involving Government and/or contractor employees.

3. Property or fire damage if over $200,000 (Government and contractor).

4. Any unusual incident that might raise questions at the HQUSACE level or generate inquiries from the Post or Base Commander or create substantial public interest.

TELEPHONE

Duty hours ---------- (402) 221-4051

After Duty hours
and weekends -------- (402) 221-4051 (answering service will respond)

ACCIDENT INVESTIGATION AND REPORTING

1. Purpose. To establish procedures for investigating and reporting accidents occurring on Government or contractor operations.

2. Applicability.

a. Area engineers, project engineers, operations managers, and chiefs of Omaha District office elements are responsible for accident investigation and reporting. These responsibilities include the preparation and submission of accident reports to the District SOHO.

b. Individuals who are responsible for the preparation and review of the accident report are responsible for ensuring that adequate corrective measures are taken.

c. Contractors will be required to complete an acceptable ENG Form 3394, USACE Accident Investigation Report.

3. Procedures.

a. All accidents must be investigated promptly and reported in accordance with AR 385-40, as supplemented

b. Accident investigations are recorded for accident prevention purposes only. Findings and conclusions will not be used as a basis for determining legal liability or charges for negligence.

c. Persons injured or involved in the accident will not prepare or sign accident reports.

d. Who investigates accidents is determined by the first echelon of supervision not supervising the operation. Investigator(s) will be appointed according to the severity of the accident. For example, a Class C accident may be investigated by one properly appointed individual, while a Class A or B accident will require investigation and reporting by a properly appointed board.

e. The results of accident investigations may not be released without prior approval of the Department of the Army (DA) or HQUSACE. All requests for the release of accident reports will be forwarded to the District SOHO.

f. Investigation of motor vehicle accidents will be coordinated with SOHO and Logistics Management. Whenever military or civil police investigation reports will suffice, these reports will be used as the basis for the motor vehicle accident report and a copy will be submitted with the SF Form 91, Operator's Report of Motor Vehicle Accident, and ENG Form 3394, USACE Accident Investigation Report.

g. Accident Investigation Boards.

(1) A Board of Investigation will be appointed to investigate all Class A and B accidents, Government or contractor. Commanders may appoint a board of investigation for any accident he/she feels needs more extensive investigation.

(2) The report of a Board will be filed as enclosure 1 to the ENG Form 3394. The Board will be appointed by the Commander and will be composed of appropriate technical and management specialists. A safety professional will be appointed as technical advisor.

(3) Board procedures, board reports, and timelines are outlined in EP 385-1-40.

4. Quick Reference Charts. Quick reference charts are located in Appendix B, Annexes A and B.

5. Safety Exposure Data. Submit to SOHO by the fifth working day of each month, the contractor man-hours worked for the prior month. This information is due from all project and area offices, as well as any local District offices overseeing contractor man-hours.

APPENDIX B, ANNEX A

QUICK REFERENCE CHART
FOR REPORTING GOVERNMENT EMPLOYEE ACCIDENTS

Accident Class	Notification of Accident (First Report)	ENG Form 3394	OSHA Log	Notify OSHA
A	Immediately (Note 3)	Board Report (25 Days) (Note 1)	Yes	Yes
B	Immediately (Note 3)	Board Report (25 Days) (Note 1)	Yes	Yes
C	Immediately (Note 2)	7 Days	Yes	No
D	Immediately (Note 2)	7 Days	No	No
Medical Treatment	Not Required	Yes	Yes	No

NOTE 1: Class A and B accidents require investigation by a board and the ENG Form 3394 will be made a part of that report.

NOTE 2: Use Notification of Accident (First Report) – Refer to Form Flow NWO Form 1880

NOTE 3: Immediately means as soon as possible after learning of the incident but no later than 8 hours. Units will have established notification procedures to cover 24 hours a day including weekends and holidays.

Note 4: All public fatalities where the Corps has Title 36 jurisdiction will be reported immediately to SOHO.

A = $1M or more and/or fatality or permanent total disability.
B = $200K or more, but less than $1M and permanent partial disability and/or three or more people are hospitalized.
C = $20K or more, but less than $200K and/or nonfatal injury resulting in loss of time from work beyond day/shift when injury occurred. Nonfatal illness/disability causes loss of time from work.
D = Property Damage $2K or more, but less than $20K.

APPENDIX B, ANNEX B

QUICK REFERENCE CHART
FOR REPORTING CONTRACTOR ACCIDENTS

Accident Class	Notification of Accident (First Report) (NWO Form 1880)	USACE ENG Form 3394	Notify OSHA
A	Immediately (Note 2)	Board Report (25 Days) (Note 3)	Yes
B	Immediately (Note 2)	Board Report (25 Days) (Note 3)	Yes
C	Immediately (Note 1)	7 Days	No
D	Immediately (Note 1)	7 Days	No
Medical Treatment (no-lost workdays)	Not Required	No	No

NOTE 1: Use Notification of Accident (First Report) – Flow Form NWO 1880 (sample provided at Appendix B, annex C.
.
NOTE 2: Immediately means as soon as possible after learning of the incident but no later than eight (8) hours. Units will have established notification procedures to cover 24 hours a day including weekends and holidays.

NOTE 3: Class A and B accidents require investigation by a board and the ENG Form 3394 will be made a part of that report.

A = $1M or more and/or fatality or permanent total disability
B = $200K or more, but less than $1M and or permanent partial disability and/or three or more people are hospitalized.
C = $20K or more, but less than $200K and/or nonfatal injury resulting in loss of workday - Nonfatal illness/disability causes loss of workdays.
D = Property Damage $2K or more, but less than $20K.

APPENDIX B, ANNEX C
NOTIFICATION OF ACCIDENT – FIRST REPORT

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**	

Computerized Copy of NWO Form 1880, dated 1 Aug 98

ENG Form 3394

THIS PAGE INTENTIONALLY BLANK

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 Program (IRP) HTW activities include accidents that occurred during 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. **EOUIPMENT/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 involved in the accident from the list below. Enter the name and place 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**
LWD	**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
SHOULDER	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
BRUISE;		
	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
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	DE	EFFECT OF
ENVIRON-		
		MENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS
CONDITION		
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

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)
0310	CAUGHT
0320	CAUGHT ON
0330	CAUGHT IN
	CAUGHT BETWEEN
0410	PUNCTURED, LACERATED
0420	PUNCTURED BY
0430	CUT BY
0440	STUNG BY
	BITTEN BY
0510	CONTACTED
	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
0610	EXERTED
	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
0710	EXPOSED
0720	INHALED
0730	INGESTED
0740	ABSORBED
	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC.)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY
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.

INSTRUCTIONS FOR SECTION 7 - MOTOR VEHICLE ACCIDENT

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

a. TYPE OF VESSEL/FLOATING PLANT - Select the most appropriate 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 0N 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 sequence of events that describe what happened leading up to and including 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 experience and training in performing tasks such as lifting office 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.

INSTRUCTIONS 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.
Indirect causes: failure to enforce USACE safety requirements; improper 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)

2ND REVIEW - The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, 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.

(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	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ 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	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	☐ 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)*

a. 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 VESSEI/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

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE:

10.	ACCIDENT DESCRIPTION *(Continuation)*

13a.	DIRECT CAUSE *(Continuation)*

13b.	INDIRECT CAUSES *(Continuation)*

14.	ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

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

Computerized Copy of NWO Form 1880, dated 1 Aug 98

Material Safety Data Sheets (MSDSs):

100 ppm Isobutylene Calibration Gas

Alconox

Gasoline

Nitric acid

THIS PAGE INTENTIONALLY BLANK

!! This is an ARCHIVE Record !!

MSDS Safety Information

TOP

FSC:	MSDS Date:	MSDS Num:
6830	06/01/1985	CBCWH

Submitter:	LIIN:	Tech Review:	Status CD:
N EN	00N065361	11/15/1995	C

Product ID:	MFN:
ISOBUTYLENE	01

Article:	Kit Part:
N	N

Cage:

Responsible Party 00742

Name:

AIR PRODUCTS AND CHEMICALS INC

Address:	Box:
7201 HAMILTON BLVD	A1

City:	State:	Zip:
ALLENTOWN	PA	18195

Country:

US

Info Phone Number:

215−481−8257

Emergency Phone Number:

215−481−8257

Radioactive Ind:

N

Preparer's Name:

N/P

Proprietary Ind:

N

Review Ind: N

Published: Y

Special Project CD: N

Contractor Summary

TOP

Cage:	Name:
00742	AIR PRODUCTS AND CHEMICALS INC

Address:

7201 HAMILTON BLVD

City:	State:	Zip:
ALLENTOWN	PA	18195−1501

Country:	Phone:
US	800−345−3148/ 800−752−1597

Ingredients

TOP

Cas: 115−11−7 M UD0890000 M

Code: RTECS #: Code:

Name: **PROPENE, 2−METHYL−; (ISOBUTYLENE)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

N/K (FP N)

Code: M OSHA STEL: Code:

ACGIH TLV: N/K (FP N)

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

N

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **SUPP DATA:FOLLOWED BY BLISTERING.**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **FIRST AID PROC:GIVE OXYG. MED ASSISTANCE SHOULD BE SOUGHT IMMED. SKIN:REMOVE CONTAM CLTHG & FLUSH AFFECTED AREAS (ING 4)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 3:W/LUKEWARM WATER. DO NOT USE HOT WATER. MD SHOULD SEE PATIENT PROMPTLY IF CRYOGENIC "BURN" HAS CAUSED (ING 5)**

% Text: N/K Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 4:BLISTERING OF SKIN OR DEEP TISSUE FREEZING.**

% Text: N/K Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **WASTE DISP METH:SECURED & VALVE PROT CAP IN PLACE. FOR EMER DISP ASSISTANCE, CALL "800" EMER PHONE NUMBER LISTED HEREIN.**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **OTHER PREC:USE CHECK VALVE/TRAP IN DISCHARGE LINE TO PVNT HAZ BACK FLOW INTO CYL. PROT CYLS FROM PHYSICAL DMG. (ING 8)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 7:STORE IN COOL, DRY, WELL−VENTILATED AREA OF NON−COMBUST CONSTRUCTION AWAY FROM HEAVILY TRAFFICKED AREAS & (ING 9)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 8:EMER EXITS. DO NOT ALLOW TEMP WHERE CYLS ARE STORED TO EXCEED 130F (54C). CYLS SHOULD BE STORED UPRIGHT & (ING 10)**

% Text: N/K Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 9:FIRMLY SECURED TO PVNT FALLING/BEING KNOCKED OVER. FULL & EMPTY CYLS SHOULD BE SEGRAGATED. USE "FIRST IN− (ING 11)**

% Text: N/K Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 10:FIRST OUT" INVENTORY SYS TO PVNT FULL CYLS BEING STORED FOR EXCESSIVE PERIODS OF TIME. POST "NO SMOKING (ING 12)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M

OSHA STEL:

Code:

ACGIH TLV: NOT APPLICABLE

Code: M

ACGIH STEL: N/P

Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 11:OR OPEN FLAMES" SIGNS IN STOR/USE AREA. THERE SHOULD BE NO SOURCES OF IGNIT IN STOR/USE AREA. FOR ADDNL (ING 13)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M

OSHA STEL:

Code:

ACGIH TLV: NOT APPLICABLE

Code: M

ACGIH STEL: N/P

Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 12:HNDLG/STOR RECS CONSULT AIR PRODS SPECIALTY GAS CATALOG SAFETY & TECHNICAL INFO SECTION/COMPRESSED GAS (ING 14)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M

OSHA STEL:

Code:

ACGIH TLV: NOT APPLICABLE

Code: M N/P

Code:

ACGIH STEL:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 13:ASSOC PAMPHLET P−1. ISOBUTYLENE IS NONCORR & MAY BE USED W/ANY COMMON STRUCTURAL MATL. EARTH−GROUND & (ING 15)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 14:BOND ALL LINES & EQUIP ASSOC W/ISOBUTYLENE SYS. ELEC EQUIP SHOULD BE NON−SPARKING/EXPLO PROOF. COMPRESSED(ING 16)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL: Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: **ING 15:GAS CYLS SHOULD NOT BE REFILLED EXCEPT BY QUALIFIED PRODUCERS OF COMPRESSED GASES. SHIPMENT OF COMPRESSED(ING 17)**

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL:

Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P

Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

Cas: X 9999999ZZ M

Code: RTECS #: Code:

Name: ING 16:GAS CYL WHICH HAS NOT BEEN FILLED BY OWNER/WITH HIS (WRITTEN) CONSENT IS VIOLATION OF FEDERAL LAW (49CFR).

% Text: N/K

Environmental Wt:

Other REC Limits: N/K

OSHA PEL:

NOT APPLICABLE

Code: M OSHA STEL:

Code:

ACGIH TLV: NOT APPLICABLE

Code: M ACGIH STEL: N/P

Code:

EPA Rpt Qty:

DOT Rpt Qty:

Ozone Depleting Chemical:

========== Health Hazards Data ==========

TOP

LD50 LC50 Mixture

NONE SPECIFIED BY MANUFACTURER.

Route Of Entry Inds − Inhalation:YES Skin:YES Ingestion:NO

Carcinogenicity Inds − NTP:NO IARC:NO OSHA:NO

Health Hazards Acute And Chronic

ISOBUTYLENE IS DEFINED AS SIMPLE ASPHY. OXYGEN LEVELS SHOULD BE MAINTAINED AT >18 MOLAR PERCENT AT NORMAL ATMOSPHERIC PRESS WHICH IS EQUIV TO PARTIAL PRESS OF 135 MMHG.
INHAL:MOD CONCS WHICH EXCLUDE A DEQ SUPPLY OF OXYG TO LUNGS CAUSE DIZZ,DROW & EVENTUAL UNCON. IT ALSO HAVE VERY MILD ANESTH EFTS WHICH(EFTS OF OVEREXP)

Explanation Of Carcinogenicity

NOT RELEVANT

Signs And Symptions Of Overexposure

HLTH HAZ:MIGHT CAUSE LACK OF COORD/LESSENED MENTAL ALERTNESS. SKIN/EYE CONT:IT IS MILDLY IRRIT TO MUC MEMBS. DUE TO ITS RAPID RATE OF EVAP, ISOBUTYLENE CAN CAUSE TISS FREEZING/FROSTBITE ON CONT. ISOBU TYLENE HAVE VERY MILD ANESTH EFT, HOWEVER, MAJOR HLTH HAZ IS EXCLUSION OF ADEQ SUPPLY OF OXYG TO LUNGS. (SUPP DATA)

Medical Cond Aggravated By Exposure

NONE SPECIFIED BY MANUFACTURER.

First Aid

PROMPT MED ATTN IS REQD IN ALL CASES OF OVEREXP TO ISOBUTYLENE. RESCUE PERS SHOULD BE EQUIPPED W/NIOSH/MSHA APPRVD SCBA & MUST BE AWARE OF EXTREME FIRE & EXPLO HAZ. INGEST:CALL MD IMMED (FP N). EYES:I MMED FLUSH W/POTABLE WATER FOR MIN OF 15 MINS, SEEK ASSISTANCE FROM MD (FP N). INHAL:MOVE EXPOS PERS TO UNCONTAM AREA. IF NOT BRTHG, GIVE ARTF RESP, PREF MOUTH−TO−MOUTH. IF BRTHG IS DFCLT, (ING 3)

Spill Release Procedures

EVACUATE ALL PERS FROM AFFECTED AREA. USE APPROP PROTECTIVE EQUIPMENT. IF LEAK IS IN USER'S EQUIPMENT, BE CERTAIN TO PURGE PIPING W/INERT GAS PRIOR TO ATTEMPTING REPAIRS. IF LEAK IS IN CNTNR VALVE, CA LL "8OO" EMER PHONE NUMBER LISTED HEREIN.

Neutralizing Agent

NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods

ALL FED, STATE & LOC REGS REGARDING HLTH & POLLUTION SHOULD BE FOLLOWED IN WASTE DISP. CONT MFR FOR SPECIFIC RECS. DO NOT DISP OF UNUSED QTYS. RETURN PROPERLY LABELED SHIPPING CNTNR TO MFR FOR DISP W/ VALVE(S) TIGHTLY CLSD, OUTLET SEAL(S) (ING 6)

Handling And Storage Precautions

USE ONLY IN WELL−VENTILATED AREAS. VALVE PROT CAPS MUST REMAIN IN PLACE UNLESS CNTNR IS SECURED W/VALVE OUTLET PIPED TO USE POINT.

Other Precautions

DO NOT DRAG, SLIDE/ROLL CYLS. USE SUITABLE HAND TRUCK FOR CYL MOVEMENT. USE PRESS REDUCING REGULATOR WHEN CONNECTING CYL TO LOWER PRESS (<250 PSIG) PIPING/SYS. DO NOT HEAT CYL BY ANY MEANS TO INCR DIS CHARGE RATE OF PROD FROM CYL. (ING 7)

========== Fire and Explosion Hazard Information ==========

TOP

Flash Point Method:

CC

Flash Point:

Flash Point Text: −105F,−76C

Autoignition Temp:

Autoignition Temp Text: N/A

Lower Limits: 1.8%

Upper Limits: 9.6%

Extinguishing Media

WATER, CARBON DIOXIDE, DRY CHEMICAL.

Fire Fighting Procedures

USE NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP (FP N). KEEP CYL(S) COOL W/WATER SPRAY FROM DIST. IF POSS W/OUT RISK, MOVE CYLS(S) AWAY FROM FIRE AREA IF (SUPDAT)

Unusual Fire/Explosion Hazard

ISOBUTYLENE IS DENSER THAN AIR & CAN TRAVEL CONSIDERABLE DISTS TO IGNIT SOURCE & FLASH BACK. CYL(S) MAY EXPLODE/VENT WHEN EXPOS TO FIRE. ISOBUTYLENE IS (SUPDAT)

========== Control Measures ========== TOP

Respiratory Protection

NIOSH/MSHA APPROVED POSITIVE PRESSURE AIR LINE W/MASK OR SELF−CONTAINED BREATHING APPARATUS SHOULD BE AVAILABLE FOR EMERGENCY USE.

Ventilation

HOOD W/FORCED VENT. LOCAL EXHAUST:TO PREVENT ACCUMULATION ABOVE LEL. MECHANICAL(GENERAL):I/A/W ELECTRICAL CODES.

Protective Gloves

PLASTIC OR RUBBER GLOVES.

Eye Protection

ANSI APPROVED CHEM WORKERS GOGGS (FP N).

Other Protective Equipment

EYE WASH FOUNTAIN DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N). SAFETY SHOES.

Work Hygienic Practices

NONE SPECIFIED BY MANUFACTURER.

Supplemental Safety and Health

APPEAR/ODOR:BURNING ANTHRACITE COAL. FIRE FIGHT PROC:POSS W/OUT RISK, STOP FLOW OF GAS TO FIRE. ALLOW GAS FIRE TO BURN ITSELF OUT. VENTILATE LOW AREAS WHERE FLAMM/EXPLO MIXTS MAY FORM. EXPLO HAZ:FLAMM OVER WIDE RANGE IN AIR. EFTS OF OVEREXP:FROSTBITE EFTS ARE CHANGE IN COLOR OF SKIN TO GRAY/WHITE POSSIBLY (ING 2)

Physical/Chemical Properties

TOP

HCC:

NRC/State LIC No:

Net Prop WT For Ammo:

Boiling Point:

B.P. Text: 19.6F,−6.9C

Melt/Freeze Pt:

M.P/F.P Text: −221F,−140C

Decomp Temp:

Decomp Text: N/K

Vapor Pres: 39 PSIA

Vapor Density: N/K

Volatile Org Content %:

Spec Gravity: N/K

VOC Pounds/Gallon:

PH: N/K

VOC Grams/Liter:

Viscosity: N/P

Evaporation Rate & Reference: N/K

Solubility in Water: INSOLUBLE

Appearance and Odor: COLORLESS GAS W/UNPLEASANT ODOR SIMILAR TO THAT WHICH IS EMITTED WHEN (SUPDAT)

Percent Volatiles by Volume: N/K

Corrosion Rate: N/K

Reactivity Data

TOP

Stability Indicator:

YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: OXIDIZERS.

Hazardous Decomposition Products: NONE.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization : NOT RELEVANT

========== Toxicological Information ========== TOP

Toxicological Information:

N/P

========== Ecological Information ========== TOP

Ecological:

N/P

========== MSDS Transport Information ========== TOP

Transport Information:

N/P

========== Regulatory Information ========== TOP

Sara Title III Information:

N/P

Federal Regulatory Information: N/P

State Regulatory Information: N/P

========== Other Information ========== TOP

Other Information:

N/P

========== HMIS Transportation Information ========== TOP

Responsible Party Cage:

00742

Trans ID NO: 42775

Product ID: ISOBUTYLENE

MSDS Prepared Date: 06/01/1985

Review Date: 10/24/1995

MFN: 1

Submitter: N TN

Status CD: C

Article W/O MSDS N

Tech Entry NOS Shipping Nm:

:

Radioactivity:

Form:

Net Explosive Weight:

Coast Guard AMMO Code:

Magnetism: N/P

Net Unit Weight:

AF MMAC Code:

DOD Exemption NUM:

Limited Quantity IND:

Multiple KIT Number: 0

Kit IND: N

Kit Part IND: N

Review IND: Y

Unit Of Issue: NK

Container QTY: NK

Type Of Container:

Additional Data:

========== **Detail DOT Information** ========== TOP

DOT PSN Code:

XXX

Symbols: N/R

DOT Proper Shipping Name: SEE ADDITIONAL DATA FIELD IN HMIS FOR FURTHER INFORMATION

DOT PSN Modifier:

Hazard Class: N/A

NIN ID Num:

DOT Packaging Group:

Label:

Special Provision:

Packaging Exception:

Non Bulk Pack:

Bulk Pack:

Max Qty Pass:

Max Qty Cargo:

Vessel Stow Req:

Water/Ship/Other Req:

========== Detail IMO Information ========== TOP

IMO PSN Code:

XXX

IMO Proper Shipping Name: SEE ADDITIONAL DATA FIELD IN HMIS FOR FURTHER INFORMATION

IMO PSN Modifier:

IMDG Page Number: N/A

UN Number:

UN Hazard Class: N/A

IMO Packaging Group:

Subsidiary Risk Label:

EMS Number: N/A

MED First Aid Guide NUM: N/A

========== Detail IATA Information ========== TOP

IATA PSN Code:

XXX

IATA UN ID NUM:

IATA Proper Shipping Name: SEE ADDITIONAL DATA FIELD IN HMIS FOR FURTHER INFORMATION

IATA PSN Modifier:

IATA UN Class:

Subsidiary Risk Class:

IATA Label:

UN Packing Group:

Packing Note Passenger:

Max Quant Pass:

Max Quant Cargo:

Packaging Note Cargo:

Exceptions:

========== Detail AFI Information ==========

TOP

AFI PSN Code: XXX

AFI Symbols:

AFI Proper Shipping Name: SEE ADDITIONAL DATA FIELD IN HMIS FOR FURTHER INFORMATION

AFI PSN Modifier:

AFI Hazard Class: N/A

AFI UN ID NUM: N/A

AFI Packing Group: N/A

AFI Label:

Special Provisions: N/A

Back Pack Reference: N/A

========== HMIS HAZCOM Label ==========

TOP

Print Labels

Product ID:

ISOBUTYLENE

Cage: 00742

Assigned IND: N

Company Name:

AIR PRODUCTS AND CHEMICALS INC

Street: 7201 HAMILTON BLVD

PO Box:

City:

ALLENTOWN

State: PA

Zipcode: 18195−1501

Country: US

Health Emergency Phone:

215−481−8257

Label Required IND:

Y

Date Of Label Review: 11/15/1995

Status Code: C

MFG Label NO:

Label Date: 11/15/1995

Year Procured:

Origination Code:

G

Chronic Hazard IND: N

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: DANGER

Respiratory Protection IND: YES

Health Hazard:

Moderate

Contact Hazard: Moderate

Fire Hazard:

Severe

Reactivity Hazard: None

Hazard And Precautions

EXTREMELY FLAMMABLE. ACUTE:INHALATION:DIZZINESS, DROWSINESS, UNCONSCIOUSNESS. MILD ANESTHETIC, LACK OF COORDINATION OR LESSENED MENTAL ALERTNESS. SKIN/EYE:MILDLY IRRITATING TO MUCOUS MEMBRANES, TISSUE FREEZING, FROSTBITE CHARACTERIZED BY SKIN COLOR CHANGE & BLISTERING. CHRONIC:NONE LISTED BY MANUFACTURER.

==========

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 MSDS

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.
813-248-0585 (outside of the United States).

Manufacturer: Alconox, Inc.
30 Glenn St.
Suite 309
White Plains, NY 10603.

Supplier MSDS date: 2005/03/09

D.O.T. Classification: Not regulated.

Section 2 : HAZARDOUS INGREDIENTS

C.A.S.	CONCENTRATION %	Ingredient Name	T.L.V.	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 DATA

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 : CONTROL MEASURES

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.

MSDS Safety Information

TOP

FSC: 9130 **NIIN:** 00−148−7104 **MSDS Date:** 04/09/1987 **MSDS Num:** BPBRW

Submitter: D DG **Tech Review:** 06/25/1999 **Status CD:** C

Product ID: 00351 UNLEADED REGULAR GASOLINE **MFN:** 01

Article: N **Kit Part:** N

Responsible Party **Cage:** 38431

Name: TEXACO INC.

Box: 509

City: BEACON **State:** NY **Zip:** 12508−0509

Country: US

Info Phone Number: 914−831−3400 EXT 204

Emergency Phone Number: 914−831−3400 EXT 204

Preparer's Name: R. T. RICHARDS

Proprietary Ind: N Review Ind: Y

Published: Y Special Project CD: N

Contractor Summary

TOP

Cage: 38431 **Name:** DIGITAL CONTROL SYSTEMS INC

Address: 3160 GRAND MARAIS E

City: WINDSOR, N8W 4W5 **State:** ON **Zip:** 00000

Country: CN **Phone:** NONE

Cage: 7B131 **Name:** TEXACO INC

Address: UNKNOWN **Box:** 509

City: BEACON **State:** NY **Zip:** 12508−0509

Country: US **Phone:** 914−831−3400

Item Description Information

TOP

Item Manager:

Item Name: GASOLINE,AUTOMOTIVE

Specification Number: VV−V−00169A Type/Grade/Class: CL A,B,C,D,E;GR PREM

Unit of Issue: GL Quantitative Expression:

UI Container Qty: X Type of Container: BULK

Ingredients

TOP

Cas: 71−43−2 Code: M RTECS #: CY1400000 Code: M

Name: **BENZENE (SARA III)**

% Text: 1−3.99 Environmental Wt:

Other REC Limits: NONE SPECIFIED

OSHA PEL: 1PPM/5STEL;1910.1028 Code: M OSHA STEL: Code:

ACGIH TLV: 10 PPM; A2; 9192 Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: 10 LBS DOT Rpt Qty: 10 LBS

Ozone Depleting Chemical: N

Cas: 108−88−3 Code: M RTECS #: XS5250000 Code: M

Name: TOLUENE (SARA III)

% Text: 4−10.99 Environmental Wt:

Other REC Limits: NONE SPECIFIED

OSHA PEL: 200 PPM/150 STEL Code: M OSHA STEL: Code:

ACGIH TLV: 50 PPM; 9293 Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: 1000 LBS DOT Rpt Qty: 1000 LBS

Ozone Depleting Chemical: N

Cas: 100−41−4 Code: M RTECS #: DA0700000 Code: M

Name: ETHYL BENZENE (SARA III)

% Text: 1−3.99 Environmental Wt:

Other REC Limits: NONE SPECIFIED

OSHA PEL: 100 PPM/125 STEL Code: M OSHA STEL: Code:

ACGIH TLV: 100 PPM/125STEL 9192 Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: 1000 LBS DOT Rpt Qty: 1000 LBS

Ozone Depleting Chemical: N

Cas: 1330−20−7 Code: M RTECS #: ZE2100000 Code: M

Name: XYLENES (O−,M−,P− ISOMERS) (SARA III)

% Text: 4−10.99 Environmental Wt:

Other REC Limits: NONE SPECIFIED

OSHA PEL: 100 PPM/150 STEL Code: M OSHA STEL: Code:

ACGIH TLV: 100 PPM/150STEL;9192 Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: 1000 LBS DOT Rpt Qty: 1000 LBS

Ozone Depleting Chemical: N

Cas: 95−63−6 Code: M RTECS #: DC3325000 Code: M

Name: 1,2,4−TRIMETHYLBENZENE (SARA III)

% Text: 1−3.99 Environmental Wt:

Other REC Limits: NONE SPECIFIED

OSHA PEL: 25 PPM Code: M OSHA STEL: Code:

ACGIH TLV: 25 PPM; 9192 Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: DOT Rpt Qty:

Ozone Depleting Chemical: N

Cas: 1634−04−4 Code: M RTECS #: KN5250000 Code: M

Name: **METHYL TERT−BUTYL ETHER (SARA III)**

% Text: 0−10 Environmental Wt:

Other REC Limits: NONE SPECIFIED

OSHA PEL: NOT ESTABLISHED Code: M OSHA STEL: Code:

ACGIH TLV: NOT ESTABLISHED Code: M ACGIH STEL: N/P Code:

EPA Rpt Qty: 1 LB DOT Rpt Qty: 1 LB

Ozone Depleting Chemical: N

========== Health Hazards Data ==========

TOP

LD50 LC50 Mixture ORAL LD50 (RAT) = 18.75 ML/KG

Route Of Entry Inds − Inhalation: YES Skin: YES Ingestion: NO

Carcinogenicity Inds − NTP: YES IARC: YES OSHA: YES

Health Hazards Acute And Chronic

ACUTE: EYES−CAUSES SLIGHT−MODERATE EYE IRRITATION. SKIN−MODERATELY IRRITATING. CHRONIC: RECENT STUDIES WITH LABORATORY ANIMALS HAVE SHOWN THAT GASOLINE VAPORS CAUSE KIDNEY DAMAGE & KIDNEY CANCER IN RA TS & LIVER CANCER IN MICE.

Explanation Of Carcinogenicity

PRODUCT CONTAINS BENZENE WHICH IS LISTED AS A CARCINOGEN BY NTP, IARC AND OSHA.

Signs And Symptions Of Overexposure

RESPIRATORY SYSTEM: MAY CAUSE DIZZINESS, IRRITATION OF EYES, NOSE AND THROAT, VOMITING, BLUISH COLOR OF THE SKIN AND CNS EFFECTS.

Medical Cond Aggravated By Exposure

NONE SPECIFIED BY MANUFACTURER.

First Aid

EYES: FLUSH WITH WATER FOR 15 MINUTES. SKIN: WASH EXPOSED AREA WITH SOAP AND WATER. INGESTION: DO NOT INDUCE VOMITING. MAY CAUSE CHEMICAL PNEUMONITIS. CALL A PHYSICIAN. INHALATION: SHOULD SYMPTOMS NOT ED UNDER EXPOSURE OCCUR, REMOVE TO FRESHAIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. (REMOVE GASOLINE−SOAKED CLOTHING)

Spill Release Procedures

ELIMINATE ALL IGNITION SOURCES INCLUDING INTERNAL COMBUSTION ENGINES AND POWER TOOLS. VENTILATE AREA. AVOID BREATHING VAPORS. USE SCBA OR SUPPLIED−AIR MASK FOR LARGE SPILLS IN CONFINED AREAS. CONTAIN SPILL IF POSSIBLE. REMOVE WITH INERT ABSORBENT.

Neutralizing Agent

NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods

PREVENT WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD ANY PRODUCT, RESIDUE, DISPOSAL CONTAINER OR LINER IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.

Handling And Storage Precautions

TRANSPORT, HANDLE AND STORE IN ACCORDANCE WITH OSHA REGULATION 1910.106 AND APPLICABLE D.O.T. REGULATIONS.

Other Precautions

DANGER! EXTREMELY FLAMMABLE. HARMFUL OR FATAL IF SWALLOWED. MAY BE FATAL IF INHALED; MAY CAUSE IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN. KEEP AWAY FROM HEAT, SPARKS AMD FLAMES. AVOID BR EATHING VAPORS. FOR USE AS MOTOR FUEL.

========== Fire and Explosion Hazard Information ==========

TOP

Flash Point Method: COC

Flash Point:

Flash Point Text: −40F,−40C

Autoignition Temp:

Autoignition Temp Text: N/A

Lower Limits: 1.4 %

Upper Limits: 7.6 %

Extinguishing Media

DRY CHEMICAL, FOAM, CARBON DIOXIDE.

Fire Fighting Procedures

WATER MAY BE INEFFECTIVE ON FLAMES, BUT SHOULD BE USED TO COOL FIRE−EXPOSED CONTAINERS. IF A SPILL OR LEAK HAS NOT IGNITED, USE WATER SPRAY TO DISPERSE VAPORS.

Unusual Fire/Explosion Hazard

FLOWING GASOLINE CAN BE IGNITED BY SELF−GENERATED STATIC ELECTRICITY; USE ADEQUATE GROUNDING. CARBON MONOXIDE & CARBON DIOXIDE MAY BE FORMED ON BURNING IN AIR.

========== Control Measures ==========

TOP

Respiratory Protection

SCBA OR SUPPLIED AIR RESPIRATORY PROTECTION REQUIRED FOR ENTRY INTO TANKS, VESSELS, OR OTHER CONFINED SPACES CONTAINING GASOLINE.

Ventilation

ADEQUATE TO MEET PERMISSIBLE CONCENTRATIONS.

Protective Gloves

NITRILE, TEFLON, VITON

Eye Protection

CHEMICAL−TYPE GOGGLES, FACE SHIELD

Other Protective Equipment

PROTECTIVE CLOTHING SUCH AS UNIFORMS, COVERALLS OR LAB COATS SHOULD BE WORN.

Work Hygienic Practices

LAUNDER OR DRY CLEAN WHEN SOILED.

Supplemental Safety and Health

WARNING STATEMENT: DANGER! EXTREMELY FLAMMABLE. HARMFUL OR FATAL IF SWALLOWED.

Physical/Chemical Properties

TOP

HCC: F1

NRC/State LIC No: N/R

Net Prop WT For Ammo:

Boiling Point:

B.P. Text: >90F,>32C

Melt/Freeze Pt:

M.P/F.P Text: NOT GIVEN

Decomp Temp:

Decomp Text: N.A.

Vapor Pres: >−350 MMHG

Vapor Density: 3 − 4.0

Volatile Org Content %:

Spec Gravity: 0.7 − .78

VOC Pounds/Gallon:

PH: N.A.

VOC Grams/Liter:

Viscosity: N/P

Evaporation Rate & Reference: N.D.

Solubility in Water: SLIGHT

Appearance and Odor: LIGHT STRAW TO LIGHT RED LIQUID

Percent Volatiles by Volume: 100 %

Corrosion Rate: N.A.

Reactivity Data

TOP

Stability Indicator: YES

Stability Condition To Avoid: HEAT, SPARKS, FLAME AND OTHER SOURCES OF IGNITION.

Materials To Avoid: STRONG OXIDIZERS

Hazardous Decomposition Products: TOXIC LEVELS OF CARBON MONOXIDE, CARBON DIOXIDE, IRRITATING ALDEHYDES AND KETONES.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization NONE. WILL NOT OCCUR.

:

Toxicological Information

TOP

Toxicological Information: N/P

Ecological Information

TOP

Ecological: N/P

MSDS Transport Information

TOP

Transport Information: N/P

Regulatory Information

TOP

Sara Title III Information: N/P

Federal Regulatory Information: N/P

State Regulatory Information: N/P

========== Other Information ==========

TOP

Other Information: N/P

==========

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.

MSDS Number: **N3660** * * * * * *Effective Date:* ***11/07/08*** * * * * * *Supercedes:* ***02/15/08***

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3
Product Codes:
J.T. Baker: 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670, 9761
Mallinckrodt: 1409, 2704, 2705, 2706, 2707, 2716, 6623, H862, H988, H993, H998, V077, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.
Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.
Fire Extinguishing Media:
Water spray may be used to keep fire exposed containers cool. Do not get water inside container.
Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® acid neutralizers are recommended for spills of this product.

---

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial*

Ventilation, A Manual of Recommended Practices, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.
Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3
Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

Conditions to Avoid:
Light and heat.

---

11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

```
--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
-------------------------------------   -----    -----------    -------------
Nitric Acid (7697-37-2)                  No          No            None
Water (7732-18-5)                        No          No            None
```

---

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

---

15. Regulatory Information

```
  --------\Chemical Inventory Status - Part 1\---------------------------------
  Ingredient                                        TSCA  EC   Japan  Australia
  ----------------------------------------------  ----  ---  -----  ---------
  Nitric Acid (7697-37-2)                            Yes  Yes
Yes      Yes
  Water (7732-18-5)                                  Yes  Yes
Yes      Yes

  --------\Chemical Inventory Status - Part 2\---------------------------------
                                                             --Canada--
  Ingredient                                        Korea  DSL   NDSL  Phil.
  ----------------------------------------------  -----  ---   ----  -----
  Nitric Acid (7697-37-2)                            Yes   Yes   No     Yes
  Water (7732-18-5)                                  Yes   Yes   No     Yes

  --------\Federal, State & International Regulations - Part 1\----------------
                                              -SARA 302-    ------SARA 313------
  Ingredient                                  RQ    TPQ     List  Chemical Catg.
  ----------------------------------------  ---   -----   ----  --------------
  Nitric Acid (7697-37-2)                     1000  1000    Yes        No
  Water (7732-18-5)                           No    No      No         No

  --------\Federal, State & International Regulations - Part 2\----------------
                                                         -RCRA-    -TSCA-
  Ingredient                                  CERCLA     261.33     8(d)
  ----------------------------------------  ------     ------    ------
  Nitric Acid (7697-37-2)                     1000       No         No
  Water (7732-18-5)                           No
No         No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: Yes Pressure: No
Reactivity: No          (Mixture / Liquid)
```

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**
Label Hazard Warning:
POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 14.
Disclaimer:
****
Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

THIS PAGE INTENTIONALLY BLANK

TABLE OF CONTENTS

Section 1 Project/Task Organization 1-1
1.1 Management Responsibilities 1-1
1.2 Quality Assurance Responsibilities 1-2
1.3 Project Chemist Responsibilities 1-3
1.4 Laboratory Responsibilities 1-3
1.5 Project Objectives 1-3
1.6 Project Schedule 1-4
1.7 Site Description 1-4
1.7.1 Current Data Input Requirements 1-4

Section 2 Quality Assurance Objectives for Measurement of Data 2-1
2.1 Precision 2-1
2.1.1 Definition 2-1
2.1.2 Field Precision Objectives 2-1
2.1.3 Laboratory Precision Objectives 2-1
2.2 Accuracy 2-1
2.2.1 Definition 2-1
2.2.2 Field Accuracy Objectives 2-2
2.2.3 Laboratory Accuracy Objectives 2-2
2.3 Representativeness 2-2
2.3.1 Definition 2-2
2.3.2 Measures to Ensure Representativeness of Field Data 2-2
2.3.3 Measures to Ensure Representativeness of Laboratory Data 2-2
2.4 Completeness 2-2
2.4.1 Definition 2-2
2.4.2 Field Completeness Objectives 2-3
2.4.3 Laboratory Completeness Objectives 2-3
2.5 Comparability 2-3
2.5.1 Definition 2-3
2.5.2 Measures to Ensure Comparability of Field Data 2-3
2.5.3 Measures to Ensure Comparability of Laboratory Data 2-3
2.6 Sensitivity 2-4
2.6.1 Definition 2-4
2.6.2 Sensitivity Requirements for Field Data 2-4
2.6.3 Sensitivity Requirements for Laboratory Data 2-4

Section 3 Special Training Requirements and Certification 3-1
3.1 Training 3-1
3.2 Certification 3-1

Section 4 Document and Records 4-1
4.1 QAPP Distribution 4-1
4.2 Data Reporting Format and Content 4-1
4.3 Records Disposition 4-1

TABLE OF CONTENTS

Section 5 Sampling Process Design 5-1
5.1 Sampling Procedures 5-1
5.2 Custody Procedures 5-1
5.2.1 Field Custody and Documentation Procedures 5-1
5.2.2 Laboratory Custody Procedures 5-4
5.2.3 Final Evidence Files 5-4

Section 6 Analytical Methods 6-1
6.1 Field Analytical Methods 6-1
6.2 Laboratory Analytical Methods 6-1
6.2.1 Total Petroleum Hydrocarbons 6-1
6.2.2 Metals 6-2

Section 7 Quality Assessment/Quality Control Measurement 7-1
7.1 Final Quality Control Checks 7-1
7.1.1 Field Quality Control Checks 7-1
7.2 Laboratory Quality Control Checks 7-1
7.2.1 Method Blank 7-2
7.2.2 Instrument Blank 7-2
7.2.3 Surrogate Spikes 7-2
7.2.4 Matrix Spikes and Matrix Spike Duplicates 7-2
7.2.5 Matrix Duplicates 7-2
7.2.6 Laboratory Control Samples 7-3

Section 8 Calibration Procedures and Frequency 8-1
8.1 Field Instrument Calibration 8-1
8.2 Laboratory Instrument Calibration 8-2
8.3 Standard/Reagent Preparation 8-2

Section 9 Preventive Maintenance 9-1
9.1 Field Instrument Preventive Maintenance 9-1
9.2 Laboratory Instrument Preventive Maintenance 9-1
9.3 Inspection/Acceptance Requirements for Supplies and Consumables 9-1

Section 10 Data Management 10-1

Section 11 Assessment and Response Actions 11-1
11.1 Field Performance and System Audits 11-1
11.1.1 Internal Field Audits 11-1
11.1.2 External Field Audits 11-1
11.1.2.1 External Field Audit Process 11-1
11.2 Performance and System Audits 11-2
11.2.1 Performance Audits 11-2
11.2.2 System Audits 11-2
11.2.3 Audit Records 11-2
11.3 Laboratory Performance and Systems Audits 11-2

TABLE OF CONTENTS

11.3.1 Internal Laboratory Audits (Bench Audit) 11-3
11.3.2 External Laboratory Audits 11-3
11.4 Specific Routine Procedures Used to Evaluate Data Precision, Accuracy, and Completeness 11-4
11.4.1 Accuracy Assessment 11-5
11.4.2 Precision Assessment 11-5
11.4.3 Completeness Assessment 11-6
11.5 Overall Assessment of Data 11-6

Section 12 Corrective Actions 12-1
12.1 Field Corrective Action 12-1
12.2 Laboratory Corrective Action 12-1
12.3 Corrective Action During Data Review/Validation 12-1

Section 13 Quality Assurance Reports to Management 13-1
13.1 Frequency, Contents, and Distribution of Monthly Progress Reports ... 13-1

Section 14 Data Review, Validation, and Reporting 14-1
14.1 Data Review and Validation 14-1
14.1.1 Laboratory Internal Data Review 14-1
14.1.2 URS Data Review and Validation 14-1
14.2 Reconciliation with User Requirements 14-2

Section 15 References 15-1

TABLE OF CONTENTS

List of Tables

Table 1-1	Laboratory Analytical Methods
Table 2-1	Accuracy and Precision for Total Petroleum Hydrocarbons Analysis
Table 2-2	Accuracy and Precision for Metals Analysis
Table 2-3	Surrogate Compound Accuracy Criteria
Table 2-4	Method Detection Limits, Reporting Limits, and Screening Levels for Total Petroleum Hydrocarbons Analysis
Table 2-5	Method Detection Limits, Reporting Limits, and Screening Levels for Metals Analysis
Table 5-1	Sample Containers, Preservation, and Holding Times
Table 7-1	Data Review/Validation Criteria for USEPA Method SW8015B
Table 7-2	Data Review/Validation Criteria for USEPA Method SW6010B

List of Figures

Figure 1-1	Project Management Team

TABLE OF CONTENTS

List of Acronyms

µg/L	micrograms per liter
ADR	automated data review
AFB	Air Force Base
APPL	Agriculture and Priority Pollutants Laboratories, Inc.
°C	Degrees Celsius
CENWO	Corps of Engineers, Northwestern Division Omaha District
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CMS	Corrective Measures Study
COA	Certificate of Analysis
COC	chain of custody form
COPC	chemicals of potential concern
CX	Center of Expertise
DoD	Department of Defense
DoD QSM	Department of Defense Quality Systems Manual
DQCR	daily quality control report
DQO	data quality objective
DRO	diesel range organics
EM	Engineering manual
EMAX	EMAX Laboratories, Inc.
ERPIMS	Environmental Restoration Program Information Management System
ERSC	Environmental Restoration Services Contract
FSP	Field Sampling Plan
GC	gas chromatography
GC-MS	gas chromatography-mass spectrometry
GRO	gasoline range organics
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	High density polyethylene
HNO_3	nitric acid
HTRW	Hazardous, Toxic and Radioactive Waste
ICP	inductively coupled plasma
ID	identification
J	estimated
LCS	laboratory control sample

LCSD	laboratory control sample duplicate
MDL	method detection limit
mg/kg	milligram per kilogram
mL	milliliter
MS/MSD	matrix spike/matrix spike duplicate
N/A	not applicable
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
NMAC	New Mexico Administrative Code
ORO	oil range organics
OSHA	Occupational Health and Safety Administration
oz	ounce
PARCCS	precision, accuracy, representativeness, completeness, comparability and sensitivity
PE	Professional Engineer
pH	hydrion ion exponent
PhD	Doctor of Philosophy
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	quality control
%R	percent recovery
R	rejected
RFP	request for proposal
RL	reporting limit
RPD	relative percent difference
SCFS	sample collection field sheet
SOP	standard operating procedure
SOW	statement of work
SSL	soil screening levels

SWMU	Solid Waste Management Unit
TAL	target analyte list
TPH	Total Petroleum Hydrocarbons
U	nondetect
UJ	estimated nondetect
URS	URS Group, Inc.
U.S.	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WP	work plan

THIS PAGE INTENTIONALLY BLANK

TITLE/SIGNATURE PAGE
DRAFT QUALITY ASSURANCE PROJECT PLAN
CORRECTIVE MEASURES STUDY
CANNON AIR FORCE BASE, CURRY COUNTY, NEW MEXICO
MAY 2009

USACE Project Manager **Jerome Stolinski**	Date
USACE QA Officer/Project Chemist **TBD**	Date
	5/28/09
URS Project Manager **Jeff Voelker**	Date
	5/28/09
URS QA Officer **Robert Goodwin, P.G.**	Date
Agriculture & Priority Pollutants Laboratories QA Officer **Frances Lediaev**	Date
EMAX Laboratories, Inc. QA Officer **Kenette Pimentel**	Date

THIS PAGE INTENTIONALLY BLANK

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

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

URS Group, Inc. (URS) has been contracted by the United States Army Corps of Engineers (USACE) Omaha District (CENWO) to complete a Corrective Measures Study (CMS) at Solid Waste Management Unit (SWMU) 103, Playa Lake at Cannon Air Force Base (AFB). The purpose of the CMS is to develop Corrective Measures Alternatives and to recommend the selected final Corrective Measure(s) for SWMU 103.

1.1 MANAGEMENT RESPONSIBILITIES

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

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

URS Program Manager - (Jeff Williamson, P.E.) – Mr. Williamson is the Program Manager is the Principal-in-Charge for URS, and has overall responsibility to the Omaha District for execution of the delivery order under URS's Environmental Restoration Services Contract (ERSC).

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

URS Program Health and Safety Officer (Dennis Day, CIH) – Mr. Day reports directly to the URS PM and will be responsible for ensuring that all URS safety procedures for this project are being followed.

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

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

URS Project Health and Safety Officer (Tony Host) is responsible for developing the health and safety plan for the project and communication of all health and safety issues with the URS Field Manager. The URS Project Health and Safety Officer will address any issues that arise during field operations.

URS Risk Assessor (Melanie Karst, Ph.D.) will perform the Human Health Assessment for the project.

1.2 QUALITY ASSURANCE RESPONSIBILITIES

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

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

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

URS QA Officer (Robert Goodwin, Ph.D.) – Mr. Goodwin is responsible for ensuring all field and laboratory procedures follow those protocols established in the QAPP and meet the regulatory guidance. Additional responsibilities for the project include:

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

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

URS PM. The URS QA Officer or Senior Chemist should serve as the peer reviewer of the QAPP prior to the submittal to the USACE.

Agriculture & Priority Pollutants Laboratories (APPL) (Frances Lediaev) and EMAX Laboratories, Inc (Kenette Pimentel) QA Officers – Ms. Lediaev and Ms. Pimentel have the responsibility to ensure the laboratory protocols are being followed as required by the QAPP. The QA Officers will review each chemical data package prior to submission to URS. It is the responsibility of the QA Officers to report any technical deficiencies to the laboratory manager and to implement corrective actions. The QA Officers are responsible for informing the URS QA Officer of any issues that may impact data quality. This includes deviations from established protocols. The QA Officers responsibilities include:

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

1.3 PROJECT CHEMIST RESPONSIBILITIES

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

1.4 LABORATORY RESPONSIBILITIES

APPL and EMAX are responsible for the analysis of samples as identified in this QAPP and will report chemical data as identified in **Section 4**. In addition, daily responsibilities include the verification of sample preservation and the temperature of each sample cooler upon receipt. The laboratory PM's, APPL (Diane Anderson) and EMAX (Molly Nguyen) will communicate any cooler temperatures that are not within $4^{o}C \pm 2^{o}C$ to the URS Field Manager and URS Project Chemist. The laboratory will also verify that the required chemical preservatives have been marked on the sample labels and chain of custody (COC) forms. Any discrepancies between the COC and sample labels will be brought to the attention of the URS Field Manager and URS Project Chemist and will be resolved immediately.

1.5 PROJECT OBJECTIVES

The objective of the Cannon AFB CMS is to develop and evaluate Corrective Measures Alternatives and to recommend the final Corrective Measure(s) that is most cost effective, most reliable and easiest to implement for SWMU 103, Playa Lake. **Section 4** of the WP discusses the project objectives.

1.6 PROJECT SCHEDULE

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

1.7 SITE DESCRIPTION

The SWMU 103, Playa Lake description, including location, size and boundaries, history and historical and present uses are presented in **Sections 3.1** and **3.2** of the WP.

1.7.1 Current Data Input Requirements

The following collectively summarizes the data inputs required to meet the project data quality objectives (DQOs) at Cannon AFB. Data input requirements are further detailed in **Section 11.4** of this QAPP and DQOs are discussed in **Section 4** of the WP.

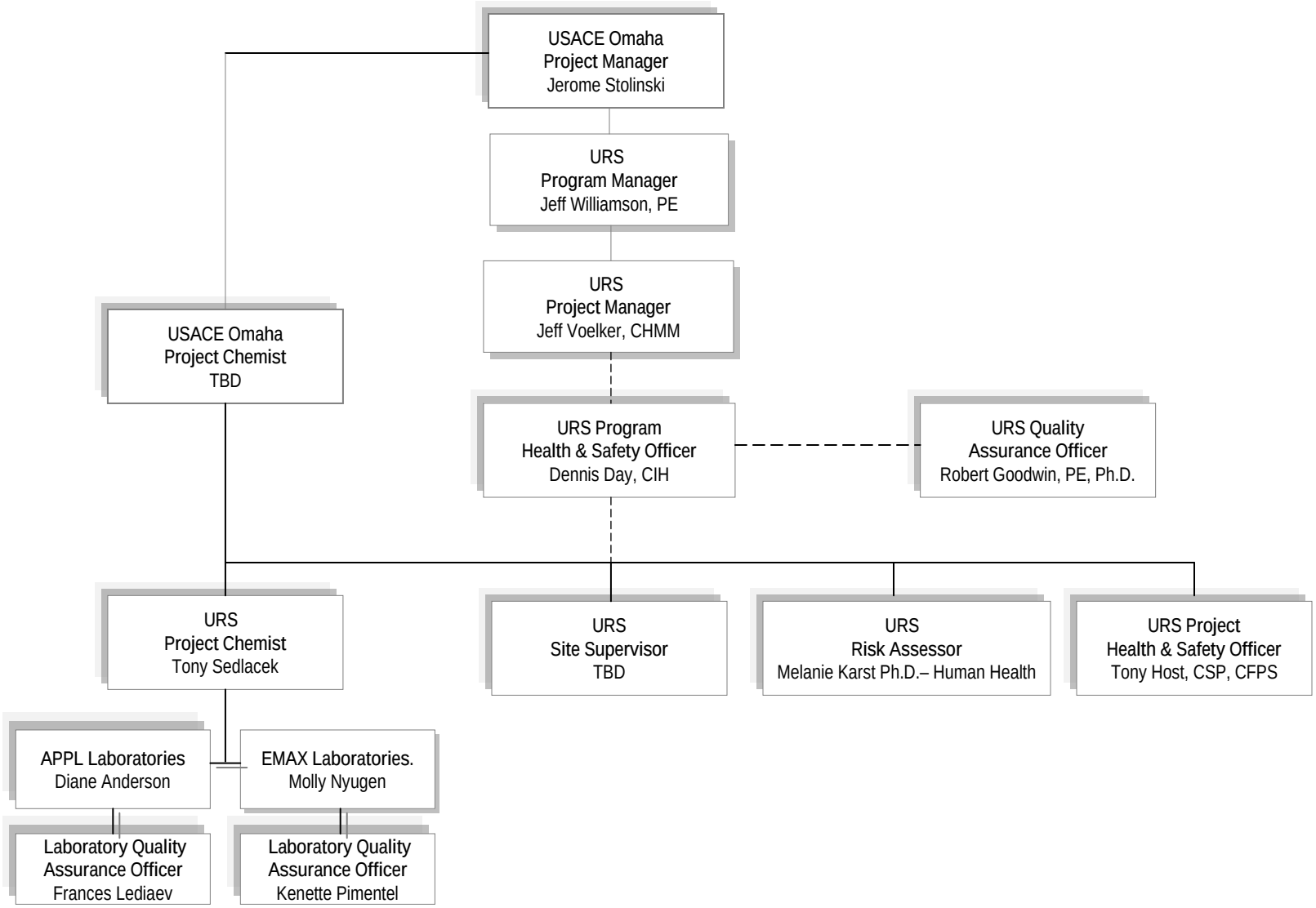
Sediment and surface water samples will be collected within SWMU 103, Playa Lake, to evaluate potential impacts to human and ecological receptors from Chemicals of Concern (CoCs). Sediment samples will be analyzed for total petroleum hydrocarbons (TPH) – diesel range organics (DRO), TPH – oil range organics (ORO), TPH– gasoline range organics (GRO), project specific metals (arsenic, vanadium, silver and selenium). Surface water samples will be analyzed for project specific total and dissolved metals (lead, silver and selenium). The list of analytical procedures is identified in **Table 1-1**.

TABLE 1-1
LABORATORY ANALYTICAL METHODS
CANNON AIR FORCE BASE, NEW MEXICO

		Preparation Method		
Parameter	**Analyte List**	**Surface Water**	**Sediment**	**Analytical Method**
Total Petroleum Hydrocarbons	TPH-DRO, TPH-ORO	N/A	3540C	USEPA SW-846 8015B
Total Petroleum Hydrocarbons	TPH-GRO	N/A	5030B/5035	USEPA SW-846 8015B
Metals	Project Analyte List*	3010A	3050B	USEPA SW-846 6010B

Notes: All metals will be analyzed by USEPA SW-846 Method 6010B. Surface water will be analyzed for total and dissolved metals.
Metals will be filtered and preserved in the field.
*Project Analyte List is shown in Table 3-9
Method = Preparation is provided in the method
USEPA SW-846 = Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, USEPA SW-846, Final Update IV.
USEPA = United States Environmental Protection Agency
TPH = Total Petroleum Hydrocarbon
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ORO = Oil Range Organics
N/A = Not Applicable

THIS PAGE INTENTIONALLY BLANK



URS

PROJECT NO.	PROJECT MANAGEMENT TEAM CANNON AIR FORCE BASE	FIGURE NO.
16170402		1-1

Q:\1617\0402\CMS WP\QAPP\Fig1-1_rev0.ppt

THIS PAGE INTENTIONALLY BLANK

The overall QA objective for this project is to develop and implement procedures for field and laboratory activities that will provide results that will meet the project objectives and are legally defensible in a court of law. This section will provide in greater detail specific project objectives and intended data usages mentioned in **Section 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.

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

2.1 PRECISION

2.1.1 Definition

Precision refers to the degree to which repeated measurements are similar to one another. It measures the agreement (reproducibility) among individual measurements, obtained under prescribed similar conditions. Measurements that are precise are in close agreement. The equations to be used for precision in this project can be found in **Section 11** of this QAPP. Precision control limits for chemical data are provided in **Tables 2-1** and **2-2**.

2.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates and QA splits at an approximate rate of ten percent duplicate/split of analytical samples collected. The anticipated number of duplicates/splits for this project is found in **Tables 5-1** and **5-2** of the WP.

2.1.3 Laboratory Precision Objectives

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

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

2.2 ACCURACY

2.2.1 Definition

Accuracy is defined as the measure of the closeness of an individual measurement or the average of a number of measurements to the true value. This measurement is generally determined by the percent recovery (%R) of a known value. The equation to be used for accuracy in this

project can be found in **Section 11** of this QAPP. Accuracy control limits are given in **Tables 2-1** through **2-3**.

2.2.2 Field Accuracy Objectives

Accuracy in the field is assessed by the adherence to all sample handling, preservation, and holding time criteria.

2.2.3 Laboratory Accuracy Objectives

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

2.3 REPRESENTATIVENESS

2.3.1 Definition

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

2.3.2 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 WP is followed and that proper sampling techniques are used. These will include the analysis of method blank data. In designing the sampling program, media of concern have been specified.

2.3.3 Measures to Ensure Representativeness of Laboratory Data

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

2.4 COMPLETENESS

2.4.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected under correct, normal conditions. For this project, data will be considered complete if all QC elements have met the criteria established in this QAPP. Qualified

data will be considered usable, and therefore will be considered complete. Data qualified as rejected (**R**) will not be considered usable or complete. The equation for completeness is presented in **Section 11** of this QAPP.

2.4.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid field measurements obtained from all field measurements taken during the investigation. Completeness is impacted if field measurements and/or a sample were not collected from a specified location due to environmental conditions. The equation for completeness is presented in **Section 11** of this QAPP. The completeness goal for field measurements and sample collection is 100 percent.

2.4.3 Laboratory Completeness Objectives

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

2.5 COMPARABILITY

2.5.1 Definition

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

2.5.2 Measures to Ensure Comparability of Field Data

Measures to ensure field data are comparable will include all persons reviewing the QAPP and Field Sampling Plan (FSP) prior to mobilization to Cannon AFB. The URS Field Manager will routinely oversee field activities to verify they are being completed as identified in the SOPs. The URS Field Manager will document the oversight findings in the daily reports to management. Any non-compliance issues will be addressed as identified in the Corrective Actions (**Section 12**) of this QAPP.

2.5.3 Measures to Ensure Comparability of Laboratory Data

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

2.6 SENSITIVITY

2.6.1 Definition

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

2.6.2 Sensitivity Requirements for Field Data

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

2.6.3 Sensitivity Requirements for Laboratory Data

The laboratory MDLs, RLs and project sensitivity goals are identified in **Tables 2-4** and **2-5**. The laboratory will establish MDLs annually and will analyze MDL verification samples on a quarterly basis. MDL studies for each compound are available upon request. RL verification samples will be analyzed with each instrument calibration.

TABLE 2-1
ACCURACY AND PRECISION FOR TOTAL PETROLEUM HYDROCARBONS ANALYSIS
CANNON AIR FORCE BASE, NEW MEXICO

	Accuracy (%R)	Precision (RPD)
Spiking Compound	**Sediment**	**Sediment**
Total Petroleum Hydrocarbons		
Diesel Range Organics	64-122	30
Gasoline Range Organics	37-150	30
Oil Range Organics	50-150	30

Note: The accuracy and precision values are applicable to MS/MSD and LCS/LCSD samples.
%R = Percent recovery
LCS/LCSD = Laboratory control sample/Laboratoy control sample duplicate
MS/MSD = Matrix spike/matrix spike duplicate
RPD = Relative percent difference

THIS PAGE INTENTIONALLY BLANK

TABLE 2-2
ACCURACY AND PRECISION FOR METALS ANALYSIS
CANNON AIR FORCE BASE, NEW MEXICO

	LCS Accuracy (%R)		Precision (RPD)	
Spiking Compound	**Water**	**Sediment**	**Water**	**Sediment**
Arsenic	N/A	80-120	N/A	20
Lead	80-120	N/A	20	N/A
Selenium	80-120	80-120	20	20
Silver	80-120	80-120	20	20
Vanadium	N/A	80-120	N/A	20

Notes: The precision values are applicable to MS/MSD and LCS/LCSD samples.
All metals will be analyzed by USEPA SW-846 Method 6010B. Surface water will be analyzed for total and dissolved metals.
Metals samples will be filtered and preserved in the field.
%R = Percent recovery
LCS/LCSD = Laboratory control sample/Laboratoy control sample duplicate
MS/MSD = Matrix spike/Matrix spike duplicate
RPD = Relative percent difference
N/A = Not Applicable
USEPA = United States Environmental Protection Agency

THIS PAGE INTENTIONALLY BLANK

TABLE 2-3
SURROGATE COMPOUND ACCURACY CRITERIA
CANNON AIR FORCE BASE, NEW MEXICO

QC Parameter	Surrogates	Accuracy (%R) Sediment
TPH-DRO/TPH-ORO	Octacosane	70-120
	Ortho-Terphenyl	75-120
TPH-GRO	Bromofluorobenzene	40-125

%R - Percent recovery
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ORO = Oil Range Organics
QC = Quality Control
TPH = Total Petroleum Hydrocarbons

THIS PAGE INTENTIONALLY BLANK

TABLE 2-4
METHOD DETECTION LIMITS, REPORTING LIMITS AND SCREENING LEVELS FOR TOTAL PETROLEUM HYDROCARBONS
CANNON AIR FORCE BASE, NEW MEXICO

	Sediment (mg/kg)		Screening	
Total Petroleum Hydrocarbons	**MDL**	**RL**	**Levels (mg/kg)**	**Source**
Diesel Range Organics	6.46E-01	1.00E+00	2.50E+03	SSL
Gasoline Range Organics	3.40E-01	1.00E+00	2.50E+03	SSL
Oil Range Organics	3.51E+00	1.00E+01	2.50E+03	SSL

Undetermined values display a dash in the associated cell.

mg/kg = milligram per kilogram

MDL = Method Detection Limit

RL = Reporting Limit

SSL = TPH Screening Guideline (NMED 2006)

TPH = Total Petroleum Hydrocarbon

THIS PAGE INTENTIONALLY BLANK

TABLE 2-5
METHOD DETECTION LIMITS, REPORTING LIMITS AND SCREENING LEVELS FOR METALS ANALYSIS
CANNON AIR FORCE BASE, NEW MEXICO

	Surface Water (µg/L)				Sediment (mg/kg)		Residential	
Metals	MDL	RL	Screening Levels (µg/L)	Source	MDL	RL	Screening Levels (mg/kg)	Source
Arsenic	N/A	N/A	N/A	N/A	1.74E-01	1.00E+00	3.90E+00	SSLs
Lead	1.10E-01	2.00E-01	-	-	N/A	N/A	N/A	N/A
Selenium	1.00E-01	1.00E+00	4.20E+03 *	NMAC	2.44E-01	1.00E+00	3.91E+02	SSLs
Silver	3.00E-02	2.00E-01	-	-	3.60E-02	2.00E+00	3.91E+02	SSLs
Vanadium	N/A	N/A	N/A	N/A	5.60E-02	2.00E+00	7.82E+01	SSLs

Note: All analytes will be determined by inductively coupled plasma (ICP) unless otherwise noted.
All metals will be analyzed by USEPA SW-846 Method 6010B. Surface water will be analyzed for total and dissolved metals.
Surface water samples will be filtered and preserved in the field.
*Screening level is for dissolved fraction in surface water only.
Undetermined values display a dash in the associated cell.
mg/kg = milligram per kilogram
µg/L = microgram per Liter
MDL = Method Detection Limit
NMAC = New Mexico Administrative Code. Title 20 Environmental Protection. Chapter 6 Water Quality. Part 4 Standards for interstate and intrastate surface waters. Section 20.6.4.900 Subsections J.
RL = Reporting Limit
USEPA = United States Environmental Protection Agency
N/A = Not Applicable
SSL = TPH Screening Guideline (NMED 2006)

THIS PAGE INTENTIONALLY BLANK

3.1 TRAINING

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

3.2 CERTIFICATION

The contract laboratories have current National Environmental Laboratory Accreditation Program (NELAP) certification. APPL and EMAX are compliant with the most recently published version of the DoD QSM. No additional certifications are required for this investigation.

THIS PAGE INTENTIONALLY BLANK

4.1 QAPP DISTRIBUTION

The URS PM and QA officer will be responsible for ensuring that each project member has access to the most current version of the QAPP and applicable addenda. Documents required as a result of this investigation include the daily quality control reports (DQCR), field and laboratory audit reports (if completed), corrective measures report.

4.2 DATA REPORTING FORMAT AND CONTENT

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

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

The contents of the raw data package include:

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

4.3 RECORDS DISPOSITION

All project files and records will be stored on-site until the Final Report has been approved by USACE. The project files will be moved to an off-site storage facility for a minimum of 10

years. Project information can be attained through a written request to the URS PM. The requested information should be available within 7 working days.

5.1 SAMPLING PROCEDURES

The sampling procedures to be used during the field activities will be consistent for the objectives of this project. The SOPs are presented in **Section 5** of the WP. Sample containers, preservatives, and holding time requirements for each parameter and matrix are presented in **Table 5-1**.

5.2 CUSTODY PROCEDURES

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

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

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

5.2.1 Field Custody and Documentation Procedures

Verifiable sample custody is an integral part of all field and laboratory operations associated with Cannon AFB. Traceable steps will be taken in the field and in the laboratory to document and ensure that all samples have been properly acquired, preserved, identified, and that sample integrity has not been jeopardized. The following sections provide detail related to completing verifiable field and laboratory documentation. Field documentation procedures are outlined in SOP 6 - Sample Identification, Handling, Documentation, Shipping and Tracking.

Field Logbook

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

- Project name and number
- Date
- Signature of any team member entering information on each respective page
- Current weather conditions and daily forecast

- Names of all personnel on site, including subcontractors and site visitors
- Initial personal protective equipment (PPE) level
- Health and safety information

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

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

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

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

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

Chain-of-Custody

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

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

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

The laboratory will compare the samples entered on the COC forms with the sample containers received by the laboratory. If the laboratory finds any discrepancies, the laboratory will contact the URS Project Chemist for resolution. The COC forms will be the primary source of information for the laboratory to enter data into the laboratory's sample tracking system. Additional chain-of-custody procedures are detailed in SOP 6.

Sample coolers packaging is an integral part of field activities. Procedures for proper sample packaging will be followed as identified in SOP 6.

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

Sample Collection Field Sheets

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

Photographic Documentation

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

Sample Identification and Labeling

Samples collected during the Cannon AFB activities will have discrete sample identification numbers. The unique sample identifications are necessary to identify and track each of the many samples collected for analysis during the duration of the project. Whenever possible, sample-labeling procedures from previous investigations will be followed. Samples collected

during the field activities at Cannon AFB will be labeled with unique sample numbers as indicated in SOP 6.

5.2.2 Laboratory Custody Procedures

Laboratory custody procedures for sample receiving and log-in; sample storage and numbering; sample tracking during preparation and analysis; and storage of data are described in detail in APPL Laboratories QAPP and EMAX Quality Assurance Manual (QAM). A copy of the laboratory QAPP is available upon request.

5.2.3 Final Evidence Files

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

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

TABLE 5-1
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES
CANNON AIR FORCE BASE, NEW MEXICO

	Parameter	Container	Preservative	Holding Time Extraction/Analysis
Surface Water Samples	Metals*	(2) 500 mL HDPE	4°C	6 months to analysis
	Metals	(2) 500 mL HDPE	4°C, HNO_3 to pH < 2.0	6 months to analysis
Sediment Samples	TPH-GRO	(2) 4 oz teflon lined glass jars	4^oC	14 Days to analysis
	TPH-DRO	8 oz teflon lined glass jar	4^oC	14 Days to extract / 40 Days to analysis
	TPH-ORO	8 oz teflon lined glass jar	4^oC	14 Days to extract / 40 Days to analysis
	Metals	8 oz teflon lined glass jar	4°C	6 months to analysis

Sample containers will arrive on-site already prepared with the appropriate preservative.
* Samples will be filtered and preserved in the field.
< = less than
^oC = degree Celsius
mL = milliliter
HCl = Hydrochloric Acid
HDPE = High Density Polyethylene
HNO_3 = Nitric acid
pH = hydrion ion exponent
TPH = Total Petroleum Hydrocarbon
DRO = Diesel Range Organics
GRO = Gasoline Range Organics
ORO = Oil Range Organics
oz = ounce

THIS PAGE INTENTIONALLY BLANK

Sediment and surface water samples will be collected during field activities as part of Cannon AFB sampling. Sediment and surface water samples will be submitted to APPL of Clovis, California. Samples will be analyzed following the methodologies specified in **Table 1-1**. Each analytical method is summarized below.

Hard copy analytical data packages from the laboratory will consist of the QC summary. A pdf copy of the QC summary and raw data package will be provided. A detailed summary of the contents of the data packages is included in **Section 4** of this QAPP. In addition, the laboratory will submit electronic data in ADR and ERPIMS Prime Project formats. The turnaround time for all data (hard copy and electronic) will be 21 calendar days.

6.1 FIELD ANALYTICAL METHODS

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

Field Measurement	Field Instrument
Specific Conductance	YSI Model 556 MPS or equivalent
Turbidity	LaMotte Model 2020 Turbidity Meter or equivalent
Dissolved Oxygen	YSI Model 556 MPS or equivalent
pH	YSI Model 556 MPS or equivalent
Temperature	YSI Model 556 MPS or equivalent

6.2 LABORATORY ANALYTICAL METHODS

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

6.2.1 Total Petroleum Hydrocarbons

USEPA SW-846 Method 8015B is a gas chromatography (GC) method for determining volatile and extractable petroleum hydrocarbons in solid and liquid matrices. Volatile petroleum hydrocarbons include TPH-GRO and extractable petroleum hydrocarbons include TPH-DRO and TPH-ORO. TPH-GRO corresponds to the hydrocarbon range of C_6-C_{10}, DRO corresponds to the hydrocarbon range of C_{10} to C_{28} and ORO corresponds to the hydrocarbon range of C_{28}-C_{35}. TPH-GRO samples will be prepared using USEPA Method 5035 (sediment), TPH-DRO and TPH-ORO sediment samples will be prepared using USEPA Method 3540C and analyzed using USEPA Method 8015B. The list of target analytes, MDLs and RLs are shown in **Table 2-4**.

6.2.2 Metals

The metals analyses for SWMU 103, Playa Lake consists of project specific target analyte list (TAL) of metals. Samples for metals analysis will be prepared by USEPA SW-846 Methods 3010A (aqueous) and 3050B (sediment). Aqueous metals samples will be prepared and analyzed for the project specific TAL metals following Methods 6010B. Method 6010B involves inductively coupled plasma (ICP) emission spectroscopy to measure characteristic emission spectra by optical spectrometry. The list of target analytes, MDLs and RLs are shown in **Table 2-5**

7.1 FINAL QUALITY CONTROL CHECKS

The overall QA objectives for SWMU 103, Playa Lake are to develop and implement QC procedures for field and laboratory activities that will provide data with the degree of quality consistent with the intended use. The sample set, chemical analysis results, and interpretations should be based on data that meet or exceed QA objectives established for the project.

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

7.1.1 Field Quality Control Checks

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

Field Duplicate Samples

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

Field QA Split Samples

A field QA split sample is a field duplicate sample that is submitted to a second laboratory for analysis and will be used to assess laboratory measurement bias. All QA split samples will be analyzed for the parameters listed in **Table 1-1**. QA split samples will be collected at an approximate rate of five percent and sent to EMAX Laboratories, Inc. The QA split will be used to monitor the overall QA of the project.

7.2 LABORATORY QUALITY CONTROL CHECKS

APPL has a QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical methods are documented in written SOPs. Each SOP includes a QC section, which addresses the minimum requirements for the procedure. The following paragraphs describe the QC samples required for SWMU 103, Playa Lake. Evaluation criteria for data review and validation are included in **Tables 7-1** and **7-2**.

7.2.1 Method Blank

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

7.2.2 Instrument Blank

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

7.2.3 Surrogate Spikes

Surrogate spikes are compounds that will be added to every blank, standard, sample and matrix spike sample as specified in the analytical methodology. Surrogate compounds are generally brominated, fluorinated, or isotopically labeled compounds not expected to be in environmental samples. The results of the surrogate spike will be used to evaluate the accuracy of the analytical measurement on a sample-specific basis. Surrogate compound recovery criteria are presented in **Table 2-3**.

7.2.4 Matrix Spikes and Matrix Spike Duplicates

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

Evaluation criteria for MS/MSD samples are dependent upon sample matrix, analytical instrumentation and analytical method requirements. Evaluation criteria for MS/MSD samples are included in **Tables 2-1** and **2-2**.

7.2.5 Matrix Duplicates

A matrix duplicate (or laboratory duplicate) is a separate aliquot of a sample taken from the sample container and carried through each step of the preparation and analytical method for metals. The results of matrix duplicates will be reported as RPD and will be evaluated to assess laboratory and method precision. Matrix duplicates will be completed for metals analysis. Matrix duplicate criteria are identified in **Table 2-2**.

7.2.6 Laboratory Control Samples

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

Evaluation criteria for LCS are dependent upon sample matrix, analytical instrumentation and analytical method requirements. LCS evaluation criteria are identified in **Tables 2-1** and **2-2**.

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

THIS PAGE INTENTIONALLY BLANK

TABLE 7-1
DATA REVIEW/VALIDATION CRITERIA FOR USEPA METHOD SW8015B
CANNON AIR FORCE BASE, NEW MEXICO

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	URS Flagging Criteria
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed.	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study.	Samples cannot be analyzed without a valid MDL.	Apply **R**-flag to data without a valid MDL study
Holding time	Every sample	Soil TPH-DRO and TPH-ORO: 14 days to extraction, 40 days to analysis. Soil TPH-GRO: 14 days to analysis.	Contact URS as to additional measures to be taken.		Apply **J**-flag to detects and **UJ**-flag to nondetects to samples < 2X holding time criteria. Apply **J**-flag to detects and **R**-flag to nondetects to samples > 2X holding time criteria.
Sample temperature	Every cooler	4±2 °C	Contact URS as to additional measures to be taken.	None	Samples arriving at temperature 6-10°C, apply **J**-flag to detects and **UJ**-flag to nondetects. Samples arriving at temperature > 10°C, apply **J**-flag to detects and **R**-flag to nondetects.
Minimum five point initial calibration for all analytes (ICAL)	Initial calibration prior to sample analysis	One of the options below: Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be used for second order, 7 points shall be used for third order)	Correct problem then repeat initial calibration		Apply **R**-flag to data without a valid ICAL
Second source calibration verification	Once after each initial calibration	Value of second source for all analytes within ± 20% of expected value (initial source)	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.	Apply **R**-flag to data without second source verification

TABLE 7-1
DATA REVIEW/VALIDATION CRITERIA FOR USEPA METHOD SW8015B
CANNON AIR FORCE BASE, NEW MEXICO

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	URS Flagging Criteria
Retention time window verification	Each calibration verification standard	Analyte within established window	Correct problem, then reanalyze all samples analyzed since the last acceptable retention time check. If they fail, redo ICAL and reset retention time window	No samples shall be run without a verified retention time window at the initial calibration	Apply **R**-flag to data outside retention time window
Calibration verification (ICV and CCV)	ICV: Daily, before sample analysis. CCV: After every 10 field samples and at the end of the analysis sequence.	All analytes within ± 20% of expected value form ICAL	ICV: Correct problem, rerun ICV. If that fails, repeat initial calibration. CCV: Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification	If %D for an individual analyte is > 20%, no samples may be analyzed until the problem has been corrected	**ICV:** Apply **R**-flag to data with ICV outside criteria. **CCV**: High bias: Apply **J**-flag to detects. Low bias: Apply **J**-flag to detects and **UJ**-flag to nondetects.
Method blank	One per preparatory batch	No analytes detected > 1/2 RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	None	Apply **U**-flag to analytes detected in field samples < 5X blank contamination.
Laboratory control sample (LCS)	One per preparatory batch	QC acceptance criteria specified in QAPP **Table 2-1.**	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	LCS should contain all analytes to be reported, including surrogates	High bias: Apply **J**-flag to detects. Low bias: Apply **J**-flag to detects and **UJ**-flag to nondetects. Very low bias (%R<10%): Apply **J**-flag to detects and **R**-flag to nondetects.
Matrix spike/Matrix spike duplicate (MS/MSD)	One per preparatory batch per matrix	QC acceptance criteria specified in QAPP **Table 2-1.** RPD ≤ 30% (between MS and MSD)	Examine the project-specific DQOs. Contact URS as to additional measures to be taken.	For matrix evaluation only. If MS results are outside QC limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error.	For the specific analyte(s) in the parent sample, apply **J**-flag to detects if acceptance criteria are not met.

TABLE 7-1
DATA REVIEW/VALIDATION CRITERIA FOR USEPA METHOD SW8015B
CANNON AIR FORCE BASE, NEW MEXICO

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	URS Flagging Criteria
Surrogate spike	All field and QC samples	QC acceptance criteria specified in QAPP **Table 2-3**.	For QC and field samples, correct problem, then reprep and reanalyze all failed samples for failed surrogates in the associated preparatory batch, if sufficient sample material is available.	Analytes identified in QAPP **Table 2-3**.	High bias: Apply **J**-flag to detects Low bias: Apply **J**-flag to detects and **UJ**-flag to nondetects. Very low bias (%R<10%): Apply **J**-flag to detects and **R**-flag to nondetects.
Field Duplicate	One per 10 field samples	If both the parent and duplicate values are > 5X the RL, then 50% RPD for soils and 25% RPD for waters. If either the parent or duplicate value is < 5X the RL, then the difference between the parent and duplicate must be < 2X the RL.	N/A	N/A	Apply **J**-flag to detects and **UJ**-flag to nondetects

THIS PAGE INTENTIONALLY BLANK

TABLE 7-2
DATA REVIEW/VALIDATION CRITERIA FOR USEPA METHOD SW6010B
CANNON AIR FORCE BASE, NEW MEXICO

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	URS Flagging Criteria
MDL study	At initial set-up and subsequently once per 12-month period; otherwise quarterly MDL verification checks shall be performed.	See 40 CFR 136B. MDL verification checks must produce a signal at least 3 times the instrument's noise level.	Run MDL verification check at higher level and set MDL higher or reconduct MDL study.	Samples cannot be analyzed without a valid MDL.	Apply **R-**flag to data without a valid MDL study.
IDL study (ICP only)	At initial set-up and after significant change	Detection limits established shall be $\leq$ MDL	N/A	Samples cannot be analyzed without a IDL.	Apply **R-**flag to data without a valid IDL study
Holding time	Every sample	Metals sediment samples: 6 months Metals aqueous samples (total and dissolved): HNO_3 to pH < 2.0, 6 months	Contact URS as to additional measures to be taken.	None	Apply **J-**flag to detects and **UJ-**flag to nondetects to samples < 2X holding time criteria. Apply **J-**flag to detects and **R-**flag to nondetects to samples > 2X holding time criteria.
Sample temperature	Every cooler	4 $\pm$ 2 °C	Contact URS as to additional measures to be taken.	None	Samples arriving at temperature 6-10°C, apply **J-**flag to detects and **UJ-**flag to nondetects. Samples arriving at temperature > 10°C, apply **J-**flag to detects and **R-**flag to nondetects.
Initial Calibration (ICAL). Minimum three calibration standards and a calibration blank	Hexavalent chromium: Initial calibration prior to sample analysis	r > 0.995	Correct problem then repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.	Apply **R-**flag to data without a valid ICAL.
Initial calibration for all analytes (ICAL) ICP: minimum of two standards and a blank	Metals: Initial calibration prior to sample analysis		Correct problem then repeat initial calibration.		Apply **R-**flag to data without a valid ICAL.

TABLE 7-2
DATA REVIEW/VALIDATION CRITERIA FOR USEPA METHOD SW6010B
CANNON AIR FORCE BASE, NEW MEXICO

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	URS Flagging Criteria
Second source calibration verification (ICV)	Once after each initial calibration, prior to sample analysis	Value of second source for all analytes within ± 10% of expected value (initial source)	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat initial calibration.	Problem must be corrected. No samples may be run until calibration has been verified.	Apply **R-**flag to data without second source verification
Calibration verification (CCV)	Hexavalent Chromium: After every 15 field samples and at the end of the analysis sequence.	All analytes within ± 10% of expected value form ICV	Correct problem then repeat CCV and reanalyze all samples since last successful calibration verification.	If %D for an individual analyte is > 10%, no samples may be analyzed until the problem has been corrected.	**ICV:** Apply **R**-flag to data with ICV outside criteria. **CCV**: High bias: Apply **J**-flag to detects. Low bias: Apply **J**-flag to detects and **UJ**-flag to nondetects.
	Metals: After every 10 samples and at the end of the analysis sequence.	ICP: All analytes within ± 10% of expected value from ICAL.	Correct problem, rerun calibration verification. If that fails, then repeat initial calibration. Reanalyze all samples since the last successful calibration verification.	Problem must be corrected. Results may not be reported without a valid CCV.	Apply **R**-flag to data with CCV outside criteria.
Method blank	One per preparatory batch	No analytes detected > 1/2 RL. For common laboratory contaminants, no analytes detected > RL.	Correct problem. If required, reprep and reanalyze method blank and all samples processed with the contaminated blank.	None	Apply **U**-flag to analytes detected in field samples < 5X blank contamination.
Interference check solutions (ICS) (ICP only)	At the beginning of an analytical run	ICS-A: Absolute value of concentration for all nonspiked analytes < 2X MDL (unless they are a verified trace impurity from one of the spiked analytes). ICS-AB: Within ± 20% of expected value.	Terminate analysis; locate and correct problem; reanalyze ICS.	No samples may be analyzed without a valid ICS	Apply **R**-flag to data with ICS outside criteria.

TABLE 7-2
DATA REVIEW/VALIDATION CRITERIA FOR USEPA METHOD SW6010B
CANNON AIR FORCE BASE, NEW MEXICO

QC Check	Minimum Frequency	Acceptance Criteria	Laboratory Corrective Action	Comments	URS Flagging Criteria
Laboratory control sample (LCS)	One per preparatory batch	QC acceptance criteria specified in QAPP **Table 2-2**.	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes, if sufficient sample material is available.	LCS should contain all analytes to be reported.	High bias: Apply **J**-flag to detects. Low bias: Apply **J**-flag to detects and **UJ**-flag to nondetects. Very low bias (%R<30%): Apply **J**-flag to detects and **R**-flag to nondetects.
Dilution test	Each preparatory batch or when a new or unusual matrix is encountered	Five fold dilution must agree within ± 10% of the original determination.	ICP: Perform post-digestion spike (PDS) addition.	Only applicable for samples with concentrations > 50X MDL (ICP).	Apply **J**-flag to data from parent sample outside criteria.
Post-digestion spike (ICP only)	When dilution test fails or analyte concentration in all samples < 50X MDL	75-125%	Run samples by method of standard additions.	The spike addition should produce a level between 10-100X MDL.	Apply **J**-flag to data from parent sample outside criteria.
Matrix spike/Matrix spike duplicate (MS/MSD)	One per preparatory batch per matrix	QC acceptance criteria specified in QAPP **Table 2-2**. RPD ≤ 30% (between MS and MSD)	Examine the project-specific DQOs. Contact URS as to additional measures to be taken.	For matrix evaluation only. If MS results are outside QC limits, the data shall be evaluated to determine the source of difference and to determine if there is a matrix effect or analytical error. No data flagging if native concentrations are > 4X spiking amount.	For the specific analyte(s) in the parent sample. High bias: Apply **J**-flag to detects. Low bias: Apply **J**-flag to detects and **UJ**-flag to nondetects. Very low bias (%R<30%): Apply **J**-flag to detects and **R**-flag to nondetects.
Laboratory sample duplicate	One per preparatory batch per matrix (if MS/MSD is not performed)	RPD ≤ 20% (sample and sample duplicate)	Examine the project-specific DQOs. Contact URS as to additional measures to be taken.	For the specific analyte(s) in the parent sample, apply **J**-flag to detects if acceptance criteria are not met.	Data shall be evaluated to determine the source of difference. Apply **J**-flag to detects if acceptance criteria are not met.
Field Duplicate	One per 10 field samples	If both the parent and duplicate values are > 5X the RL, then 50% RPD for soils and 25% RPD for waters. If either the parent or duplicate value is < 5X the RL, then the difference between the parent and duplicate must be < 2X the RL.	N/A	None	Apply **J**-flag to detects and **UJ**-flag to nondetects.

THIS PAGE INTENTIONALLY BLANK

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

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

8.1 FIELD INSTRUMENT CALIBRATION

The calibration and general maintenance of field instrumentation will be the responsibility of the URS Field Manager. Calibration procedures are presented in the respective SOPs located in **Section 5** of the WP. All documentation pertinent to the calibration and/or maintenance of field equipment will be maintained in a dedicated, active instrument logbook. Entries made into the logbook regarding the status of any field equipment will contain, but are not necessarily limited to, the following information:

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

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

8.2 LABORATORY INSTRUMENT CALIBRATION

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

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

8.3 STANDARD/REAGENT PREPARATION

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

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

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

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

9.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

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

9.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

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

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

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

9.3 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

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

Supply Name	Inspection/ Testing Requirements	Acceptance Criteria	Testing Method	Frequency of Testing	Responsible Individual	Expiration Date	Handling/Storage Requirements
Glass sample jars and bottles	Certified as pre-cleaned by supplier	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Field Manager	None	Store in dry and secure location
HDPE bottles	Certified as pre-cleaned by supplier and containing HNO_3	Certified as pre-cleaned by laboratory	Review of documentation and visual inspection	Upon receipt	Field Manager	3 months	Store in dry and secure location

The goal of data management procedures is to document the procedures for tracking and managing investigative data collected during the field activities associated with SWMU 103, Playa Lake at Cannon AFB. The primary data management objective is to provide data of known quality to end users and decision-makers. The data management procedures for each field activity are summarized in the associated SOP for each activity. The procedure for overall field activity data management is the responsibility of the URS Field Manager and will be completed as summarized in SOP 6 of the WP. Laboratory data management is the responsibility of the APPL and EMAX QA Officers. The management of laboratory data will be completed following the written laboratory SOP for data management and the associated instrument and analytical method SOPs. The SOPs are included in the APPL and EMAX QAPP (available upon request).

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

THIS PAGE INTENTIONALLY BLANK

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

11.1 FIELD PERFORMANCE AND SYSTEM AUDITS

11.1.1 Internal Field Audits

Internal Field Audit Responsibilities

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

Internal Field Audit Frequency

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

Internal Field Audit Procedures

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

11.1.2 External Field Audits

External Field Audit Responsibilities

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

External Field Audit Frequency

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

11.1.2.1 External Field Audit Process

External field audits will be conducted according to the field activity information presented in the QAPP. The external field audit process can include (but not be limited to): sampling equipment decontamination procedures, sample bottle preparation procedures, sampling

procedures, examination of field sampling and safety plans, sample vessel cleanliness and QA procedures, procedures for verification of field duplicates, sample preservation and preparation for shipment, as well as field screening practices.

11.2 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 WP, identify any nonconformances, and verify corrective action of identified deficiencies.

11.2.1 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 performance audit by the USACE QA Officer, 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 PM. Performance audits are used to quantitatively assess the accuracy of measurement data through the use of performance evaluation and blind check samples. The performance audit, if needed, will be performed by the QA Officer or his/her designee in accordance with documented procedures.

11.2.2 System Audits

The URS QA Officer may conduct a system audit of the fieldwork performance. The URS 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 PM is responsible for overseeing that the project performance satisfies the QA/QC objectives set forth in this QAPP. Reports and technical correspondence will be peer reviewed by an assigned qualified individual, otherwise external to the project, before being finalized.

11.2.3 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.

11.3 LABORATORY PERFORMANCE AND SYSTEMS AUDITS

The primary responsibility for determining the NELAC and DoD QSM compliance of environmental testing laboratories rests with the PM district and members of the project delivery team (e.g., district chemist). It is suggested that districts institute an evaluation mechanism of

"documented self declaration", by the laboratories for compliance with the DoD QSM. Upon implementation of the policy the Hazardous, Toxic and Radioactive Waste (HTRW) Center of Expertise (CX) will transition to a technical assistance role in support of districts, in all aspects of compliance with this policy (e.g., evaluation of laboratory self-declaration); in addition to providing complementary compliance support activities (e.g., additional desk audits, on-site inspections, etc.) (USACE 2004).

11.3.1 Internal Laboratory Audits (Bench Audit)

Laboratory Bench Audit Responsibilities

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

Laboratory Bench Audit Frequency

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

Laboratory Bench Audit Procedures

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

11.3.2 External Laboratory Audits

External Laboratory Audit Responsibilities

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

External Laboratory Audit Frequency

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

Overview of the External Laboratory Audit Process

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

An external on-site review can consist of: sample receipt procedures, custody, and sample security and log in procedures, sample throughput tracking procedure, review of instrument calibration records, instrument logs and statistics (number and type), review of QA procedures, logbooks, sample prep procedures, sample analytical SOP review, instrument (normal or extended 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.

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

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

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

- The sensitivity parameters chosen based on conditions and chemicals of potential concern (COPCs) involved in a project (i.e., New Mexico Environment Department TPH Screening Guidelines - Soil Screening Levels [2006])
- The COPCs, as they relate to the data quality level parameters chosen
- The choice of analytical and sample preparation methods for chemicals of concern whose method detection limits will meet or exceed the data quality level concentrations for those contaminants

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

11.4.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample will be spiked with a known amount of the analytes included in **Tables 2-1** through **2-3**. 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 water). The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery.

Accuracy is similarly assessed by determining percent recoveries for surrogate compounds added to each field and QC sample to be analyzed for organic analyses. Accuracy for the metals 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:

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

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

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

11.4.2 Precision Assessment

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

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

11.4.3 Completeness Assessment

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

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

11.5 OVERALL ASSESSMENT OF DATA

The laboratory data collected during this investigation will be used to evaluate Corrective Measures Alternatives and recommend the selected final Corrective Measure(s) for SWMU 103. The QC results associated with each analytical parameter will be compared to the objectives presented in **Tables 2-1** through **2-3** of this QAPP. Only data generated in association with QC results meeting these objectives will be considered usable for decision-making purposes.

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

- Were all samples obtained using the SOPs and methodologies proposed in the QAPP?
- Were all proposed analyses performed according to the laboratory SOPs?
- Were samples obtained from all proposed sampling locations?
- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?
- Were any analytes not expected to be present at the range, or a given unit, identified as target parameters?
- Were all field and laboratory data validated according to the validation protocols, including project-specific QC objectives, proposed in the QAPP?
- Which data sets were found to be unusable (qualified as "**R**") based on the data validation results?
- Which data sets were found to be usable for limited purposes (qualified as "**J**") based on the data validation results?
- What effects do qualifiers applied as a result of data validation have on the ability to implement the project decision rules?
- Has sufficient data of appropriate quality been generated to support a human health and/or ecological screening risk assessment?

- Were the human health and/or ecological screening risk assessments conducted properly?
- Were all issues requiring corrective action, as presented in the monthly QA Reports to management fully resolved?
- Were the project-specific decision rules used as proposed during the actual investigation?
- For any cases where the proposed procedures and/or requirements have not been met, has the effect of these issues on the project objectives been evaluated?
- Based on the overall findings of the CMS, 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 PM, or designee.

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

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

THIS PAGE INTENTIONALLY BLANK

12.1 FIELD CORRECTIVE ACTION

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

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

12.2 LABORATORY CORRECTIVE ACTION

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

12.3 CORRECTIVE ACTION DURING DATA REVIEW/VALIDATION

The URS Project Chemist or designee may identify the need for corrective action during either the data review/validation or data assessment. Potential corrective measures may include re-sampling by the URS field personnel (e.g., missed holding times or samples analyzed for incorrect analytes) or re-extraction/re-analysis of samples (e.g., surrogate recoveries outside criteria or sample require dilution for analyte quantitation) by the laboratory. These measures

are dependent upon the ability to mobilize the URS field personnel and whether the data to be collected is necessary to meet the required project QA objectives (e.g., holding time was not exceeded for samples to be re-analyzed, etc.). If the URS Project Chemist or designee identifies a corrective action situation, the URS PM will be responsible for approval of corrective actions and also ensuring the implementation of the corrective measure.

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

13.1 FREQUENCY, CONTENTS, AND DISTRIBUTION OF MONTHLY PROGRESS REPORTS

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

The progress reports will include the following QA information:

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

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

THIS PAGE INTENTIONALLY BLANK

14.1 DATA REVIEW AND VALIDATION

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

14.1.1 Laboratory Internal Data Review

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

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

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

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

14.1.2 URS Data Review and Validation

One hundred percent of the data will undergo a data review by the URS Project Chemist or designee using ADR. The data review will include the review of the QC parameters listed below. In general, the review will follow the guidance from **Tables 7-1** and **7-2**. The criteria used to evaluate the QC parameters are those criteria identified in **Tables 2-1** through **2-3**.

- COC form
- Cooler receipt form
- Holding time/sample preparation
- Case narrative
- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)

- MS/MSDs
- Surrogate spikes
- Laboratory duplicates
- Laboratory control standards

In addition, approximately 10 percent of the data will undergo a data validation by the URS Project Chemist or designee. This validation will follow the criteria listed in **Tables 7-1** and **7-2**. The validation will use the QC criteria presented in **Tables 2-1** through **2-3** of this QAPP. The validation is a more comprehensive review of the data than the data review. The validation will include all of the elements identified in the review; however the validation will include additional parameter reviews and the recalculation of the raw data. The QC parameters to be validated include the following:

- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks
- MS/MSDs
- Surrogate spikes
- Laboratory duplicates
- Laboratory control standards
- Initial calibration
- Continuing calibration
- Retention time windows
- Interference standard (ICP analysis)
- Serial dilution (metals analysis)

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

Tables 7-1 and **7-2** will be used as guidance during the data review and validation procedures and summarize the general criteria to be used during the review and validation procedures.

14.2 RECONCILIATION WITH USER REQUIREMENTS

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

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

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

THIS PAGE INTENTIONALLY BLANK

Department of Defense (DOD). 2006. Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 3. January.

National Environmental Laboratory Accreditation Conference (NELAC). 2003a. National Environmental Laboratory Accreditation Conference. July.

New Mexico Administrative Code (NMAC). 2002. Title 20 Environmental Protection. Chapter 6 Water Quality. Part 4 Standards for intrastate and interstate surface waters. Section 20.6.4.900 Subsections J. October.

United States Army Corps of Engineers (USACE). 2001. Engineering and Design - Requirements for the Preparation of Sampling and Analysis Plan, EM 200-1-3. February.

USACE. 2004a. Hazardous, Toxic and Radioactive Waste Chemical Data Quality Management Policy for Environmental Laboratory Testing. September.

United States Environmental Protection Agency (USEPA). 1999. National Functional Guidelines for Organic Data Review, EPA540-R-99-008. October.

USEPA. 2001. Requirements for Quality Assurance Project Plans, EPA/240/B-01/003. March.

USEPA. 2002. Guidance for Quality Assurance Project Plans, EPA/240/R-02/009. December.

USEPA. 2004. National Functional Guidelines for Inorganic Data Review, EPA540-R-04-004. October.

USEPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4, February.

USEPA. 2008. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition of SW-846, Final Update IVB. January.

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

1.1 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.

1.2 CONTRACTORS BADGES, VEHICLE PASSES, AND CAMERA PASSES

1.2.1 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.

1.2.2 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.

1.2.3 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.

1.3 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.

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

2.1 PURPOSE AND SCOPE

This document defines the SOP for identification and description of field sampling locations. This procedure will be used to identify and describe sampling locations in such a manner that the sample location may be relocated for repetitive or additional sampling. Sampling point locations and frequencies will be presented in the Field Sampling Plan (FSP).

Applicable SOPs are listed below:

- SOP No. 3 – Sediment Sampling
- SOP No. 4 – Surface Water Sampling

2.2 SURVEYING AND DESCRIPTION PROCEDURE

2.2.2 Equipment List

- Camera and film or digital camera
- Field logbook
- Waterproof and permanent marking pens
- Global positioning system (GPS) unit

2.2.3 Global Positioning System Procedure

A GPS unit will be used to mark sampling locations. The horizontal and vertical coordinates for ground surface at each location will be collected to sub-meter accuracy and referenced to the appropriate North American Datum of 1983 (NAD83) State Plane Coordinate System in feet. These elevations will be referenced to the North American Vertical Datum of 1988 (NAVD88). The time stamp registered for each sample location will be recorded in the field logbook.

Prior to the start of fieldwork, the GPS unit will be calibrated to a known reference point. The result of the calibration will be recorded in the field logbook. Additionally, weather conditions during calibration and surveying will be recorded in the field logbook.

2.2.4 Description

Each sampling site will be described in the field logbook by recording the following information:

- Installation/sample collection date
- Description of sampling location
- Type of sample and collection method
- Distance of sampling point to adjacent structures (roads, buildings, etc.)
- Description of the installed marker, if applicable
- Installer's name

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

3.1 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedures (SOPs) for collecting sediment samples with standing water at the Cannon Air Force Base. These procedures give descriptions of equipment, field procedures, and Quality Assurance/Quality Control (QA/QC) procedures implemented for the collection of sediment samples. Specific sample locations and frequency of collection will be presented in Field Sampling Plan (FSP).

This procedure is intended to be used together with FSPs and other appropriate SOPs. Health and safety procedures and equipment for the investigation are detailed in the Cannon AFB CMS Site Safety and Health Plan (SSHP). Applicable SOPs are listed below:

- SOP No. 2 - Surveying and Description of Sampling Locations
- SOP No. 5 - Equipment Decontamination
- SOP No. 6 - Sample Handling, Documentation, and Tracking

3.2 PROCEDURES FOR COLLECTING SEDIMENT SAMPLING

3.2.2 Sediment Sampling in Standing Water

Equipment List for Collecting Sediment Samples in Standing Water

The following equipment items may be used for pond or ditch sediment sampling in standing water:

- Decontamination equipment
- Stainless-steel sludge sampler or equivalent
- Stainless-steel scoop or spoon
- Mixing pan
- Weighted tape measure with 0.1-foot increments
- Ruler marked in 0.1-foot increments
- Field notebook
- Sample bottles provided by the laboratory
- Sample bottle labels
- Sample transportation coolers
- 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
- Chest Waders
- Belly Boat
- Life Vest

Sampling Procedures

Prior to sampling, initiate field notes regarding site conditions, sample team personnel, site identification, date, and sample identification. These items will be recorded on the Soil/Sediment Sample Collection Field Sheet (Figure 1). Sampling points will be sampled from the shore when possible and proceed from the deepest to most shallow or farthest sampling location to the closest to the shore of the pond. When sampling from an area with shallow water conditions, sampling personnel may wade into the water in order to obtain samples. When wading, sampling personnel shall take care to minimize agitation of the bottom sediment.

Typical steps to be followed in collecting sediments in standing water are:

- Measure depth of water overlying sediment material.
- Decontaminate all sampling equipment according to SOP No. 5
- Place all sampling equipment on plastic sheeting near the sampling location.
- If volatile samples are required, they will be collected first from the top 2 inches of bed materials. To collect a VOA sample, push and slowly turn the sludge sampler into the bed material. The sampler should be pushed in far enough to fill the sampler bucket beyond the butterfly valve. Retract the sludge sampler slowly. Remove sediment material from the center of the sampler to obtain the least disturbed material for VOA analysis. Do not mix sample material collected for VOA analysis.
- Fill sample containers for the remaining analytes. If liquid is present, attempt to maintain the proportion of solid to water that exists in the mixture while filling the sample containers.
- As each container is filled, carefully wipe the upper edges of the container with a paper towel so that sediments are removed from the threads and mouth of the jar. This is done to ensure that a tight seal exists after the container is closed.
- Label, store and document the samples as described in Section 5.6.1 of the Field Sampling Plan (FSP).
- Decontaminate equipment as described in SOP No. 5.
- Perform personal decontamination as required by the SSHP.

3.2.3 Decontamination

Sampling equipment will be decontaminated before and after each sample to minimize potential cross-contamination. Detailed decontamination procedures are in SOP No.5.

3.2.4 Field Quality Assurance/Quality Control Procedures and Samples

Sediment sampling will progress from the farthest downstream location to the location nearest the discharge point or source. QA/QC samples will be collected during sediment sampling.

Field Quality Assurance/Quality Control 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.

3.2.4.1 Field Blanks

No field blanks will be collected for sediment sampling activities.

3.2.4.2 Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the sediment 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 sediment 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.

3.2.4.3 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.

3.2.5 Sample Handling, Documentation and Tracking

Samples will be identified, handled and recorded as described in this SOP and SOP No. 6. The parameters for analysis and preservation will be specified in the FSP.

3.2.6 Documentation

Documentation of sediment sampling in the field will provide verification of the proper acquisition of samples and also provide a permanent record. Sample Collection Field Sheets will be completed for all sediment samples. These observations and data will be recorded with black

waterproof and permanent ink in a bound weatherproof field book with consecutively numbered pages. The information in the field book will include the following at a minimum:

- Project name and number
- Sampler's name
- Date and time of sample collection
- Sample number
- Sampling method
- Observations at the sampling site
- Unusual conditions
- 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

THIS PAGE INTENTIONALLY BLANK

4.1 PURPOSE AND SCOPE

This document defines the Standard Operating Procedure (SOP) for collecting surface water samples at Cannon Air Force Base (AFB). This procedure gives descriptions of equipment, field procedures, and Quality Assurance/Quality Control (QA/QC) procedures necessary to collect surface water samples. The sample locations and frequency of collection will be presented in the Field Sampling Plan (FSP).

This SOP is intended to be used together with the FSP and other appropriate SOPs. Health and safety procedures and equipment that will be required during the investigation are detailed in the Site Health and Safety Plan (SSHP). Applicable SOPs are listed below:

- SOP No. 2 - Surveying and Description of Sampling Locations
- SOP No. 5 - Equipment Decontamination
- SOP No. 6 - Sample Handling, Documentation, and Tracking

4.2 SURFACE WATER SAMPLING PROCEDURES

Surface water samples will be collected as grab samples from the shore when possible and proceed from the farthest sampling location to the closest to the shore of the pond. Grab samples characterize a medium at a particular point in space and time. Grab samples are collected by sample container immersion or by using a transfer device, such as a beaker, dipper, or bailer.

Grab water samples are typically collected by filling a container held just beneath the surface of a body of water. If an open bottle is lowered to the bottom and raised to the surface at a uniform rate, and at such a rate as to have the bottle filled when reaching the surface, the resulting sample will roughly approach the collection of what is known as a depth-integrated sample. This approach may be used for grab samples that will be collected or collected and transferred when the depth of water exceeds 1.0 foot. Another approach, which may be used for water sampling of any depth, is the use of a bailer that is lowered to just above the bottom of the water column, withdrawn, and used to fill the sample containers. This method probably provides the most representative sample and also prevents preservative loss.

4.2.1 Equipment List

Equipment that may be used for collecting surface water samples:

- Laboratory-provided sample containers
- Teflon, stainless-steel, or glass beakers, dippers, or bailers
- Photoionization detector (PID)
- Cooler with ice
- Turbidity meter
- pH meter (with automatic temperature compensation)

- Conductivity meter

Equipment used during decontamination:

- Alconox soap (or equivalent)
- Potable water
- Distilled water
- Paper towels
- Buckets

4.2.2 Sampling Procedures

Laboratory-provided sample containers will be used where possible to directly collect water samples. Where required by site conditions, remote sampling into sampling containers will be allowed by clamping the container onto the end of a stainless-steel extension rod.

Beakers or dippers, which may be attached to stainless-steel or aluminum rods, may be used if remote sampling site conditions prevent sampling by direct sample container immersion. The beakers or dippers will be obtained from a scientific instrument supplier so that the material composition of such a sampling container may be documented in the field notes. The selected type of transfer device, the composition of this device, and the volume of the device will be recorded in the field notes. Bailers may be used if direct access to the sampling point can be reached.

Electronic equipment used during sampling includes a pH meter with temperature scale and automatic temperature compensation, a conductivity meter, and a turbidity meter. Before going into the field, the sampler shall verify that these instruments are operating properly. The pH, turbidity and conductivity meters require calibration prior to use every day. Calibration times and readings will be recorded in a field logbook to be kept by the field sampler. Specific instructions for calibrating the instruments are given in the manufacturers' instruction manuals.

4.2.2.1 Equipment Decontamination

Before any sampling begins, all bailers, beakers, dippers, and other sampling devices shall be decontaminated. Mobile decontamination supplies will be provided so that equipment can be decontaminated in the field. Each piece of sampling equipment shall be decontaminated before sampling operations and between sampling locations. Used solutions will be placed in the container for disposal. The procedures presented in SOP No. 5, Decontamination, will be followed for decontamination of field equipment and for personnel decontamination.

4.2.2.2 Samples Collected by Container Immersion

- The outside of all capped sample bottles shall be triple rinsed with the surface water being sampled before filling the bottles with the sample to be analyzed
- Submerge the sample bottle below the water surface

- Allow container to fill to desired volume
- Analyze the water for field parameters, which include temperature, pH, conductivity and turbidity
- Remove the container
- Add preservative to the sample, if necessary, and place the cap on the container and tighten
- Label sample in accordance with the FSP
- Decontaminate the container's outside surface as required
- Record time of sampling
- Store samples on ice in cooler

4.2.2.3 Samples Collected by Bailer

- The bailer (Teflon or stainless steel) will be decontaminated according to procedures described in SOP No. 5
- The depth of standing water will be determined, and the bailer will be lowered to the appropriate sampling location in accordance with the sampling plan. The bailer will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The bailer will be inserted and withdrawn very slowly and carefully to avoid agitation of the bottom sediments.
- The surface water will be analyzed for field parameters, which include temperature, pH, conductivity and turbidity.
- The required sample containers will be filled in the appropriate sequence from the water in the bailer. VOCs will be collected first, followed by SVOCs. No specific order is required for any remaining parameters.
- Sample labeling, handling, and field parameter sampling will follow the procedures described in SOP No 6.

4.2.2.4 Field Quality Assurance/Quality Control Procedures and Samples

The sampling order will be dependent on the stream flow direction. Sampling will progress from the furthest downstream location to the furthest upstream location. QA/QC samples will be collected during surface water sampling.

Field QA/QC samples are designed to help identify potential sources of external sample contamination and 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.

Field Blanks

Field blanks are QC samples that check for potential external contamination of samples and will consist of trip blanks. The sample collection coordinator or the project QA/QC coordinator will designate trip blanks. The samples will be assigned a QA/QC identification number, stored in an iced cooler, and shipped to the laboratory with the other samples.

A trip blank serves as a check on sample contamination originating from the container or sample transport. One trip blank will be sent with each cooler containing water samples for volatile organic analyses.

Duplicate Samples

Duplicate samples are samples collected to assess precision of sampling and analysis. For the surface water 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 surface water 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. Duplicate samples will be blind to the laboratory.

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.

4.2.3 Sample Identification, Handling, and Documentation

Samples will be identified, handled and recorded as described in this SOP and SOP No. 6.

4.2.4 Documentation

4.2.4.1 Field Sampling Data Sheet

A field sampling data sheet for surface water samples (Figure 1) will be completed at each sampling location. The data sheet will be completely filled in. If items on the sheet do not apply to a specific location, the item will be labeled as not applicable (NA). The information on the data sheet includes the following:

- Sample location number
- Date and time of sampling
- Person performing sampling

- Conductivity, temperature, turbidity, and pH
- Type of sample
- Number of samples taken
- Sample identification number
- Preservation of samples
- Record of any QC samples from site
- Any irregularities or problems which may have a bearing on sampling quality

4.2.4.2 Field Notes

Field notes shall be kept in a bound field book. The following information will be recorded using waterproof ink:

- Names of personnel
- Weather conditions
- Sample location number
- Date and time of sampling
- Site conditions
- Decontamination information
- Field instrument calibration information
- Water depth
- Depth of sample
- Analyses that will be performed by the laboratory

THIS PAGE INTENTIONALLY BLANK

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

OVA 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:

ENG FORM 5056-R, AUG 94 **(Proponent: CECW-EG)**

FIGURE 2

URS

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NO.

PROJECT	INSPECTOR	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

THIS PAGE INTENTIONALLY BLANK

5.1 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:

- SOP No. 3 – Sediment Sampling
- SOP No. 4 – Surface Water Sampling

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., 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.

5.2 EQUIPMENT DECONTAMINATION PROCEDURES

5.2.1 Equipment List

The following is a list of equipment that may be needed to perform decontamination:

- Brushes
- Wash tubs
- Buckets
- Scrapers, flat bladed
- 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

5.2.2 Decontamination

5.2.2.1 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

5.2.2.2 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.

5.2.2.3 Field Equipment

Field equipment will be decontaminated at the decontamination station located near the staging area. The following steps will be used to decontaminate field 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.

Following decontamination, field equipment will be moved to a clean area. If the equipment is not used immediately, it will be stored in a clean area.

5.2.2.4 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, etc., will be pressure washed before the equipment is removed from the site to limit exposure of off-site personnel to potential contaminants.

5.2.2.5 Wastewater

Unless otherwise specified, liquid wastewater from decontamination will be containerized, labeled, and stored for later disposal as IDW.

5.2.3 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

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

6.1 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:

- SOP No. 3 – Sediment Sampling
- SOP No. 4 – Surface Water Sampling

6.2 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.

6.3 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., C103 – SD02 - 00)
- 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.

6.4 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.

6.4.1 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.

6.4.2 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.

6.4.3 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.

6.4.4 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.

6.5 SAMPLE DOCUMENTATION AND TRACKING

This section describes documentation required in the field notes and on the sample Chain-of-Custody forms.

6.5.1 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.

6.5.2 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

This appendix presents

New Mexico Environmental Department's

TPH Screening Guidelines

October 2006

and a summary of relevant soil screening levels from the

New Mexico Environment Department's

Technical Background Document for Development of Soil Screening Levels

Revision 4.0

June 2006

THIS PAGE INTENTIONALLY BLANK

NEW MEXICO ENVIRONMENT DEPARTMENT TPH SCREENING GUIDELINES
October 2006

In some instances, it may be practical to assess areas of soil contamination that are the result of releases of petroleum products such as jet fuel and diesel, using total petroleum hydrocarbon (TPH) analyses. TPH results may be used to delineate the extent of petroleum-related contamination at these sites and ascertain if the residual level of petroleum products in soil represents an unacceptable risk to future users of the site. Petroleum hydrocarbons represent complex mixtures of compounds, some of which are regulated constituents and some compounds that are not regulated. In addition, the amount and types of the constituent compounds in a petroleum hydrocarbon release differ widely depending on what type of product was spilled and how the spill has weathered. This variability makes it difficult to determine the toxicity of weathered petroleum products in soil solely from TPH results; however, these results can be used to approximate risk in some cases, depending upon the nature of the petroleum product, the release scenario, how well the site has been characterized, and anticipated potential future land uses. In some cases, site clean up cannot be based solely on results of TPH sampling. The New Mexico Environment Department (NMED) will make these determinations on a case by case basis. If NMED determines that additional data are necessary, these TPH guidelines must be used in conjunction with the screening guidelines for individual petroleum-related contaminants in Table 3 and other contaminants, as applicable.

The screening levels for each petroleum carbon range from the Massachusetts Department of Environmental Protection (MADEP) Volatile Petroleum Hydrocarbons/Extractable Petroleum Hydrocarbons (VPH/EPH) approach and the percent composition table below were used to generate screening levels corresponding to total TPH. Except for waste oil, the information in the compositional assumptions table was obtained from the Massachusetts Department of Environmental Protection guidance document *Implementation of the MADEP VPH/EPH Approach* (October 31, 2002). TPH toxicity was based only on the weighted sum of the toxicity of the hydrocarbon fractions listed in Table 1.

Table 1. TPH Compositional Assumptions in Soil

Petroleum Product	C11-C22 Aromatics	C9-C18 Aliphatics	C19-C36 Aliphatics
Diesel #2/ new crankcase oil	60%	40%	0%
#3 and #6 Fuel Oil	70%	30%	0%
Kerosene and jet fuel	30%	70%	0%
Mineral oil dielectric fluid	20%	40%	40%
Unknown oil[a]	100%	0%	0%
Waste Oil[b]	0%	0%	100%

[a] Sites with oil from unknown sources must be tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

A TPH screening guideline was calculated for each of the types of petroleum product based on the assumed composition from Table 1 for petroleum products and the direct soil standards incorporating ceiling concentrations given in the MADEP VPH/EPH Excel spreadsheet for each of the carbon fractions. Groundwater concentrations are based on the weighted sum of the noncarcinogenic toxicity of the petroleum fractions.

Method 1 from the MADEP VPH/EPH document was applied, which represents generic cleanup standards for soil and groundwater. Method 1 applies if contamination exists in only soil and groundwater. The MADEP VPH/EPH further divides groundwater into standards. Standard GW-1 applies when groundwater may be used for drinking water purposes. GW-1 standards are based upon ingestion and use of groundwater as a potable water supply. The TPH screening guidelines for sites with potable groundwater are presented in Table 2a.

Table 2a. TPH Screening Guidelines for Potable Groundwater (GW-1)

TPH			Concentration in Groundwater (mg/L)
Petroleum Product	**Residential Direct Exposure (mg/kg)**	**Industrial Direct Exposure (mg/kg)**	
Diesel #2/crankcase oil	520	1120	1.72
#3 and #6 Fuel Oil	440	890	1.34
Kerosene and jet fuel	760	1810	2.86
Mineral oil dielectric fluid	1440	3040	3.64
Unknown oil [a]	200	200	0.2
Waste Oil [b]	2500	5000	Petroleum-Related Contaminants
Gasoline	Not applicable	Not applicable	Petroleum-Related Contaminants

[a] Sites with oil from unknown sources must be tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

The second standard is GW-2, which is applicable for sites where the depth to groundwater is less than 15 feet from the ground surface <u>and</u> within 30 feet of an occupied structure. The structure may be either residential or industrial. GW-2 standards are based upon "inhalation exposures that could occur to occupants of the building impacted by volatile compounds, which partition from the groundwater" (MADEP 2001). The GW-2 screening guidelines ONLY apply for the evaluation of inhalation exposures. If potential ingestion or contact with contaminated soil and/or

groundwater could occur, then the screening guidelines provided in Table 2.a should be applied. Table 2.b lists the TPH screening guidelines for the inhalation scenario.

Table 2b. TPH Screening Guidelines – Vapor Migration and Inhalation of Groundwater (GW-2)

TPH			Concentration in Groundwater (mg/L)
Petroleum Product	**Residential Direct Exposure (mg/kg)**	**Industrial Direct Exposure (mg/kg)**	
Diesel #2/crankcase oil	880	2200	30.4
#3 and #6 Fuel Oil	860	2150	35.3
Kerosene and jet fuel	940	2350	15.7
Mineral oil dielectric fluid	1560	3400	10.4
Unknown oil[a]	800	2000	50.0
Waste Oil[b]	2500	5000	Petroleum-Related Contaminants
Gasoline	Not applicable	Not applicable	Petroleum-Related Contaminants

[a] Sites with oil from unknown sources must be tested for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, and polychlorinated biphenyls (PCBs) to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

[b] Compositional assumption for waste oil developed by NMED is based on review of chromatographs of several types of waste oil. Sites with waste oil must be tested for VOCs, SVOCs, metals, and PCBs to determine if other potentially toxic constituents are present. The TPH guidelines in Table 2 are not designed to be protective of exposure to these constituents therefore they must be tested for, and compared to, their individual NMED soil screening guidelines.

Mineral oil based hydraulic fluids can be evaluated for petroleum fraction toxicity using the screening guidelines from Tables 2a and 2b specified for waste oil, because this type of hydraulic fluid is composed of approximately the same range of carbon fractions as waste oil. However, these hydraulic fluids often contain proprietary additives that may be significantly more toxic than the oil itself; these additives must be considered on a site- and product-specific basis (see ATSDR hydraulic fluids profile reference). **Use of alternate screening guideline values requires prior written approval from the New Mexico Environment Department.** TPH screening guidelines in Tables 2a and 2b must be used in conjunction with the screening levels for petroleum-related contaminants given in Table 3 because the TPH screening levels are NOT designed to be protective of exposure to these individual petroleum-related contaminants. Table 3 petroleum-related contaminants screening levels are based on the *NMED Technical Background Document for Development of Soil Screening Levels, Rev 4.0 (June 2006).*

The list of petroleum-related contaminants does not include polyaromatic hydrocarbons (PAHs) with individual screening levels that would exceed the total TPH screening levels (acenaphthene, anthracene, flouranthene, flourene, and pyrene). In addition, these TPH screening guidelines are based solely on human health, not ecological risk considerations, protection of surface water, or

potential indoor air impacts from soil vapors. Potential soil vapor impacts to structures or utilities are not addressed by these guidelines. Site-specific investigations for potential soil vapor impacts to structures or utilities must be done to assure that screenings are consistently protective of human health, welfare or use of the property. NMED believes that use of these screening guidelines will allow more efficient screenings of petroleum release sites at sites while protecting human health and the environment. Copies of the references cited below are available on the MADEP website at http://www.state.ma.us/dep/bwsc/vph_eph.htm and the NMED website at http://www.nmenv.state.nm.us/HWB/guidance.html.

Revised Table 3. Petroleum-Related Contaminants Screening Guidelines

Petroleum-Related Contaminants	Values for Direct Exposure to Soil		NMED DAF[a] 20 GW Protection (mg/kg in soil)	NMED DAF[b] 1 GW Protection (mg/kg in soil)
	NMED Residential SSL (mg/kg)	NMED Industrial SSL (mg/kg)		
Benzene	1.03E+01	2.58E+01	2.01E-02	1.00E-03
Toluene	2.52E+02	2.52E+02	2.17E+01	1.08E+00
Ethylbenzene	1.28E+02	1.28E+02	2.02E+01	1.01E+00
Xylenes[c]	8.20E+01	8.20E+01	2.06E+00	1.03E-01
Naphthalene	7.95E+01	3.00E+02	3.94E-01	1.97E-02
2-Methyl naphthalene[d]	5.00E+02	1.00E+03	---[e]	---[e]
Benzo(a)anthracene	6.21E+00	2.34E+01	1.09E+01	5.43E-01
Benzo(b)fluoranthene	6.21E+00	2.34E+01	3.35E+01	1.68E+00
Benzo(k)fluoranthene	6.21E+01	2.34E+02	3.35E+02	1.68E+01
Benzo(a)pyrene	6.21E-01	2.34E+00	2.78E+00	1.39E-01
Chrysene	6.15E+02	2.31E+03	3.48E+02	1.74E+01
Dibenz(a,h)anthracene	6.21E-01	2.34E+00	1.04E+01	5.18E-01
Indeno(1,2,3-c,d)pyrene	6.21E+00	2.34E+01	9.46E+01	4.73E+00

[a] DAF - Dilution Attenuation Factor

[b] For contaminated soil in contact with groundwater.

[c] Based upon total xylenes

[d] No NMED value available, value taken from Massachusetts Contingency Plan, 310 CMR 40.0985, 4/3/06.

[e] No NMED value available and leachability-based value for DAF =1 or 20 not established in the Massachusetts Contingency Plan, 310 CMR 40.0985, 4/3/06.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1997. Toxicological Profile for Hydraulic fluids.

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 1994. “Background Documentation for the Development of the MCP Numerical Standards.”

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 2002. “Characterizing Risks Posed by Petroleum

Contaminated Sites: Implementation of the MADEP VPH/EPH Approach," Policy, October 31, 2002.

Massachusetts Department of Environmental Protection, Bureau of Waste Site Cleanup and Office of Research and Standards. 2003. "Updated Petroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology." November 2003.

New Mexico Environment Department, Hazardous Waste Bureau and Groundwater Quality Bureau Voluntary Remediation Program. 2006. "Technical Background Document for Development of Soil Screening Levels." June 2006. Revision 4.0.

SUMMARY OF NMED SOIL SCREENING LEVELS (JUNE 2006)
RFI WORK PLAN ADDENDUM
CANNON AFB, NEW MEXICO

Chemical	Residential Soil (mg/kg)	End-point	Industrial/ Occupational Soil (mg/kg)	End-point	Construction Worker Soil (mg/kg)	End-point	Tap Water (ug/L)	End-point	DAF 1 (mg/kg)	DAF 20 (mg/kg)
Arsenic	3.90E+00	ca	1.77E+01	ca	8.52E+01	nc	4.42E-01	ca	1.45E-02	2.90E-01
Lead	4.00E+02	IEUBK	8.00E+02	IEUBK	8.00E+02	IEUBK				
Selenium	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc	1.83E+02	nc	9.52E-01	1.90E+01
Silver	3.91E+02	nc	5.68E+03	nc	1.55E+03	nc	1.83E+02	nc	1.57E+00	3.13E+01
Vanadium	7.82E+01	nc	1.14E+03	nc	3.10E+02	nc	3.65E+01	nc	3.65E+01	7.30E+02

Notes:

ca = carcinogenic effects

DAF = Dilution Attenuation Factor

IEBUK = Integrated Exposure Uptake Biokinetic

mg/kg = milligram per kilogram

nc = noncarcinogenic effects

NMED = New Mexico Environmental Department

µg/L = micrograms per liter

VOC = Volatile organic compounds

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

The Draft Summary of Risk Evaluations at the Playa Lake (SWMU 103) (W-C 1998) reviewed all field and analytical activities that have occurred and summarized all subsequent risk evaluations (human and ecological) that have been completed for SWMU 103. The document described three phases of investigation that have occurred at SWMU 103. These investigations include a Phase I Final RCRA Facility Investigation (RFI) (W-C 1994), a Phase II RFI (W-C 1997), and the Summary of Risk Evaluations (W-C 1998), a comprehensive human health and ecological risk assessment of the Phase I and Phase II RFI data following current guidance of that time. The third phase included a re-evaluation of the risk potential associated with surface water, soil, and sediment exposures, and concluded by summarizing any potential risks observed at Playa Lake (SWMU 103). A synopsis of each of the three phases is provided below.

1.1 SETTING – PHASE I RFI

The Phase I RFI or Playa Lake (SWMU 103) included sample collection and a screening-level risk evaluation (W-C 1994). As part of the Phase I RFI, surface water samples were collected from three locations and sediment samples were collected from four locations within Playa Lake. The water samples were described as algae-rich with an olive-green hue. The sediment samples were described as black silt with a strong sulfurous odor. All surface water and sediment samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, total petroleum hydrocarbons (TPH), pesticides/polychlorinated biphenyls (PCBs), and herbicides.

As a conservative risk-screening approach, maximum detected chemical concentrations from the Phase I RFI were screened against highly conservative USEPA Region III Risk Based Concentrations (RBCs) in accordance with RCRA Subpart S guidance. Other screening criteria included the State of New Mexico's TPH clean-up level of 1,000 mg/kg (New Mexico Environmental Improvement Board 1993), USEPA's recommended soil lead level of 500 mg/kg (USEPA 1990), and Federal MCLs for some surface water analytes. Prior to risk screening, the metals analytes were first screened against upper tolerance limit (UTL) background concentrations. If metals concentrations exceeded background, then they too were screened against applicable criteria.

The results of the Phase I risk screening concluded that no surface water screening results exceeded screening criteria, and surface water was not evaluated further. Sediment screening results indicated that three metals (beryllium, silver, vanadium) along with TPH exceeded applicable screening criteria. A Phase I Baseline Risk Assessment (BRA) was completed for these four analytes to evaluate potential sediment exposures.

The Phase I BRA identified occupational workers, hypothetical construction workers, hypothetical trespassers, and farm workers as potential sediment receptors through ingestion or dermal contact. The Phase I BRA results indicated that no adverse human health risks were anticipated from potential exposure to concentrations of beryllium, silver, vanadium, or TPH in sediment even with prolonged exposure. The Phase I RFI report indicated that no significant human health risks were expected due to chemical exposure from Playa Lake water or sediment.

However, because this lake has been historically utilized for wastewater storage, the Phase I RFI report suggested further investigation of subsurface soil in and around the lake to evaluate a potential groundwater pathway.

1.2 PHASE II RFI

The Phase II RFI investigation (W-C 1997) included the collection of soil samples and subsurface sediment samples to further assess the vertical and horizontal extent of potential site contamination at Playa Lake. Six soil borings (four samples per boring from 0 to 20 feet) and five subsurface sediment borings (two samples per boring at 2 to 3 feet and 4 to 5 feet) were collected during the Phase II investigation in November and December 1994. All samples were analyzed for VOCs, SVOCs, metals, total recoverable petroleum hydrocarbons (TRPH), chlorinated herbicides, pesticides, and PCBs. Whenever applicable, maximum Phase II chemical concentrations were compared with Phase I maximum chemical concentrations. Next, Phase II maximum chemical concentrations that exceeded Phase I maximums were screened to evaluate the nature and extent of any contamination and to assess any risks associated with potential exposure to chemicals of concern (COCs).

Phase II analytical data confirmed low levels of VOCs, SVOCs, and pesticides in subsurface sediments (i.e., 2 to 5 feet), and identified low concentrations of VOCs, SVOCs, pesticides, and the PCB (Aroclor-1248) in shallow subsurface soils. TRPH was only detected in surface soils from the soil borings, and only bis(2-ethylhexyl) phthalate (a common laboratory contaminant) was reported in a single subsurface soil sample collected at 20 feet bgs.

The human health routes and receptors addressed by the Phase II risk assessment forsoil and sediment were the same as those addressed during Phase I. The higher of the maximum concentrations detected during Phase I and Phase II were screened against USEPA Region III RBCs. Of the Phase II maximum chemical concentrations, only Aroclor-1248, manganese, and beryllium exceeded residential and industrial RBCs. However, the maximum detected beryllium concentration was within typical regional background concentrations. The estimated risk associated with Aroclor-1248 fell within USEPA's target risk range of 10^{-6} to 10^{-4}. An estimated hazard quotient for manganese (2.3) exceeded the recommended hazard quotient of 1.0. However, the maximum manganese concentration was detected in a sample collected beneath the Playa Lake where the potential for a residential exposure scenario is unlikely.

A maximum TRPH concentration of 734 mg/kg was detected and compared to the New Mexico Action Level of 100 mg/kg (USEPA had not established a toxicity factor for the combined chemicals, so an appropriate RBC could not be calculated). However, only a small fraction of TRPH constituents are known to be toxic, (e.g., benzene, naphthalene, pyrene, and toluene) these chemicals were analyzed for individually during both the Phase I and II, and all results indicated low concentrations below applicable screening levels. Therefore, it is not likely that TRPH constituents would contribute significantly to risk at Playa Lake (SWMU 103).

The Phase II RFI included an evaluation of the groundwater pathway. The results from the deepest sediment samples (5 feet bgs) collected during the Phase II RFI were compared to surface sediment samples collected during the Phase I. The deepest sediment results were also compared to applicable residential soil RBCs to evaluate any potential current or historical transport of contaminants to groundwater. VOCs and pesticides were detected in the deepest sediment samples (5 feet bgs), but all were at levels below residential screening RBCs. Results of the subsurface sediment analysis showed that only beryllium and manganese were detected at concentrations greater than residential RBCs. Beryllium and manganese are both naturally occurring and are not very mobile in soil or groundwater. Groundwater at Cannon AFB ranges from 240 to 280 feet bgs, and was not likely to be impacted by these relatively immobile COCs. Therefore, no further action (NFA) was recommended with regard to groundwater beneath Playa Lake (SWMU 103).

Phase II RFI data were screened against Phase I results, background levels, and RBCs (residential and industrial). The results of the screening indicated that no unacceptable human health risks due to detected chemicals were expected from Playa Lake (SWMU 103). Therefore, the results of the Phase I BRA were supported by the Phase II RFI data, and NFA was recommended for lake sediments and surrounding soil.

1.3 SUMMARY OF RISK EVALUATIONS AT THE PLAYA LAKE (SWMU 103)

1.3.1 Supplemental Evaluation of Potential Human Health Exposures

As part of this evaluation (W-C 1998), potential risks from exposure to surface water were re-estimated using the Phase I RFI results. For this follow-up human health assessment, detected surface water concentrations were compared to USEPA Region VI Human Health MSSLs for tapwater (USEPA 1997). Only arsenic was identified at a concentration that exceeded the MSSLs. Comparing water samples from Playa Lake, a former wastewater overflow, to drinking water standards is a highly conservative approach, as the lake will not likely be used as a drinking water source. Therefore, in accordance with the findings of Phase I BRA, no unacceptable human health risks were indicated by this surface water risk assessment and NFA was recommended for Playa Lake (SWMU 103) for surface water.

Potential risks associated with exposure to surface soils were assessed by comparing maximum detected surface soil concentrations of COCs to USEPA Region VI MSSLs (residential, industrial, and soil-to-groundwater levels). Results of this human health risk assessment indicated that Aroclor-1248 exceeded both residential and industrial MSSLs, arsenic exceeded the industrial MSSLs, and barium exceeded the soil-to-groundwater levels. Benzo(a)pyrene, antimony, beryllium, iron, and manganese also exceeded only their respective residential screening levels. Because of its historical use as a wastewater storage pond, these residential exceedances are overly conservative for Playa Lake (SWMU 103). Based on the more appropriate industrial MSSLs, potential risk from arsenic and Aroclor-1248 were within the acceptable USEPA target risk range of 10^{-6} to 10^{-4}. It was also estimated that about 30 additional chemicals would have to exceed their MSSLs by a similar margin to push the total risk to 10^{-4}.

In addition, the use of maximum chemical concentrations to estimate risk also likely overestimated the actual risk associated with each particular COC. In summary, based on the follow-up human health risk assessment, surface soils at Playa Lake (SWMU 103) posed no unacceptable risks to potential receptors.
Since each maximum detected COC concentration for total soils (surface and subsurface) occurred in surface soil samples, the potential estimated risks associated with total soils were the same as those for surface soil samples and the same conservative arguments applied. Therefore, total soils did not present an unacceptable risk to potential receptors.

Potential risks associated with exposure to sediments were re-assessed by comparing maximum detected sediment concentrations of COCs to USEPA Region VI soil to groundwater MSSLs. Barium, chromium, nickel, selenium, dieldrin, and benzene were detected at concentrations exceeding MSSLs. Sediment concentrations were not compared to residential or industrial MSSLs because they were covered by water and, therefore, not directly accessible to human receptors. In addition it may not have been appropriate to compare sediment levels to soil MSSLs, as sediment is generally considered a distinct environmental media from soil, but USEPA Region VI did not have sediment MSSLs at the time of this risk evaluation.

TPH analysis is a nonspecific methodology typically used to quantify complex mixtures of petroleum-derived constituents in environmental media. It is performed as a screening methodology to assess the potential for TPH constituents to be present at a given site. From this initial TPH analysis, an appropriate sampling methodology is developed to target more specific analytes. In the case of the Phase I and Phase II data collection activities, specific VOC and SVOC analytes were collected along with the overall TPH samples. Analysis of these specific TPH constituents showed that no unacceptable risks or health hazards were anticipated from exposure to lake sediment, soil, or surface water. Therefore, no unacceptable risks from TPH were anticipated based on the Phase I and Phase II RFI data.

1.3.2 Evaluation of Potential Ecological Exposures

The Draft Summary of Risk Evaluations at the Playa Lake (W-C 1998) was written to address specific comments and concerns posed by NMED regarding potential deficiencies in the historical data collection, analyses, and associated risk assessments, especially the ecological risk assessment. The ecological risk evaluation identified elevated sulfide and selenium concentrations as potential ecological concerns, but concluded based on typical concentrations of sulfides and selenium associated with natural sources and the intrinsic conservatism applied during the ecological risk assessment that no further action was warranted for ecological concerns at the Playa Lake (SWMU 103). It does not appear that this document was ever submitted for regulatory review. An updated ecological risk screening using current methodologies is included as Appendix F.

1.4 CURRENT HUMAN HEALTH RISK SCREENING

In order to reevaluate potential risks to human health associated with Playa Lake (SWMU 103) using current methods and screening criteria, maximum concentrations for all detected chemicals were compared with NDEM soil screening levels (SSLs) (NMED 2006a), as presented in Table 1-1. The maximum TPH concentration in sediment (5,890 mg/kg) exceeds the residential screening guideline for waste oil (2,500 mg/kg) (NMED 2006b). The maximum arsenic (10.8 mg/kg) and vanadium (130 mg/kg) concentrations exceed the corresponding residential SSLs (4.3 mg/kg and 32.8 mg/kg, respectively). These are the only chemicals detected at Playa Lake (SWMU 103) that exceed current residential SSLs. All three maximum concentrations were associated with a single sediment sample (CAN103-1032) collected within the bermed area of the Playa Lake (SWMU 103) as part of the Phase I RFI (W-C 1994).

THIS PAGE INTENTIONALLY BLANK

TABLE 1
COMPARISON OF PHASE II SEDIMENT/SOIL CONCENTRATIONS TO PHASE I SEDIMENT/SOIL CONCENTRATIONS AND RBCS
SWMU 103, CANNON AFB
Wastewater Playa Lake

Chemical	Phase I/II Maximum Detected Concentration (mg/kg)	NMED SSL for Residential Soil (mg/kg)	BKGD UTL
Acetone	1.00E-01	2.81E+04	
2-Butanone	6.80E-02	3.18E+04	
Methylene Chloride	5.50E-03	1.82E+02	
Benzene	2.20E-02	1.03E+01	
Carbon Disulfide	2.30E-02	4.60E+02	
Chloromethane	4.00E-03	2.18E+01	
Toluene	3.60E-03	2.52E+02	
Benzo(a)anthracene	5.30E-02	6.21E+00	
Benzo(a)pyrene	6.10E-02	6.21E-01	
Benzo(b)fluoranthene	9.50E-02	6.21E+00	
Bis(2-ethylhexyl)phthalate	5.80E+00	3.47E+02	
Butylbenzylphthalate	3.20E-01	NA	
Chrysene	6.70E-02	6.15E+02	
Di-n-butylphthalate	2.00E-01	6.11E+03	
Di-n-octylphthalate	4.30E-01	NA	
Fluoranthene	6.90E-02	2.29E+03	
Pyrene	7.10E-02	2.29E+03	
4,4'-DDD	2.20E-01	2.44E+01	
4,4'-DDE	2.00E-01	1.72E+01	
4,4'-DDT	2.40E-01	1.72E+01	
Aroclor-1248	7.50E-01	1.12E+00	
Dieldrin	2.40E-03	3.04E-01	
Endrin	2.60E-03	1.83E+01	
gamma-Chlordane	2.40E-03	1.62E+01	
TRPH	5.89E+03	2.50E+03	NA
Aluminum	2.47E+04	7.78E+04	
Antimony	4.90E+00	3.13E+01	
Arsenic	1.08E+01	3.90E+00	4.30E+00
Barium	1.30E+03	1.56E+04	
Beryllium	1.60E+00	1.56E+02	
Cadmium	2.60E+00	3.90E+01	
Chromium	3.55E+01	1.00E+05	
Cobalt	1.13E+01	1.52E+03	
Copper	1.02E+02	3.13E+03	
Lead	3.93E+01	4.00E+02	
Manganese	9.02E+02	3.59E+03	
Mercury	5.10E-01	1.00E+05	
Nickel	2.77E+01	1.56E+03	
Selenium	1.32E+01	3.91E+02	
Silver	3.37E+01	3.91E+02	
Thallium	3.40E-01	5.16E+00	
Vanadium	1.30E+02	7.82E+01	3.28E+01
Zinc	2.75E+02	2.35E+04	

NA = Not Available

= Max exceeds SSL

THIS PAGE INTENTIONALLY BLANK

TABLE 2
COMPARISON OF PHASE I SURFACE WATER CONCENTRATIONS TO NMAC WATER QUALITY STANDARDS

Chemical	Phase I/II Maximum Detected Concentration (mg/L)	Human Health Screening for Surface Water (mg/L)*
Metals		
Arsenic	5.70E-03	9.00E-03
Barium	7.60E-02	NA
Copper	7.20E-03	NA
Lead	6.00E-03	NA
Silver	9.20E-03	NA
Vanadium	8.90E-03	NA
Zinc	1.90E-02	2.60E+01
VOCs		
Isophorone	1.40E-03	9.60E+03

NA = Not Available

= Max Exceeds Human Health Screening Level

* Human health screening values for surface water were obtained from NMAC 20.6.4 WQCC, Chapter 6 Water Quality, Part 4: Standards for Interstate and Intrastate Surface Waters.

THIS PAGE INTENTIONALLY BLANK

THIS PAGE INTENTIONALLY BLANK

1.1 PURPOSE AND METHODOLOGY

The purpose of this ecological risk assessment (ERA) is to use historical data to evaluate potential environmental risks associated with the Playa Lake Solid Waste Management Unit 103 (SWMU 103) at Cannon Air Force Base (AFB), Clovis, New Mexico. Previous evaluations of Playa Lake (SWMU 103) were completed using data collected in 1993 and 1994 (URS 1998). The Hazardous Waste Bureau (HWB) of the New Mexico Environmental Department (NMED) recently issued *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (NMED 2008) and the USEPA has developed Ecological Soil Screening Levels (ESSLs) (USEPA 2003-2008) that reviewed, evaluated, and updated the available toxicity data and biotic uptake data. In addition, considerable relevant toxicological data has been published since the URS (1998) report.

This ERA re-evaluates the 1993-1994 Playa Lake (SWMU 103) data using updated methodologies and toxicological data. Because considerable changes have been made at the Playa Lake (SWMU 103), specifically the installation of a new wastewater treatment plant (WWTP) in 1998, the type of discharge Playa Lake (SWMU 103) now receives has changed. The results of this re-evaluation of the 1993-1994 data will be used as a guide to focus future sampling efforts for the on-going corrective measures study.

The ERA herein follows the current NMED HWB guidance (NMED 2008) and incorporates USEPA ESSLs, as well as other more recent ecotoxicological information. The HWB ERA process consists of two levels:

1. Level I Screening-Level ERA
2. Level II Site-Specific ERA

The HWB (2008) guidance addresses Level I, the Screening-Level ERA (i.e., ecoscreen) and approaches it in two phases: (1) a scoping assessment; and (2) a Level I screening ERA. The overall objectives of the HWB ecoscreen are to determine the need for interim action, determine the need for further evaluation, prioritize sites, and focus future site-specific risk assessments. In the Phase I, Scoping Assessment, a qualitative determination is made as to whether there are habitat or potential receptors present that could become exposed to any hazardous substances reportedly released from the site. For those sites where valid pathways for potential exposure exist or may exist in the future, a Phase II screening ERA is required.

Based on the knowledge that Playa Lake (SWMU 103) received all sanitary and industrial wastewater from the Cannon AFB between 1943 and 1966, only a portion of which was treated in an Imhoff unit prior to discharge, it was assumed likely that the lake sediment and surface water potentially contained hazardous substances. The lake is known to be a breeding habitat for the barred tiger salamander (*Ambystoma mavortium*) which is fed on by a breeding colony of black-crowned night herons (*Nycticorax nycticorax*) (Essex 2009). Playa Lake (SWMU 103)

also serves as a stop-over for migrating waterfowl. In addition, heavy rains have occasionally caused the lake to flood its shoreline, possibly distributing potentially contaminated surface water and sediment to the surrounding soil where terrestrial organisms may reside. Therefore, a Phase II ecoscreen was initiated.

The Phase II, Level I screening ERA is presented in the following sections as outlined in the HWB guidance:

1. Problem Formulation – in which the exposure setting is characterized, data are evaluated for detection status and quantitation limits, site-related inorganic chemical concentrations are distinguished from background concentrations, chemicals of potential ecological concern (COPECs) are identified, and assessment and measurement endpoints are defined through the development of conceptual site exposure models (CSEMs).

2. Exposure and Effects Analysis – All exposure pathways identified as potentially complete are evaluated in this section. Exposure assessments are conducted for each community and each guild receptor. Community measurement receptors (such as benthic macroinvertebrates) are evaluated through direct contact with the medium. Guild measurement receptors (such as carnivorous birds) are assessed quantitatively by estimating exposure through a daily ingested dose and comparing that with an ingestion toxicity reference value (TRV).

3. Risk Characterization – Potential risks are estimated by comparing an exposure with one or more TRVs to calculate ecological screening quotients (ESQs). Potential risks are described in the context of the uncertainty of the assumptions and the effect represented by the TRV. Any uncertainties associated with chemical constituents for which screening values are not available is also discussed in this section.

4. Conclusions and Recommendations – The results of the COPEC screening are presented in a tabular format that provides justification for COPEC elimination and includes any additional information that may be useful for decision making.

1.2 PROBLEM FORMULATION

Playa Lake (SWMU 103) occupies approximately 13 acres within Cannon AFB near the ordnance area at the east-central edge of the Base (**Figure 1**). This shallow pond is maintained near total capacity by inflow from a wastewater treatment plant located to the west. The lake is an estimated 1,000 feet across at its widest and its greatest estimated depth is 5 feet with a gradually sloping bottom.

1.2.1 Site History

Playa Lake (SWMU 103) received all of Cannon AFB's sanitary and industrial wastewater from 1943 to 1966; a portion of the wastewater was treated with an Imhoff unit prior to discharge to the lake. In 1966, a lagoon system was placed in operation that provided aeration treatment of the wastewater prior to discharge of treated effluent into Playa Lake. The lake received treated sanitary and industrial wastewater effluent from the wastewater treatment lagoons from 1966 until the lagoons were decommissioned in 2003. A new WWTP was built and put into commission in 1998. A portion of the treated effluent from this plant is discharged to a golf course pond where it is used for irrigation. The remainder of the effluent is discharged to Playa Lake. This WWTP is regulated by a National Pollution Discharge Elimination System permit issued by the USEPA and a New Mexico Ground Water Discharge Permit. The WWTP consistently meets its discharge requirements. In 2006 and 2007 it was awarded the New Mexico Water and Wastewater Association's Good Housekeeping Award for best overall operations and maintenance practices.

1.2.2 Current Use

The Playa Lake continues to receive treated effluent directly from the wastewater treatment plant. There are no streams or water bodies entering or exiting the lake. Water exits the lake via evaporation and possibly infiltration. Very little vegetation surrounds the lake; weeds and annuals are found seasonally in the wet zones of the shoreline. A few individual elms and hybrid poplars are also located along the shoreline.

1.2.3 Characterization of Exposure Setting

In general, a playa lake is a flat-bottomed depression in a desert basin that seasonally becomes a shallow lake. Most playas fill with water only after desert storms while a few are fed by underlying groundwater. Playas are important because they store water in geographic regions that typically receive minimal annual precipitation and where permanent rivers and streams are rare. Consequently, playas often support a large array of wildlife and contribute to the biodiversity of the high plains. Playas are important habitat for migratory birds and waterfowl. Almost all playa lakes are affected by agricultural activities (USEPA 2008b) primarily because early agricultural activity was situated adjacent to the lakes which served as important irrigation sources for crops and drinking water sources for livestock. As with many playa lakes, Playa Lake (SWMU 103) at Cannon AFB has no natural inflow or outflow streams. Therefore, there is no direct surface water exchange with other water bodies in the area. Playa Lake was seined within the last 10 years and no fish were collected (Crow 2009). However, playa lakes are a breeding ground for many species of salamanders whose larvae were observed in the nets (Crow 2009).

Playa Lake (SWMU 103), under investigation at Cannon AFB, differs from the many other playa lakes in the region because it is not ephemeral in nature but is maintained as a permanent water body. Water levels in Playa Lake (SWMU 103) are maintained by discharge from the Base

WWTP. The original concern when the data were collected in 1993-1994 was that wastewater from the base, including storm water runoff from runways and roads was being discharged to Playa Lake with limited treatment. Since 1998, the new WWTP captures and cleans wastewater prior to being discharged to Playa Lake (SWMU 103). Approximately 10 discharges per day occur from the Cannon AFB WWTP. The discharge water undergoes a chlorination process and dechlorinization process prior to being released into Playa Lake (SWMU 103). This ERA evaluates conditions in Playa Lake (SWMU 103) based on surface water and sediment data collected in 1993-1994. The possible effects of recent lake improvements on potential exposure and risk pathways since 1994 are discussed in the Conclusions Section (**Section 1.6**).

1.2.4 Conceptual Site Exposure Model

The CSEM provides a schematic representation of contaminant source(s), release and transport of hazardous constituents, and point and route of receptor exposure to contaminated media. The exposure component of the CSEM is based on assumptions about the existing food web at Playa Lake (SWMU 103). Primary producers (rooted and floating aquatic vegetation) provide a food base for primary consumers (zooplankton and sediment-dwelling organisms). Playa Lake (SWMU 103) lacks fish, but salamanders and other amphibious larvae are secondary consumers. The Lake is visited by aquatic birds which may be primarily herbivorous (e.g., Canada goose), omnivorous (e.g., duck species), or predatory (e.g., heron). In the terrestrial portion of Playa Lake (SWMU 103), herbivorous and omnivorous small mammals and birds feed on vegetation and soil invertebrates. Terrestrial birds and mammals are prey for higher trophic-level receptors (e.g., hawks and carnivorous mammals).

The CSEM helps to focus the investigation on those receptors at the highest risk and the pathways by which they may be exposed. Exposure includes the ingestion of diet items that may have accumulated hazardous chemicals in their tissue. The CSEM for ecological receptors potentially or actually present at Playa Lake (SWMU 103) is presented in **Figure 2**. Aquatic receptors may come in direct contact with surface water or sediment and higher trophic level aquatic receptors may ingest surface water and sediment as well as contaminated food items. Because sludge material may have extended beyond the water level of Playa Lake (SWMU 103), terrestrial receptors may also come in contact with soil containing site-related contamination.

1.2.4.1 Representative Assessment and Measurement Endpoints – Aquatic Ecosystems

Assessment endpoints are particular components or attributes of the ecosystem that are critical to maintenance of ecosystem function and structure. The assessment endpoints establish a clear connection between what is and should be protected and the regulatory goals for a site. Assessment endpoints can encompass a single species or a group of species with common characteristics. Measurement endpoints are often a defined species used to represent a functional group of organisms at the site. Other considerations in selecting measurement endpoints are the species sensitivity to the toxins present, potential for a high level of exposure, social and

economic importance, the availability of natural history information on the species, and relevance to risk management goals at the site.

A study in the high plains of west Texas indicated that playa lakes were found to host a high diversity of macroinvertebrate fauna, despite their temporary nature (Hall et al. 2004). However, diversity was not as great in permanently flooded playas, such as Playa Lake (SWMU 103), that have been incorporated into stormwater systems (Wolf 1996).

Water-column Organisms – Based on the study of west Texas playas (Hall et al., 2004), resident macroinvertebrates in playa wetlands include water mites (Subclass: Arachnida), fairy and tadpole shrimp (Class: Branchiopoda), and seed shrimp (Class: Ostracoda). Numerous transient species may also be represented. Food for many of these organisms consists of algae, bacteria, Protozoa, rotifers and bits of detritus. These organisms could be exposed to site-related chemicals through direct contact with water and through ingestion of contaminated prey. They are, in turn, food for many higher trophic-level receptors.

- *Assessment Endpoint* – Viability and function of the aquatic plankton community.

- *Measurement Endpoint* – Comparison of surface water exposure concentrations with NM ambient water quality standards for the protection of aquatic life or other similar toxicity values.

Benthic Macroinvertebrates – Typical resident benthic macroinvertebrates in playa lakes include lumbricid and tubificid worms, leaches and chironomid (midge) larvae (Hall et al. 2004). Benthic macroinvertebrates may become exposed to site-related chemicals through direct contact with and ingestion of sediment.

- *Assessment Endpoint* – Viability and function of the benthic macroinvertebrate community.

- *Measurement Endpoint* – Comparison of sediment exposure concentrations with sediment quality guidelines or other similar toxicity values.

Salamander Larvae – Cannon AFB's Playa Lake is a breeding habitat for the barred tiger salamander (*A. mavortium*) (Essex 2009). Female barred tiger salamanders can lay 200-2000 eggs on sticks, aquatic vegetation, debris, or other substrate (Rorabaugh 2009). Eggs of these amphibians take 14-50 days to hatch and the larval period is typically longer than 2 months. Tiger salamander larvae can grow to be up to five or more inches long and some individuals stay in the larval state (with external gills) after becoming sexually mature, a condition called neotony (Tyning 1990). Larvae feed on a wide variety of invertebrates and small vertebrates, including their own kind. They rarely eat vegetation. The larvae usually stay close to the bottom in shallow water with vegetation. They are not known to bury themselves in sediment; therefore, direct contact with sediment is not a significant pathway. Barred tiger salamander larvae could

be exposed to site-related chemicals through direct contact with contaminated water and through ingestion of contaminated prey and/or sediment.

- *Assessment Endpoint* – Viability and function of breeding amphibian community.

- *Measurement Endpoint* – Comparison of exposure concentrations with ambient water quality standards for the protection of aquatic life or other similar toxicity values.

Omnivorous Aquatic Birds – Several species of waterfowl use Playa Lake during migration. The mallard (*Anas platyrhynchos*) was chosen as a representative omnivorous aquatic bird. It is generally found in shallow water where it dabbles for plant food, but may also take in insects, mollusks, and other sediment-dwelling organisms (Alsop 2002).

- *Assessment Endpoint* – Survival, growth and reproduction of omnivorous aquatic birds.

- *Measurement endpoint* – Comparison of the estimated dietary dose that a mallard receives with TRVs from the literature.

Predatory Aquatic Birds – Cannon AFB's Playa Lake is also the breeding habitat for the black-crowned night heron (*N. nycticorax*). During the breeding season there may be as many as 50 birds utilizing Playa Lake (SWMU 103) (Essex 2009). While normally fish eaters, black-crowned night heron are opportunistic feeders, they are known to feed on frogs, other amphibians, crustaceans, insects, chicks of other birds, and mammals (USGS 2009). At Playa Lake (SWMU 103), they feed on the tiger salamanders (Essex 2009). Night herons could become exposed to site-related chemicals through ingestion of contaminated prey, contaminated water, and through incidental ingestion of contaminated sediment.

- *Assessment Endpoint* – Survival, growth and reproduction of aquatic predatory birds.

- *Measurement Endpoint* – Comparison of the estimated dietary dose that a representative night heron receives with TRVs from the literature.

1.2.4.2 Representative Assessment and Measurement Endpoints – Terrestrial Ecosystems

Apart from the vegetation associated with the moist areas surrounding Playa Lake (SWMU 103), vegetation in terrestrial areas is sparse, consisting of bunch grasses and weeds. The vegetated area is maintained for fire control by mowing. Therefore, terrestrial vegetation is not considered an assessment endpoint for this risk assessment.

Soil Invertebrates – Soil invertebrates are an important part of the terrestrial community and often serve as a food base for higher trophic-level receptors. Concentrations of chemicals in soil that are potentially toxic to soil invertebrates could deplete an important food source for the community food web.

- *Assessment Endpoint* – Viability and function of the soil invertebrate community.

- *Measurement Endpoint* – Comparison of soil exposure concentrations with direct soil toxicity values.

Small Mammals – Small mammals inhabiting the terrestrial portion of Playa Lake (SWMU 103) may include the omnivorous deer mouse (*Peromyscus maniculatus*) and western harvest mouse (*Reithrodontomys megalotis*), and the herbivorous cottontail rabbit (*Sylvilagus floridans*) (Essex 2009). Small mammals could become exposed to site-related chemicals incidental ingestion of soil through preening and feeding and through ingestion of contaminated prey. Nonseed plant materials provide a significant proportion of small mammals' daily water requirements (USEPA, 1993). Therefore, small mammals are not expected to get their daily water intake from Playa Lake (SWMU 103). Direct contact with soil is not considered significant because most of their epidermis is protected by fur.

- *Assessment Endpoint* – Survival, growth and reproduction of omnivorous small mammals.

- *Measurement Endpoint* – Comparison of dietary doses that a representative omnivorous small mammal (deer mouse) receives with TRVs from the literature.

Omnivorous Birds – Birds feeding on vegetation and soil invertebrates could be exposed to site-related contaminants in the soil through incidental ingestion of soil and ingestion of contaminated vegetation and soil invertebrates. Although not normally found in a high-desert habitat, a representative omnivorous bird is the American robin (*Turdus migratorius*).

- *Assessment Endpoint* – Survival, growth, and reproduction of omnivorous birds.

- *Measurement Endpoint* – Comparison of dietary doses that a representative omnivorous bird (American robin) receives with TRVs from the literature.

Carnivorous Mammals – As a representative of a medium-sized, primarily carnivorous mammal, the coyote (*Canis latrans*) is likely to frequent the area surrounding Playa Lake. Its principle diet is composed of mice, rabbits, ground squirrels, other small rodents, insects, reptiles, and fruits and berries of wild plants. The coyote could become exposed to site-related chemicals through ingestion of contaminated prey and incidental ingestion of soil. The coyote is not expected to get a significant portion of its daily water intake from Playa Lake.

- *Assessment Endpoint* – Survival, growth and reproduction of carnivorous mammals.

- *Measurement Endpoint* – Comparison of the dietary dose that a representative carnivorous mammal (coyote) receives with TRVs from the literature.

Carnivorous Birds – The most common hawk at Cannon AFB is the Swainson's hawk (*Buteo swainsoni*) (Essex 2009). Less common are the ferruginous hawk (*Buteo* regalis) and the red-tailed hawk (*Buteo jamaicensis*); the northern harrier (*Circus cyaneus*) is also present during winter months. Carnivorous birds could become exposed to site-related chemicals through ingestion of contaminated prey. Incidental soil ingestion for carnivorous hawks is considered negligible.

- *Assessment Endpoint* – Survival, growth, and reproduction of carnivorous birds.

- *Measurement Endpoint* – Comparison of the dietary dose that a carnivorous bird (Swainson's hawk) receives with TRVs from the literature.

1.2.5 Data Collection and Evaluation

Surface water and sediment were collected from Playa Lake in September 1993 as part of the Phase I evaluation (**Figure 3**). Three surface water samples were collected from the 0.5 to 3.5-foot interval below the water surface. Surface water samples were analyzed for Resource Conservation and Recovery Act (RCRA) Appendix IX volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), metals, total petroleum hydrocarbons (TPH), pesticides/polychlorinated biphenyls (PCBs), and herbicides. Complete analytical data are presented in Attachment 1, *Analytical Data.* Water samples were universally algae-rich, with a medium- to olive-green color. Suspended algal material was visible in all samples collected. Conductivity was constant for all samples at 5,000 millohms. Water temperature ranged from 20.1ºC to 21.9ºC and pH ranged from 9.6 to 10.0.

Four sludge/sediment samples were collected from the bottom of Playa Lake with a stainless-steel petite-ponar dredge. The samples were analyzed for VOCs, SVOCs, metals, TPH, pesticides/PCBs, and herbicides. Complete analytical data are presented in Attachment 1, *Analytical Data*. Sludge samples were described as black organic silt with a very fetid, sulfurous odor. Sample CAN103-1033 showed a colloidal texture which was not apparent at other locations.

The Phase II RFI field investigation was completed during November and December 1994, and consisted of sampling surface and subsurface soils around Playa Lake and lake sediment (**Figure 3**). The Phase II sampling rationale was developed to gather information to further assess the vertical and horizontal extent of contamination in and around Playa Lake (SWMU 103). Testing was in accordance with EPA SW-846 methodology, and the analyte list was selected on the basis of the potential contamination indicated by the past and current operations at the time at the

SWMU. Laboratory analytical data were evaluated in accordance with USACE and USEPA guidance as outlined in the Quality Assurance Project Plan of the Phase II Work Plan (W-C 1993).

Six soil borings were drilled and soil samples collected at locations surrounding the Playa Lake in December 1994. Surface soil samples from all soil borings were collected from 0 to 2 feet. All borings were also sampled at intervals of 3 to 5 feet, 8 to 10 feet, 13 to 15 feet, and 18 to 20 feet at various locations, along the shore, of Playa Lake (SWMU 103). The sediment sample borings were drilled to a depth of 5 feet below the bottom of the lake. The soil and sediment boring locations were chosen to assess the lateral and vertical presence and extent of site-related contaminants. The sediment borings were sampled at intervals of 2 to 3 feet and 4 to 5 feet.

For the ecological risk assessment, relevant samples were limited to the surface water and surficial sediment samples collected in 1993 and the surface soil samples (0-2 feet) collected in 1994. Sediment samples were collected in 1994 to assess the vertical extent of site-related chemicals, and were not considered ecologically relevant because of their depth (2 to 5 feet). Summaries of the chemicals detected in each of the samples used in the ecological risk assessment are presented in **Tables 1** (water), **2** (sediment), and **3** (surface soil).

The evaluation of quantitation limits, persistence, mobility, and bioaccumulation are discussed in the following subsections.

1.2.6 Screening against Inorganic Background Concentrations

Soil was the only medium for which background data were available. Because there were only six surface soil samples collected from Playa Lake (SWMU 103), data were insufficient for performing a more rigorous means comparison test. Therefore, the maximum detected concentrations were compared with background UTLs. If a maximum concentration exceeded the background UTL, that constituent was selected as a preliminary COPEC (pCOPEC). All other inorganics were considered to be within the range of background. A summary of the Playa Lake (SWMU 103) surface soil samples and a comparison with background UTLs is presented in **Table 4**. The maximum concentrations of antimony, calcium and manganese exceeded their respective UTLs. While the detected concentrations of beryllium did not exceed the background UTL, the maximum reporting limit (1 mg/kg) was greater than the background UTL (0.73 mg/kg). This introduces a degree of uncertainty to the outcome of the screening. Because the detected concentrations of beryllium (range 0.26 to 0.48 mg/kg) were less than the UTL and the maximum reporting limit was only slightly greater than the UTL, beryllium was not carried forward as a pCOPEC for surface soil. Alternatively, selenium, silver, and sodium were not detected in surface soil, but the maximum reporting limits exceeded their respective 95% UTL for background. The UTLs for selenium and silver were each based on a maximum concentration and both concentrations were J-qualified. A "J" qualification indicates that the observed value was lower than the required reporting limit but greater than the method detection limit and is; therefore, considered an estimated value. The uncertainty associated with presence or absence of selenium and silver in Playa Lake (SWMU 103) surface soil will be discussed in

the uncertainty section (**Section 1.5.11**). As a result of the screening against background the following inorganic pCOPECs were retained for further evaluation in surface soil:

- Antimony
- Calcium
- Manganese

Due to the lack of background data for sediment and surface water, all detected constituents were retained as pCOPECs and carried forward into the next screening step.

1.2.7 Identification of Preliminary Contaminants of Potential Ecological Concern

In this step, pCOPECs were evaluated by comparing the maximum detected concentration with available toxicity data. Preliminary COPECs with maximum concentrations exceeding selected ecological screening values (ESVs) were identified as COPECs and carried forward in the risk assessment. The maximum reporting limit for non-detects was also compared with the lowest ESV. When the maximum reporting limit was greater than the ESV, the constituent was identified as an uncertainty.

1.2.7.1 Selection of Ecological Screening Values

The primary source for soil ecological toxicity screening values was USEPA's ESSLs. Where available, the more conservative plant or soil invertebrate ESSL was used for the direct ESV and the more conservative of the bird or mammal ESSL was used for the ingestion ESV. If ESSLs were not available, soil ESVs were selected from the USEPA Region V Ecological Screening Levels (ESLs) (USEPA 2003), Environment Canada, or the published literature. MacDonald et al. (2000) was the primary source for sediment ESVs, and the New Mexico Chronic Water Quality Standards for the Protection of Aquatic Life (NMED 2007) were used for surface water ESVs. If toxicity data were not available from these sources, ESVs were selected from USEPA Region V ESLs, the published literature or other peer-reviewed databases. For 2-butanone, carbon disulfide, and chloromethane, sediment ESVs were calculated using equilibrium partitioning methodology (USEPA 1993) assuming 1% organic carbon content in sediment. Selected ESVs and their sources are presented in **Table 5**.

1.2.7.2 Screening of Contaminants of Potential Ecological Concern

Tables 6, **7**, and **8** provide the summary statistics and COPEC screening for constituents detected in surface soil, surface water, and sediment respectively.

Surface Soil – The maximum concentrations of all detected constituents were less than their respective direct ESVs (**Table 6**). Therefore, adverse effects to the soil invertebrate community from exposure to site-related chemicals are not anticipated. Antimony was detected at concentrations that exceeded its ingestion ESV (**Table 6**). Acetone, methylene chloride and toluene were each detected in one out of six samples at concentrations well below their respective direct ESVs (**Table 6**). Ingestion ESVs were not available for these constituents; however, because of a low affinity to become accumulated in an organism's lipids as expressed in their octanol-water partitioning coefficients (log K_{ow} = -0.24, 1.25, 2.73, respectively), they are not considered bioaccumulative for the ingestion pathway. NMED HWB guidance (2008) considers organic chemicals with log K_{ow} values equal to or greater than 4 as having a high bioaccumulation potential. Ingestion ESVs also were not available for Aroclor 1248, 4,4'-DDE or 4,4'-DDT, which were each detected in one out of five samples at concentrations lower than their respective direct ESVs. Because of its bioaccumulative potential (log K_{ow} = 6.2) and the relatively high maximum detection (750 µg/kg), Aroclor 1248 was retained as a potential ingestion COPEC for surface soil.

DDE and DDT were not considered COPECs because, although they are potentially bioaccumulative, the maximum detected concentrations were low and likely in the range of ambient conditions for an agricultural area. Prior to becoming a military airfield in 1943, the land surrounding the airfield was used for farming (Crow 2009) and the properties immediately surrounding the WWTP and Playa Lake are still cultivated. Residual mean DDT and DDE concentrations measured in agricultural fields in Georgia and South Carolina in 1999 were 4.7 µg/kg DDT and 7.7 µg/kg DDE (Kannan et al. 2003); means of 24.6 µg/kg DDT and 22.7 µg/kg DDE were reported for Alabama soils (Harner et al. 1999); and a mean ∑DDT of 9.6 µg/kg was found in the U.S. Corn Belt (Aigner et al. 1998). Given that the detected concentrations of DDE and DDT in the Playa Lake soil are low relative to other agricultural areas in the U.S., the low frequency of detection (1/5), and the large home ranges of top predators, DDE and DDT in soil are unlikely to pose unacceptable risks to ecological receptors and were, therefore, not carried forward as COPECs.

Total recoverable petroleum hydrocarbons (TRPH) were detected at 734 mg/kg in soil which was below the direct ESV. An ingestion ESV was not available for petroleum hydrocarbons; however, most petroleum hydrocarbons are readily metabolized by vertebrates, modified into a readily excretable form and, thus, do not accumulate in tissue (CCME 2008). In addition, petroleum hydrocarbons are not readily absorbed into plant tissue (CCME 2008). Therefore, TRPH in soil was not considered a COPEC for soil.

In summary, two constituents detected in surface soil, antimony and Aroclor 1248, will be carried forward for further evaluation as COPECs for higher trophic-level receptors.

Surface Water – Available data on inorganics were expressed as total concentrations (**Table 7**). Currently, water quality standards for arsenic, copper, lead, silver, and zinc are based on the dissolved (bioavailable) fraction. Where the maximum total concentration was below the dissolved fraction criterion (i.e., arsenic, copper, and zinc), that constituent could be eliminated

as a COPEC for surface water. The surface water ESV for vanadium was selected from USEPA Region 5 ESLs and is based on total concentration; therefore, vanadium was not considered a COPEC. Lead was detected in one of three samples at a total concentration of 6 µg/L. The current chronic criterion for lead is 1.94 µg/L dissolved (assuming a hardness of 100). Without knowing what fraction of the 6 µg/L total lead is in the dissolved form, it is not possible to evaluate lead's potential for adverse effects to aquatic organisms. However, the total concentration is used for the ingestion pathway of higher trophic-level receptors. A chronic criterion was not available for silver; therefore, the acute dissolved criterion was presented. The maximum total detection of silver exceeded the acute dissolved criterion; however, as with lead, potential adverse effects to aquatic receptors cannot be predicted. Because these constituents cannot be quantitatively evaluated, they will be discussed in the uncertainty section.

Although the bioavailable fraction is considered the most relevant for predicting toxicity to water column organisms, it is not as applicable to semi-aquatic species, such as the mallard duck and night heron, which drink the unfiltered surface water. However, when water ingestion rates (L/day), surface water concentrations (µg/L) and body weights (kg) are considered, exposure through surface water ingestion is negligible. For example, the ingested dose to the night heron from ingesting silver in water from the most contaminated location is approximately 0.0006 mg/kgBW/day; much lower than the avian No Observable Adverse Effects Level (NOAEL) for silver (2.02 mg/kgBW/day). In addition, none of the constituents detected in surface water is considered bioaccumulative. Therefore, exposure to surface water through ingestion was not evaluated unless a chemical was identified as a COPEC in another medium.

Sediment – **Table 8** presents the COPEC screening for Playa Lake sediment. The maximum concentrations of carbon disulfide, bis(2-ethylhexyl)phthalate, arsenic, cadmium, copper, lead, mercury, nickel, selenium, silver and zinc all exceeded their respective ESVs and were identified as COPECs. Calcium, magnesium, potassium, and sodium are considered essential nutrients and were not carried forward as COPECs. Sediment ESVs were not available for barium, beryllium, and vanadium, all of which were identified as COPECs and will be discussed in the uncertainty section. A discrete value was not given for the maximum detection of butyl benzyl phthalate or di-n-butyl phthalate so their status as COPECs could not be defined. These constituent will be discussed in the uncertainty section. A sediment ESV was also not available for total petroleum hydrocarbons (TPHs). The primary toxic components of TPH are benzene, toluene, ethylbenzene, xylene and polycyclic aromatic hydrocarbons (PAHs) (MDEP 2007). Of these constituents, only benzene was detected in sediment. Benzene concentrations ranged from 6.6 µg/kg to 16 µg/kg in sediment, all less than the sediment ESV of 57 µg/kg. Therefore, TPH was not carried forward as a COPEC in sediment.

In summary, based on no-effects ESVs for sediment, the following constituents were identified as COPECs or uncertainties in Playa Lake sediment:

COPECs	Uncertainties
Carbon disulfide	
Bis(2-ethylhexyl)phthalate	
Arsenic	
Cadmium	Barium
Copper	Beryllium
Lead	Vandium
Mercury	Butyl benzyl phthalate
Nickel	Di-n-butyl phthalate
Selenium	
Silver	
Zinc	

1.3 EXPOSURE ANALYSIS

In general, the frequencies of detections of analytes in all media were too few to calculate a 95% upper confidence limit of the mean (95% UCL).

The exposure and effects analysis has two forms: one for community endpoints in which exposure concentrations are compared with direct exposure TRVs and one for representative guild endpoints in which estimated ingested doses are compared with ingestion TRVs. The approach for community endpoints will be evaluated first, followed by guild-specific endpoints.

1.3.1 Community Endpoints/Direct Exposure

1.3.1.1 Soil Invertebrate Community

For this risk assessment, the soil invertebrate community was evaluated by comparing the maximum detected value with a no-effects ESV.

1.3.1.2 Water Column Community

The water column community was evaluated by comparing the maximum detected concentrations with surface water ESVs. Surface water ESVs were generally ambient water quality standards or an equivalent toxicological value. Current water quality standards for several inorganic constituents are based on the dissolved fraction in the water column. Because surface water samples were analyzed for total and not dissolved metals, few conclusions can be made about potential effects to water column organisms.

1.3.1.3 Benthic Macroinvertebrate Community

TRVs for freshwater benthic macroinvertebrates have been derived for several constituents on a consensus basis (MacDonald et al. 2000). Two values were derived for each constituent: (1) the threshold effect concentration (TEC) which is intended to identify contaminant concentrations below which harmful effects on sediment-dwelling organisms are not expected; and, (2) the probable effects concentration (PEC) which is intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms were expected to occur frequently. The TEC, or its equivalent if unavailable in MacDonald et al (2000), were used as screening values to identify preliminary COPECs for sediment. Constituents for which the maximum concentration was below the TEC/ESV are not expected to cause harmful effects and were thus eliminated as COPECs. To identify those constituents that are likely to cause harm to benthic organisms, additional comparisons were made using the PEC or its equivalent. Because sampling was limited (N=4), the exposure concentration was represented by the maximum detected concentration.

1.3.2 Indirect Exposure through Ingestion

Receptors evaluated for indirect exposure through ingestion are the deer mouse, American robin, coyote, and Swainson's hawk for the terrestrial ecosystem; and the mallard duck and black-crowned night heron for the aquatic ecosystem. For the terrestrial ecosystem, only antimony and Aroclor 1248 were identified as COPECs for higher trophic-level receptors. Therefore, Aroclor 1248 and antimony will be assessed for the terrestrial receptors. Of the analytes detected in sediment and surface water, only mercury and selenium are considered bioaccumulative. Mercury was detected in two out of four sediment samples at 0.39 and 0.51 mg/kg. Selenium was detected in four out of four samples at a range of 3.3 to 13.2 mg/kg. Although the potential for bioaccumulation of silver varies from organism to organism (Ratte 1999), it was carried forward in the aquatic food web because the concentrations in sediment were high (range 9.8 to 33.7 mg/kg) relative to background (maximum detection 0.51 mg/kg).

Ingestion exposure, or average daily dose (ADD), was estimated using the following equation for terrestrial receptors:

$$ADD = \frac{\left[\left(IR_{food} \times C_{food}\right) + \left(IR_{soil} \times C_{soil}\right)\right] \times AUF}{BW}$$

Where:

ADD	=	Average daily dose (mg/kgBW/day)
IR_{food}	=	Ingestion rate of food (kg/day)
C_{food}	=	Concentrations of COPEC in food (mg/kg)
IR_{soil}	=	Ingestion rate of soil (kg/day)
C_{soil}	=	Concentration of COPEC in soil (mg/kg)

AUF = Area use factor (percent)
BW = Body weight (kg)

As discussed previously, water ingestion was not considered for terrestrial receptors. Neither of the soil COPECs (antimony and Aroclor 1248) was detected in Playa Lake (SWMU 103) surface water.

Ingestion exposure was estimated using the following equation for aquatic receptors:

$$ADD = \frac{\left[\left(IR_{food} \times C_{food}\right) + \left(IR_{water} \times C_{water}\right) + \left(IR_{soil} \times C_{soil}\right)\right] \times AUF}{BW}$$

Where:

ADD = Average daily dose (mg/kgBW/day)
IR_{food} = Ingestion rate of food (kg/day)
C_{food} = Concentrations of COPEC in food (mg/kg)
IR_{water} = Ingestion rate of water (L/day)
C_{water} = Concentration of COPEC in water (mg/L)
IR_{soil} = Ingestion rate of soil (kg/day)
C_{soil} = Concentration of COPEC in soil (mg/kg)
AUF = Area use factor (percent)
BW = Body weight (kg)

Assumptions and sources regarding body weight, ingestion rates, and diet composition for each representative higher trophic-level receptor are presented in **Table 9**.

1.3.2.1 Estimating COPEC Concentrations in Diet Items

The concentrations of soil COPECs (antimony and Aroclor 1248) in diet items for terrestrial receptors were estimated using information compiled in U.S. EPA's *Ecological Soil Screening Levels for Antimony* (USEPA 2005), USFWS (2003) for PCB uptake into plants, Sample et al. (1998) for PCB uptake into earthworms, and USEPA (2000) for PCB uptake into small mammals. Because the uptake factors are expressed on a dry weight basis, all ingestion rates (with the exception of water) are expressed in dry weight. For the aquatic ecosystem, uptake of the aquatic COPECs (mercury, silver, and selenium) into tiger salamander larvae was assumed to be similar to the uptake of these elements into fish. Ratte (1999) was the source for identifying the uptake of silver into the tissue of algae, benthic invertebrates, and fish (as a surrogate for salamander larvae). A paper on mercury bioaccumulation by the Massachusetts Department of Environmental Protection (MDEP 2003) served as a source for the bio-uptake of mercury in freshwater systems. Various sources were used to derive uptake factors of selenium from sediment to biota. A U.S. Geological Survey report on selenium in water, sediment, and biota of

a freshwater stream (USGS 2002) was the source of sediment-to-plant, sediment-to-chironomid, and chironomid-to-fish uptake. The aquatic plant was represented by the leaves of the water buttercup (*Ranunculus* sp.), a perennial rooted in sediment. Other sources for sediment-to-chironomid uptake were Zhang and Moore (1996) and Saiki et al. (1993). The mottled sculpin was selected for the chironomid-to-fish uptake factor from USGS (2002) because the majority of their diet consists of chironomids and other aquatic insects (WYFG, undated). Data on rotifer-to-fathead minnow uptake came from Bennett et al. (1996), and data on chironomid-to-sunfish uptake were selected from Saiki et al. (1996). **Tables B-1** through **B-3** of Attachment 2 present the data used and the plots and equations for selenium uptake factors. Uptake factors or algorithms and their sources for all COPECs are presented in **Table B**.

1.4 TOXICITY ASSESSMENT

Estimated average daily doses were compared with a range of oral toxicity values; (1) the no-observed-adverse-effects level (NOAEL); and (2) the lowest-observed-adverse-effects level (LOAEL). Because a complete continuum of concentrations is not tested when determining toxicity, there may be a wide gap between the test concentration showing no effects and that showing adverse effects. The true NOAEL may fall somewhere between the reported NOAEL and LOAEL.

The primary sources for NOAELs and LOAELs were the USEPA ESSL documents (USEPA 2003 through 2008). The NOAEL used to estimate risk in this assessment was the one used in deriving the ESSL. The ESSL database was used to select a LOAEL. If the ESSL NOAEL was based in a geometric mean, the lowest LOAEL greater than the ESSL NOAEL was selected for the risk assessment. If the ESSL NOAEL was from a specific study and that study reported a LOAEL, the LOAEL from the study was used in the risk assessment. If the study did not report a LOAEL, then the lowest LOAEL greater than the ESSL NOAEL was selected. USEPA ESSLs were available for antimony (USEPA 2005), selenium (USEPA 2007), and silver (USEPA 2006). For those COPECs for which an ESSL has not yet been developed (i.e., mercury and polychlorinated biphenyls), published literature was reviewed for selection of NOAELs and LOAELs.

The general strategy for selecting (or deriving) a single NOAEL and LOAEL as a TRV dose from among the many values reported in the literature for the remaining constituents was as follows:

- Toxicity studies on the receptor species present at Playa Lake (SWMU 103) were given first priority. Where values were not available for specific receptors (which is characteristic of the vast majority of literature values), values from surrogate receptors were selected.
- Studies measuring effects that could be related to population-level impacts were given priority. Priority endpoints included survival, growth, and reproductive effects. Effects

such as liver damage, carcinogenesis, enzyme induction, and histopathology were generally not considered appropriate measures.

- In general, studies with the lowest LOAEL and associated NOAEL endpoints were preferred. However, all data were examined, and LOAELs and NOAELs from different studies were also considered based on test organism, study design (e.g., dilution series ratio), and availability of information.
- The duration of the study was given consideration, as well as the toxicological endpoint. Preference was given to studies that were chronic or subchronic over a single event or acute exposures. Where data were available for more than one dosing regimen, chronic was selected first, subchronic second, and acute only if no other data were available.
- Body weight changes in adult test species were not considered a priority endpoint. However, body weight changes in juvenile individuals were assumed to indicate growth (or lack thereof) and, therefore, were considered a relevant endpoint.
- Studies were considered based on the mode of administrating the dose. Studies in which the dose was administered through diet were given preference. If diet studies were not available, studies in which the toxicant was administered in water were considered. Intraparitoneal or intravenous studies were not used. Studies using gavage, capsules of oral intubation were not used when food studies were available.
- In one case (methyl mercury), only LD_{50} data were available for birds. The LD_{50} was divided by an uncertainty factor of 100 to derive a NOAEL, and an uncertainty factor of 10 to derive a LOAEL.

Oral toxicity reference values (NOAELs and LOAELs) for birds and mammals are presented in **Table 11** along with the test species, durations of exposure, measurement endpoints, and references.

1.5 RISK CHARACTERIZATION

This section provides an estimate of risk in the form of ecological screening quotients (ESQs) for single chemicals. The ESQ is the ratio of the exposure concentration (or dose) to the TRV concentration (or dose). In this risk assessment, no-effect TRVs and lowest-effects TRVs are used to give a range of possible outcomes. For sediment, ESQs were calculated using the TEC (no-effects) and the PEC (possible-effects). For higher trophic-level receptors, NOAEL-based ESQs (ESQ_{NOAEL}s) and LOAEL-based ESQs (ESQ_{LOAEL}s) were calculated and presented. When

effects of different chemicals are on the same target organs, the single ESQs can be added for a cumulative ecological screening quotient (CESQ). ESQs are described for community or guild endpoints in the following sections.

1.5.1 Terrestrial Invertebrate Community

The maximum concentrations of all detected constituents were less than their respective direct ESVs (**Table 6**). Therefore, adverse effects to the soil invertebrate community from exposure to site-related chemicals are not anticipated.

1.5.2 Water Column Community (including Salamander Larvae)

The comparison of the maximum concentrations of constituents in surface water samples with surface water ESVs is presented in **Table 7**. Because most of the ESVs are selected from ambient water quality standards, they are assumed to include protection of salamander larvae. A requirement in developing water quality standards is the use of fish species and one other organism from the Phylum Chordata (which could include a frog or salamander species). Therefore, the tiger salamander is considered to be protected under the water quality standards or equivalent ESVs.

A chronic water quality standard is unavailable for silver. The acute criterion based on the dissolved fraction, assuming a hardness = 100, is 2.4 µg/L. The total concentrations of silver in surface water samples ranged from 5.2 µg/L to 9.2 µg/L. The NM water quality standard for lead is expressed as a dissolved concentration dependent on water hardness. The chronic dissolved criterion for lead (assuming a hardness = 100) is 1.9 µg/L and lead was detected as a total concentration of 6 µg/L in one of three surface water samples (maximum reporting limit 0.005 µg/L). Because it is not possible to know what fraction of the total concentration of lead or silver is dissolved and bioavailable, potential risks to aquatic receptors could not be evaluated.

1.5.3 Benthic Macroinvertebrate Community

Ecological screening for the benthic macroinvertebrate community is presented in **Table 8**. The ESV for sediment is based on the TEC or its equivalent. This is the concentration below which adverse effects to the benthic community are not expected. **Table 8** shows that carbon disulfide, bis(2-ethylhexyl)phthalate, arsenic, cadmium, copper, lead, mercury, nickel, selenium, silver and zinc were detected at concentrations greater than their respective ESVs and were identified as sediment COPECs. Calcium, magnesium, potassium, and sodium are essential nutrients and are not considered COPECs. Butyl benzyl phthalate and di-n-butyl phthalate could not be evaluated because the maximum detection was not delimited. Sediment ESVs are unavailable for barium, beryllium, and vanadium, thus, potential effects are uncertain. However, the maximum concentration of barium in sediment (231 mg/kg) is less than the barium UTL for soil (642 mg/kg). Therefore, barium in sediment is unlikely to be site-related and is probably representative of ambient conditions. The maximum detections of beryllium and vanadium in

sediment (0.99 and 130 mg/kg, respectively) were greater than their soil UTLs (0.73 and 25.3 mg/kg, respectively) and, therefore, cannot be attributed to background. Butyl benzyl phthalate, di-n-butyl phthalate, beryllium and vanadium will be discussed in **Section 1.5.11**, Uncertainty Anaylsis.

Table 12 provides ESQs for chemicals identified as COPECs. In this table the ESQs based on the PEC are also presented. The maximum concentrations of selenium and silver each exceeded their PECs, resulting in ESQs of 3.3 and 15, respectively. This suggests a probability for risk to the benthic macroinvertebrate community from exposure to selenium and silver in sediment.

1.5.4 Survival, Growth and Reproduction of the Omnivorous Small Mammal Population

The ADD and ESQs for the representative omnivorous small mammal (deer mouse) are presented in **Tables 13** and **14**. **Table 14** presents both the NOAEL-based and LOAEL-based ESQ to define the range of possible risks. The NOAEL-based ESQ for Aroclor was much less than one for the deer mouse indicating that the small mammal population is unlikely to be adversely affected by exposure to Aroclor in soils around Playa Lake. The NOAEL-based ESQ for antimony slightly exceeds one (1.1); however, the LOAEL-based ESQ is less than one (0.1). The LOAEL was based on a decrease in progeny weight (see **Table 11**) in laboratory rats. Therefore, it is unlikely that the presence antimony in soil will have an adverse effect on the population of small mammals in the vicinity of Playa Lake

1.5.5 Survival, Growth and Reproduction of the Omnivorous Bird Population

The ADD and ESQs for the representative omnivorous bird (American robin) are presented in **Tables 13** and **14**. NOAEL- and LOAEL-based ESQs were less than one for Aroclor 1248 indicating a low probability of adverse effects to omnivorous bird populations from exposure to this chemical. Available data on the toxicity of antimony to birds are insufficient for estimating avian TRVs (USEPA 2005); therefore, potential risks to the omnivorous bird population could not be evaluated.

1.5.6 Survival, Growth and Reproduction of the Carnivorous Mammal Population

The ADD and ESQs for the representative carnivorous mammal (coyote) are presented in **Tables 13** and **14**. ESQs for antimony and Aroclor 1248 are all less than 1.0, indicating no unacceptable risks to the coyote population associated with Playa Lake soils.

1.5.7 Survival, Growth and Reproduction of the Carnivorous Bird Population

The ADD and ESQs for the representative carnivorous bird (Swainson's hawk) are presented in **Tables 13** and **14**. As with the American robin, risk from exposure to antimony could not be evaluated due to the lack of avian TRVs. ESQs for Aroclor 1248 are all less than 1.0 for this receptor, indicating no unacceptable risks to the carnivorous bird population from exposure to soils at Playa Lake.

1.5.8 Survival, Growth and Reproduction of the Omnivorous Aquatic Bird Population

The ADD and ESQs for the representative omnivorous aquatic bird (mallard) are presented in **Tables 15** and **16**. The NOAEL-based ESQ for exposure to mercury in sediment is equal to 1.0 for the mallard, while the LOAEL-based ESQ for mercury was 0.1. Both ESQs were less than 1 for exposure to silver. Therefore, unacceptable risks to the omnivorous bird population from exposure to mercury and silver in sediment and surface water are not expected. However, the selenium NOAEL-based ESQ (2.5) and the LOAEL-based ESQ (1.3) were both greater than 1.0. Because the avian TRV for selenium is based on mortality, a potential for risk to the omnivorous aquatic bird population may exist. This exposure route and assessment endpoint may require further evaluation.

1.5.9 Survival, Growth and Reproduction of the Predatory Aquatic Bird Population

The ADD and ESQs for the representative predatory aquatic bird (black-crowned night heron) are presented in **Tables 15** and **16**. NOAEL-based ESQs are greater than one for mercury (1.1), selenium (2.3) and silver (3.5). However, LOAEL-based ESQs are much less than one for mercury and silver, indicating a low potential for risk from exposure to these constituents. The avian TRV for mercury was based on a derivation from an LD_{50} and consequently contains a degree of uncertainty. The potential for risk to the predatory aquatic bird population from exposure to mercury may require further evaluation. The NOAEL-based and LOAEL-based ESQs for selenium are 2.3 and 1.0, respectively. Therefore, the potential for risk to predatory birds from exposure to selenium may require further evaluation.

1.5.10 Cumulative Risk Estimates

Cumulative risk estimates assume that exposure to multiple contaminants are additive for COPECs that affect the same target organisms and/or act by similar mechanisms. Because of the dissimilarity of actions of antimony and Aroclor 1248, it would be imprudent to calculate CESQs for terrestrial receptors. Although the avian aquatic receptors are both potentially affected by mercury, silver, and selenium for which both had TRVs based on mortality endpoints, information on the specific toxic mechanism is insufficient to assume additive effects.

1.5.11 Uncertainty Analysis

Within any of the steps of the ecological risk evaluation process, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support; the degree of uncertainty varies accordingly. Regulatory risk evaluation methodology requires that conservative assumptions be made throughout the risk evaluation to ensure that receptor populations are protected and ecological risks are appropriately quantified. As a result of cumulative conservatism, when all of the assumptions are combined, it is more likely that risks are overestimated rather than underestimated. This section discusses the following sources of uncertainties associated with the ERA:

- Data collection and evaluation
- Exposure assessment
- Toxicity assessment
- Risk characterization

1.5.11.1 Data Collection and Evaluation

Sediment and surface water data, though few in number, were collected from areas where contaminants were assumed to collect; particularly from within the bermed area receiving wastewater discharge and the center of the lake where particulates would naturally migrate. Uncertainty associated with biases in sampling will positively bias the results and lead to an overestimate of risk. In addition, the maximum concentration was used as an exposure concentration, thus increasing the bias in the risk estimate. Thus, the ERA is likely to have over-estimated risks due to biased sampling.

The maximum concentrations of selenium (13.2 mg/kg) and silver (33.7 mg/kg) detected in sediment were in a Phase I surface sample CAN103-1031 located near the center of the bermed area (**Figure 2**). A Phase I surface sediment sample taken near the periphery of the bermed area (CAN103-1031) was much lower for both selenium (3.3 mg/kg) and silver (9.8 mg/kg). During Phase II field activities, sediment cores were advanced to 5 feet, with the uppermost sample taken from the 2-3 foot interval. Results of the 2-3 foot samples are presented in **Figure 3**. The Phase II sediment sample CAN103-10310 is between the two Phase I samples located within the bermed area. Selenium and silver concentrations in the 2-3 foot interval of CAN103-10310 were 0.13J mg/kg and non-detect (RL=1.1), respectively. This suggests a localized area of contamination and that selenium and silver have not been accumulating in the lake bottom over a long period of time.

Phase I sediment and surface water samples were collected in 1993, five years before the new WWTP was put in operation. The WWTP has been in operation for more than 10 years and has been meeting or exceeding the requirements of its NPDES permit for discharge to Playa Lake (Air Force Print News 2008). Although the total suspended solids (TSS) discharged averages 2-

4 mg/L, deposition of particulates in the bermed area where the maximum selenium and silver concentrations were detected in sediment may have covered or diluted the concentrations in this area. If concentrations of selenium and silver in sediment have attenuated over time, this ERA has likely overestimated risk.

Samples were analyzed using USEPA methodologies and analytical equipment current for 1993-1994. Sample results were subject to data review procedures. However, reporting limits for some constituents exceeded current ESVs. For example, the range of reporting limits for antimony in soil was 6.5 mg/kg to 31.4 mg/kg for non-detects while the ingestion ESV (based on the ESSL for mammals) is 0.27 mg/kg. The maximum detected concentration for antimony in soil was 4.9 mg/kg (J-estimated) and was the value used to estimate risk. Presumably, the equipment and methodology used were capable of detecting antimony at concentrations below the required reporting limit at the time (1994). However, antimony may occur in soil at concentrations greater than 4.9 mg/kg, in which case, the ERA would have under-estimated potential risks.

Finally, surface water samples were analyzed for total metals only; analysis of the dissolved fraction was not performed. The dissolved fraction is considered to be the bioavailable fraction that has a direct effect on toxicity to aquatic organisms. The maximum total concentration was less than the dissolved ESV for arsenic, copper, and zinc, indicating a low probability of risk from these constituents. The total maximum concentration of lead (6 µg/L) exceeded the ESV based on dissolved lead (1.94 µg/L). Without information on what fraction of lead was bioavailable, it was not possible to evaluate potential risks from exposure to lead to aquatic receptors. Because lead was not detected in two of the three samples at a low reporting limit (0.005 µg/L), it is unlikely that lead poses a risk to aquatic receptors. In the three surface water samples, the total concentration of silver ranged from 5.2 to 9.2 µg/L. A chronic aquatic life standard is not available for silver for either dissolved or total concentrations; however, the acute dissolved standard for silver was calculated to be 2.4 µg/L and was used as a general comparison. It was noted during collection that water samples were rich in algae. Algae possess a high accumulation potential for small particle-sizes of heavy metals, particularly silver (Ratte 1999). Accumulation is suggested to be due to adsorption to the cell surface rather than active uptake into the cell (Ratte 1999). The presence of algae (and its accumulated silver) may account for the high total concentration in the surface water samples. Furthermore, enzymatic degradation (as occurs during ingestion) did not remove silver from the algae cell walls (Ratte 1999), thus reducing bioavailability and potential toxicity to aquatic receptors and algal herbivores.

1.5.11.2 Exposure Assessment

In estimating exposure, maximum detected concentrations were used. This approach results in a high level of confidence that risk is not under-estimated, but at the same time, may tend to over-estimate actual average exposures and associated risks.

Exposure to higher trophic-level receptors requires models for estimating the amount of chemical potentially ingested. Various assumptions were made regarding the composition of the diet, the concentration of the COPECs in various food items, the amount of soil or sediment ingested and habitat use by the receptors. For example, the tissue concentration was based on conservative extrapolation from the most contaminated area (the maximum concentration), complete assimilation efficiency of ingested material was assumed, and simplifying assumptions were made about the diet composition of receptors. For example, 100 percent of the black-crowned night heron's diet was assumed to be tiger salamander larvae when its actual diet may be much more diverse (Hoopes et al. 1994). Similarly, larval tiger salamanders were assumed to eat entirely sediment-associated chironomids; however, feeding studies in playas of the southern Great Plains indicate a preference for water-column invertebrates, such as tadpole shrimp, fairy shrimp, ostracods and larvae and eggs of their own species (Smith and Ghioca-Robrecht 2008). Selenium was not detected in surface water samples (selenium reporting limits ranged from 0.00001 to 0.00002 µg/L); therefore, uptake into these preferred prey is not expected to be as great as that of prey directly associated with contaminated sediment (maximum selenium concentration of 13.2 mg/kg). These assumptions are more likely to have resulted in an over-estimate of exposure and risk than an under-estimate.

The regression equation used to estimate selenium tissue concentration in the tiger salamander larvae was assumed to be linear, that is, greater concentrations in the diet resulted in greater concentrations in fish/salamander tissue. However, a laboratory study on fish indicates that after a time period, fish reach an equilibrium body burden of selenium (Bertram and Brooks 1986). While the regression model used in this risk assessment indicated that fish tissue concentrations were 0.9 times that of its diet, the Bertram and Brooks (1986) study found an equilibrium body burden at 0.3 times that of its diet. Thus, it is possible that the results of the ERA have over-estimated risk to the black-crowned night heron by a factor of three.

Conversely, the exposure scenarios for the higher trophic-level receptors did not include exposure through the dermal or inhalation pathways. These omissions could potentially result in an under-estimate of exposure. However, these receptors are covered with fur and feathers thus limiting dermal contact. Dermal contact of the feet of waterfowl with surface water and sediment occurs; however, dermal exposure is considered an insignificant pathway when compared with ingestion. Similarly, the inhalation exposure pathway is considered to be minor when compared with ingestion (USEPA 1998). The omission of these two pathways from the ERA is unlikely to cause a significant under-estimation of risk.

Behavior and habitat use by potential receptors also influences exposure. The maximum concentrations in sediment and surface water were from samples collected from the deepest part of the lake and the bermed area. Black-crowned night heron forage by wading in shallow water, locating their prey by sight and striking. Since the birds are only 25 to 28 inches in height (Alsop 2002) with legs approximately 7 to 8 inches long, they would not be expected to forage in the deeper water where the maximum concentrations of selenium and silver were measured in sediment. Similarly, the mallard dabbles in shallow water and rarely dives for its food (Alsop 2002). Ingestion of food and sediment from the deeper areas of Playa Lake would also be

unlikely. Based on one surface sediment sample taken on the periphery of the bermed area (CAN103-1031), selenium and silver concentrations in shallow areas are potentially lower (3.3 mg/kg and 9.8 mg/kg, respectively) and would result in much lower ESQs. Thus, behavioral considerations indicate that the exposure assumptions used may have over-estimated risk.

1.5.11.3 Toxicity Assessment

The lack of reliable toxicological information is an important uncertainty in the risk analysis. In most cases, toxicological data directly applicable to a selected receptor is not available, whereby a surrogate receptor from the available toxicological database must be used. Surrogates may be more sensitive or less sensitive to the toxicant than the receptor species, thus adding to uncertainty.

The general avian NOAEL and LOAEL for selenium were selected from the USEPA ESSL document for selenium (USEPA 2007) and were based on mortality in chickens (El-Begearmi and Combs 1982) which may or may not be more sensitive to selenium than mallards or black-crowned night herons. However, the chicken-based NOAEL and LOAEL are within the 95% confidence interval for a threshold effect for egg hatchability in mallards (DeForest et al. 2008). Thus, risk estimates may be appropriate for mallards. The LOAEL used for the black-crowned night-heron was based on a study specific to the black-crowned night heron in which the femur and radius-ulna were shorter in hatchlings of parents fed selenium in their diet (Smith et al. 1988). There were no significant differences in the number of fertile eggs or hatching success compared with controls (Smith et al. 1988). The survivability and reproductive success of black-crowned night herons with shorter leg and wing bones was not evaluated. Bioavailability and toxicity of silver and selenium in sediments has been an issue of debate (for example, Hogstrand and Wood 1998 for silver; Van DerVeer and Canton 1997, Hamilton and Lemly 1999, and DeForest et al. 2008 for selenium). The sediment toxicity reference values for silver and selenium may either under-estimate or over-estimate risk to the benthic macroinvertebrate community. In general, the sediment ESVs were derived from a variety of freshwater ecosystems which may or may not be representative of the physical and chemical environment of the Playa Lake (SWMU 103) ecosystem.

Furthermore, the lack of available toxicity information may have limited risk estimations, in particular, the absence of a chronic criterion for silver in surface water and sediment and lack of screening and toxicity data for barium, beryllium, and vanadium. The maximum concentration of barium in sediment (231 mg/kg) was less than the barium UTL for soil (642 mg/kg) so it is unlikely to be a source of risk. The maximum concentration of beryllium in sediment (0.99 mg/kg) was slightly higher than the beryllium UTL for soil (0.73 mg/kg) and is also unlikely to contribute significantly to risk. However, the maximum concentration of vanadium in sediment (130 mg/kg) was greater than the vanadium UTL for soil (25.3 mg/kg). Without sediment toxicity information on vanadium; however, it is not possible to evaluate its potential to contribute to risks. Therefore, the lack of sediment toxicity information on vanadium may contribute to an under-estimate of risk. In addition, the maximum concentrations of butyl benzyl phthalate and di-n-butyl phthalate were not adequately defined; they were indicated to be present

at concentrations less than the reporting limit. Without further information, it is not possible to tell whether they were actually present in sediment or were an artifact of laboratory preparation and analysis.

1.5.11.4 Risk Characterization

In this evaluation, the risk characterization consisted of comparing an exposure concentration to a toxicity reference value, which was expressed as an ecological screening quotient. ESQs contribute to a "line of evidence" that in later phases of a risk assessment includes other observations for interpreting the potential for ecological impact. The ESQs are simply expressed and easy to communicate to the public and other stakeholders. The issue of these values being seen as conclusive, however, has led to confusion and misinterpretation that necessitates clearly defining their application and the uncertainty with their use in evaluating the potential for ecological impact. The ESQ tool as applied in the ecological risk assessment should not be construed as an accurate "measure" of risk, but rather as an "indication" of the potential for risk to be used in conjunction with other lines of evidence in determining whether further evaluation may be warranted.

1.5.11.5 Uncertainty Assessment Summary

The following table summarizes the sources of uncertainty in the ecological risk assessment and their potential to over- or under-estimate risk.

Summary of Uncertainty Analysis

Uncertainty Element	Effect on Risk Assessment		
	Potential for Over-Estimation	**Potential for Under-Estimation**	**Potential for Over- or Under-Estimation**
Data Collection/Evaluation			
Sediment and surface water samples biased toward areas of high deposition	Moderate-High		
Use of 1993-1994 data to characterize current and future conditions (e.g., no attenuation)	Moderate-High		
Elimination of chemicals based on background levels		Low	
Insufficient data to characterize sediment and surface water (e.g., no dissolved data for surface water)	Moderate-High		
Exposure Assessment			
Use of maximum values as	Moderate-High		

exposure point concentrations			
Conservative assumptions of diet composition of higher trophic-level receptors	Moderate		
Use of literature-based uptake factors			Moderate
Omission of dermal and inhalation pathways		Low	
Assumptions that higher trophic-level receptors would feed exclusively in most contaminated areas	Moderate-High		
Toxicity Assessment			
Use of literature-based sources for toxicity reference values	Moderate		
Assumption of 100% bioavailability and assimilation	Moderate		
Absence of toxicity data for certain chemicals and receptors		Moderate	
Risk Characterization			
Use of ecological quotients to describe risk	Moderate		

1.6 CONCLUSIONS AND RECOMMENDATIONS

1.6.1 Summary of Screening-Level Ecological Risk Assessment

Two ecological exposure areas were identified in association with Playa Lake: the aquatic habitat of the lake itself, and the surrounding upland terrestrial habitat. The lake was evaluated for aquatic receptors including omnivorous and carnivorous waterfowl. The upland terrestrial habitat was evaluated for soil invertebrates, omnivorous small mammals and birds, and carnivorous mammals and birds. The results of this evaluation are based on data collected in 1993 and 1994 and do not reflect current conditions of SWMU 103. With the installation of a new WWTP in 1998, sediment deposition and chemical attenuation over time, conditions within the SWMU are likely to have improved with respect to receptor exposure. A summary of the screening-level ERA is presented in the following table:

Screening-Level Ecological Risk Assessment Summary

Assessment Endpoint	Screening Conclusion
Viability and Function of the Soil Invertebrate Community	No significant risks identified.
Survival, Growth and Reproduction of Birds and	No significant risks identified

Mammals that may forage in the upland habitat surrounding Playa Lake	
Viability and Function of the Benthic Sediment Community	Silver and selenium may pose an adverse risk to the benthic sediment community if they are still present at concentrations detected in 1993.
Viability and Function of the Water Column Community	Potential risk from exposure to lead and silver in surface water could not be evaluated because data on the dissolved (bioavailable) fractions were not provided.
Survival, Growth and Reproduction of Omnivorous Aquatic Birds	Low potential for risk from exposure to selenium in sediment (LOAEL-based ESQ = 1.3). High degree of uncertainty about this estimate because the maximum concentration was used for estimating risk and this sample was in an area of the lake inaccessible to dabbling ducks.
Survival, Growth and Reproduction of Predatory Aquatic Birds	Low to negligible potential for risk from exposure to selenium in sediment (LOAEL-based ESQ = 1.0). High degree of uncertainty about this estimate because the maximum concentration was used for estimating risk and this sample was in an area of the lake inaccessible to wading birds.

1.6.2 Recommendations

Risks to terrestrial receptors from exposure to soils around Playa Lake were not indicated. No further sampling or evaluation of soils is recommended.

Additional surface sediment and surface water samples should be taken be taken in the areas where lead, silver, and selenium were elevated in the 1993 sampling (particularly in the bermed area) to determine current concentrations of these elements in sediment and surface water. Surface water should be evaluated for both total and dissolved fractions.

1.7 REFERENCES

Aigner, E.J., A.D. Leone and R.L. Falconer. 1998. *Concentrations and enantiometric ratios of organochlorine pesticides in soils from the U.S. Corn Belt.* Environ. Sci. Tech. 32(9):1162-1168.

Air Force Print News. 2008. *From start to flush, Cannon ensures safe wastewater treatment.* 27th Special Operations Wing Public Affairs, Cannon Air Force Base, NM. 3 September. http://www.cannon.af.mil/news/story_print.asp?id=123113460

Alsop, F.J. 2002. Birds of North America. In association with the Smithsonian Institute. The American Edition. DK Publishing, New York, NY.

Bennett, W.N., A.S. Brooks and M.E. Boraas. 1996 *Selenium uptake and transfer in an aquatic food chain and its effects on fathead minnow larvae.* Arch. Environ. Cont. Toxicol. 15:513-517.

Bertram, P.E. and A.S. Brooks. 1986. *Kinetics of accumulation of selenium from food and water by fathead minnows.* Water Res. 20(7):877-884.

CCME. 2008. Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale. Supporting Technical Document. Canadian Council of Ministers of the Environment. PN 1399. ISBN 978-896997-77-3 PDF. January.

Crow, R. Personal communication via telephone between Rick Crow, Conservation Section Chief, Cannon AFB and Christine Copenhaver, Senior Scientist, URS Corporation, 4 February 2009.

DeForest, D.K., W.J. Adams and P.M. Chapman. 2008. *What is an appropriate level of protection? An example considering selenium exposure by aquatic birds.* Integr. Environ. Assess. Manage. 4(4):513-515.

El-Begearmi, M. M. and Combs Jr., G. F. 1982. *Dietary effects on selenite toxicity in the chick.* Poult. Sci. 61(4):770-776.

Essex, B. Personal communication by telephone between Brian EssexWildlife Biologist, Cannon AFB and Christine Copenhaver, Senior Scientist, URS Corporation, 12 February 2009.

Hall, D.L., M.R. Willig, D.L. Moorhead, R.W. Sites, E.B. Fish and T.R. Mollhagen. 2004. *Aquatic macroinvertebrate diversity of playa wetlands: the role of landscape and island biogeographic characteristics.* Wetlands 24(1):77-91.

Hamilton, S.J. and A. D. Lemly. 1999. *Commentary: Water-sediment controversy in setting environmental standards for selenium.* Ecotox. Environ. Safety 44:227-235.

Harner, T., J.L. Wideman, L.M.M. Jantunen, T.F. Bidleman and W.J. Parkhurst. 1999. *Residues of organochlorine pesticides in Alabama soils.* Environ. Pollut. 106(3):323-332.

Hogstrand, C. and C.M. Wood. 1998. *Toward a better understanding of the bioavailability, physiology, and toxicity of silver in fish: implication for water quality criteria.* Environ. Toxicol. Chem. 17(4):547-561.

Hoopes, E.M., P.M. Cavanagh, C.R. Griffin and J.T. Finn. 1994. Synthesis of information on marine and coastal birds of the Atlantic Coast: Abundance a, distribution, and potential risks from oil and gas activities. Volume II: Species accounts, abundance, distribution, and status. Massachusetts Cooperative Fish and Wildlife Research Unit, Amherst, MA. (As cited in USGS 2009)

Howard, V.W. and G.G. DelFrate. 1991. *Home ranges and movements of coyotes in the northern Chihuahuan desert.* In: S.E. Hygnstrom, R.M. Case and R.J. Johnson, eds, Proceedings of the 10th Great Plains Wildlife Damage Conference, University of Nebraska-Lincoln.

Kannan, K, S. Battula, B.G. Loganathan, C.S. Hong, W.H. Lam, D.L. Villeneuve, K. Sajwan, J.P. Giesy nad K.M. Aldous. 2003. *Trace organic contaminants, including toxaphene and trifluralin, in cotton fields from George and South Carolina, USA.* Arch. Environ. Contam. Toxicol. 45:30-36.

MacDonald , D.D., C.G. Ingersoll and T.A. Berger. 2000. *Development and evaluation of consensus-cased sediment quality guidelines for freshwater ecosystems.* Arch. Environ. Contam. Toxicol. 39:20-31.

MDEP. 2003. Mercury Bioaccumulation in the Food Webs of Two Northeastern Massachusetts Freshwater Ponds. Massachusetts Department of Environmental Protection, Office of Research and Standards, Boston, MA. April.

MDEP. 2007. Sediment Toxicity of Petroleum Hydrocarbon Fractions. Massachusetts Department of Environmental Protection, Office of Research Standards. Boston, MA. Prepared by: Battelle. September

NMED. 2007. Standards for Interstate and Intrastate Surface Waters. New Mexico Environmental Department, Surface Water Quality Bureau. http://www.nmcpr.state.nm.us/nmac/parts/title20/20/006.0004.pdf

NMED. 2008. Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment. Revision 2.0. New Mexico Environmental Department, Hazardous Waste Bureau. July.

Ratte, H.T. 1999. *Bioaccumulation and toxicity of silver compounds: a review.* Environ. Toxicol. Chem. 18(1):89-108.

Rorabaugh, J. 2009. Amphibians of Arizona – Barred Tiger Salamander (*Ambystoma mavortium*). http://www.reptilesofaz.com/Turtle-Amphibs-Subpages/h-a-mavortium.html.

Saiki, M.K., M.R. Jennings and W.G. Brumbaugh. 1993. *Boron, molybdenum, and selenium in aquatic food chains from the lower San Joaquin River and its tributaries, California.* Arch. Environ. Cont. Toxicol. 24:307-319.

Sample, B.E., J.T. Beauchamp, R.A. Efroymson, G.W. Suter and T.L. Ashwood. 1998. Development and Validation of Bioaccumulation Models for Earthworms. U.S. Department of Energy, Office of Environmental Management, Environmental Restoration Program. February. ES/ER/TM-220.

Smith, G.J., G.H. Heinz, D.J. Hoffman, J.W. Spann and A.J. Krynitsky. 1988. Reproduction in black-crowned night-herons fed selenium. Lake Reservoir Manage. 4:175-180. (As cited in USEPA 2007)

Smith, L.M and D.M. Ghioca-Robrecht. 2008. *Feeding ecology of polymorphic larval barred tiger salamanders of the southern Great Plains.* Can. J. Zool. 86(6):554-563.

Tyning, T.F. 1990. A Guide to Amphibians and Reptiles. Little, Brown and Company, Boston, Massachusetts.

URS. 1998. Summary of Risk Evaluations at the Playa Lake (SWMU 103), Cannon Air Force Base, New Mexico. URS Corporation, Omaha, NE. Prepared for: U.S. Army Corps of Engineers, Omaha District.

USEPA. 1993. Wildlife Exposure Factors Handbook. Volume I of II. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC. EPA/600/R-93/187a. December.

USEPA. 1998. Guidance for Ecological Risk Assessment. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC. EPA/630/R-95/002F. April.

USEPA. 2000. Ecological Soil Screening Level Guidance - Draft. Appendix 4-1: Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSL. June.

USEPA. 2003. U.S. EPA Region V Ecological Screening Values. August.

USEPA. 2005. Ecological Soil Screening Levels for Antimony. Interim Final. OSWER Directive 9285.7-61. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. February.

USEPA. 2006. Ecological Soil Screening Levels for Silver. Interim Final. OSWER Directive 9285.7-77. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. September

USEPA. 2007. Ecological Soil Screening Levels for Selenium. Interim Final. OSWER Directive 9285.7-72. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. July.

USEPA. 2008. Wetlands: Playa Lakes. U.S. Environmental Protection Agency. http://www.epa.gov/wetlands/types/playa.html (Last updated 21 October 2008, accessed February 2009)

USGS. 2002. Selenium and other trace elements in water, sediment, aquatic plants, aquatic invertebrates and fish from streams in southeastern Idaho near phosphate mining operations: June 2002. Final Report as part of the USGS Western U.S. Phosphate Project,

U.S. Geological Survey, Columbia Environmental Research Center. Prepared by S.J. Hamilton, K.J. Buhl and P.J. Lamothe. October.

USGS. 2009. Biological and Ecotoxicological Characteristics of Terrestrial Vertebrate Species Residing in Estuaries: Black-Crowned Night-Heron. U.S. Geological Survey, Patuxent. http://www.pwrc.usgs.gov/BIOECO/bcheron.htm (Accessed February 2009)

Van DerVeer, W.D. and S.P. Canton. 1997. *Selenium sediment toxicity thresholds and derivation of water quality criteria for freshwater biota of western streams.* Environ. Toxicol. Chem. 16(6):1260-1268.

Woodward-Clyde (W-C). 1993. Draft RCRA Facility Investigation. Appendix III SWMUs. Cannon AFB: Clovis, New Mexico. November.

Wolf, C.F. 1996. Aquatic Macrinvertebrate Diversity and Water Quality of Urban Lakes. M.S. Thesis, Texas Tech University, Lubbock, TX. (As cited in Hall et al. 2004.)

WYFG. Undated. Comprehensive Conservation Strategy – Mottled Sculpin (*Cottus bairdi*). Wyoming Fish and Game Department, Conservation Initiative. http://gf.state.wy.us/wildlife/CompConvStrategy/Species/Fish/PDFS/Mottled%20Sculpin.pdf

Zhang, Y. and J.N. Moore. 1996. *Selenium fractionation and speciation in a wetland system.* Environ. Sci. Tech. 30(8):2613-2619.

THIS PAGE INTENTIONALLY BLANK

TABLE 1
SUMMARY OF CHEMICALS DETECTED FOR WATER SAMPLES
PHASE I RFI - PLAYA LAKE (SWMU 103)

LOCATION	CAN103-1035-3000			CAN103-1036-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580009SA		
DATE COLLECTED	09/21/93			09/21/93			09/21/93		
	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Semivolatile Organics (µg/L)									
Isophorone	<	U	10	<	U	10	1.4	J	10
Inorganics (mg/L)									
Arsenic	0.0031	J	0.005	0.0057	J	0.005	0.0034	J	0.005
Barium	0.076		0.01	0.07		0.01	0.066		0.01
Copper	0.0069	J	0.02	0.0051	J	0.02	0.0072	J	0.02
Lead	<	UJ	0.005	0.006	J	0.005	<	UJ	0.005
Silver	0.0092	J	0.01	0.0053	J	0.01	0.0052	J	0.01
Vanadium	0.0089	J	0.01	0.0048	J	0.01	0.0081	J	0.01
Zinc	0.019	J	0.02	0.014	J	0.02	0.014	J	0.02
Water Quality (mg/L)									
Cyanide	0.014		0.01	0.011		0.01	<	U	0.01
Sulfide, Total	0.8		0.1	0.57		0.1	0.65		0.1

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

< = Not detected.
µg/L = micrograms per liter
J = Estimated value
mg/L = milligrams per liter
QUAL = Data qualification
RL = Reporting Limit
U = Not detected

THIS PAGE INTENTIONALLY BLANK

TABLE 2
SUMMARY OF CHEMICALS DETECTED FOR SEDIMENT SAMPLES
PHASE I RFI - PLAYA LAKE (SWMU 103)

LOCATION	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006SA		
DATE COLLECTED	09/21/93			09/21/93			09/21/93			09/21/93		
	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Volatile Organics (µg/kg)												
Benzene	<	J	19	22	J	98	6.6	J	19	16	J	25
2-Butanone (MEK)	<	UJ	39	<	UJ	200	18	J	37	68	J	49
Carbon disulfide	8.4	J	19	22	J	98	11	J	19	23	J	25
Chloromethane	4	J	39	<	J	200	<	J	37	<	UJ	49
Semivolatile Organics (µg/kg)												
bis(2-Ethylhexyl)phthalate	2000	J	1300	3900	J	6500	760	J	1200	1700	UJ	1600
Butyl benzyl phthalate	<	J	1300	<	J	6500	320	J	1200	<	UJ	1600
Di-n-butyl phthalate	<	J	1300	<	J	6500	200	J	1200	<	UJ	1600
Inorganics (mg/kg)												
Aluminum	3450		38.5	21300		196	12300		37.4	12300		49.2
Arsenic	2.4		1.9	10.8	J	9.8	3.3	J	1.9	4.5		2.5
Barium	90.1		3.9	231		19.6	119		3.7	150		4.9
Beryllium	<	U	0.77	<	U	3.9	0.69	J	0.75	0.99		0.98
Cadmium	2.3		1.9	<	U	9.8	<	U	1.9	2.6		2.5
Calcium	26200		77	83400		393	46400		74.9	77400		98.4
Chromium	10.4		3.9	35.5		19.6	13.5		3.7	19.8		4.9
Cobalt	<	UJ	3.9	<	U	19.6	4		3.7	5.9		4.9
Copper	40.3		7.7	102		39.3	29.4		7.5	44.3		9.8
Iron	3860		38.5	18300		196	9990		37.4	13100		49.2
Lead	14.6		1.9	39.3		9.8	16.5		1.9	16.7		2.5
Magnesium	1780		77	8700		393	4140		74.9	5640		98.4
Manganese	38		3.9	228		19.6	158		3.7	196		4.9
Mercury	0.5	UJ	0.39	<	U	2	0.39		0.37	0.51		0.49
Nickel	5.3	J	15.4	27.7	J	78.6	12.1	J	15	14.6	J	19.7
Potassium	968	J	1930	4640	J	9820	2580		1870	3380		2460
Selenium	3.3		1.9	13.2		9.8	5.2	J	1.9	4.7	J	2.5
Silver	9.8		3.9	33.7		19.6	9.9		3.7	11.5		4.9
Sodium	3940	J	1930	18900	J	9820	4230	J	1870	4260	J	2460
Vanadium	27.1		3.9	130		19.6	57.5		3.7	78.9		4.9
Zinc	90.9		7.7	275		39.3	76.9		7.5	101		9.8
Total Petroleum Hydrocarbons (mg/kg)												
TPH	2520		154	5890		786	2200		150	2290		197

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

< = Not detected.
µg/kg = micrograms per kilogram
J = Estimated value.
mg/kg = milligrams per kilogram
QUAL = Data qualification
RL = Reporting Limit.
U = Not detected.

THIS PAGE INTENTIONALLY BLANK

TABLE 3
SUMMARY OF CHEMICALS DETECTED IN SOIL SAMPLES PHASE II RFI - PLAYA LAKE (SWMU 103)

LOCATION	CAN103-1313-0000			CAN103-1314-0000			CAN103-1315-0000			CAN103-1316-0000			CAN103-1317-0000			CAN103-1318-0000		
LAB SAMPLE NUMBER	0397970007SA			0397970001SA			0397780001SA			0398000013SA			0397900001SA			0397900006SA		
DATE COLLECTED	12/12/94			12/12/94			12/11/94			12/12/94			12/12/94			12/12/94		
	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Volatile Organics (µg/kg)																		
Acetone	<	U	10	2.2	J	10	<	U	12	<	U	11	<	U	11	2.6	UJ	11
Methylene chloride	<	U	5.1	<	U	5.2	<	U	6.8	2	J	5.5	2.4	UJ	5.4	2.1	UJ	5.5
Toluene	<	U	5.1	<	U	5.2	<	U	6	<	U	5.5	<	U	5.4	1.1	J	5.5
Semivolatile Organics (µg/kg)																		
Benzo(a)anthracene	<	U	340	<	U	350	53	J	390	<	U	360	<	U	360	<	U	360
Benzo(a)pyrene	<	U	340	<	U	350	61	J	390	<	U	360	<	U	360	<	U	360
Benzo(b)fluoranthene	<	U	340	<	U	350	95	J	390	<	U	360	<	U	360	<	U	360
Chrysene	<	U	340	<	U	350	67	J	390	<	U	360	<	U	360	<	U	360
Fluoranthene	<	U	340	<	U	350	69	J	390	<	U	360	<	U	360	44	J	360
Pyrene	<	U	340	<	U	350	71	J	390	<	U	360	<	U	360	<	U	360
Pesticides/PCB's (µg/kg)																		
Aroclor 1248	<	U	34	<	U	35	750		390				<	U	36	<	U	36
4,4'-DDE	<	U	3.4	<	U	3.5	<	U	39				<	U	3.6	2.4	J	3.6
4,4'-DDT	<	U	3.4	<	U	3.5	<	U	39				<	U	3.6	3.7		3.6
Inorganics (mg/kg)																		
Antimony	<	UJ	12.2	<	UJ	31.4	<	UJ	7.2	<	UJ	13.3	4.9	J	6.5	<	UJ	6.6
Arsenic	1.2		0.51	2.1		0.52	1.2		0.6	1.5		0.55	2.2		0.54	1.9		0.55
Barium	145	J	2	249	J	5.2	87.5		1.2	182	J	2.2	105		1.1	124		1.1
Beryllium	0.26	J	0.41	<	U	1	0.4		0.24	0.32	J	0.44	0.43		0.22	0.48		0.22
Cadmium	<	U	1	<	U	2.6	<	U	0.6	<	U	1.1	<	U	0.54	<	U	0.55
Calcium	162000		40.6	260000		105	21700	J	23.8	176000	J	44.2	73600		21.7	22300		22.1
Chromium	2.4	J	2	<	UJ	5.2	5.6		1.2	1.4	J	2.2	5.4		1.1	6.8		1.1
Cobalt	<	U	2	2.7	J	5.2	2.7		1.2	1.5	J	2.2	2.6		1.1	2.9		1.1
Copper	2.6	J	4.1	6.4	J	10.5	7.1		2.4	3.7	J	4.4	6.6		2.2	7.2		2.2
Iron	3780		20.3	4430		52.4	6010		11.9	3110	J	22.1	5670		10.8	6900		11
Lead	3.4		0.51	2.5		0.52	6.9	J	0.6	3.6	J	1.1	6		0.54	9.8		1.1
Magnesium	2360		40.6	2850		105	1960		23.8	2860		44.2	1950		21.7	1700		22.1

TABLE 3
SUMMARY OF CHEMICALS DETECTED IN SOIL SAMPLES PHASE II RFI - PLAYA LAKE (SWMU 103)

LOCATION	CAN103-1313-0000			CAN103-1314-0000			CAN103-1315-0000			CAN103-1316-0000			CAN103-1317-0000			CAN103-1318-0000		
LAB SAMPLE NUMBER	0397970007SA			0397970001SA			0397780001SA			0398000013SA			0397900001SA			0397900006SA		
DATE COLLECTED	12/12/94			12/12/94			12/11/94			12/12/94			12/12/94			12/12/94		
	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL	Result	Qual	RL
Manganese	42.6	J	2	175	J	5.2	94.7		1.2	83.8		2.2	127	J	1.1	142	J	1.1
Mercury	<	U	0.1	<	U	0.1	<	U	0.12	<	U	0.11	<	U	0.11	<	U	0.11
Nickel	3.4	J	8.1	<	U	20.9	5.7		4.8	5.5	J	8.8	6.9		4.3	6.5		4.4
Potassium	957	J	1020	918	J	2620	2280		596	1430		1100	2140		542	1750		552
Selenium	<	UJ	1	<	UJ	1	<	UJ	1.2	<	UJ	1.1	<	UJ	1.1	<	UJ	1.1
Silver	<	UJ	2	<	UJ	5.2	<	U	1.2	<	U	2.2	<	U	1.1	<	U	1.1
Sodium	<	U	1020	<	U	2620	<	U	596	<	U	1100	<	U	542	<	U	552
Thallium	<	UJ	1	<	UJ	2.1	0.14	J	0.6	<	UJ	1.1	<	UJ	1.1	<	U	0.55
Vanadium	10.4		2	14.9		5.2	12.4		1.2	10	J	2.2	15.6		1.1	15.6		1.1
Zinc	9.9	J	4.1	9.1	J	10.5	18.7		2.4	9	J	4.4	15.7		2.2	20.6		2.2
Total Recoverable Petroleum Hydrocabons (mg/kg)																		
TRPH	<	U	40.6	<	U	41.9	734	J	47.7	<	U	44.2	<	U	43.4	132		44.2

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

< = Not detected

µg/kg = micrograms per kilogram

J = Estimated value

mg/kg = milligrams per kilogram

QUAL = Qualification

RL = Reporting Limit

TABLE 4
BACKGROUND COMPARISON FOR NATURAL ELEMENTS IN SOIL
PLAYA LAKE (SWMU 103)

ANALYTE	Detections	Percent Detected	Minimum Non-Detect	Maximum Non-Detect	Minimum Detection	Maximum Detection	Background 95% UTL	Site>BKG? Yes/No
Inorganicss (mg/kg)								
Antimony	1/6	17%	6.5	31.4	4.9	4.9	<1	**Yes**
Arsenic	6/6	100%	All detects	All detects	1.2	2.2	15.5	No
Barium	6/6	100%	All detects	All detects	87.5	249	642	No
Beryllium	5/6	83%	1	1	0.26	0.48	0.73	**unc**
Cadmium	0/6	0%	0.55	1.1	ND	ND	4.2*	No
Calcium	6/6	100%	All detects	All detects	21700	260000	186400	**Yes**
Chromium	5/6	83%	5.2	5.2	1.4	6.8	12.5	No
Cobalt	5/6	83%	2	2	1.5	2.9	4.5	No
Copper	6/6	100%	All detects	All detects	2.6	7.2	18.3*	No
Iron	6/6	100%	All detects	All detects	3110	6900	8720	No
Lead	6/6	100%	All detects	All detects	2.5	9.8	25.8	No
Magnesium	6/6	100%	All detects	All detects	1700	2860	11790	No
Manganese	6/6	100%	All detects	All detects	42.6	175	164	**Yes**
Mercury	0/6	0%	0.1	0.12	ND	ND	ND (0.12)	No
Nickel	5/6	83%	20.9	20.9	3.4	6.9	9	No
Potassium	6/6	100%	All detects	All detects	918	2280	2572	No
Selenium	0/6	0%	1	1.2	ND	ND	0.23J[1]	**unc**
Silver	0/6	0%	1.1	5.2	ND	ND	0.93J[1]	**unc**
Sodium	0/6	0%	542	2620	ND	ND	1042	**unc**
Thallium	1/6	17%	0.55	2.1	0.14	0.14	0.22*	No
Vanadium	6/6	100%	All detects	All detects	10	15.6	25.3	No
Zinc	6/6	100%	All detects	All detects	9	20.6	21.9	No

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

Shaded analytes were carried forward in the ecoscreen

[1] = See text for discussion

* = Maximum background concentration

BKG = Background

J = Estimated value between the method detection limit and the reporting limit

mg/kg = milligrams per kilogram

ND = Not detected (value is the maximum reporting limit for background samples)

unc = Uncertain; maximum reporting limit exceeds background screening value

UTL = Upper tolerance limit (Mean + 2 standard deviations); except where noted by (*)

THIS PAGE INTENTIONALLY BLANK

TABLE 5
ECOLOGICAL SCREENING VALUES AND SOURCES FOR SOIL, SURFACE WATER, AND SEDIMENT
PLAYA LAKE (SWMU 103)

	Direct ESV	Source/Basis	Ingestion ESV	Source/Basis
SOIL				
pCOPEC				
Inorganics (mg/kg)				
Antimony	78	USEPA 2005a; lowest of plant or soil invertebrate ESSL	0.27	USEPA 2005a; mammalian ESSL
Beryllium	40	USEPA 2005b; lowest of plant or soil invertebrate ESSL	21	USEPA 2005b; lowest of avain or mammalian ESSL
Calcium	--	Considered an essential nutrient	--	Considered an essential nutrient
Manganese	--	Considered an essential nutrient	---	Considered an essential nutrient
Selenium	0.52	USEPA 2007b; lowest of plant or soil ESSL	0.63	USEPA 2007b; lowest of avian or mammalian ESSL
Silver	560	USEPA 2006a; soil invertebrate ESSL	4.2	USEPA 2006a; lowest of avian or mammalian ESSL
Sodium	--	Considered an essential nutrient	--	Considered an essential nutrient
Volatile Organics (µg/kg)				
Acetone	2500	USEPA Region V ESL	Not available	
Methylene chloride	4050	USEPA Region V ESL	Not available	
Toluene	3000	Environment Canada 1995; seed emergence	Not available	
Semivolatile Organics (µg/kg)				
Benzo(a)anthracene	18000	USEPA 2007a; soil invertebrate ESSL	1100	USEPA 2007a; mammalian ESSL
Benzo(a)pyrene	18000	USEPA 2007a; soil invertebrate ESSL	1100	USEPA 2007a; mammalian ESSL
Benzo(b)fluoranthene	18000	USEPA 2007a; soil invertebrate ESSL	1100	USEPA 2007a; mammalian ESSL
Chrysene	18000	USEPA 2007a; soil invertebrate ESSL	1100	USEPA 2007a; mammalian ESSL
Fluoranthene	29000	USEPA 2007a; soil invertebrate ESSL	100000	USEPA 2007a; mammalian ESSL
Pyrene	18000	USEPA 2007a; soil invertebrate ESSL	1100	USEPA 2007a; mammalian ESSL
Pesticides/PCB's (µg/kg)				
Aroclor 1248	40000	Efroymson et al. 1997; plants (total PCBs)	Not available	
4,4'-DDE	596	USEPA 2003 Region V ESL	Not available	
4,4'-DDT	758	USEPA 2003 Region V ESL	Not available	
Petroleum Hydrocarbon (mg/kg)				
TRPH	24000	CCME 2008 (crude oil); earthworm survival	Not available	

TABLE 5
ECOLOGICAL SCREENING VALUES AND SOURCES FOR SOIL, SURFACE WATER, AND SEDIMENT
PLAYA LAKE (SWMU 103)

	Direct ESV	Source/Basis	Ingestion ESV	Source/Basis

SURFACE WATER	Direct ESV	Source/Basis
pCOPEC		
Semivolatile Organics (µg/L)		
Isophorone	920	USEPA 2003 Region V ESL
Inorganics (µg/L)		
Arsenic	150 (D)	NMED 2007; based on H = 100
Barium	220	USEPA 2003 Region V ESL
Copper	5.48 (D)	NMED 2007; based on H = 100
Lead	1.94 (D)	NMED 2007; based on H = 100
Silver	2.4 (D-Acute)	NMED 2007; based on H = 100
Vanadium	12	USEPA 2003 Region V ESL
Zinc	41.3 (D)	NMED 2007; based on H = 100
Other Parameters (µg/L)		
Cyanide	5.2	USEPA 2006b
Sulfide, Total	2 (as H_2S)	USEPA 2006b

SEDIMENT	Direct ESV	Source/Basis	Threshold ESV	Source/Basis
pCOPEC				
Volatile Organics (µg/kg)				
Benzene	142	USEPA 2003 Region V ESL	Not available	
2-Butanone (MEK)	42.4	USEPA 2003 Region V ESL	Not available	
Carbon disulfide	23.9	USEPA 2003 Region V ESL	Not available	
Chloromethane	47763	EqP (USEPA 1993)	Not available	
Semivolatile Organics (µg/kg)				
bis(2-Ethylhexyl)phthalate	182	USEPA 2003 Region V ESL	Not available	
Butyl benzyl phthalate	1970	USEPA 2003 Region V ESL	Not available	
Di-n-butyl phthalate	1114	USEPA 2003 Region V ESL	Not available	
Metals (mg/kg)				
Aluminum	26000	Ingersoll et al. 1996, TEL	60000	Ingersoll et al. 1996, PEL
Arsenic	9.79	MacDonald et al. 2000, TEC	33	MacDonald et al. 2000, PEC
Barium	Not available		Not available	
Beryllium	Not available		Not available	
Cadmium	0.99	MacDonald et al. 2000, TEC	4.98	MacDonald et al. 2000, PEC
Calcium	--	Considered an essential nutrient	--	Considered an essential nutrient
Chromium	43.4	MacDonald et al. 2000, TEC	111	MacDonald et al. 2000, PEC
Cobalt	50	USEPA 2003 Region V ESL	Not available	
Copper	31.6	MacDonald et al. 2000, TEC	149	MacDonald et al. 2000, PEC
Iron	190000	Ingersoll et al. 1996, TEL	250000	Ingersoll et al. 1996, PEL
Lead	35.8	MacDonald et al. 2000, TEC	128	MacDonald et al. 2000, PEC
Magnesium	--	Considered an essential nutrient	--	Considered an essential nutrient
Manganese	630	Ingersoll et al. 1996, TEL		
Mercury	0.18	MacDonald et al. 2000, TEC	1.06	MacDonald et al. 2000, PEC
Nickel	22.7	MacDonald et al. 2000, TEC	48.6	MacDonald et al. 2000, PEC
Potassium	--	Considered an essential nutrient	--	Considered an essential nutrient
Selenium	2.5	Van Derveer et al. 1996	4	Van Derveer et al. 1996
Silver	1	Long et al. 1995, ERL	4.5	NOAA 1999, UET

TABLE 5
ECOLOGICAL SCREENING VALUES AND SOURCES FOR SOIL, SURFACE WATER, AND SEDIMENT
PLAYA LAKE (SWMU 103)

	Direct ESV	Source/Basis	Ingestion ESV	Source/Basis
Sodium	--	Considered an essential nutrient	--	Considered an essential nutrient
Vanadium	Not available		Not available	
Zinc	121	MacDonald et al. 2000, TEC	459	MacDonald et al. 2000, PEC
Total Petroleum Hydrocarbons (mg/kg)				
TPH	5890	USEPA 1996, ARCS Program	Not available	

µg/kg - micrograms per kilogram
µg/L - micrograms per liter
EqP - Equilibrium Partitioning (assuming 1% organic carbon)
ERL - Effects Range Low
ESV - Ecological Screening Vlaue
ESSL - Ecological Soil Screening Value
ESL - Ecological Screening Level
H - Hardness
pCOPEC - Preliminary Contaminant of Potential Ecological Concern
PEL - Probable Effects Level
TEL - Threshold Effects Level
TEC - Threshold Effects Concentration
UET - Upper Effects Threshold

References:

CCME. 2008. Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale, Supporting Technical Document. Canadian Council of Ministers of the Environment, PN 1399. January

Efroymson, R. , M.E. Will, G.W. Suter and A.C. Wooten. 1997. Toxicological Benchmarks for Contaminants of Potentail Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, TN. ES/ER/TM-85/R3.

Environment Canada. 1995. Toxicity Testing of NCSRP Priority Substances for Development of Soil Quality Guidelines for Contaminated Sites. Alberta Guidelines Division, Evaluation and Interpretation Branch. Prepared by HydroQual Laboratories, Calgary Alberta.

Ingersoll, C.G., P.S. Haverland, E.L. Brunson, T.C. Canfield, F.J. Dwyer, C. E. Henke, N.E. Kemble, D.R. Mount, and R.G. Fox. 1996. Calculation and evaluation of sediment effect concentrations for the amphipod Hyalella azteca and the midge Chironomus riparius . J. Great Lakes Res. 22(3):602-623.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environ. Management. 19(1): 81-97.

MacDonald, D.D., C.G. Ingersoll and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

NMED. 2007. Water Quality Standards. New Mexico Environmental Department, Surface Water Quality Bureau. Title 20 Environmental Protection, Chapter 6 Water Quality, Part 4 Standards. August

NOAA. 1999. Screening quick Reference Tables. National Oceanic and Atmospheric Administration HAZMAT Report 99-1, Seattle Washington

USEPA. 1993. Technical Basis for Deriving Sediment Quality Criteria for Nonionic Contaminants for the Protection of Benthic Organisms by using Equilibrium Partitioning. U.U. Environmental Protection Agency, Office of Water.

USEPA. 1996. Assessment and Remediation of Contaminated Sediments (ARCS) Program: Calculation and Evaluation of Sediment Effect Concentrations for the Amphipod *Hyalella azteca* and the Midge *Chironomus riparius* .. U.S. Environmental Protection Agency. Great Lakes National Program Office, Chicago. IL. EPA 905-R96-008. September.

USEPA. 2003. Region V Ecological Screening Levels. August.

USEPA. 2005a. Ecological Soil Screening Levels for Antimony. Interim Final. OSWER Directive 9285.7-61. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. February.

USEPA. 2005b. Ecological Soil Screening Levels for Beryllium. Interim Final. OSWER Directive 9285.7-64. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. February.

USEPA. 2006a. Ecological Soil Screening Levels for Silver. Interim Final. OSWER Directive 9285.77-. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. September.

USEPA. 2006b. National Recommended Water Quality Driteria for Priority and Non-Priority Pollutants. U.S. Environmental Protection Agency, Office of Water (4304T)

USEPA. 2007a. Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons. Interim Final. OSWER Directive 9285.7-78. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. June.

USEPA. 2007b. Ecological Soil Screening Levels for Selenium. Interim Final. OSWER Directive 9285.7-72. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. July.

Van Derveer, W.D. and S.P. Canton. 1996. Selenium Sediment Toxicity Thresholds and Derivation of Water Quality Criteria for Freshwater Biota of Western Streams. Environmental Toxicology and Chemistry 16:1260-1268.

THIS PAGE INTENTIONALLY BLANK

TABLE 6
PRELIMINARY IDENTIFICATION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN IN SOIL
PLAYA LAKE (SWMU 103)

ANALYTE	Detections	Percent Detected	Minimum Non Detect	Maximum Non-Detect	Minimum Detection	Maximum Detection	Direct ESV	Ingestion ESV	pCOPEC Direct? Yes/No	pCOPEC Ingestion? Yes/No	Rationale
Volatile Organics (µg/kg)											
Acetone	1/6	17%	2.6	12	2.2	2.2	2500	--	No	No	b, e
Methylene chloride	1/6	17%	2.1	6.8	2	2	4050	--	No	No	b, e
Toluene	1/6	17%	5.1	6	1.1	1.1	3000	--	No	No	b, e
Semivolatile Organics (µg/kg)											
Benzo(a)anthracene	1/6	17%	340	360	53	53	18000	1100	No	No	b
Benzo(a)pyrene	1/6	17%	340	360	61	61	18000	1100	No	No	b
Benzo(b)fluoranthene	1/6	17%	340	360	95	95	18000	1100	No	No	b
Chrysene	1/6	17%	340	360	67	67	18000	1100	No	No	b
Fluoranthene	2/6	33%	340	360	44	69	29000	100000	No	No	b
Pyrene	1/6	17%	340	360	71	71	18000	1100	No	No	b
Pesticides/PCB's (µg/kg)											
Aroclor 1248	1/5	20%	34	36	750	750	40000	--	No	**Yes**	f
4,4'-DDE	1/5	20%	3.4	39	2.4	2.4	596	--	No	No	b
4,4'-DDT	1/5	20%	3.4	39	3.6	3.6	758	--	No	No	b
Inorganics (mg/kg)											
Antimony	1/6	17%	6.5	31.4	4.9	4.9	78	0.27	No	**Yes**	c
Beryllium	5/6	83%	1	1	0.26	0.48	40	21	No	No	b
Calcium	6/6	100%	All detects	All detects	21700	260000	--	--	No	No	d
Manganese	6/6	100%	All detects	All detects	42.6	175	220	4000	No	No	b
Total Recoverable Petroleum Hydrocabons (mg/kg)											
TRPH	1/6	17%	40.6	44.2	734	734	24000	--	No	No	b, e

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

Shaded analytes were carried forward in the ecoscreen

-- = Not available

µg/kg = micrograms per kilogram

ESV = Ecological Screening Value (see text for sources)

mg/kg = milligrams per kilogram

pCOPEC = Preliminary Contaminant of Potential Ecological Concern

unc = Uncertain

a = Uncertainty due to absence of ESV or maximum reporting limit exceeds an ESV

b = Maximum detection less than available ESV

c = Maximum concentration exceeds ESV

d = Chemical is considered an essential nutrient

e = Not considered bioaccumulative for the ingestion pathway

f = Potentially bioaccumulative

THIS PAGE INTENTIONALLY BLANK

TABLE 7
PRELIMINARY IDENTIFICATION OF CHEMICALS OF POTENTIAL ECOLOGICAL CONCERN IN SURFACE WATER
PLAYA LAKE (SWMU 103)

ANALYTE	Detections	Percent Detected	Minimum Non-Detect	Maximum Non-Detect	Minimum Detection	Maximum Detection	Surface Water ESV	pCOPEC? Yes/No	Rationale
Semivolatile Organics (µg/L)									
Isophorone	1/3	33%	10	10	1.4	1.4	920	No	b
Inorganics (µg/L)									
Arsenic, Total	3/3	100%	All detects	All detects	3.1	5.7	150 (D)	No	b
Barium, Total	3/3	100%	All detects	All detects	66	76	220	No	b
Copper, Total	3/3	100%	All detects	All detects	5.1	7.2	8.96 (D)	No	b
Lead, Total	1/3	33%	0.005	0.005	6	6	1.94 (D)	**unc**	c
Silver, Total	3/3	100%	All detects	All detects	5.2	9.2	2.4 (D-Acute)	**unc**	c
Vanadium, Total	3/3	100%	All detects	All detects	4.8	8.9	12	No	b
Zinc , Total	3/3	100%	All detects	All detects	14	20	40.9 (D)	No	b
Water Quality (µg/L)									
Cyanide	2/3	67%	0.01	0.01	0.011	0.014	5.2	No	b
Sulfide, Total	3/3	100%	All detects	All detects	0.57	0.8	2 (H_2S)	No	b

Note: Chronic criterion for silver was not available; value is the acute criterion for the dissolved concentration.

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

µg/L = micrograms per liter
D = Dissolved chronic criterion based on hardness = 100
ESV = Ecological Screening Value (based on New Mexico chronic freshwater standards)
H_2S = Non-priority pollutant value for hydrogen sulfide
NA = Not available
pCOPEC = Preliminary Contaminant of Potential Ecological Concern
unc = Uncertain
a = Uncertainty due to ESV based on dissolved fraction; retained as a pCOPEC
b = Maximum detection less than available ESV
c = Uncertain; the portion of the total concentration that is in the dissolved state is not known

THIS PAGE INTENTIONALLY BLANK

TABLE 8
PRELIMINARY IDENTIFICATION OF CHEMICALS OF POTENITAL ECOLOGICAL CONCERN IN SEDIMENT
PLAYA LAKE (SWMU 103)

ANALYTE	Detections	Percent Detected	Minimum Non-Detect	Maximum Non-Detect	Minimum Detection	Maximum Detection	Sediment ESV	pCOPEC? Yes/No	Rationale
Volatile Organics (µg/kg)									
Benzene	4/4	100%	All detects	All detects	6.6	16	57	No	b
2-Butanone (MEK)	2/4	50%	39	200	18	68	4396	No	b
Carbon disulfide	4/4	100%	All detects	All detects	8.4	23	2.5	**Yes**	c
Chloromethane	3/4	75%	49	49	4	<200	47763	No	b
Semivolatile Organics (µg/kg)									
bis(2-Ethylhexyl)phthalate	3/4	75%	1700	1700	760	3900	182	**Yes**	c
Butyl benzyl phthalate	3/4	75%	1600	1600	320	<6500	1970	**unc**	a
Di-n-butyl phthalate	3/4	75%	1600	1600	200	<6500	1114	**unc**	a
Metals (mg/kg)									
Aluminum	4/4	100%	All detects	All detects	3450	21300	26000	No	b
Arsenic	4/4	100%	All detects	All detects	2.4	10.8	9.79	**Yes**	c
Barium	4/4	100%	All detects	All detects	90.1	231	--	**unc**	a
Beryllium	2/4	50%	0.77	3.9	0.69	0.99	--	**unc**	a
Cadmium	2/4	50%	1.9	9.8	2.3	2.6	0.99	**Yes**	c
Calcium	4/4	100%	All detects	All detects	26200	83400	--	No	d
Chromium	4/4	100%	All detects	All detects	10.4	35.5	43.4	No	b
Cobalt	2/4	50%	3.9	19.6	4	5.9	50	No	b
Copper	4/4	100%	All detects	All detects	29.4	102	32	**Yes**	c
Iron	4/4	100%	All detects	All detects	3860	18300	190000	No	b
Lead	4/4	100%	All detects	All detects	14.6	39.3	36	**Yes**	c
Magnesium	4/4	100%	All detects	All detects	1780	8700	--	No	d
Manganese	4/4	100%	All detects	All detects	38	228	630	No	b
Mercury	2/4	50%	0.5	2	0.39	0.51	0.18	**Yes**	c
Nickel	4/4	100%	All detects	All detects	5.3	27.7	22.7	**Yes**	c
Potassium	4/4	100%	All detects	All detects	968	4640	--	No	d
Selenium	4/4	100%	All detects	All detects	3.3	13.2	2.5	**Yes**	c
Silver	4/4	100%	All detects	All detects	9.8	33.7	1	**Yes**	c
Sodium	4/4	100%	All detects	All detects	3940	18900	--	No	d
Vanadium	4/4	100%	All detects	All detects	27.1	130	--	**unc**	a
Zinc	4/4	100%	All detects	All detects	76.9	275	121	**Yes**	c
Total Petroleum Hydrocarbons (mg/kg)									
TPH	4/4	100%	All detects	All detects	2200	5890	--	**unc**	a

Results presented here are only those chemicals which were detected at least once at this SWMU and have passed data review.

Shaded analytes were carried forward in the ecoscreen

-- = Not available

µg/kg = micrograms per kilogram

ESV = Ecological Screening Value (see text for sources)

mg/kg = milligrams per kilogram

pCOPEC = Preliminary Contaminant of Potential Ecological Concern

unc = Uncertain; ESV not available, or maximum concentration not defined (i.e., di-n-butyl phthalate)

a = Uncertainty due to absence of ESV or maximum not defined

b = Maximum detection less than available ESV

c = Maximum concentration exceeds ESV

d = Chemical is considered an essential nutrient

THIS PAGE INTENTIONALLY BLANK

TABLE 9
RECEPTOR CHARACTERISTICS AND ASSUMPTIONS
PLAYA LAKE (SWMU 103)

Receptor of Interest	Guild	Body Weight (kg)	Foraging Territory (acres)	Food Ingestion Rate (kg BW/day)	Water (L/day)	Sediment/ Soil Ingestion Rate (kg BW/day)	Plants (fraction of diet)	Invertebrates (fraction of diet)	Small Mammals (fraction of diet)
American Robin	Invertivore	0.077	1.04	0.016	NA	0.001	0.45	0.55	0
Deer Mouse	Omnivore	0.015	0.27	0.0029	NA	0.0001	0.2	0.8	0
Coyote	Carnivore	10	4396	0.456	NA	0.013	0	0.05	0.95
Swainson's Hawk	Carnivore	0.907	2010	0.050	NA	0.000	0	0	1
Mallard	Omnivore	1.16	44.94	0.060	0.065	0.001	0.75	0.25	0
Black-Crowned Night Heron	Carnivore	0.861	2000	0.048	0.053	0.001	0	1	0

kg -Kilogram
kg BW/day - Kilograms body weight per day
L/day - Liters per day
NA - Not applicable

American Robin
BW - 0.077 kg; USEPA (1993)
AU - 0.42 ha; mean for Tennessee (campus); USEPA (1993)
IRf - Calculated from body weight using equation for passerines (Nagy 1987, as cited in USEPA 1993).
IRs - no data, assume soil comprises 6.0% of diet (dry weight)
Diet - plant 45%, invertebrates 55%, based on averaged seasonal content for western United States(Wheelwright 1986, as cited in USEPA 1993)

Deer Mouse
BW - 0.015 kg Adult male and female mean, Indiana; Silva and Downing (1995)
AU - 0.27 acres in Idaho desert (Bowers and Smith 1979, as cited in USEPA 1993)
IRf - rodent body-weight based equations of Nagy (1987, as cited in USEPA 1993) .
IRs - no data, assume soil to comprise 2.0% of diet (dry weight) based on data from white-footed mouse (Beyer et al., as cited in USEPA 1993)
Diet - seasonal averages for Colorado short-grass prairie (Flake 1973, as cited in USEPA 1993)

Coyote
BW - 10 kg - average reported in Arizona (Golightly and Ohmart 1984)
AU -4396 acres, northern Chihuahuan desert (Howard and DelFrate 1991)
IRf - allometric equation for all mammals; (Nagy 1987 (dw) as reported in USEPA 1993).
IRs - no data, assume soil comprises 2.08% of diet dw (based on red fox; Beyer et al. as cited in USEPA 1993)
Diet - assumed diet of 25% soil invertebrates and 75% small mammals.

Swainson's Hawk
BW - 0.9072 kg; from Rocky Mountain Research Center (Tesky 1994).
AU - breeding females forage wihtin 1.9 miles of the nest (approximately 2010 acres) (Tesky 1994).
IRf - allometric equation for non-passerines (Nagy 1987, as cited in USEPA 1993).
IRs - no data, assume negligible soil ingestion
Diet - assume 100% small mammals

Mallard
BW - Mean of males and females throughout North America (USEPA 1993)
AU - conservatively based on the lower range for females in North dakota potholes (Dwyer et al. 1985, as cited in USEPA 1993)
IRf - Based on Nagy (1987) for non-passerines in USEPA (1993).
IRw - 0.065 L/day based on equations by Caulder and Braun (1983), as cited USEPA (1993).
IRs Based on 2% of food ingestion rate (Beyer *et al.* 1993, as cited in USEPA 1993).
Diet - seasonal mean of diets from North Dakota potholes (Swanson et al. 1985, as cited in USEPA 1993).

Black-crowned Night Heron
BW - 0.861 kg (Alsop 2001)
AU - generally defends a feeding territory of 2000 acres (USGS 2009), but nest in colonies near feeding grounds in breedning season (USGS 2009).
Irf - allometric equation for non-passerine birds (Nagy 1987, as cited in USEPA 1993).
Irw - allometric equation for all birds (Calder and Braun 1983, as cited in USEPA 1993).
Irs - no data; assumed similar to mallard at 2% of food ingestion rate
Diet - With absence of fish in Playa Lake, assume feeds primarily on aquatic invertebrates.

THIS PAGE INTENTIONALLY BLANK

TABLE 10
UPTAKE FACTORS FOR TERRESTRIAL AND AQUATIC COPECs
PLAYA LAKE (SWMU 103)

Chemical of Potenital Ecological Concern	Soil-to-Vascular Plants	Source	Soil-to-Soil Invertebrates	Source	Soil-to-Small Mammals	Source	Sediment-to-Aquatic Plants	Source	Sediment-to-Benthic Invertebrates	Source	Surface Water-to-Fish	Source
Antimony	ln(Cp) = (0.937*LN(Cs)-3.223)	a	0.033	i	Cm = 0.001*50*Cd	a	Not applicable		Not applicable		Not applicable	
Mercury	Not applicable		Not applicable		Not applicable		0.233	b	0.198	b	0.233	b
Selenium	Not applicable		Not applicable		Not applicable		Cp = 1.3898(Cs)-0.2042	s	Cinv = 0.1018e^(0.2029(Cs))	s	Not applicable	
Silver	0.014	c	Not applicable		Not applicable		0.014	c	0.18	d	15	e
Aroclor 1248	0	f	Cinv (%lipid) = 4.2949*(Cs)*(%OC)	g	Cm = 0.27*(Cd)	h	Not applicable		Not applicable		Not applicable	

ln - Natural log
Cp - Concentration of COPEC in plants (mg/kg dw)
Cs - Concentration of COPEC in soil/sediment (mg/kg dw)
Cm - Concentration of COPEC in small mammal (mg/kg dw)
Cd - Concentration of COPEC in diet of small mammal (assume 50% plant-50% invertebrate) (mg/kg dw)
Cinv - Concentration of COPEC in soil/sediment invertebrate (mg/kg dw)
Cf - Concentration of COPEC in whole fish (mg/kg dw)
%lipid - Lipid content of soil invertebrates (assumed earthworm 1%)
%OC - Percent organic carbon in soil (assume 1% in desert soil)

a USEPA. 2005. Ecological Soil Screening Levels for Antimony, Interim Final. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-61. February.
b MDEP. 2003. Mercury Bioaccumulation in the Food Webs of Two Northeastern Massachusetts Freshwater Ponds. Intra-Agency Policy Deliberation Paper. Massachusetts Department of Eenvironmental Protection, Boston, MA
c Bechtel-Jacobs. 1998. Empirical models for the uptake of inorganic chemicals from soil by plants. Bechtel-Jacobs Company for the U.S. Department of Energy, Oak Ridge, TN, BJC/OR-133.
d Hirsch, M.P. 1998. Bioaccumulation of silver from laboratory-spiked sediments in the oligochaete (*Lumbriculus variegatus*). Enviorn. Toxicol. Chem. 17(4):605-609.
e Coleman, R.L. and J.E. Clearley. 1974. Silver toxicity and accumulation in largemouth bass and bluegill. Bull. Environ. Contam. Toxicol. 12(1):53-61.
f USFWS. 2003. Draft Final Report, Pre-Design Investigation, Site 36, MISCA OU, Crab Orchard Wildlife Refuge. U.S. Fish and Wildlife Service
g Sample, B.E., J.J Beauchamp, R. Efroymson, G.W. Suter II, and T.L. Ashwood. 1998a. Development and validation of bioaccumulation models for earthworms. Oak Ridge ER/TM/220.
h USEPA. 2000. Ecological Soil Screening Level Guidance - Draft. Appendices 3-3 and 4-1. June.
i Gal, J., A. Hursthouse and S. Cuthbert. 2007. Bioavailability of arsenic and antimony in soils from an abandoned mining area, Glendinning (SW Scotland). J. Environ. Sci. Health, Part A 42:1263-1274.

THIS PAGE INTENTIONALLY BLANK

TABLE 11
ORAL TOXICITY REFERENCE VALUES FOR COPECs
PLAYA LAKE (SWMU 103)

COPEC	Receptor of Concern	Endpoint	Test Species	Study Duration	Effect	Dose mg/kgBW/day	References
ANTIMONY	All mammals	NOAEL	Rat	31 days during gestation	Progeny weight	0.059	Rossi et al., 1987
		LOAEL	Rat	31 days during gestation	Progeny weight	0.59	Rossi et al., 1987
	All birds	Not available					USEPA 2005
		Not available					USEPA 2005
METHYL MERCURY	All mammals	NOAEL	Rat	3 generations	Reproduction	0.032	Verschuuren et al., 1976b
		LOAEL	Rat	3 generations	Reproduction	0.16	Verschuuren et al., 1976b
	All birds	NOAEL	Northern Bobwhite	5 days treated diet, plus 3 days untreated	Mortality	0.172	Eisler 1986 LD_{50}÷100
		LOAEL	Northern Bobwhite	5 days treated diet, plus 3 days untreated	Mortality	1.72	Eisler 1986 LD_{50}÷10
SELENIUM	All mammals	NOAEL	Pig	37 days	Decrease in body weight	0.143	Mahan and Moxon, 1984
		LOAEL	Pig	37 days	Decrease in body weight	0.273	Mahan and Moxon, 1984
	Black-crowned Night Heron	NOAEL	Not Reported				Smith et al. 1988
		LOAEL	Black-crowned Night Heron	92 days	Offspring Development	0.675	Smith et al. 1988
	All other birds	NOAEL	Chicken	2 weeks	Mortality	0.29	El-Begearmi and Combs, 1982
		LOAEL	Chicken	2 weeks	Mortality	0.579	El-Begearmi and Combs, 1982
SILVER	All mammals	NOAEL	Lowest LOAEL for survival divided by 10			6.02	USEPA 2006
		LOAEL	Pig	40 days	Mortality	60.2	Van Vleet 1976
	All birds	NOAEL	Lowest LOAEL for growth divided by 10			2.02	USEPA 2006
		LOAEL	Turkey	5 weeks	Bodyweight changes	20.2	Jensen et al., 1974
POLYCHLORINATED BIPHENYLS	All mammals	NOAEL	Mouse	108 days	Decreased conception	1.25	Welsch, 1985
		LOAEL	Mouse	108 days	Decreased conception	12.5	Welsch, 1985
	All birds	NOAEL	Screech Owl	2 breeding seasons	Reproduction	0.41	Anne et al. 2005
		LOAEL	Chicken	9 weeks	Egg hatchability	2.66	Lillie et al., 1974

COPEC = Chemical of potential ecological concern
LOAEL = Lowest-observed-adverse-effects level
mg/kgBW/day = Milligrams per kilograms body weight per day
NOAEL = No-observed-adverse-effects level

References:

Anne, M. , R. McLand and D.L. Hughes. 2005. Reproductive success of screech owls fed Aroclor 1248. Arch. Environ. Contam. Toxicol. 9(6):661-665.

Eisler, R. 1987. Mercury Hazards to Fish, Wildlife and Invertebrates: A Synoptic Review. U.S. Fish and Wildlife Service Biological Report 85(1.10). April.

El-Begearmi, M. M. and Combs Jr., G. F. 1982. Dietary effects on selenite toxicity in the chick. Poult. Sci. 61(4):770-776. (As cited in USEPA 2007)

Jensen, L. S., Peterson, R. P., and Falen, L. 1974. Inducement of Enlarged Hearts and Muscular Dystrophy in Turkey Poults with Dietary Silver. Poultry Science. 3(1): 57-64. (As cited in USEPA 2006)

Lillie, R.J., Harris, S.J., Cecil, H.C., & Bitman, J. 1974. Normal reproductive performance of mature cockerels fed Aroclor 1248. Poult. Sci., 53: 1604-1607.

Mahan, D. C. and Moxon, A. L. 1984. Effect of inorganic selenium supplementation on selenosis in postweaning swine. Journal of Animal Science. 58(5): 1216-1221. (As cited in USEPA 2007).

Rossi, F., R. Acampora, C. Vacca, S. Maione, M. G. Matera, R. Servodio, and E. Marmo. 1987. Prenatal and postnatal antimony exposure in rats: effect on vasomotor reactivity development of pups. Teratog. Carcinog.Mutagen. 7(5): 491-496. (As cited in USEPA 2005)

Smith, G.J., G.H. Heinz, D.J. Hoffman, J.W. Spann and A.J. Krynitsky. 1988. Reproduction in black-crowned night-herons fed selenium. Lake Reservoir Manage. 4:175-180. (As cited in USEPA 2007)

USEPA. 2005. Ecological Soil Screening Levels for Antimony, Interim Final. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-61. February.

USEPA. 2006. Ecological Soil Screening Levels for Silver, Interim Final. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-77. September.

USEPA. 2007. Ecological Soil Screening Levels for Selenium, Interim Final. U.S. Environmental Protection Agency. Office of Solid Waste and Emergency Response. OSWER Directive 9285.7-72. July.

Van Vleet, J. F. 1976. Induction of Lesions of Selenium Vitamin E Deficiency in Pigs Fed Silver. American Journal of Veterinary Research. 37(12): 1415-1420. (As cited in USEPA 2006).

Verschuuren, H.G., R. Kroes, E.M. Den Tonkelaar, J.M. Berkvens, P.W. Helleman, A.G. Rauws, P.L. Schuller, and G.J. Van Eschl. 1976b. Toxicity of methylmercury chloride in rats. III. Long-term toxicity study. Toxicol 6:107-123.

Welsch F. 1985. Effects of acute or chronic polychlorinated biphenyl ingestion on maternal metabolic homeostasis and on the manifestations of embryotoxicity caused by cyclophosphamide in mice. Arch Toxicol 57:104-113.

TABLE 12
ECOLOGICAL SCREENING QUOTIENTS FOR COPECs IN SEDIMENT
PLAYA LAKE (SWMU 103)

ANALYTE	Detections	Percent Detected	Maximum Detection	Sediment TEC	Sediment PEC	TEC ESQ	PEC ESQ
Volatile Organics (µg/kg)							
Carbon disulfide	4/4	100%	23	2.5	NA	**9.2**	--
Semivolatile Organics (µg/kg)							
bis(2-Ethylhexyl)phthalate	3/4	75%	3900	750	NA	**5.2**	--
Metals (mg/kg)							
Arsenic	4/4	100%	10.8	9.79	33	**1.1**	0.3
Cadmium	2/4	50%	2.6	0.99	4.98	**2.6**	0.5
Copper	4/4	100%	102	31.6	149	**3.2**	0.7
Lead	4/4	100%	39.3	36	128	**1.1**	0.3
Mercury	2/4	50%	0.51	0.18	1.06	**2.8**	0.5
Nickel	4/4	100%	27.7	22.7	48.6	**1.2**	0.6
Selenium	4/4	100%	13.2	2.5	4	**5.3**	**3.3**
Silver	4/4	100%	33.7	1.6	2.2	**21**	**15**
Zinc	4/4	100%	275	121	459	**2.3**	0.6

Shaded analytes were carried forward in the ecoscreen

-- = Could not be calculated

µg/kg = Micrograms per kilogram

ESQ = Ecological Screening Quotient

mg/kg = milligrams per kilogram

NA = Not available

PEC = Probable Effect Concentration (concentration above which effects are probable)

THIS PAGE INTENTIONALLY BLANK

TABLE 13
AVERAGE DAILY DOSE FOR TERRESTRIAL RECEPTORS
PLAYA LAKE (SWMU 103)

COPEC	EPC 0-0.5 ft mg/kg	Plant BAF foliage	Concentration in Plant Tissue mg/kg	Soil Invertebrate BAF	Concentration in Inverterbrate Tissue mg/kg	Small Mammal BAF	Concentration in Small Mammal Tissue mg/kg	ADD mg/kgBW-d			
								American Robin	Deer Mouse	Coyote	Swainson's Hawk
ANTIMONY	4.9	a	0.177	0.033	0.16	1	0.008	0.045	0.065	0.000	0.000
AROCLOR 1248	0.75	0	0.00	a	3.22	a	0.43	0.378	0.503	0.000	0.000

ADD = Average Daily Dose
BAF = Bioaccumulation factor
BW-d = Body weight per day
COPEC = Chemical of potential ecological concern
EPC = Exposure Point Concentration (maximum)
ft = feet
mg/kg = milligrams per kilogram
a = Bioaccumulation based on equation (see Table 11)

THIS PAGE INTENTIONALLY BLANK

TABLE 14

ECOLOGICAL SCREENING QUOTIENTS FOR TERRESTRIAL RECEPTOS
PLAYA LAKE (SWMU 103)

COPEC	EPC 0-0.5 ft mg/kg	American Robin		Deer Mouse		Coyote		Swainson's Hawk	
		ESQ_{NOAEL}	ESQ_{LOAEL}	ESQ_{NOAEL}	ESQ_{LOAEL}	ESQ_{NOAEL}	ESQ_{LOAEL}	ESQ_{NOAEL}	ESQ_{LOAEL}
ANTIMONY	4.9	--	--	**1.1**	0.1	0.00	0.00	--	--
AROCLOR 1248	0.75	0.9	0.1	0.4	0.04	0.00	0.00	0.00	0.00

-- - Toxicity reference value not available; could not be evaluated

EPC - Exposure point concentration

ESQ - Ecological screening quotient

mg/kg - milligrams per kilogram

NOAEL - No-observed-adverse-effects level

LOAEL - Lowest-observed-adverse-effects level

THIS PAGE INTENTIONALLY BLANK

TABLE 15
CALCULATION OF AVERAGE DAILY DOSE INGESTED BY AQUATIC RECEPTORS
PLAYA LAKE (SWMU 103)

COPEC	Sediment EPC (mg/kg)	Surface Water EPC (total, µg/L)	Surface Water EPC (diss, µg/L)	Plant BAF[a] Foliage	Concentration in Plant Tissue mg/kg	Invertebrate BSAF	Concentration in Inverterbrate Tissue mg/kg	Vertebrate BAF	Concentration in Salamander mg/kg	ADD mg/kgBW-d	
										Mallard	Black-crowned Night Heron
Mercury*	0.51	0.0	b	0.233	0.119	0.198	0.10	0.233	0.119	0.01	0.0
Selenium*	13.2	0.0	b	e	18.141	e	1.48	e	11.99	0.73	0.68
Silver*	33.7	9.2	b	0.014	0.472	0.18	15.17	15	138	0.24	7.8

* = EPC is represented by the maximum detected concentration
µg/L = Micrograms per liter
ADD = Average Daily Dose
BAF = Bioaccumulation factor
BW-d = Body weight per day
COPEC = Chemical of Potential Ecological Concern
EPC = Exposure Point Concentration
mg/kg = milligrams per kilogram
a = Bioaccumulation for silver based on soil-to-plant
b = Dissolved fraction not available
Fraction Organic Carbon

THIS PAGE INTENTIONALLY BLANK

TABLE 16
ECOLOGICAL SCREENING QUOTIENTS FOR AQUATIC RECEPTORS
PLAYA LAKE (SWMU 103)

COPEC	Sediment EPC (mg/kg)	Surface Water EPC (µg/L)	Mallard		Black-crowned Night Heron	
			ESQ_{NOAEL}	ESQ_{LOAEL}	ESQ_{NOAEL}	ESQ_{LOAEL}
Mercury	0.51	0.0	1.0	0.1	**1.1**	0.1
Selenium	13.2	0.0	**2.5**	**1.3**	**2.3**	1.0
Silver	33.7	9.2	0.11	0.0	**3.5**	0.39

µg/L - Micrograms per liter

COPEC - Chemical of Potential Ecological Concern

EPC - Exposure point concentration

ESQ - Ecological screening quotient

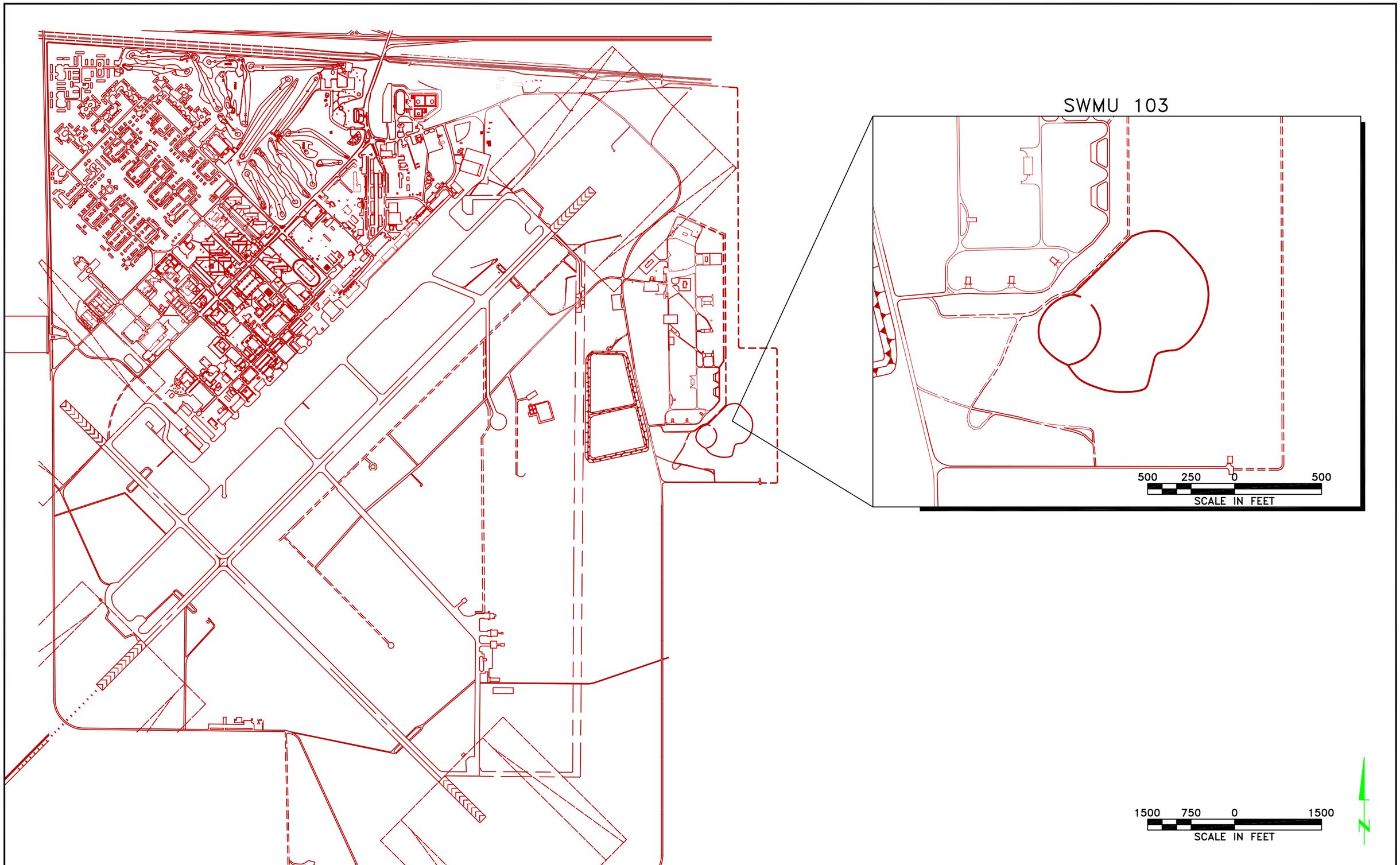
LOAEL - Lowest-observed-adverse-effects level

mg/kg - milligrams per kilogram

NOAEL - No-observed-adverse-effects level

THIS PAGE INTENTIONALLY BLANK

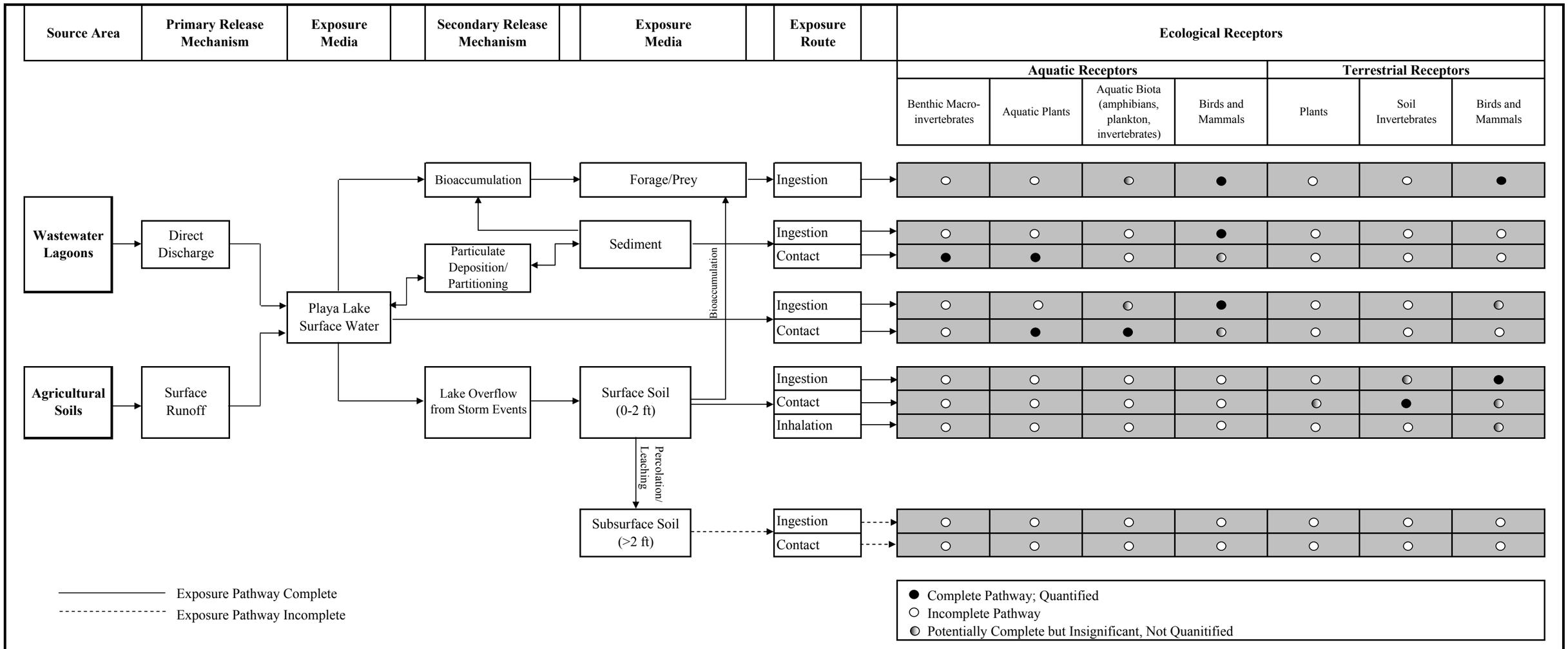
REPORT PHASE: PHASE II



February 19, 2009 2:15:56 p.m.
Drawing: J:\Cannon AFB\newF2.3-2_T6.2_rev1.DWG

SOURCE: CANNON AFB CAD FILES AND CANNON AFB FIELD SAMPLING PLAN.

DRN BY TSSM	DATE 3/02/09	PLAYA LAKE – SWMU 103 LOCATION CANNON AIR FORCE BASE NEW MEXICO	PROJECT NO. 16170402.00200	FIG. NO. 1
CHK'D BY	REVISION 1			

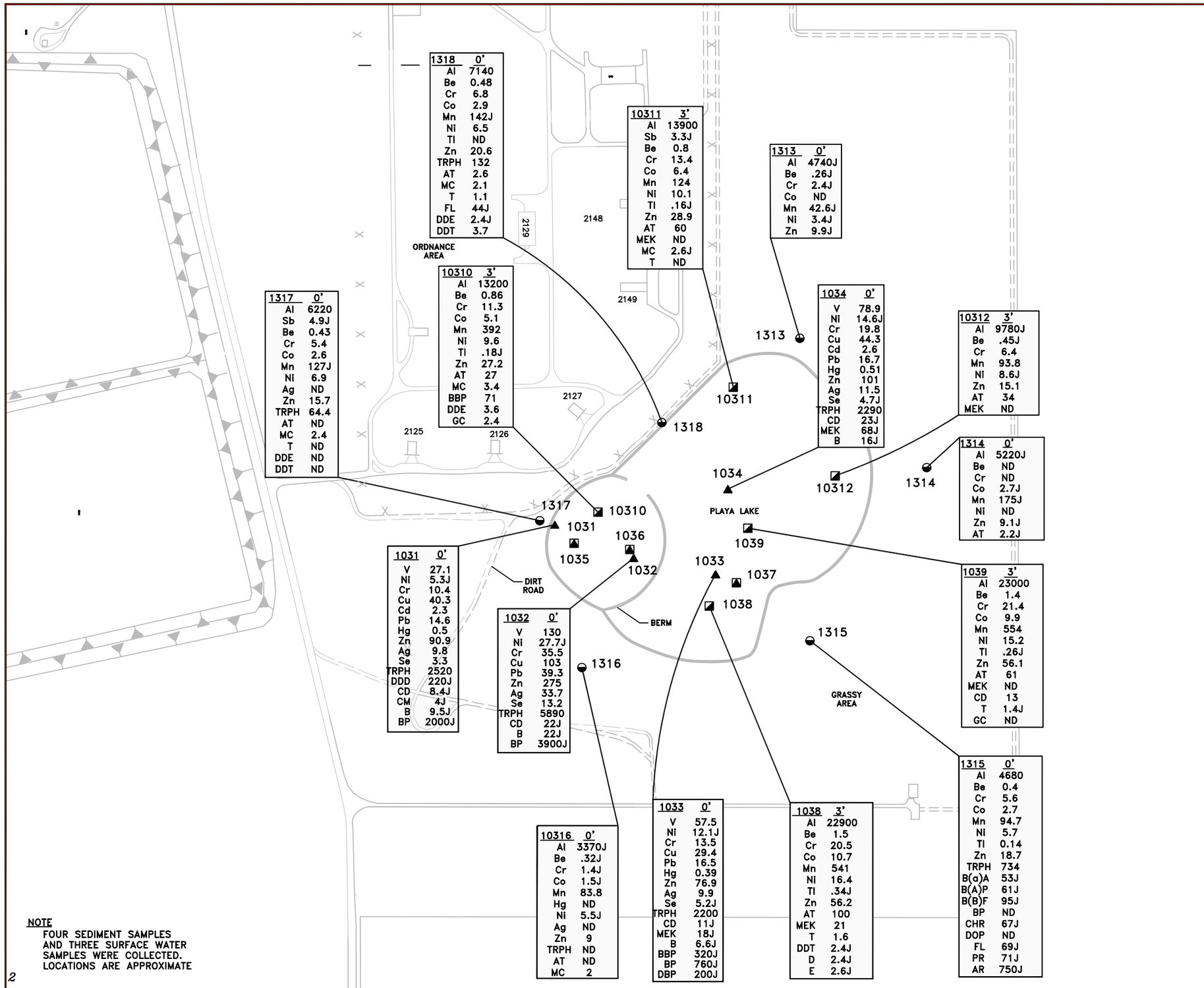


Ecological Conceptual Site Exposure Model
Playa Lake, Cannon AFB, Clovis, NM

URS Corporation

Figure 2

REPORT PHASE:PHASE II



1318	0'
Al	7140
Be	0.48
Cr	6.8
Co	2.9
Mn	142J
Ni	6.5
Tl	ND
Zn	20.6
TRPH	132
AT	2.6
MC	2.1
T	1.1
FL	44J
DDE	2.4J
DDT	3.7

10311	3'
Al	13900
Sb	3.3J
Be	0.8
Cr	13.4
Co	6.4
Mn	124
Ni	10.1
Tl	.16J
Zn	28.9
AT	60
MEK	ND
MC	2.6J
T	ND

1313	0'
Al	4740J
Be	.26J
Cr	2.4J
Co	ND
Mn	42.6J
Ni	3.4J
Zn	9.9J

10310	3'
Al	13200
Be	0.86
Cr	11.3
Co	5.1
Mn	392
Ni	9.6
Tl	.18J
Zn	27.2
AT	27
MC	3.4
BBP	71
DDE	3.6
GC	2.4

1317	0'
Al	6220
Sb	4.9J
Be	0.43
Cr	5.4
Co	2.6
Mn	127J
Ni	6.9
Ag	ND
Zn	15.7
TRPH	64.4
AT	ND
MC	2.4
T	ND
DDE	ND
DDT	ND

1034	0'
V	78.9
Ni	14.6J
Cr	19.8
Cu	44.3
Cd	2.6
Pb	16.7
Hg	0.51
Zn	101
Ag	11.5
Se	4.7J
TRPH	2290
CD	23J
MEK	68J
B	16J

10312	3'
Al	9780J
Be	.45J
Cr	6.4
Mn	93.8
Ni	8.6J
Zn	15.1
AT	34
MEK	ND

1314	0'
Al	5220J
Be	ND
Cr	ND
Co	2.7J
Mn	175J
Ni	ND
Zn	9.1J
AT	2.2J

1031	0'
V	27.1
Ni	5.3J
Cr	10.4
Cu	40.3
Cd	2.3
Pb	14.6
Hg	0.5
Zn	90.9
Ag	9.8
Se	3.3
TRPH	2520
DDD	220J
CD	8.4J
CM	4J
B	9.5J
BP	2000J

1032	0'
V	130
Ni	27.7J
Cr	35.5
Cu	103
Pb	39.3
Zn	275
Ag	33.7
Se	13.2
TRPH	5890
CD	22J
B	22J
BP	3900J

1039	3'
Al	23000
Be	1.4
Cr	21.4
Co	9.9
Mn	554
Ni	15.2
Tl	.26J
Zn	56.1
AT	61
MEK	ND
CD	13
T	1.4J
GC	ND

1315	0'
Al	4680
Be	0.4
Cr	5.6
Co	2.7
Mn	94.7
Ni	5.7
Tl	0.14
Zn	18.7
TRPH	734
B(a)A	53J
B(A)P	61J
B(B)F	95J
BP	ND
CHR	67J
DOP	ND
FL	69J
PR	71J
AR	750J

10316	0'
Al	3370J
Be	.32J
Cr	1.4J
Co	1.5J
Mn	83.8
Hg	ND
Ni	5.5J
Ag	ND
Zn	9
TRPH	ND
AT	ND
MC	2

1033	0'
V	57.5
Ni	12.1J
Cr	13.5
Cu	29.4
Pb	16.5
Hg	0.39
Zn	76.9
Ag	9.9
Se	5.2J
TRPH	2200
CD	11J
MEK	18J
B	6.6J
BBP	320J
BP	760J
DBP	200J

1038	3'
Al	22900
Be	1.5
Cr	20.5
Co	10.7
Mn	541
Ni	16.4
Tl	.34J
Zn	56.2
AT	100
MEK	21
T	1.6
DDT	2.4J
D	2.4J
E	2.6J

NOTE
FOUR SEDIMENT SAMPLES AND THREE SURFACE WATER SAMPLES WERE COLLECTED. LOCATIONS ARE APPROXIMATE

LEGEND

1037 — PHASE I WATER SAMPLE LOCATION AND NUMBER

1034 — PHASE I SEDIMENT SAMPLE LOCATION AND NUMBER

1316 — PHASE II SOIL BORING LOCATION AND NUMBER

10312 — PHASE II SEDIMENT BORING LOCATION AND NUMBER

FENCE

Al = ALUMINUM (mg/kg)
AR = AROCLOR–1248
Be = BERYLLIUM (mg/kg)
Co = COBALT (mg/kg)
Mn = MANGANESE (mg/kg)
Tl = THALLIUM (mg/kg)
AT = ACETONE
GC = gamma–Chlordane
CD = CARBON DISULFIDE
MC = METHYLENE CHLORIDE
Ni = NICKEL (mg/kg)
Cr = CHROMIUM (mg/kg)
Cu = COPPER (mg/kg)
FL = FLUORANTHENE
PR = PYRENE
Cd = CADMIUM (mg/kg)
Pb = LEAD (mg/kg)
Hg = MERCURY (mg/kg)
Zn = ZINC (mg/kg)
Ag = SILVER (mg/kg)
Se = SELENIUM (mg/kg)
DDE = 4,4'–DDE
TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (mg/kg)
DDD = 4,4'–DDD
CD = CHLORDANE
CM = CHLOROMETHANE
MEK = 2–BUTANONE
B = BENZENE
BBP = BENZYL BUTYL PHTHALATE
BP = BIS(2–ETHYLHEXYL)PHTHLATE
DBP = DI–N–BUTYLPHTHLATE
DDT = 4,4'–DDT
B(c)A = BENZO(A)ANTHRACENE
B(A)P = BENZO(A)PYRENE
B(B)F = BENZO(B)FLUORANTHENE
CHR = CHRYSENE
DOP = Di–N–OCTYLPHTHALATE
V = VANADIUM (mg/kg)
D = Dieldrin
E = Endrin
T = TOLUENE

CONCENTRATIONS ARE μg/kg EXCEPT WHERE NOTED

ND= CHEMICALS ANALYZED FOR WERE NOT DETECTED

* = ANALYSIS FOR THIS CHEMICAL WAS NOT PERFORMED

300 150 0 300
SCALE IN FEET

N

February 19, 2009 2:15:56 p.m.
Drawing: J:\Cannon AFB\newF2.3–2_T6.2_rev1.DWG

SOURCE: CANNON AFB CAD FILES AND CANNON AFB FIELD SAMPLING PLAN.

DRN BY TSSM	DATE 3/02/09	PLAYA LAKE – SWMU 103 CONCENTRATIONS OF CHEMICALS DETECTED IN SEDIMENT AND SOIL CANNON AIR FORCE BASE NEW MEXICO	PROJECT NO. 16170402.00200	FIG. NO. 3
CHK'D BY	REVISION 1			

ATTACHMENTS

THIS PAGE INTENTIONALLY BLANK

TABLE A-1
ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SWMU 103 - PHASE I - SEDIMENT

LOCATOR	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006RA			0313580006SA		
	0313580002RA*			0313580003RA*			0313580005RA								
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (µg/kg)															
Acetone	<	110	UJ	200	200	J	<	190	UJ				500	500	U
Acetonitrile															
Acrolein															
Acrylonitrile															
Allyl chloride															
Benzene	<	19	J	22	98	J	6.6	19	J				16	25	J
Bromodichloromethane	<	19	J	<	98	J	<	19	J				<	25	U
Bromoform	<	19	J	<	98	J	<	19	J				<	25	U
Bromomethane	<	39	J	<	200	J	<	37	J				<	49	U
2-Butanone (MEK)	<	39	U	<	200	UJ	18	37	J				68	49	
Carbon disulfide	8.4	19	J	22	98	J	11	19	J				23	25	J
Carbon tetrachloride	<	19	J	<	98	J	<	19	J				<	25	U
Chlorobenzene	<	19	J	<	98	J	<	19	J				<	25	U
Chloroethane	<	39	J	<	200	J	<	37	J				<	49	U
Chloroform	<	19	J	<	98	J	<	19	J				<	25	U
Chloromethane	4	39	J	<	200	J	<	37	J				<	49	U
Chloroprene															
1,2-Dibromo-3-chloro-propane (DBCP)															
Dibromochloromethane	<	19	J	<	98	J	<	19	J				<	25	U
1,2-Dibromoethane (EDB)															
Dibromomethane															
trans-1,4-Dichloro-2-butene															
Dichlorodifluoromethane															
1,1-Dichloroethane	<	19	J	<	98	J	<	19	J				<	25	U
1,2-Dichloroethane	<	19	J	<	98	J	<	19	UJ				<	25	U
1,1-Dichloroethene	<	19	UJ	<	98	UJ	<	19	UJ				<	25	U
1,2-Dichloroethene (total)	<	19	UJ	<	98	UJ	<	19	UJ				<	25	U
1,2-Dichloropropane	<	19	J	<	98	J	<	19	J				<	25	U
cis-1,3-Dichloropropene	<	19	J	<	98	J	<	19	J				<	25	U
trans-1,3-Dichloropropene	<	19	J	<	98	J	<	19	J				<	25	U
1,4-Dioxane															
Ethyl methacrylate															
Ethylbenzene	<	19	J	<	98	J	<	19	J				<	25	U
2-Hexanone	<	39	J	<	200	J	<	37	J				<	49	U
Iodomethane															

TABLE A-1
ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SWMU 103 - PHASE I - SEDIMENT

LOCATOR	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006RA			0313580006SA		
	0313580002RA*			0313580003RA*			0313580005RA								
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Toluene	<	19	J	<	98	J	<	19	J				<	25	U
1,1,1-Trichloroethane	<	19	J	<	98	J	<	19	J				<	25	U
1,1,2-Trichloroethane	<	19	J	<	98	J	<	19	J				<	25	U
Trichloroethene	<	19	J	<	98	J	<	19	J				<	25	U
Trichlorofluoromethane															
1,2,3-Trichloropropane															
Vinyl acetate	<	39	J	<	200	J	<	37	J				<	49	U
Vinyl chloride	<	39	J	<	200	J	<	37	J				<	49	U
Xylenes (total)	<	19	UJ	<	98	UJ	<	19	UJ				<	25	U
Semivolatile Organics (µg/kg)															
Acenaphthene	<	1300	UJ	<	6500	UJ	<	1200	UJ				<	1600	U
Acenaphthylene	<	1300	J	<	6500	J	<	1200	J				<	1600	J
Acetophenone															
2-Acetylaminofluorene															
4-Aminobiphenyl															
Aniline															
Anthracene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Aramite															
Benzo(a)anthracene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Benzo(a)pyrene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Benzo(b)fluoranthene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Benzo(g,h,i)perylene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Benzo(k)fluoranthene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Benzyl alcohol	<	1300	J	<	6500	J	<	1200	J				<	1600	U
bis(2-Chloroethoxy)methane	<	1300	UJ	<	6500	UJ	<	1200	UJ				<	1600	U
bis(2-Chloroethyl) ether	<	1300	UJ	<	6500	UJ	<	1200	UJ				<	1600	U
bis(2-Chloroisopropyl)ether	<	1300	UJ	<	6500	UJ	<	1200	UJ				<	1600	U
bis(2-Ethylhexyl)phthalate	2000	1300		3900	6500	J	760	1200	J				1700	1600	
4-Bromophenyl phenyl ether	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Butyl benzyl phthalate	<	1300	J	<	6500	J	320	1200	J				<	1600	U
2-sec-Butyl-4,6-dinitro-phenol															
Carbazole	<	1300	J	<	6500	J	<	1200	J				<	1600	U
4-Chloro-3-methylphenol	<	1300	J	<	6500	J	<	1200	J				<	1600	J
4-Chloroaniline	<	1300	J	<	6500	J	<	1200	J				<	1600	U
2-Chloronaphthalene	<	1300	J	<	6500	J	<	1200	J				<	1600	J
2-Chlorophenol	<	1300	J	<	6500	J	<	1200	J				<	1600	U
4-Chlorophenyl phenyl ether	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Chrysene	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Di-n-butyl phthalate	<	1300	J	<	6500	J	200	1200	J				<	1600	U
Di-n-octyl phthalate	<	1300	J	<	6500	J	<	1200	J				<	1600	U
Dibenz(a,h)anthracene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Dibenzofuran	<	1300	J	<	6500	J	<	1200	J				<	1600	J
1,2-Dichlorobenzene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
1,3-Dichlorobenzene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
1,4-Dichlorobenzene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
2,4-Dichlorophenol	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ

TABLE A-1
ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SWMU 103 - PHASE I - SEDIMENT

LOCATOR	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006RA			0313580006SA		
	0313580002RA*			0313580003RA*			0313580005RA								
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
3,3'-Dichlorobenzidine	<	2500	J	<	13000	J	<	2500	J				<	3200	UJ
2,6-Dichlorophenol															
Diethyl phthalate	<	1300	UJ	<	6500	J	<	1200	J				<	1600	UJ
Dimethoate															
p-Dimethylaminoazobenzene															
3,3'-Dimethylbenzidine															
7,12-Dimethylbenz(a)-anthracene															
a,a-Dimethylphenethyl-amine															
2,4-Dimethylphenol	<	1300	UJ	<	6500	J	<	1200	J				<	1600	UJ
Dimethyl phthalate	<	1300	J	<	6500	J	<	1200	J				<	1600	J
4,6-Dinitro-2-methylphenol	<	6200	J	<	31000	J	<	6000	J				<	7900	UJ
2,4-Dinitrophenol	<	6200	J	<	31000	J	<	6000	J				<	7900	UJ
1,3-Dinitrobenzene															
2,4-Dinitrotoluene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
2,6-Dinitrotoluene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Diphenylamine															
Disulfoton															
Ethyl methanesulfonate															
Famphur															
Fluoranthene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Fluorene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Hexachlorobenzene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Hexachlorobutadiene	<	1300	J	<	6500	J	<	1200	J				<	1600	J
Hexachlorocyclopentadiene	<	1300	J	<	6500	J	<	1200	J				<	1600	J
Hexachloroethane	<	1300	UJ	<	6500	J	<	1200	J				<	1600	UJ
Hexachlorophene															
Hexachloropropene															
Indeno(1,2,3-cd)pyrene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Isophorone	<	1300	UJ	<	6500	J	<	1200	J				<	1600	UJ
Isosafrole															
Methapyrilene															
Methyl methanesulfonate															
3-Methylcholanthrene															
2-Methylnaphthalene	<	1300	J	<	6500	J	<	1200	J				<	1600	J
Methyl parathion															
2-Methylphenol	<	1300	UJ	<	6500	J	<	1200	J				<	1600	UJ
3/4-Methylphenol	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Naphthalene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
1,4-Naphthoquinone															
1-Naphthylamine															
2-Naphthylamine															
2-Nitroaniline	<	6200	J	<	31000	J	<	6000	J				<	7900	J
3-Nitroaniline	<	6200	J	<	31000	J	<	6000	J				<	7900	UJ
4-Nitroaniline	<	6200	J	<	31000	J	<	6000	J				<	7900	UJ
Nitrobenzene	<	1300	UJ	<	6500	J	<	1200	UJ				<	1600	UJ
2-Nitrophenol	<	1300	UJ	<	6500	J	<	1200	J				<	1600	UJ

TABLE A-1
ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SWMU 103 - PHASE I - SEDIMENT

LOCATOR	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006RA			0313580006SA		
	0313580002RA*			0313580003RA*			0313580005RA								
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
4-Nitrophenol	<	6200	J	<	31000	J	<	6000	J				<	7900	UJ
5-Nitro-o-toluidine															
4-Nitroquinoline-1-oxide															
N-Nitrosodiethylamine															
N-Nitrosodimethylamine															
N-Nitroso-di-n-butylamine															
N-Nitroso-di-n-propylamine	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
N-Nitrosodiphenylamine	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
N-Nitrosomethylethylamine															
N-Nitrosomorpholine															
N-Nitrosopiperidine															
N-Nitrosopyrrolidine															
Parathion															
Pentachlorobenzene															
Pentachloroethane															
Pentachloronitrobenzene															
Pentachlorophenol	<	6200	J	<	31000	J	<	6000	J				<	7900	UJ
Phenacetin															
Phenanthrene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Phenol	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
4-Phenylenediamine															
Phorate															
2-Picoline															
Pronamide															
Pyrene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
Pyridine															
Safrole															
Sulfotepp															
1,2,4,5-Tetrachloro-benzene															
2,3,4,6-Tetrachlorophenol															
Thionazin															
2-Toluidine															
1,2,4-Trichlorobenzene	<	1300	J	<	6500	J	<	1200	J				<	1600	UJ
2,4,5-Trichlorophenol	<	6200	J	<	31000	J	<	6000	J				<	7900	J
2,4,6-Trichlorophenol	<	1300	J	<	6500	J	<	1200	J				<	1600	J
1,3,5-Trinitrobenzene															
O,O,O-Triethylphosphoro-thioate															
Pesticides/PCB's (µg/kg)															
Aroclor 1016	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
Aroclor 1221	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
Aroclor 1232	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
Aroclor 1242	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
Aroclor 1248	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
Aroclor 1254	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
Aroclor 1260	<	2500	UJ	<	13000	UJ	<	2500	UJ	<	160	UJ	<	650	J
4,4'-DDD	220	250	J	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J

TABLE A-1
ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SWMU 103 - PHASE I - SEDIMENT

LOCATOR	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006RA			0313580006SA		
	0313580002RA*			0313580003RA*			0313580005RA								
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
4,4'-DDE	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J
4,4'-DDT	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J
Aldrin	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	UJ	<		J
alpha-BHC	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	UJ	<	33	J
alpha-Chlordane	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	UJ	<	33	J
beta-BHC	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	UJ	<	33	J
Chlorobenzilate															
delta-BHC	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	UJ	<	33	J
Diallate															
Dieldrin	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J
Endosulfan I	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	UJ	<	33	J
Endosulfan II	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J
Endosulfan sulfate	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J
Endrin	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	UJ	<	65	J
Endrin aldehyde	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	U	<	65	J
Endrin ketone	<	250	UJ	<	1300	UJ	<	250	UJ	<	16	U	<	65	J
gamma-BHC (Lindane)	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	U	<	33	UJ
gamma-Chlordane	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	U	<	33	J
Heptachlor	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	U	<		J
Heptachlor epoxide	<	130	UJ	<	670	UJ	<	130	UJ	<	8.4	U	<	33	J
Isodrin															
Kepone															
Methoxychlor	<	1300	UJ	<	6700	UJ	<	1300	UJ	<	84	U	<	330	J
Toxaphene	<	13000	UJ	<	67000	UJ	<	13000	UJ	<	840	U	<	3300	J
Herbicides (µg/kg)															
2,4-D	<	150	J	<	790	J	<	150	J				<	200	UJ
2,4-DB	<	390	J	<	2000	J	<	370	J				<	490	UJ
Dalapon	<	390	J	<	2000	J	<	370	J				<	490	UJ
Dicamba	<	39	J	<	200	J	<	37	J				<	49	UJ
Dichlorprop	<	77	UJ	<	390	UJ	<	75	J				<	98	UJ
Dinoseb	<	77	J	<	390	J	<	75	J				<	98	UJ
MCPA	<	19000	J	<	98000	J	<	19000	J				<	25000	UJ
MCPP	<	19000	J	<	98000	J	<	19000	J				<	25000	UJ
2,4,5-T	<	39	J	<	200	J	<	37	J				<	49	UJ
2,4,5-TP (Silvex)	<	39	UJ	<	200	UJ	<	37	U				<	49	UJ
Metals (mg/kg)															
Aluminum	3450	38.5		21300	196		12300	37.4					12300	49.2	
Antimony	<	23.1	UJ	<	118	UJ	<	22.5	U				<	29.5	UJ
Arsenic	2.4	1.9		10.8	9.8		3.3	1.9					4.5	2.5	
Barium	90.1	3.9		231	19.6		119	3.7					150	4.9	
Beryllium	<	0.77	UJ	<	3.9	UJ	0.69	0.75	J				0.99	0.98	
Cadmium	2.3	1.9		<	9.8	UJ	<	1.9	UJ				2.6	2.5	
Calcium	26200	77		83400	393		46400	74.9					77400	98.4	
Chromium	10.4	3.9		35.5	19.6		13.5	3.7					19.8	4.9	
Cobalt	<	3.9	U	<	19.6	U	4	3.7					5.9	4.9	
Copper	40.3	7.7		102	39.3		29.4	7.5					44.3	9.8	

TABLE A-1
ANALYTICAL RESULTS FOR SAMPLES COLLECTED FROM SWMU 103 - PHASE I - SEDIMENT

LOCATOR	CAN103-1031-5001			CAN103-1032-5001			CAN103-1033-5001			CAN103-1034-5001			CAN103-1034-5001		
LAB SAMPLE NUMBER	0313580002SA			0313580003SA			0313580005SA			0313580006RA			0313580006SA		
	0313580002RA*			0313580003RA*			0313580005RA								
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Iron	3860	38.5		18300	196		9990	37.4					13100	49.2	
Lead	14.6	1.9		39.3	9.8		16.5	1.9					16.7	2.5	
Magnesium	1780	77		8700	393		4140	74.9					5640	98.4	
Manganese	38	3.9		228	19.6		158	3.7					196	4.9	
Mercury															
Mercury	0.5	0.39		<	2	U	0.39	0.37					0.51	0.49	
Nickel	5.3	15.4	J	27.7	78.6	J	12.1	15	J				14.6	19.7	J
Potassium	968	1930	J	4640	9820	J	2580	1870					3380	2460	
Selenium	3.3	1.9		13.2	9.8		5.2	1.9					4.7	2.5	
Silver	9.8	3.9		33.7	19.6		9.9	3.7					11.5	4.9	
Sodium	3940	1930		18900	9820		4230	1870	J				4260	2460	J
Thallium	<	1.9	U	<	19.6	U	<	3.7	U				<	4.9	U
Tin															
Vanadium	27.1	3.9		130	19.6		57.5	3.7					78.9	4.9	
Zinc	90.9	7.7		275	39.3		76.9	7.5					101	9.8	
TPH (mg/kg)															
Total Petroleum Hydrocarbons	2520	154		5890	786		2200	150					2290	197	

J = Estimated value.
U = Nondetected value.
RL = Reporting Limit.
*Lab ID for pesticide/PCB re-analyses

TABLE A-2
ANALYTICA RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE I - SURFACE WATER

LOCATOR	CAN103-1035-3000			CAN103-1036-3000			CAN103-1036-3000			CAN103-1037-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580012SA			0313580009RA			0313580009SA		
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (µg/L)															
Acetone	12	10		8	10	J							6.9	10	J
Acetonitrile	<	200	U	<	200	U							<	200	U
Acrolein	<	100	U	<	100	U							<	100	U
Acrylonitrile	<	100	U	<	100	U							<	100	U
Allyl chloride	<	10	U	<	10	U							<	10	U
Benzene	<	5	U	<	5	U							<	5	J
Bromodichloromethane	<	5	U	<	5	U							<	5	J
Bromoform	<	5	U	<	5	U							<	5	J
Bromomethane	<	10	U	<	10	U							<	10	J
2-Butanone (MEK)	<	10	U	<	10	U							<	10	U
Carbon disulfide	<	5	U	<	5	U							<	5	J
Carbon tetrachloride	<	5	U	<	5	U							<	5	J
Chlorobenzene	<	5	U	<	5	U							<	5	J
Chloroethane	<	10	U	<	10	U							<	10	J
Chloroform	<	5	U	<	5	U							<	5	J
Chloromethane	<	10	U	<	10	U							<	10	J
Chloroprene	<	5	U	<	5	U							<	5	U
1,2-Dibromo-3-chloro-propane (DBCP)	<	10	U	<	10	U							<	10	U
Dibromochloromethane	<	5	U	<	5	U							<	5	J
1,2-Dibromoethane (EDB)	<	10	U	<	10	U							<	10	U
Dibromomethane	<	5	U	<	5	U							<	5	U
trans-1,4-Dichloro-2-butene	<	5	U	<	5	U							<	5	U
Dichlorodifluoromethane	<	20	U	<	20	U							<	20	U
1,1-Dichloroethane	<	5	U	<	5	U							<	5	J
1,2-Dichloroethane	<	5	U	<	5	U							<	5	J
1,1-Dichloroethene	<	5	U	<	5	U							<	5	J
1,2-Dichloroethene (total)	<	5	U	<	5	U							<	5	U
1,2-Dichloropropane	<	5	U	<	5	U							<	5	J
cis-1,3-Dichloropropene	<	5	U	<	5	U							<	5	J
trans-1,3-Dichloropropene	<	5	U	<	5	U							<	5	U
1,4-Dioxane	<	500	U	<	500	U							<	500	U
Ethyl methacrylate	<	20	U	<	20	U							<	20	U
Ethylbenzene	<	5	U	<	5	U							<	5	J
2-Hexanone	<	10	U	<	10	U							<	10	J
Iodomethane	<	5	U	<	5	U							<	5	U
Isobutanol	<	200	U	<	200	U							<	200	U
Methacrylonitrile	<	5	U	<	5	U							<	5	U
Methyl methacrylate	<	20	U	<	20	U							<	20	U
4-Methyl-2-pentanone (MIBK)	<	10	U	<	10	U							<	10	U
Methylene chloride	<	5	U	<	5	U							1	5	J
Propionitrile	<	5	U	<	5	U							<	5	U
Styrene	<	5	U	<	5	U							<	5	J
1,1,1,2-Tetrachloroethane	<	5	U	<	5	U							<	5	U
1,1,2,2-Tetrachloroethane	<	5	U	<	5	U							<	5	J
Tetrachloroethene	<	5	U	<	5	U							<	5	J
Toluene	<	5	U	<	5	U							<	5	J

TABLE A-2
ANALYTICA RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE I - SURFACE WATER

LOCATOR	CAN103-1035-3000			CAN103-1036-3000			CAN103-1036-3000			CAN103-1037-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580012SA			0313580009RA			0313580009SA		
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
1,1,1-Trichloroethane	<	5	U	<	5	J							<	5	U
1,1,2-Trichloroethane	<	5	U	<	5	U							<	5	J
Trichloroethene	<	5	U	<	5	U							<	5	U
Trichlorofluoromethane	<	5	U	<	5	U							<	5	U
1,2,3-Trichloropropane	<	5	U	<	5	U							<	5	U
Vinyl acetate	<	10	U	<	10	U							<	10	U
Vinyl chloride	<	10	U	<	10	U							<	10	U
Xylenes (total)	<	5	U	<	5	U							<	5	U
Semivolatile Organics (µg/L)															
Acenaphthene	<	10	U	<	10	U							<	10	U
Acenaphthylene	<	10	U	<	10	U							<	10	U
Acetophenone	<	10	U	<	10	U							<	10	U
2-Acetylaminofluorene	<	100	U	<	100	U							<	100	U
4-Aminobiphenyl	<	10	U	<	10	U							<	10	U
Aniline	<	10	U	<	10	U							<	10	U
Anthracene	<	10	U	<	10	J							<	10	U
Aramite	<	10	U	<	10	U							<	10	U
Benzo(a)anthracene	<	10	U	<	10	J							<	10	U
Benzo(a)pyrene	<	10	U	<	10	J							<	10	U
Benzo(b)fluoranthene	<	10	U	<	10	J							<	10	U
Benzo(g,h,i)perylene	<	10	U	<	10	J							<	10	U
Benzo(k)fluoranthene	<	10	U	<	10	J							<	10	U
Benzyl alcohol	<	10	J	<	10	U							<	10	U
bis(2-Chloroethoxy)methane	<	10	U	<	10	U							<	10	U
bis(2-Chloroethyl) ether	<	10	U	<	10	U							<	10	U
bis(2-Chloroisopropyl)ether	<	10	U	<	10	U							<	10	U
bis(2-Ethylhexyl)phthalate	<	10	U	<	10	U							<	10	U
4-Bromophenyl phenyl ether	<	10	J	<	10	U							<	10	U
Butyl benzyl phthalate	<	10	U	<	10	J							<	10	U
2-sec-Butyl-4,6-dinitro-phenol	<	10	U	<	10	U							<	10	U
Carbazole	<	10	U	<	10	J							<	10	U
4-Chloro-3-methylphenol	<	10	U	<	10	U							<	10	U
4-Chloroaniline	<	10	U	<	10	U							<	10	U
2-Chloronaphthalene	<	10	U	<	10	U							<	10	U
2-Chlorophenol	<	10	J	<	10	U							<	10	U
4-Chlorophenyl phenyl ether	<	10	U	<	10	U							<	10	J
Chrysene	<	10	U	<	10	J							<	10	U
Di-n-butyl phthalate	<	10	U	<	10	J							<	10	U
Di-n-octyl phthalate	<	10	U	<	10	U							<	10	U
Dibenz(a,h)anthracene	<	10	U	<	10	J							<	10	U
Dibenzofuran	<	10	U	<	10	U							<	10	U
1,2-Dichlorobenzene	<	10	J	<	10	U							<	10	U
1,3-Dichlorobenzene	<	10	J	<	10	U							<	10	U
1,4-Dichlorobenzene	<	10	J	<	10	U							<	10	U
2,4-Dichlorophenol	<	10	U	<	10	U							<	10	U
3,3'-Dichlorobenzidine	<	20	U	<	20	J							<	20	U
2,6-Dichlorophenol	<	10	U	<	10	U							<	10	U

TABLE A-2
ANALYTICA RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE I - SURFACE WATER

LOCATOR	CAN103-1035-3000			CAN103-1036-3000			CAN103-1036-3000			CAN103-1037-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580012SA			0313580009RA			0313580009SA		
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Diethyl phthalate	<	10	U	<	10	J							<	10	U
Dimethoate	<		U	<		U							<		U
p-Dimethylaminoazobenzene	<	10	U	<	10	U							<	10	U
3,3'-Dimethylbenzidine	<	10	U	<	10	U							<	10	U
7,12-Dimethylbenz(a)-anthracene	<	10	U	<	10	U							<	10	U
a,a-Dimethylphenethyl-amine	<	10	U	<	10	U							<	10	U
2,4-Dimethylphenol	<	10	J	<	10	U							<	10	U
Dimethyl phthalate	<	10	U	<	10	U							<	10	U
4,6-Dinitro-2-methylphenol	<	50	U	<	50	J							<	50	U
2,4-Dinitrophenol	<	50	U	<	50	U							<	50	U
1,3-Dinitrobenzene	<	10	U	<	10	U							<	10	U
2,4-Dinitrotoluene	<	10	J	<	10	U							<	10	U
2,6-Dinitrotoluene	<	10	U	<	10	U							<	10	U
Diphenylamine	<	10	U	<	10	U							<	10	U
Disulfoton	<	50	U	<	50	U							<	50	U
Ethyl methanesulfonate	<	10	U	<	10	U							<	10	U
Famphur	<		U	<		U							<		U
Fluoranthene	<	10	U	<	10	J							<	10	U
Fluorene	<	10	J	<	10	U							<	10	U
Hexachlorobenzene	<	10	U	<	10	U							<	10	U
Hexachlorobutadiene	<	10	U	<	10	U							<	10	U
Hexachlorocyclopentadiene	<	10	U	<	10	U							<	10	U
Hexachloroethane	<	10	J	<	10	U							<	10	U
Hexachlorophene	<		U	<		U							<		U
Hexachloropropene	<	10	U	<	10	U							<	10	U
Indeno(1,2,3-cd)pyrene	<	10	U	<	10	J							<	10	U
Isophorone	<	10	J	<	10	U							1.4	10	J
Isosafrole	<	20	U	<	20	U							<	20	U
Methapyrilene	<	10	U	<	10	U							<	10	U
Methyl methanesulfonate	<	10	U	<	10	U							<	10	U
3-Methylcholanthrene	<	10	U	<	10	U							<	10	U
2-Methylnaphthalene	<	10	U	<	10	U							<	10	U
Methyl parathion	<	50	U	<	50	U							<	50	U
2-Methylphenol	<	10	J	<	10	U							<	10	U
3/4-Methylphenol	<	10	J	<	10	U							<	10	U
Naphthalene	<	10	U	<	10	U							<	10	U
1,4-Naphthoquinone	<	10	U	<	10	U							<	10	U
1-Naphthylamine	<	10	U	<	10	U							<	10	U
2-Naphthylamine	<	10	U	<	10	U							<	10	U
2-Nitroaniline	<	50	U	<	50	U							<	50	U
3-Nitroaniline	<	50	U	<	50	U							<	50	U
4-Nitroaniline	<	50	U	<	50	U							<	50	U
Nitrobenzene	<	10	J	<	10	U							<	10	U
2-Nitrophenol	<	10	J	<	10	U							<	10	U
4-Nitrophenol	<	50	U	<	50	U							<	50	U
5-Nitro-o-toluidine	<	10	U	<	10	U							<	10	U
4-Nitroquinoline-1-oxide	<		U	<		U							<		U

TABLE A-2
ANALYTICA RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE I - SURFACE WATER

LOCATOR	CAN103-1035-3000			CAN103-1036-3000			CAN103-1036-3000			CAN103-1037-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580012SA			0313580009RA			0313580009SA		
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
N-Nitrosodiethylamine	<	10	U	<	10	U							<	10	U
N-Nitrosodimethylamine	<	10	U	<	10	U							<	10	U
N-Nitroso-di-n-butylamine	<	10	U	<	10	U							<	10	U
N-Nitroso-di-n-propylamine	<	10	J	<	10	U							<	10	U
N-Nitrosodiphenylamine	<	10	U	<	10	U							<	10	J
N-Nitrosomethylethylamine	<	10	U	<	10	U							<	10	U
N-Nitrosomorpholine	<	10	U	<	10	U							<	10	U
N-Nitrosopiperidine	<	10	U	<	10	U							<	10	U
N-Nitrosopyrrolidine	<	10	U	<	10	U							<	10	U
Parathion	<	50	U	<	50	U							<	50	U
Pentachlorobenzene	<	10	U	<	10	U							<	10	U
Pentachloroethane	<	10	U	<	10	U							<	10	U
Pentachloronitrobenzene	<	50	U	<	50	U							<	50	U
Pentachlorophenol	<	50	U	<	50	J							<	50	U
Phenacetin	<	10	U	<	10	U							<	10	U
Phenanthrene	<	10	U	<	10	U							<	10	J
Phenol	<	10	J	<	10	U							<	10	U
4-Phenylenediamine	<		U	<		U							<		U
Phorate	<	100	U	<	100	U							<	100	U
2-Picoline	<	10	U	<	10	U							<	10	U
Pronamide	<	10	U	<	10	U							<	10	U
Pyrene	<	10	U	<	10	J							<	10	U
Pyridine	<	20	U	<	20	U							<	20	U
Safrole	<	10	U	<	10	U							<	10	U
Sulfotepp	<	50	U	<	50	U							<	50	U
1,2,4,5-Tetrachloro-benzene	<	10	U	<	10	U							<	10	U
2,3,4,6-Tetrachlorophenol	<	50	U	<	50	U							<	50	U
Thionazin	<	50	U	<	50	U							<	50	U
2-Toluidine	<	10	U	<	10	U							<	10	U
1,2,4-Trichlorobenzene	<	10	U	<	10	U							<	10	U
2,4,5-Trichlorophenol	<	50	U	<	50	U							<	50	U
2,4,6-Trichlorophenol	<	10	U	<	10	U							<	10	U
1,3,5-Trinitrobenzene	<	10	U	<	10	U							<	10	U
O,O,O-Triethylphosphoro-thioate	<	10	U	<	10	U							<	10	U
Pesticides/PCB's (µg/L)															
Aroclor 1016	<	2	U	<	1	U	<	5	U	<	2	U	<	1	U
Aroclor 1221	<	2	U	<	1	U	<	5	U	<	2	U	<	1	U
Aroclor 1232	<	2	U	<	1	U	<	5	U	<	1	U	<	1	U
Aroclor 1242	<	2	U	<	1	U	<	5	U	<	2	U	<	1	U
Aroclor 1248	<	2	U	<	1	U	<	5	U	<	1	U	<	1	U
Aroclor 1254	<	2	U	<	1	U	<	5	U	<	2	U	<	1	U
Aroclor 1260	<	2	U	<	1	U	<	5	U	<	2	U	<	1	U
4,4'-DDD	<	0.2	U				<	0.5	U	<	0.1	U			
4,4'-DDE	<	0.2	U				<	0.5	U	<	0.1	U			
4,4'-DDT	<	0.2	U				<	0.5	U	<	0.2	U			
Aldrin	<	0.1	U				<	0.25	U	<	0.05	U			
alpha-BHC	<	0.1	U				<	0.25	U	<	0.05	U			

TABLE A-2
ANALYTICA RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE I - SURFACE WATER

LOCATOR	CAN103-1035-3000			CAN103-1036-3000			CAN103-1036-3000			CAN103-1037-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580012SA			0313580009RA			0313580009SA		
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
alpha-Chlordane	<	0.1	U				<	0.25	U	<	0.1	U			
beta-BHC	<	0.1	U				<	0.25	U	<	0.05	U			
Chlorobenzilate	<	0.2	U				<	0.5	U	<	0.2	U			
delta-BHC	<	0.1	U				<	0.25	U	<	0.1	U			
Diallate	<	2	U				<	5	U	<	1	U			
Dieldrin	<	0.2	U				<	0.5	U	<	0.1	U			
Endosulfan I	<	0.1	U				<	0.25	U	<	0.05	U			
Endosulfan II	<	0.2	U				<	0.5	U	<	0.2	U			
Endosulfan sulfate	<	0.2	U				<	0.5	U	<	0.2	U			
Endrin	<	0.2	U				<	0.5	U	<	0.2	U			
Endrin aldehyde	<	0.2	U				<	0.5	U	<	0.2	U			
Endrin ketone															
gamma-BHC (Lindane)	<	0.1	U				<	0.25	U	<	0.1	U			
gamma-Chlordane	<	0.1	U				<	0.25	U	<	0.1	U			
Heptachlor	<	0.1	U				<	0.25	U	<	0.1	U			
Heptachlor epoxide	<	0.1	U				<	0.25	U	<	0.05	U			
Isodrin	<	0.2	U				<	0.5	U	<	0.2	U			
Kepone	<	2	U				<	5	U	<	2	U			
Methoxychlor	<	1	U				<	2.5	U	<	0.5	U			
Toxaphene	<	10	U				<	25	U	<	10	U			
Herbicides (µg/L)															
2,4-D	<	1.2	U	<	1.2	J							<	1.2	U
2,4-DB															
Dalapon															
Dicamba															
Dichlorprop															
Dinoseb															
MCPA															
MCPP															
2,4,5-T	<	0.2	U	<	0.2	J							<	0.2	U
2,4,5-TP (Silvex)	<	0.17	U	<	0.17	U							<	0.17	U
Metals (mg/L)															
Aluminum															
Antimony	<	0.06	U	<	0.06	U							<	0.06	U
Arsenic	0.0031	0.005	J	0.0057	0.005								0.0034	0.005	J
Barium	0.076	0.01		0.07	0.01								0.066	0.01	
Beryllium	<	0.002	U	<	0.002	U							<	0.002	U
Cadmium	<	0.005	U	<	0.005	U							<	0.005	U
Calcium															
Chromium	<	0.01	U	<	0.01	U							<	0.01	U
Cobalt	<	0.01	U	<	0.01	U							<	0.01	U
Copper	0.0069	0.02	J	0.0051	0.02	J							0.0072	0.02	J
Iron															
Lead	<	0.005	U	0.006	0.005								<	0.005	U
Magnesium															
Manganese															
Mercury	<	0.0002	U	<	0.0002	U							<	0.0002	U

TABLE A-2
ANALYTICA RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE I - SURFACE WATER

LOCATOR	CAN103-1035-3000			CAN103-1036-3000			CAN103-1036-3000			CAN103-1037-3000			CAN103-1037-3000		
LAB SAMPLE NUMBER	0313580011SA			0313580008SA			0313580012SA			0313580009RA			0313580009SA		
COLLECT DATE	09/21/93			09/21/93			09/21/93			09/21/93			09/21/93		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Mercury															
Nickel	<	0.04	U	<	0.04	U							<	0.04	U
Potassium															
Selenium	<	0.01	U	<	0.02	U							<	0.01	U
Silver	0.0092	0.01	J	0.0053	0.01	J							0.0052	0.01	J
Sodium															
Thallium	<	0.01	U	<	0.01	U							<	0.01	U
Tin	<	0.1	U	<	0.1	U							<	0.1	U
Vanadium	0.0089	0.01	J	0.0048	0.01	J							0.0081	0.01	J
Zinc	0.019	0.02	J	0.014	0.02	J							0.014	0.02	J
TPH (mg/L)															
Total Petroleum Hydrocarbons															
Water Quality (mg/L)															
Cyanide	0.014	0.01		0.011	0.01								<	0.01	U
Sulfide, Total	0.8	0.1		0.57	0.1								0.65	0.1	

J = Estimated value.

R = Rejected value.

U = Nondetected value.

RL = Reporting Limit.

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-10310-003			CAN103-10310-005			CAN103-10310-603			CAN103-10311-003			CAN103-10311-005			CAN103-1038-003		
LAB SAMPLE NUMBER	0396080005SA			0396080007SA			0396080006SA			0396080008SA			0396080009SA			0396080001RA		
COLLECT DATE	12/02/94			12/02/94			12/02/94			12/02/94			12/02/94			12/01/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	27	11		20	11		28	11		60	12		35	12				
Benzene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Bromodichloromethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Bromoform	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Bromomethane	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
2-Butanone (MEK)	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Carbon disulfide	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	7.1	5.9				
Carbon tetrachloride	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Chlorobenzene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Chloroethane	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Chloroform	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Chloromethane	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Dibromochloromethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,1-Dichloroethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,2-Dichloroethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,1-Dichloroethene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,2-Dichloroethene (total)	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,2-Dichloropropane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
cis-1,3-Dichloropropene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
trans-1,3-Dichloropropene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Ethylbenzene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
2-Hexanone	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
4-Methyl-2-pentanone (MIBK)	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Methylene chloride	3.4	5.7	J	2.3	5.7	J	2.7	5.7	J	2.6	6	J	1.9	5.9	J			
Styrene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,1,2,2-Tetrachloroethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Tetrachloroethene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Toluene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	2.7	5.9	J			
1,1,1-Trichloroethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
1,1,2-Trichloroethane	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Trichloroethene	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Vinyl acetate	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Vinyl chloride	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Xylenes (total)	<	5.7	U	<	5.7	U	<	5.7	U	<	6	U	<	5.9	U			
Semivolatile Organics (ug/kg)																		

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-10310-003			CAN103-10310-005			CAN103-10310-603			CAN103-10311-003			CAN103-10311-005			CAN103-1038-003		
LAB SAMPLE NUMBER	0396080005SA			0396080007SA			0396080006SA			0396080008SA			0396080009SA			0396080001RA		
COLLECT DATE	12/02/94			12/02/94			12/02/94			12/02/94			12/02/94			12/01/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
bis(2-Ethylhexyl)phthalate	<	380	U	<	380	U	38	380	J	<	400	U	<	390	U			
4-Bromophenyl phenyl ether	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Butyl benzyl phthalate	71	380	J	<	380	U	<	380	U	<	400	U	<	390	U			
Carbazole	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
4-Chloro-3-methylphenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
4-Chloroaniline	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2-Chloronaphthalene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2-Chlorophenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
4-Chlorophenyl phenyl ether	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Chrysene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Di-n-butyl phthalate	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Di-n-octyl phthalate	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Dibenz(a,h)anthracene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Dibenzofuran	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
1,2-Dichlorobenzene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
1,3-Dichlorobenzene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
1,4-Dichlorobenzene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2,4-Dichlorophenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
3,3'-Dichlorobenzidine	<	750	U	<	760	U	<	750	U	<	800	U	<	780	U			
Diethyl phthalate	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2,4-Dimethylphenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Dimethyl phthalate	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
4,6-Dinitro-2-methylphenol	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
2,4-Dinitrophenol	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
2,4-Dinitrotoluene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2,6-Dinitrotoluene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Fluoranthene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Fluorene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Hexachlorobenzene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Hexachlorobutadiene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Hexachlorocyclopentadiene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Hexachloroethane	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Indeno(1,2,3-cd)pyrene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Isophorone	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2-Methylnaphthalene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2-Methylphenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
4-Methylphenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Naphthalene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2-Nitroaniline	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
3-Nitroaniline	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
4-Nitroaniline	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
Nitrobenzene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2-Nitrophenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
4-Nitrophenol	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
N-Nitroso-di-n-propylamine	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
N-Nitrosodiphenylamine	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Pentachlorophenol	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-10310-003			CAN103-10310-005			CAN103-10310-603			CAN103-10311-003			CAN103-10311-005			CAN103-1038-003		
LAB SAMPLE NUMBER	0396080005SA			0396080007SA			0396080006SA			0396080008SA			0396080009SA			0396080001RA		
COLLECT DATE	12/02/94			12/02/94			12/02/94			12/02/94			12/02/94			12/01/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Phenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Pyrene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
1,2,4-Trichlorobenzene	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
2,4,5-Trichlorophenol	<	1800	U	<	1800	U	<	1800	U	<	1900	U	<	1900	U			
2,4,6-Trichlorophenol	<	380	U	<	380	U	<	380	U	<	400	U	<	390	U			
Pesticides/PCB's (ug/kg)																		
Aroclor 1016	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
Aroclor 1221	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
Aroclor 1232	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
Aroclor 1242	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
Aroclor 1248	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
Aroclor 1254	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
Aroclor 1260	<	38	U	<	38	U	<	38	U	<	40	U	<	39	U	<	43	U
4,4'-DDD	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
4,4'-DDE	3.6	3.8	J	<	3.8	U	3.2	3.8	J	<	4	U	<	3.9	U	<	4.3	U
4,4'-DDT	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
Aldrin	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
alpha-BHC	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
alpha-Chlordane	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
beta-BHC	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
delta-BHC	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
Dieldrin	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
Endosulfan I	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
Endosulfan II	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
Endosulfan sulfate	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
Endrin	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
Endrin aldehyde	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
Endrin ketone	<	3.8	U	<	3.8	U	<	3.8	U	<	4	U	<	3.9	U	<	4.3	U
gamma-BHC (Lindane)	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
gamma-Chlordane	2.4	1.9		1.2	2	J	2.2	1.9		<	2.1	U	<	2	U	<	2.2	U
Heptachlor	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
Heptachlor epoxide	<	1.9	U	<	2	U	<	1.9	U	<	2.1	U	<	2	U	<	2.2	U
Methoxychlor	<	19	U	<	20	U	<	19	U	<	21	U	<	20	U	<	22	U
Toxaphene	<	190	U	<	200	U	<	190	U	<	210	U	<	200	U	<	220	U
Herbicides (ug/kg)																		
2,4-D	<	46	U	<	46	U	<	46	U	<	48	U	<	47	U			
2,4-DB	<	110	U	<	110	U	<	110	U	<	120	U	<	120	U			
Dalapon	<	110	U	<	110	U	<	110	U	<	120	U	<	120	U			
Dicamba	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
Dichlorprop	<	23	U	<	23	U	<	23	U	<	24	U	<	24	U			
Dinoseb	<	23	U	<	23	U	<	23	U	<	24	U	<	24	U			
MCPA	<	5700	U	<	5700	U	<	5700	U	<	6000	U	<	5900	U			
MCPP	<	5700	U	<	5700	U	<	5700	U	<	6000	U	<	5900	U			
2,4,5-T	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			
2,4,5-TP (Silvex)	<	11	U	<	11	U	<	11	U	<	12	U	<	12	U			

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-10310-003			CAN103-10310-005			CAN103-10310-603			CAN103-10311-003			CAN103-10311-005			CAN103-1038-003		
LAB SAMPLE NUMBER	0396080005SA			0396080007SA			0396080006SA			0396080008SA			0396080009SA			0396080001RA		
COLLECT DATE	12/02/94			12/02/94			12/02/94			12/02/94			12/02/94			12/01/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	13200	11.4		12400	11.5		14100	11.4		13900	12.1		11600	11.8				
Antimony	<	6.8	UJ	<	6.9	UJ	<	6.8	UJ	3.3	7.3	J	<	7.1	UJ			
Arsenic	4.6	0.57		3	0.57		4.3	0.57		1.2	0.6		2	0.59				
Barium	94.4	1.1		110	1.1		99.2	1.1		111	1.2		132	1.2				
Beryllium	0.86	0.23		0.72	0.23		0.82	0.23		0.8	0.24		0.85	0.24				
Cadmium	<	0.57	U	0.66	0.57		0.93	0.57	J	<	0.6	U	<	0.59	U			
Calcium	2100	22.8		2180	23		2140	22.8		1290	24.2		1410	23.6				
Chromium	11.3	1.1		12.1	1.1		12.7	1.1		13.4	1.2		12.5	1.2				
Cobalt	5.1	1.1		7.2	1.1		5.8	1.1		6.4	1.2		7.6	1.2				
Copper	8.3	2.3		9.6	2.3		8.9	2.3		9.2	2.4		9.9	2.4				
Iron	12500	11.4		12200	11.5		12800	11.4		12400	12.1		11300	11.8				
Lead	7.6	0.57	J	7.6	0.57	J	8.4	1.1	J	7.6	0.6	J	8.2	0.59	J			
Magnesium	2100	22.8		2030	23		2190	22.8		2760	24.2		2740	23.6				
Manganese	392	1.1		501	1.1		410	1.1		124	1.2		198	1.2				
Mercury	<	0.11	U	<	0.11	U	<	0.11	U	<	0.12	U	<	0.12	U			
Nickel	9.6	4.6		10.6	4.6		10.1	4.6		10.1	4.8		11.3	4.7				
Potassium	2370	569		2280	574		2460	569		2920	605		2460	591				
Selenium	0.13	0.57	J	<	0.57	UJ	0.16	0.57	J	0.15	0.6	J	0.13	0.59	J			
Silver	<	1.1	U	<	1.1	U	<	1.1	U	<	1.2	U	<	1.2	U			
Sodium	99.1	569	J	124	574	J	170	569	J	392	605	J	345	591	J			
Thallium	0.18	0.57	J	0.15	0.57	J	0.16	0.57	J	0.16	0.6	J	0.21	0.59	J			
Vanadium	24.5	1.1		21.8	1.1		24.7	1.1		18.7	1.2		19.8	1.2				
Zinc	27.2	2.3		29	2.3		30	2.3		28.9	2.4		27.1	2.4				
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	<	45.5	U	<	45.9	U	47.5	45.5		<	48.4	U	<	47.2	U			

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-1038-003			CAN103-1038-005			CAN103-1039-003			CAN103-1039-005			CAN103-1312-0003			CAN103-1312-0005		
LAB SAMPLE NUMBER	0396080001SA			0396080002SA			0396080003SA			0396080004SA			0396550001SA			0396550002SA		
COLLECT DATE	12/01/94			12/01/94			12/02/94			12/02/94			12/04/94			12/04/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	100	13		85	13		61	13		76	13		34	12		81	12	
Benzene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Bromodichloromethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Bromoform	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Bromomethane	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
2-Butanone (MEK)	21	13		16	13		<	13	U	14	13		<	12	U	12	12	
Carbon disulfide	<	6.5	U	<	6.4	U	13	6.4		<	6.4	U	<	6	U	<	5.9	U
Carbon tetrachloride	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Chlorobenzene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Chloroethane	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
Chloroform	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Chloromethane	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
Dibromochloromethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,1-Dichloroethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,2-Dichloroethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,1-Dichloroethene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,2-Dichloroethene (total)	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,2-Dichloropropane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
cis-1,3-Dichloropropene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
trans-1,3-Dichloropropene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Ethylbenzene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
2-Hexanone	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
4-Methyl-2-pentanone (MIBK)	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
Methylene chloride	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Styrene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,1,2,2-Tetrachloroethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Tetrachloroethene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Toluene	1.6	6.5	J	3.6	6.4	J	1.4	6.4	J	2.7	6.4	J	<	6	U	<	5.9	U
1,1,1-Trichloroethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
1,1,2-Trichloroethane	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Trichloroethene	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Vinyl acetate	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
Vinyl chloride	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
Xylenes (total)	<	6.5	U	<	6.4	U	<	6.4	U	<	6.4	U	<	6	U	<	5.9	U
Semivolatile Organics (ug/kg)																		

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-1038-003			CAN103-1038-005			CAN103-1039-003			CAN103-1039-005			CAN103-1312-0003			CAN103-1312-0005		
LAB SAMPLE NUMBER	0396080001SA			0396080002SA			0396080003SA			0396080004SA			0396550001SA			0396550002SA		
COLLECT DATE	12/01/94			12/01/94			12/02/94			12/02/94			12/04/94			12/04/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
bis(2-Ethylhexyl)phthalate	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4-Bromophenyl phenyl ether	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Butyl benzyl phthalate	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Carbazole	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4-Chloro-3-methylphenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4-Chloroaniline	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2-Chloronaphthalene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2-Chlorophenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4-Chlorophenyl phenyl ether	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Chrysene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Di-n-butyl phthalate	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Di-n-octyl phthalate	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Dibenz(a,h)anthracene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Dibenzofuran	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
1,2-Dichlorobenzene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
1,3-Dichlorobenzene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
1,4-Dichlorobenzene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2,4-Dichlorophenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
3,3'-Dichlorobenzidine	<	850	U	<	850	U	<	850	U	<	840	U	<	790	U	<	770	U
Diethyl phthalate	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2,4-Dimethylphenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Dimethyl phthalate	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4,6-Dinitro-2-methylphenol	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
2,4-Dinitrophenol	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
2,4-Dinitrotoluene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2,6-Dinitrotoluene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Fluoranthene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Fluorene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Hexachlorobenzene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Hexachlorobutadiene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Hexachlorocyclopentadiene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Hexachloroethane	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Indeno(1,2,3-cd)pyrene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Isophorone	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2-Methylnaphthalene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2-Methylphenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4-Methylphenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Naphthalene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2-Nitroaniline	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
3-Nitroaniline	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
4-Nitroaniline	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
Nitrobenzene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2-Nitrophenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
4-Nitrophenol	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
N-Nitroso-di-n-propylamine	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
N-Nitrosodiphenylamine	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Pentachlorophenol	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-1038-003			CAN103-1038-005			CAN103-1039-003			CAN103-1039-005			CAN103-1312-0003			CAN103-1312-0005		
LAB SAMPLE NUMBER	0396080001SA			0396080002SA			0396080003SA			0396080004SA			0396550001SA			0396550002SA		
COLLECT DATE	12/01/94			12/01/94			12/02/94			12/02/94			12/04/94			12/04/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Phenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Pyrene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
1,2,4-Trichlorobenzene	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
2,4,5-Trichlorophenol	<	2100	U	<	2000	U	<	2000	U	<	2000	U	<	1900	U	<	1900	U
2,4,6-Trichlorophenol	<	430	U	<	420	U	<	420	U	<	420	U	<	400	U	<	390	U
Pesticides/PCB's (ug/kg)																		
Aroclor 1016	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
Aroclor 1221	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
Aroclor 1232	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
Aroclor 1242	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
Aroclor 1248	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
Aroclor 1254	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
Aroclor 1260	<	43	U	<	42	U	<	42	U	<	42	U	<	40	U	<	39	U
4,4'-DDD	<	4.3	U	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
4,4'-DDE	<	4.3	U	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
4,4'-DDT	2.4	4.3	J	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
Aldrin	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
alpha-BHC	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
alpha-Chlordane	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
beta-BHC	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
delta-BHC	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
Dieldrin	2.4	4.3	J	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
Endosulfan I	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
Endosulfan II	<	4.3	U	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
Endosulfan sulfate	<	4.3	U	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
Endrin	2.6	4.3	J	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
Endrin aldehyde	<	4.3	U	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
Endrin ketone	<	4.3	U	<	4.2	U	<	4.2	U	<	4.2	U	<	4	U	<	3.9	U
gamma-BHC (Lindane)	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
gamma-Chlordane	<	2.2	U	<	2.2	U	<	2.2	U	1.1	2.2	J	<	2	U	<	2	U
Heptachlor	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
Heptachlor epoxide	<	2.2	U	<	2.2	U	<	2.2	U	<	2.2	U	<	2	U	<	2	U
Methoxychlor	<	22	U	<	22	U	<	22	U	<	22	U	<	20	U	<	20	U
Toxaphene	<	220	U	<	220	U	<	220	U	<	220	U	<	200	U	<	200	U
Herbicides (ug/kg)																		
2,4-D	<	52	U	<	51	U	<	51	U	<	51	U	<	48	U	<	47	U
2,4-DB	<	130	U	<	130	U	<	130	U	<	130	U	<	120	U	<	120	U
Dalapon	<	130	U	<	130	U	<	130	U	<	130	U	<	120	U	<	120	U
Dicamba	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
Dichlorprop	<	26	U	<	26	U	<	26	U	<	25	U	<	24	U	<	23	U
Dinoseb	<	26	U	<	26	U	<	26	U	<	25	U	<	24	U	<	23	U
MCPA	<	6500	U	<	6400	U	<	6400	U	<	6400	U	<	6000	U	<	5900	U
MCPP	<	6500	U	<	6400	U	<	6400	U	<	6400	U	<	6000	U	<	5900	U
2,4,5-T	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U
2,4,5-TP (Silvex)	<	13	U	<	13	U	<	13	U	<	13	U	<	12	U	<	12	U

TABLE A-3
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SEDIMENT

LOCATOR	CAN103-1038-003			CAN103-1038-005			CAN103-1039-003			CAN103-1039-005			CAN103-1312-0003			CAN103-1312-0005		
LAB SAMPLE NUMBER	0396080001SA			0396080002SA			0396080003SA			0396080004SA			0396550001SA			0396550002SA		
COLLECT DATE	12/01/94			12/01/94			12/02/94			12/02/94			12/04/94			12/04/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	22900	12.9		19200	12.8		23000	12.8		24700	12.7		9780	24	J	6460	23.4	J
Antimony	<	7.8	UJ	<	7.7	UJ	<	7.7	UJ	<	7.6	UJ	<	14.4	UJ	<	14.1	UJ
Arsenic	2.2	0.65		1.9	0.64		2	0.64		1.9	0.64		0.92	0.6		0.84	0.59	
Barium	183	1.3		176	1.3		184	1.3		250	1.3		278	2.4	J	78.8	2.3	J
Beryllium	1.5	0.26		1.4	0.26		1.4	0.26		1.6	0.25		0.45	0.48	J	0.32	0.47	J
Cadmium	<	0.65	U	<	0.64	U	<	0.64	U	0.72	0.64		<	1.2	U	<	1.2	U
Calcium	3740	25.9		3290	25.6		3300	25.6		4780	25.4		143000	48		173000	46.9	
Chromium	20.5	1.3		20.1	1.3		21.4	1.3		22.7	1.3		6.4	2.4		4	2.3	
Cobalt	10.7	1.3		8.3	1.3		9.9	1.3		11.3	1.3		<	2.4	U	<	2.3	U
Copper	17.5	2.6		15	2.6		16.5	2.6		18.9	2.5		3.9	4.8	J	2.9	4.7	J
Iron	20800	12.9		17200	12.8		20200	12.8		21700	12.7		6340	24		4380	23.4	
Lead	15.5	3.2	J	12.2	1.3	J	14	1.3	J	19.6	3.2	J	3.7	0.6	J	3.3	0.59	J
Magnesium	4730	25.9		3920	25.6		4400	25.6		4630	25.4		3860	48		3190	46.9	
Manganese	541	1.3		452	1.3		554	1.3		902	1.3		93.8	2.4		118	2.3	
Mercury	<	0.13	U	<	0.13	U	<	0.13	U	<	0.13	U	<	0.12	U	<	0.12	U
Nickel	16.4	5.2		15.2	5.1		15.2	5.1		17	5.1		8.6	9.6	J	3.5	9.4	J
Potassium	4540	647		3960	640		4580	640		4750	636		2130	1200		1500	1170	
Selenium	<	1.3	UJ	0.17	1.3	J	0.18	0.64	J	0.18	1.3	J	<	2.4	UJ	<	1.2	U
Silver	<	1.3	U	<	1.3	U	<	1.3	U	<	1.3	U	<	2.4	U	<	2.3	U
Sodium	572	647	J	560	640	J	614	640	J	576	636	J	<	1200	U	<	1170	U
Thallium	0.34	0.65	J	0.31	0.64	J	0.26	0.64	J	0.27	0.64	J	<	1.2	UJ	<	1.2	UJ
Vanadium	27.3	1.3		24.6	1.3		26.2	1.3		32.1	1.3		17	2.4	J	11	2.3	J
Zinc	56.2	2.6		47.1	2.6		56.1	2.6		61.8	2.5		15.1	4.8		10.5	4.7	
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	<	51.8	U	<	51.2	U	<	51.2	U	<	50.9	U	<	48	U	<	46.9	U

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1313-0000			CAN103-1313-0005			CAN103-1313-0010			CAN103-1313-0015			CAN103-1313-0020			CAN103-1314-0000		
LAB SAMPLE NUMBER	0397970007SA			0397970008SA			0397970009SA			0397970010SA			0397970011SA			0397970001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	2.2	10	J
Benzene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Bromodichloromethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Bromoform	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Bromomethane	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
2-Butanone (MEK)	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
Carbon disulfide	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Carbon tetrachloride	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Chlorobenzene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Chloroethane	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
Chloroform	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Chloromethane	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
Dibromochloromethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,1-Dichloroethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,2-Dichloroethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,1-Dichloroethene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,2-Dichloroethene (total)	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,2-Dichloropropane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
cis-1,3-Dichloropropene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
trans-1,3-Dichloropropene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Ethylbenzene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
2-Hexanone	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
4-Methyl-2-pentanone (MIBK)	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
Methylene chloride	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Styrene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,1,2,2-Tetrachloroethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Tetrachloroethene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Toluene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,1,1-Trichloroethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
1,1,2-Trichloroethane	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Trichloroethene	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Vinyl acetate	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
Vinyl chloride	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	10	U
Xylenes (total)	<	5.1	U	<	5.6	U	<	5.5	U	<	5.6	U	<	5.4	U	<	5.2	U
Semivolatile Organics (ug/kg)																		

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1313-0000			CAN103-1313-0005			CAN103-1313-0010			CAN103-1313-0015			CAN103-1313-0020			CAN103-1314-0000		
LAB SAMPLE NUMBER	0397970007SA			0397970008SA			0397970009SA			0397970010SA			0397970011SA			0397970001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
bis(2-Ethylhexyl)phthalate	<	570	U	<	600	U	<	600	U	<	430	U	<	620	U	<	350	U
4-Bromophenyl phenyl ether	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Butyl benzyl phthalate	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Carbazole	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
4-Chloro-3-methylphenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
4-Chloroaniline	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2-Chloronaphthalene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2-Chlorophenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
4-Chlorophenyl phenyl ether	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Chrysene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Di-n-butyl phthalate	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Di-n-octyl phthalate	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Dibenz(a,h)anthracene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Dibenzofuran	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
1,2-Dichlorobenzene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
1,3-Dichlorobenzene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
1,4-Dichlorobenzene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2,4-Dichlorophenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
3,3'-Dichlorobenzidine	<	670	U	<	740	U	<	720	U	<	750	U	<	720	U	<	690	U
Diethyl phthalate	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2,4-Dimethylphenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Dimethyl phthalate	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
4,6-Dinitro-2-methylphenol	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
2,4-Dinitrophenol	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
2,4-Dinitrotoluene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2,6-Dinitrotoluene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Fluoranthene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Fluorene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Hexachlorobenzene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Hexachlorobutadiene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Hexachlorocyclopentadiene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Hexachloroethane	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Indeno(1,2,3-cd)pyrene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Isophorone	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2-Methylnaphthalene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2-Methylphenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
4-Methylphenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Naphthalene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2-Nitroaniline	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
3-Nitroaniline	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
4-Nitroaniline	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
Nitrobenzene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2-Nitrophenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
4-Nitrophenol	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
N-Nitroso-di-n-propylamine	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
N-Nitrosodiphenylamine	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Pentachlorophenol	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1313-0000			CAN103-1313-0005			CAN103-1313-0010			CAN103-1313-0015			CAN103-1313-0020			CAN103-1314-0000		
LAB SAMPLE NUMBER	0397970007SA			0397970008SA			0397970009SA			0397970010SA			0397970011SA			0397970001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Phenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Pyrene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
1,2,4-Trichlorobenzene	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
2,4,5-Trichlorophenol	<	1600	U	<	1800	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
2,4,6-Trichlorophenol	<	340	U	<	370	U	<	360	U	<	370	U	<	360	U	<	350	U
Pesticides/PCB's (ug/kg)																		
Aroclor 1016	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
Aroclor 1221	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
Aroclor 1232	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
Aroclor 1242	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
Aroclor 1248	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
Aroclor 1254	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
Aroclor 1260	<	34	U	<	37	U	<	36	U	<	37	U	<	36	U	<	35	U
4,4'-DDD	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
4,4'-DDE	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
4,4'-DDT	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
Aldrin	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
alpha-BHC	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
alpha-Chlordane	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
beta-BHC	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
delta-BHC	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
Dieldrin	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
Endosulfan I	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
Endosulfan II	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
Endosulfan sulfate	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
Endrin	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
Endrin aldehyde	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
Endrin ketone	<	3.4	U	<	3.7	U	<	3.6	U	<	3.7	U	<	3.6	U	<	3.5	U
gamma-BHC (Lindane)	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
gamma-Chlordane	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
Heptachlor	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
Heptachlor epoxide	<	1.7	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.8	U
Methoxychlor	<	17	U	<	19	U	<	19	U	<	19	U	<	19	U	<	18	U
Toxaphene	<	170	U	<	190	U	<	190	U	<	190	U	<	190	U	<	180	U
Herbicides (ug/kg)																		
2,4-D	<	41	UJ	<	45	UJ	<	44	U	<	45	U	<	44	U	<	42	U
2,4-DB	<	100	UJ	<	110	UJ	<	110	U	<	110	U	<	110	U	<	100	U
Dalapon	<	100	UJ	<	110	UJ	<	110	U	<	110	U	<	110	U	<	100	U
Dicamba	<	10	UJ	<	11	UJ	<	11	U	<	11	U	<	11	U	<	10	U
Dichlorprop	<	20	UJ	<	22	UJ	<	22	U	<	23	U	<	22	U	<	21	U
Dinoseb	<	20	UJ	<	22	UJ	<	22	U	<	23	U	<	22	U	<	21	U
MCPA	<	5100	UJ	<	5600	UJ	<	5500	U	<	5600	U	<	5400	U	<	5200	U
MCPP	<	5100	UJ	<	5600	UJ	<	5500	U	<	5600	U	<	5400	U	<	5200	U
2,4,5-T	<	10	UJ	<	11	UJ	<	11	U	<	11	U	<	11	U	<	10	U
2,4,5-TP (Silvex)	<	10	UJ	<	11	UJ	<	11	U	<	11	U	<	11	U	<	10	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1313-0000			CAN103-1313-0005			CAN103-1313-0010			CAN103-1313-0015			CAN103-1313-0020			CAN103-1314-0000		
LAB SAMPLE NUMBER	0397970007SA			0397970008SA			0397970009SA			0397970010SA			0397970011SA			0397970001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	4740	20.3	J	2480	55.9	J	4940	21.9		4050	11.3		2550	10.9	J	5220	52.4	J
Antimony	<	12.2	UJ	<	33.5	UJ	<	13.2	U	<	6.8	U	<	6.5	UJ	<	31.4	UJ
Arsenic	1.2	0.51		2.5	0.56		2	0.55		1.5	0.56		0.96	0.54		2.1	0.52	
Barium	145	2	J	1300	5.6	J	377	2.2		179	1.1		86.2	1.1	J	249	5.2	J
Beryllium	0.26	0.41	J	<	1.1	U	<	0.44	U	0.25	0.23		0.15	0.22	J	<	1	U
Cadmium	<	1	U	<	2.8	U	<	1.1	U	<	0.56	U	<	0.54	U	<	2.6	U
Calcium	162000	40.6		329000	112		191000	43.8		91700	22.6		81100	21.8		260000	105	
Chromium	2.4	2	J	<	5.6	UJ	5.3	2.2		3.6	1.1		2.6	1.1	J	<	5.2	UJ
Cobalt	<	2	U	<	5.6	U	1.7	2.2	J	2.2	1.1		1.4	1.1		2.7	5.2	J
Copper	2.6	4.1	J	<	11.2	U	2.5	4.4	J	2.6	2.3		1.3	2.2	J	6.4	10.5	J
Iron	3780	20.3		1530	55.9		3620	21.9		2730	11.3		1860	10.9		4430	52.4	
Lead	3.4	0.51		1.5	0.56		2.2	5.5	J	3.2	0.56		2.2	0.54		2.5	0.52	
Magnesium	2360	40.6		4880	112		5950	43.8		5800	22.6		3400	21.8		2850	105	
Manganese	42.6	2	J	15	5.6	J	50.6	2.2		51.9	1.1		21.7	1.1	J	175	5.2	J
Mercury	<	0.1	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.1	U
Nickel	3.4	8.1	J	<	22.4	U	6.6	8.8	J	4.4	4.5	J	2.5	4.4	J	<	20.9	U
Potassium	957	1020	J	<	2800	U	812	1100	J	837	565		604	545		918	2620	J
Selenium	<	1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1	UJ
Silver	<	2	UJ	<	5.6	UJ	<	2.2	U	<	1.1	U	<	1.1	UJ	<	5.2	UJ
Sodium	<	1020	U	<	2800	U	<	1100	U	<	565	U	<	545	U	<	2620	U
Thallium	<	1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	2.1	UJ
Vanadium	10.4	2		9	5.6		20.8	2.2		17.4	1.1		6.7	1.1		14.9	5.2	
Zinc	9.9	4.1	J	5.7	11.2	J	9	4.4		6.1	2.3		3.8	2.2	J	9.1	10.5	J
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	<	40.6	U	<	44.7	U	<	43.8	U	<	45.2	U	<	43.6	U	<	41.9	U

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1314-0005			CAN103-1314-0010			CAN103-1314-0015			CAN103-1314-0020			CAN103-1314-1363			CAN103-1315-0000		
LAB SAMPLE NUMBER	0397970002SA			0397970003SA			0397970004SA			0397970005SA			0397970006SA			0397780001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/11/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Benzene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Bromodichloromethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Bromoform	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Bromomethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
2-Butanone (MEK)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Carbon disulfide	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Carbon tetrachloride	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Chlorobenzene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Chloroethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Chloroform	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Chloromethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Dibromochloromethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,1-Dichloroethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,2-Dichloroethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,1-Dichloroethene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,2-Dichloroethene (total)	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,2-Dichloropropane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
cis-1,3-Dichloropropene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
trans-1,3-Dichloropropene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Ethylbenzene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
2-Hexanone	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
4-Methyl-2-pentanone (MIBK)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Methylene chloride	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6.8	U
Styrene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,1,2,2-Tetrachloroethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Tetrachloroethene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Toluene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,1,1-Trichloroethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
1,1,2-Trichloroethane	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Trichloroethene	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Vinyl acetate	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Vinyl chloride	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Xylenes (total)	<	5.3	U	<	5.3	U	<	5.4	U	<	5.5	U	<	5.3	U	<	6	U
Semivolatile Organics (ug/kg)																		

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1314-0005			CAN103-1314-0010			CAN103-1314-0015			CAN103-1314-0020			CAN103-1314-1363			CAN103-1315-0000		
LAB SAMPLE NUMBER	0397970002SA			0397970003SA			0397970004SA			0397970005SA			0397970006SA			0397780001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/11/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
bis(2-Ethylhexyl)phthalate	<	350	U	<	800	U	<	510	U	<	480	U	<	520	U	<	390	U
4-Bromophenyl phenyl ether	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Butyl benzyl phthalate	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Carbazole	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
4-Chloro-3-methylphenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
4-Chloroaniline	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2-Chloronaphthalene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2-Chlorophenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
4-Chlorophenyl phenyl ether	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Chrysene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	67	390	J
Di-n-butyl phthalate	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Di-n-octyl phthalate	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Dibenz(a,h)anthracene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Dibenzofuran	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
1,2-Dichlorobenzene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
1,3-Dichlorobenzene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
1,4-Dichlorobenzene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2,4-Dichlorophenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
3,3'-Dichlorobenzidine	<	700	U	<	700	U	<	710	U	<	720	U	<	700	U	<	790	U
Diethyl phthalate	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2,4-Dimethylphenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Dimethyl phthalate	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
4,6-Dinitro-2-methylphenol	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
2,4-Dinitrophenol	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
2,4-Dinitrotoluene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2,6-Dinitrotoluene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Fluoranthene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	69	390	J
Fluorene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Hexachlorobenzene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Hexachlorobutadiene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Hexachlorocyclopentadiene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Hexachloroethane	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Indeno(1,2,3-cd)pyrene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Isophorone	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2-Methylnaphthalene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2-Methylphenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
4-Methylphenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Naphthalene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2-Nitroaniline	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
3-Nitroaniline	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
4-Nitroaniline	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
Nitrobenzene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2-Nitrophenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
4-Nitrophenol	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
N-Nitroso-di-n-propylamine	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
N-Nitrosodiphenylamine	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Pentachlorophenol	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1314-0005			CAN103-1314-0010			CAN103-1314-0015			CAN103-1314-0020			CAN103-1314-1363			CAN103-1315-0000		
LAB SAMPLE NUMBER	0397970002SA			0397970003SA			0397970004SA			0397970005SA			0397970006SA			0397780001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/11/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Phenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Pyrene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	71	390	J
1,2,4-Trichlorobenzene	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
2,4,5-Trichlorophenol	<	1700	U	<	1700	U	<	1700	U	<	1800	U	<	1700	U	<	1900	U
2,4,6-Trichlorophenol	<	350	U	<	350	U	<	360	U	<	360	U	<	350	U	<	390	U
Pesticides/PCB's (ug/kg)																		
Aroclor 1016	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	<	390	U
Aroclor 1221	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	<	390	U
Aroclor 1232	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	<	390	U
Aroclor 1242	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	<	390	U
Aroclor 1248	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	750	390	
Aroclor 1254	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	<	390	U
Aroclor 1260	<	35	U	<	35	U	<	36	U	<	36	U	<	35	U	<	390	U
4,4'-DDD	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
4,4'-DDE	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
4,4'-DDT	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
Aldrin	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
alpha-BHC	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
alpha-Chlordane	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
beta-BHC	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
delta-BHC	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
Dieldrin	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
Endosulfan I	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
Endosulfan II	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
Endosulfan sulfate	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
Endrin	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
Endrin aldehyde	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
Endrin ketone	<	3.5	U	<	3.5	U	<	3.6	U	<	3.6	U	<	3.5	U	<	39	U
gamma-BHC (Lindane)	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
gamma-Chlordane	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
Heptachlor	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
Heptachlor epoxide	<	1.8	U	<	1.8	U	<	1.8	U	<	1.9	U	<	1.8	U	<	20	U
Methoxychlor	<	18	U	<	18	U	<	18	U	<	19	U	<	18	U	<	200	U
Toxaphene	<	180	U	<	180	U	<	180	U	<	190	U	<	180	U	<	2000	U
Herbicides (ug/kg)																		
2,4-D	<	42	U	<	42	U	<	43	U	<	44	U	<	42	U	<	48	U
2,4-DB	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U	<	120	U
Dalapon	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U	<	120	U
Dicamba	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
Dichlorprop	<	21	U	<	21	U	<	22	U	<	22	U	<	21	U	<	24	U
Dinoseb	<	21	U	<	21	U	<	22	U	<	22	U	<	21	U	<	24	U
MCPA	<	5300	U	<	5300	U	<	5400	U	<	5500	U	<	5300	U	<	6000	U
MCPP	<	5300	U	<	5300	U	<	5400	U	<	5500	U	<	5300	U	<	6000	U
2,4,5-T	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U
2,4,5-TP (Silvex)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	12	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1314-0005			CAN103-1314-0010			CAN103-1314-0015			CAN103-1314-0020			CAN103-1314-1363			CAN103-1315-0000		
LAB SAMPLE NUMBER	0397970002SA			0397970003SA			0397970004SA			0397970005SA			0397970006SA			0397780001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/11/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	9920	10.6	J	4690	21.2	J	5490	21.6	J	5860	11		5920	21.1		4680	11.9	
Antimony	<	6.4	UJ	<	12.7	UJ	<	13	UJ	<	6.6	U	<	12.7	U	<	7.2	UJ
Arsenic	2.9	0.53		1.6	0.53		1.6	0.54		0.87	0.55		1.7	0.53		1.2	0.6	
Barium	90.7	1.1	J	240	2.1	J	309	2.2	J	146	1.1		226	2.1		87.5	1.2	
Beryllium	0.4	0.21		<	0.42	U	<	0.43	U	0.25	0.22		<	0.42	U	0.4	0.24	
Cadmium	<	0.53	U	<	1.1	U	<	1.1	U	<	0.55	U	<	1.1	U	<	0.6	U
Calcium	58700	21.2		193000	42.4		190000	43.3		99500	21.9		195000	42.3		21700	23.8	J
Chromium	8.4	1.1	J	2.4	2.1	J	3.1	2.2	J	3.8	1.1		4.1	2.1		5.6	1.2	
Cobalt	3.4	1.1		1.7	2.1	J	1.6	2.2	J	1.6	1.1		1.1	2.1	J	2.7	1.2	
Copper	5.2	2.1		2.6	4.2	J	2.9	4.3	J	2.3	2.2		2.6	4.2	J	7.1	2.4	
Iron	7990	10.6		3640	21.2		3640	21.6		3750	11		4110	21.1		6010	11.9	
Lead	5.2	0.53		2.9	0.53		2.7	0.54		3.6	0.55		3.2	0.53		6.9	0.6	J
Magnesium	2260	21.2		2880	42.4		4550	43.3		3840	21.9		2980	42.3		1960	23.8	
Manganese	96.3	1.1	J	95.6	2.1	J	56.8	2.2	J	31.4	1.1		116	2.1		94.7	1.2	
Mercury	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.12	U
Nickel	8.8	4.2	J	3.9	8.5	J	4.9	8.7	J	4.2	4.4	J	3.9	8.5	J	5.7	4.8	
Potassium	1560	531		980	1060	J	1030	1080	J	1130	548		1210	1060		2280	596	
Selenium	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.2	UJ
Silver	<	1.1	UJ	<	2.1	UJ	<	2.2	UJ	<	1.1	U	<	2.1	U	<	1.2	U
Sodium	<	531	U	<	1060	U	<	1080	U	<	548	U	<	1060	U	<	596	U
Thallium	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	0.14	0.6	J
Vanadium	15.1	1.1		7.7	2.1		7.8	2.2		6.6	1.1		8.1	2.1		12.4	1.2	
Zinc	16.9	2.1	J	8.5	4.2	J	8.8	4.3	J	7.3	2.2		10	4.2		18.7	2.4	
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	<	42.5	U	<	42.4	U	<	43.3	U	<	43.9	U	<	42.3	U	734	47.7	J

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1315-0005			CAN103-1315-0010			CAN103-1315-0015			CAN103-1315-0020			CAN103-1315-1362			CAN103-1316-0000		
LAB SAMPLE NUMBER	0397780002SA			0397780003SA			0397780005SA			0397780006SA			0397780004SA			0398000013SA		
COLLECT DATE	12/11/94			12/11/94			12/11/94			12/11/94			12/11/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	<	11	U	<	11	U	<		U	<		U	<	11	U	<	11	U
Benzene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Bromodichloromethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Bromoform	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Bromomethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
2-Butanone (MEK)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Carbon disulfide	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Carbon tetrachloride	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Chlorobenzene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Chloroethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Chloroform	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Chloromethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Dibromochloromethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,1-Dichloroethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,2-Dichloroethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,1-Dichloroethene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,2-Dichloroethene (total)	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,2-Dichloropropane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
cis-1,3-Dichloropropene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
trans-1,3-Dichloropropene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Ethylbenzene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
2-Hexanone	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
4-Methyl-2-pentanone (MIBK)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Methylene chloride	<	5.3	U	<	5.5	U	<		U	<		U	<	5.6	U	2	5.5	J
Styrene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,1,2,2-Tetrachloroethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Tetrachloroethene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Toluene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,1,1-Trichloroethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
1,1,2-Trichloroethane	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Trichloroethene	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Vinyl acetate	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Vinyl chloride	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Xylenes (total)	<	5.3	U	<	5.5	U	<	5.6	U	<	5.6	U	<	5.6	U	<	5.5	U
Semivolatile Organics (ug/kg)																		

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1315-0005			CAN103-1315-0010			CAN103-1315-0015			CAN103-1315-0020			CAN103-1315-1362			CAN103-1316-0000		
LAB SAMPLE NUMBER	0397780002SA			0397780003SA			0397780005SA			0397780006SA			0397780004SA			0398000013SA		
COLLECT DATE	12/11/94			12/11/94			12/11/94			12/11/94			12/11/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
bis(2-Ethylhexyl)phthalate	<	350	U	<	370	U	<	370	U	5800	370		<	370	U	<	360	U
4-Bromophenyl phenyl ether	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Butyl benzyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Carbazole	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
4-Chloro-3-methylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
4-Chloroaniline	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2-Chloronaphthalene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2-Chlorophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
4-Chlorophenyl phenyl ether	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Chrysene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Di-n-butyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Di-n-octyl phthalate	<	350	U	<	370	U	<	370	U	430	370		<	370	U	<	360	U
Dibenz(a,h)anthracene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Dibenzofuran	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
1,2-Dichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
1,3-Dichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
1,4-Dichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2,4-Dichlorophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
3,3'-Dichlorobenzidine	<	710	U	<	730	U	<	740	U	<	740	U	<	740	U	<	730	U
Diethyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2,4-Dimethylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Dimethyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
4,6-Dinitro-2-methylphenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
2,4-Dinitrophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
2,4-Dinitrotoluene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2,6-Dinitrotoluene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Fluoranthene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Fluorene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Hexachlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Hexachlorobutadiene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Hexachlorocyclopentadiene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Hexachloroethane	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Indeno(1,2,3-cd)pyrene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Isophorone	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2-Methylnaphthalene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2-Methylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
4-Methylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Naphthalene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2-Nitroaniline	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
3-Nitroaniline	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
4-Nitroaniline	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
Nitrobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2-Nitrophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
4-Nitrophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
N-Nitroso-di-n-propylamine	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
N-Nitrosodiphenylamine	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Pentachlorophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1315-0005			CAN103-1315-0010			CAN103-1315-0015			CAN103-1315-0020			CAN103-1315-1362			CAN103-1316-0000		
LAB SAMPLE NUMBER	0397780002SA			0397780003SA			0397780005SA			0397780006SA			0397780004SA			0398000013SA		
COLLECT DATE	12/11/94			12/11/94			12/11/94			12/11/94			12/11/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Phenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Pyrene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
1,2,4-Trichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
2,4,5-Trichlorophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
2,4,6-Trichlorophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	370	U	<	360	U
Pesticides/PCB's (ug/kg)																		
Aroclor 1016	<	35	U	<	37	U	<	37	U	<	37	U	<	37	U			
Aroclor 1221	<	35	U	<	37	U	<	37	U	<	37	U	<	37	U			
Aroclor 1232	<	35	U	<	37	U	<	37	U	<	37	U	<	37	U			
Aroclor 1242	<	35	U	<	37	U	<	37	U	<	37	U	<	37	U			
Aroclor 1248	48	35		<	37	U	<	37	U	<	37	U	<	37	U			
Aroclor 1254	<	35	U	<	37	U	<	37	U	<	37	U	<	37	U			
Aroclor 1260	<	35	U	<	37	U	<	37	U	<	37	U	<	37	U			
4,4'-DDD	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
4,4'-DDE	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
4,4'-DDT	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
Aldrin	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
alpha-BHC	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
alpha-Chlordane	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
beta-BHC	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
delta-BHC	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
Dieldrin	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
Endosulfan I	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
Endosulfan II	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
Endosulfan sulfate	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
Endrin	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
Endrin aldehyde	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
Endrin ketone	<	3.5	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.7	U			
gamma-BHC (Lindane)	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
gamma-Chlordane	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
Heptachlor	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
Heptachlor epoxide	<	1.8	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U			
Methoxychlor	<	18	U	<	19	U	<	19	U	<	19	U	<	19	U			
Toxaphene	<	180	U	<	190	U	<	190	U	<	190	U	<	190	U			
Herbicides (ug/kg)																		
2,4-D	<	43	U	<	44	U	<	45	U	<	45	U	<	45	U			
2,4-DB	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U			
Dalapon	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U			
Dicamba	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U			
Dichlorprop	<	21	U	<	22	U	<	22	U	<	22	U	<	22	U			
Dinoseb	<	21	U	<	22	U	<	22	U	<	22	U	<	22	U			
MCPA	<	5300	U	<	5500	U	<	5600	U	<	5600	U	<	5600	U			
MCPP	<	5300	U	<	5500	U	<	5600	U	<	5600	U	<	5600	U			
2,4,5-T	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U			
2,4,5-TP (Silvex)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U			

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1315-0005			CAN103-1315-0010			CAN103-1315-0015			CAN103-1315-0020			CAN103-1315-1362			CAN103-1316-0000		
LAB SAMPLE NUMBER	0397780002SA			0397780003SA			0397780005SA			0397780006SA			0397780004SA			0398000013SA		
COLLECT DATE	12/11/94			12/11/94			12/11/94			12/11/94			12/11/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	5280	10.7		2800	55.5		3250	56		2410	11.2		2600	22.3		3370	22.1	J
Antimony	<	6.4	UJ	<	33.3	UJ	<	33.6	U	<	6.7	UJ	<	13.4	UJ	<	13.3	UJ
Arsenic	1.4	0.53		1.6	0.55		1.6	0.56		0.65	0.56		1.3	0.56		1.5	0.55	
Barium	143	1.1		176	5.5		147	5.6		82.2	1.1		111	2.2		182	2.2	J
Beryllium	0.37	0.21		<	1.1	U	<	1.1	U	<	0.22	U	<	0.45	U	0.32	0.44	J
Cadmium	<	0.53	U	<	2.8	U	<	2.8	U	<	0.56	U	<	1.1	U	<	1.1	U
Calcium	78600	21.4	J	305000	111	J	249000	112	J	96500	22.3	J	203000	44.6	J	176000	44.2	J
Chromium	9.4	1.1		<	5.5	U	<	5.6	U	2.3	1.1		1.7	2.2	J	1.4	2.2	J
Cobalt	2.4	1.1		<	5.5	U	<	5.6	U	0.87	1.1	J	2.2	2.2		1.5	2.2	J
Copper	6.4	2.1		2.5	11.1	J	4.1	11.2	J	1.8	2.2	J	3.3	4.5	J	3.7	4.4	J
Iron	5890	10.7		3180	55.5		3740	56		2370	11.2		3060	22.3		3110	22.1	J
Lead	5.3	1.1	J	1.7	1.1	J	1.5	0.56	J	1.6	0.56	J	1.6	0.56	J	3.6	1.1	J
Magnesium	1900	21.4		5800	111		6650	112		2240	22.3		5600	44.6		2860	44.2	
Manganese	139	1.1		110	5.5		107	5.6		54.8	1.1		99.3	2.2		83.8	2.2	
Mercury	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U
Nickel	6.3	4.3		<	22.2	U	<	22.4	U	<	4.5	U	4.6	8.9	J	5.5	8.8	J
Potassium	1230	534		385	2770	J	431	2800	J	684	559		595	1120	J	1430	1100	
Selenium	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ
Silver	<	1.1	U	<	5.5	U	<	5.6	U	<	1.1	U	<	2.2	U	<	2.2	U
Sodium	213	534	J	<	2770	U	<	2800	U	<	559	U	<	1120	U	<	1100	U
Thallium	<	1.1	UJ	<	2.2	U	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ
Vanadium	13.4	1.1		16.9	5.5		18.2	5.6		5.5	1.1		15.9	2.2		10	2.2	J
Zinc	14.2	2.1		4.9	11.1	J	3.3	11.2	J	4.4	2.2		3.6	4.5	J	9	4.4	J
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	<		R	<		R	<	44.8	U	<		R	<		R	<	44.2	U

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1316-0005			CAN103-1316-0010			CAN103-1316-0015			CAN103-1316-0020			CAN103-1316-1364			CAN103-1317-0000		
LAB SAMPLE NUMBER	0398000014SA			0397970012SA			0397970013SA			0397970014SA			0397970015SA			0397900001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	<	10	U	<	11	U	<	11	U	8	11	J	4.9	11	J	<	11	U
Benzene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Bromodichloromethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Bromoform	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Bromomethane	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
2-Butanone (MEK)	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Carbon disulfide	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Carbon tetrachloride	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Chlorobenzene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Chloroethane	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Chloroform	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Chloromethane	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Dibromochloromethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,1-Dichloroethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,2-Dichloroethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,1-Dichloroethene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,2-Dichloroethene (total)	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,2-Dichloropropane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
cis-1,3-Dichloropropene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
trans-1,3-Dichloropropene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Ethylbenzene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
2-Hexanone	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
4-Methyl-2-pentanone (MIBK)	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Methylene chloride	2	5.2	J	<	5.4	U	<	5.7	U	<	5.6	U	4.9	5.4	J	2.4	5.4	UJ
Styrene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,1,2,2-Tetrachloroethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Tetrachloroethene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Toluene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,1,1-Trichloroethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
1,1,2-Trichloroethane	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Trichloroethene	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Vinyl acetate	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Vinyl chloride	<	10	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Xylenes (total)	<	5.2	U	<	5.4	U	<	5.7	U	<	5.6	U	<	5.4	U	<	5.4	U
Semivolatile Organics (ug/kg)																		

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1316-0005			CAN103-1316-0010			CAN103-1316-0015			CAN103-1316-0020			CAN103-1316-1364			CAN103-1317-0000		
LAB SAMPLE NUMBER	0398000014SA			0397970012SA			0397970013SA			0397970014SA			0397970015SA			0397900001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
bis(2-Ethylhexyl)phthalate	<	340	U	<	620	U	<	970	U	<	490	U	<	720	U	<	360	U
4-Bromophenyl phenyl ether	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Butyl benzyl phthalate	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Carbazole	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
4-Chloro-3-methylphenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
4-Chloroaniline	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2-Chloronaphthalene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2-Chlorophenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
4-Chlorophenyl phenyl ether	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Chrysene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Di-n-butyl phthalate	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Di-n-octyl phthalate	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Dibenz(a,h)anthracene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Dibenzofuran	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
1,2-Dichlorobenzene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
1,3-Dichlorobenzene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
1,4-Dichlorobenzene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2,4-Dichlorophenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
3,3'-Dichlorobenzidine	<	690	U	<	710	U	<	750	U	<	740	U	<	710	U	<	720	U
Diethyl phthalate	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2,4-Dimethylphenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Dimethyl phthalate	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
4,6-Dinitro-2-methylphenol	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
2,4-Dinitrophenol	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
2,4-Dinitrotoluene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2,6-Dinitrotoluene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Fluoranthene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Fluorene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Hexachlorobenzene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Hexachlorobutadiene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Hexachlorocyclopentadiene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Hexachloroethane	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Indeno(1,2,3-cd)pyrene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Isophorone	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2-Methylnaphthalene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2-Methylphenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
4-Methylphenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Naphthalene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2-Nitroaniline	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
3-Nitroaniline	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
4-Nitroaniline	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
Nitrobenzene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2-Nitrophenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
4-Nitrophenol	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
N-Nitroso-di-n-propylamine	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
N-Nitrosodiphenylamine	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Pentachlorophenol	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1316-0005			CAN103-1316-0010			CAN103-1316-0015			CAN103-1316-0020			CAN103-1316-1364			CAN103-1317-0000		
LAB SAMPLE NUMBER	0398000014SA			0397970012SA			0397970013SA			0397970014SA			0397970015SA			0397900001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Phenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Pyrene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
1,2,4-Trichlorobenzene	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
2,4,5-Trichlorophenol	<	1700	U	<	1700	U	<	1800	U	<	1800	U	<	1700	U	<	1700	U
2,4,6-Trichlorophenol	<	340	U	<	350	U	<	380	U	<	370	U	<	350	U	<	360	U
Pesticides/PCB's (ug/kg)																		
Aroclor 1016				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
Aroclor 1221				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
Aroclor 1232				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
Aroclor 1242				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
Aroclor 1248				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
Aroclor 1254				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
Aroclor 1260				<	35	U	<	38	U	<	37	U	<	35	U	<	36	U
4,4'-DDD				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
4,4'-DDE				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
4,4'-DDT				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
Aldrin				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
alpha-BHC				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
alpha-Chlordane				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
beta-BHC				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
delta-BHC				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
Dieldrin				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
Endosulfan I				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
Endosulfan II				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
Endosulfan sulfate				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
Endrin				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
Endrin aldehyde				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
Endrin ketone				<	3.5	U	<	3.8	U	<	3.7	U	<	3.5	U	<	3.6	U
gamma-BHC (Lindane)				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
gamma-Chlordane				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
Heptachlor				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
Heptachlor epoxide				<	1.8	U	<	1.9	U	<	1.9	U	<	1.8	U	<	1.8	U
Methoxychlor				<	18	U	<	19	U	<	19	U	<	18	U	<	18	U
Toxaphene				<	180	U	<	190	U	<	190	U	<	180	U	<	180	U
Herbicides (ug/kg)																		
2,4-D				<	43	U	<	46	U	<	45	U	<	43	U	<	43	U
2,4-DB				<	110	U	<	110	U	<	110	U	<	110	U	<	110	U
Dalapon				<	110	U	<	110	U	<	110	U	<	110	U	<	110	U
Dicamba				<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Dichlorprop				<	21	U	<	23	U	<	22	U	<	21	U	<	22	U
Dinoseb				<	21	U	<	23	U	<	22	U	<	21	U	<	22	U
MCPA				<	5400	U	<	5700	U	<	5600	U	<	5400	U	<	5400	U
MCPP				<	5400	U	<	5700	U	<	5600	U	<	5400	U	<	5400	U
2,4,5-T				<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
2,4,5-TP (Silvex)				<	11	U	<	11	U	<	11	U	<	11	U	<	11	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1316-0005			CAN103-1316-0010			CAN103-1316-0015			CAN103-1316-0020			CAN103-1316-1364			CAN103-1317-0000		
LAB SAMPLE NUMBER	0398000014SA			0397970012SA			0397970013SA			0397970014SA			0397970015SA			0397900001SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	6370	10.4	J	3860	10.7	J	4530	22.8	J	3870	11.2	J	7300	10.7	J	6220	10.8	
Antimony	<	6.2	UJ	<	6.4	UJ	<	13.7	UJ	<	6.7	UJ	<	6.4	UJ	4.9	6.5	J
Arsenic	0.76	0.52		1.1	0.54		1.5	0.57		0.78	0.56		1.2	0.54		2.2	0.54	
Barium	58.7	1	J	47	1.1	J	313	2.3	J	92.4	1.1	J	48.8	1.1	J	105	1.1	
Beryllium	0.4	0.21		0.36	0.21		<	0.46	U	0.3	0.22		0.43	0.21		0.43	0.22	
Cadmium	<	0.52	U	<	0.54	U	<	1.1	U	<	0.56	U	<	0.54	U	<	0.54	U
Calcium	1520	20.8	J	28900	21.5		144000	45.7		29300	22.3		22800	21.5		73600	21.7	
Chromium	9.1	1	J	3.9	1.1	J	2.9	2.3	J	3.5	1.1	J	7	1.1	J	5.4	1.1	
Cobalt	2.3	1		3.4	1.1		2.2	2.3	J	2.6	1.1		3.5	1.1		2.6	1.1	
Copper	7.1	2.1		3.9	2.1		4.5	4.6	J	2.9	2.2		3.9	2.1		6.6	2.2	
Iron	7110	10.4	J	4750	10.7		4680	22.8		3710	11.2		7690	10.7		5670	10.8	
Lead	7.2	0.52	J	5.9	0.54		6.2	1.1		4	2.8		6.3	0.54		6	0.54	
Magnesium	1160	20.8		1940	21.5		3140	45.7		2110	22.3		2440	21.5		1950	21.7	
Manganese	31.2	1		77.1	1.1	J	74.9	2.3	J	41.2	1.1	J	105	1.1	J	127	1.1	J
Mercury	0.14	0.1		<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U
Nickel	4.9	4.2		6.1	4.3	J	3.3	9.1	J	4.7	4.5	J	8.1	4.3	J	6.9	4.3	
Potassium	1410	521		1060	537		1380	1140		1250	558		1600	536		2140	542	
Selenium	<	0.52	UJ	<	1.1	U	<	2.3	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ
Silver	1.9	1		<	1.1	UJ	<	2.3	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	U
Sodium	<	521	U	<	537	U	<	1140	U	<	558	U	<	536	U	<	542	U
Thallium	<	0.52	UJ	<	1.1	U	<	1.1	UJ	<	0.56	UJ	<	0.54	UJ	<	1.1	UJ
Vanadium	15.5	1	J	16.6	1.1		13.8	2.3		9.5	1.1		18.8	1.1		15.6	1.1	
Zinc	31.3	2.1	J	8.3	2.1	J	8.2	4.6	J	8.3	2.2	J	13.6	2.1	J	15.7	2.2	
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	<	41.7	U	58.5	43		<	45.7	U	<	44.6	U	50.8	42.9		<	43.4	U

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1317-0005			CAN103-1317-0010			CAN103-1317-0015			CAN103-1317-0020			CAN103-1318-0000			CAN103-1318-0005		
LAB SAMPLE NUMBER	0397900002SA			0397900003SA			0397900004SA			0397900005SA			0397900006SA			0397900019SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)																		
Acetone	5.8	11	UJ	7.2	11	UJ	5.7	11	J	<	11	U	2.6	11	UJ	<	11	U
Benzene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Bromodichloromethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Bromoform	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Bromomethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
2-Butanone (MEK)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Carbon disulfide	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Carbon tetrachloride	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Chlorobenzene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Chloroethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Chloroform	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Chloromethane	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Dibromochloromethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,1-Dichloroethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,2-Dichloroethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,1-Dichloroethene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,2-Dichloroethene (total)	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,2-Dichloropropane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
cis-1,3-Dichloropropene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
trans-1,3-Dichloropropene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Ethylbenzene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
2-Hexanone	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
4-Methyl-2-pentanone (MIBK)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Methylene chloride	2.4	5.3	UJ	3	5.6	UJ	2.4	5.6	J	2	5.5	UJ	2.1	5.5	UJ	<	5.7	U
Styrene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,1,2,2-Tetrachloroethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Tetrachloroethene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Toluene	2	5.3	J	<	5.6	U	<	5.6	U	<	5.5	U	1.1	5.5	J	<	5.7	U
1,1,1-Trichloroethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
1,1,2-Trichloroethane	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Trichloroethene	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Vinyl acetate	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Vinyl chloride	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Xylenes (total)	<	5.3	U	<	5.6	U	<	5.6	U	<	5.5	U	<	5.5	U	<	5.7	U
Semivolatile Organics (ug/kg)																		

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1317-0005			CAN103-1317-0010			CAN103-1317-0015			CAN103-1317-0020			CAN103-1318-0000			CAN103-1318-0005		
LAB SAMPLE NUMBER	0397900002SA			0397900003SA			0397900004SA			0397900005SA			0397900006SA			0397900019SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
bis(2-Ethylhexyl)phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4-Bromophenyl phenyl ether	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Butyl benzyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Carbazole	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4-Chloro-3-methylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4-Chloroaniline	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2-Chloronaphthalene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2-Chlorophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4-Chlorophenyl phenyl ether	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Chrysene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Di-n-butyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Di-n-octyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Dibenz(a,h)anthracene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Dibenzofuran	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
1,2-Dichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
1,3-Dichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
1,4-Dichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2,4-Dichlorophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
3,3'-Dichlorobenzidine	<	700	U	<	740	U	<	740	U	<	730	U	<	730	U	<	750	U
Diethyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2,4-Dimethylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Dimethyl phthalate	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4,6-Dinitro-2-methylphenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
2,4-Dinitrophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
2,4-Dinitrotoluene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2,6-Dinitrotoluene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Fluoranthene	<	350	U	<	370	U	<	370	U	<	370	U	44	360	J	<	370	U
Fluorene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Hexachlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Hexachlorobutadiene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Hexachlorocyclopentadiene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Hexachloroethane	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Indeno(1,2,3-cd)pyrene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Isophorone	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2-Methylnaphthalene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2-Methylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4-Methylphenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Naphthalene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2-Nitroaniline	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
3-Nitroaniline	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
4-Nitroaniline	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
Nitrobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2-Nitrophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
4-Nitrophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
N-Nitroso-di-n-propylamine	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
N-Nitrosodiphenylamine	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Pentachlorophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1317-0005			CAN103-1317-0010			CAN103-1317-0015			CAN103-1317-0020			CAN103-1318-0000			CAN103-1318-0005		
LAB SAMPLE NUMBER	0397900002SA			0397900003SA			0397900004SA			0397900005SA			0397900006SA			0397900019SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Phenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Pyrene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
1,2,4-Trichlorobenzene	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
2,4,5-Trichlorophenol	<	1700	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U	<	1800	U
2,4,6-Trichlorophenol	<	350	U	<	370	U	<	370	U	<	370	U	<	360	U	<	370	U
Pesticides/PCB's (ug/kg)																		
Aroclor 1016	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
Aroclor 1221	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
Aroclor 1232	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
Aroclor 1242	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
Aroclor 1248	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
Aroclor 1254	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
Aroclor 1260	<	350	U	<	37	U	<	37	U	<	37	U	<	36	U	<	37	U
4,4'-DDD	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
4,4'-DDE	200	35		<	3.7	U	<	3.7	U	<	3.7	U	2.4	3.6	J	<	3.7	U
4,4'-DDT	240	35		<	3.7	U	<	3.7	U	<	3.7	U	3.7	3.6		<	3.7	U
Aldrin	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
alpha-BHC	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
alpha-Chlordane	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
beta-BHC	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
delta-BHC	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
Dieldrin	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
Endosulfan I	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
Endosulfan II	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
Endosulfan sulfate	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
Endrin	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
Endrin aldehyde	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
Endrin ketone	<	35	U	<	3.7	U	<	3.7	U	<	3.7	U	<	3.6	U	<	3.7	U
gamma-BHC (Lindane)	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
gamma-Chlordane	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
Heptachlor	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
Heptachlor epoxide	<	18	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U	<	1.9	U
Methoxychlor	<	180	U	<	19	U	<	19	U	<	19	U	<	19	U	<	19	U
Toxaphene	<	1800	U	<	190	U	<	190	U	<	190	U	<	190	U	<	190	U
Herbicides (ug/kg)																		
2,4-D	<	43	U	<	45	U	<	45	U	<	44	U	<	44	U	<	45	U
2,4-DB	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U
Dalapon	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U	<	110	U
Dicamba	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
Dichlorprop	<	21	U	<	22	U	<	22	U	<	22	U	<	22	U	<	23	U
Dinoseb	<	21	U	<	22	U	<	22	U	<	22	U	<	22	U	<	23	U
MCPA	<	5300	U	<	5600	U	<	5600	U	<	5500	U	<	5500	U	<	5700	U
MCPP	<	5300	U	<	5600	U	<	5600	U	<	5500	U	<	5500	U	<	5700	U
2,4,5-T	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U
2,4,5-TP (Silvex)	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U	<	11	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1317-0005			CAN103-1317-0010			CAN103-1317-0015			CAN103-1317-0020			CAN103-1318-0000			CAN103-1318-0005		
LAB SAMPLE NUMBER	0397900002SA			0397900003SA			0397900004SA			0397900005SA			0397900006SA			0397900019SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94			12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)																		
Aluminum	5390	10.6		4090	22.4		4440	22.4		6170	11.1		7140	11		5330	22.6	
Antimony	<	6.4	UJ	<	13.5	UJ	<	13.5	UJ	<	6.6	UJ	<	6.6	UJ	<	13.6	U
Arsenic	1.7	0.53		1.8	0.56		1	0.56		1.2	0.55		1.9	0.55		0.95	0.57	
Barium	144	1.1		333	2.2		67.5	2.2		223	1.1		124	1.1		133	2.3	
Beryllium	0.36	0.21		<	0.45	U	<	0.45	U	0.4	0.22		0.48	0.22		<	0.45	U
Cadmium	<	0.53	U	<	1.1	U	<	1.1	U	<	0.55	U	<	0.55	U	<	1.1	U
Calcium	77700	21.3		197000	44.9		140000	44.9		11800	22.1		22300	22.1		147000	45.2	
Chromium	6.3	1.1		3.9	2.2		2.2	2.2		5.5	1.1		6.8	1.1		3.8	2.3	
Cobalt	2.9	1.1		3.2	2.2		1.7	2.2	J	2.3	1.1		2.9	1.1		2.4	2.3	
Copper	8.6	2.1		2.6	4.5	J	1.4	4.5	J	3	2.2		7.2	2.2		5.1	4.5	
Iron	5310	10.6		2460	22.4		2920	22.4		5140	11.1		6900	11		4450	22.6	
Lead	6.2	1.1		1.7	1.1		2.4	1.1		4.3	0.55		9.8	1.1		3.8	0.57	
Magnesium	1980	21.3		9160	44.9		7140	44.9		5120	22.1		1700	22.1		2840	45.2	
Manganese	77.3	1.1	J	24.9	2.2	J	30.1	2.2	J	34.6	1.1	J	142	1.1	J	70.5	2.3	
Mercury	0.14	0.11		<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U	<	0.11	U
Nickel	6.7	4.3		9.2	9		5.2	9	J	5.5	4.4		6.5	4.4		4.3	9	J
Potassium	1280	532		723	1120	J	696	1120	J	2100	553		1750	552		1060	1130	J
Selenium	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ
Silver	4.6	1.1		<	2.2	U	<	2.2	U	<	1.1	U	<	1.1	U	<	2.3	U
Sodium	354	532	J	<	1120	U	<	1120	U	310	553	J	<	552	U	<	1130	U
Thallium	<	1.1	UJ	<	2.2	U	<	1.1	UJ	<	0.55	U	<	0.55	U	0.12	1.1	UJ
Vanadium	16.4	1.1		18.4	2.2		18.7	2.2		14.3	1.1		15.6	1.1		10.2	2.3	
Zinc	43.3	2.1		6.2	4.5		6.3	4.5		9.3	2.2		20.6	2.2		11.9	4.5	
TPH (mg/kg)																		
Total Petroleum Hydrocarbons	64.4	42.5		<	44.9	U	<	44.9	U	<	44.2	U	132	44.2		<	45.2	U

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1318-0010			CAN103-1318-0015			CAN103-1318-0020		
LAB SAMPLE NUMBER	0397900007SA			0397900008SA			0397900009SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Volatile Organics (ug/kg)									
Acetone	3.8	11	J	22	11		18	11	
Benzene	<	5.6	U	<	5.7	U	<	5.5	U
Bromodichloromethane	<	5.6	U	<	5.7	U	<	5.5	U
Bromoform	<	5.6	U	<	5.7	U	<	5.5	U
Bromomethane	<	11	U	<	11	U	<	11	U
2-Butanone (MEK)	<	11	U	<	11	U	<	11	U
Carbon disulfide	<	5.6	U	<	5.7	U	<	5.5	U
Carbon tetrachloride	<	5.6	U	<	5.7	U	<	5.5	U
Chlorobenzene	<	5.6	U	<	5.7	U	<	5.5	U
Chloroethane	<	11	U	<	11	U	<	11	U
Chloroform	<	5.6	U	<	5.7	U	<	5.5	U
Chloromethane	<	11	U	<	11	U	<	11	U
Dibromochloromethane	<	5.6	U	<	5.7	U	<	5.5	U
1,1-Dichloroethane	<	5.6	U	<	5.7	U	<	5.5	U
1,2-Dichloroethane	<	5.6	U	<	5.7	U	<	5.5	U
1,1-Dichloroethene	<	5.6	U	<	5.7	U	<	5.5	U
1,2-Dichloroethene (total)	<	5.6	U	<	5.7	U	<	5.5	U
1,2-Dichloropropane	<	5.6	U	<	5.7	U	<	5.5	U
cis-1,3-Dichloropropene	<	5.6	U	<	5.7	U	<	5.5	U
trans-1,3-Dichloropropene	<	5.6	U	<	5.7	U	<	5.5	U
Ethylbenzene	<	5.6	U	<	5.7	U	<	5.5	U
2-Hexanone	<	11	U	<	11	U	<	11	U
4-Methyl-2-pentanone (MIBK)	<	11	U	<	11	U	<	11	U
Methylene chloride	5.5	5.6	J	4.1	5.7	UJ	4.2	5.5	UJ
Styrene	<	5.6	U	<	5.7	U	<	5.5	U
1,1,2,2-Tetrachloroethane	<	5.6	U	<	5.7	U	<	5.5	U
Tetrachloroethene	<	5.6	U	<	5.7	U	<	5.5	U
Toluene	<	5.6	U	<	5.7	U	1.9	5.5	J
1,1,1-Trichloroethane	<	5.6	U	<	5.7	U	<	5.5	U
1,1,2-Trichloroethane	<	5.6	U	<	5.7	U	<	5.5	U
Trichloroethene	<	5.6	U	<	5.7	U	<	5.5	U
Vinyl acetate	<	11	U	<	11	U	<	11	U
Vinyl chloride	<	11	U	<	11	U	<	11	U
Xylenes (total)	<	5.6	U	<	5.7	U	<	5.5	U
Semivolatile Organics (ug/kg)									

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1318-0010			CAN103-1318-0015			CAN103-1318-0020		
LAB SAMPLE NUMBER	0397900007SA			0397900008SA			0397900009SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
bis(2-Chloroisopropyl)ether	<	370	U	<	380	U	<	370	U
bis(2-Ethylhexyl)phthalate	<	370	U	<	380	U	<	370	U
4-Bromophenyl phenyl ether	<	370	U	<	380	U	<	370	U
Butyl benzyl phthalate	<	370	U	<	380	U	<	370	U
Carbazole	<	370	U	<	380	U	<	370	U
4-Chloro-3-methylphenol	<	370	U	<	380	U	<	370	U
4-Chloroaniline	<	370	U	<	380	U	<	370	U
2-Chloronaphthalene	<	370	U	<	380	U	<	370	U
2-Chlorophenol	<	370	U	<	380	U	<	370	U
4-Chlorophenyl phenyl ether	<	370	U	<	380	U	<	370	U
Chrysene	<	370	U	<	380	U	<	370	U
Di-n-butyl phthalate	<	370	U	<	380	U	<	370	U
Di-n-octyl phthalate	<	370	U	<	380	U	<	370	U
Dibenz(a,h)anthracene	<	370	U	<	380	U	<	370	U
Dibenzofuran	<	370	U	<	380	U	<	370	U
1,2-Dichlorobenzene	<	370	U	<	380	U	<	370	U
1,3-Dichlorobenzene	<	370	U	<	380	U	<	370	U
1,4-Dichlorobenzene	<	370	U	<	380	U	<	370	U
2,4-Dichlorophenol	<	370	U	<	380	U	<	370	U
3,3'-Dichlorobenzidine	<	740	U	<	760	U	<	730	U
Diethyl phthalate	<	370	U	<	380	U	<	370	U
2,4-Dimethylphenol	<	370	U	<	380	U	<	370	U
Dimethyl phthalate	<	370	U	<	380	U	<	370	U
4,6-Dinitro-2-methylphenol	<	1800	U	<	1800	U	<	1800	U
2,4-Dinitrophenol	<	1800	U	<	1800	U	<	1800	U
2,4-Dinitrotoluene	<	370	U	<	380	U	<	370	U
2,6-Dinitrotoluene	<	370	U	<	380	U	<	370	U
Fluoranthene	<	370	U	<	380	U	<	370	U
Fluorene	<	370	U	<	380	U	<	370	U
Hexachlorobenzene	<	370	U	<	380	U	<	370	U
Hexachlorobutadiene	<	370	U	<	380	U	<	370	U
Hexachlorocyclopentadiene	<	370	U	<	380	U	<	370	U
Hexachloroethane	<	370	U	<	380	U	<	370	U
Indeno(1,2,3-cd)pyrene	<	370	U	<	380	U	<	370	U
Isophorone	<	370	U	<	380	U	<	370	U
2-Methylnaphthalene	<	370	U	<	380	U	<	370	U
2-Methylphenol	<	370	U	<	380	U	<	370	U
4-Methylphenol	<	370	U	<	380	U	<	370	U
Naphthalene	<	370	U	<	380	U	<	370	U
2-Nitroaniline	<	1800	U	<	1800	U	<	1800	U
3-Nitroaniline	<	1800	U	<	1800	U	<	1800	U
4-Nitroaniline	<	1800	U	<	1800	U	<	1800	U
Nitrobenzene	<	370	U	<	380	U	<	370	U
2-Nitrophenol	<	370	U	<	380	U	<	370	U
4-Nitrophenol	<	1800	U	<	1800	U	<	1800	U
N-Nitroso-di-n-propylamine	<	370	U	<	380	U	<	370	U
N-Nitrosodiphenylamine	<	370	U	<	380	U	<	370	U
Pentachlorophenol	<	1800	U	<	1800	U	<	1800	U

TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1318-0010			CAN103-1318-0015			CAN103-1318-0020		
LAB SAMPLE NUMBER	0397900007SA			0397900008SA			0397900009SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Phenanthrene	<	370	U	<	380	U	<	370	U
Phenol	<	370	U	<	380	U	<	370	U
Pyrene	<	370	U	<	380	U	<	370	U
1,2,4-Trichlorobenzene	<	370	U	<	380	U	<	370	U
2,4,5-Trichlorophenol	<	1800	U	<	1800	U	<	1800	U
2,4,6-Trichlorophenol	<	370	U	<	380	U	<	370	U
Pesticides/PCB's (ug/kg)									
Aroclor 1016	<	37	U	<	38	U	<	37	U
Aroclor 1221	<	37	U	<	38	U	<	37	U
Aroclor 1232	<	37	U	<	38	U	<	37	U
Aroclor 1242	<	37	U	<	38	U	<	37	U
Aroclor 1248	<	37	U	<	38	U	<	37	U
Aroclor 1254	<	37	U	<	38	U	<	37	U
Aroclor 1260	<	37	U	<	38	U	<	37	U
4,4'-DDD	<	3.7	U	<	3.8	U	<	3.7	U
4,4'-DDE	<	3.7	U	<	3.8	U	<	3.7	U
4,4'-DDT	<	3.7	U	<	3.8	U	<	3.7	U
Aldrin	<	1.9	U	<	2	U	<	1.9	U
alpha-BHC	<	1.9	U	<	2	U	<	1.9	U
alpha-Chlordane	<	1.9	U	<	2	U	<	1.9	U
beta-BHC	<	1.9	U	<	2	U	<	1.9	U
delta-BHC	<	1.9	U	<	2	U	<	1.9	U
Dieldrin	<	3.7	U	<	3.8	U	<	3.7	U
Endosulfan I	<	1.9	U	<	2	U	<	1.9	U
Endosulfan II	<	3.7	U	<	3.8	U	<	3.7	U
Endosulfan sulfate	<	3.7	U	<	3.8	U	<	3.7	U
Endrin	<	3.7	U	<	3.8	U	<	3.7	U
Endrin aldehyde	<	3.7	U	<	3.8	U	<	3.7	U
Endrin ketone	<	3.7	U	<	3.8	U	<	3.7	U
gamma-BHC (Lindane)	<	1.9	U	<	2	U	<	1.9	U
gamma-Chlordane	<	1.9	U	<	2	U	<	1.9	U
Heptachlor	<	1.9	U	<	2	U	<	1.9	U
Heptachlor epoxide	<	1.9	U	<	2	U	<	1.9	U
Methoxychlor	<	19	U	<	20	U	<	19	U
Toxaphene	<	190	U	<	200	U	<	190	U
Herbicides (ug/kg)									
2,4-D	<	45	U	<	46	U	<	44	U
2,4-DB	<	110	U	<	110	U	<	110	U
Dalapon	<	110	U	<	110	U	<	110	U
Dicamba	<	11	U	<	11	U	<	11	U
Dichlorprop	<	22	U	<	23	U	<	22	U
Dinoseb	<	22	U	<	23	U	<	22	U
MCPA	<	5600	U	<	5700	U	<	5500	U
MCPP	<	5600	U	<	5700	U	<	5500	U
2,4,5-T	<	11	U	<	11	U	<	11	U
2,4,5-TP (Silvex)	<	11	U	<	11	U	<	11	U

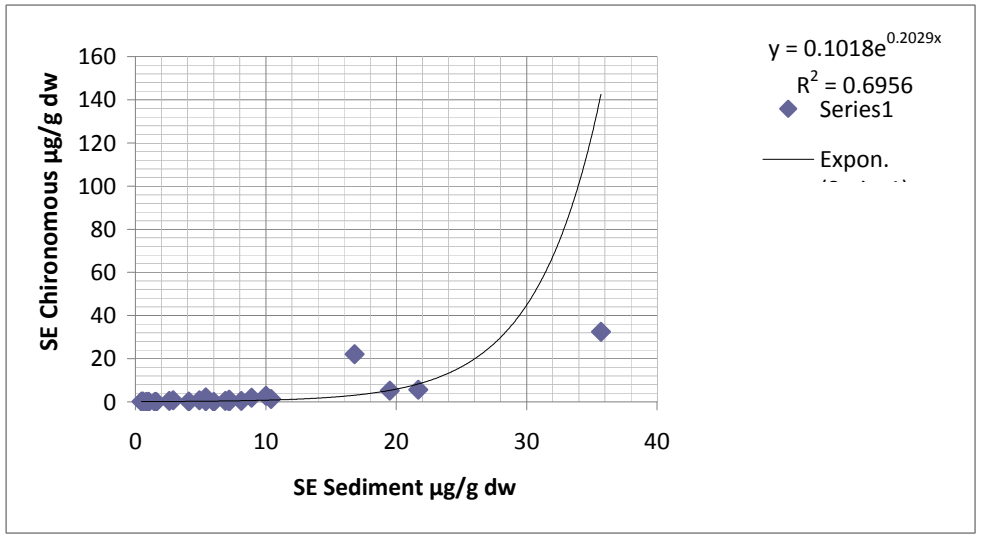
TABLE A-4
ANALYTICAL RESULTS FOR SAMPLES COLLECTED AT SWMU 103 - PHASE II - SOIL

LOCATOR	CAN103-1318-0010			CAN103-1318-0015			CAN103-1318-0020		
LAB SAMPLE NUMBER	0397900007SA			0397900008SA			0397900009SA		
COLLECT DATE	12/12/94			12/12/94			12/12/94		
	Result	RL	Qual	Result	RL	Qual	Result	RL	Qual
Metals (mg/kg)									
Aluminum	6250	11.2		3690	23		2550	22.2	
Antimony	<	6.7	UJ	<	13.8	UJ	<	13.3	UJ
Arsenic	1.5	0.56		1.1	0.57		1.1	0.55	
Barium	89.6	1.1		88.8	2.3		66.5	2.2	
Beryllium	0.44	0.22		<	0.46	U	<	0.44	U
Cadmium	<	0.56	U	<	1.1	U	<	1.1	U
Calcium	50000	22.4		172000	45.9		127000	44.3	
Chromium	5.7	1.1		1.6	2.3	J	1.8	2.2	J
Cobalt	3.7	1.1		3	2.3		2	2.2	J
Copper	6.6	2.2		2.2	4.6	J	1.9	4.4	J
Iron	5730	11.2		2690	23		2220	22.2	
Lead	5.3	0.56		2.1	0.57		1.7	1.1	
Magnesium	2650	22.4		5230	45.9		2310	44.3	
Manganese	336	1.1	J	25.8	2.3	J	28.2	2.2	J
Mercury	<	0.11	U	<	0.11	U	<	0.11	U
Nickel	7.7	4.5		8	9.2	J	5	8.9	J
Potassium	1360	560		656	1150	J	678	1110	J
Selenium	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ
Silver	<	1.1	U	<	2.3	U	<	2.2	U
Sodium	<	560	U	<	1150	U	<	1110	U
Thallium	<	1.1	UJ	<	1.1	UJ	<	1.1	UJ
Vanadium	10.8	1.1		9.8	2.3		5.2	2.2	
Zinc	14.5	2.2		5.8	4.6		4.8	4.4	
TPH (mg/kg)									
Total Petroleum Hydrocarbons	<	44.8	U	<	45.9	U	<	44.3	U

J = Estimated value.
R = Rejected value.
U = Nondetected value.
D = Sample was diluted for analysis.
RL = Reporting Limit.

TABLE C-1
RELATIONSHIP BETWEEN SELENIUM CONCENTRATIONS IN SEDIMENT AND CHIRONOMOUS

CHIR	SED	Source
21.7	5.69	Zhang & Moore 1996
16.8	22.1	
10	2.79	
10.4	1.4	
8.12	0.41	
1	0.07	Saiki et al. 1993 (Spring)
4.1	0.12	
1.6	0.04	
6.9	0.47	
7.2	0.2	
1	0.04	
0.84	0.04	
0.47	0.14	Saiki et al. 1993 (Fall)
6	0.04	
1.5	0.05	
5.4	0.34	
8.9	1.9	
0.58	0.09	
0.53	0.06	
7.2	1	USGS 2002
35.7	32.5	
2.9	0.8	
4.9	0.8	
19.5	5.2	
2.6	0.5	
5.4	2.1	

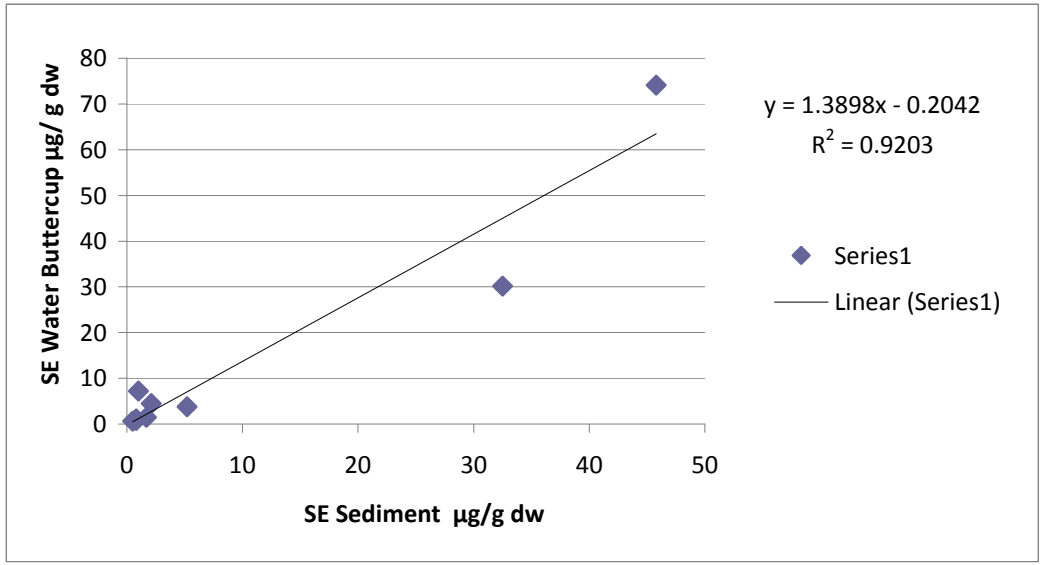


THIS PAGE INTENTIONALLY BLANK

TABLE C-2

RELATIONSHIP BETWEEN SELENIUM CONCENTRATIONS IN SEDIMENT AND AQUATIC PLANTS

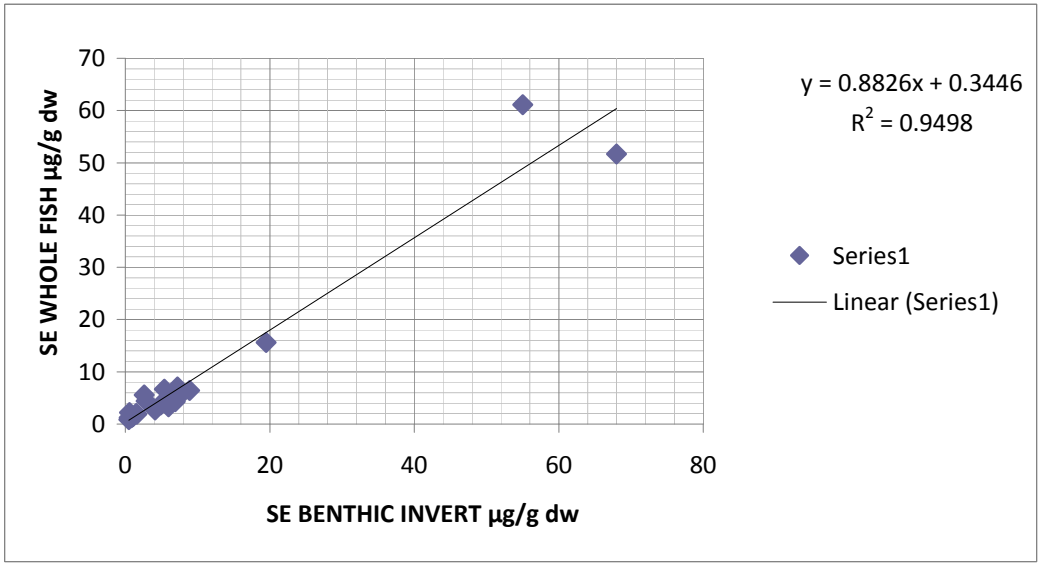
SED µg/g	AQ PLANT µg/g	Source
1	7.2	USGS 2002 IDAHO
32.5	30.2	
45.8	74.1	
0.8	0.8	
0.8	1.1	
1.7	1.5	
5.2	3.8	
0.5	0.6	
2.1	4.5	



THIS PAGE INTENTIONALLY BLANK

TABLE C-3
RELATIONSHIP BETWEEN SELENIUM CONCENTRATION IN BENTHIC INVERTEBRATES AND AQUATIC PREDATORS

BENTH INVERT	FISH	Source
7.2	7.1	USGS 2002
2.9	4.4	
4.9	3.7	
19.5	15.6	
2.6	5.6	
5.4	6.7	
68	51.7	Bennett et al 1986
55	61.1	
1	1.4	Saiki et al. 1993 (Spring)
4.1	2.7	
1.6	1.9	
6.9	4.3	
7.2	5	
1	1.4	
0.84	1.2	
0.47	0.87	Saiki et al. 1993 (Fall)
6	3.3	
1.5	2	
5.4	4.5	
8.9	6.4	
0.58	2.2	
0.53	1.2	



THIS PAGE INTENTIONALLY BLANK