



July 31, 2012

Ms. Cecilia Horner
U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, NM 87109

**SUBJECT: SUBMITTAL OF FINAL SITE-SPECIFIC WORK PLAN – COMPLETION OF A-ZONE
EXPLORATION BORINGS AND INSTALLATION OF B-ZONE BACKGROUND MONITORING
WELLS FOR BROWN & BRYANT SUPERFUND SITE
600 SOUTH DERBY STREET, ARVIN, CALIFORNIA
CONTRACT NO. W912PP-10-D-0014, TASK ORDER NOS. 0015 AND 0016**

Dear Ms. Horner:

Please find enclosed one hard copy (HC) and one CD copy in PDF of the Final Site-Specific Work Plan for the Completion of A-zone Exploration Borings and Installation of B-zone Background Monitoring Wells at the Brown & Bryant Superfund Site, 600 S. Derby Street, Arvin, CA. This document is prepared by Eco & Associates, Inc. for your records.

Please do not hesitate to contact us if you need assistance or have questions regarding this document at (714) 289-0995.

Sincerely,
ECO & ASSOCIATES, INC.

Mohammad Estiri, PhD
Project Director

cc:	Alejandro Diaz	U.S. Environmental Protection Agency	- 2 HCs/2 CDs
	Carol Wies-Brewer.....	USACE, Albuquerque District	- 1 HC/1CD
	David Henry	USACE, Albuquerque District	- 1 HC/1CD
	Steve Wagner	USACE, Albuquerque District	- 1 HC/1CD
	Thad Fukushige/Rick Lainhart..	USACE, Los Angeles District	- 1 HC/1CD

Enclosure

WORK PLAN – COMPLETION OF
A-ZONE EXPLORATION BORINGS
AND
INSTALLATION OF B-ZONE
BACKGROUND MONITORING WELLS

• FINAL •

**Brown & Bryant Superfund Site
600 South Derby Street, Arvin, California
Contract No. W912PP-10-D-0014
Task Order Nos. 0015 and 0016**

**Prepared for:
U.S. Army Corps of Engineers, Albuquerque District Office
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435**

**Prepared by:
Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, California 92867
Phone: (714) 289-0995
Fax: (714) 289-0965**

Environmental Excellence



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**Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, California 92867**



Opjit S. Ghuman, PE
Project Engineer



Jack Collender, PG, REA
Project Geologist



Mohammad Estiri, PhD
Project Director

July 30, 2012

Project No. Eco-12-514

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ABBREVIATIONS, ACRONYMS, & SYMBOLS

1,2,3-TCP	1,2,3-trichloropropane
1,2-DCP	1,2-dichloropropane
1,3-DCP	1,3-dichloropropane
ASTM	American Society for Testing and Materials
B&B	Brown & Bryant, Inc.
bgs	below ground surface
COC	chemical/s of concern
DBCP	1,2-Dibromo-3-chloropropane
DO	dissolved oxygen
DOT	Department of Transportation
EC	electrical conductivity
Eco	Eco & Associates, Inc.
EDB	Ethylene dibromide
EPA	Environmental Protection Agency
FS	Feasibility Study
gpm	gallons per minute
GW	groundwater
HASP	Health and Safety Plan
HCl	hydrochloric acid
KCEHD	Kern County Environmental Health Department
L	liter
LF/MD	low-flow/minimum draw-down
mL	milliliter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
N/A	not available
N/D	not determined
NAD	North American Datum
NPL	National Priorities List
ORP	oxidation-reduction potential
OU2	Second Operable Unit
OU2 Remedy Alternative 3	Second Operable Unit Remedy Alternative 3 – Source Reduction in the A-zone
PG	Professional Geologist
PID	photoionization detector
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC/QA	Quality Control/Quality Assurance
RB	rinsate blank
RCRA	Resource and Conservation Recovery Act
RI	Remedial Investigation
SOP	Standard Operating Procedures
SSPWP	Site-Specific Project Workplan
TB	trip blank
TO	Task Order
TPH	total petroleum hydrocarbons
USA	Underground Service Alert

USACE	U.S. Army Corps of Engineers
USCS	Unified Soil Classification System
USEPA or EPA	U.S. Environmental Protection Agency
VOA	volatile organic analysis
VOC	volatile organic compound
µg/L	micrograms per liter

WORK PLAN – COMPLETION OF A-ZONE EXPLORATION BORINGS AND INSTALLATION OF B-ZONE BACKGROUND MONITORING WELLS

•FINAL•

**Brown & Bryant Superfund Site
600 South Derby Street, Arvin, California
Contract No. W912PP-10-D-0014
Task Order Nos. 0015 and 0016**

1.0 INTRODUCTION

Eco & Associates, Inc. (Eco) has been contracted by the U.S. Army Corps of Engineers (USACE) to complete twelve A-zone exploratory borings as part of the groundwater extraction system at the Brown & Bryant, Inc. (B&B) Superfund Site in Arvin, California (hereafter, referred to as “Site”). In addition, Eco has been contracted to install three background B-zone monitoring wells. These efforts will be conducted under, and in accordance with, Contract No. W912PP-10-D-0014, Task Order (TO) Nos. 0015 and 0016, respectively.

The purpose of the scope of work covered in this workplan is to evaluate the A-zone conditions at twelve locations to select the preferred order for extraction well installation. The A-zone extraction wells are to be installed as part of OU-2 remedial action that will be implemented in two phases. In the first phase, the exploratory borings will be drilled, the A-zone conditions will be assessed, and the locations for the extraction wells will be selected. The B-zone monitoring wells will also be installed during the first phase to estimate background concentrations for project chemicals of concern (COCs), if any. Subsequently, in the second phase, the A-zone extraction wells and the system for their operation will be installed.

A separate work plan is being prepared for the installation of the A-zone extraction system. This work plan along with its supporting documents will be submitted later.

1.1 SITE LOCATION

The B&B pesticide facility is located at 600 South Derby Road in Arvin, California, about 18 miles southeast of Bakersfield (Figure 1, Regional Location Map). South Derby Road is to the west, and Potato Road is to the south. Vacant land and farmland is to the east. Bear

Mountain Road (Highway 223) is approximately 0.4 miles to the north. Highway 99 is approximately 10 miles to the west.

1.2 SITE BACKGROUND

The B&B facility operated as a pesticide re-formulator and custom applicator facility from 1960 to 1989. The facility formulated agricultural chemicals including pesticides, herbicides, fumigants, and fertilizers for sale to the local farming community between 1960 and 1968. In 1981, the facility was licensed under the Resource and Conservation Recovery Act (RCRA) as a hazardous waste transporter. Contamination of soil and groundwater resulted from inadequate procedural controls, chemical spills during operations, and leaks from a surface wastewater pond and sumps. The largest releases onsite were from the wastewater pond, a sump area, and a dinoseb spill area (U.S. Environmental Protection Agency [USEPA] 1993a).

The wastewater pond located in the southwest portion of the Site was originally excavated as an unlined earthen pond in 1960. The pond was used to collect run-off water from the yard and from two sumps (since excavated). The pond was also used to collect rinse water from rinsing tanks used for fumigants. Excess pond water and rainwater run-off also collected in a topographically low area to the east and south of the pond. In addition, ponded water from precipitation and irrigation from the east has occasionally breached the berm in the southeast corner of the pond and drained into the pond. The pond was double lined with a synthetic liner in November 1979. The liner and additional soil were excavated in August 1987. Approximately 640 cubic yards of soil that showed visible signs of contamination were removed from the pond at that time. The depths of this excavation ranged from approximately one and one-half feet on the sides to five feet on the bottom (USEPA 1993a).

In 1960, an unlined earthen sump was constructed in the center of the Site. The sump was used to collect wash water from a pad where equipment and tanks used for liquid fertilizers and fumigants were washed. Water from the sump was drained to the pond through an underground pipeline. In 1980, the sump was replaced with two double lined sumps, and two lined sand traps were installed west of the pond. Dinoseb was stored in a smaller tank storage area along the eastern fence, just north of the pond. In 1983, there was a significant dinoseb spill in this area. As a result, the soil and groundwater underlying this portion of the Site has been reported with the highest concentrations of dinoseb. USEPA excavated highly contaminated soil from this area in the mid-1990s (USEPA 1993a).

In 1989, the Site was listed on the National Priorities List (NPL). In the same year, all operations at the Site ceased. Subsequently, various emergency and removal actions were initiated to minimize or eliminate immediate threats to human health and the environment (USEPA 1993a).

Currently, the Site is vacant. A warehouse is located on the property. The property is secured by a chain-link fence and paved with asphalt. A RCRA cap is in the southern portion of the Site and a non-RCRA cap in the northern portion.

Site remediation goals are established by the USEPA to protect human health and the environment. A Remedial Investigation (RI) and Feasibility Study (FS) were conducted for the Site (Panacea 2005). Remediation alternatives based on the RI/FS were established. The Site alternative under consideration as part of this investigation is a portion of the Second Operable Unit (OU2) Remedy Alternative 3 – Source Reduction in the A-zone (OU2 Remedy Alternative 3) and no action in the B-zone. Because the source of B-zone contamination is

primarily from migration from the A-zone, this alternative is considered most effective and practical.

1.3 SITE CONDITIONS

The subject Site is underlain by fluvial and lacustrine deposits. These deposits consist of unconsolidated sands, silts, and clay that are complexly interlayered and interfingered. The bottom of the water-bearing unit is used to divide the subsurface materials into the A-zone and B-zone. Numerous wells have been installed to investigate the A-zone and B-zone water-bearing units (Figure 2). A-zone and B-zone wells and the corresponding groundwater contours from October 2011 are shown in Figures 3 and 4, respectively.

The A-zone includes unsaturated soil from 65 to 85 feet below ground surface (bgs). A thin sandy clay layer occurs at the base of the A-zone between 75 and 85 feet bgs. The clay layer and the A-zone groundwater occur beneath the entire Site but disappear within 640 feet south of the Site, 560 feet east of the Site, and 500 feet west of the Site.

The B-zone includes unsaturated soil beneath the A-zone and the second water-bearing unit (B-zone groundwater) at 140 to 165 feet bgs. The B-zone extends to at least 250 feet bgs and ends at a clay layer that confines the drinking water aquifer beneath it. The thickness of the clay layer at the base of the B-zone is estimated to be about 27 feet from the driller's log for city well No. 1. The thickness of this clay layer beneath the Site is unknown.

Groundwater in the A-zone flows in a generally southern direction with some mounding of the water table observed extending southward from the southwest corner of the Site. The saturated thickness of the A-zone groundwater varies from less than 5 feet to 10 feet or more. The groundwater velocity in the A-zone has been estimated at 53 feet per year. Aquifer testing of three of the on-Site extraction wells showed a groundwater yield of approximately ¼ gallon per minute (gpm) or 360 gallons per day.

For reference to provide information on COC concentration in the A-zone (October 2011 groundwater monitoring event), plots for 1,2-DCP, chloroform, and 1,2,3-TCP are presented as Figures 5 through 7.

2.0 OBJECTIVES AND SCOPE OF WORK

The A-zone mitigation includes installation of extraction wells at or near the Site. The extraction wells (18-inches in diameter) are design to be pumped periodically so that they function as sumps for the water in the area of their installation. The extracted water will be pumped into a holding tank to be located in the on-Site warehouse. Water temporarily stored in the holding tank will be removed (once or twice a month) for proper off-Site disposal. The locations for the extraction wells will be selected after completion of the exploratory borings as described in this work plan. Twelve (12) exploratory boring locations are identified as shown on Figure 8.

The information gathered from the exploratory borings will be analyzed to prepare a preferred sequence for the installation of the extraction wells. Initially, three (3) extraction wells will be installed and the extraction system operated. Based on operating experience from the first three wells, additional extraction wells may be added to the system.

In addition, three background B-zone groundwater-monitoring wells will be installed at locations upgradient and north of the Site. The locations for background B-zone wells are shown on Figure 9. These wells will be used to sample and analyze for project chemicals of

concern (COCs). Background concentrations for B-zone COCs will be established based on results from groundwater samples from these wells.

The objectives of the exploratory boring program and the B-zone background wells are as follows:

- Explore the stratigraphic and hydrogeologic conditions at 12 locations in the area of the Site for suitability of extraction well installation;
- Obtain the depth to the base of the A-zone water bearing zone and to determine if the clay layer (A-zone aquitard) is at least 5 feet thick;
- Identify the available column of water in the A-zone for pumping;
- Obtain soil samples to finalize well design for screen slot size and filter material; and,
- Obtain background concentrations for B-zone COCs.

The work plan is to be implemented on an expedited schedule so the existing Health & Safety Plan, the Quality Assurance Project Plan, and Sampling and Analysis Plan for B&B Groundwater Monitoring will apply to all of the work of this plan. Copies of forms for use on this project are provided in Appendix A. Copies of the Health & Safety Plan, the Quality Assurance Project Plan, and the Sampling and Analysis Plan, are presented as Appendices B, C, & D.

3.0 EXPLORATORY BORINGS

Twelve (12) exploratory borings will be drilled to a depth of approximately 100 feet below grade. The borings will be completed through the overburden of the A-Zone, through the A-zone, and at least 5 feet into the basal unit of the A-zone. A Geoprobe Model 8040DT will be used to complete the borings. This Geoprobe is mounted on rubber tracks and has a weight of 15,500 pounds. The recommended weight for traffic on the non-RCRA cap was recommended by Morrison-Knudsen to be 10,000 pounds. As the Geoprobe weight is higher than that recommended, its trafficability on the non-RCRA cap will be carefully observed, and if necessary, wooden blocks or other means will be used to make sure that there is no damage to the cap. Based on observations and experience, the use of the Geoprobe on the non-RCRA cap is not expected to result in cap damage. The traffic recommendation for the RCRA cap is 40,000 pounds but no exploratory borings are located on the RCRA cap.

The Standard Operating Procedures (SOPs) for soil and groundwater sampling using a Geoprobe are presented in Appendix E. The procedures of the SOPs will be followed for the exploratory borings.

The exploratory borings will be sampled and logged at 5-foot intervals. Starting from the depth where the A-zone water bearing strata is identified, the soil will be continuously sampled. The borings will extend approximately 5 feet beyond the base of the A-zone water bearing strata. The borings will be carefully logged by the project geologist in order to determine the depth to the base of the A-zone.

From the continuous soil sample obtained in the A-zone, a sub-sample will be collected in a plastic bag as a grab sample. This sample will be analyzed for grain-size distribution. The results of the grain-size distribution analysis will be utilized to design the well screen slot

size and filter material gradation in accordance with American Society for Testing and Materials (ASTM) D-5092.

Upon completion, the boring will be evaluated as to the occurrence and depth to groundwater. This data will be carefully logged and documented. The boring will be backfilled with a bentonite-cement grout mixture placed as the Geoprobe rods are withdrawn.

A second boring will be completed adjacent to the original boring to obtain one or two groundwater grab samples. If the water column of the A-zone is estimated to be about 10 feet or less, one groundwater grab sample will be obtained from approximately the middle of the estimated saturated zone. If the saturated zone is greater than 10 feet, two water samples will be obtained: one from $\frac{1}{4}$ of the saturated depth and the other from $\frac{3}{4}$ of the saturated depth.

The location of each boring will be identified using a portable GPS system (Trimble unit) to provide the coordinates. The coordinates will be documented on each log in the geographic system, North American Datum (NAD) 83, Zone 5. Each boring log will document the drilling company, the drilling rig used, on-Site geologist completing the logs and applicable license numbers. Soil descriptions will be in accordance with the Unified Soil Classification System (USCS).

3.1 GEOTECHNICAL SAMPLING

All soil samples collected during the exploratory borings will be sub-sampled to plastic Ziploc bags for possible laboratory analysis. From the continuous soil sampling in the saturated zone, one grab sample will be collected representative of every 5 feet of sample. Geotechnical soil analysis will be performed as follows:

- Four samples of soil will be selected for moisture content analysis. These will consist of one sample from the saturated zone (to provided saturated moisture content – a physical property of the soil) and three from the unsaturated zone to allow classification of the soil. If convenient, the moisture content may be determined by field methods (ASTM D4643 – 08 or equivalent), except that at least one of the samples will be submitted for laboratory analysis (ASTM D2216 – 10).
- One or more samples from the saturated zone will be analyzed for grain-size distribution using sieve analysis (ASTM D6913 – 04).

The results of geotechnical analysis will be used to design the filter pack and well screen for the groundwater extraction wells.

3.2 GROUNDWATER SAMPLING AND ANALYSIS

Groundwater analysis for the grab groundwater samples will include chemicals of concern (COCs). The following analyses will be performed:

TABLE 1: ANALYTICAL TEST METHODS FOR CONTAMINANTS OF CONCERN

Constituent	EPA Analytical Method
Chloroform	8260B
1,2-Dichloropropane (1,2-DCP)	8260B

Constituent	EPA Analytical Method
1,3-Dichloropropane (1,3-DCP)	8260B
1,2,3-Trichloropropane (1,2,3-TCP)	8260 SIM
1,2-Dibromo-3-chloropropane (DBCP)	8260 SIM
Ethylene dibromide (EDB)	8260 SIM
Dinoseb	8151A

The sample container type, size, and preservative for each specific analysis are provided in the following table:

TABLE 2: CONTAINER TYPE, SIZE, AND PRESERVATIVE FOR ANALYSIS

Constituent	EPA Analytical Method	Container Type	Container Size	Volume Required	Preservative
Chloroform	8260B	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
1,2-DCP					
1,3-DCP					
1,2,3-TCP	8260 SIM	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
DBCP					
EDB					
Dinoseb	8151A	Amber glass	1 L	1 L	None

Notes: L = liter; mL = milliliter; HCl = hydrochloric acid; VOA vial = volatile organic analysis vial

The sampling procedures for groundwater samples in the exploratory borings are presented in the SOP in Appendix E.

At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. Groundwater samples will be transferred from the tubing directly into the appropriate sample containers with preservative (if required), then chilled, and processed for transportation to the laboratory.

Vials for volatile organic compound (VOC) analysis will be filled first to minimize aeration of water in the boring. The vials will be inverted and checked for air bubbles to ensure zero headspace. If any air bubbles appear, the vial contents will be emptied, the vial discarded, and a new sample collected.

Quality Control/Quality Assurance (QC/QA) samples are only to include a trip blank. No duplicate samples, Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples, or data validation are planned for this sampling event.

3.3 EXTRACTION WELL LOCATION SELECTION

The extraction well locations will be assessed based on the results of the exploratory borings. The twelve exploratory borings will be numbered as shown in Figure 8 (EB-1 through EB-2). The initial locations of the borings are based on a review of the A-zone and B-zone groundwater flows and gradients (Figures 3 and 4) and the contaminant concentrations for COCs in the A-zone (October 2011 groundwater monitoring event – Figures 5 through 7). Boring logs of nearby monitoring wells were also reviewed understand the depth to the A-zone aquitard and thickness of A-zone saturated zone.

The conditions at the exploratory borings are summarized on Table 3. Groundwater depths and contaminant concentrations are based on the October 2011 groundwater monitoring report (Eco 2012). Suspected A-zone to B-zone leakage is evaluated by the groundwater elevation contours in the A-zone (Figure 3).

TABLE 3: CONDITIONS AT THE EXPLORATORY BORING LOCATIONS

Exploratory Boring No.	Nearest A-zone Well	Nearest B-zone Well	Approx. Depth to A-zone GW	Approx. Depth to B-zone GW	Depth difference between A-zone and B-zone	Approx. Depth to Base of A-zone	1,2-DCP	Chloroform	1,2,3-TCP
							µg/L		
EB-1	WA-6	N/A	82	139	57	N/D	35	0.5	50
EB-2	PWA-2	PWB-3	76	133	57	80	7,700	10	1,100
EB-3	WA-4	N/A	78	139	61	N/D	0.5	0.5	0.5
EB-4	WA-3	AR-1	77	138	61	N/D	1.7	0.4	87
EB-5	N/A	N/A	80	139	59	N/D	5,000	2.5	500
EB-6	AMW-2P	AMW-4R	77	146	69	N/D	400	0.5	50
EB-7	N/A	N/A	83	141	58	N/D	4	0.5	50
EB-8	AMW-2P	AMW-4R	74	139	65	75	500+	0.5	50+
EB-9	AP-4	N/A	83	139	56	N/D	50	0.5	30
EB-10	EPAS-2	WB2-1	75	136	61	88	5,000	4	500
EB-11	AMW-1P	N/A	80	139	59	N/D	5,000+	5	500+
EB-12	N/A	N/A	80	140	60	80	5,000+	5	500+

Notes: GW groundwater
1,2-DCP 1,2-dichloropropane
1,2,3-TCP 1,2,3-trichloropropane
µg/L micrograms per liter
N/A not available
N/D not determined

The following factors will be used to assess the locations for possible placement of extraction wells:

1. Property access
2. Proximity to existing A-zone and B-zone monitoring wells
3. Saturated thickness
4. Suspected A-zone to B-zone leakage
5. Hydraulic conductivity (based on laboratory results)
6. Groundwater contaminant concentrations (based on laboratory results)

The factors will each be assigned a weight on a qualitative basis to present the relative importance of the consideration. As an example, property access will be assigned a low weight as representing a not so important factor and saturated thickness and hydraulic conductivity a high factor. This means it is more important that at a particular site there be the ability to remove water and that the more water that can be removed from that site the better that location would be for placement of an extraction well.

A qualitative ranking for the twelve sites will be result of the assessment. This ranking will be presented in a tabular format illustrating the factor and the considerations that led to the relative ranks. The results will reviewed by USACE, EPA, and DTSC to identify the order of extraction well installation.

The three locations that are identified to be most suitable for the installation of the extraction wells will selected for the first three installations.

4.0 BACKGROUND B-ZONE MONITORING WELLS

Three background B-zone monitoring wells (BBW-1, BBW-2, and BBW-3) will be installed generally upgradient of the Site. These well locations are shown in the attached Figure 9. Well BBW-1 is proposed approximately 1,200 feet northeast of the Site along an access road for an agricultural field. Well BBW-2 is approximately 1,500 feet north of the Site along an access road for an agricultural field. Well BBW-3 is approximately 1,200 feet northwest of the Site at the northeast corner of Haven Drive and Stockton Avenue. These well locations have been reviewed and tentatively approved by the USACE. All of the work described in this section will be in accordance with the approved project plans presented in Appendices B (Health and Safety Plan), C (Quality Assurance Project Plan), and D (Sampling and Analysis Plan).

The following sections discuss the construction of the monitoring wells.

4.1 PRE-WELL INSTALLATION ACTIVITIES

Prior to installation of the monitoring wells, well installation permits will be obtained through the Kern County Environmental Health Department (KCEHD).

The USACE, KCEHD, and property owners will be notified at least 5 days prior to monitoring well installation. USACE will contact the property owners and secure right-of-entry for the proposed borings/monitoring wells where appropriate.

Underground Service Alert (USA) will be notified at least 72 hours prior to initiation of well installation. All planned monitoring well locations will be clearly marked with white paint, wooden lath, and/or flagging, as required by USA. USA will contact public utility owners of record within the Site vicinity and notify them. The utility companies will contact Eco if any of the proposed borings are located near buried utility lines. Utility owners of record in the area, or their designated agents, will clearly mark the position of their utilities on the ground surface throughout the designated area.

4.2 SOIL SAMPLING AND LOGGING

Drilling for the well borings will be conducted with a hollow-stem auger drill rig. The borings will be at least 10 inches in diameter to accommodate the 4” diameter monitoring wells. During drilling, soil samples will be collected at 5-foot intervals to the total depth of the borings, starting at 5 feet bgs. The samples will be collected and used to document geologic conditions and preparing the log for the well. No analytical testing is planned for the soil samples.

A split-spoon sampler will be used to collect undisturbed soil at each sampling interval. Three brass tubes (each 2 inches in diameter and 6 inches long) will be used as liners inside the split-spoon sampler. Soil will be driven into the liners at each planned sampling interval. After collecting the soil sample by removing the liners from the sampler, the sampler will be decontaminated and reassembled with new liners.

One or more tubes will be kept as a soil sample depending on recovery and observed condition of the sample. The lower (one closest to the sampler shoe) tube will be labeled as the first tubes and the others in sequence as the second and third tubes. The tube will be capped, labeled, and stored for possible laboratory analysis. The soil from the sampler shoe will be used for lithologic description in the field. The percent sample recovery will be recorded in the boring logs for samples that do not have 100 percent recovery. Sample recovery is defined as the length of sample recovered relative to the distance to which it was driven into the soil.

A State of California-registered geologist will review and describe the soil samples collected from each sampling interval. The soil description will include a lithologic description (using the Unified Soil Classification System), color (using the Munsell color system), general moisture content, general porosity, and mineral content (if visible), including evaporites. All soil descriptions will be recorded onto the standard boring log form.

A portion of each soil sample collected will be placed in a plastic re-sealable bag and allowed to volatilize. The headspace of each bag will be measured in the field for VOCs using a photoionization detector (PID). Headspace measurements will be recorded on the boring logs.

4.3 WELL INSTALLATION

The borings will be completed at groundwater monitoring wells. The wells will be constructed of 4-inch diameter Schedule 80 flush-joint threaded ASTM D1785 polyvinyl chloride (PVC) pipe. The well screen will be of commercial design and consist of 10-foot sections of slotted PVC Schedule 80. The slot size will be 0.01 inch. The well design is similar to B-zone monitoring wells that have been installed in recent years and found satisfactory. A typical B-zone monitoring well construction detail is provided in Figure 10. The form used to prepare this detail will be used to report the completed well features. A copy of this form is provided in Appendix A.

Twenty feet of well screen will be placed at the bottom of each well. Solid PVC casing will be placed from the top of the screen up to 0.5 feet bgs. Number 2/12 Monterey sand will be used as the filter pack and will be placed in the annulus of the screened interval, extending approximately 2 feet above and 1 foot below the screen. A minimum 5-foot-thick seal of medium bentonite chips will be placed above the filter packing. Portland cement, with approximately 5 percent bentonite, will be used above the bentonite seal to approximately 2 feet bgs. Medium bentonite chips will be placed on top of the grout up to 1½ feet from the surface.

Surface completion for Wells BBW-1 and BBW-2 will include an above grade surface wellhead monument. The well casing will extend to 1 to 2 feet above the ground surface. A watertight locking cap will be used to secure the top of the casing. The section of casing that sticks up above the ground will be protected by a steel protective monument cover set in a concrete pad. The concrete pad will be square, approximately 2 feet by 2 feet, and will be sloped slightly away from the well. The top of the pad will be approximately 4 inches off the ground. The monument will have a vented locking cap to secure the well.

Surface completion for Well BBW-3 will include a 12-inch-diameter, flush-mounted, traffic-rated well box set in concrete that is mounded 3 inches aboveground to prevent ponding inside the well.

Bollards will be placed around the wells unless the Site access for that location requires flush surface completion and/or placement of bollards is not allowable, such as in the City street. A brass tag marker will be placed in the concrete pad at each well designating the well number and the B&B project identification. The well locations and the top of casing elevations will be surveyed by a Licensed Surveyor to provide well coordinates and reference for the groundwater elevation at the well.

4.4 WELL DEVELOPMENT

After installation, the drilling crew will develop the groundwater monitoring wells with a combination of surging and bailing. A stainless steel bailer may be used to initially purge the well water to remove sediment that collected during well installation. Surging is then done to clean the PVC slots and the sand pack. After surging, a bailer will again be used to remove any newly generated sediment. Following the last bailing, a clean pump will be placed approximately 2 feet above the bottom of the well. The well will then be pumped at a flow rate between 0.5 and 5 gpm. Pumping will continue until the well water runs clear and the groundwater parameters (i.e., pH, turbidity, conductivity) stabilize. Groundwater collected during development will be placed in an appropriate storage container or 55-gallon Department of Transportation (DOT) drums. A typical well development log is provided in Appendix A.

4.5 WELL SURVEY

The completed wells will be surveyed by a Licensed Surveyor. A “V” notch or other permanent mark will be placed at the north edge of the top of the well casing that can be used as the reference point for well elevations surveying and water level monitoring. The vertical survey will be accurate to 0.01 foot. Horizontal control will be within 0.1 foot.

4.6 GROUNDWATER SAMPLING

The groundwater wells will be allowed to stabilize and re-equilibrate prior to sampling. Groundwater sampling will be conducted after a period of 72 hours after the completion of

well development. Four groundwater sampling events will be required to establish the background levels of the target COC. The first water sampling event will be shortly after the well installation as described. The remaining sampling events will be conducted as determined by USACE and may be done concurrently with the field sampling of wells in the area.

Sampling will be completed using a bladder pump with dedicated tubing for each well. All groundwater samples will be collected from the mid-point depth of the well screen.

4.6.1 WATER LEVEL MEASUREMENTS

Prior to sampling, the wells will be sounded for depth to water from the top of the casing. An electronic sounder, accurate to the nearest ± 0.01 foot, will be used to measure the depth to water. When using an electronic sounder, the probe is lowered down the casing to the top of the water column. Then the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. The electronic sounder will emit a constant tone when the probe is submerged in standing water.

Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of well screen. Total well depths will be measured to the nearest 0.1 foot.

4.6.2 PURGING

Groundwater sampling will be conducted using a low-flow, minimum draw-down (LF/MD) sampling system. Wells will be purged and sampled with a portable, decontaminated, sampling pump using LF/MD techniques. Dedicated tubing will be used for each well. During purging, field parameters (pH, temperature, electrical conductivity (EC), oxidation-reduction potential (ORP), dissolved oxygen (DO), and turbidity) will be collected and recorded on sampling logs. Samples will be collected after the parameters have stabilized, indicating that representative formation water is entering the well.

The methodology for LF/MD groundwater sampling is to purge wells at a flow rate at or below the recharge capacity of the aquifer. This low-flow approach removes a small volume of representative groundwater from the well's screened zone without disturbing stagnant water in the casing above the screen. Water removed from the well during purging will be containerized. Samples will be transferred into sampling bottles directly from the discharge line, minimizing sample contact with the air.

4.6.3 WELL SAMPLING

Groundwater samples will be obtained after the well development and further 72-hours to allow for well stabilization. Groundwater sampling will be completed using low-flow method and a bladder pump.

Groundwater samples collected from the monitoring wells will be analyzed for COCs as described in Table 1 above. In addition, samples will be collected for the following parameters:

- Nitrates and sulfates by EPA Method 300
- Total organic carbon by EPA Method 415.1
- Ferrous Iron by Method SM3500
- Sulfide by Method SM4500

- Methane and Dissolved Hydrogen by Method RSK175

The sample container type, size, and preservative for each specific analysis are provided in Table 4 below:

TABLE 4: CONTAINER TYPE, SIZE, AND PRESERVATIVE FOR ANALYSIS

Constituent	EPA Analytical Method	Container Type	Container Size	Volume Required	Preservative
Chloroform	8260B	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
1,2-Dichloropropane					
1,3-Dichloropropane					
1,2,3-Trichloropropane	8260 SIM	Glass (VOA vial)	40 mL	120 mL (3 vials)	HCl
1,2-Dibromo-3-chloropropane					
Ethylene dibromide					
Dinoseb	8151A	Amber glass	1 L	1 L	None
Nitrates, Nitrites, and Sulfates	300.1	Polyethylene	250 mL	250 mL	None
Total Organic Carbon	415.1	Polyethylene	125 mL	125 mL	HCl
Ferrous Iron	SM3500	Polyethylene	250 mL	250 mL	None
Sulfide	SM4500	Polyethylene	250 mL	250 mL	Zinc Acetate and Sodium Hydroxide
Methane	RSK175	Glass (VOA vial)	40 mL	1 L	None
Dissolved Hydrogen	RSK175	Glass (VOA vial)	40 mL	1 L	None

Notes: L = liter; mL = milliliters; HCl = hydrochloric acid; VOA vial = volatile organic analysis vial

Water sampling will be completed in accordance with the sampling procedures described in the Sampling and Analysis Plan, Appendix D.

4.6.4 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field QA/QC samples will be collected. For the purposes of this investigation, only trip blanks and rinsate blanks will be used.

- **Trip Blanks.** One laboratory-supplied trip blank (TB) will be carried in the ice chest throughout the day and submitted with the field samples for analysis. TBs will be analyzed of VOCs only.

- **Rinsate Blanks.** One equipment rinsate blank (RB) will be submitted for analysis of the analytes specified in Section 4.6.3. Rinsate blanks will be collected from de-contaminated equipment, such as the bladder pump. Typically, one rinsate sample will be collected for every one day of sampling.

5.0 DECONTAMINATION PROCEDURES

Drilling equipment will be decontaminated by steam cleaning within a decontamination trailer. The augers will be steam cleaned prior to and after drilling and the water depth equipment will be decontaminated before and after each use. Bailers used during well development will be steam cleaned before and after use. The bladder pump will be decontaminated prior to sampling at a well.

The following, decontamination procedure will be used for the decontamination of sampling equipment:

1. Non-phosphate detergent and tap-water wash (using a brush)
2. Tap-water rinse
3. Deionized/distilled water rinse (twice)

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will be covered. All liquids generated during the decontamination process will be contained in an appropriate storage tank or in 55-gallon DOT-approved drums.

6.0 WASTE DISPOSAL

Soil generated during Site exploration and B-zone monitoring well installation will be properly contained in 55-gallon DOT-approved drums or covered roll-off bins. Soil samples from the drums or bins will need to be collected for profiling purposes. The soil samples will be analyzed for the following:

- Chlorinated herbicides (EPA Method 8151)
- VOCs – full QAPP list (EPA Method 8260B)
- Title 22 (CAM 17) metals (EPA Method 6010/7000)
- Total petroleum hydrocarbons ([TPH] EPA Method 418.1 or EPA Method 8015B)

Soil disposal requirements will be based on the laboratory analysis. A copy of the laboratory report will be provided to the disposal subcontractor and arrangements will be made to remove the soil under proper manifest for disposal or recycling.

Wastewater may be generated from decontamination procedures, groundwater sampling, and well development. Wastewater will be stored in proper containers or DOT approved 55-gallon drums and labeled accordingly. The wastewater profiling will include the following tests:

- 1,2,3-TCP, EDB, DBCP (EPA Method 8260-SIM)

- Dinoseb only (EPA Method 8151)
- VOCs – Full QAPP List (EPA Method 8260B)

Water disposal requirements will be based on the laboratory analysis. A copy of the laboratory report will be provided to the disposal subcontractor and arrangements will be made to remove the water under proper manifest for disposal or recycling.

7.0 SAMPLE DOCUMENTATION AND SHIPMENT

7.1 FIELD LOGBOOKS

Field logbooks will be used to document where, when, how, and from whom any vital information was obtained. Logbook entries will be complete and accurate to permit reconstruction of field activities. A new logbook will be dedicated to this project. Logbooks are bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in black ink, and signed by the individual making the entries as well as a California Professional Geologist (PG). Language will be factual, objective, and free of personal opinions or other terminology that might prove inappropriate.

The following information will be recorded as appropriate during the collection of each sample. A sample of the groundwater sampling log form is attached in Appendix A.

- Sample location and description
- Site sketch showing sample location and measured distances
- Sampler's name(s)
- Date and time of sample collection
- Weather conditions
- Type of sampling equipment used
- On-Site measurement data (e.g., temperature, pH, conductivity, etc.)
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.)
- Preliminary sample descriptions
- Type(s) of preservation used
- Sample numbers and chain-of-custody records
- Recipient laboratory

In addition to the sampling information, the following information will be recorded as appropriate in the field logbook for each day of sampling:

- Daily safety meetings
- Daily log of Site activities
- Deviations from workplan or Site safety plan

- Changes in personnel and responsibilities as well as reasons for the changes
- Levels of safety protection
- Calibration readings for any equipment used and equipment model and serial number

7.2 CHAIN-OF-CUSTODY RECORDS

Chain-of-custody records are used to document sample collection and shipment to the laboratory for analysis. A chain-of-custody record will accompany all samples shipped for analysis. Forms will be completed and sent with the samples to the laboratory daily.

The chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area. Until the samples are shipped or delivered, the custody of the samples will be the responsibility of Eco. The project manager, contractor quality control manager, or designee will sign the chain-of-custody record. The signer will sign the "relinquished by" box and note date and time.

The shipping containers in which samples are stored (usually sturdy picnic coolers or ice chests) will be sealed before shipping.

8.0 PROJECT TEAM ORGANIZATION

Personnel responsible for preparing, coordinating, and conducting the Site exploration and B-zone monitoring well installation at the Site include the project director, corporate health and safety officer, the Site health and safety officer, project geologist, team members, and subcontractors. The personnel assigned to this project are as follows:

- Project Director – Dr. Mohammad Estiri
- Project Geologist – Mr. Quin Kinnebrew, PG, REA II (Professional Geologist, Registered Environmental Assessor)
- Health and Safety Officer – Dr. Mitra Fiuzat; Hsin Chou, CIH
- Quality Control Manager – Opjit Ghuman
- Team members – designated at the time of fieldwork
- Subcontractor and third parties – designated at the time of fieldwork

All field personnel used on this project will have successfully completed 40 hours of training in hazardous waste operations and/or a current 8-hour hazardous waste operations training refresher.

9.0 FIELD VARIANCES

Because conditions in the field may vary, it may become necessary to implement minor modifications to the procedures presented in this Workplan. When appropriate, the USACE project manager will be notified of the modifications and a verbal approval will be obtained

before implementing the modifications. Modifications to the approved Workplan will be documented in the reporting for the background well installation.

10.0 SCHEDULE

The project scope of work will be scheduled upon approval of this Workplan. The following tentative schedule is provided subject to approval by the USACE – all in 2012.

- Mobilize and conduct fieldwork – August 1 through August 24.
- Data review and preparation – September 15 through October 31.
- Reporting for Background Wells and Exploratory Borings – October 15 through November 15.

11.0 SUBMITTALS

All activities described in this plan will be documented during the completion of the work while in the field. For all fieldwork, a daily Quality Control Report form will be completed (see sample blank form in Appendix A). Photographs of fieldwork will also document the performance of the activities.

After all of the activities are completed, a completion Report will be prepared documenting the work and describing the activities. Selected photographs taken during the fieldwork will be included in the report.

The completion report will be delivered in hard copy and electronically via email to the personnel listed below:

- A. U.S. Army Corps of Engineers, Albuquerque District
ATTN: Carol Wies
4101 Jefferson Plaza NE
Albuquerque, NM 87109
(Draft and Final: 1 hard copy, 1 electronic copy)
- B. Environmental Protection Agency, Region 9
ATTN: Brunilda Davila (SFD-7-2)
75 Hawthorne St.
San Francisco, CA 94105
(Draft and Final: 1 electronic copy)
- C. Environmental Protection Agency, Region 9
ATTN: Glenn Bruck (SFD-7-2)
75 Hawthorne St.
San Francisco, CA 94105
(Draft and Final: 1 electronic copy)
- D. Environmental Protection Agency, Region 9
ATTN: Alejandro Diaz (SFD-7-2)
75 Hawthorne St.
San Francisco, CA 94105
(Final: 2 hard copies, 4 electronic copies)

- E. U.S. Army Corps of Engineers, Albuquerque District
ATTN: Cecilia Horner
4101 Jefferson Plaza NE
Albuquerque, NM 87109
(Draft and Final: 1 hard copy, 1 electronic copy)
- F. U.S. Army Corps of Engineers, Albuquerque District
ATTN: David Henry
4101 Jefferson Plaza NE
Albuquerque, NM 87109
(Draft and Final: 1 hard copy, 1 electronic copy)
- G. U.S. Army Corps of Engineers, Albuquerque District
ATTN: Steve Wagner
4101 Jefferson Plaza NE
Albuquerque, NM 87109
(Draft and Final: 1 hard copy, 1 electronic copy)
- H. U. S. Army Corps of Engineers, Los Angeles District
ATTN: Thad Fukushige/Rick Lainhart
645 N. Durfee Ave.
Los Angeles, CA 91733
(Draft and Final: 1 hard copy, 1 electronic copy)

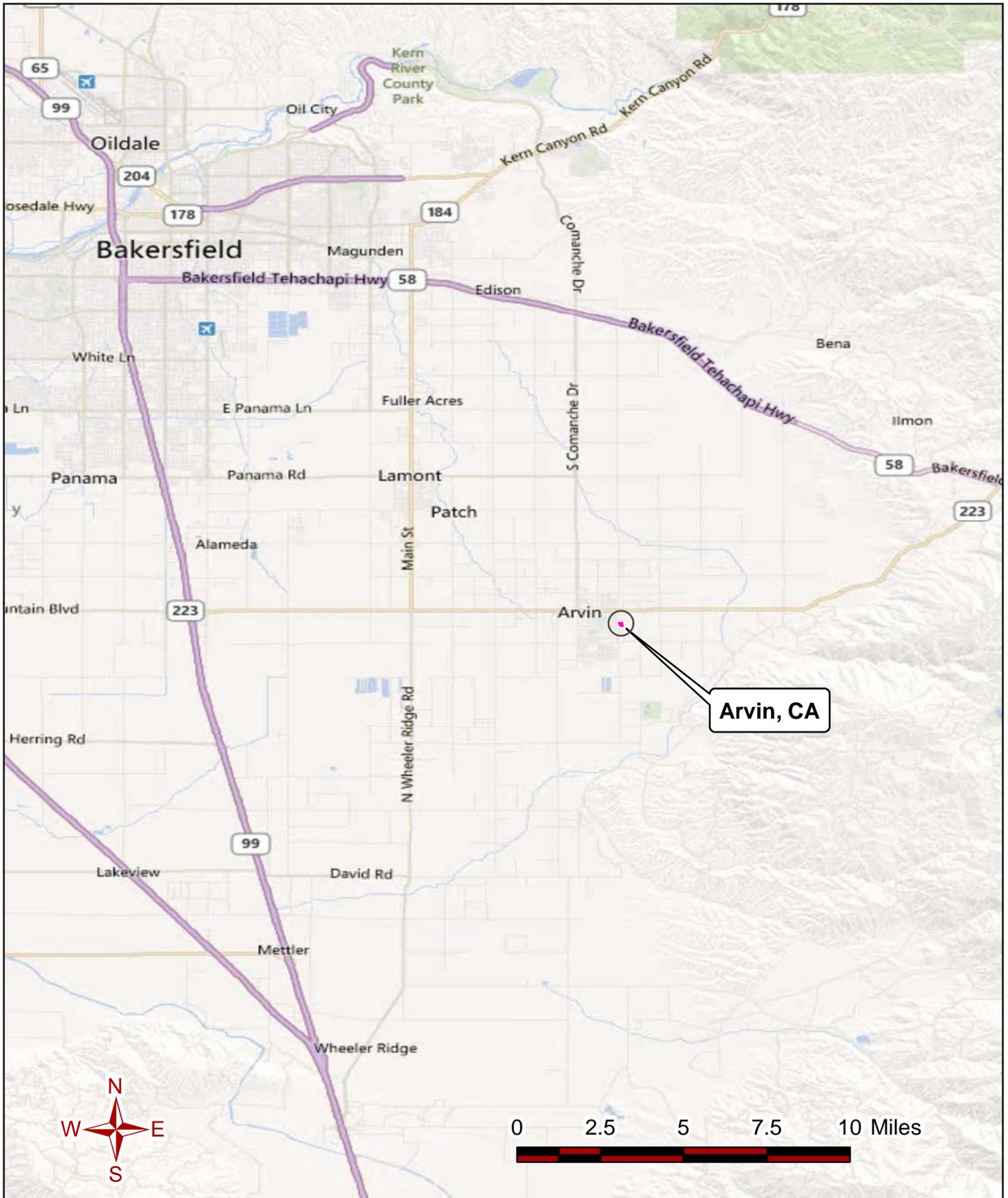
12.0 REFERENCES

- Eco & Associates, Inc., 2007. *Site-Specific Groundwater Sampling and Analysis Plan*, Brown & Bryant Superfund Site, Arvin, California, December 4, 2007.
- _____, 2010. *Monitoring Wells Installation Report*, Brown & Bryant Superfund Site, 600 South Derby Street, Arvin, California, November 22, 2010.
- _____, 2011. *Site-Specific Groundwater Sampling and Analysis Plan and Quality Assurance Project Plan*, Brown & Bryant Superfund Site, 600 South Derby Street, Arvin, California, August 19, 2011.
- _____, 2012. *October 2011 Groundwater Sampling Report*, Brown & Bryant Superfund Site, 600 South Derby Street, Arvin, California, June 8, 2012.
- Johnson A.I., R.P. Moston, and D.A. Davis, 1968. *Physical and Hydrologic Properties of Water-Bearing Materials in Subsiding Areas in Central California*, U.S. Geol. Surv. Prof. pp. 497- A.
- Panacea, 2005. *Remedial Investigation/Feasibility Report, Operable Unit No. 2, Brown & Bryant Superfund Site, Arvin, California*, September 2005.

U.S. Environmental Protection Agency (USEPA), Region IX, 1993a. *Operable Unit One Feasibility Study*, Brown & Bryant Super Fund Site, Arvin, California, dated March 1993.

_____, 1993b. *Remedial Investigation/Feasibility Study Report*, Brown & Bryant Superfund Site, Arvin, California, dated May 28, 1993.

FIGURES



Eco & Associates, Inc.
 1855 W. Katella Avenue, Suite 340
 Orange, California 92867
 Phone: 714.289.0995 Fax: 714.289.0965

REGIONAL MAP
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA
 Project No. Eco-11-482 Dated July 2012

FIGURE
1



LEGEND:

-  A-Zone Monitoring Well
-  B-Zone Monitoring Well



Environmental Excellence

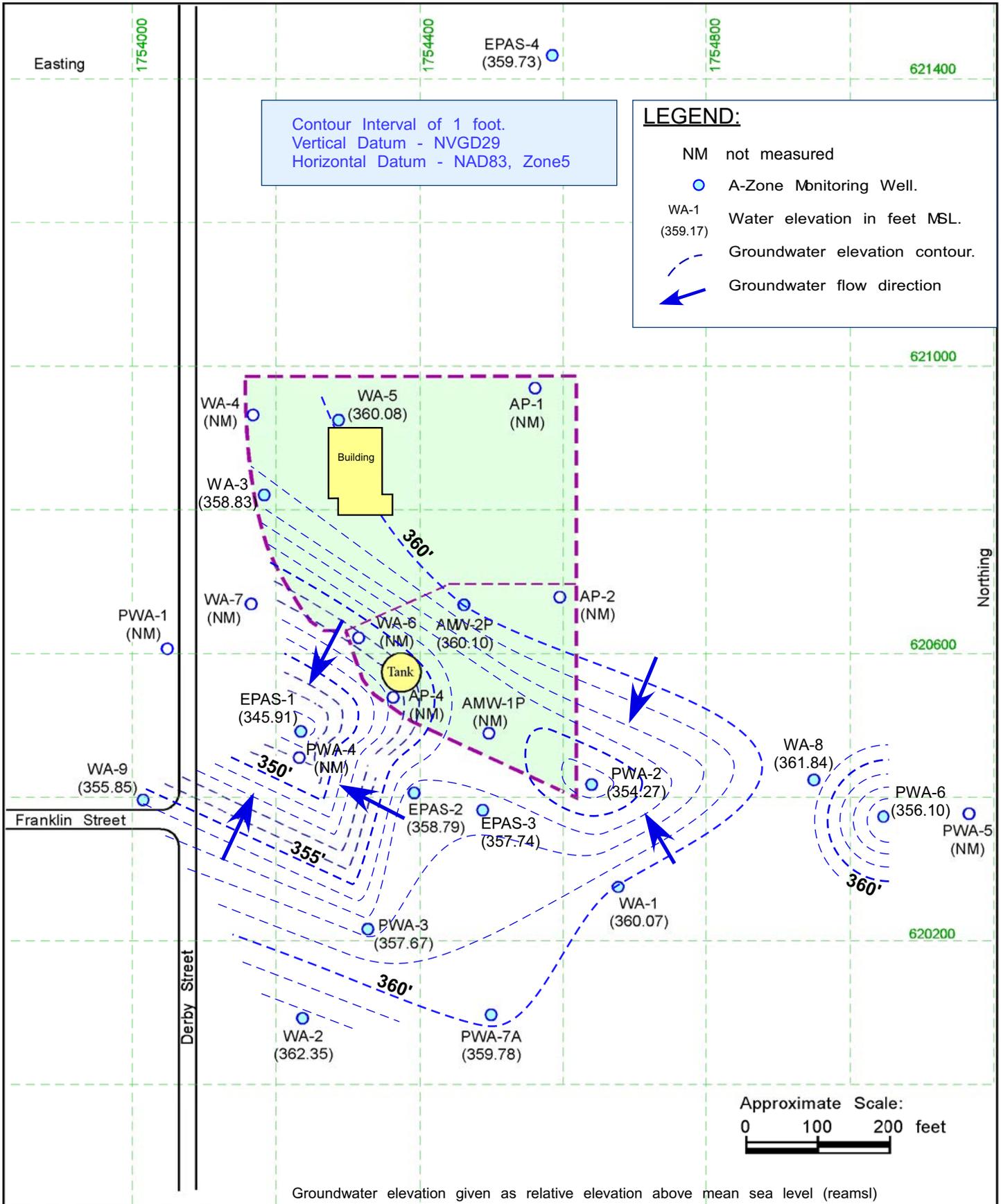


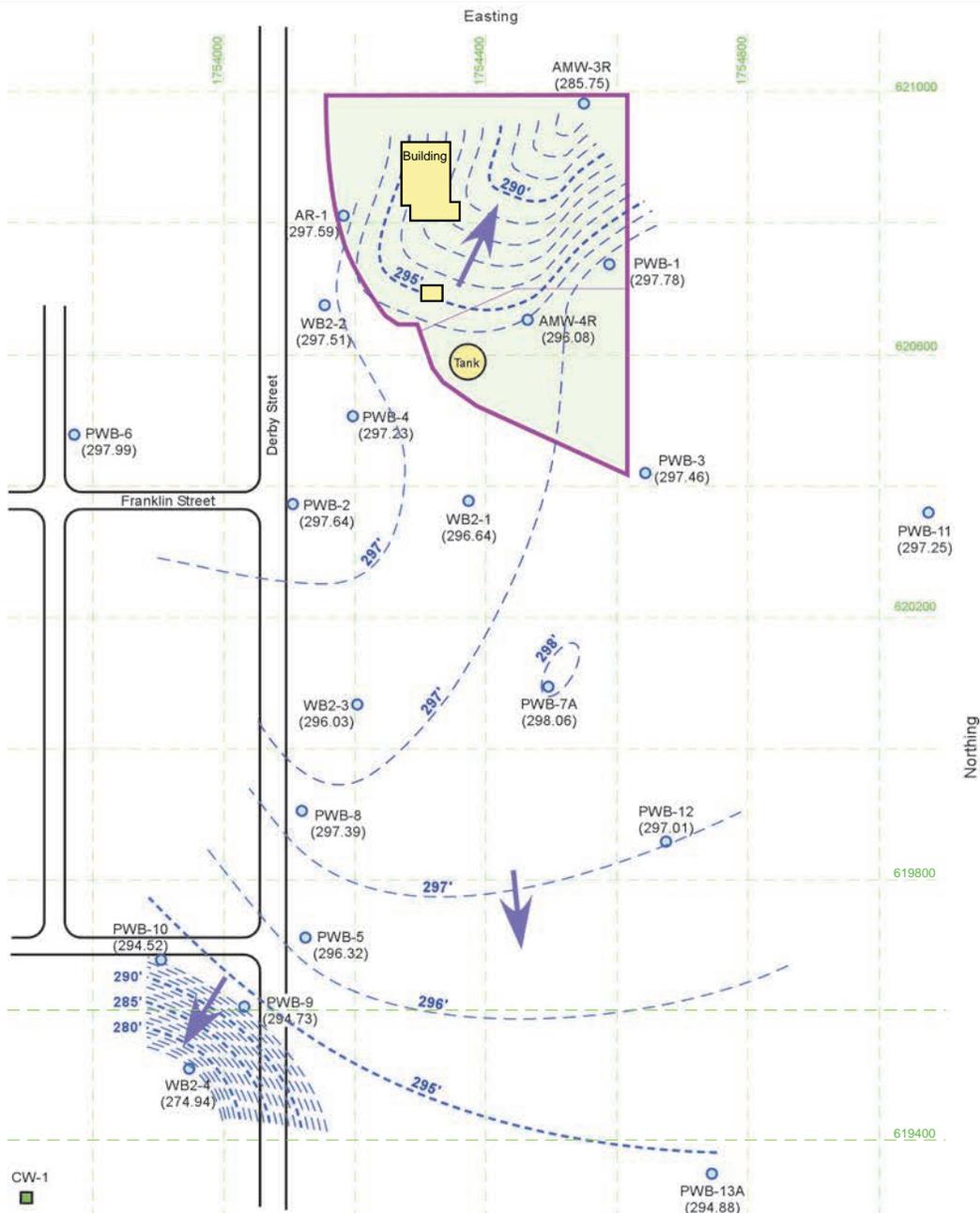
Eco & Associates, Inc.
 1855 W. Katella Avenue, Suite 340
 Orange, California 92867
 Phone: 714.289.0995 Fax: 714.289.0965

**SITE VICINITY MAP
 SHOWING WELL LOCATIONS
 Brown & Bryant Superfund Site
 600 South Derby Street, Arvin, CA**

Project No. Eco-12-514 Dated July 2012

FIGURE
 2





Contour Interval of 1 foot.
 Vertical Datum - NVGD29
 Horizontal Datum - NAD83, Zone5

LEGEND:

- City Well
- B-Zone Monitoring Well.
- PWB-1 (288.53) Water elevation in feet MSL.
- - - Groundwater elevation contour.
- ← Groundwater flow direction

Approximate Scale:
 0 100 200 feet



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Phone: 714.289.0995

Fax: 714.289.0965

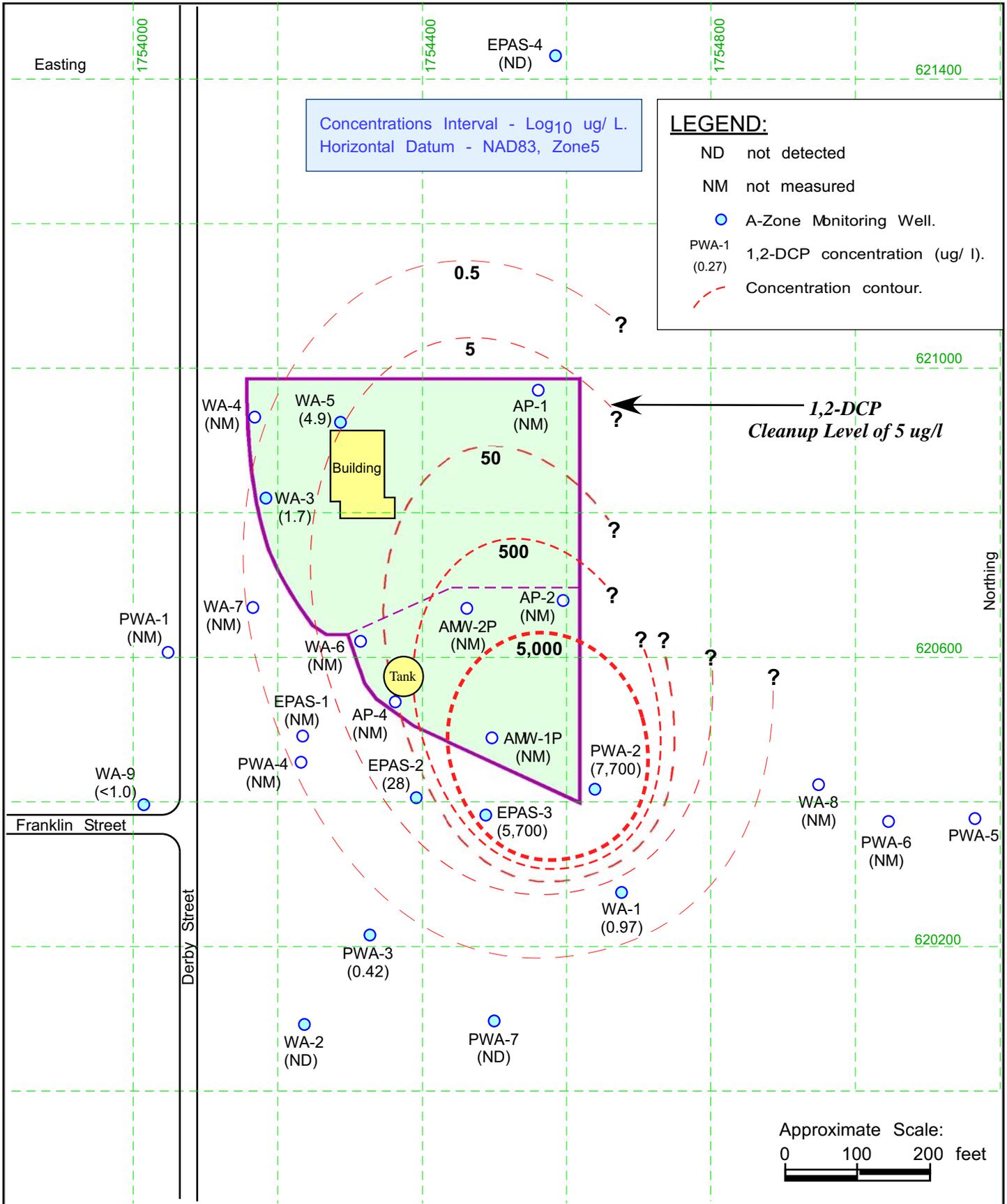
**B-ZONE WELLS SHOWING FALL 2011
 GROUNDWATER CONTOURS
 Brown & Bryant Superfund Site, Arvin, CA**

Project No. Eco-12-514

Dated July 2011

FIGURE

4



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Phone: 714.289.0995

Fax: 714.289.0965

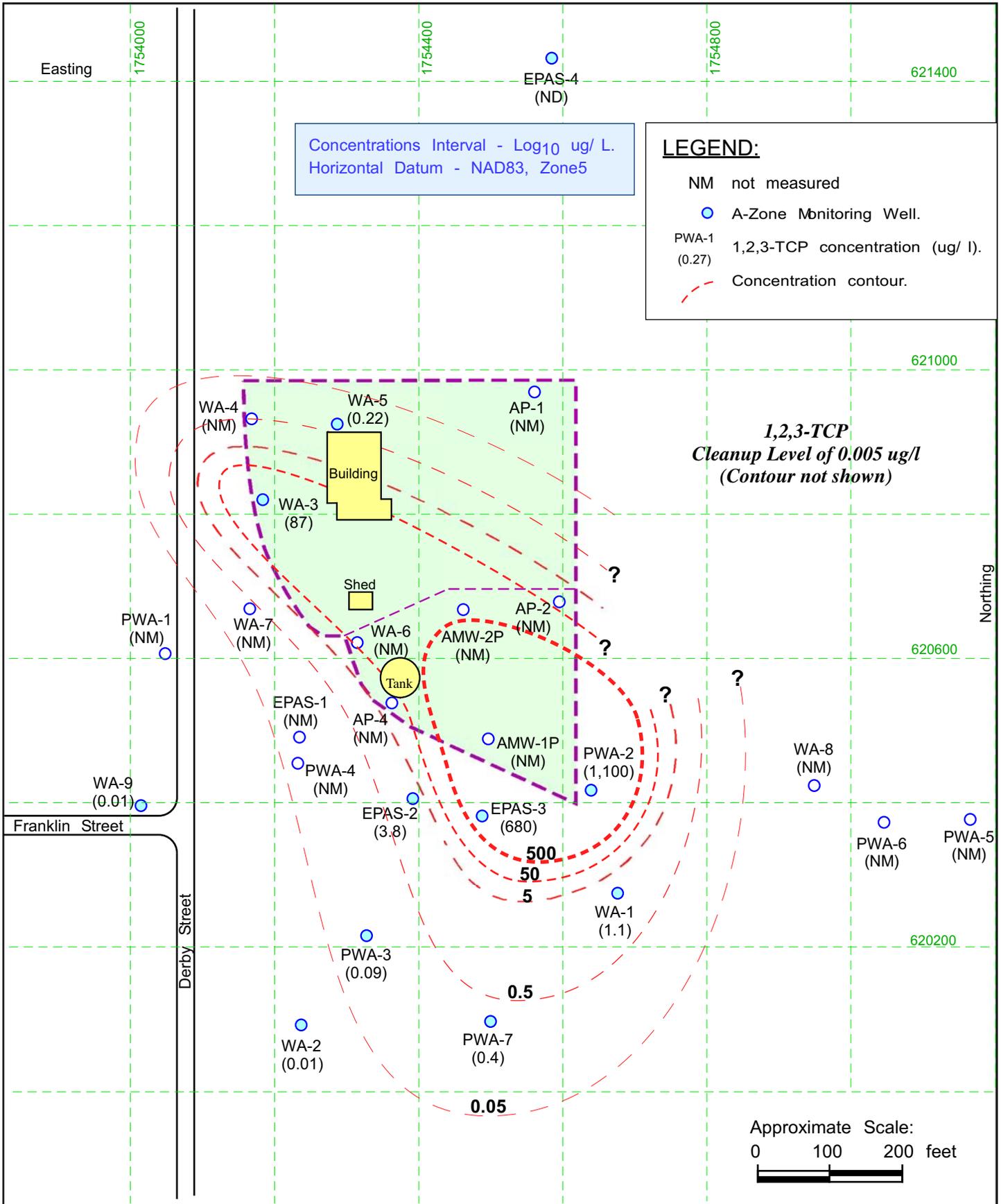
1,2-DCP ISOCONCENTRATION PLOT
A-ZONE - OCTOBER 2011
Brown & Bryant Superfund Site

Project No.: Eco-12-514

Dated July 2011

FIGURE

5

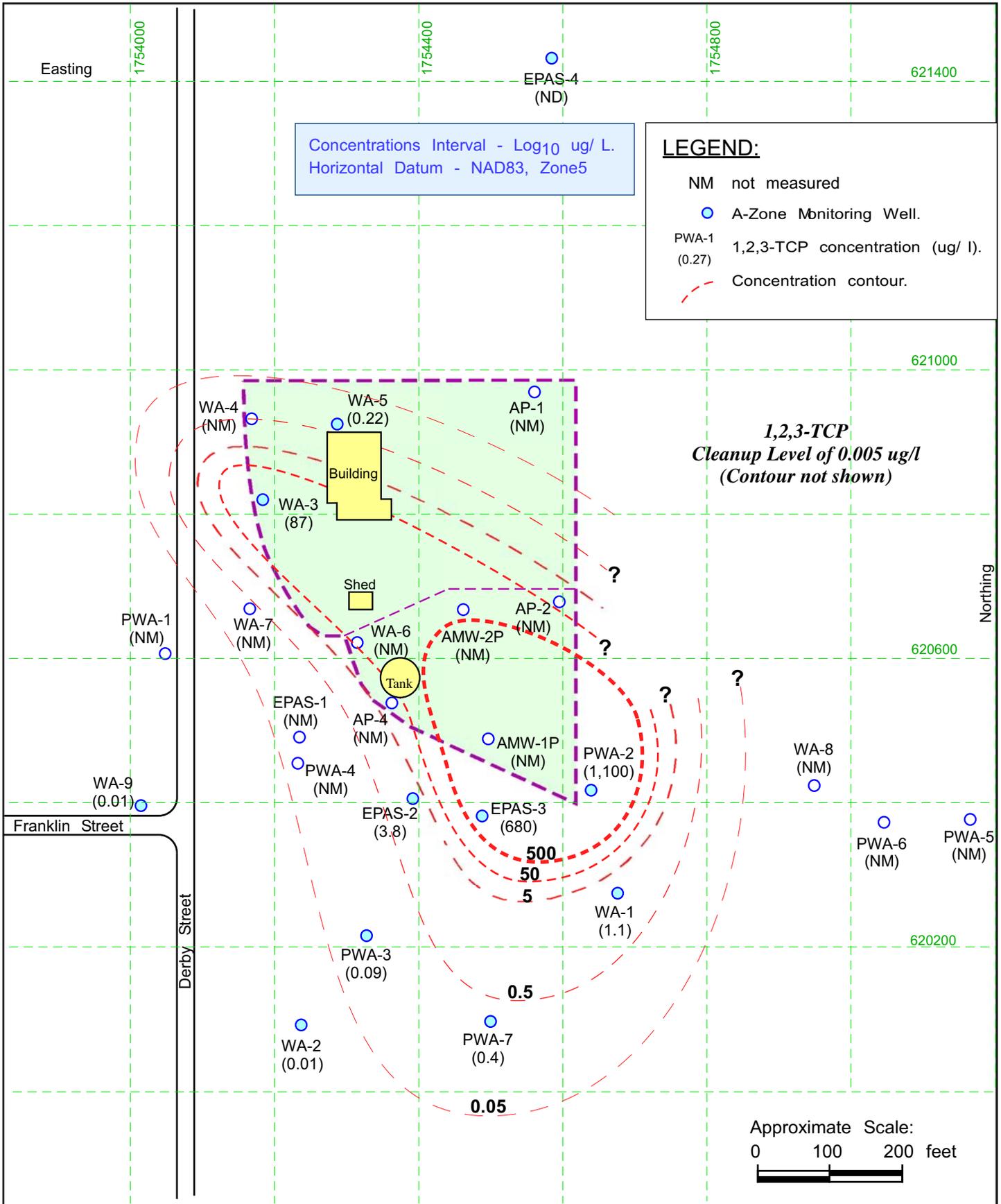


Eco & Associates, Inc.
 1855 W. Katella Avenue, Suite 340
 Orange, California 92867
 Phone: 714.289.0995 Fax: 714.289.0965

**CHLOROFORM ISOCONCENTRATION
 PLOT A-ZONE-OCTOBER 2011
 Brown & Bryant Superfund Site**

Project No.: Eco-12-514 Dated July 2012

**FIGURE
 6**



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 1855 W. Katella Avenue, Suite 340
 Orange, California 92867

Phone: 714.289.0995

Fax: 714.289.0965

1,2,3-TCP ISOCONCENTRATION PLOT
A-ZONE - OCTOBER 2011
Brown & Bryant Superfund Site

Project No.: Eco-12-514

Dated July 2012

FIGURE
 7



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 1855 W. Katella Avenue, Suite 340
 Orange, California 92867

Phone: 714.289.0995

Fax: 714.289.0965

**PROPOSED UPGRADIENT
 B-ZONE WELL LOCATIONS**
Brown & Bryant Superfund Site
600 South Derby Street, Arvin, CA

Project No. Eco-12-514

Dated July 2012

FIGURE

9

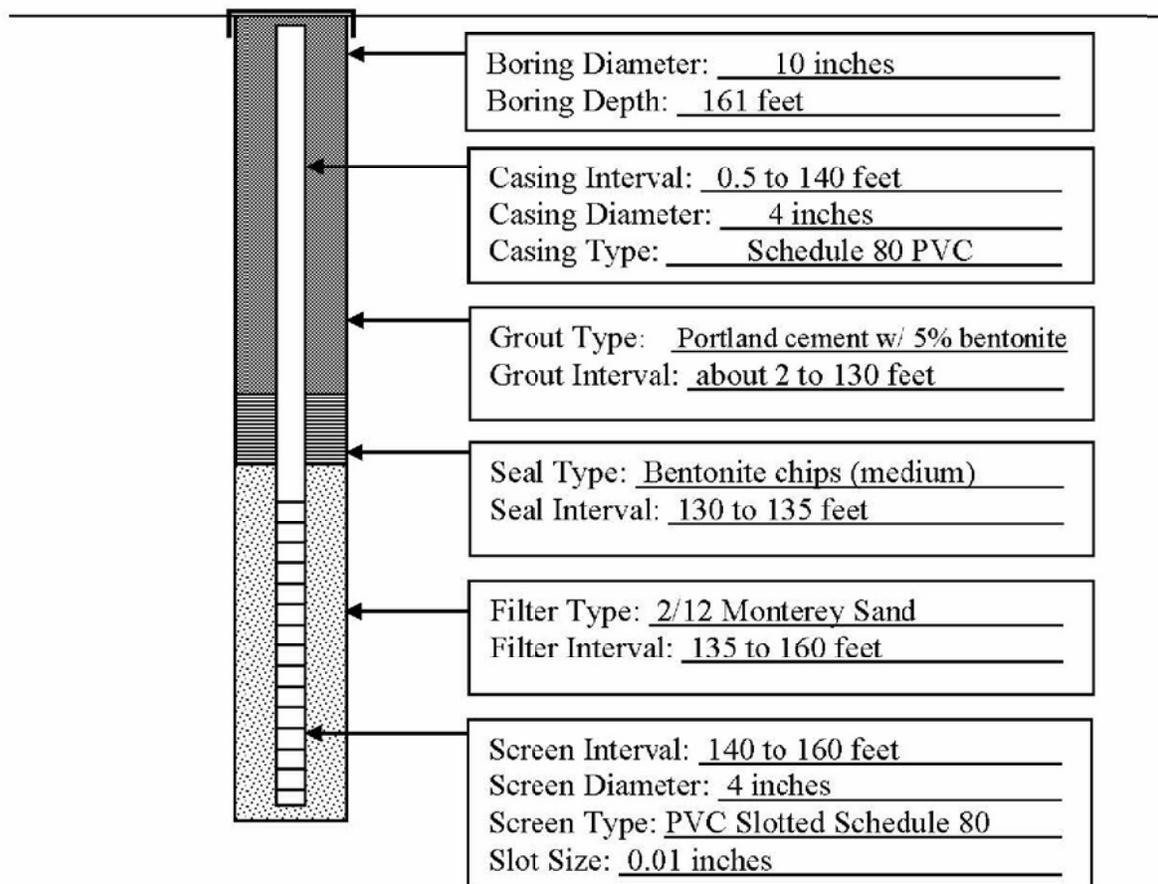
Project: Brown & Bryant Superfund Site
 Project Location: 600 S. Derby Road, Arvin CA
 Project Number: Eco-12-514

**MONITORING WELL
 CONSTRUCTION DETAILS
 FOR B-ZONE MONITORING
 WELLS**

Well Location: Background B-zone Monitoring Wells

Method of Installation:

Notes:



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 1855 W. Katella Avenue, Suite 340
 Orange, California 92867

Phone: 714.289.0995 Fax: 714.289.0965

**B-ZONE MONITORING
 WELL CONSTRUCTION DETAIL**
 Brown & Bryant Superfund Site
 600 South Derby Street, Arvin, CA

Project No. Eco-12-514

Dated July 2012

FIGURE

10

APPENDIX A

EXAMPLE LOGS AND FORMS



B&B
 600 S. Derby Street, Arvin, CA
 Eco-12-514

Log of Boring EB-1

Sheet 1 of 5

Date(s) Drilled	Logged By	Reviewed By
Drilling Method Geoprobe	Drill Bit Size/Type 2.3" O.D./ 1.7" I.D.	Total Depth of Borehole 100
Drill Rig Type Direct Push	Drilling Contractor Vironex	Approximate Surface Elevation 440
Sampling Method Acetate-lined drive sampler	Depth to Groundwater	
Borehole Backfill Bentonite Grout	Comments	

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	Unified Soil Classification	MATERIAL DESCRIPTION	Headspace, PID, ppm	Background, PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Type	Number							
0										
2										
4										
6										
8										
10										
12										
14										
16										
18										
20										
22										
24										



B&B
 600 S. Derby Street, Arvin, CA
 Eco-12-514

Log of Boring EB-1

Sheet 2 of 5

Date(s) Drilled	Logged By	Reviewed By
Drilling Method Geoprobe	Drill Bit Size/Type 2.3" O.D./ 1.7" I.D.	Total Depth of Borehole 100
Drill Rig Type Direct Push	Drilling Contractor Vironex	Approximate Surface Elevation 440
Sampling Method Acetate-lined drive sampler	Depth to Groundwater	
Borehole Backfill Bentonite Grout	Comments	

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	Unified Soil Classification	MATERIAL DESCRIPTION	Headspace, PID, ppm	Background, PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Type	Number							
24										
26										
28										
30										
32										
34										
36										
38										
40										
42										
44										
46										
48										



B&B
 600 S. Derby Street, Arvin, CA
 Eco-12-514

Log of Boring EB-1

Sheet 3 of 5

Date(s) Drilled	Logged By	Reviewed By
Drilling Method: Geoprobe	Drill Bit Size/Type: 2.3" O.D./ 1.7" I.D.	Total Depth of Borehole: 100
Drill Rig Type: Direct Push	Drilling Contractor: Vironex	Approximate Surface Elevation: 440
Sampling Method: Acetate-lined drive sampler	Depth to Groundwater	
Borehole Backfill: Bentonite Grout	Comments	

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	Unified Soil Classification	MATERIAL DESCRIPTION	Headspace, PID, ppm	Background, PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Type	Number							
48										
50										
52										
54										
56										
58										
60										
62										
64										
66										
68										
70										
72										



B&B
 600 S. Derby Street, Arvin, CA
 Eco-12-514

Log of Boring EB-1

Sheet 4 of 5

Date(s) Drilled	Logged By	Reviewed By
Drilling Method Geoprobe	Drill Bit Size/Type 2.3" O.D./ 1.7" I.D.	Total Depth of Borehole 100
Drill Rig Type Direct Push	Drilling Contractor Vironex	Approximate Surface Elevation 440
Sampling Method Acetate-lined drive sampler	Depth to Groundwater	
Borehole Backfill Bentonite Grout	Comments	

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	Unified Soil Classification	MATERIAL DESCRIPTION	Headspace, PID, ppm	Background, PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Type	Number							
72										
74										
76										
78										
80										
82										
84										
86										
88										
90										
92										
94										
96										



B&B
 600 S. Derby Street, Arvin, CA
 Eco-12-514

Log of Boring EB-1

Date(s) Drilled	Logged By	Reviewed By
Drilling Method Geoprobe	Drill Bit Size/Type 2.3" O.D./ 1.7" I.D.	Total Depth of Borehole 100
Drill Rig Type Direct Push	Drilling Contractor Vironex	Approximate Surface Elevation 440
Sampling Method Acetate-lined drive sampler	Depth to Groundwater	
Borehole Backfill Bentonite Grout	Comments	

Elevation, feet	Depth, feet	SAMPLES		Graphic Log	Unified Soil Classification	MATERIAL DESCRIPTION	Headspace, PID, ppm	Background, PID, ppm	Drilling Progress, 24-hour clock	REMARKS
		Type	Number							
96										
98										
100						Total Depth 100 Feet				

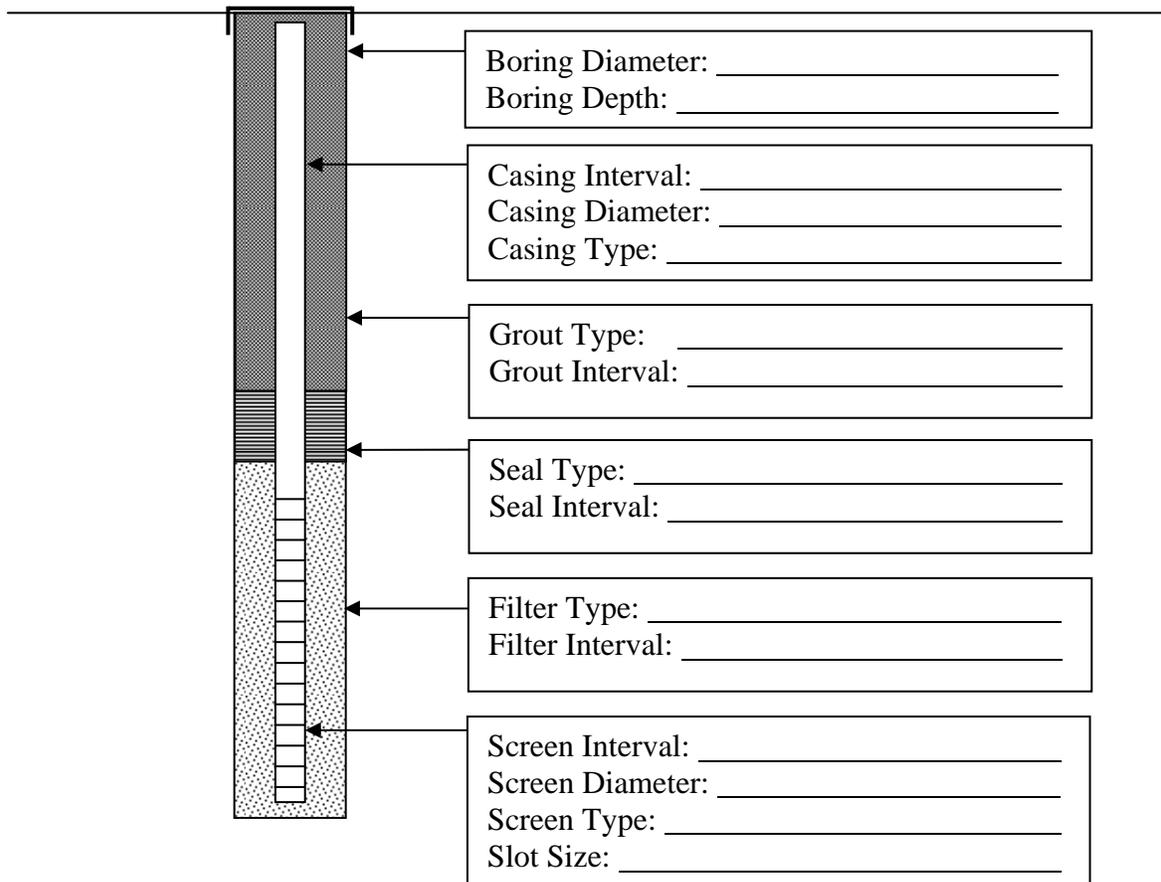
Project: Brown & Bryant Superfund Site
Project Location: 600 S. Derby Road, Arvin CA
Project Number: Eco-12-514

**MONITORING WELL
CONSTRUCTION DETAILS
FOR B-ZONE MONITORING
WELLS**

Well Location: Up-gradient B-zone Monitoring Wells

Method of Installation:

Notes:



APPENDIX B

SITE-SPECIFIC HEALTH AND SAFETY PLAN

SITE-SPECIFIC HEALTH AND SAFETY PLAN

**Brown and Bryant Superfund Site
Arvin, California**

**Prepared for:
US Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435**

**Prepared by:
Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, California 92867
Phone: (714) 289-0995
Fax: (714) 289-0965**



SITE-SPECIFIC HEALTH AND SAFETY PLAN

**Brown and Bryant Superfund Site
600 South Derby Street
Arvin, California 93203-1937
Project No. ECO-07-263**

Prepared for:

**US Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435**

Prepared by:

**Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, California 92867**



Mohammad Estiri, PhD
Project Director



Mitra Fiuzat, PhD
Project Manager

August 19, 2011

Project No. Eco-10-425

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ACTIVITY HAZARD ANALYSIS MATRIX

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- 1 SITE LOCATION MAP
- 2 HOSPITAL ROUTE

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- A CHEMICAL HAZARD SUMMARY INFORMATION
 - ACTIVITY HAZARD ANALYSIS MATRIX
 - 1,2-DICHLOROPROPANE (MSDS INFORMATION)

- 1,2,3-TRICHLOROPROPANE (MSDS INFORMATION)
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 - 1,2-DIBROMO-3-CHLOROPROPANE
 - 1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)
 - 1,3-DICHLOROPROPANE
 - DINOSEB
- B** HEALTH AND SAFETY COMPLIANCE AGREEMENT
- C** ACCIDENT INVESTIGATION REPORT (ENG FORM 3394)

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

1.0 PURPOSE AND POLICY

The purpose of this site-specific health and safety plan (HSP) is to provide a document that establishes personnel protection standards and mandatory safety practices for all field work conducted at Operable Unit No. 2 (OU2) at the Brown & Bryant (B&B) Superfund Site in Arvin, California (site, Figure 1). The HSP will also provide for contingencies that may arise during field investigations and operations. The provisions of this HSP are mandatory for all onsite investigations. All personnel shall abide by this HSP. Any supplemental plans used by subcontractors shall conform to this HSP as a minimum. All personnel who engage in field investigation activities shall be familiar with this HSP and comply with its requirements. A tailgate safety meeting will be conducted prior to initiating field operations and at least weekly thereafter. In addition, all personnel working on this project shall follow the U.S. Army Corps of Engineers' (USACE) *Safety & Health Requirements Manual (EM385-1-1)* as applicable (USACE, 2003).

This document is presented in the following format.

- Section 1 – Purpose and Policy
- Section 2 – Objectives
- Section 3 – Anticipated Field Activities
- Section 4 – Project Team Organization
- Section 5 – Training and Medical Monitoring Requirements
- Section 6 – Safety and Health Risk Analysis
- Section 7 – Emergency Response Plan
- Section 8 – Personal Protective Equipment
- Section 9 – Air Monitoring
- Section 10 – Decontamination Procedures
- Section 11 – References

In addition, the following documents are included with this plan:

- Activity Hazard Analysis Matrix
- Figure 1 – Site Location Map
- Figure 2 – Hospital Route
- Appendix A – Chemical Hazard Summary Information
- 1,2-Dichloropropane (1,2-DCP)
- 1,2,3-Trichloropropane (TCP)
- Chloroform
- 1,2-Dibromo-3-Chloropropane (DBCP)
- 1,2-Dibromoethane (Ethylene Dibromide [EDB])
- 1,3-Dichloropropane (1,3-DCP)
- Dinoseb
- Appendix B – Health and Safety Compliance Agreement
- Appendix C – Accident Investigation Report (ENG Form 3394)

2.0 OBJECTIVE

The primary objective is groundwater sampling from monitoring wells that are installed at or around the B&B Superfund Site. The purpose of the sampling is to determine the presence and measure the COC concentrations in groundwater in both the A- and B-zones (aquifers) beneath the Site and the adjoining properties to the south.

3.0 ANTICIPATED FIELD ACTIVITIES

Anticipated field activities include the following:

- Field reconnaissance of existing wells
- Well purging and development
- Groundwater sampling

The Activity Hazard Analysis Matrix accompanying this HSP presents the breakdown of hazards anticipated with each specific work activity listed above.

4.0 PROJECT TEAM ORGANIZATION

Personnel responsible for project safety are the Corporate Health and Safety Officer, the Project Director, and the Site Health and Safety Coordinator. The personnel assigned to this project are as follows:

- Project Director – Dr. Mohammad Estiri
- Corporate Health and Safety Officer – Mr. Hsin H. Chou, CIH, REA

- Site Health and Safety Officer & Project Geologist – Mr. Quin Kinnebrew, RG or designee
- Project Manager – Dr. Mitra Fiuzat
- Team members – Will be designated at the time of fieldwork
- Subcontractor and third parties - Will be designated at the time of fieldwork

All field personnel involved in hazardous waste operations (HAZWOPER) will have successfully completed 40 hours of HAZWOPER training and/or a current 8-hour HAZWOPER refresher.

4.1 CORPORATE HEALTH AND SAFETY OFFICER

The Corporate Health and Safety Officer is responsible for delivering the HSP and any addenda to the Project Director and advising the Project Director and Site Health and Safety Coordinator on health and safety matters. He has the authority to audit compliance with the provisions of this plan, suspend work or modify work practices for health and safety reasons, and dismiss from the site (with written notice to the Project Director) individuals whose onsite conduct is judged not to comply with the provisions of this HSP and/or endangers the health and/or safety of others.

4.2 PROJECT DIRECTOR

The Project Director has overall project responsibility for development, coordination, and implementation of the project workplan in a safe manner, and is the central point of contact with regulatory agencies and USACE. The Project Director is responsible for implementing the tasks of the workplan and the HSP, as well as supervising the field team members. In addition, he is responsible for consulting with the Corporate Health and Safety Officer and Site Health and Safety Coordinator regarding any changes that may affect the health and/or safety of the field team members.

4.3 SITE HEALTH AND SAFETY COORDINATOR

The Site Health and Safety Coordinator is responsible for ensuring compliance with all aspects of the HSP including health and safety procedures for work sites, field training, exposure monitoring, personal protective equipment (PPE) and clothing, audits, and consulting with health and safety representatives regarding the HSP.

4.4 FIELD TEAM MEMBERS

Field team members are responsible for understanding and adhering to this HSP. All team members will also be alert to any unsafe conditions or practices that may affect their own safety. Serious safety deficiencies will be communicated to the Site Health and Safety Coordinator. If a team member's health and/or safety is threatened by the activities of others or by changes in site conditions, the Site Health and Safety Coordinator or Corporate Health and Safety Officer shall be contacted immediately.

4.5 SUBCONTRACTORS AND THIRD PARTIES

All equipment operators, laborers, and other parties contracted by Eco will be responsible for understanding and complying with all site safety requirements. The contractors will maintain overall responsibility for site safety, air monitoring, decontamination, and hygiene for their employees and/or subcontractors as required by laws and regulations. Contractors will adhere to this HSP and applicable laws and regulations for this project. Where conflicts are encountered between laws, regulations, and this HSP, the most stringent requirement to protect the public and workers shall be used.

Contractors and third parties engaged in work at this site will be required to provide their own work equipment and personal protective gear. Employees of contractors conducting hazardous waste operations will also be required to provide documentation that they have participated in an employer-sponsored medical surveillance program and that they have completed the required Occupational Safety and Health Administration (OSHA) 40-hour training program (and the annual refresher course, if appropriate) prior to working on the project.

5.0 TRAINING AND MEDICAL MONITORING REQUIREMENTS

All field team members shall have 40-hour OSHA training as specified in Title 29 Code of Federal Regulations (CFR) Section 1910.120 (29 CFR 1910.120) and a current 8-hour annual refresher course as applicable. All field team members shall be on appropriate and current medical monitoring programs and approved by the medical physician to conduct the fieldwork. At least one onsite worker shall have training in cardiopulmonary resuscitation (CPR) and first-aid. Field team personnel shall be familiar with the use of monitoring equipment.

6.0 SAFETY AND HEALTH RISK ANALYSIS

Major health and safety concerns at the site are related to chemical, physical, biological and weather condition hazards. The Activity Hazard Analysis Matrix accompanying this HSP presents the breakdown of hazards anticipated with each specific work activity listed above.

6.1 CHEMICAL HAZARDS

The chemicals of concern (COCs) at the site are 1,2-DCP, TCP, chloroform, DBCP, EDB, 1,3-DCP, and Dinoseb. A summary of hazards associated with the COCs is presented in Appendix A. The information in Appendix A was obtained from the respective Material Safety Data Sheets (MSDSs) or International Chemical Safety Cards.

If compounds other than those specified above are discovered at this site (e.g., heavy metals), the HSP will be amended, pertinent information about the compounds will be provided in the Activity Hazard Analysis Matrix, and an appropriate risk analysis of the compound's hazards will be communicated to the onsite employees.

6.1.1 INHALATION EXPOSURE

The airborne concentrations encountered during field activities are unlikely to exceed currently published exposure limits for the seven COCs (listed in Appendix A) when proper drilling, sampling, and removal techniques are used. Eco personnel are trained in the proper techniques and have experience in conducting a variety of hazardous material work activities. Therefore, it is unlikely that personnel will be exposed to airborne concentrations above exposure limits of seven COCs. However, appropriate respirators will be used as deemed necessary by Eco personnel or as specified in this HSP.

6.1.2 DERMAL EXPOSURE

Repeated daily or prolonged contact with various chemical compounds can irritate the eyes and/or skin. Certain compounds are readily absorbed through skin and can cause systemic poisoning. However, contact of sufficient duration with chemicals on this project is judged to be unlikely with proper training and skin protection (i.e., gloves and full-body suits). All personnel are required to wear nitrile gloves and full-body suits when handling potentially hazardous materials/waste at the site.

Direct skin contact with chemical compounds can be mitigated by washing hands and other parts of the body in contact with the materials with soap and water and rinsing thoroughly. The washing is required at the beginning and end of the shift, during any break and any time skin comes in contact with chemical compounds.

6.1.3 INGESTION EXPOSURE

The potential for ingestion exposure is judged to be low for this project. No eating, drinking, or smoking will be allowed in the work zone. As noted earlier, all personnel are required to wash their hands at the beginning and end of the work shift, during breaks, and at any time the hands come in contact with chemical compounds.

6.2 PHYSICAL HAZARDS

Physical hazards are generally associated with work in confined spaces; work in and around excavations, sumps, and pits; work around heavy equipment; and work on elevated areas (e.g., hoists, ladders, tanks). The potential physical hazards for this project include the following:

- Activity
- Electrical
- Noise
- Heat stress
- Cold stress

6.2.1 ACTIVITY HAZARDS

The principal types of activity hazards expected to be encountered during this operation include the potential for slips, trips, falls, and adverse contact with tools and equipment. The PPE used shall be non-slipping type to prevent slips and adverse contact with tools. All personnel shall be alert to their surroundings to prevent trips, falls, and adverse contact with equipment at the site.

Activity hazards at the site can be categorized into three types: work conducted at ground level, work conducted above ground level, and confined space.

6.2.1.1 Work Conducted at Ground Level

The experience of personnel from Eco with this type of work and equipment, as well as adherence to the procedures outlined in this HSP, will minimize potential safety hazards in this category. In addition, use of the PPE listed in Section 8.0, which is required to be present at the site for use by personnel, will help to minimize the potential for injury.

6.2.1.2 Work Conducted Above Ground Level

No potential work above ground level (AGL) is anticipated. However, if required, full body harnesses and lifelines shall be used whenever working 6 feet AGL or higher without guardrails. Lifelines shall be attached to the anchors or other secured structures prior to initiating any work requiring harnesses and lifelines.

6.2.1.3 Confined Space

No potential work in confined spaces is anticipated. At this time, no one (neither Eco personnel nor its subcontractors) will be permitted to enter any tank or other potentially confined space at this site under this HSP. If fieldwork requires confined space entry, then a confined space entry plan will be prepared to supplement this HSP.

6.2.2 ELECTRICAL HAZARDS

Contact with electrical current can cause shock and electrical burns, and can be instantly fatal. The potential for exposure to electrical current exists through contact with electrical tools or equipment, generators and electrical control equipment, and overhead and underground powerlines. Care must be taken to avoid contact with sources of electricity. Work shall cease if lightning is observed or expected to occur.

Frayed electrical cords or electrical cords with damaged plugs shall not be used. Electrical cords shall not be used near water. If an individual is injured and in contact with power lines, rescue will be attempted with extreme caution as follows:

- If a rescue is attempted, rescuers will use a long, dry, unpainted piece of wood or a long, dry, clean rope. Rescuers will keep as far away from the victim as possible and not touch the victim until he/she is completely clear of nearby equipment or electrical lines.

- When the victim is completely clear of the electrical source but is unconscious and a heartbeat (pulse) cannot be detected, CPR will be initiated immediately and emergency response personnel contacted.

6.2.2.1 Underground Utilities

There is no underground excavation or exploration contemplated as part of the workplan activities. Groundwater sampling is to be conducted at existing monitoring wells. There are no underground utilities associated with the activities of groundwater sampling.

6.2.2.2 Overhead Power Lines

The subcontractors' field supervisors and operators shall take necessary precautions for implementing safe work practices under energized power lines. General minimum clearance requirements for energized overhead high-voltage conductors are presented in Table 1.

**TABLE 1
GENERAL CLEARANCES REQUIRED FROM
ENERGIZED OVERHEAD HIGH-VOLTAGE CONDUCTORS**

NOMINAL VOLTAGE (PHASE TO PHASE)	MINIMUM REQUIRED CLEARANCE (FEET)
600 to 50,000	6
Over 50,000 to 345,000	10
Over 345,000 to 750,000	16
Over 750,000 to 1,000,000	20

Minimum clearance requirements for the erection, operation, or dismantling of any boom-type lifting of hoisting equipment are presented in Table 2.

**TABLE 2
BOOM-TYPE LIFTING OR HOISTING EQUIPMENT
CLEARANCES REQUIRED FROM ENERGIZED
OVERHEAD HIGH-VOLTAGE LINES**

NOMINAL VOLTAGE (PHASE TO PHASE)	MINIMUM REQUIRED CLEARANCE (FEET)
600 to 50,000	10
Over 50,000 to 75,000	11
Over 75,000 to 125,000	13
Over 125,000 to 175,000	15

NOMINAL VOLTAGE (PHASE TO PHASE)	MINIMUM REQUIRED CLEARANCE (FEET)
Over 175,000 to 250,000	17
Over 250,000 to 370,000	21
Over 370,000 to 550,000	27
Over 550,000 to 1,000,000	42

6.2.3 NOISE

Noise is defined as unwanted sound in the form of vibration conducted through liquids, solids, or gases. The effects of noise on humans include psychological effects (e.g., interference with communication by speech, job performance, and safety) and physiological damage (e.g., hearing loss). Of these, the most debilitating is hearing loss. Permissible exposure limits (PELs) for noise are given in Table 3.

**TABLE 3
PERMISSIBLE EXPOSURE LIMITS FOR NOISE**

DURATION (PER DAY)	MEASUREMENT (dBA)
8 hours	90
6 hours	92
4 hours	95
3 hours	97
2 hours	100
1.5 hours	102
1 hours	105
30 minutes	110
15 minutes	115

dBA = decibels on an A-rated scale

Factors that affect the degree and extent of hearing loss are intensity or loudness of the noise, type of noise, period of exposure each day, total work duration, and distance from the source.

There is no potential for loud noise during the sampling activities at groundwater monitoring wells. Prolonged exposure to noise exceeding the PELs is not likely.

6.2.4 HEAT STRESS

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury. Of particular importance is heat stress, resulting when protective clothing decreases natural body ventilation. Heat stress can occur even when temperatures are moderate. All personnel are encouraged to take as many breaks as needed to accommodate the workload and weather conditions.

One or more of the following recommendations will help reduce heat stress:

- Availability of plenty of liquids
- Availability of cooling devices, if necessary, to aid natural body ventilation
- As necessary, use of long cotton underwear, which acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing
- Installation of mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing
- In extremely hot weather, conduct of nonemergency response operations in the early morning or evening
- Availability of adequate shelter to protect personnel against heat, cold, rain, snow, or other adverse weather conditions that decrease physical efficiency and increase the probability of accidents
- In hot weather, rotation of workers wearing protective clothing
- Good hygienic standards, including frequent change of clothing and daily showering. Clothing will be permitted to dry during rest periods. Workers who notice skin problems will immediately consult medical personnel.

6.2.4.1 Effects of Heat Stress

If the body's physiological processes fail to maintain normal body temperature because of excessive heat, a number of physical reactions can occur. Such reactions can range from mild (e.g., fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to death. Medical help must be obtained for the more serious cases of heat stress.

6.2.4.2 Heat-Related Problems

Heat-related problems include the following:

- **Heat Rash** – Caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Decreases ability to tolerate heat as well as being a nuisance.
- **Heat Cramps** – Caused by profuse perspiration with inadequate fluid intake and chemical replacement (especially salts). Signs include muscle spasm and pain in the extremities and abdomen.

- **Heat Exhaustion** – Caused by increased stress on various organs to meet increased demands to cool the body. Signs include shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness and lassitude.
- **Heat Stroke** – The most severe form of heat stress. The body must be cooled immediately to prevent severe injury and/or death. Signs include red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; and possibly coma. Medical help must be obtained immediately.

6.2.4.3 Heat Stress Monitoring

Monitoring of personnel wearing impervious clothing will begin when the ambient temperature is 70°F or greater. Table 4 presents the suggested frequency for such monitoring. Monitoring frequency will increase as the ambient temperature increases or as slow recovery rates are observed. Heat stress monitoring will be performed by a person with current first-aid certification and who is trained to recognize heat stress symptoms.

**TABLE 4
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING
FOR ACCLIMATIZED WORKERS¹**

ADJUSTED TEMPERATURE ²	NORAMAL WORK ENSEMBLE ³	IMPERMEABLE ENSEMBLE
90°F or above (32°C) ⁴	After each 45 minutes of work	After each 15 minutes of work
87.5° - 90°F (30.8° - 32.2°C)	After each 60 minutes of work	After each 60 minutes of work
82.5° - 87.5°F (23.1° - 30.8°C)	After each 90 minutes of work	After each 90 minutes of work
77.5° - 82.5°F (25.3° - 28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5° - 25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Notes:

1. For work levels of 250 kilocalories/hour.
2. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat.
3. Estimate percent sunshine by judging what percent of time the sun is not covered by clouds that are thick enough to produce a shadow (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows).
4. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and trousers.
5. °F = degrees Fahrenheit; °C = degrees Celsius

To monitor the body's recuperative abilities from excess heat, one or more of the following techniques can be used:

- To monitor the worker, measure heart rate by counting the radial pulse during a 30-second period as early as possible during the rest period.
- If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and maintain the same rest period. Continue reducing work cycle by one-third until heart rate is less than 110 beats per minute.

- Use a clinical thermometer (3 minutes under the tongue) or equivalent device to measure oral temperature at the end of the work period (before drinking).

If oral temperature exceeds 99.6 degrees Fahrenheit (°F) (37.6 degrees Celsius [°C]), reduce the next work cycle by one-third without changing the rest period.

If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, reduce the next work cycle by one-third. Continued reducing work cycle by one-third until temperature is less than 99.6°F (37.6°C).

- Do not permit workers to wear semi-permeable or impermeable garments when oral temperature exceeds 100.6°F (38.1°C).

Other methods for heat stress monitoring, such as the wet bulb globe temperature (WBGT) index from the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) booklet, may be used (ACGIH, 1999).

6.2.5 COLD STRESS

Persons working outdoors in temperatures at or below freezing may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause either severe injury via freezing exposed body surfaces (frostbite) or profound generalized cooling, possibly causing death. Areas of the body that have high surface-area-to-volume ratios (e.g., fingers, toes, and ears) are the most susceptible to frostbite.

Local injury resulting from cold is included in the generic term “frostbite.” There are several degrees of damage. Frostbite can be categorized as follows:

- **Frost Nip or Incipient Frostbite** – Characterized by sudden blanching or whitening of skin.
- **Superficial Frostbite** – Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- **Deep Frostbite** – Tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages: (1) shivering; (2) apathy, listlessness, and (sometimes) rapid cooling of the body to less than 95°F; (3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; (4) freezing of the extremities; and (5) death.

All personnel are required to wear sufficient clothing and gloves to prevent cold stress.

6.3 BIOLOGICAL HAZARDS

Biological hazards are any virus, bacteria, fungus, parasite, or living organism that can cause a disease in human beings. Such hazards can be a part of the total environment or associated with certain occupations. Diseases transmitted from animals to humans are common. Infectious and parasitic diseases can also result from exposure to contaminated water, sewage, insects, infected people, or infected animals.

6.3.1 SEWAGE

Raw sewage exposure is not anticipated on this project. However, field personnel will minimize direct skin contact with potentially hazardous materials/waste by washing hands and other parts of the body in contact with questionable materials with soap and water and rinsing thoroughly. Washing is required at the beginning and end of the shift, during any break, and any time skin comes in contact with these substances. Good personal hygiene is a must on this project.

6.3.2 POISONOUS INSECTS, ARACHNIDS, PLANTS, AND ANIMALS

Contact with insects, arachnids, plants, and animals present at the site will be avoided. Poisonous inhabitants, such as snakes, spiders, scorpions, and insects, may be present at the site. Before beginning fieldwork each day, the work area will be observed for the potential presence of these inhabitants, and measures taken to minimize potential for contact with these elements. All personnel are instructed to stay away from these inhabitants.

Snakebites can be dangerous. All snakebites will initially be treated as if they are poisonous. The effect of a poisonous bite depends on size of the victim, location of the bite, and amount of venom injected. The victim will be transported to an appropriate facility for immediate medical attention.

Stinging and biting insects/arachnids—including bees, spiders, scorpions, and ticks—may be present. Insect repellent may be used to discourage insect contact with skin. Insect/arachnid bites are generally not dangerous unless they are from a black widow spider, a brown recluse (“fiddle-back”) spider, or a tick infected with Lyme disease. A victim of a bite will lie down and remain motionless; cold packs will be applied and medical attention sought immediately. If an individual is allergic to bee or wasp stings and is stung, immediate medical attention will be sought.

Signs of Lyme disease may appear within a few days or weeks after the bite of an infected tick. Infection may begin with a small red area at the bite site, which spreads to 5 to 7 inches (bull’s-eye appearance). The area may look black and blue in dark-skinned people. Rash symptoms may or may not occur. Flu-like symptoms (fever, headache, joint and muscle pain) may also occur. Lyme disease is a serious illness; individuals suspecting infection with Lyme disease will seek medical help.

Plants such as poison oak and ivy may be present at the site and can cause an allergic reaction and skin rash in some individuals. Specially prepared creams that act as a barrier on the skin for protection against poison oak and ivy are commercially available and may minimize the potential for development of skin rash if exposure occurs. If an individual is exposed to poison oak or ivy, he/she will wash the exposed area(s) thoroughly with soap and water immediately.

The major concern with animal bites and scratches is the potential for infection and/or rabies. Although rabies can be fatal, it takes a few days to develop. The victim will obtain medical attention quickly if an animal bite or scratch occurs. In the meantime, the wound will be scrubbed with soap and water, rinsed thoroughly under running water, dried off, and covered with a clean bandage.

Field personnel will avoid all contact with potential poisonous insects/arachnids, plants, and animals.

6.3.3 HANTAVIRUS

An outbreak of an unexplained illness has occurred in the southwestern region of the United States. Laboratory findings from the Centers for Disease Control and Prevention have shown that the illness is caused by Hantavirus. Available data indicate that the common deer mouse is the main host, but the virus can also be found in pinion mice, brush mice, and western chipmunks.

Human infection may occur when infective saliva or excreta are inhaled as aerosols produced directly from the animal. The rodents shed the virus in their urine, droppings and saliva. The virus is mainly transmitted to humans when they breathe in air contaminated with the virus. This happens when fresh rodent urine, droppings or nesting materials are stirred up. When tiny droplets containing the virus get into the air, this process is known as “aerosolization.”

Transmission may also occur when dried materials contaminated by rodent excreta are disturbed, directly introduced into broken skin, introduced into the eyes, or possibly ingested in contaminated food or water. Persons can also be infected after being bitten by rodents.

Symptoms of Hantavirus-associated disease include fever, muscle aches, headache, and cough, progressing rapidly to severe lung disease, often requiring intensive care treatment. All exposed personnel must seek medical attention within 45 days of the last potential exposure.

The following preventive measures will be used:

- Employees will assess the potential presence of rodents and the population size by looking for such signs as droppings, runways, nests, and/or gnawings around entrances.
- Any building, room, and/or area suspected of containing rodents/rodent droppings will be aired out prior to entering. All doors and windows will be opened to ventilate the building at least 30 to 45 minutes. Personnel will not remain inside during ventilation.
- In most cases, no PPE will be required outdoors and/or in open areas or in buildings that are ventilated as described above provided that rodents/rodent wastes are not handled or disturbed. As a general rule, PPE shall be worn when cleaning up rodent wastes in buildings or other confined areas. If deemed necessary by the Site Health and Safety Coordinator, Modified Level D PPE will be used in conjunction with a half-face, air-purifying respirator equipped with high-efficiency particulate air (HEPA) cartridges. Respirators and cartridges will be certified by the National Institute for Occupational Safety and Health (NIOSH).
- All rodent droppings, nesting materials, and other areas with evidence of rodent inhabitation will be sprayed with a 10% bleach solution or disinfectant

solution to kill the virus, if present, and reduce dust. After spraying, the wet material will be wiped up with paper towels. All debris, including any used PPE, will be double bagged prior to disposal.

- Any non-disposable PPE (except for respirator cartridges) will be disinfected with a bleach solution after use. Respirator cartridges will not be disinfected after use but will be changed and disposed of when they become difficult to breathe through.
- Floors of linoleum, wood, or concrete will be mopped with a detergent and disinfectant solution.
- Floors will only be vacuumed with vacuums equipped with HEPA filters.
- Dry sweeping shall not be used to clean up droppings from rodent infestations.

6.4 OTHER WEATHER CONDITION HAZARDS

Weather conditions may cause hazards other than heat and cold stress. These hazardous conditions may include the following:

- **Lightning and Thunderstorm** – When working outdoors, all work will be halted if lightning or a thunderstorm is observed and approaching.
- **Wind** – When working outdoors, all work will be stopped when:
 - wind speed exceeds 25 miles per hour (40 kilometers per hour);
 - potentially hazardous materials are being blown offsite;
 - visible dust is observed and may interfere with the fieldwork; and/or
 - based on the professional judgment of the Site Health and Safety Coordinator, the wind may pose a health and safety risk to the workers and/or the environment.
- **Light Rain (Drizzle or Sprinkling)** – Fieldwork may continue if the Site Health and Safety Coordinator judges that the rain does not pose a significant health and safety risk to workers and the environment.
- **Heavy Rain** – When working outdoors, work will be halted during heavy rain conditions.

7.0 EMERGENCY RESPONSE PLAN

All hazardous waste site activities present a degree of risk to onsite personnel. During routine operations, worker risk is minimized by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

Eco employees have participated in Red Cross CPR and first-aid courses (or equivalent courses) to enable them to more effectively handle physical and medical emergencies that may arise in the field. These trained personnel will perform CPR and first-aid; they shall be trained in accordance with 29 CFR 1910.1030. At least one CPR- and first-aid-trained person will be at the site during any sampling or construction work.

7.1 GUIDELINES FOR PRE-EMERGENCY PLANNING AND TRAINING

Employees and subcontractors must read this HSP and familiarize themselves with the information presented herein. Before project initiation, the field team will review the HSP and the emergency response plan contained herein (Section 7). Employees and subcontractors will be required to have a copy of the emergency contacts and telephone numbers immediately accessible onsite and to know the route to the nearest emergency medical services (Figure 2).

7.2 EMERGENCY RECOGNITION AND PREVENTION

Emergency conditions are considered to exist if any of the following occur:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while onsite
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated
- When working in or around areas with volatile organic compounds (VOCs), concentrations of organic vapors exceed 50 parts per million (ppm) (sustainable)
- Potential for dog, snake, or other poisonous animal bites or stings
- The lower explosive limit (LEL) exceeds 10 percent

Some ways of preventing emergency situations include the following:

- Field team members will remain close together to assist each other during emergencies.
- During continual operations, onsite workers will act as safety backup to each other, and offsite personnel will provide emergency assistance.
- All field team members will make use of all their senses to alert themselves to potentially dangerous situations, which they will avoid (e.g., presence of strong and irritating or nauseating odors).
- Personnel will practice unfamiliar operations before performing the actual procedure in the field.
- Field team members will be familiar with the physical characteristics of fieldwork, including:
 - Wind direction in relation to contamination zones;
 - Accessibility to associates, equipment, and vehicles;
 - Communications;
 - Hot zone(s) (area[s] of known or suspected contamination);
 - Site access;
 - Nearest water sources; and
 - Location of first-aid kit and HSP.

- Presence of personnel and equipment in the work area enclosure will be minimized, consistent with effective site operations.
- Work areas for various operational activities must be established.
- Will any member of the field crew experience any adverse effects or symptoms of exposure while onsite, or will organic vapors exceed the action limits stated in Section 9.0 of this HSP, the entire field crew shall immediately halt work and act according to instructions provided by the Site Health and Safety Coordinator.
- The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated will result in the evacuation of the field team and reevaluation of the hazard and the level of protection required.
- Will an accident occur, the Project Manager or Site Health and Safety Coordinator is responsible completing an accident investigation report (ENG Form 3394C). Follow-up action will be taken to correct the situation that caused the accident.

General emergency procedures and specific procedures for handling personal injury and chemical exposure are described in the following sections.

7.3 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION PROCEDURES DURING EMERGENCY

When an emergency occurs, decisive action is required. Rapidly made choices may have far-reaching, long-term consequences. Delays of minutes can create life-threatening situations. Personnel must be ready to respond to emergency situations immediately. All personnel will know their own responsibilities during an emergency, who is in charge during an emergency, and the extent of their authority. This section outlines personnel roles, lines of authority, and communication procedures during emergencies.

Should an emergency situation occur at the Site, the Site Health and Safety Coordinator will have the following duties:

- Assume total control and be responsible for on-site decision-making.
- Be responsible for coordinating all activities until emergency response teams (e.g., ambulance, fire department) arrive onsite.
- Ensure that the necessary personnel and agencies are contacted as soon as possible after an emergency occurs.

In addition, all onsite personnel must know the locations of the nearest telephone and the emergency contact number as presented in Section 7.9 of this HSP. In an event that Site Health and Safety Coordinator is incapacitated, then any onsite workers with CPR and first-aid training can and shall assume Site Health and Safety Coordinator's role. Once the role is assumed by a worker, he/she shall assume that role until relief by another trained personnel or by Corporate Health and Safety Officer.

7.4 EVACUATION ROUTES AND PROCEDURES, SAFE DISTANCES, AND PLACES OF REFUGE

Should emergency conditions occur, all onsite personnel shall evacuate the area as instructed, transport injured personnel, or take other measures to mitigate the situation. Evacuation routes and safe distances will be initially decided by the Site Health and Safety Coordinator until instructed otherwise by the emergency response teams (e.g., fire department, ambulance, police).

7.5 DECONTAMINATION OF PERSONNEL DURING AN EMERGENCY

Procedures for leaving a contaminated area must be planned and implemented prior to starting the field work. Work areas and decontamination procedures must be established based on expected site conditions. If a member of the field crew is exposed to chemicals, the emergency procedure outlined below will be followed:

- Another team member (buddy) will remove the victim from the immediate area of contamination.
- Precautions will be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the victim's clothing, the clothing will be removed if it is safe to do so.
- First-aid will be administered and the victim transported to the nearest medical facility, if necessary.

If uninjured employees are required to evacuate a contaminated area in an emergency situation, emergency decontamination procedures will be followed. At a minimum, these procedures would involve moving into a safe area and removing protective equipment. Care will be taken to minimize contamination of the safe area and personnel. Contaminated clothing will be placed in plastic garbage bags or other suitable containers. Employees will wash or shower as soon as possible.

7.6 EMERGENCY SITE SECURITY AND CONTROL

The Project Director or his designee at the Site (the Site Health and Safety Coordinator or alternative) must know who is on Site, and who is in the work area, during all working hours. All workers and visitors must sign in and sign out in the Daily Quality Control Report (daily log of project activities). This report will document the presence of workers and visitors at the work Site at all times.

In an emergency situation, Site Health and Safety Coordinator will define an exclusion zone. Only necessary rescue and response personnel will be allowed into the exclusion zone.

7.7 PROCEDURES FOR EMERGENCY MEDICAL TREATMENT AND FIRST-AID

7.7.1 CHEMICAL EXPOSURE TREATMENT

In the event of chemical exposure (e.g., skin contact, inhalation, ingestion), the following procedures will be implemented:

- Another team member (buddy) will remove the victim from the immediate area of contamination.
- Precautions will be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the victim's clothing, the clothing will be removed if it is safe to do so.
- If the chemical has contacted the skin, the skin will be washed with copious amounts of water, preferably under a shower.
- In case of eye contact, an emergency eyewash will be used. Eyes will be washed for at least 15 minutes.
- If necessary, the victim will be transported to the nearest hospital or medical center. If necessary, an ambulance will be called to transport the victim.

7.7.2 PERSONAL INJURY

In the event of personal injury, the following procedures will be implemented:

- Field team members trained in first-aid can administer treatment to an injured worker.
- The victim will be transported to the nearest hospital or medical center. If necessary, an ambulance will be called to transport the victim.
- The Project Manager or Site Health and Safety Coordinator are responsible for the completion of an accident investigation report (ENG Form 3394).

7.8 FIRE OR EXPLOSION

In the event of fire or explosion, personnel shall evacuate the area immediately, and qualified personnel shall administer necessary first-aid to injured employees. Personnel shall proceed to a safe area and telephone emergency support services (call 911, the local police station at (661) 854-5583 or the Fire Department at (661) 854-5517). Upon contacting emergency support services, the caller will state his/her name, nature of the hazard (e.g., fire, high combustible vapor levels), location of the incident, and whether there are any physical injuries requiring an ambulance. The caller will not hang up until emergency support services have all of the additional information they may require.

7.9 EMERGENCY CONTACT(S)

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) will be made from the list below. For emergency situations, telephone or radio contact will be made with the site point of contact or site emergency personnel who will then contact the appropriate response teams.

7.9.1 WORK SITE ADDRESS

Site Name: Brown & Bryant Superfund Site
Site Address: 600 South Derby Road, Arvin, California

Note:

The sampling location may not be on Site. Therefore, prior to starting any field activities, the Site Health and Safety Coordinator or designee shall determine and inform all personnel of the actual work location (in reference to the Site) and hospital locations.

7.9.2 U.S. ARMY CORPS OF ENGINEERS

Primary Contact:

Ms. Cecelia Horner, PE
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435

(505) 342-3474 Office
(505) 681-2955 Mobile

Alternate1:

Richard S. Lainhart
Los Angeles District
645 North Durfee Avenue
South El Monte, CA 91733

(626) 401-4094 Office
(951) 316-0430 Mobile

Alternate 2:

Mr. Thad Fukushige
Los Angeles District
645 North Durfee Avenue
South El Monte, CA 91733
(626) 401-4048 Office
(626) 278-0325 Mobile

7.9.3 ECO & ASSOCIATES, INC., CONTACTS

Primary Contact:

Mohammad Estiri, Ph.D.,
Project Director
1855 W. Katella Avenue, Suite 340
Orange, CA 92867
(714) 289-0995 Office
(714) 325-9237 Mobile

Alternate 1:

Quin Kinnebrew, Site Health and Safety Coordinator
1855 W. Katella Avenue Suite 340
Orange, CA 92867
(714) 289-0995 Office
(714) 315-5354 Mobile

Alternate 2:

Mitra Fiuzat, Project Manager
1855 W. Katella Avenue Suite 340
Orange, CA 92867
(714) 289-0995 Office
(714) 325-6371 Mobile

7.9.4 HOSPITAL

The hospital is located approximately 10 miles of driving distance from the site. Figure 2 in this HSP shows the route from the site to the hospital.

Kern Medical Center
1830 Flower Street
Bakersfield, CA 93305
(661) 326-2000

7.9.5 EMERGENCY SERVICES

Fire Department	911
Police/Sheriff's Department	911
Paramedics	911

In case the 911 services are overloaded and cannot promptly respond to a site emergency, the following backup emergency services telephone numbers may be used:

Local Fire Department	(661) 854-5517
-----------------------	----------------

Local Police/Sheriff Department (661) 854-5583

8.0 PERSONAL PROTECTIVE EQUIPMENT

It is Eco's policy not to conduct any work that would require Level A protection. The project-specific PPE and the equipment and activities that define Levels B, C, and D are presented in the following sections. Although Levels B and C are described, it is highly unlikely that these levels of protection will be used during sampling activities at groundwater monitoring wells. Work will be started at Level B PPE and is expected to be completed at Level B protection. The conditions that may require a change are indicated.

8.1 PROJECT SPECIFIC PERSONAL PROTECTIVE EQUIPMENT

The potential safety and health risks/hazards/exposures mentioned described in Section 6.0 will be reviewed with onsite personnel prior to initiating fieldwork. Based on evaluation of potential risks/hazards/exposures, all aspects of the project would have an initial designated protection of Level D PPE. However, if respiratory protection is required based on observed site conditions and/or monitoring results, then only NIOSH-approved respirators and organic vapor cartridges will be used on this project.

8.2 LEVEL D ACTIVITIES

At a minimum, Level D PPE will be used. Level D PPE will consist of the following:

- Hard hat
- Steel-toed shoes or shank rubber boots (non-slip type)
- Work cloth
- Safety glasses (splash) within 20 feet of drilling activities
- Neoprene or nitrile gloves (non-slip type) when handling soil, water, or groundwater
- Full-body harnesses and lifelines when working above 6 feet without guardrails

The following procedures for Level D activities will be implemented:

- All personnel involved in Level D activities will be trained by experienced personnel in the appropriate use of the equipment, decontamination procedures, and emergency procedures, and be provided other applicable information prior to the commencement of activities.
- At least two people are required to be onsite during the fieldwork.
- Work zones will be delineated according to prevailing winds, anticipated levels of contaminants in the workers' breathing zone, and results obtained from air monitoring activities.
- Appropriate personnel decontamination areas and site-specific procedures will be established.
- Saranex[®] or Tyvek[®] coveralls and respirators will be available onsite and used as directed by the Site Health and Safety Coordinator.

8.3 LEVEL C ACTIVITIES

Level C PPE shall be used under the following conditions:

- If organic vapor levels in the workers' breathing zone cannot be maintained below 20 ppm (multiplied by the instrument's relative response) with mitigation measures.

In addition to confined space retrieval equipment, Level C PPE will consist of the following:

- Full-face or half-face air-purifying respirators (with organic vapor/acid gas cartridges and/or HEPA cartridges)
- Hard hat
- Steel-toed shoes or shank rubber boots (non-slip type)
- Appropriate disposable coveralls (chemical-resistant) taped around the respirator mask, ankles, and wrists
- Safety glasses (splash) within 20 feet of drilling activities
- Neoprene or nitrile gloves (non-slip type) when handling soil, water, or groundwater
- Radio communication
- Local supply air ventilation
- Full-body harnesses and lifelines when working above 6 feet without guardrails

The following procedures for Level C activities will be implemented:

- All personnel involved in Level C activities will be trained by experienced personnel in the appropriate use of the equipment, decontamination procedures, and emergency procedures, and be provided other applicable information prior to the commencement of activities.
- At least two people are required to be onsite during the fieldwork.
- Work zones will be delineated according to prevailing winds, anticipated levels of organic vapors in the workers' breathing zone, and results obtained from air monitoring activities.
- Appropriate personnel decontamination areas and site-specific procedures will be established.

8.4 LEVEL B ACTIVITIES

Field activities will stop temporarily and Level B PPE shall be used under the following conditions:

- If organic vapor levels in the workers' breathing zone cannot be maintained at or below 50 ppm (multiplied by the instrument's relative response) with mitigation measures.

In addition to confined space retrieval equipment, Level B PPE will consist of the following:

- Self-contained breathing apparatus (SCBA) or airline respirators with a cascade system and a 5-minute escape pack, preferably with radio communication
- Appropriate disposable coveralls (chemical-resistant) taped around the respirator mask, ankles, and wrists
- All Level C gear
- Certified Grade D Level breathing air to be used at all times (support personnel will have available 30-minute SCBAs in the event of an emergency)

The following procedures for Level B activities will be implemented:

- All personnel involved in Level B activities will be trained by experienced personnel in the appropriate use of the equipment, decontamination procedures, and emergency procedures, and be provided other applicable information prior to the commencement of field activities.
- An adequate number of personnel will be onsite to provide for a buddy system and support personnel (a minimum of one person outside the contamination reduction zone is required).
- Work zones will be delineated according to prevailing winds, anticipated levels of organic vapors in the workers' breathing zone, and results obtained from air monitoring activities.
- Appropriate personnel decontamination areas and site-specific procedures will be established.

8.5 ADDITIONAL EQUIPMENT NEEDS

The field team will have the following items readily available:

- Copy of this HSP, including list of emergency contacts
- Soap
- First-aid kit
- Eyewash bottle
- Paper towels
- Duct tape
- Water
- Plastic garbage bags
- Resuscitation devices
- Temperature gauge
- Respirator with appropriate filter cartridges
- Earplugs

9.0 AIR MONITORING

The purpose of air monitoring is to identify and quantify airborne contaminants in order to verify and determine the level of worker protection needed.

If used, real-time sampling instruments will be calibrated and used in accordance with manufacturers' instructions. Direct-reading instrument calibration will be verified and documented before and after use (when necessary).

Time-weighted average (TWA) sampling, analytical, and calibration protocols will follow appropriate OSHA and/or NIOSH protocols for personal sampling. All personal sampling pumps will be calibrated before and after each sampling period in accordance with manufacturers' instructions and OSHA and/or NIOSH methods.

9.1 COMBUSTIBLE GAS AND OXYGEN MONITORING

Because the groundwater and soil sampling work will be conducted in an open (ambient) area, it is judged that a combustible gas and oxygen (CGI/O₂) meter will not be required.

9.2 VOLATILE ORGANIC COMPOUND MONITORING

High concentrations of VOCs are not anticipated to be present at the site. Air monitoring for VOCs is not required during site activities. However, if actual site conditions differ from anticipated conditions, then monitoring will be performed and action levels checked as deemed necessary by the Site Health and Safety Coordinator.

A flame ionization and/or photo-ionization detector (FID/PID) will be used to monitor the potential presence of VOCs:

- When evaluating work site conditions or any other area of suspected heavy organic contamination;
- Prior to initiation of any activities using spark-or flame-producing equipment; and
- During drilling and soil and groundwater sampling activities.

Table 5 below shows action limits pertaining to values within the work zone.

**TABLE 5
VOLATILE ORGANIC COMPOUND ACTION LIMITS**

PID/FID READINGS	LEVEL OF PROTECTION AND ACTION
Background to 5 ppm above background	Level D
5 to 20 ppm above background (sustainable)	Modified Level D (Level D with NIOSH-approved respiratory)

PID/FID READINGS	LEVEL OF PROTECTION AND ACTION
	protection and full-body coveralls)
>20 to 50 ppm above background (sustainable)	Level C (Institute engineering controls and start personal monitoring)
>50 ppm to 100 ppm above background	Level B (Institute engineering controls and start personal monitoring)
> 100 ppm above background	Stop work: Evaluate source and mitigation measures.

Notes:

1. Action limits will be multiplied by the relative response of the instrument to give the instrument action limit.
2. When a specific contaminant is expected or known to be present, the appropriate Dräger tube will be used.
3. PID = Photo-ionization detector; FID = flame ionization detector; ppm = parts per million; NIOSH = National Institute for Occupational Safety and Health

10.0 DECONTAMINATION PROCEDURES

10.1 PERSONNEL DECONTAMINATION

An exclusion zone, a contamination reduction zone, and a support zone will be established by the Site Health and Safety Coordinator at each drilling location and/or field operation. Defined ingress and egress points will be established, and personnel will enter and exit only through these points.

This procedure may be modified somewhat by the Site Health and Safety Coordinator, if necessary. The contamination reduction zone will include provisions for collecting disposable protective equipment in garbage bags; washing boots, gloves, Saranex® or Tyvek® (if used), field instruments, and tools; and washing hands, face, and other exposed body parts. Onsite personnel shall shower upon return to their hotel or homes at the end of the workday. Refuse from decontamination and PPE shall be disposed of by Eco or its subcontractor(s).

Decontamination equipment will include the following:

- Plastic buckets and pails
- Scrub brushes and long-handled brushes
- Detergent
- Containers of water
- Paper towels
- Plastic garbage bags
- Distilled water

10.2 EQUIPMENT DECONTAMINATION

All sampling equipment shall be decontaminated prior to initial usage and between each sampling event/location. Equipment shall be washed with detergent or equivalent and triple rinsed.

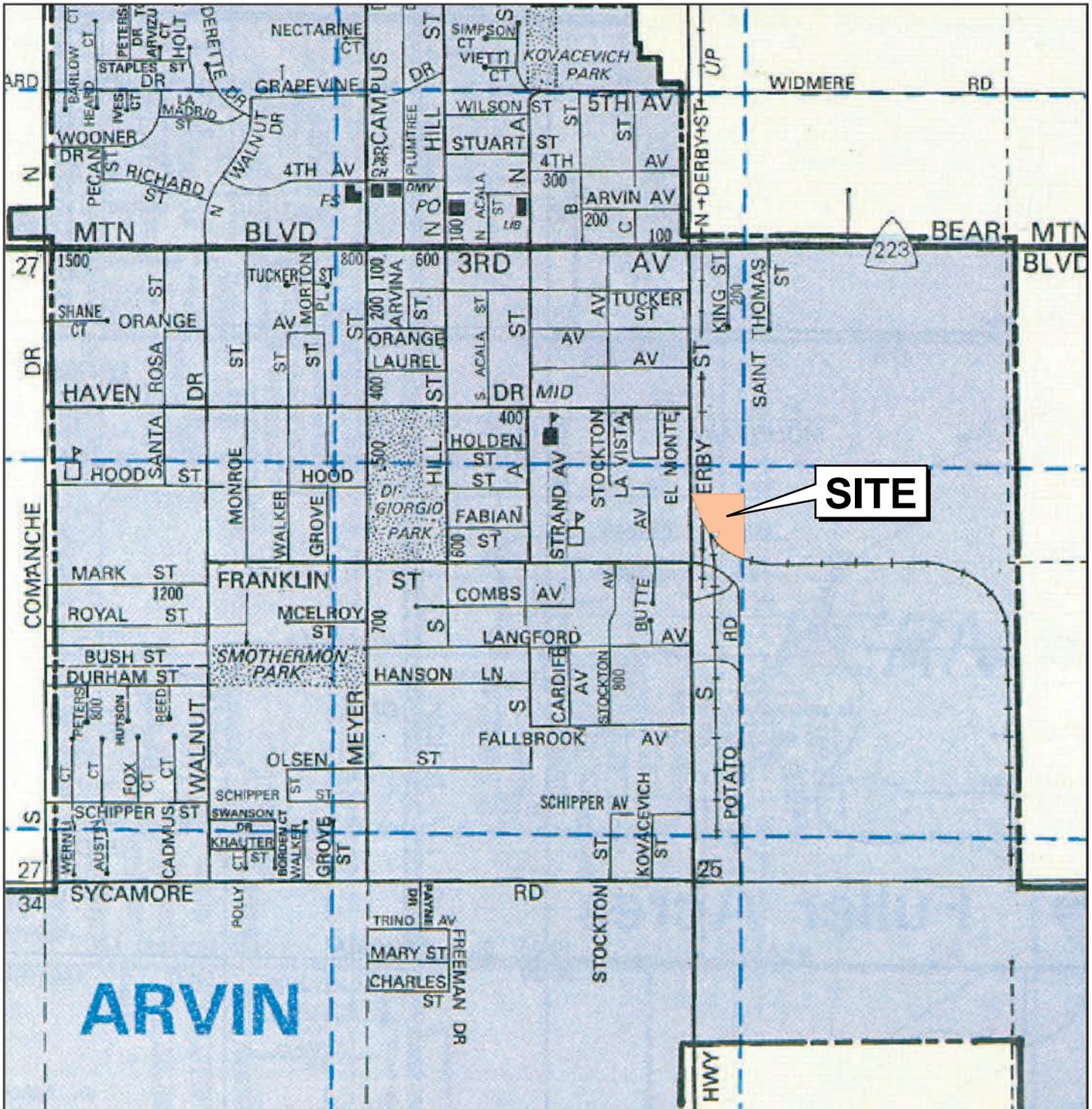
11.0 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH), 1999. *1999 TLVs and BEIs, Threshold Limit Value for Chemical Substances and Physical Agents and Biological Exposure Indices*.

U.S. Army Corps of Engineers (USACE), 1992. *Safety and Health Requirements Manual, EM 385-1-1*, October 1992.

*GROUNDWATER SAMPLING AND ANALYSIS – HEALTH AND
SAFETY PLAN*

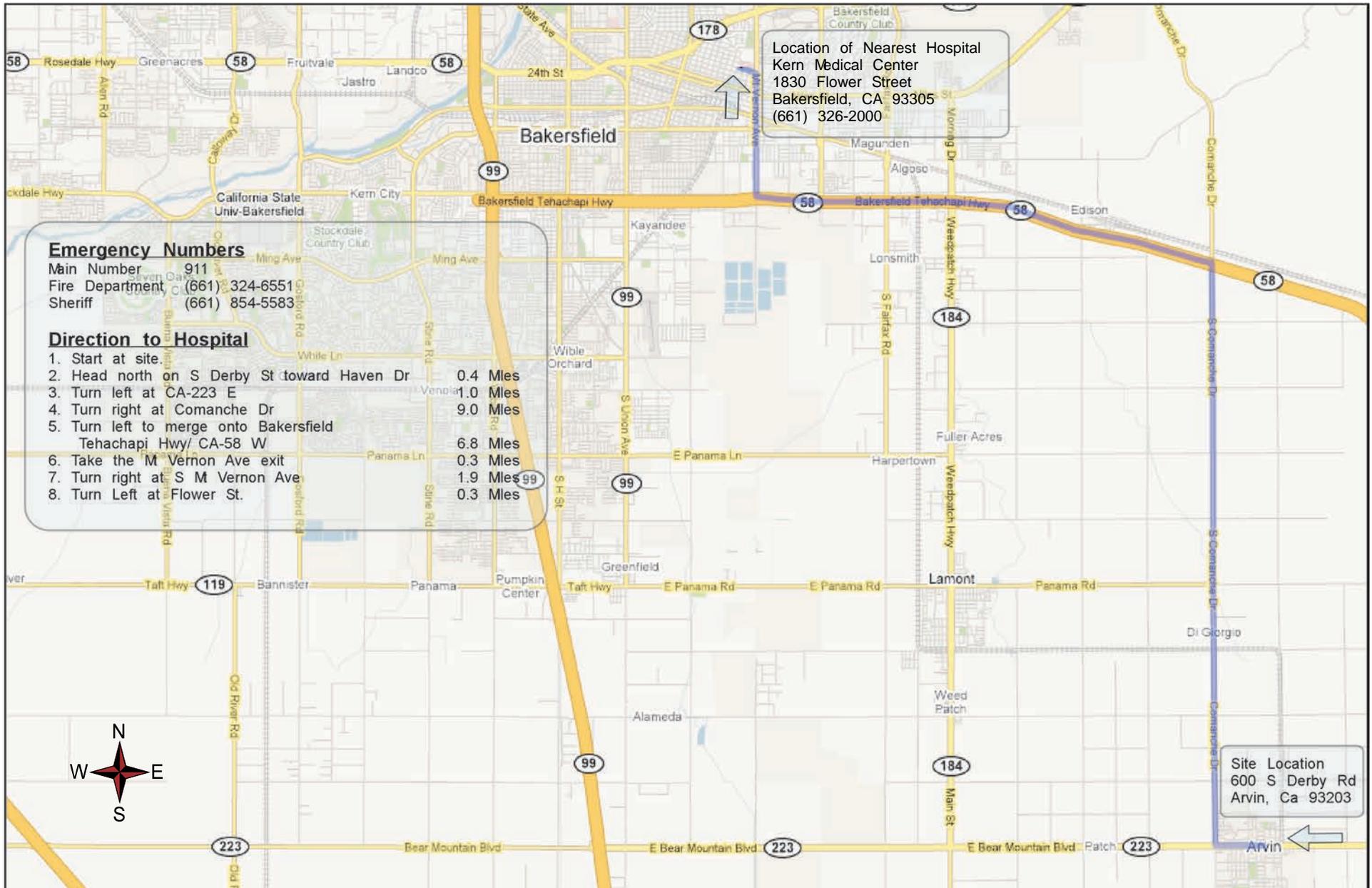
FIGURES



Base map from *The Thomas Guide, 1998 Central Valley Cities Street Guide and Directory*. Reproduced with permission granted by THOMAS BROS. MAPS®. This map is copyrighted by THOMAS BROS. MAPS®. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission. All rights reserved.



	Eco & Associates, Inc. 1855 W. Katella Avenue, Suite 340 Orange, California 92867 Phone: 714.289.0995 Fax: 714.289.0965	SITE VICINITY MAP Brown & Bryant Superfund Site 600 South Derby Street, Arvin, California	FIGURE: 1
	Project No.: Eco-10-425	Dated August 2011	



Eco & Associates, Inc.
 1855 W. Katella Avenue, Suite 340
 Orange, California 92867
 Phone: 714.289.0995 Fax: 714.289.0965

HOSPITAL ROUTE
 From:
 600 South Derby Road, Arvin Ca 93203
 To:
 1830 Flower St, Bakersfield, CA 93305

PROJECT NO: Eco-10-425
 DATED: August 2011

FIGURE:
 2

*GROUNDWATER SAMPLING AND ANALYSIS – HEALTH
AND SAFETY PLAN*

ACTIVITY HAZARD ANALYSIS MATRIX

ACTIVITY HAZARD ANALYSIS MATRIX

ANTICIPATED FIELD ACTIVITY	HAZARD POTENTIAL											
	CHEMICAL			PHYSICAL					BIOLOGICAL			OTHER WEATHER CONDITION HAZARDS
	INHALATION	DERMAL	INGESTION	ACTIVITY (TRIP, SLIP, AND FALL)	CONFINED SPACE ENTRY	ELECTRICAL	NOISE	HEAT AND COLD STRESS	SEWAGE	POISONOUS INSECTS, ARACHNIDS, PLANTS, AND ANIMALS	HANTAVIRUS	
FIELD RECONNAISSANCE OF EXISTING WELLS	L	L	L	L-M	NP	L	L	L	L	L-M	L	L
ECOLOGICAL AND LAND SURVEY OF THE SITE AND SITE VICINITY	L	L	L	L-M	NP	L	L	L	L	L-M	L	L
WELL PURGING	L	L-M	L	L-M	NP	L	L	L-M	L	L	L	L
GROUNDWATER SAMPLING	L	L-M	L	L-M	NP	L	L	L	L	L	L	L

Notes:

1. L = low; L-M = low to moderate; M = moderate; M-H = moderate to high; and H = high.
2. NP = not permitted under this health and safety plan (HSP).
3. The above hazard potential is based on currently available information and anticipated field activities. If site conditions differ from anticipated conditions and such difference poses a health or safety concern for the workers or the environment, then the HSP will be modified accordingly to address those conditions.

*GROUNDWATER SAMPLING AND ANALYSIS – HEALTH
AND SAFETY PLAN*

APPENDIX A

**CHEMICAL HAZARD SUMMARY
INFORMATION**

1,2-DICHLOROPROPANE

1.0 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name:	1,2-Dichloropropane, 98%
Catalog Numbers:	AC113670000, AC113670010, AC113670025, AC113670050, AC113670500, AC11367250, AC113672500
Synonyms:	Propylene Dichloride
Company Identification (Europe):	Acros Organics N.V. Janssen Pharmaceuticaaan 3a 2440 Geel, Belgium
Company Identification (USA):	Acros Organics One Reagent Lane Fairlawn, NJ 07410
For information in North America, call:	800-ACROS-01
For information in Europe, call:	0032(0) 14575211
For emergencies in the US, call CHEMTREC:	800-424-9300
For emergencies in Europe, call:	0032(0) 14575299

2.0 COMPOSITION, INFORMATION ON INGREDIENTS

CAS #	CHEMICAL NAME	%	EINECS #
78-87-5	1,2-Dichloropropane	98.0	201-152-2

Hazard Symbols: XN F

Risk Phrases: 11 20/22

3.0 HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Appearance:

- Colourless. Flash Point: 21 deg C.

Warning! Combustible liquid:

- May be harmful if swallowed.
- May cause central nervous system depression.
- May be absorbed through the skin.
- May cause cardiac disturbances.
- May cause liver and kidney damage.
- Causes eye and skin irritation.
- Causes digestive and respiratory tract irritation.
- May cause blood abnormalities.

Target Organs:

- Blood, kidneys, heart, central nervous system, liver.

3.2 POTENTIAL HEALTH EFFECTS

Eye:

- Causes moderate eye irritation.
- Vapors cause eye irritation.
- May cause eye injury.

Skin:

- Causes skin irritation.
- Prolonged and/or repeated contact may cause defatting of the skin and dermatitis.
- May be absorbed through the skin.

Ingestion:

- May be harmful if swallowed.
- May cause effects similar to those of acute inhalation.
- Causes gastrointestinal tract irritation.

Inhalation:

- Inhalation of high concentrations may cause central nervous system effects characterized by headache, dizziness, unconsciousness, and coma.
- Causes respiratory tract irritation.
- May cause liver and kidney damage.
- May cause anemia.
- Vapors may cause dizziness or suffocation.
- May cause cardiac abnormalities.
- Symptoms of inhalation include:

- anorexia,
- abdominal pain,
- vomiting,
- blood abnormalities, and
- hematuria.

Chronic Inhalation:

- Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion.

4.0 FIRST AID MEASURES

Eyes:

- Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin:

- Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:

- Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:

- Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:

- Treat symptomatically and supportively.

5.0 FIRE FIGHTING MEASURES

5.1 GENERAL INFORMATION

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Containers may explode in the heat of a fire. Flammable Liquid. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas.

5.2 EXTINGUISHING MEDIA

For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Use water spray to cool fire-exposed containers. Water may be ineffective. Do NOT use straight streams of water.

6.0 ACCIDENTAL RELEASE MEASURES

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation. A vapor suppressing foam may be used to reduce vapors.

7.0 HANDLING AND STORAGE

7.1 HANDLING

Wash thoroughly after handling. Use only in a well ventilated area. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

7.2 STORAGE

Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area.

8.0 EXPOSURE CONTROLS, PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

8.2 EXPOSURE LIMITS

CHEMICAL NAME	ACGIH	NIOSH	OSHA – FINAL PELs
1,2-Dichloropropane	75 ppm 110 ppm STEL	NIOSH Potential Occupational Carcinogen – see Appendix A Potential NIOSH Carcinogen	75 ppm TWA; 350 mg/m ³ TWA

8.3 OSHA VACATED PELs:

1,2-Dichloropropane: 75 ppm TWA; 350 mg/m³ TWA

8.4 PERSONAL PROTECTIVE EQUIPMENT

Eyes:

- Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

- Wear appropriate protective gloves to prevent skin exposure.

Clothing:

- Wear appropriate protective clothing to prevent skin exposure.

Respirators:

- Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

9.0 PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Appearance:	Colourless
Odor:	Sweet
pH:	Not available.
Vapor Pressure:	50 mm Hg @ 25 deg C
Vapor Density:	3.9
Evaporation Rate:	>1 (Butyl Acetate = 1)
Viscosity:	Not available.
Boiling Point:	95 - 96 deg C @ 760.00mm Hg
Freezing/Melting Point:	-100 deg C
Autoignition Temp.:	557 deg C (1,034.60 deg F)
Flash Point:	21 deg C (69.80 deg F)
NFPA Rating: (est.)	Health: 2; Flammability: 3; Reactivity: 0
Explosion Limits	Lower: 3.40 vol % Upper: 14.50 vol %
Decomposition Temp:	
Solubility:	IN WATER: 3 G/L (20°C)
Specific Grav./Dens.:	1.1560g/cm ³
Molecular Formula:	C ₃ H ₆ Cl ₂

Molecular Weight:	112.99
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10.0 STABILITY AND REACTIVITY

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials:	Oxidizing agents, acids, , aluminum, orthodichlorobenzene + ethylene dichloride + aluminum. Will attack some forms of plastic, rubber, and coatings.
Hazardous Decomposition Products:	Hydrogen chloride, phosgene, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization:	Has not been reported.

11.0 TOXICOLOGICAL INFORMATION

RTECS#: CAS# 78-87-5: TX9625000		
LD50/LC50:	CAS# 78-87-5: <ul style="list-style-type: none"> - Inhalation, rat: LC50 = 14 gm/m³/8H; - Oral, mouse: LD50 = 860 mg/kg; - Oral, rat: LD50 = 1947 mg/kg; - Skin, rabbit: LD50 = 8750 mg/kg. 	
Carcinogenicity:	1,2-Dichloropropane - ACGIH:	A4 - Not Classifiable as a Human Carcinogen
	California:	carcinogen; initial date 1/1/90
	NIOSH:	occupational carcinogen
	IARC:	Group 3 carcinogen
Epidemiology:	No information available.	
Teratogenicity:	No information available.	
Reproductive Effects:	orl-mus TDL0: 130 gm/kg/2Y-I	
Neurotoxicity:	No information available.	
Mutagenicity:	mmo-sat 100 µg/plate mma-mus: lym 11600 µg/l cyt-ham: ovr 660 mg/l sce-ham: ovr 113 mg/l sce-ham: lng 3300 µmol/l See also <i>Dictionary of</i>	

	<i>Substances and Their Effects, 1992.</i>
Other Studies:	See actual entry in RTECS for complete information.

12.0 ECOLOGICAL INFORMATION

Ecotoxicity: See also Dictionary of Substances and Their Effects.

13.0 DISPOSAL CONSIDERATIONS

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Part. Additionally, waste generators must consult state and local hazardous waste regulation ensure complete and accurate classification.

RCRA P-Series:	None listed.
RCRA U-Series:	CAS# 78-87-5: waste number U083.

14.0 TRANSPORT INFORMATION

US DOT	
Shipping Name:	1,2-DICHLOROPROPANE
Hazard Class:	3
UN Number:	UN1279
Packing Group:	II

CANADIAN TDG	
Shipping Name:	PROPYLENE DICHLORIDE
Hazard Class:	3(9.2)
UN Number:	UN1279
Other Information:	FLASHPOINT 15 C

15.0 REGULATORY INFORMATION**15.1 US FEDERAL****15.1.1 TSCA**

CAS# 78-87-5 is listed on the TSCA inventory.

HEALTH & SAFETY REPORTING LIST	
CAS# 78-87-5: EFFECTIVE DATE: OCTOBER 4, 1982; SUNSET DATE: OCTOBER 4, 1992	
Chemical Test Rules	<ul style="list-style-type: none"> - CAS# 78-87-5: Testing required by: manufacturers; - processors (40 CFR 7 Section 12b) CAS# 78-87-5: 4a/12b/4 term
TSCA Significant New Use Rule	None of the chemicals in this material have a SNUR under TSCA.

15.1.2 SARA

Section 302 (RQ)	CAS# 78-87-5: final RQ = 1000 pounds (454 kg)
Section 302 (TPQ)	None of the chemicals in this product have a TPQ.
SARA Codes	CAS # 78-87-5: acute, chronic, flammable.
Section 313	This material contains 1,2-Dichloropropane (CAS# 78-87-5, 98.0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

15.1.3 CLEAN AIR ACT

- CAS# 78-87-5 is listed as a hazardous air pollutant (HAP).
- This material does not contain any Class 1 Ozone depletors.
- This material does not contain any Class 2 Ozone depletors.

15.1.4 CLEAN WATER ACT

- CAS# 78-87-5 is listed as a Hazardous Substance under the CWA.
- CAS# 78-87-5 is listed as a Priority Pollutant under the Clean Water Act.
- None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

15.1.5 OSHA

- None of the chemicals in this product are considered highly hazardous by OSHA.

15.2 STATE

1,2-Dichloropropane can be found on the following state right to know lists:

- California,
- New Jersey,
- Florida,
- Pennsylvania,
- Minnesota,
- Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

- **WARNING:** This product contains 1,2-Dichloropropane, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: None of the chemicals in this product are listed.

16.0 ADDITIONAL INFORMATION

- MSDS Creation Date: 2/17/1999
- Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

1,2,3-TRICHLOROPROPANE

1.0 CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name:	1,2,3-Trichloropropane, 99+ %
Catalog Numbers:	AC149550000, AC149550010, AC149550050, AC149552500, AC149555000
Synonyms:	Glycerine Trichlorohydrin, Trichlorohydrin, Allyl Trichloride.
Company Identification (Europe):	Acros Organics N.V. Janssen Pharmaceuticaaan 3a 2440 Geel, Belgium
Company Identification (USA):	Acros Organics One Reagent Lane Fairlawn, NJ 07410
For information in North America, call:	800-ACROS-01
For information in Europe, call:	0032(0) 14575211
For emergencies in the US, call CHEMTREC:	800-424-9300
For emergencies in Europe, call:	0032(0) 14575299

2.0 COMPOSITION, INFORMATION ON INGREDIENTS

CAS #	CHEMICAL NAME	%	EINECS #
96-18-4	1,2,3-Trichloropropane	99+	02-486-1

Hazard Symbols: XN

Risk Phrases: 21/22

3.0 HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Appearance:

- yellow. Flash Point: 82 deg C.

Warning! Combustible liquid.

- May be harmful if absorbed through the skin. May be harmful if swallowed. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. Cancer hazard. May cause cancer in humans.

Target Organs:

- None.

3.2 POTENTIAL HEALTH EFFECTS

Eye:

- May cause eye irritation.

Skin:

- May cause skin irritation. May be harmful if absorbed through the skin.

Ingestion:

- May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed.

Inhalation:

- May cause respiratory tract irritation. Vapors may cause dizziness or suffocation.

Chronic:

- May cause cancer in humans.

4.0 FIRST AID MEASURES

Eyes:

- Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:

- Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:

- Never give anything by mouth to an unconscious person. Get medical aid immediately. If conscious drink water, then induce vomiting. If unconscious, immediately take victim to a physician and do NOT attempt to induce vomiting.

Inhalation:

- Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

- Treat symptomatically and supportively.

5.0 FIRE FIGHTING MEASURES

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Combustible Liquid. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas. May be ignited by heat, sparks, and flame. Containers may explode when heated.

Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam. Cool containers with flooding quantities of water until well after fire is out.

6.0 ACCIDENTAL RELEASE MEASURES

General Information:

- Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

- Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container.
- Clean up spills immediately, observing precautions in the Protective Equipment section.
- Remove all sources of ignition.
- Use a spark-proof tool.
- Provide ventilation.

7.0 HANDLING AND STORAGE

7.1 HANDLING

Wash thoroughly after handling. Use only in a well ventilated area. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Avoid contact with heat, sparks and flame. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

7.2 STORAGE

Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

8.0 EXPOSURE CONTROLS, PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS

Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

8.2 EXPOSURE LIMITS

CHEMICAL NAME	ACGIH	NIOSH	OSHA – FINAL PELs
1,2,3-Trichloropropane	10 ppm; skin – potential for cutaneous absorption	10 ppm TWA; 60 mg/m ³ TWA; NIOSH Potential Occupational Carcinogen – see Appendix A Potential NIOSH Carcinogen	50 ppm TWA; 300 mg/m ³ TWA

8.3 OSHA VACATED PELs

1,2,3-Trichloropropane: 10 ppm TWA; 60 mg/m³ TWA

8.4 PERSONAL PROTECTIVE EQUIPMENT

Eyes:

- Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:

- Wear appropriate protective gloves to prevent skin exposure.

Clothing:

- Wear appropriate protective clothing to prevent skin exposure.

Respirators:

- Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

9.0 PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Appearance:	Yellow
Odor:	Chloroform-like
pH:	Not available.
Vapor Pressure:	2.9 hPa @ 20 deg C

Vapor Density:	5.1
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	156 deg C @ 760.0
Freezing/Melting Point:	-14 deg C
Autoignition Temp.:	304 deg C (579.20 deg F)
Flash Point:	82 deg C (179.60 deg F)
NFPA Rating: (est.)	Health: 2; Flammability: 2; Reactivity: 0
Explosion Limits	Lower: 3.20 vol % Upper: 12.60 vol %
Decomposition Temp.:	
Solubility:	Slightly soluble.
Specific Grav./Dens.:	1.3870g/cm ³
Molecular Formula:	ClCH ₂ CH(Cl)CH ₂ Cl
Molecular Weight:	147.43

10.0 STABILITY AND REACTIVITY

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Incompatible materials, ignition sources, excess heat.
Incompatibilities with Other Materials:	Oxidizing agents.
Hazardous Decomposition Products:	Hydrogen chloride, carbon monoxide, carbon dioxide.
Hazardous Polymerization:	Has not been reported.

11.0 TOXICOLOGICAL INFORMATION

RTECS#: CAS# 96-18-4: TZ9275000		
LD50/LC50:	CAS# 96-18-4: Inhalation, mouse: LC50 =3400 mg/m ³ /2H; Oral, mouse: LD50 = 369 mg/kg; Oral, rabbit: LD50 = 380 mg/kg; Oral, rat: LD50 = 505 mg/kg; Skin, rabbit: LD50 = 1770 mg/kg.	
Carcinogenicity:	1,2,3-Trichloropropane - ACGIH:	A3 - Animal Carcinogen
	California:	Carcinogen; initial date 10/1/92
	NIOSH:	Occupational carcinogen
	NTP:	Suspect carcinogen
	OSHA:	Possible Select carcinogen
	IARC:	Group 2A carcinogen
Epidemiology:	The National Toxicology Program has concluded that this chemical can be reasonably be considered a human carcinogen.	
Teratogenicity:	No information available.	
Reproductive Effects:	No information available.	
Neurotoxicity:	No information available.	
Mutagenicity:	No information available.	
Other Studies:	No data available.	

12.0 ECOLOGICAL INFORMATION

Other:

- No information available.

13.0 DISPOSAL CONSIDERATIONS

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Part. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series:	None listed.
RCRA U-Series:	None listed.

14.0 TRANSPORT INFORMATION

US DOT	
Shipping Name:	TOXIC LIQUID, ORGANIC, N.O.S. (1,2,3-TRICHLOROPROPANE)
Hazard Class:	6.1
UN Number:	UN2810
Packing Group:	III

CANADIAN TDG	
Shipping Name:	CORROSIVE SOLID NOS (2-MESITYLENESULFONYL CHLORIDE)
Hazard Class:	8(9.2)
UN Number:	UN1759

15.0 REGULATORY INFORMATION

15.1 US FEDERAL

15.1.1 TSCA

CAS# 96-18-4 is listed on the TSCA inventory.

HEALTH & SAFETY REPORTING LIST	
CAS# 96-18-4: EFFECTIVE DATE: JUNE 1, 1987; SUNSET DATE: JUNE 1, 1997	
Chemical Test Rules	None of the chemicals in this product are under a Chemical Test Rule.
Section 12b	None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule	None of the chemicals in this material have a SNUR under TSCA.

15.1.2 SARA

Section 302 (RQ)	CAS# 96-18-4: (This CAS Number is listed in Section 313 but is NOT list in Section 302.)
Section 302 (TPQ)	None of the chemicals in this product have a TPQ.
SARA Codes	CAS # 96-18-4: acute, chronic, flammable
Section 313	This material contains 1,2,3-Trichloropropane (CAS# 96-18-4, 99%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

15.1.3 CLEAN AIR ACT

- This material does not contain any hazardous air pollutants.
- This material does not contain any Class 1 Ozone depletors.
- This material does not contain any Class 2 Ozone depletors.

15.1.4 CLEAN WATER ACT

- None of the chemicals in this product are listed as Hazardous Substances under the CWA.
- None of the chemicals in this product are listed as Priority Pollutants under the CWA.
- None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

15.1.5 OSHA

- None of the chemicals in this product are considered highly hazardous by OSHA.

15.2 STATE

1,2,3-Trichloropropane can be found on the following state right to know lists:

- California,
- New Jersey,
- Florida,
- Pennsylvania,
- Minnesota,
- Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

- **WARNING:** This product contains 1,2,3-Trichloropropane, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: None of the chemicals in this product are listed.

16.0 ADDITIONAL INFORMATION

MSDS Creation Date: 8/25/1998

Revision #2 Date: 8/02/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

CHLOROFORM

Trichloromethane
Methane trichloride
Formyl chloride
CHCl₃
Molecular mass: 119.4

CAS # 67-66-3
RTECS # FS9100000
ICSC # 0027
UN # 1888
EC # 602-006-00-4

TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/ FIREFIGHTING
FIRE	Not combustible (See Notes). Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	
INHALATION	Cough. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Redness. Pain.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness. Pain.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal pain. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Rest. Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Evacuate danger area! Consult an expert! Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: self-contained breathing apparatus).	Separated from strong oxidants, strong bases, metals, acetone, food and feedstuffs. Keep in the dark. Ventilation along the floor.	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Xn symbol R: 22-38-40-48/20/22 S: 36/37 UN Hazard Class: 6.1 UN Packing Group: III Marine pollutant.	

IMPORTANT DATA	<p>PHYSICAL STATE / APPEARANCE: VOLATILE COLOURLESS LIQUID, WITH CHARACTERISTIC ODOR.</p> <p>PHYSICAL DANGERS: The vapour is heavier than air.</p> <p>CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming irritating and toxic fumes (hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126). The substance decomposes slowly under influence of air and light. Reacts violently with strong bases, strong oxidants, some metals, such as aluminium, lithium, magnesium, potassium, sodium and acetone, causing fire and explosion hazard. Attacks plastic, rubber and coatings.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV (as TWA): 10 ppm; 50 mg/m³ (ACGIH 1992-1993). MAK: 10 ppm; 50 mg/m³; II,1, B (1992). MAK: class III B (1992).</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin, and by ingestion.</p> <p>INHALATION RISK: A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. The substance may cause effects on the heart, liver, kidneys, and the central nervous system resulting in unconsciousness. The effects may be delayed. Medical observation is indicated.</p>
	<p>PHYSICAL PROPERTIES</p> <p>Boiling point: 62°C Melting point: -64°C Relative density (water = 1): 1.48 Solubility in water, g/100 ml at 20°C: 0.8</p>	<p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. This substance is possibly carcinogenic to humans.</p> <p>Vapour pressure, kPa at 20°C: 21.2 Relative vapour density (air = 1): 4.12 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.7 Octanol/water partition coefficient as log Pow: 1.97</p>
	<p>ENVIRONMENTAL DATA</p> <p>This substance may be hazardous to the environment; special attention should be given to water.</p>	
	NOTES	
<p>Turns combustible on addition of small amounts of a flammable substance or an increase in the oxygen content of the air. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding.</p> <p style="text-align: right;">Transport Emergency Card: TEC (R)-146 NFPA Code: H 2; F 0; R 0;</p>		
ADDITIONAL INFORMATION		
<p>IMPORTANT LEGAL NOTICE:</p>	<p>Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.</p>	

1,2-DIBROMO-3-CHLOROPROPANE

3-Chloro-1,2-dibromopropane
 Dibromochloropropane
 DBCP
 $\text{BrCH}_2\text{BrCHCH}_2\text{Cl}$
 Molecular mass: 236.4

CAS # 96-12-8
 RTECS # TX8750000
 ICSC # 0002
 UN # 2872
 EC # 602-021-00-6

TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIREFIGHTING
FIRE	Combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 77°C explosive vapour/air mixtures may be formed.	Above 77°C closed system, ventilation.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Burning sensation. Cough. Headache. Shortness of breath. Sore throat. Weakness.	Local exhaust or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Burning sensation. Nausea. Sore throat. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

ETHYLENE DIBROMIDE

1,2-Dibromoethane
EDB
 $\text{Br}(\text{CH}_2)_2\text{Br}/\text{C}_2\text{H}_4\text{Br}_2$
Molecular mass: 187.9

CAS # 106-93-4
RTECS # KH9275000
ICSC # 0045
UN # 1605
EC # 602-010-00-6

TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIREFIGHTING
FIRE	Combustible under specific conditions. Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion on contact with powdered metals: see Chemical Dangers.		
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Burning sensation. Cough. Laboured breathing. Shortness of breath. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Pain. Redness. Blisters.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Pain. Redness. Severe deep burns.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal cramps. Confusion. Diarrhoea. Headache (further see Inhalation).		
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
<p>Evacuate danger area!</p> <p>Consult an expert!</p> <p>Collect leaking and spilled liquid in sealable containers as far as possible.</p> <p>Absorb remaining liquid in dry sand or inert absorbent and remove to safe place.</p> <p>Extra personal protection: complete protective clothing including self-contained breathing apparatus.</p> <p>Do NOT let this chemical enter the environment.</p>	<p>Separated from strong oxidants, strong bases, powdered metals, food and feedstuffs: see Chemical Dangers. Dry.</p> <p>Keep in the dark.</p> <p>Ventilation along the floor.</p>	<p>Do not transport with food and feedstuffs.</p> <p>T symbol R: 45-23/24/25-36/37/38 S: 53-44 UN Hazard Class: 6.1 UN Packing Group: II</p> <p>IMO: marine pollutant.</p>	

IMPORTANT DATA	<p>PHYSICAL STATE; APPEARANCE:</p> <p>COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS:</p> <p>On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes, hydrogen bromide (see ICSC # 0282) and bromine (see ICSC # 0107).</p> <p>The substance decomposes slowly under influence of light and moisture producing corrosive hydrogen bromide.</p> <p>Reacts vigorously with powdered aluminium or magnesium, metals such as sodium, potassium and calcium, strong bases and strong oxidants, causing fire and explosion hazard.</p> <p>Attacks fats, rubber, some plastics and coatings.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs):</p> <p>TLV not established.</p>	<p>ROUTES OF EXPOSURE:</p> <p>The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.</p> <p>INHALATION RISK:</p> <p>A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE:</p> <p>The substance irritates the eyes, the skin and the respiratory tract.</p> <p>The substance may cause effects on the central nervous system, resulting in lowering of consciousness.</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</p> <p>Lungs may be affected by repeated or prolonged exposure causing bronchitis.</p> <p>The substance may have effects on the liver and kidneys.</p> <p>This substance is probably carcinogenic to humans.</p> <p>Animal tests show that this substance possibly causes toxic effects upon human reproduction.</p>
	<p>PHYSICAL PROPERTIES</p> <p>Boiling point: 131°C</p> <p>Melting point: 10°C</p> <p>Relative density (water = 1): 2.2</p> <p>Solubility in water, g/100 ml at 20°C: poor</p>	<p>Vapour pressure, kPa at 20°C: 1.5</p> <p>Relative vapour density (air = 1): 6.5</p> <p>Relative density of the vapour/air-mixture at 20°C (air = 1): 1.08</p> <p>Octanol/water partition coefficient as log Pow: 1.93</p>
	<p>ENVIRONMENTAL DATA</p> <p>This substance may be hazardous to the environment; special attention should be given to water.</p>	
NOTES		
Depending on the degree of exposure, periodic medical examination is indicated.		
Transport Emergency Card: TEC (R)-802 NFPA Code: H3; F0; R0;		
ADDITIONAL INFORMATION		
<p>IMPORTANT LEGAL NOTICE:</p>	<p>Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.</p>	

1,3-DICHLOROPROPANE			
$C_3H_6Cl_2$ / $CH_2ClCH_2CH_2Cl$ Molecular mass: 113.0			
CAS # 142-28-9 RTECS # TX9660000 ICSC # 0724 UN # 1992			
TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPOMS	PREVENTION	FIRST AID/FIREFIGHTING
FIRE	Highly flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 16°C explosive vapour/air mixtures may be formed.	Above 16°C use a closed system, ventilation, and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
INHALATION	Dizziness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest.
SKIN	Redness. Pain.	Protective gloves.	First rinse with plenty of water, then remove contaminated clothes and rinse again.
EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Evacuate danger area! Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Extra personal protection: filter respirator for organic gases and vapours. Do NOT wash away into sewer	Separated from food and feedstuffs, oxidants, acids, bases, alumina. Cool. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. UN Hazard Class: 3 UN Subsidiary Risks: 6.1 UN Packing Group: II Marine pollutant.	

IMPORTANT DATA	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and by ingestion.
	PHYSICAL DANGERS: The vapour is heavier than air and may travel along the ground; distant ignition possible.	INHALATION RISK: No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: The substance decomposes on heating producing hydrogen chloride and phosgene.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract.
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	
PHYSICAL PROPERTIES	Boiling point: 120°C Melting point: -99°C Relative density (water = 1): 1.19 Solubility in water, g/100 ml at 20°C: 0.3 Vapour pressure, kPa at 20°C: 2.4	Relative vapour density (air = 1): 3.9 Flash point: 16°C o.c. Explosive limits, vol% in air: see Notes Octanol/water partition coefficient as log Pow: 2.0
ENVIRONMENTAL DATA		

NOTES

Explosive limits are unknown in literature, although the substance is combustible and has a flash point < 61°C. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.

Transport Emergency Card: TEC (R)-30G32

IMPORTANT LEGAL NOTICE:

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DINOSEB			
2-sec-Butyl-4,6-dinitrophenol 2-(1-Methylpropyl)-4,6-dinitrophenol 2,4-Dinitro-6-(1-methylpropyl)phenol 2,4-Dinitro-6-sec-butylphenol $C_{10}H_{12}N_2O_5$ Molecular mass: 240.2			
CAS # 88-85-7 RTECS # SJ9800000 ICSC # 0149 UN # 2779 EC # 609-025-00-7			
TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion.		
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Blue skin. Convulsions. Headache. Sweating. Laboured breathing. Unconsciousness.	Ventilation (not if powder), local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES	Redness. Pain. Blurred vision. Temporary loss of vision.	Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal pain. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Rest. Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Do NOT wash away into sewer. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs. Ventilation along the floor.	Do not transport with food and feedstuffs. T symbol N symbol R: 61-62-24/25-36-44-50/53 S: 53-45-60-61 Note: E UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant.	

IMPORTANT DATA	PHYSICAL STATE; APPEARANCE: ORANGE CRYSTALS , WITH PUNGENT ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin and by ingestion.
	PHYSICAL DANGERS:	INHALATION RISK: A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster.
	CHEMICAL DANGERS: The substance decomposes on heating producing toxic fumes including nitrogen oxides. The solution in water is a weak acid. Attacks many metals in presence of water.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. The substance may cause effects on the gastrointestinal tract and central nervous system. Exposure to the aerosol in hot environment may result in death.
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established. PDK not established.	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the kidneys, liver, blood, immune system and eyes , resulting in cataract. May cause reproductive toxicity in humans.
PHYSICAL PROPERTIES	Melting point: 38-42°C Relative density (water = 1): 1.3 at 30°C Solubility in water: none at 20°C (<0.1 g/100 ml)	Vapour pressure, Pa at 20°C: 0.007 Relative vapour density (air = 1): 8.3
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. This substance may be hazardous to the environment; special attention should be given to honey bees, birds and mammals. The substance may cause long-term effects in the aquatic environment.	

NOTES

Temperature of decomposition unknown in literature. If the pesticide is present under the form of a formulation containing hydrocarbon solvents, vomiting may not be induced. Depending on the degree of exposure, periodic medical examination is indicated. Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Aatox, Aretit, BNP 20, BNP 30, Basanite, Butaphene, Caldon, Chemox General, Chemox PE, Desicoil, Dibutox, Dinitrall, DN 289, Dow General, Dytop, Fanicide, Gebutox, Hivertox, HOE 26150, Ivosit, Kiloseb, Knowx-Weed, Ladob, Laseb, Nitropone C, Persevttox, Phenotan, Premerge, Sinox General, Sparic, Spurge, Subitex and Unicrop are trade names.

Transport Emergency Card: TEC (R)-61G53b
If the pesticide is formulated with an organic solvent, also consult ICSC of the solvent.

ADDITIONAL INFORMATION**IMPORTANT LEGAL NOTICE:**

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CHLOROFORM			
Trichloromethane Methane trichloride Formyl chloride CHCl_3 Molecular mass: 119.4			
CAS # 67-66-3 RTECS # FS9100000 ICSC # 0027 UN # 1888 EC # 602-006-00-4			
TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/ FIREFIGHTING
FIRE	Not combustible (See Notes). Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	
INHALATION	Cough. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Redness. Pain.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness. Pain.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal pain. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Rest. Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Evacuate danger area! Consult an expert! Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: self-contained breathing apparatus).	Separated from strong oxidants, strong bases, metals, acetone, food and feedstuffs. Keep in the dark. Ventilation along the floor.	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Xn symbol R: 22-38-40-48/20/22 S: 36/37 UN Hazard Class: 6.1 UN Packing Group: III Marine pollutant.	

IMPORTANT DATA	PHYSICAL STATE / APPEARANCE: VOLATILE COLOURLESS LIQUID, WITH CHARACTERISTIC ODOR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin, and by ingestion.
	PHYSICAL DANGERS: The vapour is heavier than air.	INHALATION RISK: A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming irritating and toxic fumes (hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126). The substance decomposes slowly under influence of air and light. Reacts violently with strong bases, strong oxidants, some metals, such as aluminium, lithium, magnesium, potassium, sodium and acetone, causing fire and explosion hazard. Attacks plastic, rubber and coatings.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. The substance may cause effects on the heart, liver, kidneys, and the central nervous system resulting in unconsciousness. The effects may be delayed. Medical observation is indicated.
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV (as TWA): 10 ppm; 50 mg/m ³ (ACGIH 1992-1993). MAK: 10 ppm; 50 mg/m ³ ; II,1, B (1992). MAK: class III B (1992).	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 62°C Melting point: -64°C Relative density (water = 1): 1.48 Solubility in water, g/100 ml at 20°C: 0.8	Vapour pressure, kPa at 20°C: 21.2 Relative vapour density (air = 1): 4.12 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.7 Octanol/water partition coefficient as log Pow: 1.97
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to water.	

NOTES

Turns combustible on addition of small amounts of a flammable substance or an increase in the oxygen content of the air. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding.

Transport Emergency Card: TEC (R)-146
NFPA Code: H 2; F 0; R 0;

ADDITIONAL INFORMATION**IMPORTANT LEGAL NOTICE:**

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1,2-DIBROMO-3-CHLOROPROPANE

3-Chloro-1,2-dibromopropane
 Dibromochloropropane
 DBCP
 $\text{BrCH}_2\text{BrCHCH}_2\text{Cl}$
 Molecular mass: 236.4

CAS # 96-12-8
 RTECS # TX8750000
 ICSC # 0002
 UN # 2872
 EC # 602-021-00-6

TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIREFIGHTING
FIRE	Combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 77°C explosive vapour/air mixtures may be formed.	Above 77°C closed system, ventilation.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Burning sensation. Cough. Headache. Shortness of breath. Sore throat. Weakness.	Local exhaust or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Burning sensation. Nausea. Sore throat. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

ETHYLENE DIBROMIDE

1,2-Dibromoethane
EDB
 $\text{Br}(\text{CH}_2)_2\text{Br}/\text{C}_2\text{H}_4\text{Br}_2$
Molecular mass: 187.9

CAS # 106-93-4
RTECS # KH9275000
ICSC # 0045
UN # 1605
EC # 602-010-00-6

TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIREFIGHTING
FIRE	Combustible under specific conditions. Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion on contact with powdered metals: see Chemical Dangers.		
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Burning sensation. Cough. Laboured breathing. Shortness of breath. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Pain. Redness. Blisters.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Pain. Redness. Severe deep burns.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal cramps. Confusion. Diarrhoea. Headache (further see Inhalation).		
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
<p>Evacuate danger area!</p> <p>Consult an expert!</p> <p>Collect leaking and spilled liquid in sealable containers as far as possible.</p> <p>Absorb remaining liquid in dry sand or inert absorbent and remove to safe place.</p> <p>Extra personal protection: complete protective clothing including self-contained breathing apparatus.</p> <p>Do NOT let this chemical enter the environment.</p>	<p>Separated from strong oxidants, strong bases, powdered metals, food and feedstuffs: see Chemical Dangers. Dry.</p> <p>Keep in the dark.</p> <p>Ventilation along the floor.</p>	<p>Do not transport with food and feedstuffs.</p> <p>T symbol R: 45-23/24/25-36/37/38 S: 53-44 UN Hazard Class: 6.1 UN Packing Group: II</p> <p>IMO: marine pollutant.</p>	

IMPORTANT DATA	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.
	PHYSICAL DANGERS:	INHALATION RISK: A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming toxic and corrosive fumes, hydrogen bromide (see ICSC # 0282) and bromine (see ICSC # 0107). The substance decomposes slowly under influence of light and moisture producing corrosive hydrogen bromide. Reacts vigorously with powdered aluminium or magnesium, metals such as sodium, potassium and calcium, strong bases and strong oxidants, causing fire and explosion hazard. Attacks fats, rubber, some plastics and coatings. OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the central nervous system, resulting in lowering of consciousness. EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Lungs may be affected by repeated or prolonged exposure causing bronchitis. The substance may have effects on the liver and kidneys. This substance is probably carcinogenic to humans. Animal tests show that this substance possibly causes toxic effects upon human reproduction.
	PHYSICAL PROPERTIES	Boiling point: 131°C Melting point: 10°C Relative density (water = 1): 2.2 Solubility in water, g/100 ml at 20°C: poor
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to water.	

NOTES

Depending on the degree of exposure, periodic medical examination is indicated.

Transport Emergency Card: TEC (R)-802
NFPA Code: H3; F0; R0;**ADDITIONAL INFORMATION****IMPORTANT LEGAL NOTICE:**

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1,3-DICHLOROPROPANE			
$C_3H_6Cl_2$ / $CH_2ClCH_2CH_2Cl$ Molecular mass: 113.0			
CAS # 142-28-9 RTECS # TX9660000 ICSC # 0724 UN # 1992			
TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPOMS	PREVENTION	FIRST AID/FIREFIGHTING
FIRE	Highly flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 16°C explosive vapour/air mixtures may be formed.	Above 16°C use a closed system, ventilation, and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
INHALATION	Dizziness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest.
SKIN	Redness. Pain.	Protective gloves.	First rinse with plenty of water, then remove contaminated clothes and rinse again.
EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Evacuate danger area! Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Extra personal protection: filter respirator for organic gases and vapours. Do NOT wash away into sewer	Separated from food and feedstuffs, oxidants, acids, bases, alumina. Cool. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. UN Hazard Class: 3 UN Subsidiary Risks: 6.1 UN Packing Group: II Marine pollutant.	

IMPORTANT DATA	PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and by ingestion.
	PHYSICAL DANGERS: The vapour is heavier than air and may travel along the ground; distant ignition possible.	INHALATION RISK: No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C.
	CHEMICAL DANGERS: The substance decomposes on heating producing hydrogen chloride and phosgene.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract.
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.	
PHYSICAL PROPERTIES	Boiling point: 120°C Melting point: -99°C Relative density (water = 1): 1.19 Solubility in water, g/100 ml at 20°C: 0.3 Vapour pressure, kPa at 20°C: 2.4	Relative vapour density (air = 1): 3.9 Flash point: 16°C o.c. Explosive limits, vol% in air: see Notes Octanol/water partition coefficient as log Pow: 2.0
ENVIRONMENTAL DATA		

NOTES

Explosive limits are unknown in literature, although the substance is combustible and has a flash point < 61°C. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.

Transport Emergency Card: TEC (R)-30G32

IMPORTANT LEGAL NOTICE:

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

DINOSEB			
2-sec-Butyl-4,6-dinitrophenol 2-(1-Methylpropyl)-4,6-dinitrophenol 2,4-Dinitro-6-(1-methylpropyl)phenol 2,4-Dinitro-6-sec-butylphenol $C_{10}H_{12}N_2O_5$ Molecular mass: 240.2			
CAS # 88-85-7 RTECS # SJ9800000 ICSC # 0149 UN # 2779 EC # 609-025-00-7			
TYPES OF HAZARD/EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible. Liquid formulations containing organic solvents may be flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion.		
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Blue skin. Convulsions. Headache. Sweating. Laboured breathing. Unconsciousness.	Ventilation (not if powder), local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
EYES	Redness. Pain. Blurred vision. Temporary loss of vision.	Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal pain. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Rest. Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Do NOT wash away into sewer. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: P3 filter respirator for toxic particles).	Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs. Ventilation along the floor.	Do not transport with food and feedstuffs. T symbol N symbol R: 61-62-24/25-36-44-50/53 S: 53-45-60-61 Note: E UN Hazard Class: 6.1 UN Packing Group: II Marine pollutant.	

IMPORTANT DATA	PHYSICAL STATE; APPEARANCE: ORANGE CRYSTALS , WITH PUNGENT ODOUR.	ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin and by ingestion.
	PHYSICAL DANGERS:	INHALATION RISK: A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster.
	CHEMICAL DANGERS: The substance decomposes on heating producing toxic fumes including nitrogen oxides. The solution in water is a weak acid. Attacks many metals in presence of water.	EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. The substance may cause effects on the gastrointestinal tract and central nervous system. Exposure to the aerosol in hot environment may result in death.
	OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established. PDK not established.	EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the kidneys, liver, blood, immune system and eyes , resulting in cataract. May cause reproductive toxicity in humans.
PHYSICAL PROPERTIES	Melting point: 38-42°C Relative density (water = 1): 1.3 at 30°C Solubility in water: none at 20°C (<0.1 g/100 ml)	Vapour pressure, Pa at 20°C: 0.007 Relative vapour density (air = 1): 8.3
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. This substance may be hazardous to the environment; special attention should be given to honey bees, birds and mammals. The substance may cause long-term effects in the aquatic environment.	

NOTES

Temperature of decomposition unknown in literature. If the pesticide is present under the form of a formulation containing hydrocarbon solvents, vomiting may not be induced. Depending on the degree of exposure, periodic medical examination is indicated. Carrier solvents used in commercial formulations may change physical and toxicological properties. Do NOT take working clothes home. Aatox, Aretit, BNP 20, BNP 30, Basanite, Butaphene, Caldon, Chemox General, Chemox PE, Desicoil, Dibutox, Dintrall, DN 289, Dow General, Dytop, Fanicide, Gebutox, Hivertox, HOE 26150, Ivosit, Kiloseb, Knowx-Weed, Ladob, Laseb, Nitropone C, Persevttox, Phenotan, Premerge, Sinox General, Sparic, Spurge, Subitex and Unicrop are trade names.

Transport Emergency Card: TEC (R)-61G53b
If the pesticide is formulated with an organic solvent, also consult ICSC of the solvent.

ADDITIONAL INFORMATION**IMPORTANT LEGAL NOTICE:**

Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

GROUNDWATER SAMPLING AND ANALYSIS PLAN

APPENDIX B

**HEALTH AND SAFETY COMPLIANCE
AGREEMENT**

HEALTH AND SAFETY COMPLIANCE AGREEMENT

Brown & Bryant Superfund Site
Arvin, California
Project No: Eco-10-425

I have reviewed and understand the entire Health and Safety Plan for the above-referenced project. I 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.

I have been approved to wear a respirator by a physician based on a medical examination. I have been trained in the appropriate use, care, and storage of respiratory equipment. I have been respirator fit-tested, and I will have my respirator available for use in the field. I understand that I am to use the equipment supplied to me by my employer. I further understand that this equipment is provided solely for my benefit with the intent to minimize my exposure to potentially hazardous conditions. In the event of such usage, I agree to indemnify and hold harmless Eco & Associates, Inc., and all of its employees, from and against any and all losses, demands, claims, liabilities, lawsuits, damages, costs, and expenses arising, in any way, from the use of the equipment.

Visitors will be required to review this Health and Safety Plan. It is required that visitors be escorted in the restricted access work zone. Visitors must comply with Eco & Associates, Inc.'s escort directions at all times while on site. Noncompliance with escort directions will not be tolerated, and violators will be requested to leave the site immediately.

SIGNATURE	PRINT NAME	DATE

Meeting Leader: _____ Date: _____

*GROUNDWATER SAMPLING AND ANALYSIS – HEALTH
AND SAFETY PLAN*

APPENDIX C

**ACCIDENT INVESTIGATION REPORT
(ENG FORM 3394)**

REPORT NO. <i>(For Safety Staff only)</i>		EROC CODE GO	UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT <i>(For Use of this Form See Attached Instructions and USACE Suppl to AR 385-40)</i>			REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)
1. ACCIDENT CLASSIFICATION						
PERSONNEL CLASSIFICATION		INJURY/ILLNESS/FATAL	PROPERTY DAMAGE		MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT CIVILIAN <input type="checkbox"/> MILITARY <input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER		<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> CONTRACTOR		<input type="checkbox"/>	<input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER		<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> PUBLIC		<input type="checkbox"/> FATAL <input type="checkbox"/> OTHER			<input type="checkbox"/>	
2. PERSONAL DATA						
a. NAME (Last, First, MI)		b. AGE	c. SEX <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	d. SOCIAL SECURITY NUMBER		e. GRADE
f. JOB SERIES/TITLE		g. DUTY STATUS <input type="checkbox"/> ON DUTY <input type="checkbox"/> TDY <input type="checkbox"/> OFF DUTY		h. EMPLOYMENT STATUS AT TIME OF ACCIDENT <input type="checkbox"/> ARMY ACTIVE <input type="checkbox"/> ARMY RESERVE <input type="checkbox"/> VOLUNTEER <input type="checkbox"/> PERMANENT <input type="checkbox"/> FOREIGN NATIONAL <input type="checkbox"/> SEASONAL <input type="checkbox"/> TEMPORARY <input type="checkbox"/> STUDENT <input type="checkbox"/> OTHER (Specify)		
3. GENERAL INFORMATION						
a. DATE OF ACCIDENT <i>(month/day/year)</i>	b. TIME OF ACCIDENT <i>(military time)</i> hrs	c. EXACT LOCATION OF ACCIDENT			d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR	
e. CONTRACT NUMBER <input type="checkbox"/> CIVIL WORKS <input type="checkbox"/> MILITARY <input type="checkbox"/> OTHER (SPECIFY)		f. TYPE OF CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/> SERVICE <input type="checkbox"/> A/E <input type="checkbox"/> DREDGE <input type="checkbox"/> OTHER (SPECIFY)		g. HAZARDOUS/TOXIC WASTE <input type="checkbox"/> SUPERFUND <input type="checkbox"/> DERP <input type="checkbox"/> IRP <input type="checkbox"/> OTHER (SPECIFY)		
4. CONSTRUCTION ACTIVITIES (Fill in line and corresponding code number in box from list - see instructions)						
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 instructions)						
a. SEVERITY OF ILLNESS/INJURY (CODE) #		b. ESTIMATED DAYS LOST		c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS REST. DUTY	
e. BODY PART AFFECTED (CODE) PRIMARY # (CODE) #		g. TYPE AND SOURCE OF INJURY/ILLNESS (CODE) TYPE # (CODE) #				
f. NATURE OF ILLNESS/INJURY (CODE) #						
6. PUBLIC FATALITY (Fill in line and correspondence code number in box - see instructions)						
a. ACTIVITY AT TIME OF ACCIDENT (CODE) #			b. PERSONAL FLOATATION DEVICE USED? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A			
7. MOTOR VEHICLE ACCIDENT						
a. TYPE OF VEHICLE		b. TYPE OF COLLISION		c. SEAT BELTS		
<input type="checkbox"/> PICKUP/VAN <input type="checkbox"/> AUTOMOBILE <input type="checkbox"/> TRUCK <input type="checkbox"/> OTHER (Specify)		<input type="checkbox"/> SIDE SWIPE <input type="checkbox"/> HEAD ON <input type="checkbox"/> REAR END <input type="checkbox"/> BROADSIDE <input type="checkbox"/> ROLL OVER <input type="checkbox"/> BACKING <input type="checkbox"/> OTHER (Specify)		USED NOT USED NOT AVAILABLE (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 instructions)						
a. TYPE OF VESSEL/FLOATING PLANT (CODE) #			b. TYPE OF COLLISION/MISHAP (CODE) #			
10. ACCIDENT DESCRIPTION (Use Additional paper, if necessary)						
See attached page.						

11. CASUAL FACTORS (Read Instructions Before Completing)					
a. (Explain YES answers in item 13) DESIGN: Was design of facility, workplace or equipment a factor?	YES	NO	a. (CONTINUED) 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?	YES	NO
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	<input type="checkbox"/>	<input type="checkbox"/>	OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc. contribute to the accident?	<input type="checkbox"/>	<input type="checkbox"/>
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	<input type="checkbox"/>	<input type="checkbox"/>	SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	<input type="checkbox"/>	<input type="checkbox"/>
OPERATING PROCEDURES: Were operating procedures a factor?	<input type="checkbox"/>	<input type="checkbox"/>	PERSONAL PROTECTIVE EQPT: Did the improper selection, use or maintenance of personal protective eqpt contribute to the accident?	<input type="checkbox"/>	<input type="checkbox"/>
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	<input type="checkbox"/>	<input type="checkbox"/>	DRUGS/ALCOHOL: In your opinion, was deugs or alcohol factor to the accident?	<input type="checkbox"/>	<input type="checkbox"/>
HUIMAN FACTORS: Did any human factors such as size or strength of person, etc., contribute to accident?	<input type="checkbox"/>	<input type="checkbox"/>	b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?		
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc. contribute to the accident?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> YES (If yes, attach a copy)	<input type="checkbox"/> NO	
12. TRAINING					
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING		c. DATE OF MOST RECENT FORMAL TRAINING		
<input type="checkbox"/> YES <input type="checkbox"/> NO	<input type="checkbox"/> CLASSROOM <input type="checkbox"/> 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 CORPS CONTRACTOR		d. DATE (Month/Day/Year)	e. ORGANIZATION IDENTIFIER (Div,Br,Sect)		f. OFFICE SYMBOL
16. MANAGEMENT REVIEW (1st)					
a. <input type="checkbox"/> CONCUR	b. <input type="checkbox"/> NON CONCUR		c. COMMENTS		
SIGNATURE	TITLE		DATE		
17. MANAGEMENT REVIEW (2nd - Chief Operations, Construction, Engineering, etc.)					
a. <input type="checkbox"/> CONCUR	b. <input type="checkbox"/> NON CONCUR		c. COMMENTS		
SIGNATURE	TITLE		DATE		
18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW					
a. <input type="checkbox"/> CONCUR	b. <input type="checkbox"/> NON CONCUR		c. ADDITIONAL ACTIONS/COMMENTS		
SIGNATURE	TITLE		DATE		
19. COMMAND APPROVAL					
COMMENTS					
COMMANDER SIGNATURE					DATE

10. ACCIDENT DESCRIPTION (Continuation)

13a. DIRECT CAUSE (Continuation)

13b. INDIRECT CAUSES (Continuation)

14. ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) (Continuation)

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

AUGUST 19, 2011

•REVISED FINAL•

**Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California**

**Prepared for:
U.S. Army Corps of Engineers
Albuquerque District
Albuquerque, New Mexico**

**Prepared by:
Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, California 92867
Phone: (714) 289-0995
Fax: (714) 289-0965**

Environmental Excellence





August 19, 2011

Ms. Cecilia Horner, PE
United States Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435

via FedEx

SUBJECT: SUBMITTAL OF REVISED FINAL (REV. 2) WORK PLANS (QAPP AND SAP) FOR THE BROWN & BRYANT SUPERFUND SITE IN ARVIN, CALIFORNIA

Dear Ms. Horner:

Please find enclosed one copy of the Revised Final Work Plans (the Quality Assurance Project Plan and the Sampling and Analysis Plan) for the Brown & Bryant Superfund Site in Arvin, CA, prepared by Eco & Associates, Inc. for your records.

We appreciate the opportunity to work with you and your colleagues on this project. If you have any questions, please do not hesitate to contact us at (714) 289-0995.

Sincerely,
ECO & ASSOCIATES, INC.

Mohammad Estiri, Ph.D.
Project Director

cc: Ms. Brunilda Davila, U.S. Environmental Protection Agency (3 copies)
Ms. Carol Wies, USACE, Albuquerque District (1 copy)
Mr. Thad Fukushige, USACE, Los Angeles District (1 copy)
Mr. Richard Lainhart, USACE, Albuquerque District (1 copy)
Mr. Steven Wagner, USACE, Albuquerque District (1 copy)

Enclosure

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco, CA 94105

September 7, 2011

MEMORANDUM

SUBJECT: Approval of the "Quality Assurance Project Plan and the Sampling and Analysis Plan, Brown & Bryant Superfund Site, Arvin, California," August 19, 2011, Eco & Associates, Inc., [DCN#H2CA0005QV2].

FROM: Rich Freitas, Environmental Scientist *RF*
Quality Assurance Office, MTS-3

Through: Eugenia McNaughton, Manager *Eugenia McNaughton*
Quality Assurance Office, MTS-3

TO: Bruni Davila, Remedial Project Manager
Site Cleanup Section, SFD-7-2

The attached responses to the QA Office concerns dated July 18, 2011 are satisfactory and the indicated changes have been made to the final document. The quality assurance project plan and the sampling and analysis plan are approved.

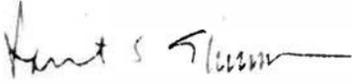
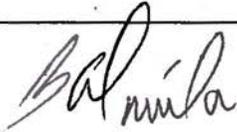
The review was based on the guidance provided in "EPA Requirements for Quality Assurance Project Plans," (EPA QA/R-5, EPA/240/B-01/003, March, 2001), "Guidance for Quality Assurance Project Plans" (EPA QA/G-5, EPA/600/R-02/009, December, 2002) as well as guidance and information presented on the Region 9 Quality Assurance web site (<http://www.epa.gov/region9/qa>).

If you have any questions please contact me at (415) 972-3804.

ECO DOCUMENT SIGNATURE PAGE

Signatures Below Indicate Approval of the Attached Document

Document Name/Project No.	Document Author
Quality Assurance Project Plan Project No.: Eco-11-425	Eco Project Team
Status	Date Submitted
<input type="checkbox"/> Draft <input type="checkbox"/> Draft Final <input type="checkbox"/> Final <input checked="" type="checkbox"/> Revised Final	08/05/2011
Is This a Formal Contract Deliverable?	Comments
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Revised for EPA comments.

Name, Project Position	Signature	Date
Opjit S. Ghuman, P.E. Eco Project Engineer		08/05/2011
Mitra Fiuzat, Ph.D Eco Project Manager		08/05/2011
Eugenia McNaughton, Ph.D EPA Region 9 Quality Assurance Program		9/7/11
Brunilda Davila EPA Region 9 Remedial Project Manager		9/28/11





August 5, 2011

Ms. Cecilia Horner, PE
United States Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435

**SUBJECT: SUBMITTAL OF REVISED FINAL WORK PLAN (QAPP AND SAP)
& RESPONSE TO COMMENTS
BROWN & BRYANT SUPERFUND SITE
ARVIN, CALIFORNIA**

Dear Ms. Horner:

In a memorandum dated July 18, 2011, EPA provided their comments on the revised final Quality Assurance Project Plan (QAPP), and Sampling and Analysis Plan (SAP) for the subject project. Both of these plans were dated June 10, 2011 and prepared to meet revised project requirements that were identified in discussions between the project team members during the first half of the year. Revisions have been made to these plans to accommodate the comments provided and the plans are re-submitted as revised final plans with a date of "August 5, 2011" for both plans. This transmittal letter also identifies the comments that required changes and the responses describing the changes made.

COMMENTS FROM RICH FREITAS OF EPA — JULY 18, 2011

Quality Assurance Project Plan

[Title and signature page] — On the signature page, please include Eugenia McNaughton, Ph.D., Manager, EPA Region 9, Quality Assurance Program and Bruni Davila, Remedial Project Manager, EPA Region 9, Superfund Program. Please also include next to each signature line a space to include the date of signature.

Signature Page is revised as requested. If necessary a separate signature page will be added to include the requisite signatures.

[Section 5.2.2 Groundwater, " ... groundwater depths within the well will be measured to the nearest 0.01 ft] — Wells with excessive turbidity or sediment buildup in the well should be redeveloped prior to sample collection.

Turbidity is measured during the sampling. The water is already filtered through porous intake of the Barcad. If the turbidity is still excessive, in line filtering may be considered during sampling. There is no opportunity for re-development of wells outfitted with Barcad. The well would require re-construction and this is not currently planned. No change to the QAPP is made because of this comment.

[Section 5.2.2.2, Existing Monitoring Wells, page 15, 2nd bullet, "The samples will be filtered and preserved by the laboratory ...] — Samples for metals analyses should be filtered inline at the well head and preserved in the field. Please clarify.

Language modified. This comment is not applicable as no metals analyses are performed.

[Section 11.3.2 Automated Data Review, page 30, "Data qualifying protocols and flags are based on EPA validation guidelines ...] — Please provide the reference for the EPA validation guidelines that will be used.

The language is modified to correctly refer to the control limits.

Site-Specific Groundwater Sampling and Analysis Work Plan

Comment 1: [Section 2.2 Previous Investigations, 2nd paragraph, " ... (see Tables 1 and 2 for analytical results from Site wells.) ...] — Tables 1 and 2 do not show analytical results. Please include this information as separate tables ..

Requested information is provided as separate tables.

[Section 2.2 Previous Investigations, 5th paragraph, "The wells tested and the analytical results are presented in Tables 1 and 2 ...] — Table 1 shows a list of wells at the site but Table 2 does not show analytical results. Please include the analytical results as a separate table.

See response to comment 1 above.

[Section 2.2 Previous Investigations] — A recent contour map of contamination concentrations should be included for each major contaminant in each aquifer zone. Also a contour map of the groundwater elevations in each aquifer zone is needed. Please include.

Copies of the requested contour maps from the April 2011 monitoring report (draft) are included as requested.

[Section 2.3 Previous Agency Inspections and Findings, "Public and private wells within 3 miles of the Site provide drinking water to 7,200 people and irrigate 19,600 acres of cropland. City of Arvin Well#1 is 1,500 feet from the site ...] — Please provide a well location map for public and private wells in the immediate vicinity of the site. As a table, please provide the construction details for these wells.

As requested, wells in 3 mile radius of the site or wells of the Arvin water district will be added in a figure showing their locations. Well construction diagram for CW-1 that is the well closest to the site will also be included. Construction details for other wells are not currently available. We will request these details and add them by addendum when, or if they become available.

[Section 2.4, Site Geology and Hydrogeology] — Hydrogeologic cross-sections would be useful here to show the A,B, and C zone aquifers. Please include if available.

Soil profile showing the A, B, and C-zones is included. Also, a cross-section across the site is included. These figures are the ones that were prepared for the RI/FS document.

[Section 2.5, Well Description & Locations, "The city well (CW-1) .. is shown on Figure 2."] — Figure 2 does not show well CW-1. Please correct.

Figure 2 is corrected to show the location of CW-1. CW-1 is also shown in the added figure showing public/private wells in the area of the site.

[Section 5.1.1, "Historic analytical results for the on-site and off-site wells are provided in Tables 1 and 2. "] — These tables do not include historic analytical results. Please include as separate tables.

The table numbers are revised and a separate table is included to show the results for COCs in the wells during the years for site monitoring.

[Section 5.1.3 Well Inspections] — Wells with excessive turbidity or sediment buildup in the well should be redeveloped prior to sample collection.

See response to Comment 2 for the QAPP.

[Section 5.2.1 Water-Level Measurements] — The measured well depth should be compared to the original design depth of the well to determine if the well screen has silted up and may require redevelopment.

Well depths will be measured and recorded to identify the extent of silting/sedimentation. Whereas silting/sedimentation is not expected in Barcad fitted wells, if access to the full depth of installation is not available then the well will need to be removed from monitoring, re-constructed, or re-installed. There is no opportunity for re-development of the wells.

[Section 5.2.2 Barcad Systems] — Please include an as-built well construction diagram with the Barcad purge/sampling system in place.

It is understood from the comments that the reviewer desires the plan to be a stand-alone document to the extent possible. However, as-built diagrams for Barcad installations would require considerable effort. Tables describing the same information and/or schematic as-built information are already included in the project reports. Pending further discussion, Barcad as-built diagrams are not included in the plans. However, a tabulated form of this data is provided.

[5.2.4 Well Sampling, 2nd paragraph, "The sample container type, size, and preservative for each specific analysis are provided in Table 5."] — Table 5 is missing. Please include.

Table 5 is included.

[Section 8.2 Bottles and Preservatives, "The number of sample containers, volumes, and materials are listed in the Section 5.2.3."] — This information is missing from Section 5.2.3. Please correct.

The identified information is included.

[Section 12.2 Distribution, "One draft paper copy each will be submitted to Ms. Cecelia Homer, Mr. Travis Cain, Mr. Thad Fukushige, and Mr. Richard Lainhart"] — Please replace Travis Cain with Bruni Davila who is the new EPA project manager for this site. Her mailing address is USEPA, Superfund SFD-7-2, 75 Hawthorne, San Francisco, CA 94105. Please also verify the names and addresses listed under this section.

Changes are made as requested.

[Appendix B. Site-specific Health and Safety Plan] — This section was not reviewed.

No review of the SSHASP is noted.

If you have any questions, please do not hesitate to call me at (714) 289-0995.

Sincerely,
ECO & ASSOCIATES, INC.

Mohammad Estiri, Ph.D.
Project Director

ECO DOCUMENT SIGNATURE PAGE

Signatures Below Indicate Approval of the Attached Document

Document Name/Project No.	Document Author
Quality Assurance Project Plan Project No.: Eco-11-425	Eco Project Team
Status	Date Submitted
<input type="checkbox"/> Draft <input type="checkbox"/> Draft Final <input type="checkbox"/> Final <input checked="" type="checkbox"/> Revised Final	08/05/2011
Is This a Formal Contract Deliverable?	Comments
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Revised for EPA comments.

Name, Project Position	Signature	Date
Opjit S. Ghuman, P.E. Eco Project Engineer		08/05/2011
Mitra Fiuzat, Ph.D Eco Project Manager		08/05/2011
Eugenia McNaughton, Ph.D EPA Region 9 Quality Assurance Program		
Brunilda Davila EPA Region 9 Remedial Project Manager		

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ABBREVIATIONS, ACRONYMS & SYMBOLS

µg/L	micrograms per liter
ADR	Automatic Data Review
APPL	Agriculture & Priority Pollutants Laboratories, Inc.
B&B	Brown & Bryant Superfund Site
CEG	Certified Engineering geologist
CIH	Certified Industrial Hygienist
COC	chemical of concern
CQC	Contractor Quality Control
CV	coefficient of variation
DHS	California Department of Health Services
DOD QSM	Department of Defense Quality Systems Manual
DOT	Department of Transportation
DQO	data quality objectives
DTSC	Department of Toxic Substances Control
Eco	Eco & Associates, Inc.
EDD	electronic data deliverables
EPA	U.S. Environmental Protection Agency
FSP	Field Sampling Plan
GC	gas chromatography
HSP	Site-Specific Health and Safety Plan
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
MS/MSD	matrix spike/matrix spike duplicate
NELAC	National Environmental Laboratory Accreditation Conference
PID	photoionization detector
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	standard operating procedure
TR/COC	Traffic Report/Chain of Custody
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

QUALITY ASSURANCE PROJECT PLAN

•REVISED FINAL•

**Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California**

1.0 INTRODUCTION

1.1 GENERAL INFORMATION

This Quality Assurance Project Plan (QAPP) presents the specific quality assurance (QA) and quality control (QC) activities associated with planned investigations and ongoing groundwater monitoring at Brown & Bryant Superfund Site (B&B) in the City of Arvin, Kern County, California (hereafter, "Site"). This QAPP is revised from the previous document prepared by Eco in 2007. The revision was necessary to reflect changes in the monitoring that was required following project technical reviews in 2011 and because of the lower contaminant levels required by the OU2 ROD. The main components requiring revision are analytical parameters to evaluate the attenuation of chemicals of concern (COCs). Groundwater data will continue to be obtained periodically; however, for the next few years, it is expected these will be collected biannually.

An earlier document (same title) was prepared by Panacea, Inc. (2001). This document was updated by Eco in 2007 to specifically address the proposed investigation and monitoring activities and include the requirements set forth in the revised Department of Defense Quality Systems Manual (DOD QSM, version 3, 2006).

The QAPP describes the specific protocols that will be followed for sample handling and storage, chain-of-custody, and laboratory analysis. The information contained in this QAPP is for use in groundwater sampling and analysis that is described in the project workplans, or will be described in new workplans.

All QA/QC procedures will be conducted in accordance with applicable professional standards; state and federal requirements, regulations, and guidelines; and specific project goals and requirements. All analytical laboratory work will be consistent with the requirements provided in DOD QSM (version 3, 2006). The overall QA objective for data is to ensure that they are obtained with known and acceptable quality. In order to meet these objectives, the following QA/QC parameters will be addressed for all data measurements:

- Precision

- Accuracy
- Completeness
- Comparability
- Representativeness

The QAPP is a standalone project document that has been prepared for groundwater investigations and monitoring at the Site. Existing project workplans will be used in conjunction with this QAPP. If additional investigations are necessary, then companion workplans to this document will be prepared.

1.2 DATA NEEDS

This section will identify data needs for field investigations and monitoring programs that will be detailed in other project workplans. When this QAPP was prepared, the only ongoing activity and related Site work were the installation of additional groundwater monitoring wells and the sampling and laboratory analyses of groundwater from existing monitoring wells. No specific details for this section are necessary.

Since monitored natural attenuation (MNA) is accepted as a remedy for the B-zone at the site, it is expected that sufficient data be obtained regarding the groundwater conditions that would support a comprehensive evaluation of the remedy. The data for natural attenuation require a quantitative understanding of source mass (A-zone contributions to the B-zone); groundwater flow (including preferential pathways); contaminant phase distribution and partitioning between soil, groundwater, and soil gas; rates of biological and non-biological transformation; and documentation of how these factors vary with time.

Whereas quantitative evaluation of MNA requires more than groundwater data, those components that are groundwater related are addressed in this plan. If additional groundwater data are deemed necessary, and groundwater investigations are planned, an addendum to this plan will be prepared that will address more completely the nature of the additional data and data quality objectives for that data.

2.0 PROJECT DESCRIPTION

The Site is located at 600 South Derby Street in the City of Arvin, California, approximately 18 miles southeast of the City of Bakersfield (Figures 1 and 2). Arvin is primarily an agricultural community located in a light industrial and commercial area.

To the west of the Site is the residential community of Arvin. A produce packing facility is located north of the Site, agricultural fields are east of the Site, and warehouse facilities are south of the Site. The Site is located on the eastern side of the City.

The Site is currently vacant and secured by a chain-link fence. An engineered bituminous pavement covers the entire Site and acts as a Resource Conservation and Recovery Act (RCRA) cap in the Site's southern portion and as a non-RCRA cap in the Site's northern portion. Structures currently present within the fenced area are groundwater monitoring wells, a warehouse, and an open metal shed (see Figure 3).

2.1 SITE HISTORY

The Site operated as a pesticide reformulator and custom applicator facility from 1960 to 1989. This facility formulated agricultural chemicals, including pesticides, herbicides,

fumigants, and fertilizers. In 1981, the B&B facility was licensed under RCRA as a hazardous waste transporter.

Contamination of soil and groundwater resulted from facility operations and maintenance practices that included chemical spills and leaks from a surface wastewater pond and sumps at the Site. The largest releases on Site were reported to be from a waste pond, a sump area, and a dinoseb spill area (U.S. Environmental Protection Agency [EPA], 1993).

The waste pond in the southwest portion of the Site was originally excavated as an unlined earthen pond in 1960. The pond was used to collect runoff water from the yard and two sumps (since excavated). The pond was also used to collect rinse water from rinsing tanks used for fumigants. Excess pond water and rainwater runoff also collected in a topographically low area to the east and south of the pond. In addition, ponded water from precipitation and irrigation from the east has occasionally breached the berm in the southeast corner of the pond and drained into the pond. The pond was double-lined with a synthetic liner in November 1979.

In 1960, an unlined earthen sump was constructed in the center of the Site. The sump was used to collect washwater from a pad where equipment and tanks used for liquid fertilizers and fumigants were washed. Water from the sump was drained to the pond through an underground pipeline. In 1980, the unlined sump was replaced with two double-lined sumps.

Dinoseb was stored in a smaller tank storage area along the eastern fence, just north of the pond. In 1983, a significant dinoseb spill occurred in this area. As a result, the soil and groundwater underlying this portion of the Site have been reported to contain the highest concentrations of dinoseb. The EPA excavated highly contaminated soil from this area in the mid-1990s.

Between 1983 and 1988, investigations were conducted at the Site to evaluate the nature and extent of chemicals in the soil and groundwater. Limited cleanup work began under the supervision of the California Department of Health Services (DHS). In 1989, the B&B facility ceased operations.

The EPA divided the Site into two operable units. The first operable unit (OU-1) consisted of the original source area of contamination (facility waste pond, tanks, sump area and the dinoseb spill area), the surface soils, the subsurface soils to the first water bearing unit (A-zone soils), and the first water bearing unit, the A-zone groundwater located approximately 65 to 70 feet below ground surface (bgs). The ROD for the OU-1 was signed in November of 1993. The selected OU-1 remedy included extraction and treatment of the A-zone groundwater. However, based on design studies and additional information collected during the remedial action phase of the project, the A-zone groundwater extraction and treatment was not installed. The pump test information indicated that A-zone groundwater yield was not sufficient and sustainable for traditional extraction and treatment. Action in the A-zone was carried forward to be addressed in conjunction with the B-zone groundwater in the second operable unit (OU-2). The actions in the 1993 OU-1 ROD for A-zone groundwater were interim actions.

The OU-2 ROD was signed in September 2007. The remedial action for OU-2 at the B&B Site addresses contaminated groundwater. The overall cleanup strategy for the B&B Site is to reduce contamination in groundwater to protect human health and the environment. The major components for the Selected Remedy include the following:

- Relocation of the Arvin City Well CW- 1

- Installation of an extraction system in the shallow A-zone aquifer with above ground ultraviolet (UV)/oxidation water treatment and disposal of the treated water to the City of Arvin sewer system
- Monitored Natural Attenuation – Conduct groundwater monitoring of the B-zone to evaluate: 1) the effectiveness of the remedy, 2) the location of the plume, and 3) that remediation goals have been met by natural attenuation in the B-zone.
- Placement of institutional controls on the Site and nearby properties to limit use of B-zone groundwater

Investigations and groundwater monitoring have continued at the Site in support of operations and maintenance required by the OU-1 and OU-2 Records of Decision.

2.2 PROJECT OBJECTIVES

The objective of this plan is to define the QA procedures that will be used to perform the field investigations for this project. Contaminants of concern (COCs) in the groundwater will be monitored in addition to field investigations in support of this monitoring. The investigative work will be undertaken to further define COCs in the groundwater and to estimate the progress of natural attenuation of COCs.

2.3 PROJECT SCHEDULE

The schedule of investigation activities will be in accordance with a proposed schedule approved by the EPA and the U.S. Army Corps of Engineers (USACE). The schedule will be based on project requirements and needs.

2.4 DESCRIPTION OF WELLS

Forty-four groundwater monitoring wells and 9 unused groundwater extraction wells on the Site and adjoining properties were constructed between 1984 and 2007 at locations designed to assess the extent of the plume, contaminant concentrations, and aquifer characteristics. A list of the groundwater monitoring wells is provided in Table 1. Well locations are shown on Figure 3. These wells are part of the groundwater monitoring at the Site that will be performed periodically.

2.5 WELL CONSTRUCTION AND GROUNDWATER DEPTHS

The on-site wells used during this study vary in construction. A description of the well depths, screen intervals, and diameters is provided in Table 1. The groundwater depths measured during this study are also provided in Table 1. Survey information for wells that were not surveyed at this time will be updated when the survey information becomes available.

All wells to be sampled are equipped with dedicated BarCad[®] groundwater sampling equipment. During sampling of water in the BarCad[®] system, measurements of pH, conductivity, and temperature of water samples are collected during each of two purges of the BarCad[®] system. These readings are recorded as part of the sampling log.

2.6 BARCAD[®] SYSTEM

The BarCad[®] system is a groundwater sampling instrument designed for permanent installation at a fixed elevation in groundwater monitoring wells. The BarCad[®] system is made up of the BarCad[®] unit, which consists of a ceramic porous filter (approximately 1.5 inches in diameter and 16 inches long), a 1-inch-diameter polyvinyl chloride (PVC) stinger pipe connecting the BarCad[®] unit to the top of the well, and a stainless steel probe with polyethylene tubing leading up the inside of the PVC stinger pipe to the well head. At the well head, attached to the top of the PVC riser tube, is a fitting equipped with an airtight Swagelok[®] fitting for the polyethylene tubing to exit the interior of the PVC stinger pipe and a quick-connect fitting to connect the pressurized inert gas supply.

The BarCad[®] groundwater sampling system works by applying pressurized inert gas (nitrogen) to the inside of the PVC stinger pipe, which in turn pressurizes the water column inside the BarCad[®] unit and drives the existing water into the stainless steel probe and up the polyethylene tubing to the surface. Subsequently, the inert gas displaces all of the water in the BarCad[®] unit and PVC stinger pipe through the stainless steel probe and polyethylene tubing, purging the BarCad[®] system of all existing water. Once the system is purged, inert gas pressure is removed from the BarCad[®] system to allow groundwater to flow into the BarCad[®] unit. Inert gas pressure is then reapplied and the resulting water can be collected for laboratory analysis.

One well volume of groundwater is purged (completely) from the BarCad[®] reservoir in a single purge event. Once the reservoir is emptied of groundwater and the nitrogen pressure is released, the BarCad[®] reservoir again opens to aquifer, allowing fresh groundwater to infill the BarCad[®] reservoir. During groundwater purging at the Site, groundwater is purged from the BarCad[®] reservoir twice. The initial purge removes all possible stagnant water from the BarCad[®] reservoir. The second purge is expected to rinse initial groundwater from the reservoir and tubing. The groundwater removed during the third purge is anticipated to be representative of the adjoining aquifer. This groundwater is collected and submitted for chemical analyses. The pH, temperature, and conductivity measurements of each well volume purged (one reservoir volume) are anticipated to be similar. Due to the nature of the BarCad[®] system, these measurements are not required to ensure that representative formation water is being collected.

2.7 SAMPLE ANALYSES

The objective of the sampling and analysis conducted during the periodic groundwater monitoring events is to assess the concentration of chemicals of concern (COCs) in groundwater in both the A and B zones beneath the Site and adjoining properties and to obtain pertinent groundwater data for evaluation of its quality.

The collected groundwater samples are analyzed for the seven COCs. The COCs and test methods used for their analysis are provided in Table 2 and these are as follows:

- Chloroform – EPA Test Method 8260B
- 1,2-Dibromo-3-Chloropropane (DBCP) – EPA Test Method 8260SIM
- 1,2-Dichloropropane (1,2-DCP) – EPA Test Method 8260B
- 1,3-Dichloropropane – EPA Test Method 8260B
- 1,2,3-Trichloropropane (TCP) – EPA Test Method 8260SIM

- Ethylene Dibromide (EDB) – EPA Test Method 8260SIM
- Dinoseb – EPA Test Method 8151A

In addition to these analyses, water samples are collected and analyzed as follows:

- Nitrates – EPA Test Method 300.0
- Sulfates – EPA Test Method 300.0
- Total Organic Carbon – EPA Test Method 415.1

2.8 GROUNDWATER SAMPLING

2.8.1 WATER-LEVEL MEASUREMENTS

Each well is sounded for depth to water from a surveyed point on the top fitting of the BarCad® pipe casing. All of the water depth measurements are collected prior to groundwater purging. An electronic sounder, precise to the nearest ± 0.01 foot, is used to measure the depth to water in each well. Significant groundwater fluctuations as a result of barometric or other changes are not anticipated in the data collected.

2.8.2 PURGING

Two BarCad® sampler volumes of water are purged from each well prior to the collection of water samples. Water quality measurements (including turbidity, dissolved oxygen, specific electrical conductance, pH, redox-potential and temperature) will be measured. The purging will continue till the stabilization criterion is achieved. The stabilization criteria will be based on three successive readings of the water quality field parameters that are within the following limits: pH ± 0.1 ; Specific electrical conductance (SEC) $\pm 3\%$ FS/cm; oxidation-reduction potential (ORP) ± 10 millivolts; turbidity $\pm 10\%$ NTUs (when turbidity is greater than 10 NTUs); dissolved oxygen ± 0.3 milligrams per liter.

If after two sampler volumes the measured parameters are not within the limits described above, the field geologist will continue the purging till the parameters are sufficiently stable prior to taking samples. The record of the water parameters during purging will be maintained in the water sampling log.

2.8.3 WELL SAMPLING

All wells are sampled immediately following purging. Samples are collected from the dedicated discharge tubing associated with each well. Immediately prior to sampling, the flow of nitrogen gas is adjusted and/or the discharge tubing kinked so that a gentle stream of water is obtained.

The sample container type, size, and preservative for each specific analysis are provided in Table 3.

Samples are collected in the sequence that is described in the Groundwater Monitoring Plan. The plan also provides the standard procedures to be used for sampling.

3.0 PROJECT ORGANIZATION AND FUNCTIONAL AREA RESPONSIBILITIES

Figure 4 presents the project organization, QC responsibilities, and laboratory assignments for project activities during the investigation. The personnel assigned to this project are as follows:

Project Director: Dr. Mohammad Estiri, responsible for overall administration of the B&B project for the USACE.

Corporate Health and Safety Officer: Mr. Mike Levin, Certified Industrial Hygienist (CIH), responsible for implementing the Site-Specific Health and Safety Plan (HSP);

QA/QC Manager: Mr. Opjit Ghuman, responsible for overseeing both analytical and field QA/QC activities for the project.

Project Manager: Dr. Mitra Fiuzat, directly responsible for on-site operations and supervision and support of subcontractors, including the analytical laboratory.

Project Geologist and Field Manager: Quin Kinnebrew, Certified Engineering Geologist (CEG), directly responsible for field activities and project geology.

CQC Staff: Mr. Carlos Hernandez, responsible for QC check of analytical data for the project.

Team Members: Are designated at the time of fieldwork.

Subcontractors and Third Parties: Are designated at the time of fieldwork, as necessary.

3.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

Eco & Associates, Inc. (Eco) is the lead and prime contractor for the workplan activities. Eco will provide overall project management that will include the coordination and direction of the efforts of project team members. Eco will be responsible for scheduling conference calls and/or meetings and providing status reports as needed.

The laboratory that will conduct the analyses for this phase of the project is EMAX Laboratories, Inc. (EMAX). EMAX is a certified small, disadvantaged, woman-owned laboratory located in Torrance, California. The laboratory is in compliance with the DOD QSM and includes participation in the National Environmental Laboratory Accreditation Conference (NELAC) Standard Proficiency Testing Program. QA personnel for the laboratory will be designated in the laboratory's Quality Assurance Plan. The analytical laboratory will designate a project manager for this project.

3.2 QUALITY CONTROL RESPONSIBILITIES

The personnel with QC responsibilities are distinct from project management in that the oversight performed to ensure data quality will be independent of analytical and field activities. However, corrective measures necessitated by review of analytical or field activities will be implemented through project management communication.

The QA/QC Manager assigned by Eco will oversee both the analytical and field QA/QC activities for the project. Analytical data generated by the laboratories may also be subject to evaluation by Eco (see Sections 13.0 and 14.0). Data evaluation will be the responsibility of the QA/QC Manager and project staff under the supervision of the QA/QC Manager.

Quality of data gathered in the field will be the responsibility of the field QA/QC Manager. That individual will ensure the quality of data obtained in the field by implementing the QA/QC procedures specified in this QAPP.

4.0 QUALITY ASSURANCE OBJECTIVES

4.1 OVERALL QUALITY ASSURANCE OBJECTIVES

The overall QA objectives of the workplan are to assure that sampling, field and laboratory chain-of-custody, laboratory analyses, field and laboratory data measurements, and reporting activities provide data quality consistent with the intended use. The primary QA objective is to assure that all data collected and used for the workplan, risk assessment, and remedial cost estimates are accurate, precise, representative, and legally defensible. QA is the overall goal, while QC represents the specific steps and procedures followed during the course of the project to achieve QA. QA objectives for data are usually expressed in terms of accuracy, precision, method reporting limits, completeness, representativeness, and comparability. The data generated from the workplan activities will not be considered invalid if the criteria are not fully achieved, but variances will trigger the appropriate QA/QC measures needed to evaluate and correct these activities if necessary (see Section 13.0). QA objectives for field measurement systems are also an important aspect of any environmental investigation. Field QA objectives are discussed in Section 6.0.

4.2 QUALITY ASSURANCE OBJECTIVES FOR ANALYTICAL DATA

Quality criteria to be used at the Site address the following data characteristics:

- Precision
- Accuracy
- Completeness
- Comparability
- Representativeness

4.2.1 QUANTITATIVE QUALITY ASSURANCE OBJECTIVES

Quantitative QA objectives for analytical data are defined as precision, accuracy, completeness, method detection, and quantitation limits. Quantitative QA objectives are established to ensure the overall quality of the analytical data produced by the laboratory.

The DOD-specified laboratory control sample (LCS) controls limits (see Appendix DOD-D of the DOD QSM [2006, version 3]) will be used when assessing batch criteria for acceptance of the results. This guidance is applicable for all quantitative aspects discussed below. The laboratory will be specifically instructed to use preparatory methods that are consistent with DOD requirements and will allow them to meet project precision and accuracy goals.

4.2.1.1 Precision

Precision (statistical analytical error) is the level of agreement among repeated measurements of the same characteristic. Determining the agreement among replicate/duplicate measurements of the same sample and measurements of duplicate samples will assess data precision. Precision of the measurement data gathered during the work effort at the Site will be based on laboratory control sample analyses (repeatability),

replicate analyses (replicability), and results obtained from duplicate/replicate field samples (sample replicability). A field replicate is defined as a single sample that is collected and then divided into two equal parts for the purpose of analysis. Field replicates will not be collected for any media sampled. Field duplicate samples alone shall be used as a QC measure to monitor precision relative to sample collection activities.

Field duplicates are defined as two samples collected independently at a single sampling location during a single act of sampling. Field duplicates will be acquired at a rate of 1 per 10 environmental samples, or 10 percent of the total number. Field duplicates will be collected for all media samples and analyzed for the same parameters. Field sample duplicates shall be used as a QC measure to monitor precision relative to sample collection activities. Precision of duplicates may depend on sample homogeneity.

Precision is independent of the error (accuracy) of the analyses and reflects only the degree to which the measurements agree with one another, not the degree to which they agree with the "true" value for the parameter measured. Precision is calculated in terms of relative

$$RPD = \frac{X_1 - X_2}{(X_1 + X_2)} \times 100$$

percent difference (RPD), which is expressed as follows:

where X_1 and X_2 represent the individual values found for the target analyte in the two replicate analyses.

The acceptability limit for all soil field duplicates is to have an RPD not greater than 25 percent more than the established laboratory RPD for laboratory duplicates. The acceptability limit for all water field duplicates is to have an RPD not greater than 15 percent more than the established laboratory RPD for laboratory duplicates.

4.2.1.2 Accuracy

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system. Data accuracy will be evaluated from analyses of LCS, surrogate standards, and matrix spike/matrix spike duplicate samples (MS/MSD) expressed as the percentage recovery measured relative to the true (known) concentrations. LCS analyses are matrix spikes on a blank matrix (de-ionized water, reagent sand) to assess the laboratory's accuracy independent of matrix effects. The percentage recovery for surrogate standards and LCS samples is given by:

$$\text{Recovery (\%)} = \frac{A}{T} \times 100$$

where

A = measured concentration of the LCS, and

T = known concentration.

For each shipment of samples that is sent to the laboratory, one sample will be provided in sufficient quantity such that an MS/MSD can be generated in addition to an aliquot reserved

for actual sample analysis. The MS/MSD will be fortified with a group of method target compounds, while a third aliquot of the sample will be analyzed unfortified. Accuracy will be measured in terms of percent recovery of each of the fortified components. The percentage recovery for MS samples will be used to evaluate the accuracy of analyses as given by:

$$\text{Recovery (\%)} = \frac{(A - B)}{T} \times 100$$

where

A = measured concentration of the spiked sample,

B = concentration of unspiked sample, and

T = amount of spike added.

Failure of MS/MSD and/or LCS analyses to meet QC criteria will initiate a review of the data for the corresponding analytical batch. If review indicates out-of-control data due to laboratory error, Eco will perform resampling/re-extraction/reanalysis to correct the out-of-control condition. QC criteria for analyses (surrogate, LCS, MS/MSD recoveries) will be in accordance with the requirements of the DOD QSM.

Failure of the selected analytical laboratory to present QC criteria that are acceptable to the USACE will result in the USACE directing Eco to retain another analytical laboratory for contract services.

The control limits reflect the minimum and maximum recoveries expected for individual measurements for an in-control system. Recoveries outside the established limits indicate some assignable cause, other than normal measurement error, and possible need for corrective action. This includes recalibration of the instrument, re-extraction/reanalysis of the QC sample, re-extraction/reanalysis of the samples in the batch, or flagging the data as suspect if the problems cannot be resolved. For highly contaminated samples, recovery of MS may depend on sample homogeneity.

Equipment, trip, and laboratory blanks will be analyzed to quantify artifacts introduced during sampling, transport, or analysis that may affect the accuracy of the data. In addition, the initial and continuing calibration results will be reviewed to verify that the analytical instrument accurately measures the sample concentrations.

4.2.1.3 Completeness

Completeness is the percentage of valid measurements (data points) obtained as a proportion of the number of measurements (data points) planned for the investigation. Completeness will be evaluated qualitatively and quantitatively. The qualitative evaluation of completeness will be determined as a function of events contributing to the sampling event including items such as correct handling of chain-of-custody forms, cooler log-in forms, samples arriving at the laboratory intact, properly preserved, in sufficient quantity to perform the requested analysis, etc. The quantitative description of completeness will be defined as the percentage of the laboratory's controlled QC parameters that are acceptable.

Completeness is affected by factors such as sample bottle breakage and acceptance/nonacceptance of analytical results. QC parameters that will be assessed for quantitative determinations of completeness will include surrogate percent recovery for organics analyses, analysis of laboratory duplicates for the RPD, analysis of the MS/MSD,

analyses for percent recovery and RPD, analysis of LCS for percent recovery, and holding times. The requirement for the quantitative assessment of completeness will be 90 percent. The 90 percent standard will be applied such that a minimum of 90 percent of the data for each analytical method is associated with acceptable QC criteria.

Percentage completeness (C) is given by

$$C (\%) = \frac{V}{P} \times 100$$

where

V = number of valid measurements (data points)
obtained, and

P = number of measurements (data points) planned.

4.2.2 QUALITATIVE QUALITY ASSURANCE OBJECTIVES

Qualitative QA objectives for analytical data are defined as comparability and representativeness.

4.2.2.1 Comparability

Comparability is the confidence with which one data set can be compared to another. Comparability also depends on the other data quality characteristics. Only when data are judged to be representative of the environmental conditions, and when precision and accuracy are known, can data sets be compared with confidence.

Comparability is achieved by the use of appropriate sampling methods, analytical methods and data evaluations. All data will be calculated and reported in units consistent with standard procedures so that the results of the analyses can be compared with those of other laboratories, if necessary. Data comparability will be achieved by using standard units of measure (i.e., milligrams per liter [mg/L] for inorganics in water samples, micrograms per liter [μ g/L] for organics in water and milligrams per kilogram [mg/kg] dry weight for both inorganics and organics in soil samples).

4.2.2.2 Representativeness

Representativeness is defined as the degree to which data accurately and precisely depict a characteristic of a population, parameter variations at a sampling point, process condition, or an environmental condition.

Representativeness is achieved by collecting a sufficient number of unbiased samples and implementing a QC program for sample analyses. Samples are collected so that they represent variations in environmental conditions. Subjective factors to be taken into account are as follows:

- Degree of homogeneity of a site
- Degree of homogeneity of a sample taken from one point in a site
- Available information on which a sampling plan is based

Field replication (in the case of this project, field duplicates), as defined under precision, is also used to assess representativeness. Two samples that are collected at the same location (or are co-located at the same time) are considered to be equally representative of a sampling condition. To maximize representativeness of results and sampling techniques,

sample locations will be carefully chosen so they provide laboratory samples representative of the Site and the specific area. Because soil samples are less homogeneous than water, it is important for the sampler to exercise good judgment when collecting a sample. Samples exhibiting obvious stratification or lithologic changes should not be used as replicates.

The laboratory's objective for representativeness of field samples is to ensure that a set of data accurately depicts the distinguishing characteristic of a sample source. Representativeness is assured by homogenizing samples prior to aliquot removal. Samples for volatile organic compound (VOC) analyses will not be homogenized prior to analysis. Results are considered reliable and representative if the sample distribution is within statistically defined bounds of the population mean and variance.

4.3 QUALITY ASSURANCE OBJECTIVES FOR FIELD MEASUREMENTS

4.3.1 LEVEL OF QUALITY CONTROL EFFORT

Equipment blanks, ambient blanks (if appropriate), trip blanks, field duplicates, and MS samples will be submitted for analyses to assess the quality of the data resulting from the field sampling program. The laboratory will also analyze a percentage of the groundwater samples in duplicate, in addition to the MS samples. Equipment, ambient (if appropriate), and trip blanks will be submitted to the analytical laboratory with the groundwater samples. Equipment blanks will be collected to quantify any contamination introduced during sample collection. Ambient blanks will be collected only if dust, exhaust, or other potential sources of ambient contamination are present in close proximity of the sampling locations. Trip blanks are used to assess the potential for contamination of the samples by VOCs during sample shipment and storage. Field duplicate samples are analyzed as a check of sampling and analytical reproducibility; laboratory duplicates provide an estimate of the reproducibility of measurement. The MS provides information about the effect of the sample matrix on preparation/extraction and measurement methodology. All MSs will be prepared in duplicate.

4.3.2 LEVEL OF EFFORT FOR LABORATORY QUALITY CONTROL

The quality of data generated by the project and the third party analytical laboratory will be assessed from documentation of sample handling and custody, results of field QC samples, and results from internal QC analyses. The minimum internal QA/QC measures for the laboratories are as follows:

- MS/MSD analyses with every 20 samples or with every sample batch less than 20 samples (not valid for third party laboratory)
- Method blanks at the beginning of each analytical run as specified by the method QC protocol
- Instrument calibration (including initial calibration, initial calibration verification, and continuing calibration) as required by method QC protocol
- Analyses of LCS (duplicate not required if MS/MSD is submitted)
- Analyses of surrogate standards
- Chain-of-custody maintained and documented
- Data, documentation, and reports maintained for a minimum of 3 years

- Maintenance of QC control limits during all analyses as specified by method QC protocol
- Laboratory is committed to follow method-specific QC requirements outlined in Tables B-2 through B-10 of the DOD QSM, version 3.

4.3.3 QUALITY CONTROL (QC) LIMITS

Control limits, as outlined within each analytical procedure, are the maximum and/or minimum values defining a range for a specific parameter considered to satisfy the QC criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is (or becomes) out-of-control, corrective action must be taken to bring the analysis back into control. Appropriate measures for corrective action are described in Section 16.

Exceptions will be made on a case-specific basis. If the control limit is technically impractical for a particular sample or analysis, documentation and narrative explanation should be submitted with the data report and raw data. The documentation must include evidence that a good faith effort was made to meet the control limit; this will generally include two attempts to analyze the sample within control limits.

The requirements as described in DOD QSM (in Appendix DOD-D) will be followed for control limits. On page 179 of the reference document, the approach to the control limits policy is described, which includes the approach to corrective action in case of LCS failure.

5.0 SAMPLING PROCEDURES AND SAMPLE CUSTODY

In addition to this section, sampling procedures are also contained in the Groundwater Monitoring Plan. This section also discusses field documentation procedures, decontamination, and waste disposal. These procedures will be used during work activities for the project. A detailed description of the sampling procedures is provided in Section 5.2. Section 5.3 describes sample location surveying procedures. Section 5.4 describes field documentation procedures. Sections 5.5 and 5.6 provide added information on decontamination and waste disposal procedures.

5.1 SAMPLE VOLUME, CONTAINERS, AND PRESERVATION

For each sample, the media being sampled will be placed into the appropriate sample container, preserved, and capped tightly with a Teflon-lined lid.

Once collected, each sample container will be labeled with the following information:

- Sample number
- Location
- Date
- Time
- Analyses requested
- Preservative
- Filtered/unfiltered
- Sampler's initials

The containers will be sealed in a plastic bag and placed directly into a cooler at that is kept chilled with ice. The temperature of cooler will be maintained by the stored ice during storage and shipping. Upon receipt, the laboratory will record the temperature of the cooler for documentation of sample temporary storage and record and data validation.

5.2 SAMPLING PROCEDURES

The procedures below detail the sampling protocol for soils and groundwater to be used during work activities that are either ongoing or may be conducted.

5.2.1 SOIL SAMPLES

No soil sampling is planned as part of any proposed investigation at the Site. If performed, soil samples will be collected using drilled auger borings or trenching. No hand-auger drilling is anticipated at the Site. If soil is to be sampled at the Site then more detailed sampling information will be provided in an addendum to this plan.

An Eco field geologist, under the direct supervision of a California Registered Geologist or Engineer, will log the collected soil samples. Soil sample lithology will be identified using the Unified Soil Classification System. In addition, an aliquot of the soil sample interval will be collected and screened for organic vapors using a photoionization detector (PID) instrument. The field geologist will record a measurement of the headspace above the soils. A soil sample will be placed in a glass mason jar. The soil sample will be broken into small pieces and set aside for approximately five minutes. The probe of the PID will be inserted into the jar and the headspace measurements recorded in the field logbook and on the field-drilling log.

5.2.2 GROUNDWATER

Additional groundwater monitoring wells may be installed as part of ongoing Site monitoring. All data will be collected from the existing forty-four (44) wells on and in the vicinity of the Site. The groundwater monitoring activities are described in the project Groundwater Sampling Workplan. Prior to groundwater sampling, groundwater depths within the well will be measured to the nearest 0.01 foot with either an interface probe or a water level indicator. The appropriate level of personal protection will be determined according to the approved HSP prior to the beginning of field activities. Decontamination procedures, as described in Section 5.5, will be followed during sampling activities.

5.2.2.1 Drilled Borings

Borings will be drilled for the installation of groundwater monitoring wells. The locations of the wells will be recorded in a field notebook and on a Site Plan Map. The appropriate level of personal protection will be determined according to the approved HSP prior to the beginning of field activities. Decontamination procedures as described in Section 5.5 will be followed during sampling activities.

The soil boreholes for the wells will be drilled using disk augers. No soil samples will be collected during drilling of borings for the installation of groundwater monitoring wells.

During drilling operations, an Eco geologist will log each soil borehole for lithology using the Unified Soil Classification System.

5.2.2.2 Existing Monitoring Wells

The following procedures will be used while performing groundwater sampling activities on existing monitoring wells:

- A portable temperature/pH/conductivity meter and turbidity meter will be calibrated at the beginning of each day of the sampling event and noted on the calibration log form.
- The wells will be purged by removing the water in the BarCad® system prior to sampling for well water.
- Disposable sampling gloves will be donned prior to procuring samples. Gloves will be worn while sampling each well. Gloves will be discarded after the well sampling is complete.
- A water sample will be collected with the appropriate sampling equipment and placed in the appropriate sample container.
- The samples will be numbered and the sampling containers labeled following the procedures outlined in Section 5.4.
- The samples will be preserved as noted in Table 3. Note that water samples collected for metals analyses will be inline filtered and preserved during sample collection.
- All field documentation and chain-of-custody records for each sample will be completed as specified in Section 5.4. Coolers that contain samples for VOC analysis to be shipped to a California-certified analytical laboratory will contain a trip blank prepared by the appropriate laboratory.
- Duplicate and rinsate samples will be obtained at the frequency described in Section 6.0. Rinsate and duplicate samples should be clearly marked with a reference number on the sample containers and chain-of-custody forms. These will correspond to the proper identification in the field notebook, but they will be submitted blind to each of the laboratories.

Documentation of field and sample collection activities will include the use of field logbooks, field sheets, sample labels, and chain-of-custody forms. Photographs and boring logs may also be used to document field activities.

5.3 SAMPLE LOCATIONS AND SURVEYING

5.3.1 SAMPLING SITE LOCATIONS

Planned sampling locations are described in the Groundwater Monitoring Plan. If additional groundwater wells are installed and included for sampling, they will be added to the list of monitored wells. The locations of all wells are established by survey at the time of installation. These location surveys are not repeated during the project. The depth of the water sample is also established at this time when the BarCad® installation is completed.

5.3.2 SURVEYING

The location of groundwater monitoring wells is flagged (or appropriately marked) after completion for identification and surveying of its location. The location of the casing and its elevation are surveyed by a licensed surveyor shortly after the completion of installation. This survey information will establish the location of the groundwater sample.

No other field surveys of the investigation locations are planned.

5.4 FIELD DOCUMENTATION

The field team is responsible for the care and custody of samples collected until they are transferred to another party, dispatched to each of the laboratories, or disposed of.

5.4.1 SAMPLE DOCUMENTATION

Sample ID numbers will be affixed to each sample container and entered on the chain-of-custody. For soil samples, which typically consist of multiple stainless steel liners, a single sample number shall apply to all liners of the same sample. The sample number, along with the date and time the sample was obtained, will be recorded in the field log (or data sheet) and written on the sample label. After collection and identification, the samples will be maintained under chain-of-custody procedures.

All duplicate samples will be labeled in the same manner as field samples so they cannot be identified as duplicates or replicates by laboratory personnel. Their status as field duplicates/replicates will be noted in the field logbook and/or on the data sheets.

5.4.2 SAMPLE TAGS

Samples are identified by a sample tag that should include the following information:

- Project name and number
- Field identification sample number
- Date and time of sample collection
- Printed full name of the individual who collected the sample
- Location
- Type of sample (e.g., soil, water) and depth at which obtained
- Type of analysis to be conducted
- Preservative used
- Whether the sample is filtered or unfiltered (for water)

5.4.2.1 Soil Samples

No soil samples will be collected during Site investigations.

5.4.2.2 Groundwater Samples

Groundwater samples from existing monitoring wells will be labeled using the identifiers established during previous investigations.

An example of the groundwater sampling numbering system is provided below.

Example:

YYMMDD-WELL

where

YYMMDD = Sample date, and

WELL = Monitoring well ID (e.g., AMW-4 or PWB-1)

QA samples such as blanks and duplicates will be similarly marked except that the well number will be replaced with the appropriate QA designation and identifier. As an example, 080607-FDUP-4 is the fourth duplicate collected on June 7, 2008.

5.4.2.3 FORMS II Lite™

Following sample collection, FORMS II Lite™ will be used to document and export field data electronically to the EPA Superfund Analytical Services Tracking System (ANSETS). The Traffic Report/Chain of Custody Report (TR/COC) export file from FORMS II Lite™, captures most of the essential ANSETS data and will be submitted to meet ANSETS requirements. Submittal of the TR/COC export file will be an email attachment to holman.elizabeth@epa.gov.

5.4.3 SAMPLE CUSTODY

A sample is the physical evidence collected from a site or from the environment. Using the procedures presented in this section will control custody and tracking of the evidence collected. The chain-of-custody procedures are as follows:

- Prior to sample packaging and shipment, the chain-of-custody form will be completed for the sample collected.
- When the form is full or when all samples have been collected that will fit in a single cooler, the field QA/QC sample manager will check the form and/or cooler contents for possible errors.
- Corrections will be made to the record with a single strike mark and will be initialed. Each cooler will be accompanied by a separate chain-of-custody.

The possession and handling of samples should be traceable from the time of collection, through analysis, and until final disposition. A numbering system will be used to allow tracking of sample information and positive identification of sample results. Components of the chain-of-custody (sample labels and seals, a field logbook, chain-of-custody record, and sample analysis request form) and procedures for their use are described in the following sections. Sample custody procedures will follow EPA and Department of Toxic Substances Control (DTSC) guidance procedures.

A sample is considered to be under a person's custody if it is

- in a person's physical possession,
- in view of the person after he/she has taken possession,
- secured by the person so that no one can tamper with the sample, and
- secured by that person in an area that is restricted to unauthorized personnel.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record must be filled out and accompany every sample. Standard forms have been developed for labeling samples and tracing chain-of-custody. The person who collects the sample initially fills out the chain-of-custody form. Each person who later receives the samples must sign the form. Samples must not be left unattended unless they are secured and sealed. Information noted on this record will include the following:

- Date chain-of-custody form was filled out
- Page number and total number of pages

- Name and address of laboratory where samples are to be shipped
- Name and address of contractor
- Project title
- Project number
- Method of shipment
- Project Manager's name
- Project Manager's telephone and fax numbers
- Signature of person(s) collecting the samples
- Entire field sample number
- Sample depth
- Date and time sample was collected
- Type of matrix (e.g., soil)
- Type or size of sample container
- Preservation temperature (4° C)
- Preservation chemical
- Note if sample has been filtered in the field
- Number of sample containers
- Types of analyses required
- Signature and printed name of the person giving up the sample
- Date and time at which sample was relinquished
- Signature and printed name of receiving person
- Date and time at which samples were received

A chain-of-custody record will accompany each cooler of samples collected and be delivered or shipped to an analytical laboratory. The primary purpose of the chain-of-custody procedure is to document the possession of the samples from collection, through storage and analysis, and to reporting. Chain-of-custody forms become the permanent records of all sample handling and shipping. If an express courier is used, the bill of lading will serve the purpose of the chain-of-custody until the shipping container is received by each of the laboratories.

5.4.4 SAMPLES PACKAGING AND SHIPPING

Shipping procedures will comply with Department of Transportation (DOT) requirements. All samples will be classified as environmental and be packaged carefully to avoid breakage or contamination. Sample labels are necessary to prevent misidentification; gummed paper labels will be affixed to sample containers prior to (or at the time of) sampling. Sample labels will be filled out at the time of sample collection to identify each sample with the appropriate code. The sample location and type of sample will be recorded in the sampling logbook.

The following sample packaging requirements will be followed:

- All samples will be chilled in temporary coolers using double-bagged water ice and/or blue ice as specified in Table 3.

- All glass sample bottles will be wrapped in bubble pack and placed in plastic bags to minimize the potential for contamination and breakage. All other sample containers will be placed in sealed plastic bags.
- About 3 inches of inert cushioning material will be placed in the bottom of the cooler before placing the sample containers in it.
- The chain-of-custody record will be placed in a plastic bag and taped to the inside of the cooler lid.
- A temperature blank will be included in each cooler.
- All shipping containers will be custody-sealed on two sides (the right front and back left) and sealed with strapping tape at a minimum of two locations. Labels are not to be covered.
- The drain will be taped shut.
- “This Side Up” labels will be placed on all four sides and “Fragile” labels on at least two sides.

The chain-of-custody record listing the variables to be analyzed by the laboratory will accompany the samples and include the total number and type of samples shipped for analysis.

5.4.5 FIELD LOGBOOKS

All information pertinent to a field survey and/or sampling event will be recorded on appropriate data sheets and/or in a project field logbook that will be a waterproof, bound book with consecutively numbered pages. The logbook will be signed and dated by the assigned person prior to initiation of the fieldwork. The designated person will make all entries. If the logbook is transferred, the person relinquishing the logbook and the person receiving the logbook will sign and date the logbook. Entries in the logbook will be made in waterproof ink. The logbook entries will include the following:

- Name and address of field contact
- Date of entry
- Names and affiliations of personnel on Site
- General description of each day’s field activities
- Documentation of weather conditions during sampling
- Location of sampling (e.g., boring number and depth)
- Calibration of field equipment
- Observations of sample or collection environment if needed
- Identification of sample device
- Any field measurements made
- Sequence of collection
- Type of sample matrix (e.g., soil)
- Date and time of sample collection
- Field sample identification number
- Sample distribution (e.g., laboratory, hauler, etc.)

- Sampler's name
- Sample type (composite, split, etc.)
- Field filtering of water samples (if applicable)
- Preservative used

The bottom of each page in the logbook will be signed or initialed by the person making the entries. Unused portions of the logbook pages will be crossed out, signed, and dated at the end of each workday. Logbook entries must be dated, legible, in ink, and contain accurate documentation. Language used will be objective, factual, and free of personal opinions. Hypotheses for observed phenomena may be recorded; however, they must be clearly indicated as such and only relate to the subject observation. Field logs will become part of the project records. They will be delivered to the USACE at the end of the project.

Bound field logbooks with sequentially numbered pages will provide the means of recording pertinent field activities performed or observations made. Because field activities are often quite diverse, the field logbook entries must be in sufficient detail so that the sampling situation or field activity can be reconstructed at a later date.

5.4.6 PHOTOGRAPHS

A photographic record of field conditions, drilling, and sampling will be made. Photographs, as taken, will be recorded in the appropriate logbook section or in additional sections, as needed. Information to be recorded includes

- roll and frame number,
- date,
- time,
- weather condition,
- name of photographer,
- location (e.g., boring sample number),
- subject (e.g., confirmation sample), and
- names of any personnel included in the photograph.

When photographs are developed, the information in the field logbook will be transferred to the back of each photograph. All photographs will become part of the project file and are subject to all standard document controls. All photographs will be delivered to the USACE at the end of the project.

Selected photographs taken during the field activities will be included with the reporting for each activity.

5.4.7 CORRECTION TO DOCUMENTATION

All original data recorded in field logbooks, on sample tags, or in custody records, as well as other data sheet entries, will be written with waterproof ink. If an error (e.g., incorrect data or sample depth) is made on the document, a correction will be made by crossing a line through the error (in such a manner that the original entry can still be read) and entering the correct information. All corrections will be initialed and dated.

5.5 DECONTAMINATION PROCEDURES

All Geoprobe™ sampling equipment will be cleaned between each sampling use by using an Alconox solution followed by a rinse with tap water. All monitoring well developing, purging, reusable sampling, hand augers, and measurement equipment will be thoroughly decontaminated between successive sampling events following the same procedure. All hollow-stem drilling augers, bits, connecting rods, and sampling equipment will be cleaned between soil boreholes using a steam cleaner.

Decontamination water will be collected and disposed of as specified in Section 5.6. Disposable sampling equipment (e.g., gloves, polyethylene tubing, and disposable bailers) will be collected in plastic garbage bags. Full bags will be placed in a designated storage/disposal area.

5.6 DISPOSAL PROCEDURES

Water generated during the investigation will be containerized and stored following the Site's specific guidelines. If drums are used, these will be properly labeled and sampled for waste characterization. Final disposition of the water will be determined upon receipt of laboratory analyses or will be handled in accordance with site-specific requirements.

6.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field QC will include the collection of equipment blanks, ambient blanks (if necessary), trip blanks, and field duplicates along with MS samples. A summary of the QC samples, their QA objectives, and acceptance limits is provided in Table 4.

QC samples will be collected as blind samples so that the laboratory remains unaware of the nature of those samples and performs analyses identically to the sample analyses. The appropriate types and frequencies of field QC samples depend on the sample type, sample matrix, and intended data use.

Equipment blanks consist of analyte-free reagent water that is poured through the sampling device or equipment, collected in a clean sampling bottle, preserved as needed, and analyzed with the samples. Equipment blanks may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide representative samples.

A **field duplicate** sample is a second sample collected at the same location as the original sample. It is collected simultaneously with (or in immediate succession to) the original sample using identical recovery techniques and it is treated in an identical manner during storage, transportation, and analysis. Field duplicate sample results may be used to provide a measure of method variability, including both sampling and analytical precision. A replicate of the duplicate sample is also collected for purposes of third party laboratory analysis.

Two aliquots of one of the field samples are collected and designated as MS/MSD on the chain-of-custody form. The samples are spiked with a solution of known concentration in the laboratory for the duplicate analysis, and the results for each spiked compound will be used to assess the precision and accuracy of the method as it is performed for a specific sample matrix.

A **trip blank** is a sample of reagent water prepared at the laboratory and shipped to and from the field with sample bottles. The sampling staff never opens the trip blank bottles. Trip blanks are used to detect potential sample contamination during storage and transport.

An **ambient blank** is a sample of analyte-free reagent water that is poured into a sample bottle at the location where sampling is occurring. Ambient blanks are used to identify any potential contamination present in the ambient air. Ambient blanks will only be collected if necessary based on observed dust, exhaust, or other potential sources of air contamination observed at the sampling locations.

6.1 EQUIPMENT BLANKS

Equipment blanks will be used to quantify artifacts introduced into the sample during collection. Potential sources of artifacts include sampling gloves, pump tubing, core samples, scoops, trowels, hand augers, and extension sections. For fieldwork using dedicated equipment, no equipment blank will be necessary. At least one equipment blank will be collected for every 20 samples collected, or one for each day of sampling, whichever is more frequent. Surfaces or materials exposed during actual sampling will be decontaminated. The blank will then be collected by pouring analyte-free water, supplied by the laboratory performing the analyses, over and/or through the decontaminated, non-dedicated sampling equipment. The blank will be analyzed for the same suite of monitoring parameters as the associated water samples. The concentration levels of any artifact found in the equipment blank will be noted and compared to the corresponding sample results as part of the data quality evaluation. If a sample concentration is less than five times the concentration detected in the equipment blank, the measured concentration may be biased high due to artifacts introduced during sampling or analysis.

6.2 FIELD DUPLICATES

Field duplicates will be collected to measure the sampling and analytical variability (precision) associated with the sample concentrations. During each sampling event, one monitoring location will be selected at random for duplicate sampling (one duplicate for every 10 samples). The duplicate sample will be analyzed for the same suite of monitoring parameters as the original sample. At all sampling locations, duplicate samples will be collected immediately after the corresponding original sample has been collected. The field duplicate will be submitted as a “blind” sample to the laboratory. The RPD between the original sample and field duplicate will be calculated for each parameter as part of the data evaluation. Field precision outside the acceptance limit of 20 percent RPD will indicate high variability, and therefore estimated concentrations, associated with the field duplicate and original sample.

In addition to the 10 percent duplicate samples to be sent to the project analytical laboratory, replicates of the duplicate samples will be collected and sent to a third party independent laboratory for analyses.

6.3 MATRIX SPIKE/MATRIX SPIKE DUPLICATES

Three times the standard sample volume will be collected for groundwater samples and be designated as MS/MSDs. The MS recoveries will reflect the accuracy of the data and indicate a potential bias for the samples included in the analysis and/or extraction batch (low spike recovery indicates a potential low bias, high spike recovery indicates a potential high bias). The MS/MSD RPDs will be calculated as a measure of precision, and the acceptance limit will

be 20 percent. Precision outside the acceptance limit will indicate high variability and possible matrix interference, and therefore estimated concentrations, for the samples associated with the batch.

6.4 TRIP BLANK

Trip blanks are composed of deionized water added to a clean preserved volatile organic analysis vial. The trip blank accompanies sample containers from the analytical laboratory to the field and back again to the analytical laboratory. Trip blanks will be prepared and submitted by the laboratory for each shipment of environmental samples for VOC analyses (every cooler containing VOC samples will contain a trip blank). Trip blanks will be analyzed for all VOC analyses specified for samples in the corresponding cooler.

6.5 AMBIENT BLANKS

Ambient blanks are used to identify and quantify any contamination present in the ambient air at the sampling locations. Ambient air blanks will only be collected if field conditions suggest that potential ambient air contamination may exist. Conditions such as dust or exhaust present in the air at the sampling location would warrant the collection of an ambient blank. Ambient blanks are collected by pouring analyte-free reagent water supplied by the laboratory into a sample bottle at the location where sampling is occurring. The concentrations of any analytes detected in an ambient blank will be noted and compared to the corresponding sample results as part of the data quality evaluation. If a corresponding sample concentration is less than five times the concentration detected in the ambient blank, the measured concentration may be biased high due to ambient air contamination.

For this project, no ambient blanks are currently planned for collection. If collected because of unlikely and unexpected field conditions, the samples will be analyzed only for VOCs.

7.0 LABORATORY SAMPLE CUSTODY PROCEDURES

Upon receipt of the environmental samples, all samples will proceed through an orderly processing sequence specifically designed to ensure continuous integrity of both the sample and its documentation. The protocol for sample receipt, custody, storage, and documentation will be detailed in the analytical laboratory's QA/QC Plan.

Authorized laboratory personnel (i.e., Sample Custodian) will sign a Sample Condition Log-in Sheet to acknowledge receipt of shipment and document the condition of samples upon receipt. The Sample Custodian will examine the shipment, noting whether or not custody seals are still intact. The temperature of the temperature blank is recorded on the log-in sheet and the chain-of-custody form; the chain-of-custody form is then signed and dated. The contents of the ice chests are compared to the chain-of-custody record, and any discrepancies are noted in the log-in sheet. Eco will be notified of any discrepancies. For hand-delivered samples, an authorized laboratory staff member will sign the chain-of-custody form and a copy of it will be given to the person delivering the samples. A copy will also be sent to Eco with the completed laboratory analysis results.

A laboratory tracking number is assigned to each sample shipment group. This number is kept in a bound, paginated notebook. A unique laboratory number is assigned to each sample and transferred to the proper analyst or stored in the appropriate secured area. An internal chain-of-custody form is initiated by the Sample Custodian to track the movement of samples within the laboratory. Samples are stored in designated areas separate from

chemical standards and solvents. Laboratory personnel are responsible for the care and custody of samples from the time they are received until the samples are exhausted or returned to the Sample Custodian.

The laboratory for the project will create a project file. The project file will contain all documents associated with the project, including correspondence from the client, copies of the chain-of-custody records, raw data, copies of entries from laboratory notebooks that pertain to the project, and a copy of the final report. When a project is complete, all records are passed to the Document Custodian who inventories the file, checks for completeness, and puts the file into document archive.

8.0 CALIBRATION AND MAINTENANCE

The calibration and maintenance history of instruments used to take measurements and analyze samples is an important aspect of the QA/QC program for the project. Only laboratory personnel trained for the manufacturer's established instrument procedures will perform instrument calibration and maintenance.

8.1 FIELD INSTRUMENTS AND EQUIPMENT

All field instrumentation, sampling equipment, and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field practices. Lists of field equipment that may be used during the investigations and general maintenance requirements are presented in Table 5. Field calibration will be performed in accordance with the manufacturer's directions and using standard calibration solutions and gases. Calibration checks will be performed at least once prior to and at least once following each day of instrument use in the field. Results will be documented on the sampling record for each sampling station.

Equipment that becomes questionable or inoperable during use will be removed from service. Such equipment may be repaired and recalibrated to approved QC standards by the team leader or qualified personnel, as appropriate. Equipment that cannot be repaired will be replaced.

The calibration and general maintenance of field instruments is the responsibility of field team geologists or designated personnel. A field logbook and calibration record form will be maintained by these individuals to document calibration, maintenance, and status of all instruments used during the environmental investigation.

Measurement of sample pH will be made by dipping the pH probe directly into water samples or into a separate sample aliquot. The pH measurement will be made as soon as possible after collection of the field parameter sample, preferably within a few minutes. The pH value displayed on the calibrated instrument will be recorded after the reading has stabilized. If the pH value falls outside of the calibrated range, then the pH meter will be recalibrated using the appropriate buffer solutions.

Temperature will be measured directly from the water source or from a separate sample aliquot. Temperature measurements will be made with a mercury-filled thermometer, bimetallic thermometer, or electronic thermistor. All temperature measurements will be recorded in °C.

Specific conductance will be measured by dipping the probe directly into the water source or a separate sample aliquot. The probe must be immersed to the manufacturer's

recommended depth. Specific conductance will be reported in micromhos/centimeter at 25°C. If the meter is not equipped with an automatic temperature compensation function, then the field value will be adjusted at a later time using the temperature data and the following formula:

$$SC_{25} = \frac{SC_T}{[1 + \{(T - 25) \times 0.025\}]}$$

where

SC_{25} is the specific conductance at 25°C, and

SC_T is the measured specific conductance at the temperature T°C.

The value displayed on the calibrated instrument will be recorded after the reading has stabilized. If the value falls outside of the calibrated “range” set by the range dial on the instrument, then the range setting will be changed to a position which gives maximum definition. If the specific conductance value falls outside the value of the calibrated range of the conductivity standard solution, then the instrument will be recalibrated using the appropriate standard prior to measurement. Equipment related to health and safety concerns (e.g., HNu™ and Miniram dust monitor) is discussed in the HSP.

8.2 LABORATORY INSTRUMENTS

Calibration and maintenance of analytical instruments are required to ensure that the analytical system is operating correctly and functioning at the proper sensitivity to meet the specified data quality objectives.

The qualified analytical laboratory is responsible for maintaining its laboratory equipment. Preventive maintenance is done on a scheduled basis to minimize down time and the potential interruption of analytical work. Each instrument is calibrated with standard solutions or gases appropriate to the type of instrument and the range established for the analytical method.

Maintenance, tuning, calibration, and standardization procedures for laboratory instruments will generally follow the frequency and procedures established by the EPA for solid waste SW-846 methods (EPA, 1986). The laboratory will also follow manufacturer's recommended guidelines for maintenance. Calibration results will be reported with the results for associated sample analyses. Detailed records will be maintained in a dedicated logbook for each piece of laboratory equipment.

Laboratory QC is necessary to control the analytical process, assess the precision and accuracy of analytical results, and identify assignable causes for atypical analytical results. Laboratory QC will include calibration standards, method blanks, laboratory control samples, surrogate standards, and MS/MSDs.

Resampling may be performed if samples exceed their specific holding time requirements or if they are not preserved properly.

9.0 ANALYTICAL METHODS

Samples of groundwater collected during periodic sampling events will be analyzed in the laboratory for the following analyses:

- Chemicals of concern (COCs) — EPA Test Methods 8260B, 8260SIM, & 8151A
- Water quality parameters — nitrates and sulfates (EPA Test Method 300.0) & total organic carbon (EPA Test Method 415.1).

The analytical methods identified above and the practical quantitation limits (PQLs) are summarized in Table 6.0 (Tables 6.0 through 6.4). Each method used should be documented in the form of the laboratory's standard operating procedures (SOPs) that contain detailed instructions concerning both the use and the expected performance of the method. Any deviations from published methodologies are documented and explained in the SOPs.

10.0 FIELD METHODS

Calibration of direct-reading field instrumentation will follow the procedures outlined in Section 8.0 and will be performed according to equipment manufacturer's instructions.

11.0 DATA REDUCTION, VALIDATION, AND REPORTING

11.1 FIELD DATA REDUCTION, VALIDATION, AND REPORTING

Field measurement values (e.g., pH, temperature, turbidity, dissolved oxygen, and conductivity measurements) are generally reported directly in the units of final use on the appropriate field forms without need for additional calculations. The Field Manager is responsible for monitoring the collection and reporting of field data and identifying anomalous data and transcriptional and/or computational errors. The Field Manager will discuss any anomalous data with the field personnel who originated that data. Corrective actions will be initiated as appropriate. Such actions may consist of re-measuring a particular parameter, collecting a new sample, or other suitable corrective action.

After the Field Manager reviews and checks the records for a sampling day, the original records will be sent to the project office for storage in the project file. The records will be incorporated into the project database. Copies of the records may be made for use at the field Site.

11.2 LABORATORY DATA REDUCTION, VALIDATION, AND REPORTING

Data validation will be performed by an independent third party. The data validation process will review all analytical data and associated data deliverables. The data will be evaluated for compliance with the QA objectives and QC control limits based on the DOD QSM. In cases where the limits are not available, the control limits provided by a qualified analytical laboratory will be used.

The laboratory data will be evaluated for QA. This includes verifying specified detection limits, cross contamination (through blank analysis results), holding time requirements, and QC acceptance limits. The percent recoveries from the MS/MSD, LCS, and surrogates will be checked to confirm the project plan acceptance limits. Percent recoveries from MS/MSD and/or duplicate samples will be used to determine the RPDs. Results of analysis will be checked to ensure that the desired detection limits, as specified in the report, are achieved. Any questionable values or reported results with unjustified high detection limits will be addressed to the laboratory, and samples will be reanalyzed if considered necessary.

DOD QSM guidelines will be followed when there is conflict between requirements of this document with the lab performance or any other missing criteria. A case narrative prepared by the analytical laboratory assessing data quality will be submitted to the laboratory's Project Manager (or a designee) with every data package prior to transmittal to the client.

11.3 DATA VALIDATION

Data validation is the process of evaluating the data generated by a laboratory against a set of project-specific criteria. This practice ensures that the data are reliable and adequate for the intended use. The validation process is accomplished through the detailed guidelines outlined in the EPA Contract Laboratory Program for Organic Data Review (EPA, 1994).

All computer-generated data and data sheet reports are stored electronically and maintained with the paper copies by the laboratory for a minimum of 7 years after the completion of all analytical work. A copy of the electronic data is submitted to Eco within 2 weeks of completion of the analysis.

To achieve the QA objective, the data generated by the lab should be accurate, precise, complete, and representative of the Site. The items noted below are fully reviewed for this purpose.

The following items are reviewed for documentation:

Chain-of-Custody Form: Sample IDs and analyses performed are verified to be in accordance with the information requested on the chain-of-custody form. The field sample ID is matched with the laboratory sample ID number.

Extraction Log: Includes detailed descriptions of initial volume/weight of the sample, final volume of the extract, the amount and concentration of all the standards spiked as surrogate, and QC standard to the samples and QC samples prior to extraction for each extraction batch.

Instrument Run Log: Specify sequence of uninterrupted injection of samples with lab sample ID number. It represents the order in which each standard, method blank, sample, and QC sample have been analyzed by each instrument within a certain time period.

Case Narrative/Corrective Action: A brief description of the steps taken to complete sample analysis. References the methods requested by chain-of-custody form are included. Corrective actions describing any deficiencies and specific procedures followed toward correcting the deficiencies are included.

Method Blank: A sample of a matrix similar to the batch of associated samples is processed simultaneously through all steps of analytical procedure. No target analytes or interferences that impact the analytical results should be present in the method blank.

The following items are reviewed for QC indicators:

Tuning Criteria: Instrument performance is checked before each analysis by a tune check standard (4-bromoflourobenzene (BFB) for EPA Method 8260B). The result will be matched against pre-set values for main ions by gas chromatography/matrix spike (GC/MS). The tune standard check analysis should pass all the method criteria.

Initial Calibration: At least five standard calibration levels are chosen. The relative response factor (RRF) at each calibration level for each target compound must be greater than or equal to the minimum acceptable relative response factor of the compound. The percent relative standard deviation (%RSD) among response factors for each target compound must

be less than or equal to the required maximum value (DOD QSM, Appendix B, Tables B-2 and B-3).

Continuing Calibration: At the start of each analysis batch and prior to the analysis of samples, initial calibration of each system must be verified by analysis using a midpoint calibration standard. To show the linearity of the instrument, certain set criteria by each method should be fulfilled (DOD QSM, Appendix B, Tables B-2 and B-3).

MS/MSD: Analytical precision is verified through the performance of spiking a specific matrix and a duplicate by a known amount of standard/standards. The RPD calculated between the two results determine the precision. The control limits are set by each method.

Laboratory Control Sample: Analytical accuracy is performed by spiking an LCS for each batch. LCSs consist of a matrix similar to the client sample being processed but free of any interference. The control limits are specific to each method.

Surrogate Percent Recovery: A measured amount of a closely related organic compound, known as the surrogate, is added to all the samples, QC samples, and the method blank before analysis or extraction. Any loss or maltreatment of the sample during the extraction/analysis process would be reflected by percent recovery of the surrogate. Acceptance limits are set by each method.

$$\% \text{ Recovery} = \left[\frac{\text{Quantity determined}}{\text{Quantity spiked}} \right] \times 100$$

The following items are reviewed for samples:

- Holding times
- Chromatograms/quantitation reports labeled with sample ID and sample weight/volume with the ID numbers of the surrogate and the QC standards traceable to the preparation log book
- Second column confirmation data (if applicable)
- Extracted ion chromatogram profile

11.3.1 IMPLEMENTATION OF DATA VALIDATION

The data are delivered in two separate packages: Level III and Level IV. Level III data packages are submitted for all the samples for each analysis method according to the chain-of-custody form. Level IV data packages are presented for 10 percent of the samples. The data submitted at Level III are validated by Automatic Data Review (ADR) software (Laboratory Data Consultants, Inc., 2002). A detailed report is submitted with each data package.

Documentation submitted for LEVEL III includes the following:

- Sample ID number
- Date of sample collection
- Sample matrix type
- Analysis method
- Analytes and concentrations

- Quantitation limits
- Laboratory qualifiers and qualifier definitions
- Copies of sample logs and chain-of-custody logs
- Sample preparation log
- Summary of initial and continuing calibration
- Analysis batch sequence
- QC results with the corresponding QC batch

Documentation submitted for LEVEL IV includes the following:

The items in Level III with corresponding raw data for all the initial calibrations, continuing calibrations, internal standard area counts and retention times (where applicable), and raw data for 10 percent of the samples are submitted.

Data validation is performed in three stages as follows:

1. An initial review of the analytical reports and QA/QC information is performed for all the analytical data by ADR software.

The following criteria are reviewed by ADR:

- Holding times
- Lab QC
 - LCS/LCSD recovery and acceptance limits
 - MS/MSD recovery and acceptance limits
 - Surrogate recovery
 - Method blanks
- Field QC
 - Field duplicates and percent difference limits
 - Trip blanks when applicable
- Detection limits
- Qualified samples with specified reason codes

Any result outside the acceptance limits will be flagged. Tables B-2 through B-10 present method-specific QC requirements (DOD-QSM).

2. For LEVEL III data validation, the injection and extraction sequence log and summary of initial and continuing calibrations are fully reviewed in addition to items checked by ADR.
3. A full review of all analytical report QA/QC information, as well as the corresponding raw and analytical data, is performed on 10 percent of the samples chosen for Level IV review. Overall review evaluates the effects of QA/QC information on the data usability. These effects include parameters such as holding times, calibration requirements, surrogate recovery, LCS recovery, and MS/MSD recoveries and related RPDs. The Level IV review compares the reported analytical results with those obtained from the raw data (raw data include chromatogram and result sheets for each designated

sample, all the QC samples, and initial and continuing calibration standards. In addition, calculations and corresponding equations, as well as analyte identification, will be verified. Raw data, including chromatograms and result sheets for both primary and confirmation columns, will be verified where applicable.

A third independent party is responsible for the data validation. The comprehensive report of data validation is sent to the client.

11.3.2 AUTOMATED DATA REVIEW

All laboratory data for samples analyzed by the laboratory are submitted in the ADR software electronic data deliverables (EDD) format in accordance with the project-specific requirements. The data are reviewed using the USACE ADR software in conjunction with the electronic project library developed for this project and the laboratory EDDs. The ADR reports generated during the review are provided as an attachment to the data validation report.

During the review, data will have been assessed against pre-established criteria included in the electronic library for the following parameters:

- Sample holding times
- Spiked samples including laboratory control samples and matrix spikes
- Method blanks
- Laboratory duplicates including LCS duplicates and MS duplicates
- Surrogates
- Reporting limits
- Field QC samples (i.e., field duplicates and trip blanks)

Following comparison of the data to the established criteria, data will have either been accepted without qualification, qualified as estimated (assigned a "J" flag), or rejected ("R"). Data-qualifying protocols and flags are based on the control limits assigned to constituents for each EPA method. A copy of electronic library with the reason codes is included with each ADR report.

12.0 INTERNAL QUALITY CONTROL CHECKS

12.1 INTERNAL FIELD QUALITY CONTROL CHECKS

Field QC checks will include the review and approval of all field documentation by the Site Manager and/or Project Manager. Signature or initial approval of field documentation will indicate that the provisions outlined in the Field Sampling Plan (FSP), QAPP, and HSP have been appropriately implemented.

Field QC samples will also be collected. The types of field QC samples to be collected include trip blanks, field equipment rinsates, and field duplicates. A minimum of one equipment rinsate blank and one field duplicate will be submitted per 20 samples for water samples. A minimum of one field duplicate will be submitted for every 10 soil samples. In addition, one field equipment rinsate (from soil sampling equipment) will be collected per field crew per day. Field duplicates will be analyzed for the same analytes as those analyzed for the

environmental sample collected at that sampling location. Equipment rinsate samples will be analyzed for all of the analytes analyzed in environmental samples on that given day. A minimum of one trip blank will be collected per shipping container that contains samples for VOC analysis.

12.2 LABORATORY QUALITY CONTROL CHECKS

12.2.1 SENSITIVITY

Sensitivity is the capability of the methodology or instrumentation to discriminate between measurement responses for quantitative differences for a specific parameter. Sensitivity will be measured by the PQLs for each parameter, which is the lowest level that the laboratory can reliably achieve within specified limits of accuracy and precision during routine laboratory operating conditions. The PQLs for the analytes of interest will be project specific as described in this document and these are consistent with the requirements of DOD QSM. If dilution is used to bring the reported concentration of a single compound of interest within range, but results in non-detect values for all other analytes, the results of the initial analysis and the dilution will be reported with the appropriate notations in the narrative. Failure of the laboratory to present detection limits that are acceptable to the USACE will result in the USACE directing Eco to retain another laboratory for contract services.

Matrix effects (i.e., highly contaminated samples requiring dilution for analysis, dilution to bring detected levels within the range of calibration, and matrix interference requiring elevation of detection limits) will be considered in assessing compliance with the requirements for sensitivity. The acceptability limit for all field rinsates is to be below the reporting limits for each compound. A detailed analysis of all failures to meet requirements for sensitivity will be included in the narrative section of the certificate of analysis.

The qualified analytical laboratory will have a written QA/QC program that provides rules and guidelines to ensure the reliability and validity of all analytical work conducted in their laboratory. Compliance with the QA/QC program is coordinated and monitored by designated laboratory QA personnel.

For multi-analyte methods (organics analyses), each analysis of the aggregate of analytes will be considered a single sample result. RPDs will be compared to the RPD limits established in the QAPP or in the DOD QSM. When analytes are present at concentrations below or near the quantitation limit, precision will be evaluated using MS/MSD results. When RPDs exceed previously established control limits, the analyst or his/her supervisor must investigate why the data exceed stated acceptance limits, and report these findings to the QA/QC Officers and Project Manager. RPDs outside the established control limits can indicate some assignable cause (other than normal measurement errors) and the need for corrective action. Follow-up actions can include recalibration or reanalysis of the MS/MSDs.

12.2.2 DATA QUALITY INDICATORS

The effectiveness of a QA program is measured by the quality of the data generated by each laboratory. Data quality is judged in terms of its precision, accuracy, completeness, comparability, representativeness, and method detection limits. The precision and accuracy of analytical laboratory results are established by internal QC procedures that include the routine analysis of blanks, laboratory control samples, MS, duplicates, or other QC procedures specified in the analytical methodologies.

12.2.3 REPORTING LIMITS

12.2.3.1 Method Detection Limit

A method detection limit (MDL) is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. Requirements established in 40 Code of Federal Regulations (CFR) 136B are used for determining MDLs.

12.2.3.2 Reporting Limits

The laboratory will be advised to meet the project-specific requirements regarding the reporting limits. The following instructions will be provided:

1. The samples will be initially analyzed without dilution to satisfy the PQLs listed in Table 6.0. In cases where some analytes exceed the calibration range, the detection limits will be multiplied by the dilution factor used in quantitation only for detected over-the-range components. In such cases, a sample might need to be analyzed several times.
2. To correct the reporting limits of the soil for moisture content, the results obtained on a wet basis will be back-calculated for the moisture content.

Detection limits are sample matrix-dependent and may be raised due to matrix interferences. Because reporting limits are based on detection limits, in these cases reporting limits will also increase. When dealing with complex matrices, practicality of the analysis regarding preparation and instrumentation and non-target interferences will need to be taken into consideration.

Maximum PQLs were identified for all compounds for aqueous and solid analyses (see Table 6.0). The reporting limits for analytes are compatible with the DOD-QSM requirements.

The results received by the laboratory will be reviewed. The reporting of data will be compared to the MDL limits with the appropriate designated QC flags where the concentrations are estimated to be below the respective PQLs.

13.0 CORRECTIVE ACTION

When errors, deficiencies, or out-of-control situations exist, the QA program provides systematic procedures, called corrective actions, to resolve problems and restore proper functioning to the sampling and/or analytical system.

If the analytical results from laboratory QC samples fall outside of the control limits, the laboratory will initiate corrective actions. The QA/QC Manager will also review field data and narrative records related to the samples in question for potential sources of error. If an error in laboratory procedures or sample collection and handling procedures cannot be found, the Project Manager or her designee will review the results and assess whether reanalysis or resampling is required. Completion of a corrective action should be evidenced by data once again falling within prescribed QC limits.

13.1 FIELD CORRECTIVE ACTION

The Project Manager or her designee will review the procedures being implemented in the field for consistency with the established protocols. Sample collection, preservation, documentation, labeling, and shipping will be checked for accuracy and completeness.

13.2 LABORATORY CORRECTIVE ACTION

The laboratory's Operations Manager or assigned designee will review the data generated to ensure that all QC samples have been run as specified in the protocol. This review will include calibration procedures, frequency, and results. Instrument maintenance logs also may be checked. Recoveries of laboratory control samples and MS samples will be checked for consistency with method accuracy and precision. Where QC sample results fall outside the acceptable ranges, deficiencies will be reported to the Eco QA/QC Officer, who will immediately report the discrepancies to the Project Manager. Corrective actions will be defined by the Eco QA/QC officer in conjunction with the Project Manager and documented appropriately. Full documentation of the corrective action procedure will be filed with each of the laboratory's QA departments when there is a proper resolution. A corrective action memo shall also be provided to the Project QA officer for inclusion in the project file.

14.0 PERFORMANCE AND SYSTEM AUDITS

Internal system audits, if performed, will be the responsibility of the Eco Project QA Officer. The objectives of the performance and system audits are to ensure that the QA program developed for this project is being implemented according to the specified requirements, assess the effectiveness of the QA program, identify nonconformance, and verify that any identified deficiencies are corrected. If any significant deviations from the QAPP are documented, corrective action measures will be immediately implemented and documented as detailed in Section 13.0.

15.0 QUALITY CONTROL REPORTS TO MANAGEMENT

The reporting system is a valuable tool for measuring the overall effectiveness of the QA program. It serves as an instrument for evaluating the program design, identifying problems and trends, and planning for future needs.

15.1 FIELD REPORTS

The Contractor Quality Control (CQC) staff in the field will report to the Eco QA/QC Manager (or Eco Site Manager) on a routine basis regarding progress of the fieldwork and QC issues associated with the field activities.

15.2 ANALYTICAL LABORATORY REPORTS

The qualified analytical laboratory will maintain detailed procedures of laboratory recordkeeping to document the validity of all analytical work. Each data set report submitted to the Eco Project Manager will contain the qualified analytical supervisor's (or authorized designee's) written verification that the approved analytical method (without modification) was performed and all QA/QC checks were within the established protocol limits on all samples.

16.0 DEFINITIONS

The following terms are defined for use in this document:

ACCURACY: Accuracy is the closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and a common systematic error (or bias) component.

BATCH: A group of samples that behave similarly with respect to sampling or testing procedures being used and are processed as a unit. The number of samples in a batch may not exceed 20. Field QC samples are each counted as individual samples. All samples in a batch must be processed as a unit with the same method sequence and the same lots of reagents and standards. The manipulations common to each sample in a batch must be performed simultaneously or in a continuous sequence without interruption.

BIAS: Bias is the deviation, due to matrix effects, of the measured value from a known spiked amount. Bias can be assessed by comparing a measured value to an accepted reference value in a sample of known concentration or by determining the recovery of a known amount of contaminant spiked into a sample (MS). Thus, the bias (B) due to matrix effects based on an MS is calculated as

$$B = (X_s - X_u) - K$$

where

X_s = measured value for spiked sample,

X_u = measured value for unspiked sample, and

K = known value of the spike in the sample.

Using the following equation yields the percent recovery (%R):

$$\% R = \frac{100 \times (X_s - X_u)}{K}$$

CONTROL SAMPLE: A QC sample introduced into a process to monitor the performance of the system.

DATA QUALITY OBJECTIVE (DQO): A statement of the overall level of uncertainty that a decision-maker is willing to accept in results derived from environmental data. This is qualitatively distinct from quality measurements such as precision, bias, and detection limit.

DATA VALIDATION: The process of evaluating the available data against the project DQOs to make sure that the objectives are met. Data validation may be very rigorous, or cursory, depending on project DQOs. The available data reviewed will include analytical results, filed QC data and lab QC data, and may also include field records.

LABORATORY CONTROL SAMPLE (LCS): A known matrix spiked with compound(s) representative of the target analytes. This is used to document laboratory performance.

MATRIX: The component or substrate (e.g., surface water, drinking water) that contains the analyte of interest.

MATRIX DUPLICATE: An intra-laboratory split sample used to document the precision of a method in a given sample matrix.

MATRIX SPIKE (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A MS is used to document the bias of a method in a given sample matrix.

MATRIX SPIKE DUPLICATE (MSD): Intra-laboratory split sample spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

METHOD BLANK: An analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination resulting from the analytical process.

For a method blank to be acceptable for use with the accompanying samples, the concentration in the blank of any analyte of concern should not be higher than the highest of either:

1. the method detection limit,
2. five percent of the regulatory limit for that analyte, or
3. five percent of the measured concentration in the sample.

METHOD DETECTION LIMIT (MDL): The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

ORGANIC-FREE REAGENT WATER: For volatiles, all references to water in the methods refer to water in which interference is not observed at the method detection limit of the compounds of interest.

PRACTICAL QUANTITATION LIMITS (PQLs): The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. The PQL is generally 5 to 10 times the MDL. However, it may be nominally chosen within these guidelines to simplify data reporting.

PRECISION: The agreement among a set of replicate/duplicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses. These samples should contain concentrations of analyte above the MDL and may involve the use of MSs. The most commonly used estimates of precision are the relative standard deviation (RSD) or the coefficient of variation (CV):

$$RSD = CV = \frac{100 \times S}{\bar{x}}$$

where

\bar{x} = the arithmetic mean of the x_i measurements, and

S = variance.

When only two samples are available, the RPD is as follows:

$$RPD = 100 \times \left[\frac{\frac{(X_1 - X_2)}{(X_1 + X_2)}}{2} \right]$$

SPLIT SAMPLES: Aliquots of sample taken from the same container and analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicate samples should be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra- or inter-laboratory precision.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards that cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

SURROGATE: An organic compound similar to the target analyte(s) in chemical composition and behavior in the analytical process but which is not normally found in environmental samples.

TRIP BLANK: A sample of analyte-free media taken from the laboratory to the sampling site and returned to the laboratory unopened. A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organic samples.

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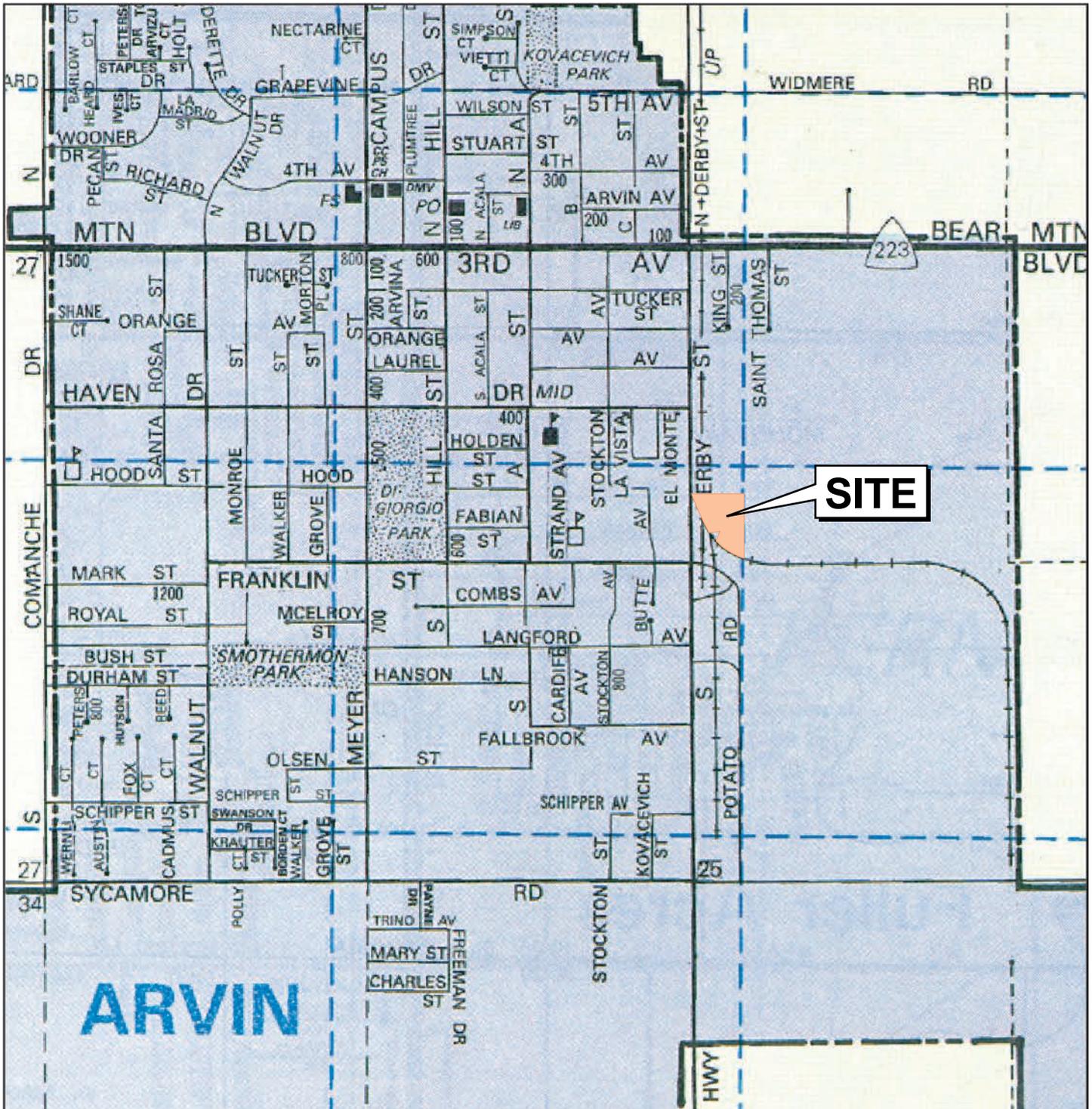
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FIGURES



Base map from *The Thomas Guide, 1998 Central Valley Cities Street Guide and Directory*. Reproduced with permission granted by THOMAS BROS. MAPS®. This map is copyrighted by THOMAS BROS. MAPS®. It is unlawful to copy or reproduce all or any part thereof, whether for personal use or resale, without permission. All rights reserved.



	Eco & Associates, Inc. 1855 W. Katella Avenue, Suite 340 Orange, California 92867 Phone: 714.289.0995 Fax: 714.289.0965	SITE VICINITY MAP Brown & Bryant Superfund Site 600 South Derby Street, Arvin, California	FIGURE: 1
	Project No.: Eco-10-425	Dated August 2011	



Environmental Excellence



Eco & Associates, Inc.
 1855 W. Katella Avenue, Suite 340
 Orange, California 92867

Phone: 714.289.0995

Fax: 714.289.0965

SITE LOCATION MAP

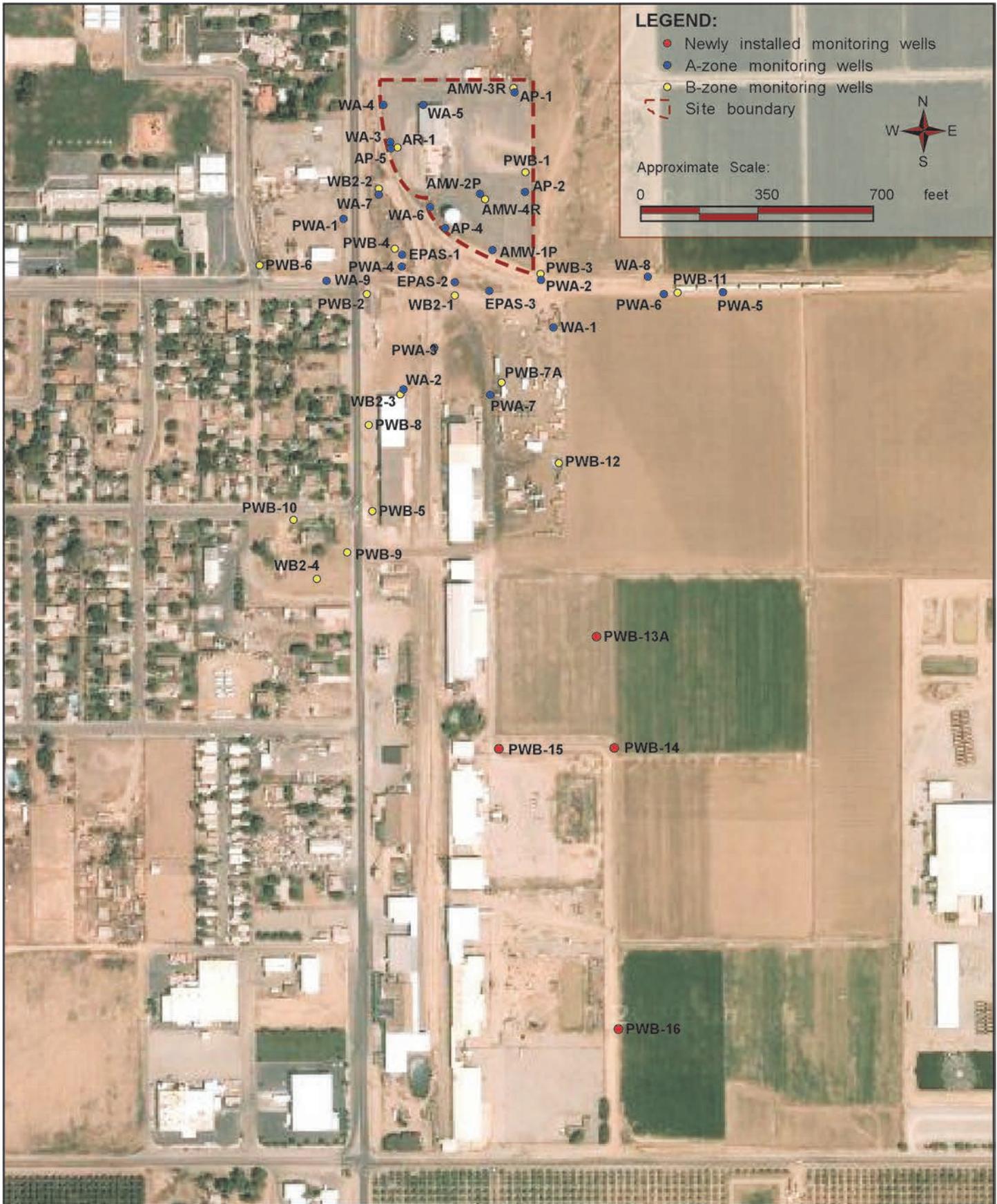
Brown & Bryant Superfund Site
 600 South Derby Street, Arvin, California

Project No.: Eco-10-425

Dated August 2011

FIGURE:

2

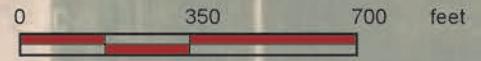


LEGEND:

- Newly installed monitoring wells
- A-zone monitoring wells
- B-zone monitoring wells
- ▭ Site boundary



Approximate Scale:



Eco & Associates, Inc.
 1855 W. Katella Avenue, Suite 340
 Orange, California 92867

Phone: 714.289.0995

Fax: 714.289.0965

SITE PLAN & WELL LOCATIONS

Brown & Bryant Superfund Site
 600 South Derby Street, Arvin, CA

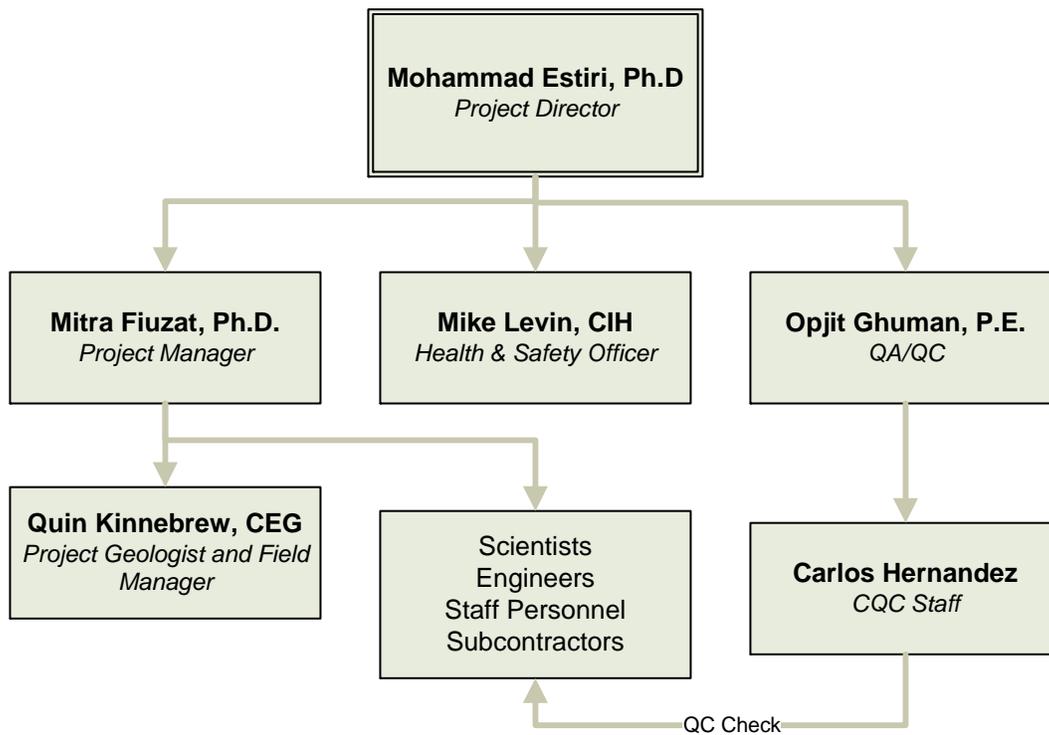
Project No.: Eco-10-425

Dated August 2011

FIGURE:

3

Figure 4



Organization Chart
Eco & Associates, Inc.

TABLES

TABLE 1
Groundwater Well Depths and Elevations

April 2011

Well ID	Well Depth (ft btc)	Well Screen Interval (ft bgs)	Well Diameter (inches)	Depth to Groundwater (ft btc)	Casing Elevation (reamsl)	Groundwater Elevation (reamsl)
A-ZONE WELLS						
AMW-1P	70.70	60.8-70.8	4	73.46	435.78	362.32
AMW-2P	75.30	63.6-73.6	4	Dry	433.75	Dry
AP-1	71.15	59.5-69.5	4	Dry	434.67	Dry
AP-2	NR	NR	4	Dry	435.35	Dry
AP-4	75.19	60-70	4	Dry	436.04	Dry
WA-1	78.50	63-78	4	71.39	429.52	358.13
WA-2	75.50	63-73	4	69.52	428.24	358.72
WA-3	80.08	68-78	4	77.18	436.03	358.85
WA-4	78.58	66-76	4	Dry	436.88	Dry
WA-5	80±	67-77	4	75.83	435.81	359.98
WA-6	78.10	64-74	4	74.82	434.90	360.08
WA-7	79.00	66-76	4	Dry	434.75	Dry
WA-8	71.60	61-71	4	Dry	433.25	Dry
WA-9	78.50	68-78	4	73.31	429.25	355.94
EPAS-1	88.75	NR	4	87.26	433.56	346.30
EPAS-2	86.20	64-84	4	76.22	433.89	357.67
EPAS-3	86.30	64-86	4	75.78	432.39	356.61
EPAS-4	84.20	62-82	4	78.45	436.38	357.93
PWA-1	85.05	65-85	4	82.32	430.07	347.75
PWA-2	84.30	64-84	4	79.62	430.57	350.95
PWA-3	84.90	64.5-84.5	4	73.28	429.42	356.14
PWA-4	84.65	64.5-84.5	4	Dry	429.82	Dry
PWA-5	84.65	64.5-84.5	4	Dry	430.32	Dry
PWA-6	76.05	63-83	4	Dry	430.25	Dry
PWA-7	78.27	58-78	4	70.84	429.02	358.18
B-ZONE WELLS						
AMW-3R*	197.4	121.5-201.5	4	153.24	433.80	280.56
AMW-4R*	200+	138-198	4	143.21	434.92	291.71
AR-1	186.4	140-186	4	142.06	435.24	293.18
WB2-1	186	169.5-179.5	4	140.13	432.38	292.25
WB2-2	180.85	168-178	4	142.04	434.94	292.90
WB2-3	186.50	172-182	4	136.37	428.13	291.76
WB2-4	180.00	168-178	4	156.19	425.41	269.22
PWB-1	186.20	166-186	4	140.73	433.83	293.10
PWB-2	160.20	140-160	4	137.51	430.52	293.01
PWB-3	164.90	144.5-164.5	4	137.72	430.67	292.95
PWB-4	164.55	144.5-164.5	4	137.95	430.78	292.83
PWB-5	164.90	144.5-164.5	4	135.71	427.47	291.76
PWB-6	159.29	139-159	4	135.54	428.48	292.94

TABLE 1 (CONT')
Groundwater Well Depths and Elevations

April 2011

Well ID	Well Depth (ft btc)	Well Screen Interval (ft bgs)	Well Diameter (inches)	Depth to Groundwater (ft btc)	Casing Elevation (reamsl)	Groundwater Elevation (reamsl)
PWB-7A	160.50	140-160	4	136.04	Unknown	Unknown
PWB-8	161.29	141-161	4	134.55	427.40	292.85
PWB-9	158.60	138-158	4	135.12	425.93	290.81
PWB-10	159.78	139-159	4	133.81	424.44	290.63
PWB-11	163.70	145-165	4	137.40	430.47	293.07
PWB-12	160.50	140-160	4	134.38	Unknown	Unknown
PWB-13A	157.00	136-156	4	134.00	Unknown	Unknown
PWB-14	162.00	141-161	4	130.00	Unknown	Unknown
PWB-15	158.00	137-157	4	135.00	Unknown	Unknown
PWB-16	157.00	136-156	4	130.00	Unknown	Unknown
C-ZONE WELL						
CW-1	730	350-700 **	Unknown	Unknown	424.11	NA

Notes:

ft btc = feet below top of casing.

ft bgs = feet below ground surface (from well construction diagrams).

reamsl = relative elevation above mean sea level (based on survey data - March 2003)

* =

** =

Data for Wells PWB-12 on are based on information available at this time and will be revised in 2011 GW Monitoring Report.

TABLE 2
Chemicals of Concern and Analytical Methods

Constituent	EPA Analytical Method ¹	Regulatory Limit ²	MCL	Proposed Reporting Limit ³
		µg/L ⁴		
Chloroform	8260B	100 ⁵	80	1
1,2-Dibromo-3-Chloropropane (DBCP)	8260 SIM	0.2 ⁶	0.2	0.05
1,2-Dichloropropane (1,2-DCP)	8260B	5 ⁶	5	1
1,3-Dichloropropane	8260B	5 ⁷	0.5	0.5
1,2,3-Trichloropropane (TCP)	8260 SIM	0.005 ⁸	0.5	0.005
Ethylene Dibromide (EDB)	8260 SIM	0.05 ⁶	0.05	0.05
Dinoseb	8151A	7 ⁶	7	0.04

NOTES:

- 1 EPA analytical methods provided on web page - http://www.epa.gov/OGWDW/methods/orch_tbl.html.
- 2 Identifies the regulatory limit considered for the project and the reference for the limit.
- 3 Identifies the laboratory detection limit to be used for the sampling and analysis. California Department of Public Health identifies detection limits for purposes of reporting as DLRs
- 4 µg/L = micrograms per liter.
- 5 There is no maximum contaminant level (MCL) specifically for chloroform. The regulatory number is that requested by EPA for this project.
- 6 EPA's National Primary Drinking Water Regulations, Maximum Contaminant Level.
- 7 There is no MCL or public health goal. However, the regulatory limit is used for 1,2-DCP.
- 8 This is the CAPH defined notification level for this compound. The response level is 100 x notification level.

TABLE 3
Summary of Analyses and Containers for Groundwater Monitoring

Constituent	EPA Analytical Method	Container Type	Container Size	Volume Required	Preservative
Chloroform	8260B	Glass (VOA ¹ vial)	40 mL ²	120 mL (3 vials)	HCl ³
1,2-Dichloropropane - (1,2-DCP)					
1,3-Dichloropropane - (1,3-DCP)					
1,2,3-Trichloropropane - (1,2,3-TCP)	8260SIM	Glass (VOA vial)	40 mL ²	120 mL (3 vials)	HCl ³
1,2-Dibromo-3-chloropropane - (DBCP)					
Ethylene dibromide - (EDB)					
Dinoseb	8151A	Amber glass	1L ²	1L	None
Nitrates & Sulfates	300	Polyethylene	250 mL	250 mL	None
Total Organic Carbon	415.1	Polyethylene	125 mL	125 mL	HCl

Notes:

- 1 VOA = volatile organic analysis
- 2 mL = milliliter; L = liter
- 3 HCl = hydrochloric acid

TABLE 4

Quality Control Sample Objectives

Sample Type	Purpose	Collection Frequency	QA Objective
Equipment Blanks	Quantify artifacts introduced during sampling, transport, or analysis of samples - measure of accuracy and representativeness.	One per 20 samples or one per day, whichever is more frequent	Target analytes not detected
Field Duplicates & Replicate for Third Party Laboratory	Measure sampling and analytical precision.	One per 10 samples	Precision: < 30% RPD ³
Matrix Spike/Matrix Spike Duplicate	Measure accuracy (MS ¹ recovery) and precision (MS/MSD ² RPD) to indicate possible bias or matrix effects.	One per 10 samples or one per 14 days, whichever is more frequent	Accuracy: Within laboratory control limits Precision: < 20% RPD
Trip Blanks	Identify and quantify contamination during storage and transport - measure of accuracy and representativeness.	One per cooler containing samples for VOC ⁴ analyses	Target analytes not detected
Ambient Blanks	Identify and quantify contamination present in ambient air - measure of representativeness.	As necessary, based on conditions at sampling location	Target analytes not detected

Notes:

- 1 MS – matrix spike
- 2 MS/MSD – matrix spike /matrix spike duplicate
- 3 RPD – relative percent difference
- 4 VOC – volatile organic compound

TABLE 5

Field Equipment Calibration and Maintenance

Equipment	Calibration and Maintenance
Organic Vapor Monitor	Will be calibrated by the manufacturer every 12 months. Field calibration will be performed every day prior to use.
pH Meters	Calibration performed with at least two buffers that bracket the expected range of the groundwater (e.g., 4 and 7, 7 and 10). Calibrated at least daily. Stabilization at +/- 0.05 unit.
Temperature Meter	Calibrated at least daily according to manufacturer's instructions. Stabilized at +/- 1 °C.
Conductivity Meter	Calibrated at least daily between 445 and 2,060 or 2,060 and 16,640. Stabilized at +/- 10%.
Dissolved Oxygen Meter	Calibrated once prior to the start of monitoring – use of 50g sodium sulfite solution in 1,000 ml of water for zero calibration.
Oxygen Reduction Potential Meter – ORP Meter	Use of Hanna 98120 – factory calibrated to provide ORP readings. Accuracy of 2mV and a range of 1,000mV.
Photoionization Detector (PID)	Will be calibrated by the manufacturer every 12 months. Field calibration will be performed every day prior to use.
Electronic Sounder	Equipment will be decontaminated before and after use in each well. Calibrated daily.

Notes:

Separate aliquots of water shall be used to make field measurements (e.g., sample containers for laboratory analysis shall not be reopened).

For groundwater samples, field measurements shall be based on the casing volume of the monitoring well so that at least four readings shall be obtained during the course of purging the target volume from the well. The target volume criterion does not apply if the well is purged dry. If the parameters have not stabilized after the target volume is removed from the well, field measurements will continue until two consecutive readings have stabilized to within the limits given above or until five casing volumes have been removed.

TABLE 6.0
Summary of Analytical Parameters
EPA Method 8260B

ANALYTE	LIQUID				
	Practical Quantitation Limits	Method Detection Limit	Control Limits		
			$\mu\text{g/L}^1$	LCS ²	MS/MSD ³
Acetone	10.0	0.95	40-140 *	40-140	≤ 30
Benzene	1.0	0.16	80-120	80-120	≤ 30
Bromobenzene	1.0	0.16	75 -125	75 -125	≤ 30
Bromochloromethane	1.0	0.15	65-130	65-130	≤ 30
Bromodichloromethane	1.0	0.14	75-120	75-120	≤ 30
Bromoform	1.0	0.14	70-130	70-130	≤ 30
Bromomethane	1.0	0.24	30-145	30-145	≤ 30
2-Butanone (MEK)	10.0	0.60	30-150	30-150	≤ 30
n-Butylbenzene	1.0	0.15	70-135	70-135	≤ 30
sec-Butylbenzene	1.0	0.12	70-125	70-125	≤ 30
tert-Butylbenzene	1.0	0.13	70-130	70-130	≤ 30
Carbon disulfide	1.0	0.20	35-160	35-160	≤ 30
Carbon tetrachloride	1.0	0.10	65-140	65-140	≤ 30
Chlorobenzene	1.0	0.21	80-120	80-120	≤ 30
Chloroethane	1.0	0.21	60-135	60-135	≤ 30
Chloroform	1.0	0.07	65-135	35-135	≤ 30
Chloromethane	1.0	0.31	40-125	40-125	≤ 30
2-Chlorotoluene	1.0	0.14	75-125	75-125	≤ 30
4-Chlorotoluene	1.0	0.13	75-130	75-130	≤ 30
Dibromochloromethane	1.0	0.19	60-135	60-135	≤ 30
1,2-Dibromo-3-Chloropropane	1.0	0.76	50-130	50-130	≤ 30
1,2-Dibromoethane (EDB)	1.0	0.20	70-130	80-120	≤ 30
Dibromomethane	1.0	0.20	75-125	75-125	≤ 30
1,2-Dichlorobenzene	1.0	0.17	70-120	70-120	≤ 30
1,3-Dichlorobenzene	1.0	0.11	75-125	75-125	≤ 30
1,4-Dichlorobenzene	1.0	0.19	75-125	75-125	≤ 30
Dichlorodifluoromethane	1.0	0.19	30-155	30-155	≤ 30
1,1-Dichloroethane	1.0	0.19	70-135	70-135	≤ 30
1,2-Dichloroethane	1.0	0.14	70-130	70-130	≤ 30

TABLE 6.0 – continued
Summary of Analytical Parameters
EPA Method 8260B

ANALYTE	LIQUID				
	Practical Quantitation Limits	Method Detection Limit	Control Limits		
	$\mu\text{g/L}^1$		LCS ²	MS/MSD ³	RPD ⁴
1,1-Dichloroethene	1.0	0.30	70-130	70-130	≤ 30
cis-1,2-Dichloroethene	1.0	0.16	70-125	70-125	≤ 30
trans-1,2-Dichloroethene	1.0	0.19	60-140	60-140	≤ 30
1,2-Dichloropropane	1.0	0.17	75-125	75-125	≤ 30
1,3-Dichloropropane	0.5	0.17	75-125	75-125	≤ 30
2,2-Dichloropropane	1.0	0.22	70-135	70-135	≤ 30
1,1-Dichloropropene	1.0	0.20	75-130	75-130	≤ 30
cis-1,3-Dichloropropene	1.0	0.15	70-130	70-130	≤ 30
trans-1,3-Dichloropropene	1.0	0.18	55-140	55-140	≤ 30
Ethylbenzene	1.0	0.23	75-125	75-125	≤ 30
Freon 113	1.0	0.21	65-135	65-135	≤ 30
Hexachlorobutadiene	1.0	0.19	50-140	50-140	≤ 30
2-Hexanone	10.0	0.92	55-130	55-130	≤ 30
Isopropylbenzene	1.0	0.16	75-125	75-125	≤ 30
p-Isopropyltoluene	1.0	0.12	75-130	75-130	≤ 30
Methyl-tert-butyl ether	1.0	0.19	65-125	65-125	≤ 30
4-Methyl-2-pentanone	10.0	1.9	60-135	60-135	≤ 30
Methylene chloride	1.0	0.35	55-140	55-140	≤ 30
Naphthalene	1.0	0.36	55-140	55-140	≤ 30
n-Propylbenzene	1.0	0.21	70-130	70-130	≤ 30
Styrene	1.0	0.25	65-135	65-135	≤ 30
1,1,1,2-Tetrachloroethane	1.0	0.13	80-130	80-130	≤ 30
1,1,2,2-Tetrachloroethane	1.0	0.10	65-130	65-130	≤ 30
Tetrachloroethene	1.0	0.15	45-150	45-150	≤ 30
Toluene	1.0	0.17	75-120	75-120	≤ 30

TABLE 6.0 – continued
Summary of Analytical Parameters
EPA Method 8260B

ANALYTE	LIQUID				
	Practical Quantitation Limits	Method Detection Limit	Control Limits		
	$\mu\text{g/L}$ ¹		LCS ²	MS/MSD ³	RPD ⁴
1,2,3-Trichlorobenzene	1.0	0.29	55-140	55-140	≤ 30
1,2,4-Trichlorobenzene	1.0	0.21	65-135	65-135	≤ 30
1,1,1-Trichloroethane	1.0	0.14	65-130	65-130	≤ 30
1,1,2-Trichloroethane	1.0	0.20	75-125	75-125	≤ 30
Trichloroethene	1.0	0.16	70-125	70-125	≤ 30
Trichlorofluoromethane	1.0	0.24	60-145	60-145	≤ 30
1,2,3-Trichloropropane	1.0	0.39	75-125	75-125	≤ 30
1,2,4-Trimethylbenzene	1.0	0.19	75-130	75-130	≤ 30
1,3,5-Trimethylbenzene	1.0	0.12	75-130	75-130	≤ 30
Vinyl acetate	20.0	0.31	65-135	65-135	≤ 30
Vinyl chloride	1.0	0.23	50-145	50-145	≤ 30
o-Xylene	1.0	0.19	80-120	80-120	≤ 30
m,p-Xylene	1.0	0.19	75-130	75-130	≤ 30
Surrogate:					
1,2-Dichloroethane-d4	70-120		70-120	70-120	NA ⁵
4-Bromofluorobenzene	75-120		75-120	75-120	NA
Dibromofluoromethane	85-115		85-115	85-115	NA
Toluene-d8	85-120		85-120	85-120	NA

Notes:

- 1 $\mu\text{g/L}$ = micrograms per liter
- 2 LCS = laboratory control sample
- 3 MS/MSD = matrix spike/matrix spike duplicate
- 4 RPD = relative percent difference
- 5 NA = not applicable

* = laboratory provided control limits

TABLE 6.1

EDB, DBCP, & 123 TCP – by Gas Chromatography/Selective Ion Monitoring
EPA Method 8260/SIM

ANALYTE	LIQUID				
	Reporting Limit	Method Detection Limit	Control Limits		
	$\mu\text{g/L}$ ¹		LCS ²	MS/MSD ³	RPD ⁴
1,2,3-Trichloropropane	0.005	0.0025	75-125	75-125	≤ 30
1,2-Dibromoethane (EDB)	0.05	0.020	80-120	80-120	≤ 30
DBCP	0.05	0.020	50-150	50-130	≤ 30
Surrogate:					
Toluene-d8	.020	.010	80-120	80-120	≤ 30

Notes:

- 1 $\mu\text{g/L}$ = micrograms per liter
- 2 LCS = laboratory control Sample
- 3 MS/MSD = matrix spike/matrix spike duplicate
- 4 RPD = relative percent difference
- 5 NA = not applicable
- * laboratory to provide Surrogate compounds and control limits

TABLE 6.2

**Chlorinated Herbicides by Gas Chromatography using Methylation
or Pentafluorobenzoylation Derivatization
EPA Method 8151A for Groundwater Sample**

ANALYTE	LIQUID				
	Practical Quantitation Limits	Method Detection Limit	Control Limits		
			$\mu\text{g/L}$ ¹	LCS ²	MS/MSD ³
2,5-Dichloro-6-methoxybenzoic acid (Dicamba)	0.1	0.03	60-110	60-110	25
2,4-Dichlorophenoxy acetic acid (2,4-D)	0.5	0.15	35-115	35-115	25
2,4-Dichlorophenoxy butyric acid (2,4-DB)	1.0	0.23	40-130	40-130	25
2-(2,4-Dichlorophenoxy) propionic acid (Dichloroprop)	0.5	0.16	70-120	70-120	25
2,2-Dichloro propionic acid (Dalapon)	2.0	0.59	20-140	20-140	25
2,4-Dinitro-6-sec-butylphenol (Dinoseb)	0.40	0.20	20-100	20-100	30
2-Methyl-4-chlorophenoxy acetic acid (MCPA)	200	25.4	60-145	60-145	25
2-(2-Methyl-4-chlorophenoxy) propionic acid (MCPA)	200	35.8	60-145	60-145	25
2,4,5- Trichlorophenoxy acetic acid (2,4,5-T)	0.1	0.03	35-110	35-110	25
2,4,5-Trichlorophenoxy propionic acid (Silvex)	0.5	0.07	50-115	50-115	25
Surrogate:					
2,4-DCAA	NA	NA ⁵	40-140	40-140	NA

Notes:

- 1 $\mu\text{g/L}$ = micrograms per liter
- 2 LCS = laboratory control sample
- 3 MS/MSD = matrix spike/matrix spike duplicate
- 4 RPD = relative percent difference
- 5 NA = not applicable

2,4-DCAA = 2,4-Dichlorophenylacetic acid

* Laboratory provided control limits

TABLE 6.3
Summary of Nitrate-N and Sulfate Analyses
EPA Method 300.0 for Groundwater Sample

ANALYTE	LIQUID				
	RL	MDL	Control Limits		
	mg/L ¹		LCS ²	MS/MSD ³	RPD ⁴
Nitrate-N	0.100	0.050	90-110	80-120	20
Sulfate	0.500	0.25	90-110	80-120	20

Notes:
 mg/L = milligrams per liter
 MDL = method detection limit
 RL= Reporting limit

TABLE 6.4

Summary of Total Organic Carbon (TOC) Analysis

EPA Method 415.1 for Groundwater Sample

ANALYTE	LIQUID				
	RL	MDL	Control Limits		
	mg/L ¹		LCS ²	MS/MSD ³	RPD ⁴
Total Organic Carbon (TOC)	1.00	0.50	80-120	75-125	20

Notes:
mg/L = milligrams per liter
MDL = method detection limit
RL= Reporting limit

APPENDIX D

SITE-SPECIFIC SAMPLING AND ANALYSIS PLAN

SITE-SPECIFIC GROUNDWATER SAMPLING AND ANALYSIS PLAN

•REVISED FINAL•

AUGUST 19, 2011

**Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California**

**Prepared for:
U.S. Army Corps Of Engineers
Albuquerque District
4101 Jefferson Plaza, NE
Albuquerque, NM 87109-3435**

**Prepared by:
Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, CA 92867
Phone: (714) 289-0995
Fax: (714) 289-0965**

Environmental Excellence



SITE-SPECIFIC GROUNDWATER SAMPLING AND ANALYSIS PLAN

•REVISED FINAL•

**Brown & Bryant Superfund Site
600 South Derby Street
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Albuquerque, NM 87109-3435**

Prepared by:

**Eco & Associates, Inc.
1855 W. Katella Avenue, Suite 340
Orange, CA 92867**



Opjit S. Ghuman, C.E.
Project Engineer



Mitra Fiuzat, PhD
Project Manager

August 19, 2011

Project No.: Eco-10-425

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ABBREVIATIONS, ACRONYMS, & SYMBOLS

°C	degrees Celsius
µg/L	micrograms per liter
1,2,3-TCP	1,2,3-Trichloropropane
1,2-DCP	1,2-Dichloropropane
1,3-DCP	1,3-Dichloropropane
APPL, Inc.	Agriculture & Priority Pollutants Laboratories, Inc.
B&B	Brown & Bryant, Inc.
Bgs	below ground surface
btc	below the top of the casing
COC	chemicals of concern
DBCP	1,2-Dibromo-3-chloropropane
DHS ELAP	California Department of Health Services, Environmental Laboratory Accreditation Program
Eco	Eco & Associates, Inc.
EDB	Ethylene dibromide
FID	flame ionization detector
gpm	gallons per minute
GW-SAP	Groundwater Sampling and Analysis Plan
H&A	Hargis & Associates
HCL	hydrochloric acid
ID	permanent identification
IDW	investigation-derived wastes
MCLs	maximum contaminant levels
mg/L	milligrams per liter
MK	Morrison Knudson Corporation
ml	milliliter
MS/MSD	matrix spike and matrix spike duplicate
NCP	National Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
Panacea	Panacea, Inc.
PID	photo-ionization detector
PPE	personal protective equipment
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
QC	quality control
RCRA	Resource and Conservation Recovery Act
reamsl	relative elevation above mean sea level
TB	trip blank
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

SITE-SPECIFIC GROUNDWATER SAMPLING AND ANALYSIS PLAN

•REVISED FINAL•

Brown & Bryant Superfund Site
600 South Derby Street
Arvin, California

1.0 INTRODUCTION

This Site-Specific Groundwater Sampling and Analysis Plan (GW-SAP) is prepared for the on-going periodic sampling events at the former Brown & Bryant, Inc. (B&B) facility, in Arvin, California. This site is a U. S. Environmental Protection Agency (USEPA) Superfund Site located at 600 South Derby Road, in the City of Arvin, Kern County, California (hereafter, the “Site”). This SAP is revised from the previous document prepared by Eco in 2007. The revision was necessary to reflect changes in the monitoring that was required following project technical reviews in 2011 and because of the lower contaminant levels required by the OU2 ROD. The main components requiring revision are analytical parameters to evaluate the attenuation of chemicals of concern (COCs). Groundwater data will continue to be obtained periodically; however, for the next few years it is expected these will be collected biannually.

This GW-SAP was prepared under Contract No. W912PP-07-P-0134 in general conformance with the field sampling plan guidelines presented by the U.S. Environmental Protection Agency (USEPA) Region IX, Hazardous Waste Management Division, Field Operations Branch (USEPA, 1995).

In the previous years since 2000 another firm, Panacea, Inc. (Panacea) was under contract to perform Site activities and to sample and analyze the wells at the Site periodically. As a part of that work, Panacea prepared a GW-SAP in 2000 among other plans and documents for USACE and USEPA. This GW-SAP prepared by Eco is an adaptation of the previously prepared plan by Panacea. In addition, the purpose of this GW-SAP is to provide a baseline to conduct periodic groundwater monitoring as required by the USACE.

This document describes the groundwater monitoring activities that will be performed during the periodically scheduled sampling events. All of the work will be performed to the quality control/assurance requirements as described in the companion document – Quality Assurance Project Plan (2011). Reference forms for use in documenting the field activities are presented in Appendix A and a copy of the project-specific Health and Safety Plan is provided as Appendix B to this document.

2.0 BACKGROUND INFORMATION

2.1 SITE BACKGROUND

The B&B Arvin facility is located at 600 South Derby Road in Arvin, California about 18 miles southeast of the City of Bakersfield (Figure 1). The Site is located on the east side of Arvin in a light industrial and commercial area; a residential area is located across the street from the facility.

The B&B facility operated as a pesticide re-formulator and custom applicator facility from 1960 to 1989. The facility formulated agricultural chemicals, including pesticides, herbicides, fumigants, and fertilizers, for sale to the local farming community between 1960 and 1968. In 1981, the facility was licensed under the Resource and Conservation Recovery Act (RCRA) as a hazardous waste transporter. Contamination of soil and groundwater resulted from inadequate procedural controls, chemical spills during operations, and leaks from a surface wastewater pond and sumps. The largest releases on site were from the waste pond, a sump area, and a dinoseb spill area.

The waste pond located in the southwest portion of the Site was originally excavated as an unlined earthen pond in 1960. The pond was used to collect run-off water from the yard and from two sumps (since excavated). The pond was also used to collect rinse water from rinsing tanks used for fumigants. Excess pond water and rain water run-off also collected in a topographically low area to the east and south of the pond. In addition, ponded water from precipitation and irrigation from the east has occasionally breached the berm in the southeast corner of the pond and drained into the pond. The pond was double lined with a synthetic liner in November 1979. The liner and additional soil were excavated in August 1987. Approximately 640 cubic yards of soil that showed visible signs of contamination were removed from the pond at that time. The depths of this excavation ranged from approximately one and one-half feet on the sides to five feet on the bottom.

In 1960, an unlined earthen sump was constructed in the center of the Site (near wells AMW-2P and AMW-4R). The sump was used to collect wash water from a pad where equipment and tanks used for liquid fertilizers and fumigants were washed. Water from the sump was drained to the pond through an underground pipeline. In 1980, the sump was replaced with two double lined sumps, and two lined sand traps were installed west of the pond. Dinoseb was stored in a smaller tank storage area along the eastern fence, just north of the pond. In 1983, there was a significant dinoseb spill in this area. As a result, the soil and groundwater underlying this portion of the Site has been reported with the highest concentrations of dinoseb. The U.S. EPA excavated highly contaminated soil from this area in the mid 1990s.

In 1989, the Site was listed on the National Priorities List (NPL). Subsequently, various emergency and removal actions were initiated to minimize or eliminate immediate threats to human health and the environment.

Currently, the Site is vacant. A warehouse and a metal shed are located on the property. The property is secured by a chain-link fence and paved with asphalt concrete. The asphalt concrete is a RCRA cap in the southern portion and a non-RCRA cap in the northern portion (Figure 2).

2.2 PREVIOUS INVESTIGATIONS

Eco's background information is based on data presented in reports cited in Section 12. These reports, dated between 1987 and 1999, generally present the results of on-site soil and

groundwater investigations, feasibility studies, and remedial action plans. A brief review of some of the more pertinent studies is provided below.

The earliest document reviewed, prepared by Hargis & Associates (H&A) in June 1987, presented a work plan to assess the extent of soil and groundwater contamination by the release of on-site chemicals. This work plan presented the results of shallow soil sampling and the groundwater testing (Wells AMW-1 through AMW-4) conducted in 1984 by H&A. The water and soil collected from these wells/borings were noted as having elevated concentrations of constituents of concern (COCs). This data was used to plan further on-site assessment. H&A implemented this work plan in 1987 and 1988. H&A's investigation included sampling vadose zone soils and the installation of six monitoring wells (AP-1 through AP-5, and AR-1). COCs were detected in each of the wells. Tables 1 and 2 provide the COC analytical results for Site wells (A-zone and B-zone, respectively) through the sampling event in April 2011.

The shallow impacted soils (up to 12-foot depths) beneath the former on-site sumps and pond were excavated in August 1987 by Canonie Environmental. Soil samples collected from the base of the excavations were noted as containing elevated concentrations of the COCs. Groundwater testing was not conducted during this remedial action.

The USEPA completed a remedial investigation feasibility study report in 1993. This report presented the findings of a remedial investigation that included assessing groundwater in the A-zone aquifer and the B-zone aquifer. Seven COCs (listed below in Section 2.3) as well as approximately 49 other organic compounds, were found widely distributed and at elevated concentrations in water in the A-zone. The highest concentrations were observed in a well located near the former sump (AMW-2P), a well located west of the sump (WA-6), and wells located near the former pond (AMW-1P, EPAS, and EPAS-3). The distribution of the contaminants was consistent with the locations of the major source areas and followed a pattern consistent with groundwater flow in the A-zone. 1,2-Dichloropropane was found to be the most widely ranging contaminant in the A-zone (over 5.5 acres). This contaminant was also reported in water samples collected from wells in the B-zone.

In February 1999, Ecology and Environment presented the results (via memoranda) of groundwater sampling conducted in July 1998 and January 1999. Relatively elevated concentrations of the COCs remain within the on-site and off-site wells. The distribution of four COCs was provided with the July 1998 results. These COCs were shown as underlying most of the Site's central and southern portions, and extending off-site to the southwest, south, and southeast.

In August 1999, Morrison Knudson Corporation (MK) presented the results of a series of aquifer tests that were performed on the newly installed extraction wells (EW-1, EW-2, and EW-3) and injection wells (IW-1 and IW-2). The objectives of the aquifer test were to determine the sustainable yield at each of the five test locations and the efficiency, specific capacity, and hydraulic properties of the perched aquifer. Data collected were used to assess the viability of using the pump-and-treat method for remediating the perched aquifer. Test results indicated relatively low yield for extraction and injection wells, suggesting only a limited success with the pump-and-treat method.

In June 1999, MK presented a monitoring well completion report for Wells MW-1, MW-2, and MW-3. These three wells were installed to serve as observation wells during aquifer testing of the three adjacent extraction wells (EW-1, EW-2, and EW-3). The new monitoring wells were

placed 8 to 15 feet from the extraction wells. This report generally presented well construction procedures and the physical parameters of soil collected.

2.3 PREVIOUS AGENCY INSPECTIONS AND FINDINGS

Inspections by the California Water Quality Control Board have documented numerous instances of inadequate procedural controls during B&B's occupancy of the Site. An on-site tank holding dinoseb and two unlined ponds for pesticide rinse water were noted as being potential contaminant release areas. One 250,000-gallon pond was noted as overflowing twice. The on-site tank, 560,000 gallons in capacity, also reportedly leaked. In 1984, the California Department of Health Services identified various pesticides in on-site wells, including dibromochloropropane, ethylene dibromide (EDB), dinoseb C, 1,2-dichloropropane, and chlorobenzene. Public and private wells within 3 miles of the Site provide drinking water to 7,200 people and irrigate 19,600 acres of cropland. City of Arvin Well #1 is 1,500 feet from the Site.

Subsurface investigations conducted on site to date have confirmed the presence of a number of potentially hazardous substances in the groundwater. Fifty six organic compounds were found within the A-zone groundwater samples and 11 were found in the B-zone groundwater samples. The primary COCs included are as follows:

- Chloroform
- 1,2-Dibromo-3-chloropropane (DBCP)
- 1,2-Dichloropropane (1,2-DCP)
- 1,3-Dichloropropane (1,3-DCP)
- 1,2,3-Trichloropropane (1,2,3-TCP)
- Ethylene dibromide (EDB)
- Dinoseb

The herbicide dinoseb has been detected at concentrations above 1,000 milligrams per liter (mg/L) in groundwater samples collected from monitoring wells completed in a perched aquifer (A-zone) underlying the Site. Dinoseb is a contact herbicide commonly used for post-emergence weed control in a variety of crops. The solubility of dinoseb in water is 52,000 micrograms per liter ($\mu\text{g/L}$) at 25°C. The maximum contaminant level (MCL) for dinoseb in drinking water is 7 $\mu\text{g/L}$ (EPA, 2007).

The contamination in the perched aquifer poses a potential threat to the underlying unconfined regional aquifer (B-zone) and the C-zone aquifer that is used for municipal drinking water.

2.4 SITE GEOLOGY AND HYDROGEOLOGY

The geology at the Site is an alluvial deposit of alternating layers and mixtures of unconsolidated sands, silts, and clay. Soil underlying the Site to a depth of 80 feet generally consists of silty fine sand to fine sandy silt. Clean well-graded sand lenses and thin seams of silty clay occur locally within these soils. The soils are thinly interbedded, with textural changes occurring every few vertical inches. These textural changes are also believed to occur laterally.

The Site geology has been divided into two zones, the A-zone and the B-zone. The A-zone includes unsaturated soil to depths of 65 to 75 feet below ground surface (bgs) and includes the first water bearing unit, the A-zone groundwater. The depth to the saturated zone (see groundwater depths in Table 3 which also presents a summary of well construction details) varied between 65 and 85 feet bgs during the January 2004 groundwater-sampling event. The base of the A-zone is a thin sandy clay layer from 75 to 85 feet bgs. The clay layer and the A-zone groundwater occur under the entire Site but disappear approximately 900 feet south of the Site.

The B-zone includes unsaturated soil below the A-zone and the second water-bearing unit (B-zone groundwater) at depths between 150 to 165 feet bgs. The B-zone extends to at least 250 feet bgs and ends at a clay layer known as the Corcoran Clay that confines the drinking water aquifer below it. The thickness of this clay layer beneath the Site is unknown.

Groundwater in the A-zone flows in a generally southern direction, with some mounding of the water table observed from the southwest corner of the Site extending south. The saturated thickness of the A-zone groundwater ranges from 0 to 10 feet. The groundwater velocity in the A-zone has been estimated at 53 feet/year. Slug test results suggest that a yield of less than 100 gallons per day can be expected for wells in the A-zone. Aquifer testing of three of the on-site extraction wells showed a groundwater yield of approximately $\frac{1}{4}$ gallon per minute (gpm). This yield was unsustainable during the testing.

The B-zone groundwater is comprised of a series of water bearing units. All of the wells in the B-zone were installed in the water-bearing unit located at approximately 170 feet bgs. The direction of flow in this unit is to the south, and the gradient is very flat (0.0004). Permeabilities are much higher than for the A-zone groundwater. Past pump tests indicated that wells could be pumped at 7 gpm for an extended period.

For reference, a schematic showing the typical thickness for the A-zone and B-zone are shown in Figure 2 and cross-section across the site is presented in Figure 3. These figures were adapted from the OU-2 RI/FS report (Panacea, 2008).

2.5 WELL DESCRIPTION & LOCATIONS

Forty eight (48) wells are part of the site groundwater monitoring program: 25 wells installed in the A-zone and 23 in the B-zone. The city well (CW-1) near the Site is also sampled, if it is in operation and being used during the sampling event. The wells locations are shown on Figure 2.

Arvin Community Service District (ACSD) in Arvin, California is a private company categorized under water distribution or supply systems for municipal and irrigation use. They operate nine wells in and around Arvin. The location of these wells is shown on Figure __. CW-1 is located closest to the site and it is shown in both Figure __ and __. The log for CW-1 during installation and its completion is shown on Figure __. This installation detail is typical for the ACSD wells.

2.6 WELL CONSTRUCTION AND GROUNDWATER DEPTHS

The on-site wells used during this study vary in construction. A description of the well depths, screen intervals, and diameters is provided in Table 3. The groundwater depths measured and surveyed casing elevations are also provided in the table. As tabulated the GW-SAP addresses the periodic monitoring for 48 wells at the Site including 25 wells that are screened in the A-zone, 19 in the B-zone and one C-zone well.

2.7 RESULTS OF SAMPLING AND ANALYSIS

Groundwater monitoring was started at the site in 1987. It has continued at periodic intervals through April 2011. The results of the groundwater sampling and analysis for COCs are presented in Tables 1 and 2, for A-zone and B-zone wells, respectively. It is currently planned to continue the monitoring on a semi-annual basis.

The following figures presented in the draft monitoring report for the April 2011 sampling event are included for reference in this plan:

- Figure __ and __ show the groundwater flow for the A-zone and the B-zone for water elevations measured in April 2011.
- Figures __ through __ show the isopach maps for A-zone concentrations for the following COCs: 1,2-DCP, chloroform, dinoseb, and 1,2,3-TCP. The measured concentrations were reported above laboratory detection limits in sufficient wells for these compounds.
- Figures __ through __ show the isopach maps for B-zone concentrations for the following COCs: 1,2-DCP, chloroform, and 1,2,3-TCP. The measured concentrations were reported above laboratory detection limits in sufficient wells for these compounds.

3.0 OBJECTIVES OF SAMPLING AND ANALYSIS EFFORT

The objective of Eco's sampling and analysis effort is to determine the presence and measure the COC concentrations in groundwater in both the A- and B-zones (aquifers) beneath the Site and the adjoining properties to the south.

As noted in the above sections, 48 monitoring wells will be used to assess the groundwater conditions during this study. Twenty-five (25) wells will be used to assess the groundwater in the A-zone, and twenty-three (23) wells will be used to assess the groundwater in the B-zone. These well locations are shown on Figure 2. Also the groundwater samples will be collected from the city well (CW-1) located south-southwest of the Site. The actual number of wells that may be monitored during a sampling event may vary depending on site conditions and USACE requirements.

One of the on-site wells, EPAS-4 (A-zone), is located up gradient of the contaminant plume (per the most recent groundwater data reported in the Ecology and Environment report (1999a)). This well will be used to collect designated background groundwater samples. Background samples are intended to be representative of conditions that exist in the Site vicinity.

The remaining well locations are located in nearby, within, or down gradient of the known contaminant plume. These wells will be used to determine the presence and measure the concentrations of COCs in groundwater in the A-and B-zones during each monitoring event.

Groundwater monitoring and sampling during this monitoring will be conducted periodically as required by USACE.

This sampling plan proposes sampling and testing for the COCs within each well, as well as any other constituents reported for each analytical method. The COCs, test methods, and proposed detection limits are provided in Table 4.

All samples will be collected using approved techniques following proper chain-of-custody protocols. All groundwater samples will be tested by EMAX Laboratories, Inc. (EMAX) in Torrance, California. EMAX is certified by National Environmental Laboratory Accreditation Program (NELAP) to perform hazardous waste analyses, and California Department of Health Services, Environmental Laboratory Accreditation Program (DHS ELAP) to perform wastewater and drinking water analyses. Eco has estimated that between 35 and 48 monitoring wells will require sampling. In addition, there will be 11 quality assurance/quality control (QA/QC) samples (4 duplicates, 2 MS/MSD, 3 QC, and 2 trip blanks) collected per sampling event. Equipment blanks will not be collected since dedicated BarCad[®] systems are installed. The number of wells used to assess the groundwater conditions may be increase in near future to better define the plume.

4.0 PROJECT TEAM ORGANIZATION

Personnel responsible for preparing, coordinating, and conducting the groundwater monitoring and sampling of the on-site wells include the project director, corporate health and safety officer, the Site health and safety officer, project geologist, team members, and subcontractors. The personnel assigned to this project are as follows:

- Project Director – Dr. Mohammad Estiri
- Corporate Health and Safety Officer – Mr. Mr. Mark M. Levin, Esq, CIH
- Site Health and Safety Officer & Project Geologist – Mr. Quin Kinnebrew, RG or designee
- Project Manager – Dr. Mitra Fiuzat
- Team members – Will be designated at the time of field work
- Subcontractor and third parties - Will be designated at the time of field work

All field personnel used on this project will have successfully completed 40 hours of training in hazardous waste operations and/or current 8-hour hazardous waste operations training refresher. A copy of the site health and safety plan for the conduct of site work is included as Appendix B to this plan. There is no change to this plan from the document that was included as part of the previous plan.

5.0 SAMPLING PROCEDURES

5.1 PRE-SAMPLING ACTIVITIES

5.1.1 WELL RANKING

Before beginning groundwater-sampling operations, the monitoring wells will be ranked as to the expected degree of contamination. Sampling will begin with the least contaminated well and end with the well having the highest expected degree of contamination. Expected contamination levels will be assigned to each well based on historic analytical data. Historic analytical results for the on-site and off-site wells are provided in Tables 1 and 2.

5.1.2 EQUIPMENT CALIBRATION

Prior to each day of sampling, all monitoring equipment will be calibrated in accordance with the manufacturer's guidelines. Calibration of pH meters will be performed with at least two buffers that bracket the expected range of the groundwater. Calibration information will be

recorded in the field logbook. Additional information and requirements for calibrations are provided in the QAPP.

5.1.3 WELL INSPECTIONS

Each monitoring well will be inspected for integrity and upgraded for additional protection, if necessary. Well inspection will include verifying the presence of suitable locking devices for protection from unauthorized access. Protection from vandalism and vehicle traffic will also be considered when inspecting wells. Aboveground riser casings, caps, and grout aprons will be inspected for damage. Permanent well identification markings will be noted. If well marking is absent on any well it will be installed. Permanent identification (ID) markings will include the well designation, total well depth, well elevation using the National Geodetic Vertical Datum (NGVD), and reference point (top of casing, top of box, or ground surface). The well ID will be installed in a manner where the information is easily read and cannot be removed from the well. Usually this is done by etching or painting this information onto a metal tag and installing the tag on the well cap or attaching the tag to the casing in some other manner. Painting this information on the outside of the well casing or inside the protective cover is acceptable but not recommended because paint chemicals may induce spurious results in subsequent groundwater quality analyses. If painting is the chosen method, it will be done after the well has been sampled and closed. If the well is to be surveyed, survey points on the well casing, well box, or grout apron will be permanently marked by etching the grout or notching the casing in a conspicuous manner. Surface well seals will be inspected for integrity, local surface spills, and proper drainage away from the well. Casings will be inspected at the surface for cracks or other damage.

After the well has been opened, the air in the wellhead area will be tested for organic vapors with the photo-ionization detector (PID) and/or a flame ionization detector (FID). Results of these observations will be recorded in the field notebook.

5.1.4 AREA PREPARATION

A plastic sheet will be placed around the wellhead beneath all sampling equipment to prevent contamination of surficial soil during purging and sampling.

5.2 GROUNDWATER SAMPLING

5.2.1 WATER-LEVEL MEASUREMENTS

All wells will be sounded for depth to water from the top of the casing and total well depth prior to purging. An electronic sounder, accurate to the nearest ± 0.01 foot, will be used to measure the depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the tip of the water column, and the graduated markings on the probe wire or tape are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water and most electronic water level sounders have a visible indicator consisting of small light bulb or diode that turns on when the probe encounters water. Total well depth will be sounded from the surveyed top of casing by lowering the weighted probe to the bottom of the well. The weighted probe will sink into silt, if present, at the bottom of well screen. Total well depths will be measured by lowering the weighted probe to the bottom of well and recording the depth to the nearest 0.1 foot.

Water-level sounding equipment will be decontaminated before and after use in each well. Water levels will be measured in wells that have the least amount of known contamination first. Wells with known or suspected contamination will be measured last.

5.2.2 BARCAD® SYSTEMS

All wells were installed with the BarCad® groundwater sampling system. The BarCad® system is a groundwater-sampling instrument designed for permanent installation at a fixed elevation in groundwater monitoring wells. The BarCad® system is made up of the BarCad® Unit which consists of a ceramic porous filter (approximately 1.5 inches in diameter and 16 inches long), 1 inch diameter polyvinyl chloride (PVC) stinger pipe connecting the BarCad® Unit to the top of the well, and inside the BarCad® Unit is a stainless steel probe with polyethylene tubing leading up the inside of the PVC stinger pipe to the well head. At the well head attached to the top of the PVC riser tube is a fitting equipped with a air tight SwageLok® fitting for the polyethylene tubing to exit the interior of the PVC stinger pipe and a quick connect fitting to the pressurized inert gas supply.

Installation of the BarCad® system consisted of attaching the PVC stinger pipe to the BarCad® Unit and lowering the BarCad® Unit inside the well casing to within 0.5-foot of the bottom of the well. Next, Monterey No. 2/12 sand was added to the inside of the well, encasing the BarCad® Unit, to at least 1.5-feet above the top of the well screen. Then a layer at least 0.5-foot thick of bentonite chips were added on top of the sand inside the well.

The BarCad® groundwater sampling system works by applying pressurized inert gas (nitrogen) to the inside of the PVC stinger pipe, which in turn pressurizes the water column inside the BarCad® Unit and drives the existing water into the stainless steel probe and up the polyethylene tubing to the surface. Subsequently, the inert gas will displace all of the water in the BarCad® Unit and PVC stinger pipe through the stainless steel probe and polyethylene tubing, purging the BarCad® System of all existing water. Once the system is purged, inert gas pressure is removed from the BarCad® system, and groundwater is able to flow into the BarCad® Unit. Inert gas pressure is then reapplied and the resulting water can be collected for laboratory analysis.

One well volume of groundwater is purged (completely) from the BarCad® reservoir in a single purge event. Once the reservoir is emptied of groundwater and the nitrogen pressure is released, the BarCad® reservoir again opens to aquifer, allowing fresh groundwater to infill the BarCad® reservoir. During groundwater purging at the Site, groundwater is purged from the BarCad® reservoir twice. The initial purge removes all possible stagnant water from the BarCad® reservoir. The second purge is expected to rinse initial groundwater from the reservoir and tubing. The groundwater removed during the third purge is anticipated to be representative of the adjoining aquifer. This groundwater is collected and submitted for chemical analyses. The pH, temperature, and conductivity measurements of each well volume purged (one reservoir volume) are anticipated to be similar. Due to the nature of the BarCad® system, these measurements are not required to ensure that representative formation water is being collected.

5.2.3 PURGING

All wells will be purged prior to sampling. If the well's casing volume is known, a minimum of two casing volumes of water will be purged using the dedicated BarCad® system. Water will be collected into a measured bucket to record the purge volume. The casing volume will be calculated based on total well depth, standing water level, and casing diameter. One casing volume will be calculated as:

$$V = \pi r^2 h \quad (7.48)$$

where

- V** = the volume of one well casing of water (in gallons);
- r** = the inner radius (diameter/2) of the well casing (in feet);
- h** = the total height of water in the well (in feet); and
- 7.48** = the number of gallons per cubic foot

Prior to the start of purging, in the middle of purging each casing volume, and after each well casing volume is purged, water temperature, pH, and specific conductance will be measured using field test meters and the measurements will be recorded. If the well casing volume is not known, water temperature, pH, and specific conductance will be measured every 2.5 minutes after starting water flow. Samples will be collected after these parameters have stabilized indicative of the collection of representative formation water. Three consecutive measurements that display consistent values of all parameters will be taken prior to sampling. Samples will be collected after three well casing volumes (15 minutes if the purge volume is not known) if parameters have stabilized. Typically, the temperature will not vary by more than ± 1 degrees Celsius ($^{\circ}\text{C}$), pH by more than 0.2 pH units, and specific conductance by more than 10 percent from reading to reading.

No water that has been tested with a field meter probe will be collected for chemical analyses. If these parameters have not stabilized after five casing volumes have been purged (30 minutes if the purged volume is not known), purging will cease, a notation will be recorded in the field logbook, and samples will be collected. Depth to water measurements, field measurements of parameters, and purge volumes will be recorded in the field logbook.

If a well dewateres during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80 percent of the static water column and be dewatered once more. After water levels have recharged to 80 percent of the static water column, groundwater samples will be collected.

5.2.4 WELL SAMPLING

Prior to sampling each well, the water level in the well will be measured as described in Section 5.2.1 and the well purged as described in Section 5.2.3. All wells will be sampled within 24 hours following purging. Supply wells with a dedicated BarCad[®] system will have samples collected directly from the port closest to the wellhead. All aerators, strainers, or hoses will be removed from the port prior to sample collection. The flow will be adjusted so that a gentle stream is obtained. A flow rate of less than 100 milliliters (mls) per minute is recommended for samples to be analyzed for volatile organic compounds (VOCs) to minimize volatilization.

The sample container type, size, and preservative for each specific analysis are provided in Table 5. At each sampling location, all bottles designated for a particular analysis will be filled sequentially before bottles designated for the next analysis are filled. If a duplicated sample is to be collected at this location, all bottles designated for a particular analysis for both sample designations will be filled sequentially before bottles for another analyses are filled. On the fill sequence for duplicated samples, bottles with the two different sample designations will alternate. Groundwater samples will be transferred from the port directly into the appropriate sample containers with preservative if required, chilled if appropriate,

and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the port to the sample container.

Vials for VOCs analyses will be filled first to minimize aeration of water in the well. A test vial will be preserved with hydrochloric acid (HCL) to determine the amount of preservative needed to lower the pH to less than 2. The appropriate amount of HCL will then be added to the sample vials prior to the addition of the sample. The vials will be filled directly from the port. The vials will be inverted and checked for air bubbles to ensure zero headspace. If a pea-size or larger air bubble appears, the vial contents will be emptied into the container used to measure purge volumes, the vial will be discarded, and a new sample will be collected.

5.3 DUPLICATE SAMPLES

Duplicate samples (ten percent of the samples collected) will be collected by Eco and will be submitted to APPL, Inc. These duplicate samples will be used for QC check purposes. The samples will be preserved, packaged, and sealed in the manner described in Section 8.2 of this workplan.

5.4 TRIP BLANKS

Trip blanks are used to evaluate whether the shipping and handling procedures are introducing contaminants into the sample stream and if cross contamination in the form of VOC migration has occurred among the collected samples. One set of trip blanks will be prepared by pouring high-performance, liquid chromatography, solvent free water into 40-mL vials prior to arriving at the Site. The vials will be sealed and shipped with empty sample containers to the Site. The sealed trip blanks are not opened in the field and are shipped to the laboratory in the same cooler with the samples collected for VOC analyses.

The trip blanks will be preserved, packaged, and sealed in the manner described in Section 8.2 of this sample plan. Each trip blank sample will be assigned a separate sample number and station number and will be submitted blind to the laboratory.

5.5 FIELD BLANKS

Two field blanks will be collected to evaluate whether contaminants have been introduced into the samples during the sampling procedures. Field blank samples will be obtained by pouring laboratory-grade, certified organic-free water into a sampling container at the sampling point. The field blanks that are collected will be analyzed for the known contaminants of concern.

The field blanks will be preserved, packaged, and sealed in the manner described in Section 8.2. Each field blank sample will be assigned a separate sample number and station number and will be submitted blind to the laboratory.

5.6 EQUIPMENT BLANKS

Equipment blanks are generally collected to evaluate field sampling and decontamination procedures by collecting a sample of rinsed water from the cleaned equipment used in the water sampling. Because of the use of dedicated equipment for each well, this type of sample is not necessary and will not be collected.

5.7 TEMPERATURE BLANKS

No temperature blanks will be collected as part of the sampling. All water samples collected will be kept in a chilled cooler immediately after their collection and labeling and they will be transported to the laboratory in the same cooler in a chilled state. The temperature of the cooler will be recorded at the laboratory and this record will be part of the laboratory report. The temperature at which the samples are received will be evaluated as part of the data validation process.

6.0 DECONTAMINATION PROCEDURES

Decontamination of sampling equipment will be conducted consistently to assure the quality of samples collected. However, it will be noted that if the on-site wells are equipped with dedicated pumps or stingers, then equipment such as portable pumps and bailers will not require decontamination. However, all other equipment, such as water depth meters, that comes into contact with potentially contaminated soil or water will be decontaminated. Disposable equipment intended for one-time use will not be decontaminated but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment. All sampling devices used will be decontaminated according to EPA Region IX-recommended procedures.

The following, to be conducted in sequence, is an EPA Region IX-recommended procedure for the decontamination of sampling equipment:

- Non-phosphate detergent and tap-water wash (using a brush) – Alconox detergent will be used for this project,
- Tap-water rinse, and
- De-ionized/distilled water rinse (twice).

Equipment will be decontaminated in a pre-designated area on pallets or plastic sheeting, and clean bulky equipment will be stored on plastic sheeting in uncontaminated areas. Cleaned small equipment will be stored in plastic bags. Materials to be stored more than a few hours will also be covered. The disposal methods for decontamination materials and fluids are presented in the following Section 7.0.

7.0 DISPOSAL OF RESIDUAL MATERIALS

In the process of collecting environmental samples during on-site groundwater monitoring and sampling, Eco will generate different types of potentially contaminated investigation-derived wastes (IDW) that include the following:

- Used personal protective equipment (PPE),
- Disposable sampling equipment,
- Decontamination fluids, and
- Purged groundwater and excess groundwater collected for sample container filling.

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during such investigations comply with all applicable or relevant and appropriate requirements to the extent practicable. Listed below are the procedures that will be followed

for handling the IDW. The procedures have enough flexibility to allow the Site investigation team to use its professional judgment on the proper method for the disposal of each type of IDW generated at each sampling location:

- Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to any acceptable municipal landfill. Any PPE and disposable equipment that is to be disposed of which can still be reused will be rendered inoperable before disposal in the refuse dumpster.
- Decontamination fluids that will be generated during sampling activities will consist of de-ionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination water will be sufficiently low to allow disposal at the Site. The water (and water with detergent) will be poured into 55-gallon drums or portable storage tanks.
- Purged groundwater will be poured into 55-gallon drums or portable storage tanks. The groundwater and decontamination water will be stored on site pending the analytical results. After Eco's review of the analytical results, Eco will recommend an appropriate method for disposing the water.

8.0 SAMPLE DOCUMENTATION AND SHIPMENT

8.1 FIELD LOGBOOKS

Field logbooks will be used to document where, when, how, and from whom any vital information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. A new logbook will be dedicated to this project. Logbooks are bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in black ink, and signed by the individual making the entries as well as a California registered geologist. Language will be factual, objective, and free of personal opinions or other terminology that might prove inappropriate.

The following information will be recorded as appropriate during the collection of each sample. A sample of the groundwater sampling log form is provided in Appendix A.

- Sample location and description,
- Site sketch showing sample location and measured distances,
- Sampler's name(s),
- Date and time of sample collection,
- Weather conditions,
- Type of sampling equipment used,
- On-site measurement data (e.g., temperature, pH, conductivity, etc.),
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors, etc.),
- Preliminary sample descriptions,

- Type(s) of preservation used,
- Sample numbers and chain-of-custody records, and
- Recipient laboratory.

In addition to the sampling information, the following information will also be recorded as appropriate in the field logbook for each day of sampling:

- Daily log of Site activities,
- Deviations from sampling plan or site safety plan,
- Changes in personnel and responsibilities as well as reasons for the changes,
- Levels of safety protection, and
- Calibration readings for any equipment used and equipment model and serial number.

8.2 BOTTLES AND PRESERVATIVES

The number of sample containers, volumes, and materials are listed in the Section 5.2.3. The containers will be laboratory supplied, clean, and unused. Preservatives, if required, will be added by the laboratory.

8.2.1 GROUNDWATER SAMPLES

Groundwater samples with low concentrations of VOCs will be collected in 40-mL glass vials. 1:1 HCL will be added to the vial prior to sample collection. During purging, the pH will be measured using a pH meter on at least one vial at each sample location to ensure the pH is less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCL will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be overfilled and some water will be collected in the vial cap. The water-filled cap will be placed on the vial carefully to prevent entrapment of air and to minimize the presence of headspace in the vial during sample collection. After the vial is collected, it will be checked to make sure there is no headspace. The samples will be chilled to 4°C immediately upon collection.

8.2.2 TRIP BLANKS

Low-concentration trip blanks to be analyzed for volatile organic compounds will be collected in 40-mL glass vials. 1:1 HCL will be added to the vial prior to sample collection. The pH will be measured using a pH meter on at least one vial at each sample location to ensure the pH is less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCL will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial will be discarded. The vials will be filled so that no headspace occurs. The samples will be chilled to 4°C immediately upon collection.

8.2.3 FIELD BLANKS

Low-concentration field blanks to be analyzed for VOCs will be collected in 40-mL glass vials. 1:1 HCL will be added to the vial prior to sample collection. The pH will be measured using a pH meter on at least one vial at each sample location to ensure the pH is less than 2. The tested vial will be discarded. If the pH is greater than 2, additional HCL will be added to the sample vials. Another vial will be pH tested to ensure the pH is less than 2. The tested vial

will be discarded. The vials will be filled so that no headspace occurs. The samples will be chilled to 4°C immediately upon collection.

8.2.4 EQUIPMENT BLANKS

Due to the planned use of dedicated pumps and/or bailers, equipment blanks will not be collected during this study.

8.2.5 TEMPERATURE BLANKS

No temperature blanks will be collected or transported as part of this plan.

8.3 CHAIN-OF-CUSTODY RECORDS

Chain-of-custody records are used to document sample collection and shipment to the laboratory for analysis. A chain-of-custody record will accompany all samples shipped for analysis. Forms will be completed and sent with the samples to the laboratory daily. If multiple coolers are sent to a single laboratory on a single day, forms will be completed and sent with the samples for each cooler.

The chain-of-custody record will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped or delivered, the custody of the samples will be the responsibility of Eco. The project manager, contractor quality control manager, or designee will sign the chain-of-custody record. The signer will sign the "relinquished by" box and note date and time.

The shipping containers in which samples are stored (usually sturdy picnic cooler or ice chest) will be sealed before shipping.

8.4 PHOTOGRAPHS

Photographs will be taken at areas of interest on site. They will serve to verify information entered in the field logbook. The photographs will be labeled with an information box that is typewritten and arranged as follows:

Project Number:	Contract Name:
Location/Description:	
A/E/Photographer:	
Photograph Number:	Date/Time:
Direction of view:	

Selected photographs will be included with the reporting for each sampling event.

8.5 LABELING, PACKAGING, AND SHIPMENT

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information: case number, monitoring well ID, date of collection, analytical parameters, and method of preservation. Every sample will be assigned a unique sample number.

All sample containers will be placed in a durable shipping container (belted cooler). The following outlines the packaging procedures that will be followed for low-concentration samples.

- When ice is used, secure the drain plug of the cooler with fiberglass tape to prevent melting ice from leaking out of the cooler.
- Line the bottom of the cooler with bubble wrap to prevent breakage during shipment.
- Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
- Secure bottle/container tops with clear tape and custody seal all container tops.
- Affix sample labels onto the containers with clear tape.
- Wrap all glass sample containers in bubble wrap to prevent breakage.
- Seal all sample containers in heavy-duty plastic bags. Write the sample numbers on the outside of the plastic bags with indelible ink.

All samples will be placed in coolers with the appropriate chain-of-custody records. All records will be enclosed in a large sealed plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Bagged and sealed ice used to cool samples will be placed on top and around the samples to chill them to the correct temperature. Each ice chest will be securely taped shut and sealed.

9.0 QUALITY CONTROL

9.1 LABORATORY QUALITY CONTROL SAMPLES

All collected samples will be submitted to APPL, Inc., a NELAP and California ELAP certified analytical laboratory, for analyses. Laboratory QC samples will be analyzed by the laboratory. The laboratory monitors the precision and accuracy of the results of their analytical procedures through analysis of QC samples. In part, laboratory QC samples consist of matrix spike samples and matrix spike duplicate samples. The term “matrix” refers to use of the actual media collected in the field (i.e., routine soil and water samples). Laboratory QC samples are an aliquot (subset) of the field sample. They are not a separate sample but a special designation of an existing sample. For water samples, double volumes of samples are supplied to the laboratory for its use. Two sets of water sample containers are filled, and all containers are labeled with a single sample number. The laboratory is alerted as to which sample is to be used for QC analysis by notation on the sample container label, traffic report, and/or chain-of-custody record.

At a minimum, a QC Duplicate Sample at 10 percent rate will be collected by Eco and will be submitted to APPL, Inc. for analyses.

9.2 DUPLICATE SAMPLES

Duplicate samples are collected simultaneously with a standard sample from the same source under identical conditions into separate sample containers. Ten percent duplicate

samples will be collected by Eco and will be submitted to APPL, Inc. for analyses along with the remainder of the samples collected during the sampling event.

A duplicate sample is treated independently of its counterpart in order to assess laboratory performance through comparison of the results. At least 10 percent of samples collected per event will be duplicates. At least one duplicate will be collected for each sample matrix. Every analytical group for which a standard sample is analyzed will also be tested for in one or more duplicate samples. Duplicate samples will be collected from areas of known or suspected contamination.

Pending further review, duplicate groundwater samples will be collected from Wells EPAS-2, WA-1, and WB2-1. Duplicate samples will be collected from these locations because these wells are suspected to exhibit moderate to high concentrations of contaminants.

When collecting duplicate groundwater samples, bottles with the two different sample identification numbers will alternate in the filling sequence. Note that bottles for one type of analysis will be filled before bottles for the next analysis are filled.

Duplicate samples will be preserved, packaged, and sealed in the same manner as other samples of the same matrix. Each duplicate will be assigned a separate sample number and station number and will be submitted blind to the laboratory.

Trip, Field, and Equipment Blanks:

One trip, two field, and two equipment blanks will be collected as appropriate during the sampling event.

Trip blanks will be prepared to evaluate whether the shipping and handling procedures are introducing contaminants into the samples and whether cross contamination in the form of VOC migration has occurred between the collected samples. Trip blanks will be prepared as described in Section 5.4.

Field blanks will be prepared to evaluate whether contaminants have been introduced into the samples during the sampling procedures. Field blanks will be prepared as described in Section 5.5.

Equipment blanks will be prepared to evaluate whether contaminants have been introduced into the samples during the sampling procedures. Because of the use of dedicated equipment for each well, this type of sample is not necessary and will not be collected. Field blanks will be prepared as described in Section 5.6.

All blanks will be preserved, packaged, and sealed as appropriate for water samples. Each blank will be assigned a separate sample number and station number and will be submitted blind to the laboratory.

9.3 TEMPERATURE BLANKS

There will be no temperature blanks for this sampling and analysis.

9.4 FIELD VARIANCES

Because conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this plan. When appropriate, the USACE Project Manager will be notified of the modifications and a verbal approval will be obtained before

implementing the modifications. Modifications to the approved plan will be documented in the groundwater monitoring report.

10.0 ANALYTICAL METHODS

All samples of groundwater collected during periodic sampling events will be analyzed in the laboratory for the following analyses:

- Chemicals of concern (COCs) — EPA Test Methods 8260B, 8260SIM & 8151A
- Water quality parameters — nitrates and sulfates (EPA Test Method 300) & total organic carbon (EPA Test Method 415.1).

These analyses will also be performed on all quality assurance samples. Additional information on the sampling quality control parameters is provided in the QAPP.

11.0 SCHEDULE

Based on discussions with USACE, the next groundwater-monitoring event is tentatively scheduled for October 2011. It is expected that for the next two years that sampling events will be scheduled biannually or as specifically authorized by the USACE.

The requirements of this workplan will be effective for all groundwater sampling events at the project Site.

12.0 REPORT AND DISTRIBUTION

12.1 REPORT

After the data have been gathered, they will be evaluated for technical accuracy. The report will be reviewed and signed by a California-registered geologist. One report per sampling event will be prepared to summarize the laboratory results. Each report will include the following items:

- Groundwater elevation results discussed in narrative form as well as presented in a table and displayed on a Site diagram;
- Hydrographs for tracking each well to evaluate seasonal water level trends;
- Discussion of groundwater flow;
- Distribution of COCs in different zones;
- Summary of all analytical results of all compounds found in monitoring well samples with comparison to MCLs and description of analytical method used in tabular form;
- Site diagram depicting all wells on and off-site with descriptions of those that are A-zone, B-zone, destroyed, dry, etc.;
- Concentration isopleths for the primary COCs in separate figures for the A and B groundwater zones;
- Graphs of the primary COCs in various zones with COC as header, concentration on y axis, and date sampled on x axis;

- Variation of contaminants with time in the different wells including discussion of nitrate, sulfate and total organic carbon concentrations;
- Discussion of the groundwater conditions in B-zone that relate to constituent attenuation.
- Discussions of any gaps in the data;
- Conclusions and recommendations for further data needs; and
- Summary of sampling procedures and any variations from the procedures established in this Workplan.

12.2 DISTRIBUTION

Eco will submit all draft reports as follows:

- One draft report will be submitted via email in Adobe® Portable Document File (PDF) format to Mr. Brian Jordan.
- One draft paper copy each will be submitted to Ms. Cecelia Horner, Mr. Travis Cain, Mr. Thad Fukushige, and Mr. Richard Lainhart.

Eco will submit all final reports to the following personnel for records:

- Submit one (1) final paper copy and one (1) final electronic copy to:
U.S. Environmental Protection Agency, Region IX
Superfund SFD-7-2
75 Hawthorne Street
San Francisco, CA 94105
Attn: Brunilda Davila
- Submit one (1) final paper copy and one (1) final electronic copy to:
U.S. Army Corps of Engineers
Albuquerque District
Program and Project Management Division
4101 Jefferson Plaza NE
Albuquerque, NM 87109
Attn: Cecelia Horner
- Submit one (1) final paper copy *each* and one (1) final electronic copy *each* to:
U.S. Army Corps of Engineers
Los Angeles District
Environmental Construction Branch
645 North Durfee Avenue
South El Monte, CA 91733
Attn: Thad Fukushige
Attn: Richard Lainhart
- Submit one (1) final paper copy and one (1) final electronic copy to:
U.S. Army Corps of Engineers
Albuquerque District
4101 Jefferson Plaza NE
Albuquerque, NM 87109
Attn: Brian Jordan

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APPENDIX E

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURES - GEOPROBE® SOIL AND GROUNDWATER SAMPLING

1.0 STANDARD OPERATING PROCEDURES FOR SOIL SAMPLING - GEOPROBE®

1.1 DISCRETE DEPTH SAMPLING

The Geoprobe® Large Bore soil sampling for discrete depth soil sampling will be used. The Large Bore sampler is 2-feet long and 1 1/2-inches outside diameter. Each sampler houses four (4) 1 1/8-inch diameter 6-inch long brass or stainless steel liners or one 1 1/8 inch x 2-foot clear Acetate sample liner. The Large Bore sampler incorporates a retractable point, which remains in the closed position while driving and is opened when the desired sample depth is reached.

1.1.1 LARGE BORE SAMPLER OPERATION

The large bore sampler is loaded with the desired sample liner/liners and the point is locked in place using a center rod. As rods are added to the string, a matching length center rod is added as well. Driving the rod with matching center rods keeps the sampler point in place until the target sampling depth is reached. Once at the desired depth, a two foot long drive rod is added to the rod string. However, no center rod is added and the rod string is driven the additional two feet. Driving the two foot, the sampler point is opened (as there is a 2 foot void of center rod), allowing the formations material to be pushed up into the sampler liner. Once the sample has been collected, the entire tool string is removed from the borehole and the decontaminated sampler is added to the bottom of the string and driven to the next sampling depth. The loaded sampler is then disassembled. The sample liner/liners are removed from the sampler and capped with Teflon and plastic. The dirty sampler is then decontaminated prior to its next use.

1.2 CONTINUOUS CORE OPEN HOLE SOIL SAMPLING

The Geoprobe® Macro Core sampler will be used for continuous core sampling in an open hole. The Macro Core Sampler is 4-feet or 5-feet long and 2-inches outside diameter. Each Sampler houses eight 1 3/4-inch x 6-inch stainless steel liners, or one clear Acetate sample liner of matching length.

1.2.1 MACRO CORE SAMPLER OPERATION

The Macro Core sampler is loaded with the desired sample liner/liners and the cutting shoe is installed on the end of the sampler. In general, the first sample is collected from surface to 4-feet or 5 feet, depending on the sample barrel length being used. Drive rods are 1.5-inch diameter and can be 4 foot or 5 foot long. Once the sample has been collected, the entire tool string removed from the borehole and a decontaminated sampler is added to the bottom of the string and driven to the next sampling depth (4 to 8 feet or 5 to 10 feet etc.). This continues in 4-foot or 5-foot intervals until desired depth has been reached. Each loaded sampler is then taken apart, where the sample liner/liners are removed from the sampler and

capped with Teflon lined plastic caps. The dirty sampler is then decontaminated prior to its next use.

It should be noted that the Macro Core Sampling system can also employ a point system similar to the discrete sampling system should the borehole have collapsing conditions. Use of the point system is utilized to minimize the collection of slough material.

1.3 DUAL WALL SOIL SAMPLING 2.25"

Dual Wall soil sampler is used for continuous core soil samples when collapsing borehole conditions are encountered or when cross contamination between Aquifers is a concern. The outer drive casing is 5 foot long x 2.25-inches outside diameter and 1.5-inches inside diameter. This system uses a 1.25-inch diameter inner rod and drive head connection to connect the acetate liner to the inner rod, thus eliminating a sample barrel assembly as is used with discrete and macro sampling.

1.3.1 2.25" DUAL WALL OPERATION

The 2.25" Lead drive rod uses a threaded cutting shoe at the lower end. Within the inside diameter of this cutting shoe the clear acetate sample liner fits within a beveled edge. A sample drive head assembly is attached to the top of the acetate liner via a set screw. Once the liner and drive head assembly are attached, both are lowered down the inside diameter to seat inside the first section of the 2.25-inch drive rod. Once the acetate liner is set, both the outer drive rod and the acetate sleeve are driven simultaneously to collect the initial soil sample from the surfaced to 5 feet. AS there is not point or barrel, the acetate sleeve is pulled to the surface. Another 5-foot section of outer rod is added to the string. A new acetate liner is connected to drive head assemble and is lowered down the inside diameter of the drive rod. To collect the next sample, a 5-foot 1.25-inch inner rod is added to placed he acetate liner deep enough to set into the beveled edge of the cutting shoe. Once set, the outer and inner rod is added to place the acetate liner deep enough to set into the beveled edge of the cutting shoe. Once set, the outer and inner rods are driven simultaneously to collect the next sample from 5 to 10 feet. The inner rod and acetate sleeve is pulled out of the outer rod and the process is completed until terminal depth, or refusal, are met.

2.0 STANDARD OPERATING PROCEDURES FOR GROUNDWATER SAMPLING - GEOPROBE®

The Geoprobe® Screen Point 15 Groundwater Sampler can be used for collection of groundwater samples. The Screen Point 15 Groundwater Sampler has a 41-inch stainless steel wire wound .004 slot screen. The stainless steel screen is enclosed in a 4-foot long x 1.5-inch outside diameter barrel. An expendable drive point is attached on the end of the 1.5-inch barrel to displace the soil as the sampler is being driven.

2.1 SP-15 SAMPLING PROCEDURES

Screen Point 15 Groundwater Sampler is driven to desired depth with 1.5 inch drive rod. Once at desired depth, the entire tool string is pulled back to allow the expendable point to disengage to expose the screen to the formation. The amount of exposed screen depends on how much the rod string is pulled back. From ground surface, 3/8-inch polyethylene tubing is

inserted down the inside of the 1.5-inch drive rod to the screen zone. The groundwater sample can be brought to the surface by one of three ways:

1. Peristaltic Pump, which is depth sensitive
2. Stainless Steel Check Valve attached to the end of the 3/8-inch polyethylene tubing
3. 7/16" diameter stainless steel bailer (where 3/8-inch tubing not required)

When sample collection is complete, the entire tool string is removed at which time the SP-15 sample barrel, screen and related parts are decontaminated via three bucket rinse. Or the entire rod string can be removed and decontaminated through the use of a pressure washer or steam cleaner. Only the expendable drive point is left in the boring.

2.2 TEMPORARY WELL SAMPLING PROCEDURES

Drive rod (1.75-inch or 2.25 inch diameter) is advanced to the target depth with an expendable point. Once at desired depth, clean PVC screen and then riser are added to the annular space inside the drive rod. Typically between five or ten feet of PVC screen is used per temp well, though more can be added as needed. Once the PVC is added, the entire rod string is pulled back at least a foot to allow the expendable point to disengage. The point being disengaged, the temporary casing is exposed to the formation, sliding out the bottom of the drive rod. Once the PVC casing is exposed to the formation the drive rod can be pulled back various lengths to expose as much (or as little) screen length to the formation. From the surface, groundwater samples are brought to the surface by one of four ways:

1. Peristaltic Pump, which is depth sensitive
2. Check Valve attached to the end of 3/8-inch Polyethylene tubing
3. 7/16-inch diameter stainless steel bailer (where 3/8-inch tubing not required)
4. 0.5-inch up to 1-inch diameter disposable bailers, depending on PVC casing size

When sample collection is complete, the entire drive rod string and the temporary casing string is removed at which time the last section of drive rod and point holder are decontaminated through the use of a pressure washer or steam cleaner. Only the expendable drive point is left in the boring. The temporary PVC casing can also be used as a tremie pipe for the placement of backfill material (Portland/bentonite slurry) via gravity feed or low pressure hand pump placement. If high pressure grouting is required 1.75-inch drive rod can be advanced and used as the conduit.