SOIL REMOVAL ACTION WORK PLAN

Environmental Investigation at the Formerly Used Defense Site (FUDS)
at the former Benicia Army Arsenal, Benicia, California
FUDS Number: J09CA075600

FINAL

Prepared for:

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SOIL REMOVAL ACTION WORK PLAN
BENICIA ARMY ARSENAL, BENICIA, CALIFORNIA

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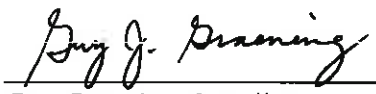

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ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
Arsenal	Benicia Army Arsenal
ASTs	above ground storage tanks
bgs	below ground surface
BSLs	Benicia Screening Levels
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHM	Conceptual Hydrogeologic Model
COC	contaminant of concern
COPCs	chemicals of potential concern
CPT	cone penetrometer
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DRO	Diesel Range Organics
ESLs	environmental screening levels
ft	feet
FUDS	Formerly Used Defense Site
GPS	Global Positioning System
GRO	Gasoline Range Organics
GSA	General Services Administration
HHRA	Human Health Risk Assessment
MDLs	method detection limit
mg/kg	milligram per kilogram
MS	Matrix Spike
MSD	Matrix Spike Duplicate
msl	mean sea level
O&M	operation and maintenance
ORP	oxidation reduction potential
OSHA	Occupational Safety and Health Administration
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PID	photoionization detector
PPE	personal protective equipment
PRGs	preliminary remediation goals

PRP	potentially responsible party
RCRA	Resource Conservation and Recovery Act
RRO	motor oil range organics
SOP	Standard Operating Procedure
SVOCs	semi-volatile organic compounds
TCE	trichloroethene
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
USA	underground service alert
USACE	Unites States Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USTs	underground storage tanks
VOCs	volatile organic compounds
WET	waste extraction test

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1.0 INTRODUCTION AND BACKGROUND

This Soil Removal Action Work Plan (Work Plan) was prepared for the former Benicia Army Arsenal (Arsenal) under General Services Administration (GSA) Contract No. GS-10F-0101L, Veterans Administration Purchase Order 674-V40113 in accordance with requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Resource Conservation Recovery Act (RCRA), as appropriate. The Arsenal is located about 25 miles northeast of San Francisco in Benicia, California, on the north side of the Carquinez Strait (Figure 1-1).

This section of the report describes the Formerly Used Defense Sites (FUDS) program, presents background information on the Arsenal, summarizes the remedial investigation and risk assessment, estimates volumes of impacted soil for removal, and lists the purpose and objectives of the Work Plan.

1.1 FUDS Program

FUDS program funding can only be used to assess and remediate Department of Defense (DoD) liability at eligible property, which is defined as real property formerly owned by, leased by, possessed by, or otherwise under the jurisdiction of the Secretary of Defense or elements of the United States military. Under the FUDS program, land that was previously utilized by DoD and that has no "beneficial use" history will be characterized and, if necessary, remediated to an appropriate standard. "Beneficial use" of former DoD land is defined as activity by subsequent landowners or lessors that would either mask contamination caused by DoD or continue contamination in the same manner.

Under the FUDS program, one of the parameters to be considered during the initiation of a project is whether the property (or specific item/site) has been beneficially used by any owner, operator, or other party that may be considered a potentially responsible party (PRP). If the United States Army Corps of Engineers (USACE) determines the contamination was caused solely by DoD, it will be mitigated by USACE through the FUDS program. If an investigation is initiated (by any party) and DoD is determined to be only partially responsible, USACE will investigate to the extent necessary to determine DoD liability.

Consideration must also be given to the ability to identify DoD generated contaminants from contaminants introduced by other PRPs, on or off the FUDS property. If identification of separate contaminant streams cannot be achieved, or if separate remediation of DoD generated contaminants cannot be realized, the project may be ineligible for remediation under the FUDS program. If commingled contamination exists, a PRP project must be initiated and the Department of Justice will negotiate a contribution settlement with the current landowner/responsible party based on a liability analysis.

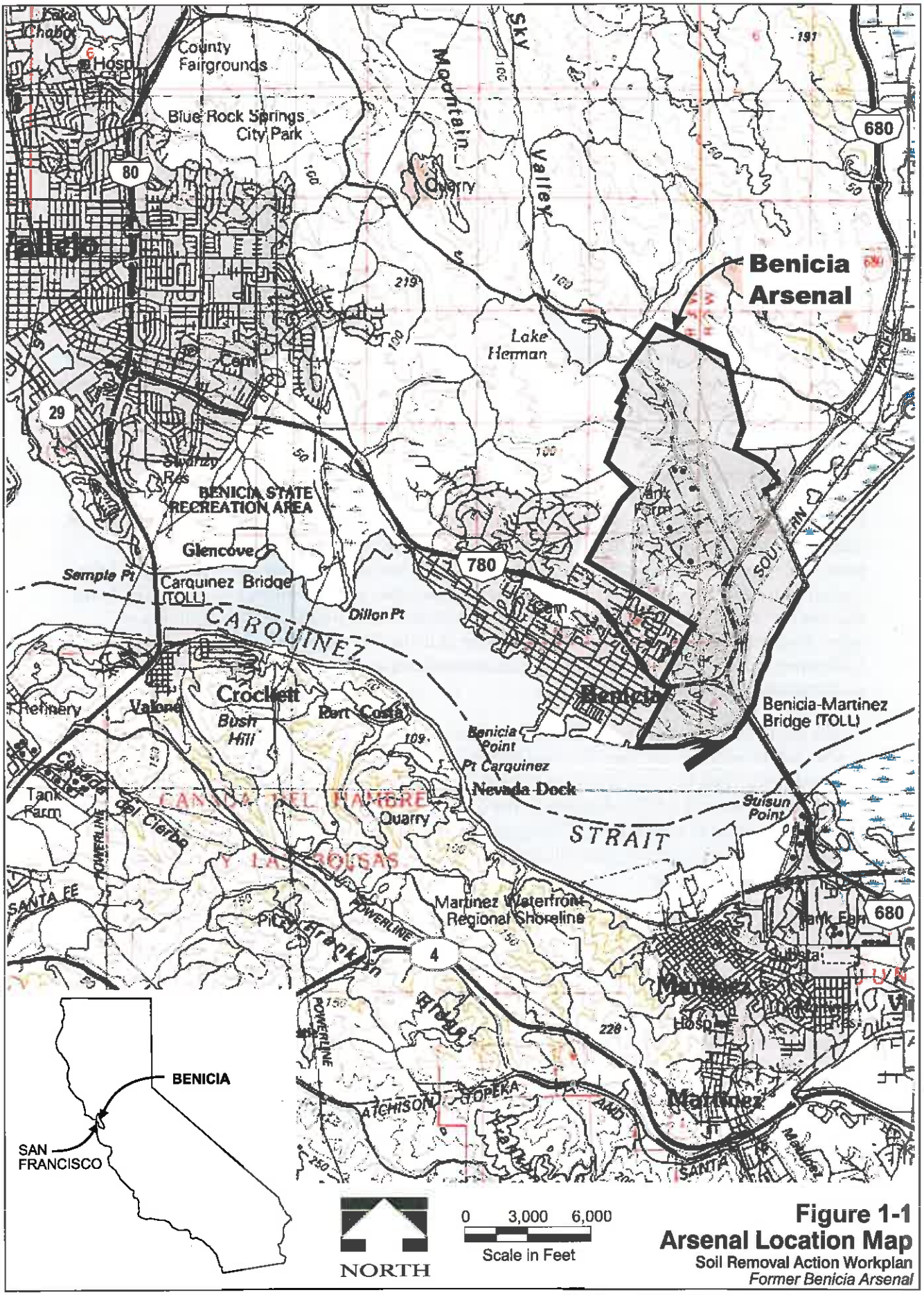

Figure 1-1
Arsenal Location Map
Soil Removal Action Workplan
Former Benicia Arsenal

Further, the Defense Environmental Restoration Program (DERP)-FUDS policy does not allow the USACE to provide cost recovery to property owners nor does it allow USACE to recover costs from property owners for remedial work. However, the property owner may initiate an investigation and/or clean-up action and subsequently seek cost reimbursement from the Department of Justice by filing a tort claim.

Data gathered and analyzed during the Benicia Arsenal remedial investigation process has determined that not all of the contamination is solely the responsibility of the DoD and that some contamination has commingled in the same geographic areas. Furthermore, the risk assessment has determined that these commingled areas are a potential risk to human health and the environment. Therefore, the FUDS program dictates that a PRP project must be initiated. Experience has shown that effective management of this situation requires that the USACE Office of Counsel takes the lead in these efforts. The goal is towards settlement of any DoD CERCLA liability and this will be conducted at a later date. This Work Plan involves the sites that USACE has determined to be contaminated only from former DoD activities, which will not be part of the PRP project.

1.2 Arsenal Background

This section describes the arsenal's physical setting, operational history, historic uses, and geology/hydrogeology.

1.2.1 Physical Setting

The City of Benicia is located northeast of San Francisco along the eastern margin of the California Coast Ranges. The Benicia Arsenal occupies an area of low hills along the northern shore of the Carquinez Strait. The Carquinez Strait separates San Pablo Bay to the west with the Suisun Bay to the east. The southernmost portion of the Arsenal rises from sea level at the Carquinez Strait to an elevation of approximately 160 feet above mean sea level (msl) in the low-lying foothills near the former location of Pine Lake.

1.2.2 Operational History

During its active life from 1849 to 1964, the Arsenal served the United States Army as a principal depot for ordnance and ordnance stores, as well as, the issuance, manufacture and testing of small arms. A massive expansion of the former Arsenal took place during World War II. Physical expansion included the addition of 1,847 acres and over 200 structures. Another full-scale expansion took place just prior to and following the Korean Conflict (1950s), with the addition of approximately 40 to 50 structures. The Arsenal eventually grew by land acquisition to a total of 2,728 acres (Jacobs, 1999). Many of these additions were warehouses for inert materials and transitory shelters. Throughout the former Arsenal's history, the functions of many buildings and operation areas changed, in response to changing government needs.

1.2.3 Historical Use of the Industrial Area

The areas that make up the Arsenal are shown on Figure 1-2. The location of activities in the Work Plan, the Industrial Area (Area I) served as the main industrial and manufacturing area throughout the 115-year history of the facility and was the center of activity at the former Arsenal. The Army operated many varieties of shops, like industrial, manufacturing, cleaning, painting, blacksmith, welding, small arms, vehicle, and artillery repair. Other areas of the Arsenal included maintenance facilities and fuel and waste storage areas. The industrial area also housed the former Arsenal's administrative offices, most of the permanent housing facilities, photographic laboratories, a firehouse, and a hospital. Fuel storage and dispensing facilities, a locomotive house, boiler houses, storehouse and warehouse facilities, open storage facilities, fillsites, and quarries were also located within this area.

After closure of the Arsenal, tenants, and landowners used some buildings for a variety of manufacturing, maintenance, and repair activities. Prior to the 1970s, it was customary to discharge untreated waste into the sewer and/or storm drain system. Regulations were later enacted and enforced to prohibit these activities. The discharge of untreated wastes into the sewer system continued for five years after the Army left in 1964, when an upgrade to the sewer system was completed and untreated wastes were diverted from the Carquinez Strait into the City of Benicia Wastewater Treatment Plant.

1.2.4 Geology and Hydrogeology

The geology and hydrogeology of the former Arsenal are discussed in detail in the *Conceptual Hydrogeologic Model* (CHM) (Brown and Caldwell, 2005c), the *Expanded SI* (Brown and Caldwell, 2005a), and summarized in this section. The former Arsenal was divided into two hydrogeologic areas based on the geology combined with the hydrogeologic characteristics (including water quality). These areas are referred as the Lowlands and the Highlands. The stratigraphy of the Lowland area (above the bedrock material) may contain the following geologic units, from oldest to youngest: older alluvium, Bay Mud, and fill material. The Lowland area on the former Arsenal includes the former marshlands. In the industrial area, the boundary between the Lowland and Highland area is the boundary of the former marshland.

Depth to the bedrock in the industrial area ranges from at surface to about 105 feet below the former marshland. The topography of the top of the bedrock indicates that several valleys were partially filled with alluvium, prior to the deposition of the estuarine Bay Mud.

The Bay Mud was deposited between 8,000 and 11,000 years ago when a rise in sea level inundated the region. Marshlands formed on top of the Bay Mud (clays and sensitive fines). Lenses of alluvial sands and silts may be present within the Bay Mud. Most soil borings in the industrial area include artificial fill consisting of sandy silt, silt, clayey silt, and sand overlying the Bay Mud. The thickness of the fill increases as the distance from bedrock highs increase; the thickness of the fill ranges from about 2 feet to 13 feet.

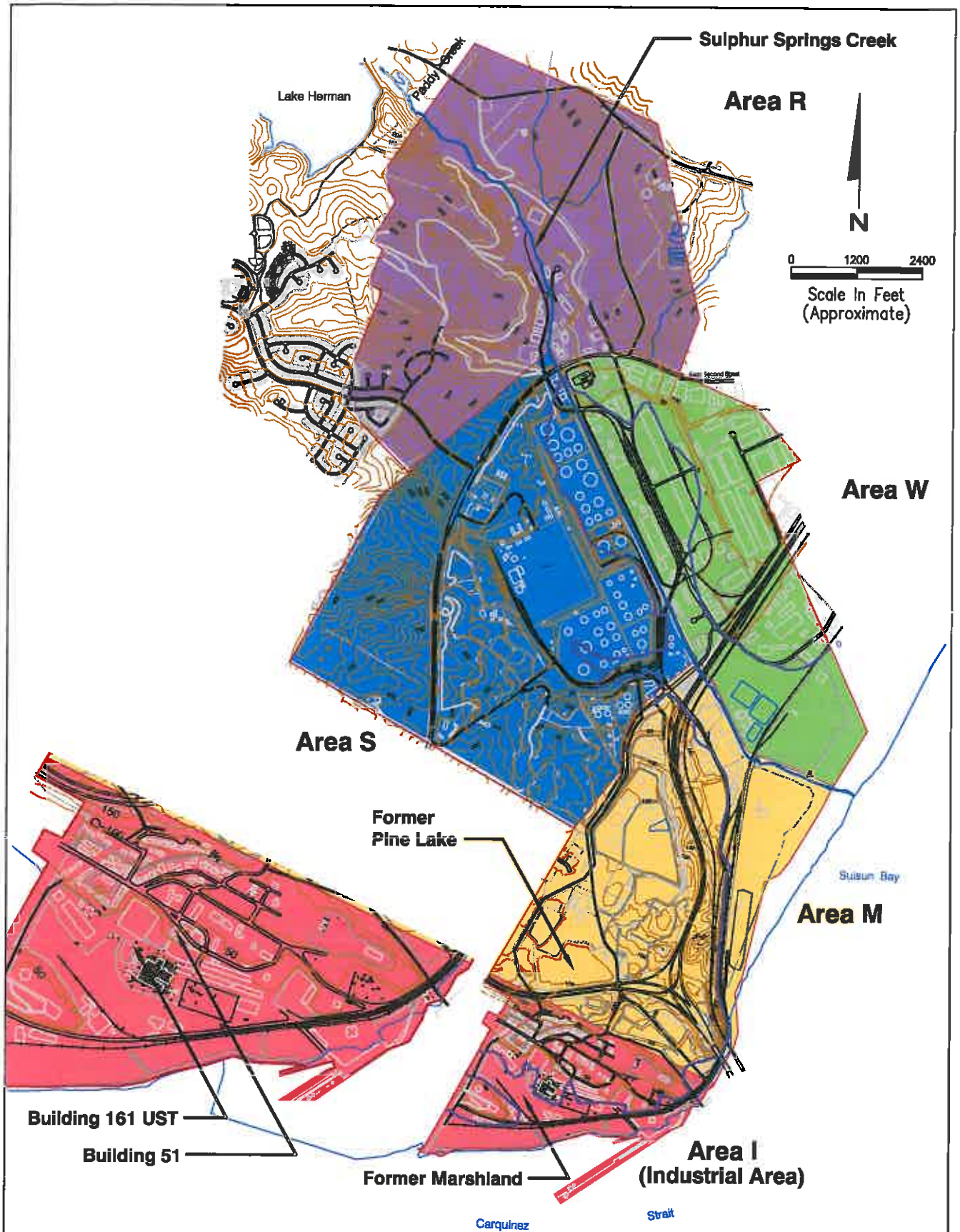

Figure 1-2
Areas of Arsenal
Soil Removal Action Workplan
Former Benicia Arsenal

Depth to first groundwater in the industrial area is less than 12 feet deep. At deeper depths, static groundwater is under confined conditions such that water levels rise to within 10 ft bgs and sometimes above the ground surface (artesian conditions). In the industrial area, fresh to saline groundwater is present. The deeper groundwater in the area, based on electrical conductivity, is saline. In the Highlands, groundwater is not found until deeper in the fractured bedrock.

1.3 Remedial Investigation

A summary of the sites that required remedial activity or a risk assessment were summarized in the *Expanded SI* (Brown and Caldwell, 2005a), *Expanded SI Addendum* (Brown and Caldwell, 2008a), *Fuel Storage Tank Removal Action* (Brown and Caldwell, 2005b), and *Fuel Storage Tank Removal Action Addendum* (Brown and Caldwell, 2008b) reports. *The Expanded SI* and *Expanded SI Addendum* reports were inclusive of the data collected in earlier reports and did not involve sites with solely petroleum hydrocarbon-containing underground storage tanks (USTs) or above ground storage tanks (ASTs). These UST or AST sites were investigated separately due to funding limitations and are documented in the several technical memorandums and removal actions. For the sites included in this Work Plan, Building 51 and Building 161 UST, summaries of the previous investigations are summarized below.

1.3.1 Building 51

Building 51 was used as a drum storage/maintenance area by the DoD and was sampled to determine the lateral extent of lead and polyaromatic hydrocarbons (PAHs) in soil. The building is located on the hills above Buildings 31 and 98 in the industrial area (Figure 1-2). Two soil samples and a duplicate were included in the *Expanded SI Report* (Brown and Caldwell, 2005a). Concentrations of lead did not exceed the risk to commercial/industrial worker of 750 mg/kg based on the Water Board Environmental Screening Level (ESL; Water Board, 2007). However, in the duplicate sample at 0.5-feet to 1.0-feet, lead concentration was 798 mg/kg and exceeded the Water Board ESL. Lead concentrations decrease in concentration with depth (Table 1-1). Since the lead concentration may be near a source, additional samples were collected.

Three soil samples were collected northwest and southeast of the Expanded SI boring, B051HP001 during the addendum field investigation (Brown and Caldwell, 2008a). Sample depths ranged from 0.5 feet bgs to 2.2 feet bgs. Fill material of silt and organics (i.e. leaves) was encountered at the surface to approximately 8 inches bgs. Sandstone underlies the fill material. Competent sandstone was encountered at depths of 2 feet bgs to 2.2 feet bgs. No groundwater was encountered.

A comparison of the lead data from the addendum investigation and the Expanded SI is provided in Table 1-1. Concentrations of lead are consistent with the reported results in the *Expanded SI Report*, around 150 mg/kg (Brown and Caldwell, 2005a). Since the lead reported in shallow soil from the June 2004 sampling location is below the Water Board ESL, the June 2004 duplicate sample of 798 mg/kg is considered to be an anomaly.

Table 1-1. Lead in Soil at Building 51

	Depth (feet bgs)	ESL (mg/kg)	Concentration (mg/kg)
B051HP001[+]	0.5-1.0	750	**155[+]/798[**]**
B051HP001[+]	1.5-2.0		153
B051HA001	1.75-2.2		34.5
B051HA002	1.5-2.0		166
B051HA003	1.75-2.2		141

[**] Duplicate sample

[+] Documented in the Expanded SI Report (Brown and Caldwell, 2005a)

ESL = Environmental Screening Level (Water Board, 2007)

Bolded values exceed their respective BSLs or ESLs

mg/kg = milligram per kilogram

bgs = below ground surface

PAHs were detected in addendum investigation soil samples above laboratory method detection limits (MDLs) and their concentrations are listed in Table 1-2. PAH concentrations are consistent with the reported results in the *Expanded SI Report* (Brown and Caldwell, 2005a). Arsenic was reported at 0.5 to 1 foot bgs in B051HP001 at a concentration of 17.1 mg/kg. The duplicate sample reported a concentration of 9.8 mg/kg. The lower concentration was presented in the *Expanded Site Addendum Report* (Brown and Caldwell, 2008a). All data (non-TPH) collected at this location were evaluated in the risk assessment.

Table 1-2. Detected PAHs in Soil at Building 51

	ESL (mg/kg)	B051HP001 Depth 0.5-1.0 feet bgs (mg/kg)[+]	B051HP001 Depth 1.5-2.0 feet bgs (mg/kg)[+]	B051HA001 Depth 1.75-2.2 feet bgs (mg/kg)	B051HA002 Depth 1.5-2.0 feet bgs (mg/kg)	B051HA003 Depth 1.7-2.2 feet bgs (mg/kg)
anthracene	40	<0.0016	<0.0015	<0.0013	0.02	<0.0059
bis(2-ethylhexyl) phthalate	120	<0.11	0.45	NA	NA	NA
benzo(a)anthracene	1.3	<0.001	0.0037	0.0061	0.047	0.019
benzo(a)pyrene	0.13	<0.0011	0.0047	<0.0013	0.066	0.023
benzo(b)fluoranthene	1.3	<0.0021	0.011	<0.0026	0.054	<0.012
benzo(g,h,i)perylene	35	<0.0021	0.0092	<0.0026	0.053	0.021
benzo(k)fluoranthene	1.3	<0.0018	0.0037	<0.0013	0.038	0.019
chrysene	13	<0.001	0.012	<0.0013	0.065	0.051
dimethyl phthalate	1,000	0.26	<0.13	NA	NA	NA
fluoranthene	40	<0.0021	0.039	<0.0026	0.17	0.084

Table 1-2. Detected PAHs in Soil at Building 51

	ESL (mg/kg)	B051HP001 Depth 0.5-1.0 feet bgs (mg/kg)*	B051HP001 Depth 1.5-2.0 feet bgs (mg/kg)*	B051HA001 Depth 1.75-2.2 feet bgs (mg/kg)	B051HA002 Depth 1.5-2.0 feet bgs (mg/kg)	B051HA003 Depth 1.7-2.2 feet bgs (mg/kg)
fluorene	640	<0.0024	<0.0021	<0.0026	0.0071	<0.012
indeno(1,2,3-c,d)pyrene	2.1	<0.0023	0.007	<0.0013	0.041	0.023
phenanthrene	40	<0.0011	0.0044	0.0033	0.09	0.019
pyrene	1,000	<0.0019	0.34	0.0095	0.23	0.1

ESL = Environmental Screening Level for Commercial/Industrial land use (Water Board, 2007)

NA = not analyzed

Bolded values exceed their respective BSLs or ESLs

mg/kg = milligrams per kilograms

* Documented in the Expanded SI Report (Brown and Caldwell, 2005a).

1.3.2 Former Building 161 UST

A 3,400-gallon single-walled steel underground storage tank was located at Building 161 and historically used to hold kerosene (typically between C4-C19). The Building 161 UST is located in the industrial area (Figure 1-2). The tank (Photo 1) was located on the north side of the former building. In January 2006 and January 2008 tank removal and site investigation activities were conducted as part of the *Expanded SI* (Brown and Caldwell, 2005a) and the *Expanded SI Addendum* (Brown and Caldwell, 2008a).

Photo 1. Building 161 UST.
Photo taken 1/6/2006. Looking east towards Jackson Street

In January 2006, approximately 2,200 gallons of water and a viscous sludge were pumped into a vacuum truck: 2,100 gallons of liquid from the UST (emptied the tank) and 100 gallons of the oily sheen in the excavation. The UST was removed from the site.

During tank removal, the west side of the excavation appeared to be impacted with hydrocarbons. Four soil borings (B161GB001, B161GB002, B161GB003, and B161GB004) were advanced surrounding the suspected impact on January 6, 2006. The samples from borings on the north and west side of the excavation (B161GB001 and B161GB002) contained very low to no concentrations above the MDLs for petroleum hydrocarbons. The detections were below commercial/industrial ESLs. The borings south of the excavation, B161GB003 and B161GB004, did contain petroleum hydrocarbons and/or trichloroethene (TCE) and their results are shown in Table 1-3. Samples were also analyzed for PCBs, PAHs, VOCs, and metals.

On January 22 and 23, 2008, four direct push borings (B161GB005 through B161GB008) were advanced and soil samples collected at pre-selected depths (4.5 to 5.5 feet bgs and 8 to 9 feet bgs) and groundwater samples were collected in each boring to delineate TPH near the limits of the UST excavation. These sample depths were agreed upon by the Water Board to represent soil samples from the top of the tank and the bottom of the tank. Additionally, the placements of the borings were deliberate such that three borings (B161GB005, B161GB006, and B161GB007) were placed closer to the UST than the borings drilled and sampled in 2006, B161GB005 was upgradient of the UST, and the other three borings downgradient of the UST (B161GB006 through B161GB008) in a triangular pattern with B161GB008 furthest downgradient.

Diesel fuel range hydrocarbons were detected above the Water Board ESL of 150 mg/kg in boring B161GB003 (660 mg/kg). A downgradient location, B161GB004, was sampled and diesel fuel range hydrocarbons were not detected above laboratory method detection limits. Therefore, diesel range hydrocarbons have been delineated. There were no gasoline range hydrocarbons detected in soil around the UST. Kerosene was indicated by the Army as the fuel stored in the UST. It was possible that the UST may have contained diesel fuel at a later date.

Lead was reported in all of the soil samples but none of the concentrations exceeded the Water Board ESL or its ambient concentration limit (Table 1-3). Likewise, none of the other analytes reported in soil in the UST excavation or the other borings advanced during the January 2006 addendum investigation exceeded their respective Water Board ESLs, including polychlorinated biphenyls (PCBs) (Table 1-3).

PCB-1254 and PCB-1260 were reported at 1.1 mg/kg and 0.34 mg/kg, respectively in B161GB005 at 5 feet bgs to 5.5 feet bgs (Table 1-3). B161GB005 is located 4 feet north of the UST excavation. The Water Board ESL for PCBs is 0.3 mg/kg (commercial/industrial use and groundwater is not a potential source of drinking water). All other 2008 soil samples collected (including all samples collected at a depth of 8 to 9 feet bgs) were reported at concentrations below their respective MDLs and thusly, below the Water Board ESL for PCBs (Table 1-3).

Table 1-3. Petroleum Hydrocarbon, Lead, TCE, and PCB Results in Soil at Former UST 161

Analyte	B161GB001	B161GB002	B161GB003	B161GB004	B161GB005	B161GB006	B161GB007	B161GB008	Water Board ESL	Ambient Concentration Limit***
Sample Depth = 4 to 5.5 feet bgs										
Lead	8.29	7.95	6.17	10.9	NA	NA	NA	NA	750	36.8
Trichloroethene	< 0.0022	<0.0022	<0.0022	0.0023	NA	NA	NA	NA	4	NE
Gasoline range (C6-C10)**	<0.6	<0.56	3.6	<0.6	NA	NA	NA	NA	450	NE
Diesel range (C10-C24)**	4*	<2.7	660	<2.6	NA	NA	NA	NA	150	NE
Motor oil range (C20-C34)	<2.7	<2.6	730	<2.5	NA	NA	NA	NA	2,500	NE
PCBs	<0.024	<0.023	<0.023	<0.022	1.1 (PCB-1254) 0.34 (PCB-1260)	<0.022	<0.021	<0.018	0.3	NE
Sample Depth = 8 to 9 feet bgs										
PCBs	NS	NS	NS	NS	<0.020	<0.021	<0.020	<0.02	0.3	NE

Concentrations in mg/kg – milligrams per kilogram
NA – not analyzed
NE – not established
NS – not sampled
ESL – Environmental Screening Level for shallow soil (<3 meters) where groundwater is NOT a potential source of drinking water, industrial/commercial land use (Water Board, 2007)
bgs – below ground surface
* reported in the duplicate sample
** kerosene (typically between C4-C19), a product allegedly used in the Building 27 UST, coincides within the gasoline and diesel range
*** Forsgren Associates/Brown and Caldwell, 2003

Grab groundwater sample were collected from the excavation sample (B161GR001) and shallow groundwater from borings B161GB006 through B161GB008. Petroleum hydrocarbons, diesel fuel, gasoline, and motor oil are all above their respective Water Board ESLs (Table 1-4). Broader investigations for these constituents were performed for the *Expanded SI* (Brown and Caldwell, 2005b) and have delineated the vertical and lateral extent of these parameters in groundwater. This impact to groundwater is part of the PRP project. The grab groundwater sample also contained two PCBs cogeners, 1254 and 1260, which are not above their Water Board ESLs.

Table 1-4. Results above ESL in Groundwater at Former UST 161

Analyte	Concentrations in µg/L					
	B161GB001 (excavation grab sample)	B161GB005	B161GB006	B161GB007	B161GB008	Water Board ESL
Diesel fuel range (C10-C24)	**27,000**	**5,500**	Not analyzed	Not analyzed	720	2,500
Gasoline range (C6-C10)	**6,900**	750	Not analyzed	Not analyzed	93	5,000
Motor oil range (C20-C34)	**18,000**	**4,000**	Not analyzed	Not analyzed	190	2,500
PCB-1254	5.6	<0.24	<0.24	<0.24	<0.24	16
PCB-1260	1.6	<0.24	<0.24	<0.24	<0.24	16

BOLD indicates concentration exceeds its ESL

µg/L – micrograms per liter

ESL – Environmental Screening Level for groundwater is not a potential source of drinking water, industrial/commercial land use (Water Board, 2007)

A product sample was collected from the UST for waste characterization. Methylene chloride, TCE, PCB-1254, and PCB-1260 were detected in the product sample (Table 1-5). The density of the product sample is 0.94 grams per millimeter which means it is lighter than water. The product was observed floating on water which substantiates that a light aqueous phase liquid was contained in the tank, like kerosene or diesel fuel. The presence of volatile organic compounds (VOCs) and PCBs in the product sample means they have co-eluted in the sample. TCE and the PCB congeners were also reported in the grab groundwater sample from the tank excavation.

Table 1-5. Building 161 UST Product Sample Results

Analyte	Result (µg/kg)	% of product
Methylene chloride	28,000	0.003%
Trichloroethene	930,000	0.093%
PCB-1254	27,000	0.003%
PCB-1260	8,200	0.001%
	Total	0.099%

µg/kg- micrograms per kilogram = parts per billion

Based on the historical use of PCBs provided above and the use of electrical equipment at the Arsenal, it is possible that Arsenal equipment contained PCB-laden dielectric oil; however, how it got into the UST is not documented. One soil sample in close proximity to the UST (B161GB005 at 5 feet bgs to 5.5 feet bgs) contained the same PCB congeners as reported in the grab groundwater sample from the UST and in the UST product sample. The impact to soil is not extensive. PCB concentrations are very low and the 2006 PCB soil sample, approximately 5 feet north of B161GB005 did not report any PCBs. The presence of PCBs in soil was evaluated in the risk assessment. PCBs have not impacted groundwater. Based on these data, the source of PCBs in the grab groundwater sample appears to be the UST. A volume of contaminated groundwater was removed from the open excavation, as well as, all of the contents from the UST. Therefore, the source PCBs and the petroleum hydrocarbons have been removed. PAH, metals, PCBs, and VOC data were evaluated in the risk assessment.

1.4 Risk Assessment

The scope of the *Human Health Risk Assessment* (HHRA; USACE, 2008) was limited to two areas contaminated solely by past DoD activities. Evaluation of data determined to be unrelated to DoD past practice was outside the scope of the assessment but will be included in a future PRP project. Detailed analysis methods and exposure assumptions used to assess potential human risks/hazards associated with exposure to contaminants are described in the *Benicia Arsenal Risk Assumptions Document* (USACE, 2005).

The objective of the HHRA was to evaluate potential human health risks associated with exposure to contaminants of potential concern (COPCs) detected in soil and groundwater. The evaluation used hypothetical exposure scenarios. Table 1-6 shows a summary of site risks associated with exposures to site media.

**Table 1-6. Summary of Estimated Site Risks and Hazards
Former Benicia Arsenal, Benicia, CA**

Receptor	Exposure Pathway	Estimated Lifetime Cancer Risk (ELCR)	Hazard Index	Exceeds USEPA Target Risk Levels[a]
Current Installation Worker	Ingestion of Surface Soil	9E-06	3E-01	Yes
	Dermal contact with Surface Soil	6E-06	9E-02	Yes
	TOTAL RISK OR HAZARD	**2E-05**	**3E-01**	**Yes**
Future Intrusive Worker	Ingestion of Surface Soil	3E-07	3E-01	No
	Dermal Contact with Surface Soils	8E-06	3E-01	Yes
	Dermal Exposure to Groundwater	6E-17	2E-11	No
	TOTAL RISK OR HAZARD	**8E-06**	**6E-01**	**Yes**
Current Indoor Worker	Ingestion of Surface Soil	9E-06	3E-01	Yes
	Dermal Contact with Surface Soils	6E-06	9E-02	Yes
	TOTAL RISK OR HAZARD	**2E-05**	**3E-01**	**Yes**

[a] USEPA establishes a condition of no significant risk if the Hazard Index is less than or equal to one and the ELCR is less than or equal to 1E-06.

Potential risks were indicated for the current installation and indoor worker receptors based on estimated lifetime cancer risks. However, USEPA recommends active remedies for industrial receptors when cancer risks exceed 1E-04 or when the hazard index exceeds one. Neither of these thresholds is exceeded at Benicia. Therefore, appropriate risk management activities (institutional controls, land-use controls) should be considered in the corrective measures study.

Based on the industrial receptor evaluation, the risks associated with exposure to soil are from the following chemicals of potential concerns (COPCs) and their source locations:

- Arsenic at B051HP001 (17.1 mg/kg at 0.5 to 1 ft bgs);
- Dibenz(a,h)anthracene at B161GB003 (4.7 mg.kg at 4.5 to 5 feet bgs); and
- PCB-1254 at B161GB005 (1.1 mg/kg at 5 to 5.5 feet bgs).

1.5 Estimated Volumes of Impacted Soil

As described in previous sections, the contaminants of concern (COC), arsenic, PCB-1254 (Arochlor 1254), and dibenz(a,h)anthracene exceed risk-based concentrations in soil at the Site. Table 1-7 provides estimated volumes of impacted soil to be removed. The total volume of impacted soil to be removed is approximately 100 cubic yards. The excavations will extend to a maximum depth of 5.5 ft bgs. The proposed limits of the excavations are shown on figures included in Section 2 of this Work Plan.

Table 1-7. Estimated Volumes of Impacted Soil

Site	Analyte	Area	Depth (bgs)	Volume
Bldg. 51	Arsenic	366.2 ft^2	1.0 ft	13.6 yd^3
Bldg. 161 UST	PCB-1254 (Arochlor 1254) and Diesel Range Organics	120.6 ft^2	5.5 ft	24.6 yd^3
	Dibenz(a,h)Anthracene and Diesel Range Organics	340.8 ft^2	5.0 ft	63.1 yd^3

1.6 Work Plan Purpose and Removal Action Objectives

The purpose of the Work Plan is to describe the field procedures and construction methods required to accomplish the soil removal action. The objectives of the soil removal action are to:

- Remove soil that contains COPCs exceeding risk-based concentrations;
- Confirm that impacted soil is removed through confirmation sampling and analysis;
- Restore the Site to the condition prior to the removal action;
- Conduct the removal action in a healthy and safe manner;
- Meet local, state, and federal requirements for soil staging, transportation, and disposal; and
- Minimize disruption to tenant and landowner activity.

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2.0 FIELD ACTIVITIES

2.1 Site Preparation and Health and Safety

Site preparation activities consist of permitting, regulatory agency coordination, surveying, utility clearance, and preparing a Accident Prevention Plan (APP).

This section also describes the construction techniques that the construction contractor will implement to manage the impacted soil and restore the Site. Brown and Caldwell, acting as the construction manager, will be present on Site during construction activity to verify that the construction contractor is implementing the techniques according to the Work Plan.

2.1.1 Permitting and Regulatory Agency Coordination

The removal action requires permission from landowners and coordination with tenants. The City of Benicia typically does not require a permit (e.g., excavation or grading permit) to conduct a removal action; however, notification will be performed with the Public Works Department. USACE will attain right of entry to each parcel.

2.1.2 Protection of the Public and the Site

Brown and Caldwell and its subcontractors will take appropriate precautions to protect the public from work activities and to reduce impact on the site from the removal activities. Litter and debris will be cleaned up daily and placed in containers for proper disposal. Containers will be emptied at least once a week and promptly removed from the work location at the end of the field activity.

2.1.3 Surveying

Various features (e.g., UST locations, soil boring locations, monitoring wells) at the Site have previously been surveyed by a California-licensed surveyor. The areas to be excavated will be delineated using a Global Positioning System (GPS) unit.

2.1.4 Utility Clearance

It is essential that the excavation areas be cleared for utility and other subsurface obstructions. Underground Service Alert (USA) will be notified in accordance with local regulations. In California, it is required to mark the digging location in white paint and to notify USA a minimum of 48 hours in advance of digging. The areas will also be marked for subsurface utilities by a private utility location.

2.2 Health and Safety Plan

An APP included as Appendix A, was developed to inform personnel of the potential hazards associated with implementing the removal action and steps to be taken to minimize or eliminate potential exposures. The APP has been prepared to meet state and federal requirements for hazardous waste operations, specifically California Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120 and 8 CCR 5192 and USACE Health and Safety Manual EM-385-1-1.

Elements of the APP include worker training and contractor certification, site control, and security measures, personal protective equipment (PPE), and air monitoring.

2.3 Soil Excavation Plan

Outlines of the excavation areas at Building 51 and Building 161 UST for each COC is provided on Figures 2-1 through 2-3. The deepest excavation is approximately 5.5 ft bgs and the total volume is approximately 100 cubic yards. The soil excavation plan consists of the following elements: construction techniques and equipment, sloping and shoring, contingency plan, dust control, and storm water and erosion control. Groundwater is not expected to be encountered and dewatering will not be required.

2.3.1 Construction Techniques

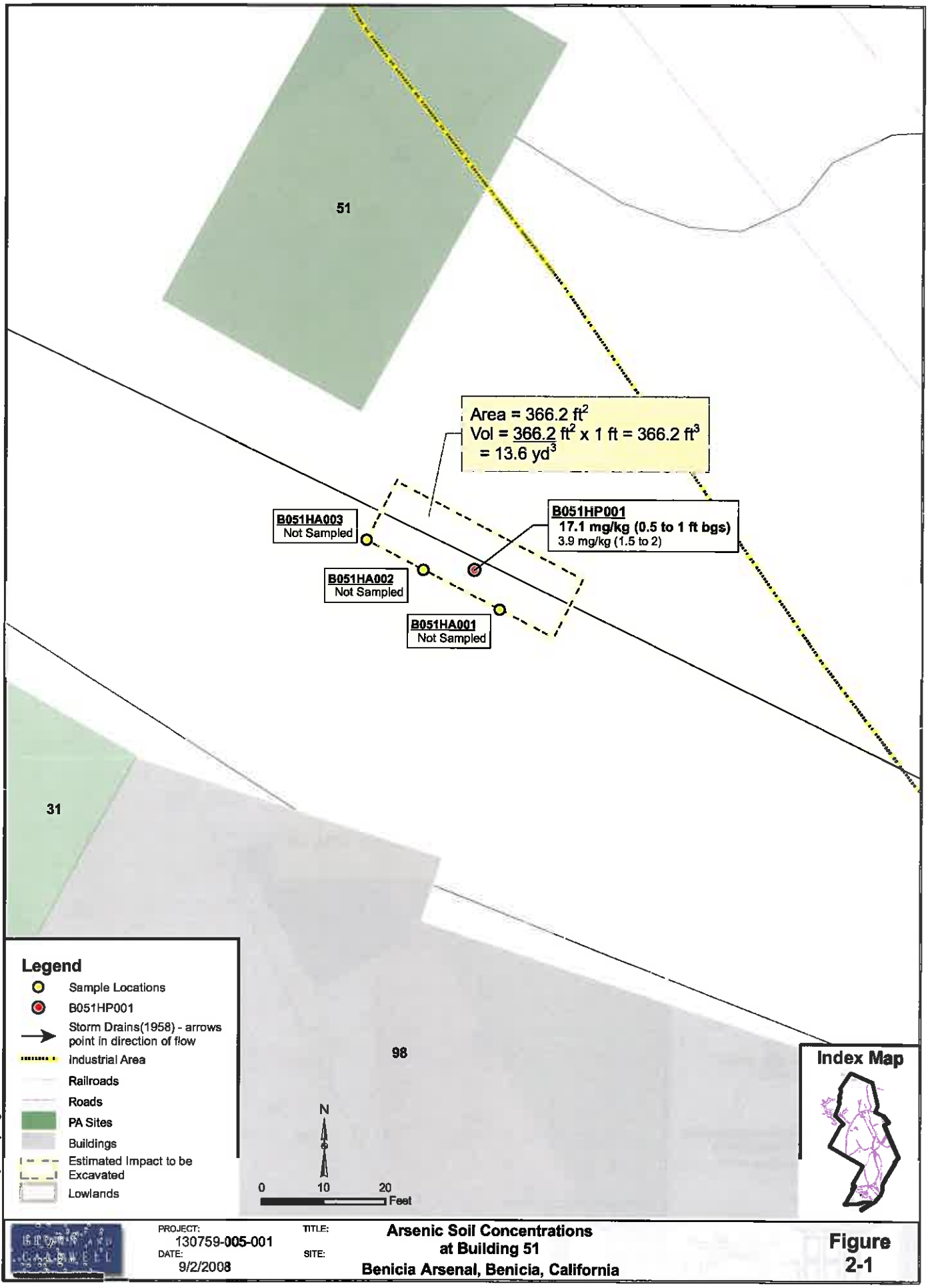
Conventional excavation and loading techniques are appropriate for this removal action. The anticipated construction equipment consists of a backhoe, front loader, roll-off truck/trailer, roll-off bins, water truck (for dust control), and conventional hand tools. Excavation will be conducted with a backhoe and spotter. The backhoe will either load excavation spoils directly to the bins or stage spoils in stockpiles on plastic for the front loader to eventually load spoils in to bins.

2.3.2 Sloping and Shoring

Site workers will stay out of excavations whenever possible. The construction contractor will slope and bench any excavations greater than 4 feet as necessary per OSHA guidelines.

2.3.3 Contingency Plan

Although no hazardous materials are known to have been disposed on the Site, the construction contractor will monitor for materials that may potentially pose an imminent health or safety hazard. Monitoring will include inspecting uncovered waste for discoloration, free liquids, and containers (e.g., chemical sacks, tanks, cylinders and drums). Using a photoionization detector (PID), the construction manager will screen ambient air during waste excavation for VOCs. If a material is encountered that is deemed as an imminent threat to human health or the environment (e.g., an unlabeled, bulging drum), then the construction contractor will cease excavation and contact the City's Hazardous Materials Division.

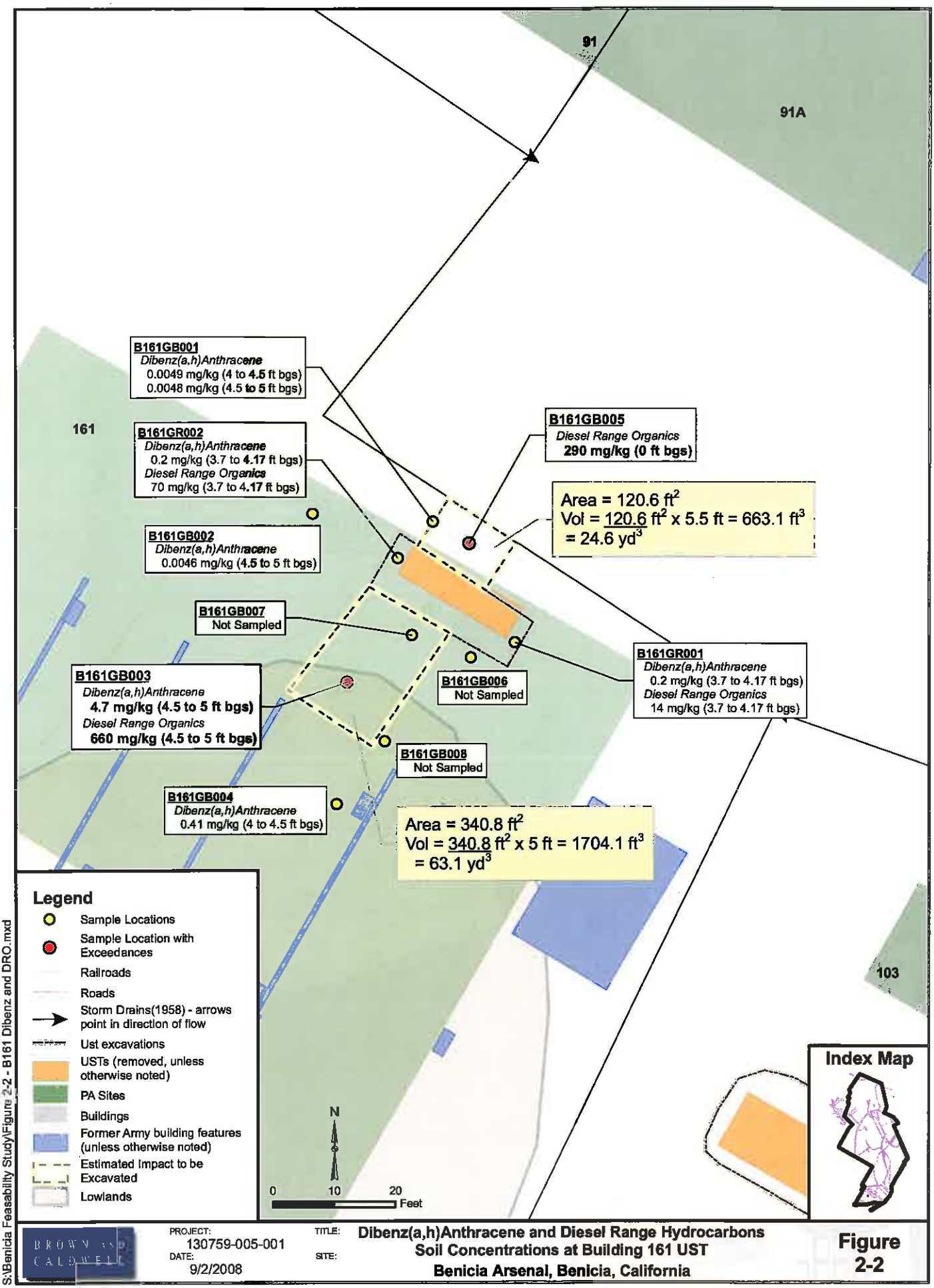


S:\Benicia Feasability Study\Figure 2-1 - B051HP Arsenic.mxd

PROJECT: 130759-005-001
DATE: 9/2/2008
TITLE:
SITE:

Arsenic Soil Concentrations at Building 51
Benicia Arsenal, Benicia, California

Figure 2-1



S:\Benicia Feasability Study\Figure 2-2 - B161 Dibenz and DRO.mxd

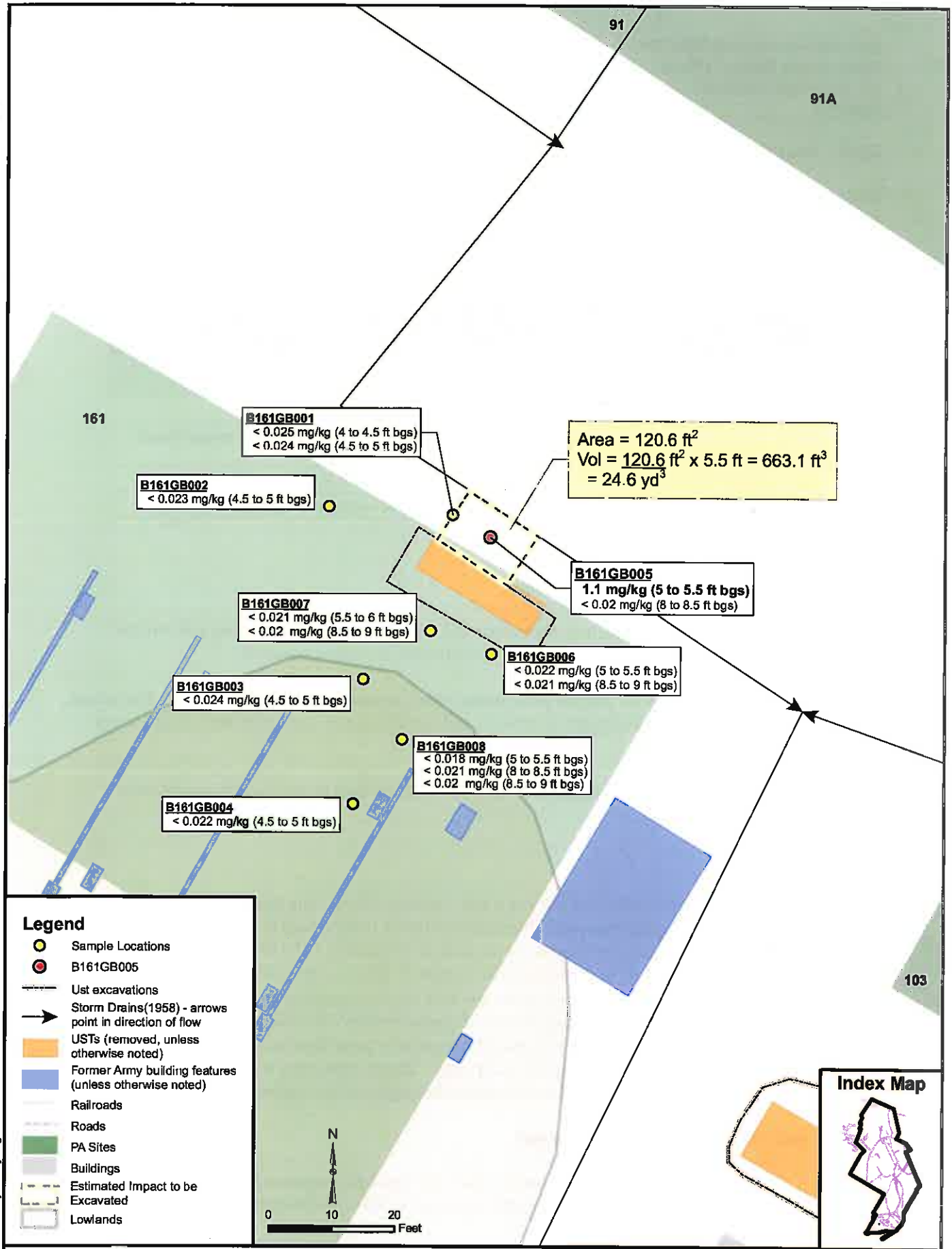
BROWN AND CALDWELL

PROJECT: 130759-005-001
DATE: 9/2/2008

TITLE: Dibenz(a,h)Anthracene and Diesel Range Hydrocarbons Soil Concentrations at Building 161 UST

SITE: Benicia Arsenal, Benicia, California

Figure 2-2



S:\Benicia Feasability Study\Figure 2-3 - B161 PCB1254.mxd

BROWN AND CALDWELL

PROJECT: 130759-006-001
DATE: 10/7/2009

TITLE: PCB-1254 (Arochlor 1254) Soil Concentrations at Building 161 UST
SITE: Benicia Arsenal, Benicia, California

Figure 2-3

2.3.4 Dust Control

The removal action has the potential to create fugitive dust from several sources as shown in the following table. The construction contractor will implement the dust control measures listed in Table 2-1 during field activities to control fugitive dust and minimize visible dust emissions.

Table 2-1. Dust Control Measures

Dust Source	Dust Control Measure
Earthwork (excavation, loading & grading)	Apply water before/during earthwork
Carryout/trackout onto paved streets	Brush tires, truck sides, cover loads & sweep streets (as necessary)
Soil staging in stockpiles/bins	Cover or apply water to soil stockpiles/bins
Disturbed surface areas	Stabilize soil & re-vegetate following final grading

2.3.5 Storm Water and Erosion Control

Prior to construction, the construction contractor will be responsible for installing erosion and sedimentation control devices to minimize the potential for stormwater runoff.

Additional prevention measures include performing heavy equipment fueling and storing hazardous materials in designated areas and parking vehicles and locating waste stockpiles away from storm water drainage points.

Temporary storm water pollution prevention controls must remain in place until restoration is complete.

2.4 Soil Staging

The construction contractor will load the impacted soil into roll-off bins (maximum 20 cubic yards) and move the bins to a staging area until characterization for transportation and disposal is complete. The volume of impacted soil to be excavated at Building 161 UST area is approximately 88 cubic yards and five 20-yard bins will likely be required. When a bin is filled to the appropriate capacity, the construction contractor will move the bins to the staging area. The volume of impacted soil to be excavated at Building 51 area is approximately 14 cubic yards and one 20-yard bin will likely be required. The bin will be placed temporarily near the excavation and then moved to the bin staging area near the Building 161 UST area. The construction contractor will cover and secure the bins. Each bin will be labeled to indicate the origin of the contents.

2.5 Soil Transportation and Disposal

Based on the investigation results conducted to date, the final disposition of the impacted soil is anticipated to be the Class II Altamont Landfill operated by Waste Management and located at

10840 Altamont Pass Road in Livermore, California. However, the ultimate disposal facility will be determined based on the analytical results and acceptance of the characterized soil.

Once the soil is characterized and acceptance for the waste has been secured by an off-site disposal facility, waste manifests will be prepared by the construction contractor or waste hauler. The USACE will sign the manifests as the waste generator, and then the bins will be loaded onto trucks. Prior to departure, trucks will be tarped, and tires will be dry-brushed as necessary to remove visible soil. The soil will be transported approximately 50 miles to the Altamont Landfill (see haul route in Appendix A – Figure 2).

2.6 Site Restoration

After the confirmation sampling (see Section 4) has demonstrated that all impacted soil has been removed, the construction contractor will proceed with backfilling the excavation and re-paving the surface.

2.6.1 Backfilling

Each excavation will be backfilled to the surface with imported material. The excavation at Building 51 will be backfilled with clean structural fill. The excavations at the Building 161 UST area will be backfilled with 1.5-inch drainage rock from the total depth of excavation to approximately 3 ft below grade and structural fill in 1 foot lifts from 3 ft below grade to the surface. Backfill will be moisture conditioned to within 3 percentage points of optimum moisture content and compacted to 90 percent relative compaction (to ASTM D-1557).

2.6.2 Paving

Any pavement removed during excavation will be replaced with an equivalent pavement. The pavement at the Building 51 excavation area is asphalt. Near the Building 161 UST area, the concrete foundation is 6 inches to 1 foot thick.

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3.0 SAMPING AND ANALYSIS PLAN

This section describes the sampling and analysis required to properly characterize the staged soil for disposal and to confirm that all impacted soil has been removed from the excavations.

3.1 Characterization Sampling and Analysis

One characterization sample will be collected for every 20 cubic yards of soil (i.e., one per bin). A total of five samples are anticipated for the 100 cubic yards of soil estimated for removal. If the excavated soil volume increases significantly beyond 100 cubic yards, the characterization sampling frequency will be reduced to one composite sample per 40 cubic yards. Each characterization sample will consist of four samples collected in separate 4-ounce glass jars. Each 4-ounce jar will contain equal grab amounts from four sides of the bin. The lab will further homogenize the composites prior to analysis.

The characterization samples will be tested for analyses determined by the disposal facility. The anticipated analyses are listed below.

- California Title 22 total metals (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, silver, selenium, thallium, vanadium, and zinc) by U.S. Environmental Protection Agency (USEPA) Methods 6010B/7471A;
- Selected soluble metals (as determined by the total metals results) by EPA Methods 6010B/7471A with California Waste Extraction Test (WET) preparation;
- Volatile organic compounds (VOCs) by EPA Method 8260B;
- Semi-volatile organic compounds (SVOCs) by U.S. EPA Method 8270C;
- PCBs by U.S. EPA Method SW8082; and
- Gasoline range organics (GRO), diesel range organics (DRO), and motor oil range organics (RRO) by EPA Method 8015M.

3.2 Confirmation Sampling and Analysis

Sampling will be conducted following excavation to confirm that impacted soil has been removed to the clean-up goals listed in Table 3-1. Confirmation soil samples will be taken at four sides of each excavation and bottom, if groundwater is not encountered, using a drive sampler with clean stainless steel sleeves. Upon removal of the sleeve from the drive sampler, teflon tape will be placed on each end and then plastic caps placed over each end.

The soil samples will be analyzed for only the constituents that were above risk based levels. If any of the analytical results are above cleanup goals, then step out soil samples will be collected from the appropriate side sample(s). Once the impacted area is delineated, a second and final round of excavation will be conducted to the depth of the original excavation and extended to location of step out soil samples. Soil samples will be submitted on a 5 day turnaround time. Samples will be

submitted to EMAX laboratories, located in Torrance, California, a Environmental Laboratory Accreditation Program (ELAP)-Certified Lab (#2672).

Table 3-1. Cleanup Goals for Confirmation Sampling

Site	Analyte	Analysis	Cleanup Goal (mg/kg)	Basis of Cleanup Goal
Bldg. 51	Arsenic	USEPA Method 6010	11.8	Ambient Concentration Limit (Brown and Caldwell, 2006)
Bldg. 161 UST	PCB-1254 (Arochlor 1254)	USEPA Method 8082	0.74	USEPA Industrial PRG
	Diesel Range Organics	USEPA Method 8015	150	Water Board ESL
	Dibenz(a,h)Anthracene	USEPA Method 8310	0.21	USEPA Industrial PRG

4.0 QUALITY ASSURANCE / QUALITY CONTROL

The removal action will be conducted according to the specifications and procedures in the *Quality Assurance Project Plan for the Benicia Arsenal* (QAPP; FA/BC, 2001). Field quality control (QC) activities include collection and analysis of QC samples, implementation of the three-phase QC program described below, and validation and verification of analytical data. In accordance with the QAPP, field QC activities, including variances from this Work Plan, will be documented in field logbooks. These activities are described in the QAPP and are summarized below.

4.1 Standard Operating Procedures

The Standard Operating Procedures (SOPs) to be implemented during this removal action are listed in Table 4-1. These SOPs are located in Appendix F of the QAPP. Requirements for sample containers, preservation methods, and analytical holding times are also included in the QAPP.

Table 4-1. Applicable SOPs for the Removal Action

SOP	Specific Aspects of SOP to be Implemented for this Action
1.0 Field Logbook	All
4.0 Sample Management	All
5.0 Field Measurement of Organic Vapors	1. A PID Model 580B OVM or equivalent will be used instead of a flame ionization detector (FID). 2. Direct reading colorimetric indicator tubes TCE (VOC related sites) will be used as prescribed in the SSHP 3. Field Calibration
6.0 Utility Clearance	All except, no lock-out/tag-out procedures
7.0 Collection of Soil Samples	Subsurface and depth-discrete soil samples will be collected using scoop/trowels, thin-walled tubes, and ring-lined samplers, as appropriate.
9.0 Packing and Shipping of Environmental Samples	All
10.0 Sample Preservation and Analysis Methods	Subcontracting laboratories will provide appropriate sample containers.
11.0 Sampling Equipment Decontamination	All
26.0 Photographic/Video Documentation	All
29.0 Trenching	A subcontractor will provide the excavator or backhoe.

4.2 Quality Control Samples

Three types of QC samples will be used to quantitatively assess the quality of data generated during the field investigation. These samples include matrix spike/matrix spike duplicate (MS/MSD) samples, field duplicates, and equipment rinsate blanks. Due to the project scope, QA split samples will not be required. The QA/QC sampling protocol is also described in the QAPP. QA/QC samples (sample duplicates, and MS/MSD) will be collected at the frequencies required in the QAPP (FA/BC, 2001).

The contract analytical laboratory procedures and services will be in accordance with the QAPP.

4.3 Three-Phase Quality Control Program

A three-phase QC program will include preparatory phase, initial phase and follow-up phase activities.

4.3.1 Preparatory Phase – Laboratory

At least one week prior to beginning fieldwork, the project team will conduct a laboratory kick-off meeting to review items outlined in the QAPP and Work Plan with the Brown and Caldwell Project Manager, the Project Chemist and the contract laboratory. The USACE Project Chemist will be invited to this meeting. The results of this meeting will be documented in minutes signed by all participants and distributed to the project team.

4.3.2 Preparatory Phase – Field

The Project Manager, Field Team Leader and Project Chemist will conduct a readiness review meeting approximately one week prior to beginning fieldwork with USACE. The purpose of this meeting will be to review and document preparation for the field investigation. All items discussed in the readiness review meeting must be completed prior to the start of fieldwork. The Field Team Leader will complete a checklist during the readiness review meeting to ensure that adequate documentation and equipment is available. This checklist may be modified, as necessary, during preparation activities.

4.3.3 Initial Phase – Laboratory

As a part of the previous field activities, USACE conducted an audit of EMAX Laboratories in May 1999 under the direction of the Project Chemist and again in June 1999 in conjunction with Jacobs Engineering. The audit results and laboratory responses to the audit findings are maintained in the project files. All issues identified during this audit have been resolved. Because the analyses planned for this Work Plan were covered in the two previous audits, no additional audits are proposed for this phase of work. EMAX Laboratories underwent USACE Missouri River Division re-validation in May 2000 and is certified by the State of California for the required analyses.

If Level III data review or Level IV data validation indicates potential fraud, significant systematic errors, or laboratory contract compliance below 80 percent, corrective action (potentially including auditing the laboratory) could be initiated. The BC Project Chemist will work in conjunction with the Program Chemist, USACE, and the Project Manager to determine the appropriate corrective action.

4.3.4 Initial Phase-Field

To ensure compliance with the QAPP and this Work Plan, field QC activities will be evaluated during the first week of the field effort through the initial phase inspection conducted by the BC Project Manager, project chemist and USACE project chemist, at a minumum. The initial phase

inspection will be documented in a meeting. Meeting minutes will be signed by all participants and attached to the daily QC report. QC activities to be evaluated during the initial phase inspection include those described in the QAPP.

4.3.5 Follow-up Phase

QC will be performed as needed throughout the Removal Action to resolve deficiencies identified during the preparatory and initial inspections or other issues noted during field activities by the BC Project Manager, Field Team Leader, or Project Chemists. Follow-up QC activities will be performed to assure continuing compliance with contract, QAPP, and Work Plan requirements until completion of all field and laboratory work. Final follow-up checks will be conducted and all deficiencies corrected prior to the start of additional fieldwork.

The BC Project Manager will participate in the QC program as described in this Work Plan and the QAPP. Additional QC phases and/or review of subcontractors may be added during the execution of work as deemed necessary by project staff and the BC Project Manager.

4.3.6 Data Validation

All laboratory data will be verified according to guidelines presented in the QAPP. Data generated for 100 percent of the field samples analyzed using definitive methods will be verified. Ten percent of the data will be provided in the United States Environmental Protection Agency (EPA) Level IV-equivalent data packages as described in the QAPP. The remaining 90 percent of the data will be verified to EPA Level III requirements. Ten percent of the data will be independently validated using procedures consistent with those specified in *Contract Laboratory Program National Functional Guidelines for Organic/Inorganic Data Review* (USEPA, CLP Organic/Inorganic, 1994a) the appropriate EPA reference methods, and the QAPP.

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5.0 SCHEDULE AND REPORTING

This section summarizes the anticipated schedule for the soil removal action and the Results Report to be prepared after the action is complete.

5.1 Schedule

The removal action is relatively small and can be completed in approximately five weeks. The major activities in the schedule consist of mobilization/initial excavation, characterization/disposal coordination, and final excavation/site restoration.

- Mobilization / Initial Excavation: this phase of the schedule will require approximately two weeks to complete. Activities in the first week consist of contractor submittals, mobilization of equipment/soil bins, and marking excavation areas. Activities in the second week consist of excavation according to the excavation plan, staging soil in bins, and collecting soil samples for characterization and confirmation sampling.
- Characterization / Disposal Coordination: this phase has the most uncertainty and will require at least two weeks to complete. Laboratory analysis of soil samples for characterization and confirmation sampling will be expedited on a 5-day turn around time. The confirmation sampling results will be verified according to the QAPP and compared to clean up goals. If any of the original sample location results exceed clean-up goals, step out samples will be taken immediately and samples expedited. The results of sampling the soil bins will be sent to the disposal facility to characterize the soil for transportation and disposal. Additional analyses (e.g., soluble metals) of the soil samples may be required by the disposal facility.
- Final Excavation / Site Restoration: this phase will require approximately one week to complete and can begin after confirmation sampling results are interpreted. Excavation will be conducted in any area where step out samples were required. Additional soil staging in bins for characterization may be required. After the final round of excavation is complete, the excavation will be backfilled and the contractor will de-mobilize.

5.2 Reporting

After the removal action has been completed, a Results Report will be prepared that documents activities were completed in accordance with this Work Plan. The report will include the information described below.

- Explanation of any variances to this Work Plan
- Field notes, observations, and photographic documentation of field activity
- Analytical results of characterization sampling and confirmation sampling
- Transportation manifests and landfill weight tickets and receipts

The report will be certified by a Professional Geologist or Civil Engineer licensed in the State of California.

6.0 REFERENCES

Brown and Caldwell. 2005a. Expanded Site Investigation Report for the Benicia Arsenal. Prepared for the U.S. Army Corps of Engineers, Sacramento, California. September.

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APPENDIX A

Accident Prevention Plan

ACCIDENT PREVENTION PLAN

ENVIRONMENTAL INVESTIGATION
AT THE FORMERLY USED DEFENSE SITE (FUDS)
BENICIA ARMY ARSENAL, BENICIA, CALIFORNIA

FUDS NUMBER: J09CA075600

FINAL

Prepared for:

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
1325 J Street
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Prepared by:

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SEPTEMBER 2009

Contract Number: GS-10F-0101L

ACCIDENT PREVENTION PLAN
FORMER BENICIA ARMY ARSENAL, CALIFORNIA

Signatures of principal personnel responsible for development and execution of this Accident Prevention Plan.

Prepared by:

Wendy Linck, P.G. #6934
Project Manager, Brown and Caldwell

Concurrence by:

Jim Bucha, CIH, CSP
Director of Health and Safety, Brown and Caldwell

Effective Dates: April 2009 to April 2010

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LIST OF ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
CCR	California Code of Regulation
CIH	Certified Industrial Hygienist
FUDS	Formerly Used Defense Site
EMR	experience modification rate
HSD	Health and Safety Director
HSP	Health and Safety Plan
H&S	Health and Safety
MSDS	Material Safety Data Sheet
PCB	polychlorinated biphenyls
PM	Project Manager
PPE	personal protective equipment
Site	Benicia Army Arsenal
SHM	Site Safety and Health Manager
SI	Site Inspection
SSHP	Site Safety and Health Plan
SSHO	Site Safety and HealthOfficer
SVOC	semi-volatile organic compound
TCE	trichloroethylene
TPH-D	total petroleum hydrocarbons in the diesel range
TPH-G	total petroleum hydrocarbons in the gasoline range
TPH-MO	total petroleum hydrocarbons in the motor oil range
TRIR	total recordable incident rate
U.S.	United States
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound

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1. INTRODUCTION AND BACKGROUND

This Accident Prevention Plan (APP) has been completed for the former Benicia Army Arsenal (Arsenal) under General Services Administration (GSA) Contract No. GS-10F-0101L with the United States Army Corps of Engineers (USACE), Sacramento District, and Brown and Caldwell in accordance with requirements of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the Resource Conservation Recovery Act (RCRA), as appropriate. This APP has been prepared to comply with USACE EM 385-1-1, *Safety and Health Requirements*, Title 8 California Code of Regulations (CCR) Sections 3203 and 1509, *Workplace Injury Illness and Prevention Plan*, and Brown and Caldwell's corporate Health and Safety Program (HSP) Manual with Injury Illness and Prevention.

Brown and Caldwell's three year loss history is provided in the table below. Included are the total recordable incident rate (TRIR) and experience modification rate (EMR; for California) for the years 2006 2007, and 2008.

	2006	2007	2008
TRIR	0.86	0.37	0.67
EMR	0.73	0.70	0.82

This Soil Removal Action will take place at the Arsenal (Site; Figure 1) and will consist of soil excavation at two locations: Building 51 and Building 161 UST (Figure 2). Arsenic is the target analyte at the Building 51 location and approximately 17 cubic yards will be excavated. PCB-1254 (Arochlor 1254) and Diesel Range Organics are the target analytes at one portion of the Building 161 UST location where approximately 25 cubic yards will be excavated. Dibenzo(a,h)Anthracene and Diesel Range Organics are the target analytes at the second location at Building 161 UST and approximately 63 cubic yards will be excavated.

The objectives of the soil removal action are to:

- Remove soil that contains COPCs exceeding risk-based concentrations;
- Confirm that impacted soil is removed through confirmation sampling and analysis;
- Restore the Site to the condition prior to the removal action;
- Conduct the removal action in a healthy and safe manner;
- Meet local, state, and federal requirements for soil staging, transportation, and disposal; and
- Minimize disruption to tenant and landowner activity.

The deepest excavation is approximately 5.5 ft bgs. The soil excavation plan consists of the following elements: construction techniques and equipment, sloping and shoring, contingency plan, dust control, and storm water, and erosion control. Groundwater is not expected to be encountered and dewatering will not be required.

Conventional excavation and loading techniques are appropriate for this removal action. The anticipated construction equipment consists of a backhoe, front loader, roll-off truck/trailer, roll-off bins, water truck (for dust control), and conventional hand tools. Excavation will be conducted with a backhoe and spotter. The backhoe will either load excavation spoils directly to the bins or stage spoils in stockpiles on plastic for the front loader to eventually load spoils in to bins.

An activity-specific activity hazard analysis is included in this APP (as discussed in Section 4) for soil excavation.

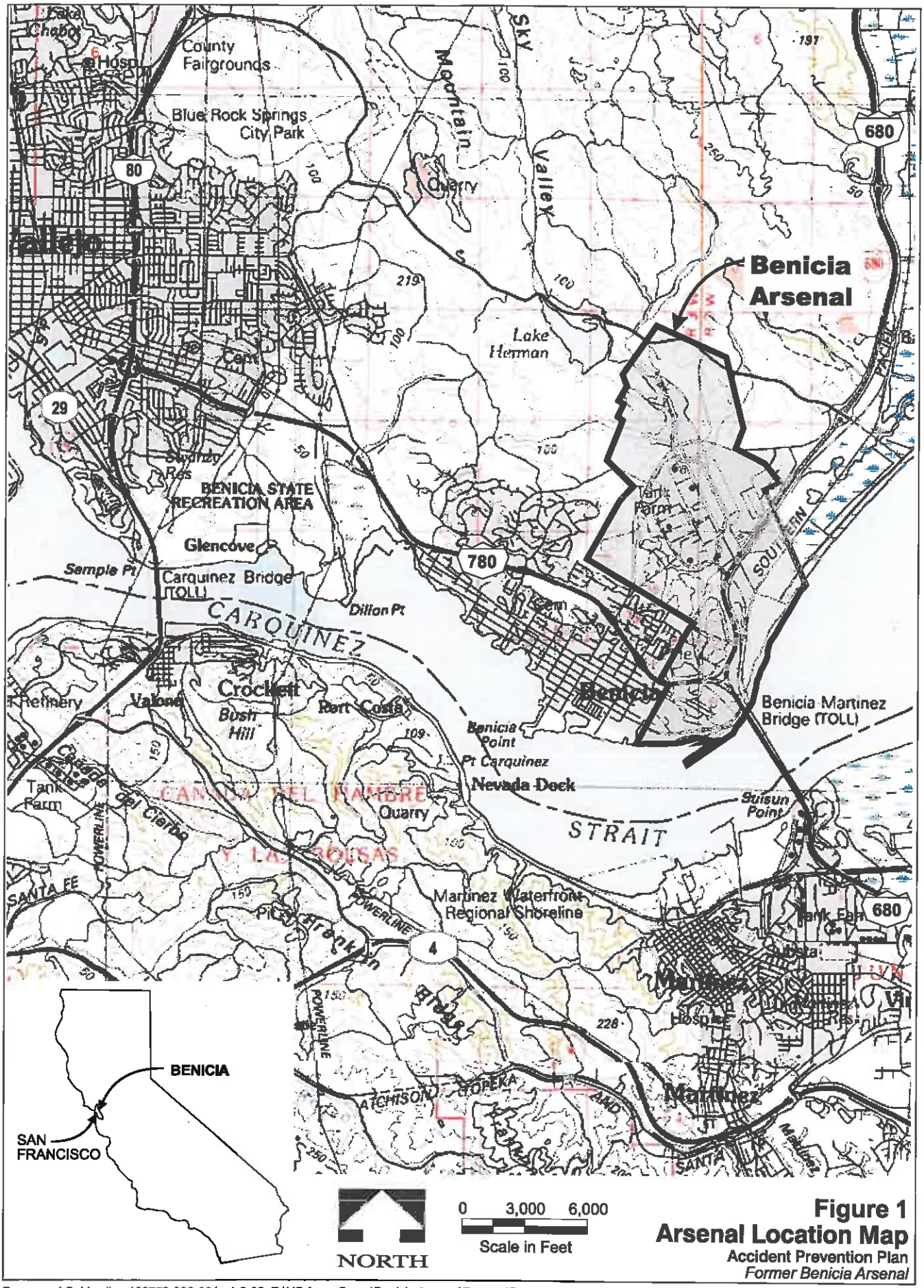

Figure 1
Arsenal Location Map
Accident Prevention Plan
Former Benicia Arsenal

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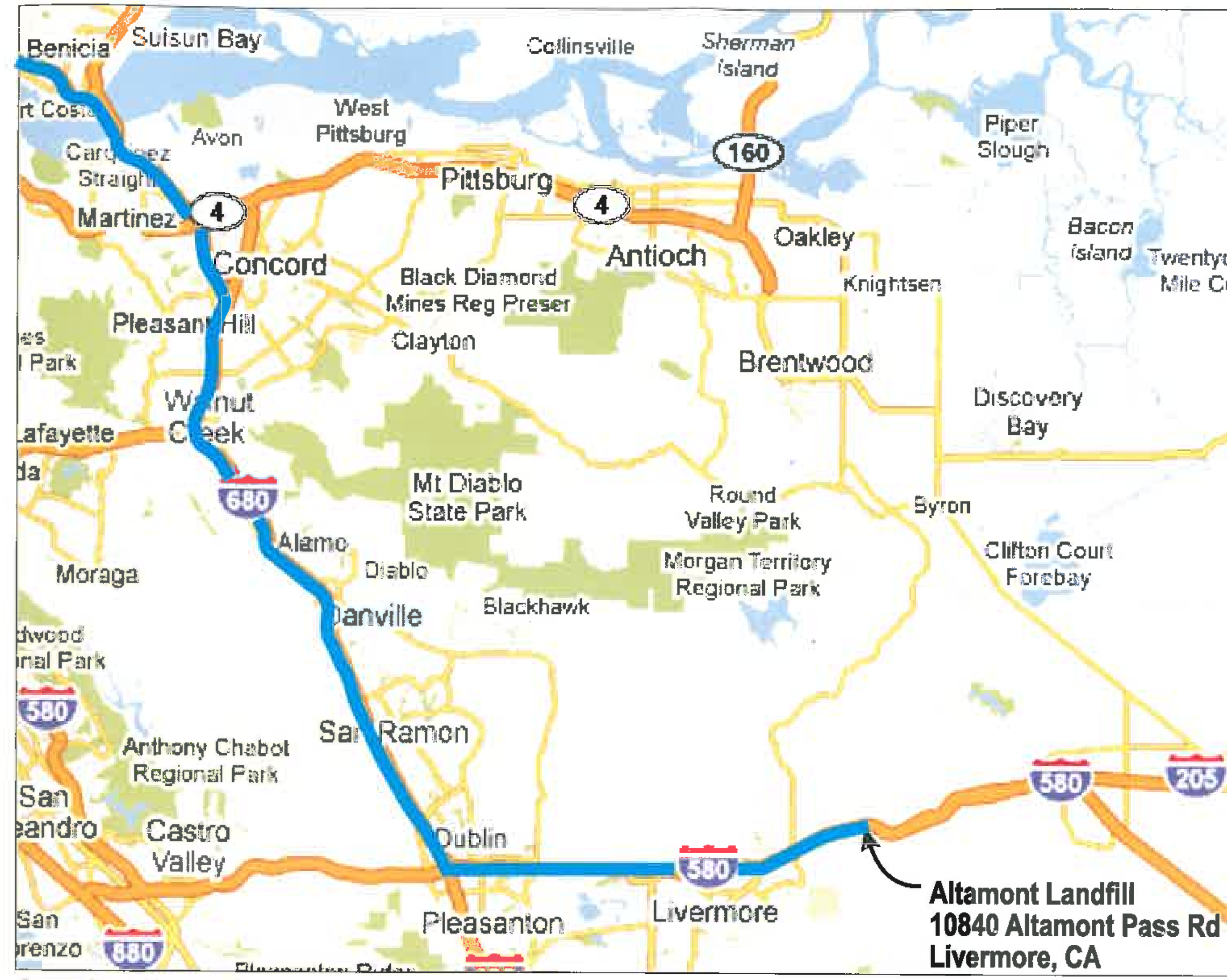
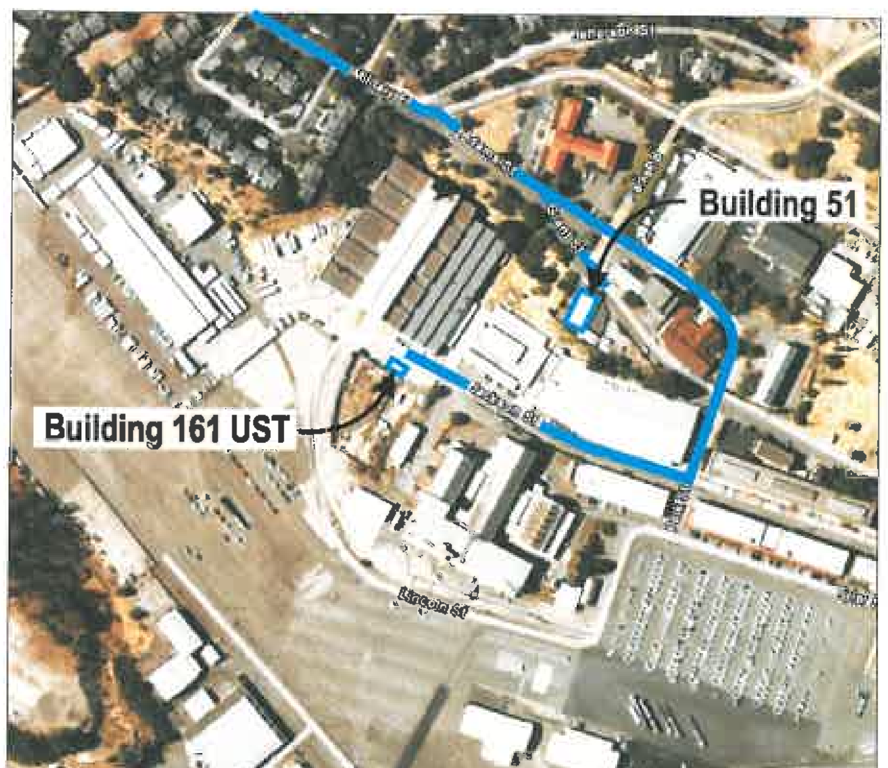
To Livermore

Source: GoogleEarth, 2009, scale 1"=1000'



Source: GoogleMaps, 2009'



Source: GoogleEarth, 2009, scale 1"=400'

NORTH

Figure 2
Site Location Map and Haul Road to Landfill
Accident Prevention Plan
Former Benicia Arsenal

2. BROWN AND CALDWELL CORPORATE STATEMENTS OF SAFETY AND HEALTH POLICY

Brown and Caldwell have long been committed to the health and safety of every employee by providing a safe work environment. As evidence of this commitment, our HSP and Site Safety and Health Plan (SSHP; Appendix A) s meet or exceed federal or state Occupational Safety and Health requirements.

The goal of an effective HSP is simple: prevent accidents, injuries and illness. Brown and Caldwell supports this goal by providing the resources necessary for an effective HSP. It is absolutely essential that every employee 1) comply with the policies and procedures described in the program manual, 2) follow specific operations procedures as required, and 3) most importantly, use common sense and safety precaution when conducting business operations.

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3. KEY PERSONNEL AND RESPONSIBILITIES

Ms. Wendy Linck of Brown and Caldwell is the Project Manager (PM). Mr. Jim Bucha, Certified Industrial Hygienist (CIH), of Brown and Caldwell is the Health and Safety Director (HSD). Greg Menna will function as the project geologist/scientist and will also function as the Site Safety and Health Officer (SSHO). The project field staff have completed 40 hours of comprehensive health and safety training, which meets the requirements of Title 29, Code of Federal Regulations Part 1910.210 (8 CCR 5192). The SSHO has the authority to monitor and correct health and safety problems as noted on site.

The PM is responsible for generating, organizing, and compiling the APP, which describes planned Brown and Caldwell field activities and identified hazards that may be encountered at the site. The PM is also responsible for ensuring that adequate training and safety briefing(s) for the project are provided to the Brown and Caldwell project team. The PM will provide a copy of the APP to each member of the Brown and Caldwell project field team and one copy to each subcontractor before the start of field activities.

The HSD is responsible for developing and coordinating the HSP. For specific projects, the HSD is responsible for reviewing and approving the APP for accuracy and incorporating new information or guidelines that aid the PMs and SSHOs in further definition and control of the potential health and safety hazards associated with the project.

The SSHO has on-site responsibility for ensuring that Brown and Caldwell team members, including subcontractors, comply with the APP. It is the SSHO's responsibility to inform the subcontractors and other field personnel of chemical and physical hazards, as he/she becomes aware of them. Deviations from the plan must be based on field conditions encountered and well documented in the field notes. The SSHOs have the authority to monitor and correct Brown and Caldwell health and safety issues as noticed on site. Additional SSHO responsibilities include:

1. Following the APP.
2. Reporting to the PM any unsafe conditions or practices.
3. Reporting to the PM all facts pertaining to incidents that result in injury or exposure to toxic materials.
4. Reporting to the PM equipment malfunctions or deficiencies.
5. Providing site safety briefing for team members.
6. Updating equipment or procedures to be used on site on the basis of new information gathered during the site investigation.
7. Inspecting Brown and Caldwell personal protective equipment (PPE) before on-site use.

8. Assisting the PM in documenting compliance with the APP by completing the standard Brown and Caldwell forms.
9. Assisting in and evaluating the effectiveness of decontamination procedures for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles.
10. Enforcing the "buddy system" as appropriate for site activities.
11. Posting location and route to the nearest medical facility; arranging for emergency transportation to the nearest medical facility.
12. Posting the telephone numbers of local public emergency services; i.e., police and fire departments.
13. Stopping operations that threaten the health and safety of the field team or surrounding populace.
14. Observing field team members for signs of exposure, stress, or other conditions related to pre-existing physical conditions or site work activities.

3.1 Project Contacts

The following is a reference list of project contacts.

USACE		
Project Manager	**Health & Safety**	**Technical Team Leader**
Kathy Greene (916) 557-6671	Not yet determined	Fred Hart (916) 557-6975

Brown and Caldwell			
Program Manager	**Project Manager**	**Health & Safety Director**	**Site Safety Officer**
Dave Zuber, P.G. (916) 853-5318	Wendy Linck, P.G. (916) 853-5325 (916) 838-2504 (cell)	Jim Bucha, CIH, CSP (916) 853-5308 (direct) (916) 216-6374 (cell)	Greg Menna – Brown and Caldwell (530) 204-5215 (direct) (916) 206-2580 (cell)

3.2 Emergency Telephone Numbers

Emergency telephone numbers are as follows:

Name or Business/Telephone Number

Fire, Police and Ambulance (707) 745-3411 or 3412

Project Personnel see table above.

4. SUBCONTRACTORS AND RESPONSIBILITIES

An activity hazard analysis (AHA) has been prepared by the contractor for soil excavation activities. This AHA is attached to the final SSHP (Appendix A in Attachment F).

This APP (and related documents) has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of Brown and Caldwell's own employees at the site. A copy of this document may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, this APP may not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on this APP to identify all hazards that may be present at the Site.

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by Brown and Caldwell at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide a copy of their own health and safety program documents for review.

Subcontractor personnel are expected to comply fully with subcontractor's health and safety programs and procedures and to observe the minimum safety guidelines applicable to their activities which may be identified in the APP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

4.1 Subcontractor Contacts

The following is a reference list of subcontractor contacts.

Subcontractors	
Excavation and Waste Transporter Contractor	**Laboratory**
Northstate Earth & Water Mike Fitzgerald (530) 351-3604	EMAX Richard Beauvil (310) 618-8889 x118

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5. TRAINING REQUIREMENTS

All Brown and Caldwell staff working on site will have completed training in hazard recognition and basic health and safety issues as required by the occupational safety and health regulations contained in 8 CCR 5192(e). In addition, each employee will be familiar with the requirements of this APP, will participate in site activity and safety briefings, and will be briefed on this APP on the first day of the project. The SSHO will have completed the 8-hour Site Supervisor course, have current training in first aid and CPR, and any additional training appropriate to the level of site hazards.

As part of annual HAZWOPER training, employees receive training in hazard recognition and control for a variety of issues, including, but not limited to, the following:

- Personal protective equipment;
- Respirator use and limitations;
- Confined space awareness;
- Excavation safety;
- Control of hazardous energy (lockout/tagout)
- Working around heavy equipment;
- Hazard communication; and
- Injury and illness prevention.

The safety briefing will be held every day prior to start of work. A **Site Activity and Safety Briefing** form, Attachment B in Appendix A, will be included with all other daily sheets (i.e., field notes, boring logs) submitted by the contractor at the end of the day.

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6. SAFETY AND HEALTH INSPECTIONS

Brown and Caldwell are committed to providing a safe working environment to all their employees through policies set forth in their respective SSHPs. Health and safety (H&S) auditing is a key component in determining HSP effectiveness and in the improvement process of the HSP. Audit findings, recommendations and corrective actions will be used to gauge how well field staff incorporates health and safety procedures into their job tasks. The scope of these audits is dependent upon the operations being performed. Field audits will be conducted based on risk, level of site activity, employee concerns and client or regulatory requirements. Administrative audits include review of project files for timely and accurate submission of forms as required by the APP. Training documentation and other records will also be reviewed to ensure field personnel have required training as specified in the APP, regulations and the Brown and Caldwell SSHP. The Health and Safety Director is responsible for administering and overseeing the overall H&S audit program. The Brown and Caldwell PMs are responsible to ensure that corrective actions have been implemented. Brown and Caldwell's Corporate Safety Manager, or his designee, will perform safety auditing of this project.

Audits will also be conducted periodically by the SSHOs to evaluate compliance with the APP, regulatory, or client requirements. In addition to audits, the H&S Staff may perform industrial hygiene monitoring to validate that site safety and health practices and procedures are adequate to protect employee health and safety.

Per Section 01.A.12.e of EM 385-1-1 (USACE, 2008), Brown and Caldwell will immediately notify the Government Designated Authority (GDA) of any OSHA or other regulatory agency inspection and provide GDA an opportunity to accompany the Contractor on the inspection. (The inspection will not be delayed due to non-availability of the GDA.) The Contractor shall provide the GDA with a copy of any citations or reports issued by the inspector and any corrective action responses to the citation(s) or report(s).

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7. SAFETY AND HEALTH EXPECTATIONS, INCENTIVE PROGRAMS AND COMPLIANCE

Brown and Caldwell's commitment to health and safety is provided in detail in the HSP. The HSP includes program goals, objectives, and accident experience goals for the company. This also applies to this project.

Site personnel, including subcontractors and visitors are expected to comply fully with their health and safety programs and procedures and to observe the minimum safety guidelines applicable to their activities which may be identified in this APP. Failure to do so may result in the removal of the personnel from the job site.

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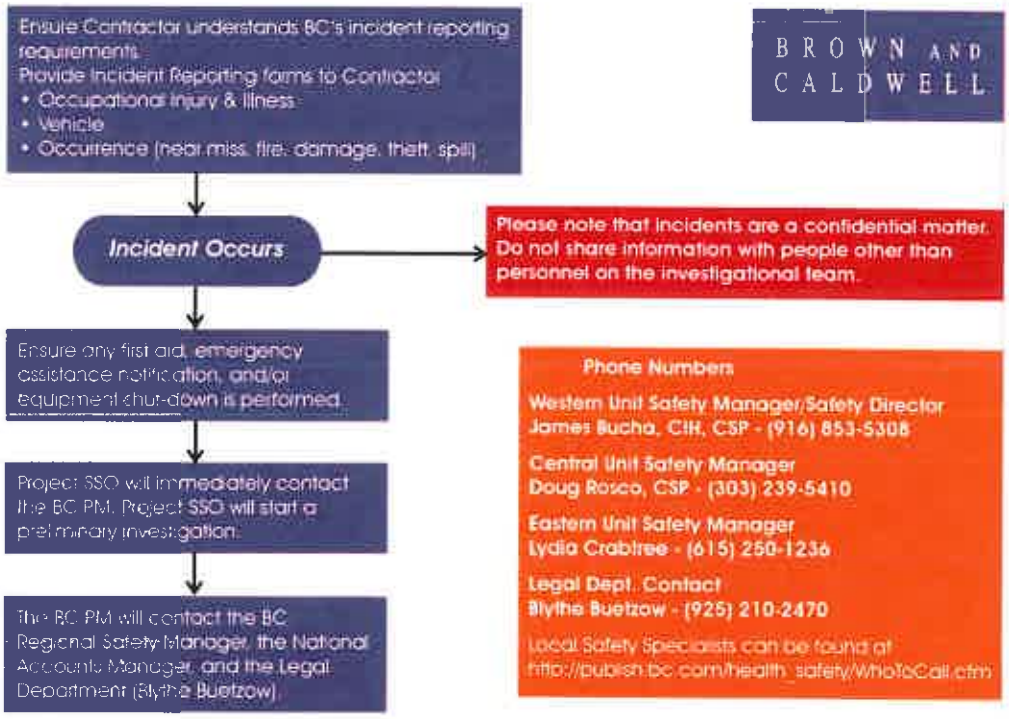
8. ACCIDENT REPORTING

All H&S incidents shall be reported to Brown and Caldwell management, USACE and H&S staff as described in the HSP (Section 102). Additional reporting requirements are provide Section 14 of the SSHP. The prompt investigation and reporting of incidents will reduce the risk of future incidents, better protect Brown and Caldwell employees, and reduce liability. The protocol for reporting a field incident is summarized below in the following graphic.

BC Field Incident Reporting Process



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9. MEDICAL SUPPORT

The nearest medical assistance center near Arsenal is **Kaiser Permanente Hospital** in Vallejo, California or **Contra-Costa Regional Medical Center. Kaiser Permanente Hospital** is located approximately 10 miles from Arsenal. **Contra Costa Regional Medical Center** is located approximately 6 miles from the Arsenal but over the Benicia-Martinez Bridge.

Directions from Arsenal are shown on the route to hospital map included in this document as Figure 3.

Total travel time from the project area to **Kaiser Permanente Hospital** is approximately 20 minutes, and the total distance is approximately 10 miles.

Total travel time from the project area to **Contra-Costa Regional Medical Center** is approximately 15 minutes, and the total distance is approximately 6 miles.

In the event of a medical emergency cell phones must dial **(707) 745-3411**, the number for the Benicia Police Department. Brown and Caldwell will post the number in the work zone area.

Figure 3
Route to Hospital
Accident Prevention Plan
Benicia Arsenal

10. PERSONAL PROTECTIVE EQUIPMENT

The purpose of PPE is to protect employees from hazards and potential hazards they are likely to encounter during site activities. The amount and type of PPE used will be based on the nature of the hazard encountered of anticipated. Respiratory protection will be utilized when an airborne hazard has been identified using real-time air monitoring devices, or as a precautionary measure in areas designated by the Safety and Health Manager (SHM) or SSHO.

Dermal protection, primarily in the form of chemical-resistant gloves and coveralls, will be worn whenever contact with chemically affected materials (e.g., soil, groundwater, sludge) is anticipated, without regard to the level of respiratory protection required.

On the basis of the hazards identified for this project, the following levels of personal protective equipment (PPE) will be required and used. Changes to the specified levels of PPE will not be made without the approval of the SSHO after consultation with the SHM.

10.1 Conditions Requiring Level D Protection

In general, site activities will commence in Level D PPE unless otherwise specified, or if the SSHO determines on site that a higher level of PPE is required. Air monitoring of employee breathing zones will be routinely conducted using real-time air monitoring devices to determine if upgrading to Level C PPE is necessary. Level D PPE will be permitted as long as air monitoring data indicate that airborne concentrations of chemicals of concern are maintained below the site-specific action levels defined in Section 7.2 of the Site Safety and Health Plan. Level A or B PPE is not anticipated and is therefore not addressed in this plan. If Level A or B PPE is necessary, this SSHP will be revised to reflect changes as appropriate.

It is important to note that dermal protection is required whenever contact with chemically-affected materials is anticipated. The following equipment is specified as the minimum PPE required to conduct activities at the Site:

- Work shirt and long pants,
- ANSI- or ASTM-approved steel-toed boots or safety shoes,
- ANSI-approved safety glasses, and
- ANSI-approved hard hat.
- High-visibility traffic safety vest (in traffic/construction areas).
- Hearing protection (in noisy areas).

Other personal protection readily available for use, if necessary, includes the following items.

- Outer nitrile gloves (11 mil or thicker) and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event).
- Chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated.
- Safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated.
- Sturdy work gloves.

Work will cease and PPE upgraded if action levels specified in Section 7.2 in the Site Safety and Health Plan are exceeded. The SHM will be notified whenever PPE is upgraded or downgraded.

10.2 Conditions Requiring Level C Protection

If air monitoring indicates that the site-specific action levels defined in Section 7.2 in the SSHP are exceeded, workers in the affected area(s) will upgrade PPE to Level C. In addition to the protective equipment specified for Level D, Level C also includes the following items.

- NIOSH-approved half- or full-face air-purifying respirator (APR) equipped with appropriate cartridges (reference Section 7.2 in the Site Safety and Health Plan). Note: safety glasses are not required when wearing a full-face APR.
- Outer nitrile gloves (11 mil or thicker) and inner nitrile surgical gloves when direct contact with chemically affected soils or groundwater is anticipated (nitrile surgical gloves may be used for collecting or classifying samples as long as they are removed and disposed of immediately after each sampling event).
- Chemical-resistant clothing (e.g., Tyvek or polycoated Tyvek coveralls) when contact with chemically affected soils or groundwater is anticipated.
- Safety shoes/boots with protective overboots or knee-high PVC polyblend boots when direct contact with chemically affected soils is anticipated.
- Hearing protection.
- Sturdy work gloves.

Respirators will be stored in clean containers (i.e., self-sealing bag) when not in use. Respirator cartridges will be replaced in accordance with the following change-out schedule.

Type of Cartridge	Cartridge Change-out Schedule
Particulate (i.e., HEPA)	At least weekly or sooner the employee detects an increase in breathing resistance. This will occur as the filter becomes loaded with particulate matter.
Sorbent (i.e., organic vapor)	At the end of each day's use or sooner if the employee detects an abnormal odor or other indicator.

Personnel who wear air-purifying respirators must be trained in their use and must have successfully passed either a qualitative or quantitative respirator fit test, and medical evaluation within the last 12 months in accordance with and 29 CFR 1910.134.

10.3 Stop Work Conditions

If air monitoring indicates that the site-specific action levels defined in Section 7.2 in the SSHP are exceeded, activities will cease, and personnel must evacuate the designated Exclusion Zone. The PM and SHM will be contacted immediately.

Work will also cease if unanticipated conditions or materials are encountered or if an imminent danger is identified. The SSHO will immediately contact the SHM for consultation.

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11. PLANS (PROGRAMS, PROCEDURES) REQUIRED BY THE SAFETY MANUAL

The plans applicable for this project are provided below. If not applicable, then "Not Applicable" has been indicated next to the heading.

a. Layout Plans – The site layout is provided in Figure 2. Otherwise, no specific layout plans are applicable for this project.

b. Emergency Response Plans –

1. Procedures and tests – Procedures to follow in the event of an emergency are provided in the Section 3.2 Emergency Telephone Numbers and Section 9.0 Medical Support. Since this project will be conducted outdoors and not within a building or structure where an escape plan is planned and tested, the route of escape for this project would be away from the emergency (e.g fire).

2. Spill Plans - If a hazardous material spill occurs, site personnel should locate the source of the spill and determine the hazard to the health and safety of site workers and the public. Attempt to stop or reduce the flow if it can be done without risk to personnel. Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained, or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

    - Right or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.
    - Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
    - Sorbent pads, soil, or booms, if used, shall be placed in appropriate containers after use, pending disposal.
    - Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.

3. Firefighting Plan – General fire safety is provided in the SSHP and attached as Appendix A to this APP. Otherwise, no specific firefighting plan is deemed necessary for this project.

4. Posting of emergency telephone numbers – As stated in Section 10 of this APP, the emergency telephone numbers to the nearest hospital and **(707) 745-3411 or 3412** will be posted in the work zone.

5. Wild land fire prevention plan – The project will be conducted in a tilled field or on asphalt/concrete pavement and not within wild lands. Therefore, a wild land fire prevention plan is not applicable for this project.
6. Man overboard/abandon ship – Not Applicable

c. Hazard Communication – Brown and Caldwell's Hazard Communication Program is contained in Section 101 of the HSP. Material Safety Data Sheets (MSDSs) for chemical products brought on site will be attached to the SSHP as Attachment F and will be available for reference at all times. Site personnel will be informed of the location of MSDSs.

The work area around the excavator, including accessory equipment and materials will be designated as the Exclusion Zone. The Exclusion Zone for excavation activities will be set at 15 feet, taken into account the reach of the excavator. Only workers with the proper PPE will be allowed access to the Exclusion Zone. Equipment necessary for site control measures is listed on Table A-3 in the SSHP attached as Appendix A.

1. Site Communication - Communication between field team members will consist of verbal and telephone (standard or cellular) communication.

d. Respiratory Protection Plan – The use of respirators and exposure limits to possible chemicals on this project is provided in the SSHP and attached to this APP as Appendix A.

e. Health Hazard Control Program – All operations, materials, and equipment has been evaluated to determine the presence of hazardous environments or hazardous or toxic agents could be released into the work environment. This analysis is provided in the SSHP and attached to this APP as Appendix A.

f. Lead Abatement Plan – Not Applicable

g. Asbestos Abatement Plan – Not Applicable

h. Abrasive Blasting – Not Applicable

i. Confined Space – Not Applicable

j. Hazardous Energy Control Plan – Brown and Caldwell's Lockout/Tagout Program is contained in Section 207 of the HSP. Other possible hazards and recommended controls for electrical hazards, utilities, and power lines is discussed in Section 206 of the Brown and Caldwell HSP and in the SSHP attached to this APP as Appendix A.

k. Critical Lift Procedures – Not Applicable

l. Contingency Plan for Severe Weather – See Section 1.3.4 of the SSHP, attached as Appendix A.

m. Access and Haul Road Plan – Once the soil is characterized and acceptance for the waste has been secured by an off-site disposal facility, waste manifests will be prepared by the construction contractor or waste hauler. The USACE will sign the manifests as the waste generator, and then the bins will be loaded onto trucks. Prior to departure, trucks will be tarped and tires will be dry-brushed as necessary to remove visible soil. The soil will be transported approximately 50 miles to the Altamont Landfill. The initial portion of the haul route is shown on Figure 2.

n. Demolition Plan – Not Applicable

o. Emergency Rescue (tunneling) – Not Applicable

p. Underground Construction Fire Prevention and Protection Plan – Not Applicable

q. Compressed Air Plan - – Not Applicable

r. Formwork and Shoring Erection and Removal Plans – Not Applicable

s. Jacking Plan (lift) Slab Plan – Not Applicable

t. Safety and Health Plan – see Appendix A

u. Blasting Plan – Not Applicable

v. Diving Plan – Not Applicable

w. Plan for Prevention of Alcohol and Drug Abuse –Brown and Caldwell recognizes that drug and alcohol abuse can subject employees to undue hazards in the workplace as well as have adverse effects on the quality of work expected from employees, agents, and sub-contractors. Brown and Caldwell's policy establishes guidelines designed to maintain a safe workplace for employees and to provide protection from the risks and adverse effects associated with the abuse of drugs and alcohol. Adopted in compliance with the Drug-Free Workplace Act of 1988, Department of Defense Drug-Free Workplace regulations, and commercial client requirements, Brown and Caldwell's policy is the basis for the company's Drug-Free Awareness Program which is designed to communicate the dangers of drug and alcohol abuse, the company's policy toward this problem, and the availability of counseling and assistance for those who may need help. Brown and Caldwell's policy applies to all employees as well as agents and sub-contractors. Further information can be obtained from Brown and Caldwell's Human Resources Department.

x. Fall Protection Plan – See Section 9.6 of the SSHP, attached as Appendix A.

y. Steel Erection Plan – Not Applicable

z. Night Operations Lighting Plan – The work cycle for this project will be conducted during daylight hours. Therefore, night operations are not anticipated and a plan has not been provided.

aa. Site Sanitation Plan – Sanitation facilities (i.e. wash room and toilets) are available at the former Arsenal along with an adequate supply of drinking water. Drinking water will be made available in the work zone.

bb. Fire Prevention Plan - General fire safety is provided in the SSHP and attached as Appendix A to this APP. Otherwise, no specific fire prevention plan is necessary for this project.

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12. CONTRACTOR INFORMATION

Contractor information is provided in the Section 4 Subcontractors and Responsibilities.

Subcontractor personnel are expected to comply fully with subcontractor's health and safety programs and procedures and to observe the minimum safety guidelines applicable to their activities which may be identified in this APP and EM 385-1-1. Where deficiencies are noted by brown and Caldwell site personnel, they will be brought to the attention of the subcontractor for remedy. Failure to correct observed hazards may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

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13. SITE SPECIFIC HAZARDS AND CONTROLS

Site specific hazards and control are provided in the SSHP (Appendix A) for each activity of the project.

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14. REFERENCES

Brown and Caldwell. 2003. Health and Safety Manual. August.

Brown and Caldwell. 1999. General Site Safety and Health Plan for the Benicia Arsenal.

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

USACE. 2008. Health and Safety Requirements Manual. EM 385-1-1. September 15.

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APPENDIX A: SITE SAFETY AND HEALTH PLAN

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TABLE OF CONTENTS

CRITICAL PROJECT INFORMATION

Primary Known Compound of Concern: Total petroleum hydrocarbons, arsenic, Arochlor 1254, and Dibenzo(a,h)Anthracene in soil. Chemical related health hazards of this project are assumed to be primarily from petroleum fuels, chlorinated solvents, oils, lubricants (specifically TPH) and may include very low concentrations of fuel constituents benzene, ethylbenzene, toluene and xylene and solvents in groundwater. Limited exposure to heavy metals (i.e., lead) may also occur in the area of the former UST

Minimum Level of Respiratory Protection: ☒ Level D ☐ Level C

PPE: Level D PPE unless otherwise specified, or if the SSHO determines on site that a higher level of PPE is required.

SEE SECTION 14 FOR SITE EMERGENCY CONTINGENCY PROCEDURES

Do not endanger your own life. Survey the situation before taking any action.

Brown and Caldwell Office Telephone	**(916) 444-0123**
Site Location Address	**10570 White Rock Road, Suite 180 Rancho Cordova, CA 95670**

EMERGENCY PHONE NUMBERS: In the event of emergency, contact the Project Manager and/or Regional Safety Unit Manager.

Emergency Services (Ambulance, Fire, Police)	**(707) 745-3411 or 3412**
Poison Control	**(800) 876-4766 or (800) 222-1222**
Hospital Name	**Kaiser Permanente Hospital or Contra-Costa Regional Medical Cntr**
Hospital Phone Number	**(707) 651-1000 (Kaiser) (925) 370-5000 (Contra-Costa Regional Medical Cntr)**
Brown and Caldwell Project Manager (PM; Wendy Linck)	**Office: (916) 853-5325 Cell: (916) 838-2504**
Brown and Caldwell Regional Safety Unit Manager (Jim Bucha, CIH,CSP)	**Office: (916) 853-5308 Cell: (916) 216-6374**
Brown and Caldwell Site Safety and Health Officer (SSHO; Greg Menna)	**Office: (530) 204-5215 Cell: (916) 206-2580**
Brown and Caldwell Corporate Risk Management	**Property Loss: Blythe Buetzow: (925) 210-2470 Injury: Angela Hernandez: (925) 210-2218**
Excavation Contractor	**TBD**
EMAX Laboratories (Richard Beauvil)	**Office: (310) 618-8889 x118**
USACE (Kathy Greene, PM)	**Office: (916) 557-6671 Cell: (916) 718-3852**
USACE (Fred Hart, Tech. Team Ldr)	**Office: (916) 557-6975**

EMERGENCY FIRST AID PROCEDURES

THE RESPONDER SHOULD HAVE APPROPRIATE TRAINING TO ADMINISTER FIRST AID OR CPR

1. Survey the situation. Do not endanger your own life. DO NOT ENTER A CONFINED SPACE TO RESCUE SOMEONE WHO HAS BEEN OVERCOME. ENSURE ALL PROTOCOLS ARE FOLLOWED INCLUDING THAT A STANDBY PERSON IS PRESENT. IF APPLICABLE, REVIEW MSDSs TO EVALUATE RESPONSE ACTIONS FOR CHEMICAL EXPOSURES.
2. Call 911 (if available) or the fire department **IMMEDIATELY**. Explain the physical injury, chemical exposure, fire, or release.
3. Decontaminate the victim if it can be done without delaying life-saving procedures or causing further injury to the victim.
4. If the victim's condition appears to be non-critical, but seems to be more severe than minor cuts, he/she should be transported to the nearest hospital by the SSHO or designated personnel: let the doctor assume the responsibility for determining the severity and extent of the injury. If the condition is obviously serious, contact emergency medical services (EMS) for transport or appropriate actions.

Notify the PM and Regional Safety Unit Manager immediately and complete the appropriate incident investigation reports as soon as possible.

STOP BLEEDING AND CPR GUIDELINES	
To Stop Bleeding	**CPR**
1. Give medical statement by indicating you are trained in 1st Aid. 2. Assure: airway, breathing and circulation. 3. Use **DIRECT PRESSURE** over the wound with clean dressing or your hand (use non-permeable gloves). Direct pressure will control most bleeding. 4. Bleeding from an artery or several injury sites may require **DIRECT PRESSURE** on a **PRESSURE POINT**. Use pressure points for 30 -60 seconds to help control severe bleeding. 5. Continue primary care and seek medical aid as needed.	1. Give medical statement by indicating you are trained in CPR. 2. Arousal: Check for consciousness. 3. Call out for help, either call 911 yourself or instruct someone else to do so. It is very important to call for emergency assistance prior to initiating CPR. 4. Open airway with chin-lift. 5. Look, listen and feel for breathing. 6. If breathing is absent, give 2 slow, full rescue breaths. 7. Look, listen and feel for breathing. 8. If breathing is absent, initiate CPR; 30 compressions for each two breaths. 9. If an automated external defibrillator (AED) is available, use it in accordance with the AED instructions.

1. INTRODUCTION

Brown and Caldwell has prepared this Site Safety and Health Plan (SSHP) for use during excavation activities to be conducted at former Benicia Army Arsenal, Benicia, California, a Formerly Used Defense Site (FUDS) (Figure 1 in the APP)("the Site"). Activities conducted under Brown and Caldwell's direction at the Site will be in compliance with applicable Occupational Safety and Health Administration (OSHA) regulations, particularly those in Title 29 of the Code of Federal Regulations, Part 1910.120 (29 CFR 1910.120), and other applicable federal, state, and local laws, regulations, and statutes.

This Site Safety and Health Plan (SSHP) provides a site-specific analysis of physical and chemicals hazards that a workers may be exposed to on this job site. It is intended to supplement the Accident Prevention Plan (APP) prepared for this Site. A copy of the APP/SSHP will be kept on site during scheduled field activities.

This SSHP addresses the identified hazards associated with planned field activities at the Site. It presents the minimum health and safety requirements for establishing and maintaining a safe working environment during the course of work. In the event of conflicting requirements, the procedures or practices that provide the highest degree of personnel protection will be implemented. If scheduled activities change or if site conditions encountered during the course of the work are found to differ substantially from those anticipated, the Regional Safety Unit Manager and Project Managers will be informed immediately upon discovery, and appropriate changes will be made to this SSHP.

Brown and Caldwell's health and safety programs and procedures, including medical monitoring, respiratory protection, injury and illness prevention, hazard communication, and personal protective equipment (PPE), are documented in each corporate Health & Safety Manual. Each manual is readily accessible to employees.

The APP/SSHP has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of Brown and Caldwell's own employees at the site. A copy of the APP/SSHP may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, the APP/SSHP does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on the APP/SSHP to identify all hazards that may be present at the Site.

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and

others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by Brown and Caldwell at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide Brown and Caldwell with a copy of their own SSHP for this project or other health and safety program documents for review.

1.1 Site Description

A soil removal action will take place at two locations: Building 51 and Building 161 UST. Arsenic is the target analyte at the Building 51 location and approximately 17 cubic yards will be excavated. PCB-1254 (Arochlor 1254) and Diesel Range Organics are the target analytes at one portion of the Building 161 UST location where approximately 25 cubic yards will be excavated. Dibenzo(a,h)Anthracene and Diesel Range Organics are the target analytes at the second location at Building 161 UST and approximately 63 cubic yards will be excavated.

1.2 Contaminant Characterization

The purpose of this removal action is remove total petroleum hydrocarbons (TPH), arsenic, PCB-1254 (Arochlor 1254), and dibenzo(a,h)anthracene that exceed risk-based levels. Other potential chemical related health hazards of this project are assumed to be primarily from very low concentrations of fuels and solvents in groundwater.

2. HAZARD ANALYSIS

An Activity Hazard Analysis (AHA) is provided for each type of activity for this project. These AHAs provide a summary of the safety, chemical, physical, biological likely to be encountered while performing the work. An activity-specific activity hazard analysis is included in this SSHP (Attachment F) for soil excavation.

Hazards that are the specialty of a subcontractor (i.e., operation of a drill rig or excavator) are not addressed in this SSHP. Subcontractors are responsible for identifying potential hazards associated with their activities and implementing proper controls. Detailed information about the chemical hazards, physical hazards, natural phenomena, and biological hazards that may be encountered during this project is provided below. This section also included a description of hazard communication and opening wells and well vaults.

2.1 Chemical Hazards

Exposure pathways of concern for chemical compounds that may be present at the Site are inhalation of airborne contaminants, direct skin contact with contaminated materials, and incidental ingestion of affected media. Wearing protective equipment and following decontamination procedures listed in Section 11 can minimize dermal contact and incidental ingestion. To minimize inhalation hazards, dust or vapor control measures will be implemented, where necessary, and action levels will be observed during scheduled activities. Site-specific action levels and air monitoring requirements are presented in Section 7.

Known or Suspected Compounds	Source (soil/water/sludge, etc.)	Known Concentration Range (ppm, mg/kg, mg/l)	
		Lowest	Highest
Arsenic	soil	Not detected	17 mg/kg
Dibenzo(a,h)Anthracene (polyaromatic hydrocarbon)	soil	Not detected	4.7 mg/kg
PCB-1254 (Arochlor 1254)	soil	Not detected	1.1 mg/kg
TPH (diesel range)	soil	Not detected	0.39 mg/kg
TPH (diesel range)	groundwater	Not detected	5,500 ug/L
Ethylbenzene	groundwater	Not detected	4 ug/L
TPH (gasoline range)	groundwater	Not detected	750 ug/L
TCE	groundwater	Not detected	2.3 ug/L
Vinyl chloride	groundwater	Not detected	0.27 ug/L

Chemical descriptions of chemicals of concern, including health effects and exposure limits, are presented in the following paragraphs. Each chemical description includes physical and odor recognition characteristics, the health effects associated with exposure, and exposure limits expressed as an 8-hour time-weighted average (TWA). Provided are federal OSHA (OSHA) permissible exposure limits (PELs; located in 29 CFR 1910.1000); California OSHA (Cal/OSHA) PELs (located in 8 CCR 5155); and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs). For sites outside California, Cal/OSHA PELs are included as an additional reference.

2.1.1 Benzene

Benzene is a clear, volatile liquid. It is colorless, highly flammable, and toxic, with a characteristic odor. It is a severe eye and moderate skin irritant. Human effects by inhalation and ingestion include euphoria, changes in sleep and motor activity, nausea and vomiting, other blood effects, dermatitis, and fever. In industry, inhalation is the primary route of chronic benzene poisoning. If the liquid is aspirated into the lung it may cause pulmonary edema. Poisoning by skin contact has also been reported. Exposure to high concentrations (3,000 ppm) may result in acute poisoning, which is characterized by the narcotic action of benzene on the central nervous system. Chronic poisoning occurs most commonly through inhalation and dermal absorption. Benzene is a known human carcinogen that can cause leukemia.

- The OSHA PEL is listed as 1 ppm.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 0.5 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects or other reproductive harm.

2.1.2 Petroleum Hydrocarbons

Petroleum distillates (naphtha) are mildly toxic by inhalation. They can cause unconsciousness, dyspnea, and a bluish tint to the skin. Recovery follows after removal from exposure. In mild form, intoxication resembles drunkenness. On a chronic basis, no true poisoning occurs; however, effects may include headache, lack of appetite, dizziness, sleeplessness, indigestion, and nausea. It is combustible when exposed to heat or flame and can react with oxidizing materials.

- The OSHA PEL is listed as 500 ppm (as petroleum distillates).
- The Cal/OSHA PEL is listed as 300 ppm (as VM&P naphtha), 100 ppm (as stoddard solvent), and 300 ppm (as gasoline).
- The TLV is listed as 300 ppm (as VM&P naphtha), 100 ppm (as stoddard solvent), and 300 ppm (as gasoline).

2.1.3 Heavy Waste Oils

Heavy waste oils, including lubricants, grease, and used motor and hydraulic fluids, have been shown to cause skin cancer during prolonged dermal exposure in laboratory animals. Therefore, dermal protection must be provided when contact with used oil is suspected. Contaminated skin should be washed as soon as possible.

The above information is provided for a class of compounds. OSHA PELs, Cal/OSHA PELs, and TLVs (if listed) vary by specific compound.

2.1.4 Vinyl Chloride

Vinyl chloride is a colorless gas with a sweet odor. It is a known human carcinogen which causes liver and blood tumors. It is a poison by inhalation. It is also a severe skin and eye irritant and can cause skin burns by rapid evaporation and consequent freezing. Chronic exposure has also shown liver injury. Short-term exposure to vinyl chloride can cause dizziness, light-headedness, nausea, dullness of visual and auditory responses, drowsiness, and unconsciousness. Irritation of the skin and eyes can also occur. Skin contact with the liquid can cause frostbite. Vinyl chloride is classified by the U.S. Environmental Protection Agency as a Group A human carcinogen.

- The OSHA PEL is listed as 1 ppm.
- The Cal/OSHA PEL is listed as 1 ppm.
- The TLV is listed as 1 ppm.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: This chemical is known to the State of California to cause cancer.

2.1.5 Trichloroethylene (TCE)

TCE is a clear, colorless liquid with a characteristic chloroform odor. It is a mildly toxic VOC that is also an experimental carcinogen, tumorigen, and teratogen. It can cause eye effects, hallucinations and distorted perceptions when inhaled. TCE is an eye and severe skin irritant. Exposure to vapors may cause eye, nose and throat irritation. Prolonged inhalation of moderate concentrations of vapor may cause headaches and drowsiness. Inhalation of high concentrations may cause narcosis and anesthesia. Severe, acute exposure can result in cardiac failure. Significant chronic exposure may damage the liver and other organs. Prolonged repeated skin contact with the liquid may cause irritation and dermatitis.

- The OSHA PEL is listed as 100 ppm.
- The Cal/OSHA PEL is listed as 25 ppm.
- The TLV is listed as 10 ppm.

WARNING: This chemical is known to the State of California to cause cancer.

2.1.6 Polychlorinated Biphenyls (PCBs)

PCBs are a series of technical mixtures consisting of many isomers and compounds that vary from mobile oil liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination, and possibly according to batch. Generally, they are moderately toxic by ingestion, and some are poisons by other routes. Most are suspect human carcinogens and experimental tumorigens, and exhibit experimental reproductive effects. They have two distinct actions on the body: a skin effect (chloracne) and a toxic action on the liver. The higher the chlorine content, the more toxic the PCBs tend to be.

- The OSHA PEL is listed as 0.5 mg/m3 for 54% chlorine content (as a PCB) and 1.0 mg/m3 for 42% chlorine content (as a PCB).
- The Cal/OSHA PEL is listed as 0.5 mg/m3 for 54% chlorine content (as a PCB) and 1.0 mg/m3 for 42% chlorine content (as a PCB).
- The TLV is listed as 0.5 mg/m3 for 54% chlorine content (as a PCB) and 1.0 mg/m3 for 42% chlorine content (as a PCB).
  Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

WARNING: These chemicals are known to the State of California to cause cancer.

WARNING: These chemicals are known to the State of California to cause birth defects or other reproductive harm.

2.1.7 Polynuclear Aromatic Hydrocarbons (PNAs)

PNAs constitute a class of materials of which benzo[a]pyrene (BaP) is one of the most common and also the most hazardous. In general, PNAs can be formed in any hydrocarbon combustion process. The less efficient the combustion process, the higher the PNA emission factor is likely to be. The major sources are stationary sources, such as heat and power generation, refuse burning, industrial activity, such as coke ovens, and coal refuse heaps. PNAs may also be released from oil spills. Because of the large number of sources, people are exposed to very low levels of PNAs every day.

Certain PNAs, such as the more common BaP, have been demonstrated to be carcinogenic at relatively high exposure levels in laboratory animals. BaP is a yellowish crystalline solid that consists of five benzene rings joined together. It is highly soluble in fat tissue and has been shown to produce tumors in the stomachs of laboratory mice. In addition, skin cancers have been induced in a variety of animals at very low levels and unspecified lengths of application.

It is important to recognize the PNAs' ability to adhere to soil and other particulates. Therefore, good particulate emission controls and the use of air purifying respirators with particulate filters are required for protection against airborne PNA hazards.

- The OSHA PEL is listed as 0.2 mg/m3 (as coal tar pitch volatiles).
- The Cal/OSHA PEL is listed as 0.2 mg/m3 (as coal tar pitch volatiles).
- The TLV is listed as 0.2 mg/m3 (coal tar pitch volatiles, as benzene soluble aerosol).

WARNING: These chemicals are known to the State of California to cause cancer.

Note: Published exposure limits designate a skin notation indicating that dermal contact can contribute to the overall exposure.

2.1.8 Arsenic

Metallic arsenic is most commonly a gray, brittle, crystalline solid. It can also be in a black or yellow amorphous form. Arsenic is also commonly found in its volatile white trioxide form. Arsenic is used in several insecticides, herbicides, defoliants, desiccants, and rodenticides and appears in a variety of forms. It is also used in tanning, pigment production, glass manufacturing, wood preservation, and anti-fouling coatings. Arsenic is classified as a known carcinogen.

Short-term exposure to arsenic can cause marked irritation of the stomach and intestines with nausea, vomiting, and diarrhea. In severe cases the vomiting and stools are bloody and the exposed individual goes into collapse and shock with weak, rapid pulse, cold sweats, coma, and death. Inorganic arsenicals are more toxic than organic arsenicals, and the trivalent form is more toxic than the pentavalent form. Acute arsenic poisoning usually results from ingestion exposures. Blood cell changes, blood vessel damage, and impaired nerve function can also result from chronic arsenic ingestion. Other effects include skin changes, irritation of the throat, increased risk of cancer of the liver, bladder, kidney, and lung.

- The OSHA PEL is listed as 0.01 mg/m3 for inorganic forms of arsenic and 0.5 mg/m3 for organic forms.
- The Cal/OSHA PEL is listed as 0.01 mg/m3 for inorganic forms of arsenic and 0.2 mg/m3 for organic forms.
- The TLV is listed as 0.01 mg/m3 for arsenic and inorganic arsenic compounds.

WARNING: This chemical is known to the State of California to cause cancer.

WARNING: This chemical is known to the State of California to cause birth defects or other reproductive harm.

2.2 Hazard Communication

In accordance with the Hazard Communication standard, material safety data sheets (MSDSs) will be maintained on site for chemical products used by Brown and Caldwell personnel at the Site (i.e., spray paint, PVC cement, etc.). Subcontractors will be responsible for maintaining MSDSs for chemical products they bring on Site. In addition, containers will be clearly labeled in English to indicate their contents and appropriate hazard warnings. Please note that labeling containers includes, but is not limited to, any waste, used PPE, and/or decontamination materials collected.

2.3 Opening Wells and Well Vaults

Direct-reading instrumentation specified in Section 7 will be used to monitor any work in a well vault at the site where VOCs are a concern. The well vault will be opened carefully with the Brown and Caldwell employee staying upwind as much as possible and then left open for a minimum of

three minutes to allow the vault to vent. If the well cap is then removed, allow another three minutes for the well head to vent before proceeding. Please note that if there are other established protocols that differ from 3 minutes; the more protective time increment will be followed. Personnel should stay upwind as much as possible while working in and around the vault.

When removing a well cap, personnel will remain upwind as much as possible and will carefully remove the cap by opening it away from them in order to minimize the likelihood of exposure to vapors. Personnel will wait a minimum of three minutes to allow the well to vent before proceeding.

2.4 Physical Hazards

The following physical hazards, as marked below, have been identified and may be encountered during scheduled field activities.

☒ Slips, Trips and Falls	☒ Housekeeping
☒ Heavy Equipment	☒ Materials and Equipment Handling - Lifting
☒ Excavations	☐ Drilling
☒ Noise	☒ Underground Utilities
☒ Overhead Utilities	☒ Equipment Refueling
☒ Electrical Equipment	☐ Lockout/Tagout
☐ Confined Spaces	☒ Fire
☒ Sharp Objects/Cutting	☐ Cutting Acetate Sleeves
☐ Elevated Platforms	☐ Ladder Use
☒ Traffic	☒ Driving
☐ Arc Flash Protection	☐ Boating Safety
☐ Building Collapse	☐ Personal Safety – Urban Setting

Actions to be taken to protect against the hazards identified are provided in the sections below.

2.4.1 Slip, Trips and Falls

Slipping hazards may exist due to uneven terrain, wet or slick surfaces, leaks or spills. Tripping hazards may be present from elevation changes, debris, poor housekeeping or tools and equipment. Some specific hazards may include: climbing/descending ladders, scaffolding, berms or curbing. Collectively, these types of injuries account for nearly 50 percent of all occupational injuries and accepted disabling claims. Prevention requires attention and alertness on the part of each worker, following and enforcing proper procedures, including good housekeeping practices, and wearing appropriate protective equipment.

2.4.2 Housekeeping

Personnel shall maintain a clean and orderly work environment. Make sure that all materials stored in tiers are stacked, racked, blocked, interlocked, or secured to prevent sliding, falling, collapse, or overturning. Keep aisles and passageways clear and in good repair to provide for free and safe

movement of employees and material-handling equipment. Do not allow materials to accumulate to a degree that it creates a safety or fire hazard.

During construction activities, scrap and form lumber with protruding nails and other items shall be kept clear from work areas, passageways, and stairs. Combustible scrap and debris shall be removed at regular intervals. Safe means must be provided to facilitate removal of debris.

Containers must be provided for collecting and separating waste, used rags and other debris. Containers used for garbage and other oily flammable or hazardous waste such as caustics, acids, harmless dusts, etc., must be separated and equipped with covers. Garbage and other waste shall be disposed of at frequent and regular intervals.

2.4.3 Heavy Equipment

Equipment, including earth-moving equipment, drill rigs, or other heavy machinery, will be operated in compliance with the manufacturer's instructions, specifications, and limitations, as well as any applicable regulations. The operator is responsible for inspecting the equipment prior to use each work shift to verify that it is functioning properly and safely.

The following precautions should be observed whenever heavy equipment is in use.

- PPE, including steel-toed boots, safety glasses, high visibility vests, and hard hats must be worn.
- Personnel must be aware of the location and operation of heavy equipment and take precautions to avoid getting in the way of its operation. Workers must never assume that the equipment operator sees them; eye contact and hand signals should be used to inform the operator of the worker's intent.
- Personnel should not walk directly in back of, or to the side of, heavy equipment without the operator's knowledge. Workers should avoid entering the swing radius of equipment and be aware of potential pinch points.
- Nonessential personnel will be kept out of the work area.

2.4.4 Materials and Equipment Handling - Lifting

The movement and handling of equipment and materials on the Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques, and proper personal safety equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be utilized to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids such as drum dollies or hydraulic lift gates.

Proper lifting techniques include the following.

- Lift with the strength of your knees, not your back.
- Firmly plant your feet approximately shoulder-width apart.
- Turn your whole body, don't bent or twist at the waist.

- Be sure that the path is clear of obstructions or tripping hazards; avoid carrying objects that will obstruct your vision.
- Use caution when holding an object from the bottom to prevent crushing of the hands or fingers when lowering.

2.4.5 Excavations

A competent person (designated by the excavation contractor) who is capable of identifying existing and predictable hazards in the surroundings, or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them, will be present during excavation activities.

Dust suppression techniques will be used during excavation activities to minimize the generation of airborne dust. If visible dust is observed during excavation activities, work will cease and engineering controls (i.e., wetting soils) will be enhanced.

The atmosphere will be tested in excavations, before employees are permitted to enter and begin work, greater than 4 feet in depth or where oxygen deficiency or toxic or flammable gases are likely to be present. The atmosphere shall be ventilated and re-tested until flammable gas concentrations less than 5 percent of the lower explosive limit (LEL) and site-specific action levels are obtained. Worker entry will not be allowed if the oxygen concentration is less than 20 percent. In addition, a safe means of access and egress (i.e., a ladder, stairs or ramp) must be provided so that no more than 25 feet of lateral travel is required by employees.

Workers will not enter unstable excavations or excavations greater than 5 feet in depth without appropriate protective systems such as benching, sloping, or shoring. If shoring or shielding systems are not used, side slopes will not be steeper than 1½:1 without written confirmation from the competent person that slope is safe for the soil conditions. Excavations will be constructed in accordance with the OSHA Excavation Safety Standard (29CFR1926 Subpart P, or Cal/OSHA equivalent).

Construction personnel should make all efforts to not enter excavations, but perform duties outside of the excavation. However, in order to secure the rigging to the tank or ensure that the piping systems are capped, it may be necessary for someone to enter the excavation. In these cases one of the following safety systems will be used (as determined to be most safe and effective by the excavation contractor):

(1) Shielding, if necessary, will consist of trench boxes placed into the excavation to maintain the walls. Excavations should be properly barricaded/flagged and materials should not be stored closer than 2 feet from the edge of the excavation.

(2) Sloping or (3) Benching of the ground during the UST removal at the site will be conducted in accordance with one of the systems outlined below:

a. For excavations less than 6 m (20 ft) in height, the slope shall be 34o, measured from the horizontal (1.5 horizontal to 1.0 vertical) unless the competent person determines

that the soil type (e.g. A or B) allows a steeper slope in accordance with OSHA regulations.

b. The excavation design will be selected from and be in accordance with written tabulated data, such as charts and tables. At least one copy of the tabulated data will be maintained at the work site during excavation. The tabulated data shall include:

i. Identification of the parameters, including the soil type, that affect the selection of a sloping or benching system drawn from the data,

ii. Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe,

iii. Explanatory information as may be necessary to aid the user in correctly selecting a protective system from the data, and

iv. The identity of the registered professional engineer who approved the data.

(3) If deeper than 20 feet (not anticipated), the sloping or benching system will be designed by a registered engineer and at least one copy of the design will be maintained at the work site during excavation. Designs will be in writing and will include:

a. The magnitude and configuration of slopes determined to be safe for the site excavation, and

b. The identity of the registered professional engineer who approved the design.

The competent person will inspect excavations daily. If there is evidence that a cave-in or slide is possible, work will cease until the necessary safeguards have been taken. An exit must be provided so that the entrant does not travel more than 25 feet to exit and any surface activity that could enhance the chances of a cave-in are temporarily halted or otherwise secured. Excavated material will be placed far enough from the edge of the excavation (a minimum of 2 feet) so that it does not fall back into the opening or affect the integrity of the sidewall. At the end of each day's activities, open excavations will be clearly marked and secured to prevent nearby workers or unauthorized personnel from entering them. Remote sampling techniques will be the preferred method of sample collection in excavations.

2.4.6 Noise

Noise may result primarily from the operation of heavy equipment, process machinery or other mechanical equipment. Hearing protection with the appropriate noise reduction rating (NRR) shall be worn in areas with high noise levels. Hearing protection of a noise reduction rating of at least 32 decibels will be worn during drilling operations or if conversation becomes difficult. A good rule of thumb to determine if hearing protection is needed is the inability to have a conversation at arms length without raising voice levels. If loud noise is present or normal conversation becomes difficult, hearing protection in the form of ear plugs, or equivalent, will be required.

2.4.7 Underground Utilities

Reasonable efforts will be made to identify the location(s) of underground utilities (e.g., pipes, electrical conductors, fuel lines, and water and sewer lines) before intrusive soil work is performed. The state underground utility notification authority (e.g., USA [1-800-227-2600] for California, Nevada and Hawaii, Dig Alert, Blue Stake, etc.) will be contacted prior to the start of intrusive field activities in accordance with local notification requirements. In areas not evaluated or serviced by the underground utility notification authority, and a reasonable potential for underground utilities exists, one or more of the following techniques will be employed to determine the location of subsurface structures.

- Contracting the services of a qualified private utility locator.
- Having a survey of the subject area conducted by staff trained in the use of subsurface utility locating equipment.
- Subsurface testing (i.e., hand digging or potholing) to the expected depth of probable utilities (not less than 5 feet).

If utilities cannot be located or if unlocated utilities are suspected to be present, subsurface activities (i.e., borings, excavation) should not be conducted before the location(s) or absence of underground utilities is confirmed.

Typical subsurface location marks are as follows:

- Red – electrical,
- Yellow – gas/oil/steam,
- Blue – water,
- Green – sanitary/storm drains/culverts,
- Orange – communications, and
- White – proposed excavation or boring.

Intrusive work should be limited to the area 3.3 feet (1 meter) on either side of the location marks. In some special cases such as fiber optics and high-pressure pipelines this area should be expanded to 16.5 feet (5 meters) on either side of the utility.

2.4.8 Overhead Utilities

If work is to be conducted in the vicinity of overhead electrical utilities, the owner of the overhead line will be contacted to determine the maximum voltage. Any overhead utility will be considered to be energized unless and until the person owning or operating such line verifies that the line is not energized, and the line is visibly grounded at the work site.

Workers will not perform work in proximity to energized high-voltage lines (including scaffolding, well drilling, pile driving, or hoisting equipment) until danger from accidental contact with high-voltage lines has been effectively guarded against.

Equipment with articulated upright booms or masts are not permitted to operate within 15 feet of an overhead utility line (less than 50kV) while the boom is in the upright position. For transmission lines in excess of 50kV, an additional distance of 4 inches for each 10 kV over 50kV will be used.

2.4.9 Equipment Refueling

Care shall be exercised while refueling generators, pumps, vehicles, and other equipment to prevent fire and spills. Personnel shall eliminate static electricity by grounding themselves (touching metal) prior to using refueling hoses and or containers of petroleum liquids. Items being refueled shall be grounded or be located on the ground and not on a trailer, work bench or inside a truck bed. Equipment that is hot must be allowed to cool prior to refueling. Spill response materials shall be available when conducting refueling operations.

2.4.10 Electrical Hazards

Electrical equipment to be used during field activities will be suitably grounded and insulated. Ground-fault circuit interrupters (GFCI), or equivalent, will be used with electrical equipment to reduce the potential for serious electrical shock. Electrical equipment including batteries, generators, panels and extension cords shall be kept dry during use. Extension cords may not be used as a permanent means of providing power and will be removed from service if they are worn, frayed, or if the grounding prong is missing.

Extension cord precautions include the following.

- Be aware of exposed or bare wires, especially on metal grating. Warning*: Electrical contact with metal can cause fatal electrocution.*
- Prior to use, inspect cords for exposed or bare wires, worn or frayed cords, and incorrect splices. Splices are permitted, but there must be insulation equal to the cable, including flexibility.
- Cables and extension cords in passageways, steps or any area where there may be foot traffic should be secured so as to not create a tripping hazard. Overhead cables and extension cords shall be rigged to a height greater than 6 feet.
- Shield extension cords that must run across driveways or areas where vehicle traffic is present.
- Do not run cords across doorways or windows where they can be frayed or cut by a closed door or window.
- Do not run wires through wet or puddled areas.
- Flexible cord sets that are used on construction sites or in damp locations shall be of hard usage or extra hard usage type.

Observation of energized machinery will take place from a safe distance. Only qualified personnel will remove guards, hatch covers, or other security devices if necessary. Equipment lockout procedures and an appropriate facility work permit requirements will be followed. Lockout/tagout procedures will be conducted before activities begin on or near energized or mechanical equipment that may pose a hazard to site personnel. Workers conducting the operation will positively isolate the piece of equipment, lock/tag the energy source, and verify effectiveness of the isolation. Only

employees who perform the lockout/tagout procedure may remove their own tags/locks. Employees shall complete lockout/tagout training before initiating this procedure.

Only qualified personnel will remove covers of electrical equipment to expose energized electrical parts. Entering electrical rooms/vaults or areas with live exposed electrical part by Brown and Caldwell employees shall be permitted only when accompanied by a qualified personnel after notification and approval of the appropriate facility personnel.

2.4.11 Fire/Explosion

Site workers should have an increased awareness concerning fire and explosion hazards whenever working with or near flammable materials, especially when performing any activity that may generate sparks, flame, or other source of ignition. Intrinsically safe equipment is required when working in or near environments with the potential for an explosive or flammable atmosphere. The SSHO will verify facility requirements for a "hot work" permit before activities that may serve as a source of ignition are conducted.

Flammable materials will be kept away from sources of ignition. In the event of fire, work will cease, the area will be evacuated, and the local fire response team will be notified immediately. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. A fully charged ABrown and Caldwell dry chemical fire extinguisher will be readily available for use during all scheduled activities at the Site.

2.4.12 Sharp Objects/Cutting Utensils

Frequently field tasks require the cutting of items such as rope, packaging or containers. Care should be exercised in using knives and/or cutting implements while performing such cutting tasks. Personnel should cut down and away from their body and other personnel. The item being cut should be braced or secured from movement while cutting. When slicing open acetate liners, such as those utilized in direct push drilling, personnel should use a hook blade cutting implement designed for this task versus a straight blade knife.

2.4.13 Traffic

Vehicular traffic presents opportunities for serious injury to persons or property. Traffic may consist of street traffic or motor vehicles operated by facility employees or visitors to the Site. Workers and other pedestrians are clearly at risk during periods of heavy traffic. Risk from motor vehicle operations may be minimized by good operating practices and alertness, and care on the part of workers and pedestrians.

Site personnel will wear high-visibility traffic safety vests whenever activities are conducted in areas of heavy traffic. Work vehicles will be arranged to be used as a barrier between site workers and nearby traffic. If required by local ordinances or site location, a traffic control plan will be developed implemented.

It is important to be conscious of all vehicular traffic that may be present during conduct of field operations. Use caution tape, barricades, or safety cones to denote the boundaries of the work area and to alert vehicle operators to the presence of operations which are non-routine to them. Be careful when exiting the work area and especially when walking out from between parked vehicles to avoid vehicular traffic.

Never turn your Back on Traffic. When working in or near a roadway, walk and work with your face to the oncoming traffic. If you must turn your back to traffic, have a coworker watch oncoming traffic for you.

Vehicle and Worksite Position. Whenever possible, place a vehicle between your worksite and oncoming traffic. Not only is the vehicle a large, visible warning sign, but if an oncoming car should fail to yield or deviate, the parked vehicle, rather than your body, would absorb the first impact of a crash. Turn the wheels so that if the vehicle were struck, it would swing away from the worksite. Even though the vehicle would protect you in a crash, it might be knocked several feet backward. Always leave some room between the rear of the vehicle and the work area.

Use of Signs and Cones to Direct Traffic. Traffic signs and cones are used to inform drivers and direct traffic away from and around you. Cones and signs are only effective if they give oncoming drivers enough time to react and make it clear how traffic should react.

Cone Positioning. The most common coning situation is setting a taper of cones that creates a visual barrier for oncoming motorists and gradually closes a lane.

The position of the taper depends on the road width, position and size of the work area, and also on the characteristics of the traffic.

2.4.14 Driving

A lot of driving is required to get to, from, and between project Sites. Safe vehicle maintenance and operation must be a priority. It requires knowledge of directions to (and conditions of) the Site in advance, careful exiting and merging into traffic, anticipating the unexpected, remaining alert to one's physical and mental condition, resisting distractions such as cell phone use, other car activities and contacting assistance when needed. Report all vehicle accidents/incidents to Brown and Caldwell's Risk Manager.

2.5 Natural Phenomena

Natural phenomena such as weather-related emergencies and acts of nature can affect employees' safety. Natural phenomena can occur with little or no warning. If an emergency situation arises as a result of natural phenomena, adhere to the contingency procedures outlined in Section 14. The following natural phenomena have been identified and may be encountered during scheduled field activities.

- ☒ Sunburn
- ☒ Heat Stress
- ☐ Cold Stress
- ☒ Lightning/Electrical Storms

☐ Hurricanes ☐ Tornados and Strong/Straight Line Winds

☒ Earthquakes

2.5.1 Sunburn

Working outdoors with the skin unprotected for extended periods of time can cause sunburn to the skin. Excessive exposure to sunlight is associated with the development of skin cancer. Field staff should take precautions to prevent sunburn by using sunscreen lotion and/or wearing hats and long-sleeved garments.

2.5.2 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of accidents. In particular, protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the possibility of heat-related illness, workers should drink plenty of fluids and establish a work schedule that will provide sufficient rest periods for cooling down. Personnel shall maintain an adequate supply of non-caffeinated drinking fluids on site for personal hydration. Workers should be aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions. These are summarized in the table below.

Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing emergency medical services. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

2.5.3 Lightning/Electrical Storms

Lightning can be unpredictable and may strike many miles in front of, or behind, a thunderstorm. Workers will therefore cease field operations at the **first** sign of a thunderstorm and suspend activities until at least 30 minutes after the last observed occurrence of lightning or thunder. For purposes of this SSHP, signs of a thunderstorm will include any visible lightning or audible thunder.

In the event of a thunderstorm, field personnel will take the following actions.

- Get inside a permanent building structure (not a shed or canopy) or fully enclosed metal vehicle (not a convertible or camper shell) with the windows fully up.
- If in a house or building, do not use the telephone or any electrical appliance that's connected to the building's electrical wiring.
- Stay away from tall isolated objects, such as trees, drill rigs, telephone poles, or flag poles.
- Avoid large open areas, such as fields or parking lots, where a person is the relatively highest object.
- Stay away from lakes, ponds, railroad tracks, fences, and other objects that could transmit current from a distant lightning strike.
- If caught out in the open without time to escape or find shelter, seek a low area (if time permits), crouch down, and bend forward holding the ankles. Tuck the head so that it's not the highest part of the body, without letting it touch the ground. Under no circumstances lay down.

If a person struck by lightning contact emergency medical services, even if he/she appears only stunned or otherwise unhurt as medical attention may still be needed. Check for burns, especially at fingers and toes, and areas next to buckles and jewelry.

2.5.4 Earthquakes

Earthquakes strike suddenly, violently, and without warning. If your project is located near a fault line, earthquakes are an unpredictable possibility. For long term projects with temporary or permanent office area, keep an emergency preparedness kit consisting of, but not limited to:

- Current project/office contacts list - how to reach folks in an emergency,
- Blankets,
- Flashlights,
- Radio (operated by batteries),
- Batteries for flashlight and radio (note: batteries should be replaced as needed to assure freshness),
- Water (unless there is a water bubbler that can be used with no electricity), and
- Snack crackers, dried fruit, etc. - a source of food that won't go bad.

This kit is meant to serve as overnight survival in the event that it becomes unsafe to leave the project site. The kit's contents should be suited to meet the size and needs of your project.

If you feel the earth shaking, consider the following tips:

- Drop down; take cover under a desk or table and hold on.
- Stay indoors until the shaking stops and you are sure it is safe to exit.
- Stay away from bookcases, shelves, or anything that could fall on you.
- Stay away from windows.
- If inside a building, expect fire alarms and sprinklers to go off during the quake.
- If you are outdoors, find a clear spot away from buildings, trees, and power lines. Drop to the ground and cover your head.

If you are in a car, slow down and drive to a clear place, preferably away from power lines. Stay in the car until the shaking stops.

2.6 Biological Hazards

The following biological hazards have been identified and may be encountered during scheduled field activities.

- ☐ Bloodborne Pathogens/Sanitary Waste
- ☒ Rodents and Mammals
- ☐ Reptiles/Snakes
- ☒ Venomous Insects
- ☒ Mosquitoes
- ☐ Fire Ants
- ☒ Spiders/Scorpions
- ☐ Ticks
- ☐ Poisonous Plants

If any biological hazards are identified at the Site, workers in the area will immediately notify the SSHO and nearby personnel.

2.6.1 Rodents/Mammals

Animals may potentially carry the rabies virus or disease causing agents. Do not attempt to feed or touch animals. Feces from some small mammals may contain diseases such as Hanta Virus. Avoid generating dust in the vicinity of rodent feces. In addition, animals such as dogs or wild predators (i.e., cougars or coyotes) may pose an attack hazard. Persons should slowly back away in a non-threatening manner if an encounter with a threatening animal occurs. In order to avoid such encounters, use the buddy system and make noise when working in areas where such animals may be present.

2.6.2 Venomous Insects

Common examples include bees, fire ants and wasps. Avoid contact with insects and their hives. If stung, remove the stinger by gently scraping it out of the skin (do not use tweezers). If the worker is

stung by an insect, immediately apply an ice pack to the affected area and wash area with soap and water and apply antiseptic. If an allergic reaction occurs, contact emergency medical services for appropriate treatment. Seek medical attention immediately if you are allergic to venomous stings such as bees or if anaphylaxis symptoms are present.

2.6.3 Mosquitoes

Mosquitoes may transmit diseases such as West Nile Virus. Symptoms of West Nile Virus include: fever, headache, tiredness, body aches, and occasional rash. Avoid mosquito bites by wearing long sleeved shirt and long pants. Apply insect repellent to clothes and/or skin (if FDA approved for topical use). Report any dead birds in the area to local health officials. Mosquitoes are most active from dusk to dawn.

2.6.4 Spiders/Scorpions

The black widow and brown recluse spiders are the most venomous. Avoid contact with spiders and scorpions and areas where they may hide. They favor dark hiding places. Inspect clothing and shoes before getting dressed. Wear gloves and safety shoes when working with lumbar, rocks, inspecting buildings, etc. Signs and symptoms of bites include: headache, cramping pain/muscle rigidity, rash and/or itching, nausea, dizziness, vomiting, weakness or paralysis, and convulsions or shock. Wash bite area with soap and water and apply antibiotic cream. Contact emergency medical services if allergic reaction or severe symptoms occur.

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3. KEY PROJECT PERSONNEL AND RESPONSIBILITES

A summary of the key project personnel and responsibilities are provided in Section 3.0 of the APP. This section provides more details. Ms. Wendy Linck of Brown and Caldwell is the Project Managers (PMs). Mr. Jim Bucha, CSP, CIH is the Safety and Health Manager (SHM). Mr. Greg Menna has been designated as the Brown and Caldwell SSHO for this project. The Brown and Caldwell project field staff have completed 40 hours of comprehensive health and safety training, which meets the requirements of 29 CFR 1910.120.

The responsibilities of key Brown and Caldwell project personnel are presented below.

3.1 Project Manager

Each PM is responsible for evaluating hazards anticipated at the Site and working with designated field staff and the SHM to prepare this SSHP to address the identified hazards. Each PM is also responsible for the following.

- Informing project participants of safety and health hazards identified at the Site.
- Providing a copy of this SSHP to Brown and Caldwell project participants and a copy to each Brown and Caldwell subcontractor prior to the start of field activities.
- Ensuring that the Brown and Caldwell project team is adequately trained and perform safety briefings in accordance with this SSHP.
- Providing the resources necessary for maintaining a safe and healthy work environment for Brown and Caldwell personnel.
- Communicating project safety concerns to the SHM for determining corrective actions.

3.2 Site Safety and Health Officer

The SSHO has on-Site responsibility for verifying that BC team members, including subcontractors, comply with the provisions of this SSHP. The SSHO has the authority to monitor and correct health and safety issues as noted on-Site. The SSHO shall have 1 year of experience implementing safety and occupational health procedures at cleanup operations, and have the training and experience to conduct exposure monitoring/air sampling and select/adjust protective equipment use. The SSHO is responsible for the following.

- Reporting unforeseen or unsafe conditions or work practices at the Site to the PM or HSD.
- Stopping operations that threaten the health and safety of BC field team or members of the surrounding community.

- Monitoring the safety performance of Site personnel to evaluate the effectiveness of health and safety procedures.
- Performing air monitoring, as necessary, as prescribed in this SSHP.
- Documenting field team compliance with this SSHP by completing the appropriate BC forms contained in the Appendices of this document.
- Conducting daily tailgate safety meetings and assuring that project personnel understand the requirements of this SSHP (as documented by each BC field team member's signature on the Signature Page).
- Limiting access to BC work areas on the Site to BC field team members and authorized personnel.
- Enforcing the "buddy system" as appropriate for Site activities.
- Performing periodic inspections to evaluate safety practices at the Site.
- Identifying the location and route to nearby medical facility and emergency contact information and coordinating appropriate responses in the event of emergency.

3.3 Site Safety and Health Manager

The SHM is responsible for final review and modification of this SSHP. The SHM is a Certified Industrial Hygienist (CIH) and Certified Safety Professional (CSP). The SHM has over 20 years of experience managing safety and occupational health at hazardous waste site cleanup operations. Modifications to this SSHP that result in less protective measures than those specified may not be employed by the PM or SSHO without the approval of the SHM. In addition, the SHM has the following responsibilities.

- Developing and coordinating the overall BC health and safety program.
- Advising the PM and SSHO on matters relating to health and safety on this project.
- Recommending appropriate safeguards and procedures.
- Modifying this SSHP, if necessary, and approving changes in health and safety procedures at the Site.

3.4 Brown and Caldwell Team Members

Brown and Caldwell employees and subcontractors are responsible for familiarizing themselves with health and safety aspects of the project and for conducting their activities in a safe manner. This includes attending site briefings, communicating health and safety observations and concerns to the SSHOs, maintaining current medical and training status and maintaining and using proper tools, equipment and PPE. Proper work practices are part of ensuring a safe and healthful working environment. Safe work practices are essential and it is the responsibility of Brown and Caldwell employees and team members to follow safe work practices when conducting scheduled activities. Safe work practices to be employed during the entire duration of fieldwork include, but are not limited to, the following.

- Following the provisions of this SSHP, company health and safety procedures and regulatory requirements.

- Reviewing safety-related information from other parties (i.e., client or contractors) as it relates to Brown and Caldwell's activities.
- Inspecting personal protective equipment (PPE) before on-site use, using only intact protective clothing and related gear, and changing suits, gloves, etc. if they are damaged or beyond their useful service life.
- Set up, assemble, and check out all equipment and tools for integrity and proper function before starting work activities.
- Assisting in and evaluating the effectiveness of Site procedures (including decontamination) for personnel, protective equipment, sampling equipment and containers, and heavy equipment and vehicles.
- Practice the "buddy system" as appropriate for site activities.
- Do not use faulty or suspect equipment.
- Do not use hands to wipe sweat away from face. Use a clean towel or paper towels.
- Practice contamination avoidance whenever possible.
- Do not smoke, eat, drink, or apply cosmetics while in chemically-affected areas of the site or before proper decontamination.
- Wash hands, face and arms before taking rest and lunch breaks and before leaving the site and the end of the workday.
- Check in and out with the SSHOs upon arrival and departure from the site.
- Perform decontamination procedures as specified in this SSHP.
- Notify the SSHOs immediately if there is an incident that causes an injury, illness or property loss. Incidents that could have resulted in injury, illness or property loss (close call) will also be reported to the SSHO.
- Do no approach or enter an area where a hazardous environment (i.e., oxygen deficiency, toxic or explosive) may exist without employing necessary engineering controls, proper PPE and appropriate support personnel.
- Use respirators correctly and as required for the Site; check the fit of the respirator with a negative or positive pressure test; do not wear respirator with facial hair or other conditions that prevent a face-to-facepiece seal.
- Confined spaces will not be entered without appropriate evaluation, equipment, training and support personnel.

3.5 Subcontractors

Subcontractor personnel are expected to comply fully with subcontractor's SSHP and to observe the minimum safety guidelines applicable to their activities which may be identified in the APP/SSHP. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

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4. TRAINING REQUIREMENTS

Please refer to Section 5.0 in the APP for a description of the training requirements.

Each employee will document that they have been briefed on the hazards identified at the site and that they have read and understand the requirements of this SSHP by signing the H&S Plan Acknowledgement Form attached as Attachment C.

A daily morning briefing to cover safety procedures and contingency plans in the event of an emergency is to be included with a discussion of the day's activities. These daily meetings will be recorded on the Daily Tailgate Safety Meeting Form. A copy of the Daily Tailgate Safety Meeting Form is included in Attachment D.

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5. PERSONAL PROTECTIVE EQUIPMENT

Please refer to Section 10.0 in the APP for a description of the required personal protective equipment for this project.

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6. MEDICAL SURVEILLANCE REQUIREMENTS

Brown and Caldwell Site personnel, including subcontractors and site visitors, who will or may work in an area designated as an exclusion zone must have fulfilled the appropriate medical monitoring requirements in accordance with 29 CFR 1910.120(f). Each individual entering an exclusion zone must have successfully completed an annual surveillance examination and/or an initial baseline examination within the last 12 months.

Medical surveillance is conducted as a routine program for Brown and Caldwell field staff in accordance with the requirements of 29 CFR 1910.120(f). There will not be any special medical tests or examinations required for staff involved in this project.

A Hepatitis B vaccination will be offered to Brown and Caldwell personnel before the person participates in a task where direct exposure to potentially infectious materials is a possibility (i.e., first aid or CPR). For personnel who have potential exposure to sanitary wastes, a current tetanus/diphtheria inoculation or booster is recommended.

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7. AIR MONITORING PLAN

A calibrated photoionization detector (PID) with a lamp strength of 10.6 eV or flame ionization detector (FID) will be used to analyze airborne volatile contaminant concentrations approximately every 15 minutes in the workers' breathing zones while workers are in the designated Exclusion Zone, or when task or exposure conditions change (whichever frequency is less). If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate.

Background concentrations will be determined at the beginning of each work shift by collecting several instrument readings upwind of the scheduled activities. Alternatively, background levels can be determined by collecting readings from a nearby (upwind) area that can reasonably be considered unaffected by Site activities.

Real-time measurements will be made as near as feasible to the breathing zone of the worker with the greatest exposure potential in each active work area. If authorized by the SHM, real time measurements may cease being taken when enough historical data is generated to warrant its cessation. Air monitoring will be reinstated if potential exposure conditions change.

The equipment will be calibrated daily, and the results will be recorded on the Air Monitoring Form. The results of air monitoring will also be recorded on the Air Monitoring Form and will be retained in the project files following completion of field activities. A copy of the Air Monitoring Form is located in Attachment A.

7.1 Monitoring Instruments

On-site worker exposure to airborne contaminants will be monitored during intrusive site activities. A miniature real-time aerosol monitor (mini-RAM or equivalent) will be used to monitor exposure to airborne dusts. The SSO, or designee, will perform routine monitoring during site operations to evaluate concentrations of airborne dusts in employee breathing zones. If airborne dusts are detected, procedures are found in the following section.

7.2 Site Specific Action Levels

The following action levels were developed for exposure monitoring with real-time air monitoring instruments. Air monitoring data will determine the required respiratory protection levels at the Site during scheduled intrusive activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 15-minute intervals.

If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. If during this time, sustained measurements are observed, the following actions will be instituted, and the PMs and SHM will be notified. For purposes of this SSHP, sustained readings are defined

as the average airborne concentration maintained for a period of one (1) minute above established background levels.

Activity	Action Level	Level of Respiratory Protection
Soil-intrusive activities	< 3 ppm above background (VOCs) < 0.5 mg/m^3 above background (dust)	Level D: No respiratory protection required.
	3 to 15 ppm (VOCs) 0.5 to 2.5 mg/m^3 (dust)	Level C: Half-or full-face air-purifying respirator fitted with organic vapor/HEPA filter cartridges. **Contact SHM prior to respirator upgrade**
	> 15 ppm (VOCs) > 2.5 mg/m^3 (dust)	Cease operations and evacuate work area. Contact RSUM and PM immediately.

8. HEAT AND COLD STRESS

8.1 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Heat-related illnesses range from heat fatigue to heat stroke, with heat stroke being the most serious condition. The effects of ambient temperature can cause physical discomfort, loss of efficiency, and personal injury, and can increase the probability of accidents. In particular, protective clothing that decreases the body's ventilation can be an important factor leading to heat-related illnesses.

To reduce the possibility of heat-related illness, workers should drink plenty of fluids and establish a work schedule that will provide sufficient rest periods for cooling down. Personnel shall maintain an adequate supply of non-caffeinated drinking fluids on site for personal hydration. Workers should be aware of signs and symptoms of heat-related illnesses, as well as first aid for these conditions. These are summarized in the table below.

Condition	Signs	Symptoms	Response
Heat Rash or Prickly Heat	Red rash on skin.	Intense itching and inflammation.	Increase fluid intake and observe affected worker.
Heat Cramps	Heavy sweating, lack of muscle coordination.	Muscle spasms, and pain in hands, feet, or abdomen.	Increase fluid uptake and rest periods. Closely observe affected worker for more serious symptoms.
Heat Exhaustion	Heavy sweating; pale, cool, moist skin; lack of coordination; fainting.	Weakness, headache, dizziness, nausea.	Remove worker to a cool, shady area. Administer fluids and allow worker to rest until fully recovered. Increase rest periods and closely observe worker for additional signs of heat exhaustion. If symptoms of heat exhaustion recur, treat as above and release worker from the day's activities after he/she has fully recovered.
Heat Stroke	Red, hot, dry skin; disorientation; unconsciousness	Lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse.	Immediately contact emergency medical services by dialing emergency medical services. Remove the victim to a cool, shady location and observe for signs of shock. Attempt to comfort and cool the victim by administering small amounts of cool water (if conscious), loosening clothing, and placing cool compresses at locations where major arteries occur close to the body's surface (neck, underarms, and groin areas). Carefully follow instructions given by emergency medical services until help arrives.

At the start of the first rest period, the worker will determine his or her heart rate (HR). This initial HR should not exceed the individual's age-adjusted maximum HR, which equals [(0.7)(220 - age in years)]. At 1 minute into the rest period, the recovery HR will be determined. The recovery HR should not exceed 100 beats per minute.

The potential for heat stress is a concern when field activities are performed on warm, sunny days and is accentuated when chemical protective clothing is worn. Heat stress prevention measures and monitoring will be implemented if site temperatures are above 70 degrees Fahrenheit (F).

Precautions to prevent heat stress will include work/rest cycles so that rest periods are taken before excessive fatigue occurs and regular intake of water to replace water lost from sweating. Work/rest cycles will be based on results of monitoring the heart rate (pulse) of each individual worker. Rest breaks will be long enough to reduce the heart rate (HR) to levels below those calculated according to the following method:

1. The worker will initially determine his or her resting HR before starting work activities.
2. If the initial HR exceeds the age-adjusted maximum HR, or the 1-minute recovery HR is greater than 110 beats per minute, then the next work period will be decreased by 10 minutes.

An initial work/rest cycle of 1 hour work and 15 minutes rest is recommended for protection of staff when the heat stress hazard is high. The recommended cycle will be adjusted up or down on the basis of worker monitoring data, environmental conditions, and the judgment of the SSHO. If at any time field team members recognize the signs or symptoms of heat stress before a scheduled rest period, they will notify the SSHO immediately in order that a rest period can be called.

To know the temperature in the field, a thermometer will be installed in the shade at the Sun Dry products office, in the area of the planned work activities. Personnel will refer to the news media (e.g. radio, television, internet) for expected weather conditions for that day and through the day. Outside temperatures will be tracked in the field notebook.

A Cal/OSHA Heat Advisory, dated 4/1/06 (http://www.dir.ca.gov/dosh/heatillnessinfo.html), has been included as Attachment F to be used during site safety briefings and to be used as a quick guide for field personnel on how to reduce the risk of heat illness.

8.2 Cold Stress

Workers performing activities during winter and spring months may encounter extremely cold temperatures, as well as conditions of snow and ice, making activities in the field difficult. Adequate cold weather gear, especially head and foot wear, is required under these conditions. Workers should be aware of signs and symptoms of hypothermia and frostbite, as well as first aid for these conditions. These are summarized in the table below:

Condition	Signs	Symptoms	Response
Hypothermia	Confusion, slurred speech, slow movement.	Sleepiness, confusion, warm feeling.	Remove subject to a non-exposed, warm area, such as truck cab; give warm fluids; warm body core; remove outer and wet clothing and wrap torso in blankets with hot water bottle or other heat source. Get medical attention immediately.
Frostbite	Reddish area on skin, frozen skin.	Numbness or lack of feeling on exposed skin.	Place affected extremity in warm, not hot, water, or wrap in warm towels. Get medical attention.
Trench Foot	Swelling and/or blisters of the feet	Tingling/itching sensation; burning; pain in the feet	Remove wet/constrictive clothing and shoes. Gently dry and warm feet with slight elevation. Seek medical attention.

9. STANDARD OPERATING PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES

9.1 Site Rules

Each person entering the Site must check-in with the SSHO prior to starting work in order to be briefed on that day's safety briefing and the review that day's planned activities. All personnel (observing and working) will adhere to Section 10.0 of this SSHP, Site Control Measures. There will be no eating or drinking within the exclusion or contaminant reduction zones. Smoking is not permitted in controlled areas (i.e., exclusion or contamination reduction zones), near flammable or combustible materials, or in areas designated by the facility as non-smoking areas.

9.2 Work Permit Requirements

Work permits are not needed for this project.

9.3 Material Handling Procedures

Soil and liquid handling is anticipated for this project. If soil or liquids are needed to be moved from the worksite, contractors will use mechanical means to transport soil or liquids. The movement and handling of equipment and materials on the Site pose a risk to workers in the form of muscle strains and minor injuries. These injuries can be avoided by using safe handling practices, proper lifting techniques, and proper personal safety equipment such as steel-toed boots and sturdy work gloves. Where practical, mechanical devices will be utilized to assist in the movement of equipment and materials. Workers will not attempt to move heavy objects by themselves without using appropriate mechanical aids such as drum dollies or hydraulic lift gates.

Proper lifting techniques include the following.

- Lift with the strength of your knees, not your back.
- Firmly plant your feet approximately shoulder-width apart.
- Turn your whole body, don't bent or twist at the waist.
- Be sure that the path is clear of obstructions or tripping hazards; avoid carrying objects that will obstruct your vision.
- Use caution when holding an object from the bottom to prevent crushing of the hands or fingers when lowering.

Spill contingency procedures are provided in Section 14 of this SSHP.

9.4 Drum, Container, and Tank Handling

Drum handling is not anticipated for this project. Drums commonly store soil or water as a result of drilling or sampling operations.

The use of roll-off containers is anticipated for this project. This type of container is commonly used to store larger amounts of soil usually impacted with contaminants encountered during excavation activities (e.g., the removal of an underground storage tanks or pipelines). The soil in the container is tested and the results are used to properly profile the waste for transport to an approved landfill.

There are no tanks anticipated to be used on this project. Tanks are commonly used to store large amounts of water (i.e. hundreds to thousands of gallons) during purging of wells for sampling or aquifer tests.

9.5 Activity Hazard Analysis of Treatment Technologies

No treatment technologies are proposed for this project.

9.6 Safe Work Practices for Fall Protection

Safe work practices for fall protection include floor openings, wall openings, standard railing requirements, and personal fall protection. For this project, there are no floor openings, wall openings or standard railing requirements anticipated.

9.6.1 Personal Fall Protection

- When working on unprotected sides or edges which are 4 feet or more above a lower level or the ground, the worker must wear and use a personal fall arrest system.
- The fall arrest system must consist of a body belt or body harness with a D-ring on the back to attach a lanyard.
- The lanyard shall be a shock absorbing or self retracting type capable of withstanding a minimum breaking strength of 5,000 pounds.
- Anchorages used for attachment of personal fall arrest equipment shall be independent of any anchorage being used to support or suspend platforms. The anchorages must be capable of supporting at least 5,000 pounds.
- The personal fall arrest system, when stopping a fall, should limit maximum arresting force on an employee to 900 pounds when used with a body belt, 1,800 pounds when used with a body harness, and be rigged such that a worker can neither free fall more than 4 feet nor contact any lower level.

10. SITE CONTROL MEASURES

Each SSHO will conduct a safety inspection of the work site before each day's activities begin to verify compliance with the requirements of the SSHP. Results of the first day's inspection will be documented on the Site Safety Checklist. A copy of the checklist is included in Attachment B. Thereafter, each SSHO should document unsafe conditions or acts, along with corrective action, in the project field log book.

Procedures must be followed to maintain site control so that persons who may be unaware of site conditions are not exposed to hazards. The work area will be barricaded by tape, warning signs, or other appropriate means. Site equipment or machinery will be secured and stored safely.

Access to the specified work area will be limited to authorized personnel. Only Brown and Caldwell employees and designated Brown and Caldwell subcontracted personnel, as well as designated employees of the client, will be admitted to the work site. Personnel entering the work area are required to sign the signature page of this SSHP, indicating they have read and accepted the health and safety practices outlined in this plan.

In some instances it may be necessary to define established work zones: an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone. Work zones may be established based on the extent of anticipated contamination, projected work activities, and the presence or absence of non-project personnel. The physical dimensions and applicability of work zones will be determined for each area based on the nature of job activity and hazards present. Within these zones, prescribed operations will commence using appropriate PPE. Movement between zones will be controlled at checkpoints.

Considerable judgment is needed to maintain a safe working area for each zone, balanced against practical work considerations. Physical and topographical barriers may constrain ideal locations. Field measurements combined with climatic conditions may, in part, determine the control zone distances. Even when work is performed in an area that does not require the use of chemical-resistant clothing, work zone procedures may still be necessary to limit the movement of personnel and retain adequate site control.

Personnel entering the designated Exclusion Zone should exit at the same location. There must be an alternate exit established for emergency situations. In all instances, worker safety will take precedence over decontamination procedures. If decontamination of personnel is necessary, exiting the Site will include the decontamination procedures described in the following section.

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11. PERSONAL HYGIENE AND DECONTAMINATION PROCEDURES

Decontamination will take place in the decontamination area identified on-Site. Workers and PPE equipment leaving the exclusion area will be inspected to determine the level of decontamination necessary to prevent the spread of potentially hazardous materials.

Despite protective procedures, personnel may come in contact with potentially hazardous compounds while performing work tasks. If so, decontamination needs to take place using an Alconox or TSP wash, followed by a rinse with clean water. Standard decontamination procedures for levels C and D are as follows.

- equipment drop,
- boot cover and outer glove wash and rinse,
- boot cover and outer glove removal,
- suit removal,
- safety boot wash and rinse,
- inner glove wash and rinse,
- respirator removal,
- inner glove removal, and
- field wash of hands and face.

Site workers should employ only applicable steps in accordance with level of PPE worn and extent of contamination present. Each SSHO shall maintain adequate quantities of clean water to be used for personal decontamination (i.e., field wash of hands and face) whenever a suitable washing facility is not located in the immediate vicinity of the work area.

Disposable items will be disposed of in an appropriate container. Wash and rinse water generated from decontamination activities will be handled and disposed of properly. Non-disposable items (i.e., respirators) may need to be cleaned or sanitized before reuse. Each site worker is responsible for the maintenance, decontamination, and sanitizing of their own PPE.

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12. EQUIPMENT DECONTAMINATION PROCEDURES

Sampling equipment and heavy equipment leaving the exclusion area will be inspected to determine the level of decontamination necessary to prevent the spread of potentially hazardous materials. Unnecessary equipment and support vehicles are to be left outside the designated Exclusion Zone so that decontamination will not be necessary.

Used equipment may be decontaminated as follows.

- Remove adhered materials (i.e., dirt or mud) to increase the effectiveness of the decontamination process.
- An Alconox or TSP and water solution may be used to wash the equipment.
- The equipment will then be rinsed with clean water until it is determined clean.

Each person must follow these procedures to reduce the potential for transferring chemically affected materials off site.

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13. EMERGENCY EQUIPMENT AND FIRST AID

Minimum emergency equipment maintained on site will include a fully charged ABC dry chemical fire extinguisher, an adequately stocked first aid kit, and an emergency eyewash station (when corrosive chemicals are present). In addition, employees will consider maintaining the personal emergency supply items listed in Section 2.5, Natural Phenomena, as appropriate. At a minimum, there will be 2 contracted employees that will have the qualifications to administer First Aid and CPR.

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14. CONTINGENCY PROCEDURES

As part of completing this SSHP, pre-emergency planning has begun. The route to hospital is determined and the emergency phone number for the hospital is tested to confirm the type of trauma cases the hospital will admit. Another part of the pre-emergency planning process requires that the route to hospital driven by each SSHO prior to beginning project work. If a shorter route is determined, an amended route map and turn by turn directions will be provided in the Exclusion Zone at each work site.

In the event of an emergency, site personnel will signal distress with three blasts of a horn (a vehicle horn will be sufficient), or other predetermined signal. Communication signals, such as hand signals, must be established where communication equipment is not feasible or in areas of loud noise.

It is each SSHO's duty to evaluate the seriousness of the situation and to notify appropriate authorities. The first part of this plan contains emergency telephone numbers as well as directions to the hospital. Nearby telephone access must be identified and available to communicate with local authorities. If a nearby telephone is not available, a cellular telephone will be maintained on site during work activities. The operation of the cellular phone will be verified to ensure that a signal can be achieved at the work location.

The SSHO, or designee, should contact local emergency services in the event of an emergency. After emergency services are notified, the PM and SHM will be notified of the situation as soon as possible. If personal injury, property damage or equipment damage occurs, the PM and each company's Risk Manager will be contacted as soon as practicable. An Accident/Incident Investigation Report will be completed within 24 hours by the SSHO, or other designated person. A copy of the Accident/Incident Investigation Report is included in Attachment E.

Per EM 385 1-1, if the following events occur to one or more personnel, the Brown and Caldwell PM and SHM will be notified immediately. The SHM shall notify OSHA and the USACE GDA immediately.

(1) A fatal injury/illness;
(2) A permanent totally disabling injury/illness;
(3) A permanent partial disabling injury/illness;
(4) Three or more persons hospitalized as inpatients as a result of a single occurrence;
(5) $200,000 or greater accidental property damage or damage in an amount specified by USACE in current accident reporting regulations; or
(6) Arc flash incident/accident.

In addition to completing Attachment E, the accident will be recorded on ENG Form 3394 per EM 385 1-1 and OSHA requirements (29 CFR 1904). Provide the completed ENG Form 3394 to the GDA.

14.1 Injury or Illness

If an exposure or injury occurs, work will be temporarily halted until an assessment can be made to determine it is safe to continue work. The SSHO, in consultation with the SHM, will make the decision regarding the safety of continuing work. The SSHO will conduct an investigation to determine the cause of the incident and steps to be taken to prevent recurrence.

In the event of an injury, the extent and nature of the victim's injuries will be assessed and first aid/CPR will be rendered as appropriate. If necessary, emergency services will be contacted or the individual may be transported to the nearby medical center. The mode of transportation and the eventual destination will be based on the nature and extent of the injury. A hospital route map is presented at the front of this SSHP.

In the event of a life-threatening emergency, the injured person will be given immediate first aid and emergency medical services will be contacted by dialing the number listed in the Critical Project Information section at the beginning of this plan. The individual rendering first aid will follow directions given by emergency medical personnel via telephone.

14.2 Vehicle Collision or Property Damage

If a vehicle collision or property damage event occurs, the SSHO, or designee, will contact the Brown and Caldwell Risk Manager for appropriate action.

14.3 Fire

In the event of fire, the alarm will be sounded and Site personnel will evacuate to a safe location (preferably upwind). The SSHO, or designee, should contact the local fire department immediately by dialing 911. When the fire department arrives, the SSHO, or designated representative, will advise the commanding officer of the location and nature of the fire nature, and identification of hazardous materials on site. Only trained, experienced fire fighters should attempt to extinguish substantial fires at the Site. Site personnel should not attempt to fight fires, unless properly trained and equipped to do so. Site personnel should not attempt to fight a fire if it poses a risk to their personal safety.

Note that smoking is not permitted in controlled areas (i.e., exclusion or contamination reduction zones), near flammable or combustible materials, or in areas designated by the facility as non-smoking areas.

14.4 Underground Utilities

In the event that an underground conduit is damaged during subsurface work, mechanized equipment will immediately be shut off and personnel will evacuate the area until the nature of the

piping can be determined. Depending on the nature of the broken conduit (e.g., natural gas, water, or electricity), the appropriate local utility will be contacted.

14.5 Site Evacuation

The SSHO will designate evacuation routes and refuge areas to be used in the event of a Site emergency. Site personnel will stay upwind from vapors or smoke and upgradient from spills. If workers are in an Exclusion or Contamination Reduction Zone at the start of an emergency, they should exit through the established decontamination corridors, if possible. If evacuation cannot be done through an established decontamination area, site personnel will go to the nearest safe location and remove chemically-affected clothing there or, if possible, leave it near the Exclusion Zone. Personnel will assemble at the predetermined refuge following evacuation and decontamination. The SSHO, or designated representative, will count and identify site personnel to verify that all have been evacuated safely.

14.6 Spill of Hazardous Materials

If a hazardous material spill occurs, site personnel should locate the source of the spill and determine the hazard to the health and safety of site workers and the public. Attempts to stop or reduce the flow should only be performed if it can be done without risk to personnel.

Isolate the spill area and do not allow entry by unauthorized personnel. De-energize sources of ignition within 100 feet of the spill, including vehicle engines. Should a spill be of the nature or extent that it cannot be safely contained, or poses an imminent threat to human health or the environment, an emergency cleanup contractor will be called out as soon as possible. Spill containment measures listed below are examples of responses to spills.

- Right or rotate containers to stop the flow of liquids. This step may be accomplished as soon as the spill or leak occurs, providing it is safe to do so.
- Sorbent pads, booms, or adjacent soil may be used to dike or berm materials, subject to flow, and to solidify liquids.
- Sorbent pads, soil, or booms, if used, must be placed in appropriate containers after use, pending disposal.
- Contaminated tools and equipment shall be collected for subsequent cleaning or disposal.

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15. DOCUMENTATION

The implementation of the SSHP must be documented on the appropriate forms (see appendices) to verify employee participation and protection. In addition, the regulatory requirements must be met for recordkeeping on training, medical surveillance, injuries and illnesses, exposure monitoring, health risk information, and respirator fit-tests. Documentation of each Brown and Caldwell employee's health and safety records are maintained by the Health and Safety Data Manager in Walnut Creek, California for Brown and Caldwell.

Health and safety documentation and forms completed, as specified by this plan, are to be retained in the project file.

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ATTACHMENT A

Air Monitoring Form

Air Monitoring Form

Instructions: Complete this form immediately prior to project start.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Performing Air Monitoring: (Print and Sign):	Date:

Photo Ionization/Flame Ionization Detectors (PIDs/FIDs)

☐ PID ☐ FID	Manufacturer:	Model:	Serial #:
Initial Calibration Reading:		End-of-Use Calibration Reading:	
Calibration Standard/Concentration:			

Mini-RAM Dust Monitor

Manufacturer:	Model:	Serial #:
Zeroed in Z-Bag? ☐ Yes ☐ No		

Monitoring Data

Time	Location and Activity	PID/FID (ppm)	Mini-RAM (mg/m³)	Time	Location and Activity	PID/FID (ppm)	Mini-RAM (mg/m³)

ATTACHMENT B

Site Safety Checklist

Site Safety Checklist

Instructions: Complete this form immediately prior to project start.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Completing Checklist: (Print and Sign):	Date:

Yes	No	N/A		Yes	No	N/A	
☐	☐	☐	Written Health and Safety (H&S) Plan is on site?	☐	☐	☐	Respirators are available, properly cleaned, and stored?
☐	☐	☐	Addenda to the H&S Plan are documented on site?	☐	☐	☐	Overhead utilities do not present a hazard to equipt./personnel?
☐	☐	☐	H&S Plan information matches conditions/activities at the site?	☐	☐	☐	Traffic control measures have been implemented?
☐	☐	☐	H&S Plan read/signed by all site personnel, including visitors?	☐	☐	☐	Trenches and excavations are safe for entry?
☐	☐	☐	Daily tailgate H&S meetings have been held/documented?	☐	☐	☐	Soil Spoils are at least 2 feet from the edge of the excavation?
☐	☐	☐	Site personnel have required training and medical?	☐	☐	☐	Emergency/FA equipt. is on site as described in the H&S Plan?
☐	☐	☐	Air monitoring is performed/documented per the H&S Plan?	☐	☐	☐	Drinking water is readily available?
☐	☐	☐	Air monitoring equipment has been calibrated daily?	☐	☐	☐	Phone is readily available for emergency use?
☐	☐	☐	Site zones are set up and observed where appropriate?	☐	☐	☐	Utility locator has cleared subject locations?
☐	☐	☐	Access to the work area limited to authorized personnel?	☐	☐	☐	Proper drum and material handling techniques are used?
☐	☐	☐	Decontamination procedures followed/match the H&S Plan?	☐	☐	☐	Waste containers/drums are labeled appropriately?
☐	☐	☐	Decontamination stations (incl. hand/face wash) are set up and used?	☐	☐	☐	Ext. cords are grounded/protected from water/vehicle traffic?
☐	☐	☐	PPE used matches H&S Plan requirements?	☐	☐	☐	Tools and equipment are in good working order?
☐	☐	☐	Hearing protection used where appropriate?	☐	☐	☐	GFCIs used for portable electrical tools and equipment?

Notes

(All "no" answers must be addressed and corrected immediately. Note additional health and safety observations here):

ATTACHMENT C

H&S Plan Acknowledgement Form

H&S Plan Acknowledgement Form

Instructions: Complete this form immediately prior to project start or as new personnel join the project.

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Performing Briefing: (Print and Sign):	Date:

Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by Brown and Caldwell at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide Brown and Caldwell with a copy of their own H&S Plan for this project or other health and safety program documents for review.

Brown and Caldwell's Health and Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of Brown and Caldwell's own employees at the site. A copy of Brown and Caldwell's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, Brown and Caldwell's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on Brown and Caldwell's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the Brown and Caldwell H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date

ATTACHMENT D

Daily Tailgate Meeting Form

Daily Tailgate Meeting Form

Name of Project/Site:	Project No:
Project/Site Location:	
Employee Completing Form: (Print and Sign):	**Date:**

Employee Acknowledgement:

The following signatures indicate that these personnel have read and/or been briefed on this Health and Safety (H&S) Plan and understand the potential hazards/controls for the work to be performed.

Important Notice to Subcontractor(s):

Subcontractors are responsible for developing, maintaining, and implementing their own health and safety programs, policies, procedures and equipment as necessary to protect their workers, and others, from their activities. Subcontractors shall operate equipment in accordance with their standard operating procedures as well as manufacturer's specifications. Any project monitoring activities conducted by Brown and Caldwell at the Site shall not in any way relieve subcontractors of their critical obligation to monitor their operations and employees for the determination of exposure to hazards that may be present at the Site and to provide required guidance and protection. If requested, subcontractors will provide Brown and Caldwell with a copy of their own H&S Plan for this project or other health and safety program documents for review.

Brown and Caldwell's Health and Safety Plan has been prepared specifically for this project and is intended to address health and safety issues solely with respect to the activities of Brown and Caldwell's own employees at the site. A copy of Brown and Caldwell's H&S Plan may be provided to subcontractors in an effort to help them identify expected conditions at the site and general site hazards. The subcontractor shall remain responsible for identifying and evaluating hazards at the site as they pertain to their activities and for taking appropriate precautions. For example, Brown and Caldwell's H&S Plan does not address specific hazards associated with tasks and equipment that are particular to the subcontractor's scope of work and site activities. (e.g., operation of a drill rig, excavator, crane or other equipment). Subcontractors are not to rely on Brown and Caldwell's H&S Plan to identify all hazards that may be present at the Site. Subcontractor personnel are expected to comply fully with subcontractor's Health and Safety Plan and to observe the minimum safety guidelines applicable to their activities which may be identified in the Brown and Caldwell H&S Plan. Failure to do so may result in the removal of the subcontractor or any of the subcontractor's workers from the job site.

Print	Sign	Date	Print	Sign	Date

Plan of the Day

(Describe the activities that are planned to be performed today)

Potential Hazards and Topics Discussed

(Describe the potential hazards and controls that may be associated with planned activities)

☐ Electrical ☐ Chemical ☐ Biological ☐ Physical ☐ Other (specify):

ATTACHMENT E

Incident Investigation Report

Incident Investigation Report

Instructions:

If an accident or incident occurs, complete all applicable information in this form, make a copy for your records, and immediately forward the original to the office Health and Safety Coordinator (HSC). If fields are not applicable, indicate with "N/A". Use separate sheet(s) if necessary and attach sketches, photographs, or other information that may be helpful in understanding how the accident/incident occurred.
HSC – Review and enter report into the Brown and Caldwell Online Safety Observation and Incident Reporting System within 3 workdays of receipt. File original in appropriate office health and safety file.

NOTE:

This report is important – please take the time necessary to properly complete it. Incomplete reports will be forwarded to appropriate management for review and action.

General Information

Date of Accident/Incident	**Time of Accident/Incident:**	**Date Accident/Incident Reported:**	**To Whom:**
Exact Location of Accident/Incident (Street, City, State):			**Brown and Caldwell Office:**
Name Project:			**Project Number:**
Employee Completing the Investigation (Print and Sign):			**Date:**

Injured Employee/Property Damage Information

Employee Name:	**Employee No.**	**Department:**	**Phone Number:**
Job Title:		**Manager's Name and Phone Number:**	
Nature of Injury/Illness (laceration, contusion, strain, etc.):		**Body Part Affected** (arm, leg, head, hand, etc.):	
Describe Property Damage and Estimate Loss :			

Description of Accident/Incident

Describe the accident sequentially, beginning with the initiating event, and followed by secondary and tertiary events. End with the nature and extent of injury/damage. Name any object or substance and tell how they were included. Examples: 1) Employee was pulling utility cart that was loaded with wastepaper from office area to hallway. Wheel of utility cart caught against door casing. Bags of heavy wastepaper that were in cart fell to end of cart. Cart tipped over onto foot of employee. Right foot was crushed between utility cart and door casing, resulting in severe contusion to right foot of employee. 2) Employee was driving rental car from office to project site. Car struck icy section of road. Employee lost control of vehicle, which skidded across road into concrete abutment on side of road. Accident resulted in damage to right fender, tire, headlight, and grill.

Incident Investigation Report

Analysis of Accident Causes

Immediate Causes - Substandard Actions

What substandard actions caused or could have caused the accident/incident? State the actions on the part of the employee or others that contributed to the occurrence of the accident/incident. Examples: 1) Employee overloaded the utility cart with wastepaper. 2) Employee exceeded safe speed on icy road, and was inattentive to hazard.

Codes (check all that apply)

- ☐ 1. Operating equipment without authority
- ☐ 2. Failure to warn
- ☐ 3. Failure to secure
- ☐ 4. Operating at improper speed
- ☐ 5. Making safety devices inoperable
- ☐ 6. Removing safety devices
- ☐ 7. Using defective equipment
- ☐ 8. Using equipment improperly
- ☐ 9. Failure to use PPE properly
- ☐ 10. Improper loading
- ☐ 11. Improper placement
- ☐ 12. Improper lifting
- ☐ 13. Improper position for task
- ☐ 14. Servicing equipment in operation
- ☐ 15. Horseplay
- ☐ 16. Alcohol or drug influence
- ☐ 17. Other (specify)

Immediate Causes - Substandard Conditions

What substandard conditions caused or could have caused the accident/incident? State the conditions that existed at the time of the accident (the specific control factors that were or may have been the direct or immediate cause or causes of the accident). Examples: 1) Wheel of utility cart was worn and would not roll properly; utility cart was overloaded with wastepaper. 2) Road was covered with icy spots; weather was foggy.

Codes (check all that apply)

- ☐ 1. Inadequate guards or barriers
- ☐ 2. Inadequate or improper PPE
- ☐ 3. Defective tools, equipment, or materials
- ☐ 4. Congestion or restricted action
- ☐ 5. Inadequate earning system
- ☐ 6. Fire and explosion hazards
- ☐ 7. Poor housekeeping
- ☐ 8. Noise exposures
- ☐ 9. Radiation exposures
- ☐ 10. High or low temperature exposures
- ☐ 11. Inadequate or excess illumination
- ☐ 12. Inadequate ventilation
- ☐ 13. Hazardous environ. conditions (vapors, dusts, etc.)
- ☐ 14. Other (specify)

Basic Causes - Personal and Job Factors

What personal and/or job factors caused or could have caused the accident/incident? State the influencing factors or underlying causes, either conditions or actions or both, that contributed to the accident/incident. Examples: 1) Employee had not been instructed in overloading hazards. 2) Employee had not been trained in driving under winter conditions; company has no driver training program.

Codes (check all that apply)

Personal Factors

☐ 1. Inadequate capability ☐ 2. Lack of knowledge ☐ 3. Lack of skill ☐ 4. Improper motivation
☐ 5. Other
(specify):_____

Job Factors

☐ 1. Inadequate leadership/supervision ☐ 2. Inadequate engineering ☐ 3. Inadequate purchasing ☐ 4. Inadequate maintenance ☐ 5. Inadequate tools/equipment
☐ 6. Inadequate work standards/procedures ☐ 7. Inadequate Wear and tear ☐ 8. Abuse or misuse
☐ 9. Other (specify):

Remedial Actions

Describe the actions taken or planned to prevent recurrence of accident/incident - provide the implementation date and person responsible for any planned corrective action.. Examples: 1) Wheels of utility cart were replaced with larger size wheels; all carts were inspected for safe operation; employees were instructed in overloading hazards. 2) All project personnel were instructed at the safety training meeting on driving under hazardous conditions; driver training program will be implemented.

Codes (check all that apply)

Job Factors

☐ 1. Reinstruction of personnel involved ☐ 2. Reprimand of personnel involved ☐ 3. Temporary/permanent reassignment of personnel ☐ 4. Action to improve clean-up
☐ 5. Equipment repair or replacement ☐ 6. Improve design ☐ 7. Improve construction ☐ 8. Improve PPE ☐ 9. Install of safety guard or device ☐ 10. Work method change ☐ 11. Order use of safer materials ☐ 12. Regional Safety Unit Manager Review ☐ 13. Other (specify):

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ATTACHMENT F

Miscellaneous Health and Safety Information

CAL/OSHA HEAT ADVISORY

When employees work in hot conditions, employers must take special precautions in order to prevent heat illness. Heat illness can progress to heat stroke and be fatal, especially when emergency treatment is delayed. An effective approach to heat illness is vital to protecting the lives of California workers.

Employers of outdoor workers must comply with the new permanent heat illness prevention standard. This standard requires employers to take four simple steps that include shade, water, training and written procedures These can greatly reduce the risk of outdoor workers developing heat illness.

Heat illness results from a combination of factors including environmental temperature and humidity, direct radiant heat from the sun or other sources, air speed, and workload. Personal factors, such as age, weight, level of fitness, medical condition, use of medications and alcohol, and acclimatization affect how well the body deals with excess heat.

Heat Illness Risk Reduction

1. Recognize the Hazard.
There is no absolute cut-off below which work in heat is not a risk. With heavy work at high relative humidity or if workers are wearing protective clothing, even work at 70°F can present a risk. In the relative humidity levels often found in hot areas of California (20 to 40 percent) employers need to take some actions to effectively reduce heat illness risk when temperatures approach 80°F. At temperatures above 90°F, especially with heavy work, heat risk reduction needs to be a major concern. **It is especially important to be vigilant during periods of abnormally high heat.**

2. Water.
There must be an adequate supply of clean, cool, potable water. Employees who are working in the heat need to drink 4 eight-ounce glasses of water per hour, including at the start of the shift, in order to replace the water lost to sweat. For an eight-hour day this means employers must provide two or more gallons per person. Many people can be very dehydrated and not feel thirsty at all. Employees need ongoing encouragement to consume adequate water.

3. Shade and Rest Breaks.
Employers are required to provide shade for recovery periods when employees need relief from the heat. The direct heat of the sun can add as much as 15 degrees to the heat index. Heat illness occurs due to a combination of environmental and internal heat that cannot be adequately dissipated. Rest breaks are important to provide time for cooling and provide an opportunity to drink water. Breaks should be taken in cooler, shaded areas. Wide brimmed hats can also decrease the impact of direct heat.

Drink water frequently.
Avoid soda, alcohol and coffee.

4. Acclimatization.
People need time for their bodies to adjust to working in heat. This "acclimatization" is particularly important for employees (1) returning to work after a prolonged absence or recent illness, (2) recently moving from a cool to a hot climate, or (3) working during the beginning stages of a heat wave. For heavy work under extremely hot conditions, a period of 4 to 10 days of progressively increasing work time starting with about 2 hours work per day, though not required, is recommended. Also recommended, for less severe conditions at least the first 2 or 3 days of work in the heat should be limited to 2 to 4 hours. Monitor employees closely for signs and symptoms of heat illness, particularly when they have not been working in heat for the last few days or when a heat wave occurs.

5. Prompt Medical Attention.
Recognizing the symptoms of heat illness and providing an effective response requires promptly acting on early warning signs. Common early symptoms and signs of heat illness include headache, muscle cramps, and unusual fatigue. However, progression to more serious illness can be rapid and can include unusual behavior, nausea/vomiting, weakness, rapid pulse excessive sweating or hot dry skin, seizures, and fainting or loss of consciousness. **Any of these symptoms require immediate attention.**

Even early symptoms may indicate serious heat exposure. If first aid trained personnel are not immediately available on-site to make an assessment and workers show any abnormal response to the heat, you should call 911 immediately. Regardless of the worker's protests, no employee with any of the symptoms of possible serious heat illness noted above should be sent home or left unattended without medical assessment and authorization.

6. Training.
Supervisors and employees must be trained in the risks of heat illness and the proper measures to protect themselves and their co-workers. Training should include:
1. Why it is important to prevent heat illness
2. Procedures for acclimatization
3. The need to drink water frequently
4. The need to take breaks out of the heat
5. How to recognize the symptoms of heat illness
6. How to contact emergency services and how to effectively report the work location to 911
7. The importance of choosing water instead of soda or other caffeinated beverages and avoiding alcoholic beverages all together during high heat.

7. Written Procedures
Employers are required to put their heat illness prevention procedures, including employee training in writing. It is recommended this document be incorporated into the employers Injury and Illness Prevention Plan. Other recommended procedures include account for all your workers during and at the end of the work shift. Check the heat index prior to starting work each day. If the temperatures are high, consider beginning and ending your shifts early. If possible, work should be performed in the shade.

08/01/2006

Activity Hazard Analysis Summary

SITE SAFETY AND HEALTH PLAN

TASK: EXCAVATION OF SOIL

Date Prepared: _____
Project Location: Benicia Arsenal
Prepared By: _____
Job/Task: _Soil Excavation
Reviewed By: _____

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Identify the principal steps involved, <u>including the equipment and machinery to be used</u>, and the sequence of work activities	Analyze each principal step for its potential chemical/ toxicological, radiological, biological and physical hazards	Develop specific controls for each potential hazard. Also: • List inspection requirements for the equipment / machinery listed • Specify worker training requirements
1. Use of backhoe to dig soil 2. Use of dump truck to haul soil 3. Use of loader to backfill excavation.	<u>Chemical/Toxicological Hazards</u>: 1. Petroleum hydrocarbons 2. VOCs <u>Radiological Hazards</u>: None are known to exist <u>Biological Hazards:</u> 1. Rodents 2. Venomous insects 3. Mosquitoes 4. Spiders <u>Physical Hazards:</u> 1. Slip/trip/fall 2. Noise 3. Underground and overhead utilities 4. Being struck by or against a piece of equipment 5. Being caught by or between equipment 6. Cave-in of excavation walls 7. Heat stress	<u>Chemical/Toxicological Hazards:</u> 1. Follow the air monitoring requirements listed in Section 7.0 of the SSHP 2. Follow the personal protective equipment (PPE) requirements in Section 10.0 of the APP. <u>Radiological Hazards:</u> Not applicable <u>Biological Hazards:</u> 1. Wear Level D PPE at minimum 2. Do not attempt to feed or touch animals. Feces from some small mammals may contain diseases such as Hanta Virus. Avoid generating dust in the vicinity of rodent feces. 3. Avoid contact with insects and their hives. 4. Avoid mosquito bites by wearing long sleeved shirt and long pants. Apply insect repellent to clothes and/or skin (if FDA approved for topical use). 5. Avoid contact with spiders and scorpions and areas where they may hide. They favor dark

		hiding places. Inspect clothing and shoes before getting dressed. Wear gloves and safety shoes when working with lumbar, rocks, inspecting buildings, etc. <u>Physical Hazards:</u> 1. Be aware of uneven terrain and that brush and debris can conceal holes. Be careful when climbing in and out of heavy equipment as steps can become slick. 2. Wear hearing protection within 10 feet of operating equipment. 3. Ensure that the underground utility search has been conducted. Look up before raising the excavator arm. Maintain a minimum of 10' between excavator arm and overhead power lines. 4. Ensure that ground personnel stay out of the swing radius of the excavator; make eye contact with the operator prior to approaching; wear traffic safety vest. 5. Chock wheels of dump truck and try to park on level ground. 6. Refer to safety guidelines in Section 2.4.5 of the SSHP for excavation safety rules. 7. Refer to safety precautions in Section 2.5.2 for heat stress and safety rules.
Equipment List: Backhoe Dump Truck	<u>Training:</u> As part of Northstate Earth & Water's contractor management system, all equipment operators shall be trained and familiar with any equipment they will operate. Proof of such may be audited by Northstate Earth & Water without prior notice.	<u>Inspections:</u> Northstate Earth & Water requires contractors using equipment to perform a daily safety inspection. Equipment must be in good and safe operating condition, with any deficiencies identified and corrected, prior to use. Contractors may use their own inspection forms, or may ask for documentation assistance from American Integrated Services. Documentation must be available for audit.

Northstate
Earth and Water Inc.

PROJECT / EQUIPMENT SERVICE REPORT

JOB NAME: ____________________

JOB NUMBER: ____________________

Date	Name	Equipment (No. or Size)	Hr's	Service Descrip.	Repairs Needed	Dated Repaired	Notes

Northstate
Earth and Water Inc.

Excavation and Trenching Checklist

Date: _____

Job Name/Number: _____ **Location:** _____

Work Scope/Work Assignments: _____

Site / Job Assessment	Yes	No	Describe
Soil Type Assessed *			(e.g. Stable Rock, Type A, B or C)
Entry Required (Purpose?)			
Depth > 5 feet BGS			
Water Present in Excavation			
Adequate Access			
Adequate Egress			
Surface Encumbrances			
Exposure to Vehicle Traffic			
Adjacent Structures			
Heavy Equipment Operating Near Excavation			
Is Excavation Considered Confined Space			
Atmospheric Testing Required Type			
Confined Space Permit Required			
Confined Space Rescue Personnel On Site			
Hot Work Permit Required			
Benching / Shoring / Sheilding Required (Type)			

* As Described on pages 8 - 10 of the Excavation and Trenching section of HASP

Competant Person

Name	Signature	Date

Northstate
Earth and Water Inc.

Date
Project Location ACOE Benica Arsenal
Description of Work PCS Excavation

Job Task and Steps	Potential Hazards	Mitigation of Potential Hazards	Responsible Person (s)
Contaminated Soil Excavation, Loading, Disposal and Site Restoration.	**Physical Hazards:** 1 Slip/Trip /Fall 2. Noise 3. Existing Utilities 4. Injury by Heavy Equipment 5. Excavation Cave-In 6. Heat Stress	**1.** Be mindful of trench excavations at all times. Install exclusionary fences / trench plates (as necessary) to exclude public from excavation area. **2.** Use of hearing protection to follow SSHASP, earplug/muffs worn in noise conditions above 85 decibels. **3.** A USA locate will be requested one week prior to beginning any site work. A private locator may be utilized to locate any underground utilities on site property. A spotter may be utilized when working near over head utilities. **4.** Ground personnel must be aware of heavy equipment at all times. Always keep eye contact with equipment operator when entering equipment work area. High visibility clothing is required on site at all times. Excavator bucket will be placed on ground when not in use, parking brakes (if applicable) will be set on trucks/ equipment when not in use Wheels will be chocked on dump trucks, when parked on incline. **5.** Benching/inclining/shoring will be utilized on excavations deeper than 5-ft BGS. A NSEW Excavation Checklist will be completed prior to beginning work (see attached). **6.** Follow SSHASP, take work and hydration breaks as necessary.	Michael Fitzgerald - NSEW Chuck Frey - B and C
	Chemical Hazards: Petroleum Hydrocarbons and associated Volatile Organic Compounds	Air Monitoring as per B and C's SSHP. Proper use and level of PPE as required from air monitoring. See Toxicity of Chemicals of Concern in SSHASP.	Michael Fitzgerald - NSEW Chuck Frey - B and C
	Biological Hazards: 1 Rodents 2 Stinging/venomous insects/spiders	animals, avoid feces of animals, avoid generating/breathing dust where rodent feces is. **2.** Avoid areas where insects/ spiders live e.g. under rocks, boards etc. Avoid insect hives/nests, if present. Where approved insect/mosquito repellant, if necessary.	Michael Fitzgerald - NSEW Chuck Frey - B and C
Equipment Utilized: Hydraulic Excavator JD 210 Skip loader 10-wheel dump truck w/trailer	**Training:** All equipment operator have minimum of 5-years experience on the equipment they are operating. All operators are trained on equipment as part of NSEWs contractor management system.	**Inspections:** Daily equipment inspections are performed on all equipment (see attached log)	

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Comment No.	Page/ Section	Agency Comments	Response to Comments
Ross Steenson, RWQCB Project Manager, General Comments, August 28, 2009			
1.	General #1	Overall Site Cleanup Process – I did not find a reference or recommendation for the proposed soil removal action in the previous technical reports. It is unclear how this document fits into the overall site cleanup process. Please add a description of the overall site cleanup process, how this document fits into that process, and the subsequent steps in the background section of the Draft Final Work Plan.	As mentioned in Section 1.4 of the Work Plan, the Human Health Risk Assessment (HHRA) was performed by USACE for all sites solely based on past DoD activities. These 2 sites indicated potential risks and the USACE has selected an active remedy in the form of this removal action. Once completed, this part of the project will end and the remainder of the site cleanup process will be addressed within the PRP evaluation process.
2.	General #2	Future Site Use – The proposed cleanup goals are based on commercial/industrial use, but there is no description of the future planned use of the site or appropriate land use controls. This information should be presented in the text to support the use of the proposed cleanup goals.	In the industrial area, where Building 161 UST is located, USACE is cleaning up the site to current land use – which is commercial/industrial. This portion of the site will be part of the PRP evaluation process where any follow-up cleanup actions will dictate future land use controls, if warranted. At Building 51, land use controls are not necessary because arsenic in soil will be cleaned up to the ambient concentration limit of 12.9 mg/kg (Ambient Concentrations of Metals in Soil [Brown and Caldwell, 2006]). Note: There was an error on Table 3-1. The cleanup goal for arsenic is the ambient concentration limit (12.9 mg/kg) which occurs in the area at concentrations higher than industrial or residential PRGs (1.6 mg/kg and 0.39 mg/kg, respectively).

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3.	General #3	Adequacy of Site Characterization – Based on my review of the data presented on Figure 2-1 (Arsenic Soil Concentrations at Building 51), Figure 2-2 (Dibenzo[a,h]Anthracene and Diesel Range Hydrocarbons Soil Concentrations at Building 161 UST), and Figure 2-3 (PCB-1254 [Aroclor 1254] Soil Concentrations at Building 161 UST), it appears that there are limited data in the vicinity of the proposed excavations. Do these figures also present the locations where the target constituents were tested but not detected? If not, these figures should be revised to present this information. Also, provide adequate justification that further characterization is not necessary.	These figures present all the data collected for the constituents of concern (COCs) included in this removal action. The rationale and reasons of sampling was biased to the source locations as presented in various site investigation reports for these sites. As mentioned in Section 3, Sampling and Analysis Plan, the impacted area will be delineated such that any hot spots are identified and removed.
3.	General #4	Selection of Screening Criteria – Please include a description of the screening criteria selection process including which exposure pathways are addressed. Given the presence of volatile organic compounds (VOCs) in the Building 161 area, the collection of soil gas samples and evaluation of the vapor intrusion pathway are necessary. In addition, the criteria currently selected exclude the drinking water pathway. Either provide a justification for exclusion of this pathway or include this pathway. Lastly, the Regional Water Board's environmental	The HHRA receptors and exposure pathways used are provided on Table 1-6 in the Work Plan. For the industrial worker, which applies to these sites, risks and hazards posed by indoor air were not performed for industrial receptors because USEPA does not have current guidance[1]. As mentioned above, once this removal action is performed this site and others in the industrial area will be moving into a PRP evaluation phase. The PRP evulation phase includes DoD and post-Army use COCs identified, like VOCs. Therefore, no

[1] USACE, 2008. Draft Final Human Health Risk Assessment Report; Benicia Arsenal, Formerly Used Defense Site (FUDS) Benicia, California.

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		screening levels (ESLs) underwent a minor revision in May 2008. Some of the criteria presented do not appear to be current. The criteria in the text and tables should be reviewed and the evaluations updated as necessary.	additional investigation is planned at this time. The recent updated ESLs were reviewed against sample results. The same samples indicated in the Work Plan exceed their respective screening levels with one additional sample. Dimethyl phthalate reported in sample B051HP001 at a depth of 0.5 to 1.0 feet bgs exceeds the May 2008 ESL of 0.035 mg/kg. Phthalates are wildly used as plasticizers, primarily in the production of polyvinyl chloride (PVC) resins. Plasticizers are added to synthetic plastic resins to impart flexibility to the finished product, improve workability during fabrication and extend or modify properties not present in the original resins. Historical records for the Arsenal do not indicate any DoD related sources that used or manufactured items composed of phthalates. Therefore, the occurrence of these phthalates is from a post Army source.

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Comment No.	Page/ Section	Agency Comments	Response to Comments
Ross Steenson, RWQCB Project Manager, Specific Comments, August 28, 2009			
1	Section 1.2.3, page 1-4; Figure 1-2	Please include a brief description of the other areas (M, R, S, and W) either in the text or on Figure 1-2. It would be helpful to have the locations of Building 51 and Building 161 illustrated on this figure.	The locations of Building 51 and the Building 161 UST have been added to Figure 1-2.
2.	Section 1.3.1 (Building 51), pages 1-6 and 1-7	Please provide sufficient background information for the reader to understand which constituents have been tested in the vicinity of this building. Unless there is a data quality issue with the elevated concentration of lead detected in soil, that sample result should be carried forward in the analysis rather than dismissed. It is not uncommon to detect widely ranging concentrations of lead in samples from fill soil that are in close proximity to each other. On page 1-7, please provide the rationale for why the lower arsenic concentration result was chosen for presentation in the Expanded Site Addendum Report.	During the Expanded SI[2], samples were collected at former drum storage/maintenance area at Building 51 to determine if former DoD activities impacted the near surface and subsurface soil from a possible surface release of fuels and solvents. Other COIs investigated were PAHs, semi-volatile organics and metals. Additional investigation was performed during the Expanded SI Addendum[3] to determine the lateral and vertical extent of lead and PAHS in soil. Details about these investigations can be found in those reports. Lead reported in the duplicate sample was found in the same area as the planned removal action. Therefore, it will be removed along with the arsenic found in the soil. Presentation of the lower arsenic concentration in the Expanded SI Addendum report was an oversight.

[2] Brown and Caldwell, 2005. Expanded Site Inspection Report for the Benicia Arsenal. September.
[3] Brown and Caldwell, 2008. Expanded Site Inspection Addendum Report for the Benicia Arsenal. July.

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Comment No.	Page/ Section	Agency Comments	Response to Comments
3.	Section 1.3.1 (Building 51)	Presentation of Groundwater Data - This section does not clearly present information regarding the groundwater sampling results. Please indicate which constituents were tested in groundwater samples and which constituents were detected as well as which constituents were detected above the appropriate screening criteria.	Building 51 is located in the highlands of the former Arsenal. Based on the Conceptual Hydrogeologic Model[4], groundwater is expected deep within the fractured bedrock. There have been numerous studies, especially by the Army, in the search of groundwater all over the Arsenal. The compilation of this information is provided in the Conceptual Hydrogeologic Model for the Benicia Arsenal (Brown and Caldwell, 2005). In summary, shallow groundwater can be found in the foothills of the Arsenal, where alluvial material (generally < 50 feet thick) is present or on the mud flats near the Carquinez Strait. Building 51 is not located in one of these valleys or on the mud flats. It is located on the overlooking foothills. Drilling for groundwater has been conducted in the foothills for deeper groundwater and was encountered at depths of hundreds of feet. Because of the depth to groundwater in areas like Building 51 is hundreds of feet deep, there is no threat to groundwater based on the minimal concentrations found in the fractured sandstone. Therefore, groundwater sampling was not an exposure pathway and sampling was attempted.

[4] Brown and Caldwell, 2005. Conceptual Hydrogeologic Model for the Benicia Arsenal. July

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Comment No.	Page/ Section	Agency Comments	Response to Comments
4.	Figure 2-3 (PCB-1254 [Aroclor 1254] Soil Concentrations at Building 161 UST)	Although this figure is labeled as presenting soil data, there are data presented in units of micrograms per liter for locations B161GB005, B161GB006, and B161GB008. Please clarify if these data are groundwater data and adjust the figure as appropriate.	This figure will be corrected to remove the groundwater results (reported in micrograms per liter). Additionally, the "<" sign was inadvertently left off the majority of the PCB-1254 results. The **bolded** value of 1.1 mg/kg PCB-1254 is correct at B161GB005.
5.	Section 2.1.2 (Protection of the Public and the Site), page 2-1	Appendix A - Accident Prevention Plan - Please specify what measures that the Army Corps of Engineers and its contractors anticipate will be implemented to protect those persons in the general vicinity of the excavations. Are there any buildings or areas in use near the planned excavations? Per the Accident Prevention Plan, it appears that real-time air monitoring will be performed at the excavations for protection of remediation workers. Will monitoring be performed beyond the immediate work area? It appears that aerosol (dust) monitoring will be performed, but no action limits are specified for dust. Please clarify this section of the Draft Work Plan text and provide adequate justification if no monitoring beyond the work area is planned.	At Building 51, there is shed that will be removed, if necessary. The building will be close to the excavation but its total depth is 1 foot deep so there is no threat of structural problems. At Building 161 UST, the closest building is Building 91A, shown on Figures 2-2 and 2-3, which is approximately 75 feet from the planned excavation. Monitoring beyond the work area was not planned based on the low concentrations in soil expected (Section 2.1 of the SSHP). Action limits are provided in Section 7.2 of the Site Safety and Health Plan (Appendix A to the APP).

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Comment No.	Page/ Section	Agency Comments	Response to Comments
6.	Section 2.1.3 (Surveying), page 2-1	The document indicates that the areas to be excavated will be delineated using a Global Positioning System (GPS) unit. Please indicate how vertical control of the excavation will be achieved, and how the final excavation boundaries (lateral and vertical) will be surveyed and to what datum(s). If the GPS unit is to be used, please provide information on horizontal and vertical location accuracy.	The GPS unit used for the project will have a vertical accuracy of 2 meters (NAV88 datum) and sub-meter of horizontal accuracy (NAD83 datum). In addition to using the GPS, final excavation boundaries and depth of the excavation along the sides will be measured using a flat tape. Excavation boundaries will be measured relative to existing buildings.
7.	Section 2.6.1 (Backfilling), page 2-7	Please state how the backfill material will be tested, including the specific analytes and estimated frequency of sampling. For instance, will the DTSC October 2001 Information Advisory – Clean Imported Fill Material be followed?	Backfill material will be tested with the DTSC advisory document as a guide.
8.	Section 3.1 (Characterization Sampling and Analysis) and Section 3.2 (Confirmation Sampling and Analysis), page 3-1	Soil sampling for volatiles analysis (VOCs and gasoline-range organics) should be performed in such a way to minimize the potential for volatilization of constituents. Collection of samples into jars likely would volatilize constituents more readily than collection using a drive sampler, and therefore should be avoided.	Agreed. Soil confirmation sampling will be performed using a drive sampler. The text will be changed.

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9.	Section 3.2 (Confirmation Sampling and Analysis), page 3-1	For excavations deeper than 3 feet, such as the excavation proposed at Building 161, I recommend collecting one sidewall sample for each 3 vertical feet of excavation. Given the paucity of characterization data, this appears particularly appropriate. Although the excavations are small, should they be expanded, I recommend one sidewall sampling location for every 20 lateral feet, and one base sample per every 400 square feet.	Your recommendations will be implemented if the excavation is expanded.
10.	Table 3-1 (Cleanup Goals for Confirmation Sampling), page 3-2	Regarding the proposed PCB cleanup goal, see General Comment #4. Typically for arsenic, ambient concentrations exceed risk-based screening criteria. If an ambient arsenic concentration is available from the document referenced in Table 1-3, incorporate that into Table 1-3 and consider revising the cleanup goal as appropriate.	Agreed. See response to General Comment #2.

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Carolyn Tatoian-Cain, Dept. of Toxic Substances Control—Comments, September 9, 2009			
1.	General	DTSC recommends USACE provide on-site active ordnance construction support.	The figure provided with this comment shows that this property is on the edge of the "OB/OD ranges." USACE reviewed documents, including the Records Research Report (Jacobs, 1999), the Archive Search Report (USACE, 1994), the Supplement to the Archive Search Report (USACE, 1997), and the Ordnance and Explosives Removal Action (EODT, 2001). There is no evidence to suggest that this property would contain Munitions and Explosives of concern (MEC). However, as a precaution, USACE will provide UXO-qualified personnel to survey the area prior to excavation.