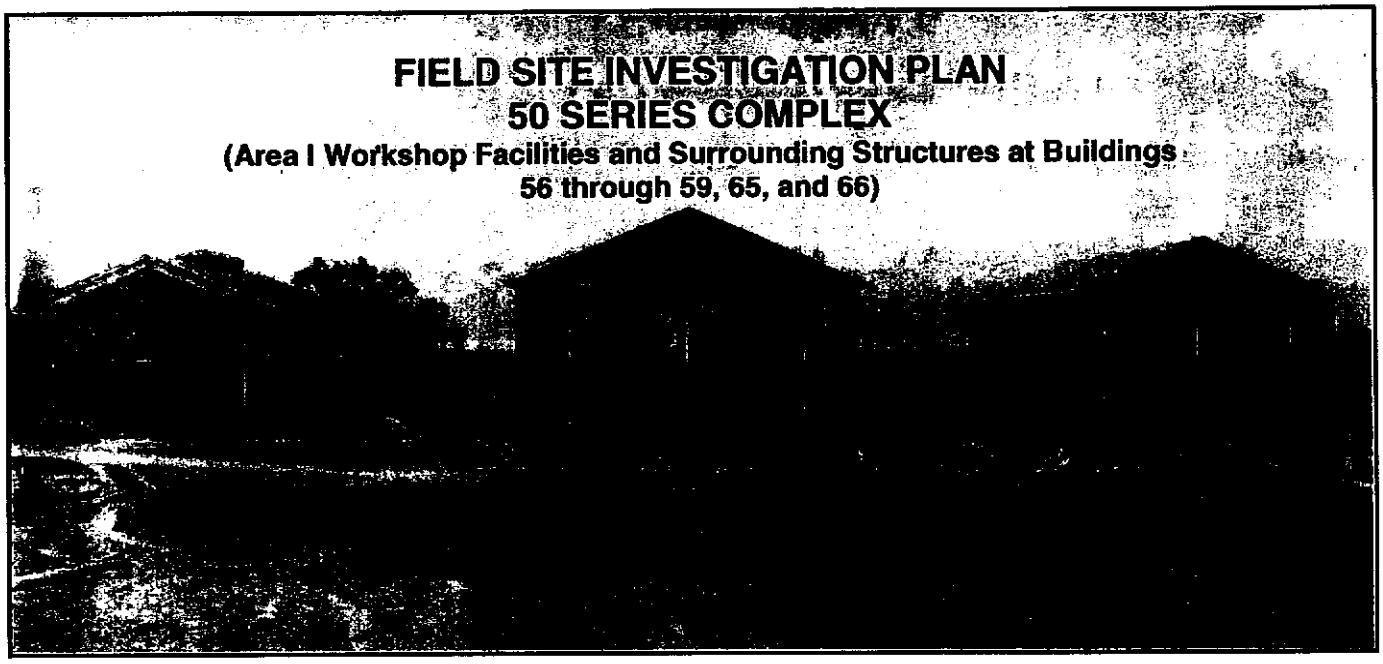

FIELD SITE INVESTIGATION PLAN
50 SERIES COMPLEX
(Area I Workshop Facilities and Surrounding Structures at Buildings 56 through 59, 65, and 66)

for
Environmental Investigation at the Formerly Used Defense Site (FUDS)
at the Benicia Arsenal
Benicia, California

FUDS Site Number: J09CA075600

Prepared for:

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UNITED STATES ARMY ENGINEER DISTRICT, SACRAMENTO DISTRICT
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August 1999

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DACW05-97-D-0035

Field Site Investigation Plan

for

50 Series Complex

(Area I Workshop Facilities and Surrounding Structures at Buildings 55 through 59, 65, and 66)

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LIST OF ACRONYMS

BC	Brown and Caldwell
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
COPC	chemicals of potential concern
DoD	Department of Defense
DOT	Department of Transportation
DQCR	data quality control report
DQO	data quality objective
EMLL	electromagnetic line locating
EPA	Environmental Protection Agency
FA/BC	Forsgren Associates/Brown and Caldwell
FSIP	field site investigation plan
FTL	field team leader
FTM	field team member
FUDS	Formerly Used Defense Site
GPR	ground penetrating radar
IDW	investigation derived waste
MS/MSD	matrix spike/matrix spike duplicate
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
PjM	project manager
PPE	personal protective equipment
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
QCR	quality control report
QCSM	quality control systems manager
QCSR	quality control summary report
RCRA	Resource Conservation Recovery Act
RRR	Records Research Report
SOP	standard operating procedure
SSHP	site safety and health plan
SSO	site safety officer
STLC	soluble threshold limit concentration
SVOC	semivolatile organic compound
TCE	trichloroethene
TDS	total dissolved solids
TOC	total organic carbon
TOMs	task order managers
TPH	total petroleum hydrocarbons
TTLC	total threshold limit concentration
USACE	United States Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic compound
XRF	X-Ray Florescence

EXECUTIVE SUMMARY

This Field Site Investigation Plan (FSIP) for Workshop Facilities and Surrounding Structures at the 50 Series Complex (Area I Workshop Facilities and Surrounding Structures at Buildings 55 through 59, 65 and 66) has been prepared for use in conducting Formerly Used Defense Site (FUDS) program investigation activities at the Benicia Arsenal (Arsenal). This FSIP contains site-specific information about the investigation and is to be used together with the Arsenal-wide Investigation Workplan (Workplan) and the February 1999 Quality Assurance Project Plan (QAPP) (Workplan, Brown and Caldwell [BC], 1999a and QAPP, BC, 1999b). This FSIP details the site specific proposed sampling design, field and analytical methods, investigation derived waste, quality assurance/quality control (QA/QC) procedures, and references. This document has been established to comply with both CERCLA and RCRA requirements, as appropriate, for hazardous and toxic waste cleanup actions, as well as the latest FUDS and United States Army Corps of Engineers (USACE) guidance documents in order to promote consistency and comparability of all activities, and to assure defensible data collection and production.

The goal of activities described in this FSIP is to ascertain whether soil or groundwater contamination resulting from past Department of Defense (DoD) use of the workshop facilities and surrounding structures may still be present. This goal will be achieved by investigation activities including geophysical surveys, trenching, soil and groundwater sampling, and soil and groundwater chemical analysis. Data collected during these activities will be used to assess if 1) no further action under FUDS is required; 2) if further investigation is necessary; or 3) if remedial action is necessary.

This FSIP was developed using the general rapid characterization approaches to investigate various use categories as outlined in Section 5 of the Workplan for the Benicia Arsenal (BC, 1999a). Using relevant information found in the Records Research Report (RRR) (RRR, Jacobs Engineering [Jacobs], 1999) and site visits, data quality objectives were developed, chemicals of potential concern (COPC) were selected, and sample locations and analyte lists prepared. This FSIP presents the results of this process.

SECTION 1. PROJECT ORGANIZATION

This section of the FSIP presents the specific personnel that will be responsible for the field site investigation of the 50 Series Complex. Staff include Program Management team consisting of the Project Manager (PjM), the Task Order Manager (TOM), the Quality Control Systems Manager (QCSM), the Project Chemist, field team members (FTMs), and several subcontractors. Figure I5-1 presents the organization chart for this project and includes specific project responsibilities.

SECTION 2. PROBLEM DEFINITION AND BACKGROUND

Based on information collected for the RRR (RRR, Jacobs, 1999), the 50 Series Complex has a long and complicated history beginning in 1876 and including the construction of as many as 16 buildings and features. The problem to be addressed in this investigation is to ascertain whether soil or groundwater contamination resulting from past DoD activities at the 50 Series Complex may still be present. Data collected from this investigation will then be used to assess if no further action under FUDS is warranted, or if additional investigation or remedial action may be necessary.

2.1 Site Location and Description

The 50 Series Complex is located in the central portion of Area I and was originally constructed as three separate workshop

buildings (Building 55, 56, and 57) between 1876 and 1884 (Figure I5-2 and Photo B55-56-57). These buildings underwent many remodeling phases including the addition of eight buildings (55A, 56A, 56B, 56C, 57A, 57B, 57C and 65(B)) and the removal and relocation of three buildings - 59, 65 and 66. Additionally, a smoke stack/incinerator and suspected fuel oil underground storage tanks (USTs) were associated with the facilities.

Photo B55-56-57. Looking south at Buildings 55, 56 and 57, circa 1900.

During the numerous remodeling phases for the workshop facilities, several buildings (Buildings 59, 65 and 66) were moved (Jacobs Engineering, 1998). The first recorded locations of these buildings are shown on Figure I5-2 and designated by "(A)," (i.e., Building 59(A)). Buildings 59 and 65 were moved to other locations still within the workshop facility complex.

The existing locations of Buildings 59 and 65 are designated by "(B)" on Figure I5-2. Former Building 66 was moved to another location not shown on Figure I5-2. In general, when the buildings were moved their purpose and use also changed. Those buildings that have remained in their same location since construction also typically had multiple uses over their lifetime. As a result, buildings within the workshop facilities are not categorized by usage.

Currently, the 50 Series Complex consists of 11 interconnected buildings: Buildings 55, 55A, 56, 56A, 56B, 56C, 57, 57A, 57B, 57C and 65 (Figure I5-2), which are owned by Mr. Gordon Potter. The 50 Series Complex stands on the southern slope of a low-lying hill. In general, the northern portion of the 50 Series Complex was constructed on the crest of the hill, and the southern portion of the complex (mainly 56A) was constructed at the base of the hill. The northern and southern portions of the complex were constructed as concrete slab on grade, which as a result of the sloping ground, appears to be more than 3 feet thick at the southern end. The center portion of the complex was constructed with wood flooring over an unfinished basement. The height of the basement ranges from 7 feet to less than a foot. Figure I5-2 presents a cross section of the west wall of Buildings 56 and 56A, the ground slope beneath Buildings 56 and 56A, and basement of Building 56A.

2.2 Site Geology and Hydrogeology

The 50 Series Complex is located near the center of Area I on a low-lying hill. The hill is formed by a small outcropping of bedrock that can be observed just east of Building 56A. Bedrock in the area consists of southwesterly, steeply dipping beds of massive sandstone, siltstone, and shale from the Martinez Formation. These beds account for the rise in elevation described previously. The Martinez Formation includes marine-derived sandstone interbedded with thin fossiliferous shale. Occasional thick beds of a well-cemented pebbly conglomerate occur throughout the formation. Soil covering these bedrock units is expected to vary in thickness from several inches to several feet.

Areas immediately surrounding the 50 Series Complex hill consist of alluvium and fill material that overlay the Martinez Formation Bedrock. Alluvial material may range from just a few feet to more than 80 feet thick and is derived from bedrock formations of the surrounding hills. Low-lying areas to the south and west of the 50 Series Complex were previously marshland

that was filled in during development of the Arsenal. Shallow water within the alluvium is believed to exist at an elevation approximately equal to the elevation of water in the Carquinez Strait. At the time of this report, specific water quality data are not available. However, the water is most likely brackish and is believed to be less than 10 feet bgs in the vicinity of the 50 Series Complex.

2.3 Site History and Historical Use

Historical use of the workshop facilities reportedly included small arms renovation shops, ammunition handling and storage, blacksmith/welding shops, a leather and canvas shop, and small arms firing ranges. Facilities included boilers, acid baths, dip tanks, continuous degreasers using trichloroethene (TCE) and other solvents, fuel oil USTs, aboveground tank or boiler stand, and one known aboveground tank. Table I5-1 summarizes background information for each of the 11 buildings and their associated features. Features observed during site visits and on historical maps that may identify the location of former activities are presented on Figure I5-3 (ground floor) and Figure I5-4 (basement area). A description of uses associated with each building and the features that will be the focus of investigation activities is presented in Section 2 of the RRR Volume 1 beginning on page 2I-16 (RRR, Jacobs, 1999).

2.4 Previous Investigation in Building 57A

Building 57A was investigated in 1994 by its present owner, Mr. Gordon Potter. Mr. Potter was required to perform the investigation for a bank loan submittal. As part of the investigation, soil samples were collected from various depths and locations near the former concrete vats for analysis. Test results from the field investigation first identified TCE in soil beneath Building 56A. Figure I5-5 presents the results from this investigation. Table I5-2 presents the chemicals that have been identified to-date at Building 57A.

SECTION 3. PROJECT DESCRIPTION

Previous investigations of the 50 Series Complex have generated only limited environmental data for metals and solvents in soil. These limited data do not indicate the maximum concentration or extent of solvent or metals contamination at the workshop buildings. No data are available for other COPCs in the area. In addition, the potential presence of the two underground cisterns, USTs, and associated piping has not been positively determined. The field work designed to obtain this information includes:

- A geophysical survey to assess the shallow subsurface for potential underground features such as cisterns, USTs and associated piping; to identify subsurface utilities; and to clear invasive investigation locations.

- Soil and groundwater sampling to determine the presence, absence, nature, and/or location of any DoD related contamination.

3.1 Project Schedule

Field activities described in this FSIP will begin approximately 3 weeks after this document is finalized. Once field activities begin, the 50 Series Complex investigation will be conducted in a sequence that enables project personnel to refine the scope of work as new data are collected. In general, non-invasive activities will be conducted first, followed by invasive activities. The initial step will be to conduct the geophysical survey inside and outside the buildings to better define targets and clear drilling locations. The initial invasive activity will be to drill, collect soil and Hydropunch® groundwater samples, and install static water level measuring points in the three perimeter soil borings. Perimeter

borings will provide data on lithology and depth to water that will be useful in later investigation activities. Indoor soil boring and sampling activities that can be reached by limited access drilling equipment will be conducted next, followed by sampling activities in locations that must be accessed by hand equipment.

SECTION 4. DATA QUALITY OBJECTIVES

The Data Quality Objectives for this field investigation are presented in Table I5-3. The USACE Data Quality Objective Guidance worksheet was used to generate Table I5-3.

SECTION 5. SAMPLE PROCESS DESIGN

This section presents the rationale and design for data collection and sampling, sample types and matrices, and sampling frequencies to be conducted at the 50 Series Complex. The goal of the investigation is to assess if former DoD activities have resulted in soil or groundwater contamination. Specific sampling activities planned for the 50 Series Complex include a geophysical survey, soil sampling, groundwater sampling, and soil gas sampling. These activities focus on historical and observed features that have the highest potential for contaminating soil and groundwater at the site.

The rationale for each sampling method and location are summarized below. Sample locations are shown on Figures I5-6, I5-7 and I5-8.

5.1 Geophysical Survey

A geophysical survey will be conducted in the area immediately in and around the workshop facilities using terrain conductivity, ground penetrating radar, and electromagnetic line locating methods. The entire perimeter will be surveyed to identify potential subsurface structures that may be related to former DoD activities at the 50 Series Complex. An indoor survey primarily consisting of ground penetrating radar and electromagnetic line locating will address specific features or areas and be used to clear investigation locations for subsurface obstructions. The following areas will be surveyed:

- The courtyard adjacent to Building 65 will be surveyed for the presence of fuel lines and USTs that supplied the two boilers.
- The 20-foot-wide by 30-feet-long sections of the western, northern, and southern perimeters of Building 120 will be surveyed for the presence of fuel lines and USTs.
- The perimeter of the complex will be surveyed for 20 feet in all directions to locate the two or more underground cisterns, identify underground utilities, and clear the areas proposed for soil borings.
- The interior of Building 57A will be surveyed to determine if dip tanks still exist below the gravel areas and to help determine where the 18-inch pipe at the southern end of the building leads.
- The hallway and entryway of the ground floor of Building 56A will be surveyed to evaluate the thickness of the concrete slab for possible sampling activities.
- The interior of most buildings will be evaluated in order to determine boring locations and potential to avoid underground piping and utilities.

5.2 Subsurface Investigation

Subsurface investigation activities within the 50 Series Complex will include conducting hand auger borings and soil borings, and collecting soil, soil gas, and groundwater

samples using Hydropunch®. Table I5-4 summarizes commonly used substances identified during site visits and in the RRR that are reported to have been used in the 50 Series Complex (RRR, Jacobs, 1999). This table also correlates each substance with an analytical method that will be used to assess if the substance is present. Table I5-5 presents specific sampling and analysis activities that will be conducted to evaluate the substances presented in Table I5-4. Parameters for each location were selected using the rapid site characterization approach as a guide (see Workplan Chapter 5) along with site specific historical records and information collected during site visits (Workplan, BC, 1999a). Additionally, Table I5-5 presents the purpose of each sampling location and sampling methods to be utilized at each location. The purpose of these activities is to assess the nature and extent of potential impacts from DoD uses.

In addition to soil, soil gas, and groundwater sampling, three soil borings will be completed as temporary water level measurement points. A brief description of each type of investigation activity is presented below.

Hand Auger Soil Borings. Approximately 24 hand auger borings will be conducted to shallow depths, typically 5 feet and less bgs. The purpose of hand auger borings is to collect shallow soil samples from areas of limited access, especially basement areas. Soil samples from hand auger borings will be collected 0, 3, and/or 5 feet bgs, with the majority of the samples at 0 and 5 feet. Sampling intervals at 0 and 5 feet bgs are designed to focus data collection activities on shallow soil intervals because features identified in the RRR (RRR, Jacobs, 1999) and/or site visits appear to be surface or near surface. A 3-foot sample will be collected instead of a 5-foot sample in the area of the Small Arms Firing Range beneath Building 57A to further focus on possible near-surface metal contamination.

Soil Borings. Approximately eight soil borings advanced by either hollow stem auger or direct push methods will be conducted to depths of greater than 10 feet. A hollow stem auger rig will typically be used in areas outside the buildings. A direct push rig will typically be used for areas inside buildings with limited access for drilling equipment. The purpose of soil borings is to collect statigraphic data and soil samples. Soil borings will typically be advanced 10 to 20 feet bgs with the exception of boring B057AHP003 which will be advanced to bedrock to obtain stratigraphic data. Borings may extend deeper than originally planned based on the lithology encountered, the depth to groundwater, or based on data from field instrumentation. A continuous core will be obtained from each perimeter borehole. The purpose of collecting the core is to evaluate the subsurface stratigraphy and soil types located in the vicinity of the 50 Series Complex. Where previous data indicate contamination at depth or where features appear to be subsurface, samples will be collected at 5, 10 and 20 feet bgs.

Hydropunch®. Approximately eight groundwater samples will be collected by Hydropunch® in areas of previously documented impacts (Building 57A) and in selected workshop facilities perimeter locations. The purpose of Hydropunch® sampling is to collect a one-time groundwater sample. The sample will be used to obtain information on groundwater impacts from previous facility use.

Soil Gas. Approximately 14 soil gas samples will be collected in shallow soils beneath the floors of the 50 Series Complex. The purpose of soil gas sampling and analysis is to evaluate areas where VOCs in soil gas below the building have potential to impact current indoor air quality, which may pose a risk to building occupants.

Static Water Level Measuring Points. Three static water level measuring points will be installed in three soil borings outside the workshop facility buildings. The purpose of these points is to obtain water level elevations, flow direction data, and to provide temporary locations for groundwater chemistry sampling. Water level monitoring points will be installed in 8-inch diameter boreholes, and constructed of 2-inch diameter screen and blank casing. Screen intervals will be installed 10 feet below and 5 feet above the water table. Screen size and filter pack material will be determined based on soil materials encountered in the soil borings.

5.3 Investigation Locations

The locations of proposed sampling activities for the 50 Series Complex are shown on Figures I5-6, I5-7 and I5-8. Sample locations for this investigation have been selected to address specific features identified during the RRR (RRR, Jacobs, 1999) or site visits. Specific sampling locations, the rationale, sampling method, and the recommended analyses are presented in Table I5-5 and described below.

Utility Tunnel. A utility tunnel in the basement area runs the length of the 50 Series Complex from Building 55 to Building 57 (Figure I5-7). This tunnel passes underneath the wooden floors of the Blacksmith Shop in Building 55, the Machine, Leather, Canvas, Small Arms and Welding Shops in Building 56, the Parkerizing Room in Building 57A, and the Small Arms Shop in Buildings 57 and 57B. Processes in all of these buildings used liquid chemicals. No background information regarding impact to soils in the utility tunnel are known. Additionally, there were no visual signs of contamination. As a result, locations are based on a systematic pattern to provide the initial magnitude of chemical contamination based on no previous information. Four borings (B055HA001, B056BHA001, B056HA002, and B057BHA001) are planned in the utility tunnel (Figure I5-6). Each of these borings is spaced approximately 50 feet apart and begins approximately 20 feet from the eastern wall of Building 55. Photo R1#4 shows the utility tunnel beneath Building 56. Each boring in the utility tunnel is associated with the building the tunnel passes under.

Photo R1 #4. Utility tunnel in basement beneath Building 56.

Photo R1#3. Tank in utility tunnel below Building 57B.

In the section of the utility tunnel beneath Building 57B, there is a tank that was constructed by turning a large drum on its side and cutting a hole in the area that is now the top (Photo R1#3). Hand auger B057BHA001 is positioned next to this tank.

Building 55 (Series 55 and 55A) - Blacksmith Shop. At least two forges were housed along the east wall in Building 55 in the northern portion of the building. The forges measured 5 or 6 feet in diameter, were circular, and sat approximately 10 feet from the wall. The metal plate in Photo R2 #18 may be associated with the forges. Heavy equipment is currently situated on top of and to the west of the metal plate.

Therefore, hand auger boring B055HA002 is located to the east side of this metal plate (between the heavy equipment and the wall in Photo R2#18). This location is the closest accessible point to the suspect forges (Figure I5-6).

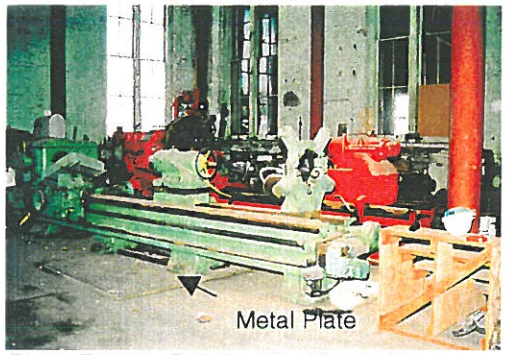


Photo R2#18. Building 55. Metal plate may be associated with the former 2 forges.

There are several re-poured areas of concrete in Building 55A. The concrete is surrounded by a metal band and may have been constructed to support large pieces of equipment that were housed in the Arsenal blacksmith shop during the later years. The largest re-poured concrete area, near the center of the building, was the reported location for a large hydraulic metal press, used to cut up rifles for salvage (personal communication, Bill Scattergood, 1998). Hand auger boring B055HA003 is located in the center of the re-poured area. The purpose of the boring is to search the area with the highest potential for contamination (Figure I5-6).

Building 56 (Series 56, 56A, 56B, and 56C) - Machine, Leather, Canvas, Small Arms, and Welding Shops. A Parkerizing tank was located beneath the east side of Building 56 near the current intersection at the north wall of 56B with Building 56 (Figure I5-6). This Parkerizing tank was reportedly up to 10 feet deep, but is currently covered with a wood floor (Photo PIC00022). The tank was reportedly pumped out and removed during the 1980s. Two soil borings are proposed to the west (B056SB001) and to the south (B056SB002) of this tank to assess the

Photo PIC00022. Northern edge of flooring constructed over former parkerizing tank in Building 56.

locations with the highest potential for contamination (Figure I5-6). Other parkerizing areas may have been located in Building 56, but no background information is available to determine a location. As a result, two additional soil borings and two hand augers are planned for Building 56: soil borings B056SB003 and B056SB004 and hand auger borings B056HA001 and B056HA003 (Figures I5-6 and I5-7). The hand auger borings are located beneath the wooden floors of the southern section Building 56 within accessible portions of the basement area. Photo R2#24 shows the basement area beneath Building 56, where the hand auger borings are planned.

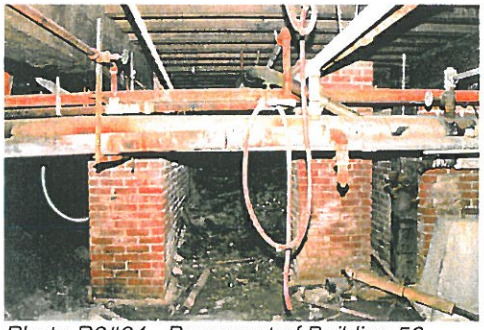


Photo R2#24. Basement of Building 56.

The northern portion of Building 56A is underlain by a basement. The southern portion of Building 56A consists of a ground floor underlain by a concrete slab, which thickens to over 3 feet at the loading dock. The concrete floor in Building 56A was observed to be in good condition with few cracks, no settling, no obvious re-pavement or patching, and no discoloration. As a result, investigation activities in Building 56A

will be conducted in the basement areas, equipment room, transformer room, and beneath the concrete floor, assuming the concrete is not so thick it prevents sampling. Soil borings planned in these areas will be conducted as follows:

Photo R1#19. Firing Range #1, Building 56A.

- The basement area contains Firing Range #1 (Figure I5-7). Small arms were fired into a long metal tube (Photo R1#19), which ended in a concrete bunker that may be filled with soil. A grab sample (B056AGR001) is planned from the soil within this concrete bunker (Figure I5-7).

- A corridor in the basement area runs beneath the east side of Building 56A. There is no background information regarding this area, but a hand auger boring (B056AHA003) is planned in the middle of this corridor to provide additional chemical data associated with the former parkerizing and degreasing operations in Building 56A (Figure I5-7).

Photo R1#14. Equipment room in Building 56A.

- The ground floor level of Building 56A contains an equipment room, a transformer room, ammunition storage, and firing areas #2 and #3 (Figure I5-6). The equipment room contained mounts for a suspected aboveground tank or boiler (Photo R1 #14) and a floor drain. Hand auger boring B056AHA004 is located next to the drain in the equipment room in the area of suspected highest potential of contamination.

- A transformer room is adjacent and east of the equipment room. The room previously had a dirt floor (RRR, Jacobs, 1999), but is currently paved, and there are no transformers in the room. Because there is no specific data for this room, hand auger boring B056AHA005 is located in central portion of the room (Figure I5-6).

- Due to limited access, hand auger boring B056AHA001 is located in the area of potential highest contamination associated with former Building 65(A) (Boiler House). Likewise, hand auger boring B056AHA002 is located near the suspected location of former Building 58 (Boiler Room/Small Arms Repair and Retinning) (Figure I5-6). Samples from these borings will also provide data for the suspected parkerizing activities associated with Building 56A.

Buildings 56B and 56C have concrete floors. No cracks were observed during site visits and no contaminant pathways are suspected. However, parkerizing may have occurred in Building 56B. Due to the lack of observed features and the lack of background chemical data for Building 56B, sample locations in Building 56B (B056BHA002 – 004) were placed in areas that do not conflict with access restrictions resulting from woodworking equipment (Photo MVC-004f and Figure I5-6).

Photo MCV-004f. Woodworking equipment and materials inside Building 56B.

There are no features to investigate in Building 56C; therefore, no investigation activities are planned.

Building 57 - Small Arms Shop.
Investigation activities in Building 57 will be conducted in the north end of each of three firing ranges located in the basement, and in two basement areas with exposed soil. We will also investigate outside the building in the area adjacent to the former continuous degreaser.

- Three firing ranges end at an earthen berm. The potential of highest contamination is suspected to be at this berm. As a result, hand auger borings B057HA001 through B057HA003 are planned at the end of each range (Figure I5-7).

- There are two exposed areas of soil - one area near the westernmost range and one in a corridor along the eastern side of the basement area (this corridor leads to an elevator in the northeast corner of the basement). Hand auger borings B057HA004 and B057HA005 are planned in these areas (Figure I5-7). Drainage from the overlying parkerizing activities in Building 57 through the wooden floor is suspected. Photo PIC00032 shows the stained wooden floor of Building 57. The two exposed areas of soil appear to be low-lying, where accumulations of drainage water may have collected.

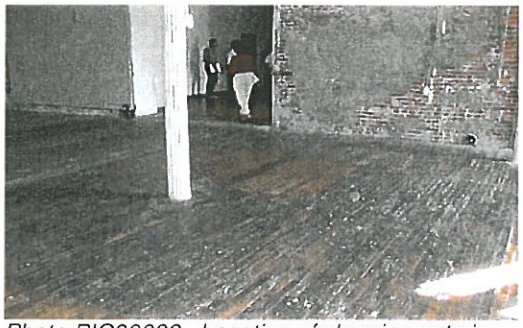


Photo PIC00032. Location of cleaning vats in Building 57.

- Hydropunch® boring B057AHP007 is located along the western side of Building 57, next to the location of the former continuous degreaser inside Building 57, where the highest potential for contamination is suspected. Photo PIC00031 shows the former location of the degreaser.

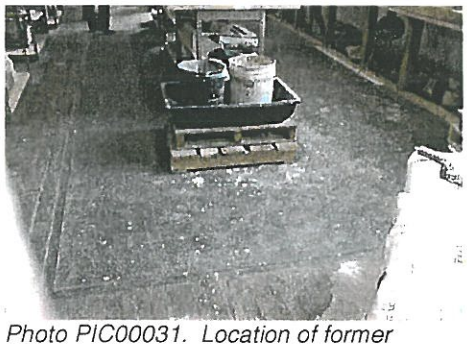


Photo PIC00031. Location of former continuous degreaser in Building 57.

Building 57A - Parkerizing Room.
Previous data collected in Building 57A indicate an impact to soil in this area. Based on observed features (including a U-shaped, gravel-filled vat), historical use, and previous data, investigation activities in Building 57A will include one soil boring (B057ASB001), one Hydropunch® boring (B057AHP008) and one grab groundwater sample (B057AGR001) (Figure I5-6). The reasons for these sampling activities are described below.

- Soil boring B057ASB001 and Hydropunch® boring B057AHP008 are located in areas with highest previous detections of contamination. Photo PIC00028 shows the gravel-filled vat inside Building 57A.

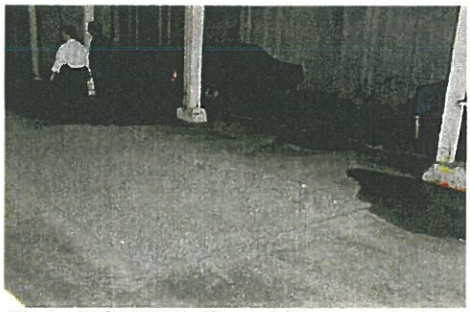


Photo PIC00028. Gravel-filled vats inside of Building 57A.

- At the southern end of Building 57A, a pipe, approximately 18 inches in diameter, protrudes vertically out of the ground (Photo R1 #7). Water/liquid can be seen inside this pipe approximately 6 feet below the floor surface. A grab water sample will be collected from this pipe (B057AGR001).

Photo R1#7. 18-inch-diameter pipe in Building 57A.

Building 57B. No records were found documenting the processes performed in this building. As a result, one boring (B057BHA001) is planned to address exposed soil in the utility tunnel beneath Building 57B.

Building 57C - Storage Area. Building 57C was built after the closure of the Arsenal in 1964. Records indicate that this building has been used exclusively for storage. Therefore, no investigation activities are planned and no further action under FUDS is proposed for this building.

Former Building 58 - Boiler Room/Small Arms Repair and Retinning. It appears that the thickest part of the concrete slab from Building 56A (2 feet to more than 3 feet thick) covers the area of what was former Building 58. Due to the limited access inside Building 56A, hand auger boring B056AHA002 is planned in the entry way of Building 56A at the suspected location of former Building 58. This boring will also be used to assess possible parkerizing activities in Building 56A.

Former Building 59(A) - Tool House. Two borings (B053SB001 and B053SB002) included in the FSIP for Building 53 address the contaminants suspected at former Building 59(A). No additional investigation activities are planned.

Former Building 65(A) and Building 65(B) - Boiler House. A 1911 drawing shows a structure (approximately 15 feet wide by 25 feet long) at the intersection of the eastern wall of Building 56 and the corridor connecting Buildings 56 and 57 (currently named Building 57B). However, this structure was not identified by name on the drawing. Mr. Milburn, a former Benicia Arsenal employee, stated that there were some USTs associated with the workshop complex and that railroad cars would deliver #5 fuel oil to the workshops. Additionally, Mr. Milburn stated that #5 fuel oil was used only in boilers (personal communication, Milburn, 1998). The 1911 drawing shows railroad tracks leading to this small structure. It is possible this structure contained the suspected USTs and a suspected boiler to heat Building 56. For clarity, only the approximate location of these suspected USTs are shown on Figure I5-3, since the present location of Building 65(B) overlaps the former structure.

It is unknown whether the suspected USTs and boiler within the 1911 structure were removed, or when the structure was

removed. Based on information provided by Mr. Milburn, hand auger boring B065HA001 is located next to the suspected USTs (Figure I5-6).

The courtyard area is a suspected location of a machine gun test firing area (Photo R1#13). One hand auger boring (B065BHA002) is located in the central portion of the area, where the highest impact is suspected (Figure I5-6).

Photo R1#13. Courtyard area and suspected former location of a machine gun test firing area.

Photo PIC00033. Building 65 Boiler Room.

The boiler room in Building 65(B) had a dirt floor, which was noticeably stained during a site visit in March 1998 (Photo PIC00033). During a return visit on 8 September 1998, it was observed that the area had been recently paved with a concrete floor. It was also observed that there was a new layer of soil placed in the courtyard, covered with brick. This soil came from the Building 65(B) boiler room (personal communication, Bill Scattergood, 1998). One hand auger boring (B065BHA003) is planned to assess the soil removed from Building 65(B) (Figure I5-5).

Former Building 66(A) - Paint Shed/Shop and Smoke Stack/Incinerator. One soil boring (B066ASB001) is planned to assess the potential contamination associated with the former paint shed and the former smoke stack/incinerator (Figure I5-6). Because Building 56A is partially covering former Building 66(A), this boring is planned next to the eastern wall of Building 56A, within the former paint shed footprint and next to the concrete pad of the former incinerator. Photo R2#6 shows the concrete foundation of the former smoke stack/incinerator.

Photo R2#6. Former smoke stack/incinerator foundation.

Suspected Fuel Oil USTs beneath Building 120. Mr. Milburn indicated that there were some USTs associated with the 50 Series Complex and that railroad cars would deliver #5 fuel oil to the workshops. Mr. Milburn was not sure about the exact location of the USTs, but believed that they were north of Building 179. Railroad tracks and an unidentified rectangular object (next to the tracks and approximately 160 feet north of Building 179) are shown on May 1932 and September 1940 drawings (RRR, Jacobs, 1999). It is suspected that the objects identified in these drawings may be fuel oil USTs. A fillport (Figure I5-3) may also be identified based on the May 1932 drawing. Based on the location of features on the 1932 and 1940 drawings, two soil borings (B120SB001 and B120SB002) are proposed outside the northwestern corner of Building 120 (Figure I5-8). The concrete slab of Building 120 is several feet thick and

access is limited due to existing tenants; therefore, the borings will be placed outside of the building in the street.

Perimeter Sampling Locations. Perimeter sampling locations are based on previous chemical data from Building 57A, suspected cisterns identified from the records search, suspected areas of likely groundwater contamination, and spatial determination of groundwater flow. The following discussion provides rationale for seven Hydropunch® borings planned around the 50 Series Complex (B057AHP001 through B057AHP007). Three perimeter locations (locations B057AHP001, 005, and 006) will be used as water level monitoring points. The three static water level measuring point locations have been selected based on site topography and the anticipated groundwater flow direction to the south. These boring locations are shown on Figure I5-8.

Photo PIC00025. Suspected oil/water separator area north of Building 57A.

- B057HP001: Two metal plates are located directly north of Building 57A and may cover a suspected clarifier or oil/water separator (Photo PIC00025). Mr. Buster Byerrum, a former Arsenal employee, thinks that the suspected clarifier or oil/water separator may have been installed by a transmission company that used the building following Arsenal closure (personal communication, Buster Byerrum, 1998). Hydropunch® boring B057AHP001 is located between the suspected oil/water separator and Building 57A. This boring will also provide groundwater data for the northwestern portion of the 50 Series Complex and be converted into a water level measuring point.

Photo PIC00009. Possible cistern location west of Building 57.

- B057HP002 and B057AHP004: The location of the two cisterns referenced by Mr. Byerrum could not be identified during site visits conducted by Brown and Caldwell. More than a dozen grates or metal plates, such as those pictured in Photo PIC00009, and circular patches, as pictured in Photo R2#10, were identified during the site visits. B057AHP002 is located near the circular patch shown in Photo R2#10. B057AHP004 is located near a suspected cistern location. These borings were also placed to obtain groundwater data in association with potential contaminant sources in the eastern and western portions of the 50 Series Complex. Additionally, B057AHP002 is located near the former Building 66(A) paint shed.

Photo R2#10. Utility vault and asphalt patches south of Building 55.

- B057AHP003, B057AHP005, and B057AHP006: These borings are located to obtain groundwater data from the northeast, southeast, and southwest portions of the 50 Series Complex. Borings B057AHP005 and B057AHP006 will be converted into water level measuring points. Boring B057AHP005 will be advanced and continuously cored to approximately 75 feet bgs to evaluate shallow stratigraphy to the alluvium/bedrock contact.

- Discussion of Hydropunch® location B057AHP007 is included above for Building 57, Small Arms Shop.

SECTION 6. SAMPLING METHOD REQUIREMENTS

SOPs to be implemented during this project are listed in Table I5-6. These SOPs are located in Appendix F of the QAPP (QAPP, BC, 1999b). Sample containers, preservation methods, and analytical holding times are included in the QAPP.

SECTION 7. ANALYTICAL METHODS SUMMARY

The chemical analyses to be conducted on each soil, soil gas, and groundwater sample are presented in Table I5-5. A detailed description of each analytical method, practical quantitation limits (PQLs), and analyte lists are presented in the QAPP (QAPP, BC, 1999b). In addition to analyte lists, Tentative Identified Compounds (TICS) will be reported for samples analyzed by EPA Methods 8260B and 8270C (USEPA, Contract Laboratory Program National Functional Guidelines for Organic Data Review [CLP organic], 1994a). QA/QC sampling protocols are described in the QAPP and in Section 9.1, Quality Control Samples of this FSIP.

Sample analysis will be completed in a 21 calendar day turnaround time (TAT). Soil and groundwater analyses will be conducted in Torrance, California at EMAX Laboratory (EMAX), and air analyses at Air Toxics Laboratory (ATL) in Folsom, California. A TAT of less than 21 calendar days is not anticipated for this project. Sample analytical results will be reported in electronic and hardcopy deliverables. Specifications for the laboratory reporting are included in the QAPP. Reporting for approximately 10 percent of the analytical data will be in Level IV - equivalent packages for full third-party validation. Upon completion of data validation, analytical results will be reported according to Section 5.4 of the Workplan (Workplan, BC, 1999a).

SECTION 8. INVESTIGATION DERIVED WASTE

The purpose of this section is to describe the specific procedures used for proper collection, characterization, storage, containerization, transport, and disposal of Investigation Derived Waste (IDW) at the 50 Series Complex. The Arsenal-wide IDW plan is described in detail in the Workplan, Section 4.5 (Workplan, BC, 1999a).

The IDW generated as part of this FSIP will include: soil from drilling and sampling activities, decontamination rinsate from drilling and shallow soil/soil gas sampling equipment, and disposable protective clothing and ground covers.

Table I5-7 presents the anticipated quantities of IDW and anticipated number of containers required for each type of IDW. Soil and groundwater will be contained in the specified containers listed on Table I5-9.

The soil and groundwater containers will be staged at a temporary waste staging area. The location of this waste staging area will be at 900 Jackson Street (Building 103). Building 103 is a secure site with perimeter fencing and lockable gates. Decontamination of drilling equipment will also be staged at Building 103. Decontamination procedures are described in the QAPP. Decontamination of sampling equipment

during hand auger activity will be staged at the FA/BC Benicia Arsenal Field Office at 952A Tyler Street.

Excess disposable wastes derived from sampling, such as PPE, gloves, and bailers will be disposed by BFI, which provides local garbage disposal service for the area.

Analysis of soil samples during the investigation will be used to characterize the waste for proper disposal. Soil derived from drilling and sampling activity will be segregated, if possible, based on visual and instrument readings from a PID and by the potential contaminant. For example, wastes with potential solvent impacts will be segregated from potential fuel-only impacts, when possible. Table I5-8 presents the solid/liquid waste disposal facilities and transporters proposed to be used for the 50 Series Complex investigation. The data presented in Table I5-8 is based on current information and requirements by contacting each facility and transporter.

SECTION 9. QUALITY CONTROL

Field quality control activities to be conducted during the investigation will include collecting and analyzing quality control samples, implementing the three-phase quality control program, and validating and verifying analytical data. These activities are described in the QAPP and are summarized below in the context of the 50 Series Complex field investigation.

9.1 Quality Control Samples

A variety of quality control samples will be used to quantitatively assess the quality of data generated during the 50 Series field investigation. These samples include matrix spike and matrix spike duplicate samples, field duplicates, split samples, trip blanks, equipment rinsate blanks, filter blanks, source water blanks, and field ambient blanks. QA/QC sampling protocol is also described in the QAPP. QA/QC samples (sample duplicates, matrix spike, matrix spike duplicate, and QA split samples) will be collected at the frequencies required in the QAPP (QAPP, BC, 1999b). Table I5-9 lists the analytical methods, associated containers, and QC samples for each planned sample. Table I5-10 summarizes the collection frequency for QC samples for this site. Performance evaluation samples will not be collected for this round because the laboratory has recently undergone an MRD validation process including PE samples for the required analyses with acceptable results. PE samples will be proposed should review of data validation results of the laboratories indicate performance problems. The contract analytical laboratory procedures and services will be in accordance with the QAPP (QAPP, BC, 1999b).

9.2 Three-phase Quality Control Program

A three-phase quality control program will include preparatory phase, initial phase, and follow-up phase activities. Three-phase quality control activities to be implemented for this FSIP are described below.

9.2.1 Preparatory Phase-Laboratory. The project team will conduct a laboratory kick-off meeting at least one week prior to beginning field work. The laboratory kick-off meeting will include a review of the items outlined in the QAPP and FSIP with the TOM, the Project Chemist, and the contract laboratories (QAPP, BC, 1999b). The results of the laboratory kick-off meeting will be documented in meeting minutes signed by meeting participants and distributed to the project team.

9.2.2 Preparatory Phase-Field. The TOM, FTL, and Project Chemist will conduct a readiness review meeting approximately one week prior to beginning field work. The USACE Technical Leader will also be invited to this meeting. The purpose of the readiness review meeting will be to review and document that preparation for the field investigation has been completed. All items discussed in the readiness review meeting

must be completed prior to the start of fieldwork. The FTL will complete the checklist presented in Table I5-11 during the readiness review meeting to ensure adequate documentation and equipment is available. This checklist may be modified, as necessary, during preparation activities.

9.2.3 Initial Phase-Laboratory. As a part of the previous field activities, a laboratory audit was conducted by USACE at EMAX in May 1999 under the direction of the Project Chemist and again in June 1999. The audit results and laboratory responses to the audit findings are maintained in the project files. Any outstanding issues from this audit will be resolved prior to beginning field work. Because analyses planned for this field effort were covered in the two previous audits, no audits are proposed for this phase of work. Both laboratories have recently undergone MRD re-validation procedures and are certified by the State of California for the required analyses.

9.2.4 Initial Phase-Field. Field quality control activities will be conducted throughout the 50 Series Complex field investigation. To ensure that quality control activities are in compliance with the QAPP and this FSIP, field quality control activities will be evaluated during the first week of the 50 Series Complex field effort through the initial phase inspection conducted by the QCSM. The initial phase inspection will be documented in an initial phase inspection meeting and meeting minutes will be signed by meeting participants and attached to the DQCR. Quality control activities that will be evaluated during the initial phase inspection include those described in the QAPP (QAPP, BC, 1999b).

9.2.5 Follow-up Phase. Follow-up phase quality control activities will be performed as needed throughout field and laboratory activities to resolve any deficiencies identified during the preparatory and initial inspections or deficiencies noted during field activities by the TOM, FTL, or Project Chemist. Follow-up activities will be conducted to assure continuing compliance with contract and QAPP and FSIP requirements until the completion of field and analytical activities (QAPP, BC, 1999b). Final follow-up checks will be conducted and all deficiencies corrected prior to the start of additional fieldwork.

The QCSM will participate in the quality control program as described in this FSIP and the QAPP (QAPP, BC, 1999b). Additional phases and/or review of the subcontractors may be added during the execution of work, as deemed necessary, by the project staff and QCSM.

9.2.6 Data Validation. All laboratory data will be verified according to guidelines presented in the QAPP. Data generated for 100 percent of the field samples collected and analyzed for definitive methods will be validated. Ten percent of the data will be provided in EPA Level IV equivalent data packages as described in the QAPP (QAPP, BC, 1999b). The remaining 90 percent will be validated to equivalent EPA Level III. Data will be independently validated to procedures consistent with those specified in "USEPA Contract Laboratory Program National Functional Guidelines for Organic/Inorganic Data Review" (EPA, CLP Organic/Inorganic, 1994a,b), the appropriate EPA reference methods, and the QAPP (QAPP, BC, 1999b). The Project Chemist shall provide data validation reports to USACE and the PjM within 21 days after receiving the analytical data from the laboratory.

SECTION 10. REFERENCES

Brown and Caldwell. 1999a. Arsenal-Wide Site Investigation Workplan for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. February.

Brown and Caldwell. 1999b. Quality Assurance Project Plan for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. February.

Brown and Caldwell. 1998. Benicia Arsenal General Site Safety and Health Plan. Prepared for US Army Corps of Engineers, Sacramento, California. January.

Jacobs Engineering. 1999. Records Research Report for the Benicia Arsenal. Prepared for US Army Corps of Engineers, Sacramento, California. April.

Meredith/Boli & Associates. 1994. Letter to Poly Investments Western, Ltd. June 22.

Personal communication, Buster Byerrum. 1998.

Personal communication, Jim Milburn. 1998.

Personal communication, Bill Scattergood. November 23, 1998 during site visit.

SM. 1998. Standard Methods for the Examination of Water and Wastewater. 18th Edition.

United States Environmental Protection Agency (USEPA). 1986. Test Methods for Evaluating Solid Waste (SW-846), Third Edition with Update I (7/92), Update II (9/94) Update IIA (8/93), Update IIB (1/95), and Update III (12/96).

United States Environmental Protection Agency (USEPA). 1994a. Contract Laboratory Program National Functional Guidelines for Organic Data Review.

United States Environmental Protection Agency (USEPA). 1994b. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.

United States Environmental Protection Agency (USEPA). 1984. Compendium of Methods for the Determination of Toxic Compounds in Ambient Air.

United States Environmental Protection Agency (USEPA). 1983. Methods for Chemical Analysis of Water and Waste.

Table I5-1

Background Information for 50 Series Complex and Surrounding Structures

Facility ID	Feature	Function	Materials Handled	Evidence	Corresponding Sampling Location
Building 55	Suspected cistern (between Building 55 and Building 56A)	Water storage and industrial waste disposal	❑ Solvents ❑ Acids ❑ Preservatives	Buster Byerrum interviews	B057AHP002
	Two forges	Heat metals	❑ Metals ❑ Fuels (unspecified)	Buster Byerrum interviews, July 1957 Equipment List, powered by "gas"	B055HA002
	Slack tub(s) (unknown location)	Cool metals	❑ Metals	Buster Byerrum interviews, 3 listed on a July 1957 Equipment List as "quench tanks"(size unknown)	B055HA002 and B055HA003
	Hydraulic press	Press metals	❑ Hydraulic oil	July 1957 Equipment List, powered by electricity (200 ton)	B055HA003
	Utility tunnel (basement)	House utilities	❑ Fuels ❑ Metals	Maps and site visit	B055HA001
	Metal plate	Unknown		Site visit	None. No contaminant sources associated with metal plate.
	Equipment pad or concrete pit	Unknown		Site visit	B055HA003
	Exposed soil	Unknown		Site visit	None. No obvious staining or discolored soil was observed and no historic feature has been associated with this area.
	Asphalt patches outside of building	Unknown, possible cistern		Site visit	B057AHP002
	Utility vault outside	Utility vault		Site visit	B057AHP002
	Storm/sewer drains and catch basins	Industrial waste disposal to Carquinez Strait	❑ All industrial wastes	Site visit	None. Investigation of these features will be part of a separate FSIP.
Building 55A	Machine shop				None. Beneficial use.
Building 56 (ground floor only)	Cistern	Water storage and industrial waste disposal	❑ Solvents ❑ Acids ❑ Preservatives ❑ Foundry waste	Buster Byerrum interviews	B057AHP003
	Floor drain	Potential industrial waste disposal to sewer and/or cistern	❑ Solvents ❑ Acids ❑ Preservatives	Site visit	None. Investigation of these features will be part of a separate FSIP.

Table I5-1 (Continued)

Background Information for 50 Series Complex and Surrounding Structures

Facility ID	Feature	Function	Materials Handled	Evidence	Corresponding Sampling Location
Building 56 (ground floor only) continued	Storm/sewer drains and catch basins	Industrial waste disposal to Carquinez Strait	❑ All industrial wastes	Site visit	None. Investigation of these features will be part of a separate FSIP.
	Parkerizing and oakite tanks	Clean and parkerize small arms	❑ Solvents ❑ Acids/alkalis ❑ Preservatives ❑ Metals	Historical records, site visit	B056HA001 - B056HA003 B056SB001 – B056SB004
	Elevator	Probable hydraulic sump		Site visit	None. No contaminant sources identified during site visit.
Building 56A (ground floor only)	Firing area 1 and Firing room with open floor drain	Small arms weapons testing	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders ❑ Copper	Site visit and RRR	B056AHA004 B056AGR001
	Equipment room – adjacent to and east of firing room with floor drain	Unknown, potential tank or boiler stand in place	❑ Fuels (unspecified)	Site visit	B056AHA004
	Transformer room with floor drain	Housed transformer(s)	❑ PCBs	Site visit	B056AHA005
	Firing area 2 and open drainage	Small arms weapons testing. Drainage may have lead to sewer and/or cistern	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders ❑ Copper	Site visit and historical drawing	None. No contaminant sources identified during site visit and concrete floor is several feet thick.
	Firing area 3	Small arms weapons testing	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders ❑ Copper	Site visit and historical drawing	None. No contaminant sources identified during site visit and concrete floor is several feet thick.
	Boiler room	Housed one boiler to heat building and produce steam for industrial operations	❑ Natural gas	Historical drawings and site visit	B056AHA002

Table I5-1 (Continued)

Background Information for 50 Series Complex and Surrounding Structures

Facility ID	Feature	Function	Materials Handled	Evidence	Corresponding Sampling Location
Building 56A (ground floor only) continued	Ammunition storage room	Ammunition storage	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders ❑ Copper	Historical drawings	None. No contaminant sources identified during site visit and concrete floor is several feet thick.
	Parkerizing and oakite tanks	Clean and parkerize small arms	❑ Solvents ❑ Acids/alkalis ❑ Preservatives	Buster Byerrum interviews, 9 tanks listed on July 1957 Equipment List (4 foot x 8 foot x 4 foot) powered by steam	B056AHA001 – B056AHA003
	Degreaser	Clean small arms	❑ Solvents ❑ Acids ❑ Preservatives	10 foot x 39 inch x 7 foot tank listed on July 1957 Equipment List, powered by electricity	B056AHA001 – B056AHA003
	Elevator	Probable hydraulic sump		Site visit and historical maps	None. No contaminant sources identified during site visit.
Building 56B (ground floor only)	Parkerizing and oakite tanks	Clean and parkerize small arms	❑ Solvents ❑ Acids, base ❑ Preservatives	Buster Byerrum interviews	B056BHA001 – B056BHA004
	Foundry facilities	Melt and mold metals	❑ Foundry sands and other unknown industrial wastes	Buster Byerrum interviews	B056BHA002 - B056BHA004
	Welding shop		❑ Metals (unspecified)		B056BHA002 - B056BHA004
Building 56C (ground floor only)	Floor drain	Suspected drain for industrial waste to sewer and/or cistern	❑ Unknown, potential wastes from Buildings 56 and 56B	Site visit	None. Investigation of these features will be part of a separate FSIP.
	Roof drains (outside)	Potential drainage to cistern	❑ None, only used as possible identifier for cistern location	Site visit	None. Investigation of these features will be part of a separate FSIP.
Building 57	Suspected cistern (southwest corner of Building 57)	Water storage and industrial waste disposal	❑ Solvents ❑ Acids ❑ Preservatives	Buster Byerrum interviews	B057AHP004
	Cleaning vats (ground floor)	Clean small arms	❑ Acids ❑ Solvents ❑ Kerosene ❑ Cosmoline ❑ Preservatives	Drawing 2994	B057HA004 and B057HA005

Table I5-1 (Continued)

Background Information for 50 Series Complex and Surrounding Structures

Facility ID	Feature	Function	Materials Handled	Evidence	Corresponding Sampling Location
Building 57 (continued)	Small arms test firing range (basement)	Small arms weapons testing	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders ❑ Copper	Site visit	B057HA001 - B057HA005
	Elevator (North) (basement to all floors)	Freight elevator - serviced all floors (including basement)	❑ Hydraulic oil	Site visit	None. No contaminant sources identified during site visit.
	Suspected elevator (South) (ground floor)	Freight elevator – did not service the basement	❑ Hydraulic oil	Buster Byerrum interviews	None. No contaminant sources identified during site visit.
	Automatic degreaser (ground floor)	Clean small arms	❑ Solvents ❑ Acids ❑ Preservatives	Historical text, Buster Byerrum interviews, and site visit	B057AHP007
	Drainage in basement	Unknown	❑ Unknown, potentially all industrial wastes from Building 57	Site visit	B057HA004 and B057HA005
	Storm/sewer drains and catch basins	Industrial waste disposal to bay	❑ All industrial wastes	Site visit	None. Investigation of these features will be part of a separate FSIP.
Building 57A	Parkerizing solvent cleaning vats (ground floor)	Clean small arms	❑ Solvents ❑ Acids ❑ Preservatives	Buster Byerrum interviews, and site visit	B057ASB001, B057BHA001 B057AHP001 – B057AHP008
	Oil/water separator (ground floor)	Unknown	❑ Unknown	Site visit, however may not be DoD	B057AHP001
	Pipe trench (ground floor)	Unknown, potential pathway for all industrial wastes to storm/sewer and/or cisterns	❑ Solvents ❑ Acids ❑ Preservatives	Site visit	None. No contaminant sources identified during site visit.
	Open pipe (ground floor)	Unknown, potential pathway for all industrial wastes to storm/sewer and/or cisterns	❑ Solvents ❑ Acids ❑ Preservatives	Site visit	None. No contaminant sources identified during site visit.
	Open Pipe (ground floor)	Unknown, potential pathway for all industrial wastes to storm/sewer and/or cisterns	❑ Solvents ❑ Acids ❑ Preservatives	Site visit	None. No contaminant sources identified during site visit.

Table I5-1 (Continued)

Background Information for 50 Series Complex and Surrounding Structures

Facility ID	Feature	Function	Materials Handled	Evidence	Corresponding Sampling Location
Building 57A (continued)	18-inch pipe (ground floor)	Unknown, potential pathway for all industrial wastes to storm/sewer and/or cisterns	❑ Solvents ❑ Acids/alkalis ❑ Preservatives	Site visit	B057AGR001
	Roof drain (ground floor)	Unknown, potential pathway for all industrial wastes to storm/sewer and/or cisterns	❑ Solvents ❑ Acids ❑ Preservatives	Site visit	None. Investigation of these features will be part of a separate FSIP.
	Suspected cistern	Water storage and industrial waste disposal	❑ Solvents ❑ Acids ❑ Preservatives	Buster Byerrum interviews	B057AHP001
Building 57B	Above ground storage tank in utility tunnel beneath parkerizing room (Building 57A)	Unknown, potential pathway for all industrial wastes to storm/sewer and/or cisterns	❑ Solvents ❑ Acids/alkalis ❑ Preservatives	Site visit	B057BHA001
Building 57C	No known features			Access not allowed on site visit	None. Constructed after DoD use.
Former Building 58	Boiler room	Housed a boiler to heat the building	Unknown, suspected fuels	Historical figures	B056AHA002, B057AHP005, B057AHP006
	Small arms repair and retinning	Temporary loading of projectiles with explosives	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders ❑ Copper	Historical figures and letter	B056AHA002
Former Building 59(A) (1910 to pre 1945)	Tool house	Stored oils, paints, and tools	❑ Oils	Historical figures, located south of Building 55	Boring B053SB001 and B053SB002 associated with Building 53 FSIP and B057AHP006
Former Building 65(A) (1918 to 1940s)	Boiler house	May have housed boiler(s) for industrial operations	❑ Fuels	Historical figures, located west of Building 58	B056AHA001 B057AHP005
Fuel Oil Tank(s)/ Boiler House [Pre-Bldg 65(B)]	Suspected USTs	Fuel oil used by boilers suspected to be delivered by railroad tank car	❑ #5 Fuel Oil	Jim Milburn recalled #5 oil being delivered by Railroad tank car to USTs. Railroad tracks lead to building on 1911 historical figure.	B065BHA001

Table I5-1 (Continued)

Background Information for 50 Series Complex and Surrounding Structures

Facility ID	Feature	Function	Materials Handled	Evidence	Corresponding Sampling Location
Building 65(B) (1940s to present)	Boiler room	Housed two boilers to heat shop buildings and produce steam for industrial operations	❑ Fuels ❑ Oils ❑ Lead	Historical figures, Marv Kaufman interview	B065BHA001
	Roof drain	Drainage	None, only used as possible identifier for cistern location. However, may have been a pathway for industrial wastes	Site visit	None. Investigation of these features will be part of a separate FSIP.
Former Building 66(A) (1918 to pre 1945)	Paint shop/shed	Stored oils and paints	❑ Oils ❑ Metals	Historical figures, located north of former Building 59(A)	B066ASB001 B057AHP002
Courtyard area		Small arms weapons testing	❑ Lead ❑ Antimony ❑ Arsenic ❑ Ammunition/powders	Buster Byerrum interviews and site visit	B065BHA002
Soil stockpile from Bldg 65 (B) Boiler Room		Stained soil from boiler(s) in Building 65(B)	❑ Unknown, potentially diesel fuels from boiler room ❑ Oils ❑ Lead	Site visit	B065BHA003
Smoke Stack/ Incinerator	Smoke stack	Incinerator	❑ Unspecified explosives ❑ Hexavalent Chromium/metals ❑ Black powder	Historical photographs, maps, and Buster Byerrum interviews	B066ASB001 B057AHP002
Fuel Oil USTs (beneath Building 120)	USTs	Suspected fuel oil storage tanks to service boilers in Building 65(B)	❑ #5 Fuel oil ❑ Oils ❑ Fuels ❑ Lead	Historical figures and Jim Milburn interview	B120SB001 and B120SB002 B057AHP003
Fuel USTs Building 53	USTs	Suspected fuel storage tanks	❑ Fuels ❑ Lead	Historical maps and interviews	B057AHP002, B057AHP006
Fuel USTs Building 154	3 USTs	Suspected fuel storage tanks	❑ Fuels ❑ Lead		B057AHP004, B057AHP005

Table I5-2

Chemicals Identified at Building 57A To-Date*

Medium	Chemicals Reported	Concentration Range
Soil	Arsenic	<0.5-2.5 mg/kg
Soil	Barium	<0.5-160 mg/kg
Soil	Beryllium	<0.5-0.90 mg/kg
Soil	Chromium	<0.5-15 mg/kg
Soil	Cobalt	<0.5-6.3 mg/kg
Soil	Copper	<0.5-20 mg/kg
Soil	Lead	<2.5-51 mg/kg
Soil	Nickel	<0.5-17 mg/kg
Soil	Vanadium	<0.5-18 mg/kg
Soil	Zinc	<1.0-210 mg/kg
Soil	Chlorobenzene	<100-7,780 µg/kg
Soil	Trichloroethene	<100-85,000 µg/kg
Soil	Trans 1,2 Dichloroethene	<100-12,200 µg/kg

*These chemicals and their respective concentration limits are based on a field investigation conducted at Building 57A in May and June, 1994 (Meredith/Boli & Associates, Inc., 22 June 1994).

Table I5-3

Data Quality Objectives for 50 Series Complex

State the Problem:

Determine the presence of acid/alkalis, fuels, oils, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, foundry wastes, metals and/or explosives contamination in soil. Determine the presence of volatile organic compounds (VOCs) in soil gas beneath 50 Series Complex floors. Determine the extent of semi-volatile organic compounds (SVOCs), VOCs and metals contamination previously identified at Building 57A.

Investigation-wide decisions:

- Assess if VOCs are present in shallow soil gas beneath Building 55, 56, 56A, 56B, 57 and 57A floors and if concentrations could impact indoor air.
- Assess the impact of soil type and stratigraphy on the presence and distribution of chemicals of potential concern (COPC).
- Assess the impact of groundwater depth, general chemical quality, gradient, and flow direction on the presence of COPC.
- Assess if COPC are present in groundwater outside the complex and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.
- Assess if COPC are present in soil located outside the complex and if determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.
- Assess if underground cisterns exist outside the complex and, if so, determine if concentrations of COPC in soil near the cisterns exceed assessment criteria which may require additional data collection, risk analysis, or remediation.

Building or Feature-specific Decisions:

- Building 55 – Assess if fuels, metals, and hydraulic oil are present in soil beneath the former forges and hydraulic press and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.
- Building 56 – 1) Assess if VOCs, preservatives, acids/alkalis, or metals are present in soil near the former dip-tanks and if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation; 2) assess if VOCs from Building 57A activities are present in Building 56 soil; and 3) determine if VOCs exceed assessment criteria which may require additional data collection, risk analysis, or remediation.
- Building 56A – 1) Assess if VOCs, preservatives, acids/alkalis, or metals are present in soil from former parkerizing operation; 2) assess if fuels, oils, metals, and PCBs are present in transformer room and equipment room soil; and 3) determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.
- Building 56B – Assess if VOCs, acids/alkalis, preservatives, or metals are present in soil from former parkerizing processes and determine if concentrations exceed assessment criteria which may require additional data, risk analysis, or remediation.

Table I5-3

Data Quality Objectives for 50 Series Complex

- Building 57 – 1) Assess firing range soil for presence of firing range metals and powder residue; 2) assess if VOCs, preservatives, and acids from Buildings 57 and 57A are present in basement soil; and 3) determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis or remediation.

- Building 57A — 1) Assess the extent of VOC contamination in soil and groundwater beneath Building 57A; 2) determine if the concentration and distribution of VOCs warrant additional data collection, risk analysis, or remediation; 3) assess if SVOCs, preservatives, oils, acids, and metals are present in soil; and 4) determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.

- Building 65B – 1) Assess if fuels, oils, or lead are present in soil removed from Building 65(B); 2) assess if fuels, oils, firing range metals, or residual powders are present in Building 65B soil and 3) determine if concentrations are reported above assessment criteria which may require additional data collection, risk analysis, or remediation.

- Building 66A Smoke Stack/Incinerator – 1) Visually assess soil near smoke stack/incinerator for evidence of burning or burning by-products and determine if additional data collection is warranted; 2) Assess if oils, metals, or explosives by-products are present in soil near the former smoke stack/incinerator, and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.

- Building 120 and 65B – 1) Determine if the underground storage tanks (USTs) and associated piping exist near Building 120 and below Building 65B, and if they require removal or closure; 2) if USTs and related pipelines exist, assess if fuels, oils, or lead are present in soil and/or groundwater beneath the USTs, and determine if concentrations exceed assessment criteria which may require additional data collection, risk analysis, or remediation.

Identify Inputs:

- Results of geophysical survey inside and outside of the 50 Series Complex.

- Numeric assessment criteria for Arsenal COPC that will be compared to soil and groundwater sample analytical data.

- Analytical results from soil samples collected from soil borings located inside and outside cistern sites.

- Analytical results from groundwater samples collected from soil borings located inside and outside the 50 Series Complex.

- Analytical results from soil gas samples for VOCs from borings beneath Buildings 55, 56, 56A, 56B, 57 and 57A.

- Results of groundwater elevation measurements.

- Results of soil identification and logging of continuous cores from soil borings.

Table I5-3

Data Quality Objectives for 50 Series Complex

Physical Study Boundaries:

- The investigation will be constructed on the ground floor and basement areas of the workshop buildings, and the perimeter of the 50 Series Complex.
- The investigation will include the area around and beneath the western portion of Building 120 to evaluate the presence of USTs.
- The investigation will not include the infrastructure of any of the buildings, or the sewer or storm drain system.

Practical Study Boundaries:

- Basement areas will be sampled only where space allows access for workers and equipment.
- Shallow groundwater will be sampled beneath USTs only if encountered near the bottom of the USTs and pipelines.
- Sampling through ground floor of Building 56A will only be conducted if geophysical survey indicates that concrete slab is less than 12 inches thick.

Temporal Study Boundaries:

- Standard field and analytical methods will generate data useable for the duration of investigation, remediation, and closure activities.
- Limited temporal influence on groundwater sampling data may result from tide-related changes in groundwater elevations.
- Field activities and sample results are not anticipated to be affected significantly by changing weather conditions.
- Hydropunch® samples are one-time groundwater samples that do not represent seasonal or daily changes in the groundwater.

General Site Decision Rules:

- If analytical values for COPC in soil and groundwater are above detection limits, then values will be compared against assessment criteria. If analytical values are below the assessment criteria, the investigation will be considered complete. If analytical values exceed assessment criteria, results will be evaluated and recommendations made for possible additional data collection, risk analysis, or remediation.
- If analytical results for COPC in groundwater from locations outside the 50 Series Complex exceed assessment criteria, then groundwater gradient and flow direction data will be evaluated. The evaluation will be used to determine possible sampling locations in order to access lateral extent of COPC.

Table I5-3

Data Quality Objectives for 50 Series Complex

Building 120 and Building 65(B) UST Decision Rules:

- If county records indicate that USTs under Building 120 and/or Building 65(B) have been removed, then the investigation will be considered complete.
- If county records are inconclusive, a geophysical survey will be conducted.
- If the geophysical survey results from the area suspected to contain the USTs and piping indicate that the USTs and pipelines are not present, then the investigation will be considered complete.
- If the geophysical survey results from the area of the USTs are inconclusive or show anomalies, then soil samples will be collected from angle borings or hand auger borings as proposed. If hand auger borings and/or angle borings confirm the presence of USTs and/or pipelines, then a tank and pipeline removal program will be initiated by USACE.

Building 56A Decision Rule:

- If geophysical data from Building 56A indicate that the concrete slab is greater than 12 inches thick in some areas, then samples will not be collected from those areas.

Tolerable Limits on Decision Errors:

- The chemical analyses will provide definitive data by conforming to accuracy, precision, and completeness objectives set forth in the Arsenal-wide Quality Assurance Project Plan (QAPP).
- Assessment Criteria will be used as absolute values to compare point-by-point to analytical results. Results that exceed assessment criteria will be evaluated further for potential risk analysis, additional data collection, or remediation.

Optimize Design for Study:

- The Scope of Work, including sampling locations and analysis, was developed based on a review of historical DoD use for each facility within the 50 Series Complex, previously collected data, and site walks to review current building conditions. The purpose of conducting the data review and site walks was to focus the investigation on the most likely sources and chemicals of possible DoD contamination.
- Sample locations were selected to address specific DoD features or processes and to maximize the potential of detecting impacts from past DoD use.
- The field investigation will be sequenced to conduct outdoor investigations first with continuous core sampling and installation of temporary static water level measuring points. These initial data will provide information about soil type and depth to water to improve data collection efforts.
- In accordance with EPA guidelines, analytical results from methods 8260 for VOCs and 8270 for SVOCs will include reporting up to 10 tentatively identified compounds (TICs) for each analysis according to the QAPP (EPA, Contract Laboratory Program National Functional Guidelines for Organic Data Review, 1994a). The TIC results will be evaluated so that any TIC reported

Table I5-3

Data Quality Objectives for 50 Series Complex

consistently in site samples will be added to the method target analyte list for subsequent investigation phases. As appropriate, reporting of TICs may be eliminated at later stages of the project.

- Analytical results from initial samples will be monitored closely to identify matrix or interference problems early in the investigation. For example, polyaromatic hydrocarbon analyses will be conducted by Environmental Protection Agency (EPA) Method 8310; however if consistent interference problems are identified, analysis may be changed to EPA Method 8270SIM.

Table I5-4
Summary of Commonly Used Substances at the 50 Series Complex and Analytical Rationale

50 Series Complex Substance of Concern	Associated Chemicals Reportedly Used in 50 Series Complex	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Acids	Unspecified acids	9045C	Field measurement (pH)	
	Phosphoric acid	9045C	Field measurement (pH)	
Bases or alkalis	Unspecified bases	9045C	Field measurement (pH)	
Cosmoline (petroleum distillate)		8015E/3550B/3630C 8260B/5035	8015E/3520C/3630C 8260B/5030B	
Degreasing fluids	Trichloroethene	8260B/5035	8260B/5030B	TO-14
Explosives[1]	Black powder	E300.0 (nitrate)	E300.0 (nitrate)	
	Nitrate residues	E300.0	E300.0	
	Unspecified explosives	8330	8330	
Firing area residual material	Arsenic	7060A or 6010A/3050B	7060A or 6010B/3010A	
	Lead	6010A/3050B	6010B/3010A	
	Antimony	7041/3050B or 6010A/3050B	7041 or 6010B/3010A	
	Ammunition powder	E300.0 (nitrate)	E300.0 (nitrate)	
Foundry wastes	Metals – unspecified	6010A/3050B	6010B/3010A	
Fuels	Gasoline	8015V/5030B, 8260B/5035	8015V/5030B, 8260B/5035	TO-14 (BTEX only)
	Diesel and fuel oil	8015E/3550B/3630C, 8260B/5035	8015E/3520C/3630C, 8260B/5030B	
	Unspecified fuels	8015V/5030B, 8015E/3550B/3630C, 8260B/5035	8015V/5030B, 8015E/3520C/3630C, 8260B/5030B	
	Lead	6010A/3050B	6010B/3010A	
	PAHs	8310/3550B/3630C	8310/3520C/3630C	
Hexavalent chromium	Hexavalent chromium	7196A/3060A	7196A	
Hydraulic oil	See Fuels	8015V/5030B, 8260B/5035, 8015E/3550B/3630C	8015E/3520C/3630C, 8260B/5030B	TO-14 (BTEX)
	PAHs	8310/3550B/3630C	8310/3520C/3630C	
	PCBs	8082/3550B	8082/3520C	
Incinerator wastes	Metals	6010A/3050B	6010B/3010A	
	Hexavalent chromium	7196A/3060A	7196A	
	Explosives	8330	8330	
	Black powder	E300.0 (nitrate)	E300.0 (nitrate)	

Table I5-4 (Continued)
Summary of Commonly Used Substances at the 50 Series Complex and Analytical Rationale

50 Series Complex Substance of Concern	Associated Chemicals Reportedly Used in 50 Series Complex	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Known industrial process fluids	SVOCs and PAHs	8270C/3550B and 8310/3550B/3630C	8270C/3520C and 8310/3520C/3630C	
Lubricants	Unspecified oils (See Oils)	8015E/3550B/3630C, 8260B/5035	8015E/3520C/3630, 8260B/5035	
Metals	Aluminum, barium, beryllium, cadmium (trace), chromium, cobalt, copper, iron, lead (trace), molybdenum, nickel, silver, tin, vanadium, and zinc)	6010A/3050B	6010B/3010A	
	Thallium	7841/3050B	7841/3020A	
	Selenium	7740/3050B	7740/3020A	
	Arsenic	7060A/3050B	7060A/3020A	
	Antimony	7041/3050B	7041/3020A	
	Mercury	7471	7471	
	Hexavalent chromium	7196A/3060A	7196A	
Oakite (lye or bluing compound)	Lye See Parkerizing process fluids	9045C	Field measurement (pH)	
Oils	Unspecified oils Light oils P-20	8015E/3550B/3630C, 8260B/5035	8015E/3520C/3630C, 8260B/5030B	TO-14 (BTEX only)
	PAHs See Preservatives	8310/3550B/3630C	8310/3520C/3630C	
PAHs	Fuel related PAHs (for example Benzo(a)anthracene and Benzo(a)pyrene)	8310/3550B/3630C	8310/3520C/3630C	
Paint	Lead	6010A/3050A	6010A/3010A	

Table I5-4 (Continued)
Summary of Commonly Used Substances at the 50 Series Complex and Analytical Rationale

50 Series Complex Substance of Concern	Associated Chemicals Reportedly Used in 50 Series Complex	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method
Parkerizing process fluids	VOCs and stoddard solvent	8260B/5035	8260B/5030B	TO-14
	Preservatives	8015E/3550B/3630C	8015E/3520C/3630C	
	Acids (phosphoric)	9045C	Field measurement (pH)	
	Bases or alkalis	9045C	Field measurement (pH)	
	Metals	6010A/3050B	6010B/3010A	
	Hexavalent chromium	7196A/3060A	7196A	
	Oakite (lye)	9045C	Field measurement (pH)	
	Light oil	8015E/3550B/3630C	8015E/3520C/3630C	
PCBs	Aroclors	8082/3550B	8082/3520C	
POLs	Fuel oil (#5 fuel only)	8015E/3550B/3630C	8015E/3520C/3630C	TO-14 (BTEX only)
	Unspecified oils	8015E/3550B/3630C	8015E/3520C/3630C	TO-14 (BTEX only)
	Gasoline	8015V/5030B, 8260B/5035	8015V/5030B, 8260B/5030B	TO-14 (BTEX only)
	Diesel	8015E/3550B/3630C	8015E/3520C/3630C	TO-14 (BTEX only)
	Stoddard solvent	8260B/5035	8260B/5030B	TO-14
	PAHs	8310/3550B/3630C	8310/3520C/3630C	
Preservatives[2] (USA 2-82, USA 2-84, AS-674, AS-673, AS-700, AS-777, "White lead")	VOCs	8260B/5035	8260B/5035	TO-14
	See Oils	8015E/3550B/3630C	8015E/3520C/3630C	
	See Metals	6010A/3050B	6010B/3010A	
Retinning	Tin	6010A/3050B	6010B/3010A	
	See Metals			
Solvents (VOCs)	Chlorobenzene	8260B/5035	8260B/5030B	TO-14
	Trans 1,2 dichloroethene	8260B/5035	8260B/5030B	TO-14
	Trichloroethene	8260B/5035	8260B/5030B	TO-14
Stoddard solvent		8260B/5035	8260B/5030B	TO-14
"White lead" (preservative)	See Fuels (light oils)	8015E/3550B/3630C	8015E/3520C/3630C	TO-14
	See Metals (lead)	6010A/3050B	6010B/3010A	

Table I5-4 (Continued)
Summary of Commonly Used Substances at the 50 Series Complex and Analytical Rationale

50 Series Complex Substance of Concern	Associated Chemicals Reportedly Used in 50 Series Complex	Laboratory Soil Method	Laboratory Water Method	Laboratory Air Method

[1] Energetic materials are to be investigated only by qualified explosives ordnance disposal personnel.

[2] Historical records have indicated that preservatives are composed of one or more of the following chemicals:

A. "White Lead"
B. Heavy (thick, almost hard) petroleum based oil
C. Light petroleum based oil
D. Thin petroleum based oil
E. Lubricating oil
F. Hydraulic oil

BTEX = Benzene, toluene, ethylbenzene, and xylenes
PAHs = Polyaromatic hydrocarbons
PCBs = Polychlorinated biphenyls
POLs = Petroleum, oil, and lubricants
SVOCs = Semi-volatile organic compounds
VOCs = Volatile organic compounds

Table I5-5
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B055HA001						B055HA002						B055HA003					
Attribute to Investigate	➢ Suspected fuels from Building 55 ➢ Metals						➢ Metals associated with two forges and slack tub(s)						➢ Suspected fuels in Building 55 associated with hydraulic press					
Boring Location[1]	Basement: Midway utility tunnel beneath Building 55						Between the suspected location of two forges.						At suspected location of hydraulic press.					
Purpose	Assess potential release of fuels in utility tunnel beneath Building 55						Located in areas with highest potential for release of fuels and metals from the former forge						Located in areas with highest potential for release of fuels and metals from the former hydraulic press					
Sampling Method	Hand auger						Hand auger						Hand auger					
COPC	Fuels, project metals[3], PAHs						VOCs, fuels, acids, project metals[3], PAHs						VOCs, Fuels, acids, project metals[3], PCBs, PAHs					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]	x		x				x		x				x		x			
Copper 6010B																		
Lead 6010B																		
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A																		
TPH extractable 8015B	x		x				x		x				x		x			
TPH volatile 8015B	x		x				x		x				x		x			
PCBs 8082													x		x			
VOCs 8260B	x		x				x		x				x		x			
SVOCs 8270C																		
PAHs 8310	x		x				x		x				x		x			
Nitroaromatics and nitroamines 8330																		
pH 9040B							x		x				x		x			
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0																		
Alkalinity E310.1																		
TO-14			x												x			
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B056HA001-002						B056HA003						B056SB001 - B056SB002					
Attribute to Investigate	➢ Parkerizing and oakite processes as part of small arms repair in Building 56						➢ Parkerizing and oakite processes as part of small arms repair in Building 56						➢ Parkerizing and oakite processes as part of small arms repair in Building 56					
Boring Location[1]	Basement: Exposed soil beneath wooden flooring in Building 56						Basement: Exposed soil beneath wooden flooring in Building 56						IB056SB001 and 002 are located near former Parkerizing tank. IB056SB003 and 004 are centrally located on concrete ground floor					
Purpose	Assess if process fluids from Building 56 and Building 57A activities are present in Building 56 basement area soil						Assess potential release of fuels in utility tunnel beneath Building 56. Assess if VOCs from Building 57A activities are present in Building 56 soil						Assess possible releases of process fluids to shallow soil during previous use					
Sampling Method	Hand auger						Hand auger						Direct push or hollow stem auger					
COPC	VOCs, preservatives[4], acids/alkalis, project metals[3,5], CrVI, SVOCs, PAHs						VOCs, preservatives[4], acids/alkalis, project metals[3,5], CrVI, SVOCs						VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI, SVOCs and PAHs (001 and 002 only)					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]	x		x				x		x				x		x	x	x	
Copper 6010B																		
Lead 6010B																		
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A	x		x				x		x				x		x	x	x	
TPH extractable 8015B	x		x				x		x				x		x	x	x	
TPH volatile 8015B																		
PCBs 8082																		
VOCs 8260B	x		x				x		x				x		x	x	x	
SVOCs 8270C	x		x				x		x				x		x	x	x	
PAHs 8310	x		x				x		x				x		x	x	x	
Nitroaromatics and nitroamines 8330																		
pH 9040B	x		x				x		x				x		x	x	x	
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0																		
Alkalinity E310.1																		
TO-14									x									
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B056SB003 - B056SB004						B056AGR001 (GRAB)						B056AHA001 - B056AHA003					
Attribute to Investigate	➢ Parkerizing and Oakite processes as part of Small Arms Repair in Building 56						Firing Area #1						➢ Parkerizing and Degreasing processes in Building 56A ➢ Former Boiler Room/Retinning and Small Arms in Building 58 ➢ Former Boiler House, Building 65(A)					
Boring Location[1]	B056SB003 and 004 are centrally located on concrete ground floor						Concrete bunker filled with soil at west end of Firing Area #1						B056AHA001: In hallway near former Building 65A B056AHA002: In hallway near former Building 58 B056AHA003: In basement of Building 56A					
Purpose	Assess possible releases of process fluids to shallow soil during previous use						Located in bunker soil with highest potential for metals and residual energetic compounds						Located in soil within rooms with highest potential for metals and residual chemicals based on previous area use					
Sampling Method	Direct push or hollow stem auger						Grab						Hand auger					
COPC	VOCs, preservatives[4], acids/alkalis, project metals[3], and CrVI						Copper, lead, arsenic, antimony, ammunition powders						VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI, fuels, PAHs, SVOCs					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]	x		x	x	x								x		x			
Copper 6010B							x											
Lead 6010B							x											
Antimony 7041							x											
Arsenic 7060A							x											
Hexavalent chromium 7196A	x		x	x	x								x		x			
TPH extractable 8015B	x		x	x	x								x		x			
TPH volatile 8015B													x		x			
PCBs 8082																		
VOCs 8260B	x		x	x	x								x		x			
SVOCs 8270C	x		x	x	x								x		x			
PAHs 8310	x		x	x	x								x		x			
Nitroaromatics and nitroamines 8330																		
pH 9040B	x		x	x	x								x		x			
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0							x											
Alkalinity E310.1																		
TO-14															x			
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B056AHA004						B056AHA005						B056BHA001					
Attribute to Investigate	➢ Suspected fuels/oils from tank in equipment room ➢ Suspected small arms weapons firing						➢ Transformer room ➢ Suspected fuels/oils from tank in equipment room						➢ Possible drainage from parkerizing on ground floor into basement from Building 56B					
Boring Location[1]	Next to floor drain in equipment room						In center of transformer room						Midway in utility tunnel beneath Building 56C					
Purpose	Assess shallow soils near floor drain as most likely area potentially impacted from fuel storage in room						Assess shallow soils in room with highest potential for impacts from former transformers						Assess shallow soils in utility tunnel with highest potential for impacts from ground floor parkerizing operations					
Sampling Method	Hand auger						Hand auger						Hand auger					
COPC	Unspecified fuels, oils, copper, lead, arsenic, antimony, ammunition powders, PAHs						PCBs, unspecified fuels, PAHs, oils, lead						VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI, SVOCs, PAHs					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]													x		x			
Copper 6010B	x		x															
Lead 6010B	x		x				x		x									
Antimony 7041	x		x															
Arsenic 7060A	x		x															
Hexavalent chromium 7196A													x		x			
TPH extractable 8015B	x		x				x		x				x		x			
TPH volatile 8015B	x		x				x		x									
PCBs 8082							x		x									
VOCs 8260B	x		x				x		x				x		x			
SVOCs 8270C													x		x			
PAHs 8310	x		x				x		x				x		x			
Nitroaromatics and nitroamines 8330																		
pH 9040B													x		x			
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0	x		x															
Alkalinity E310.1																		
TO-14															x			
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B056BHA002						B056BHA003						B056BHA004					
Attribute to Investigate	➢ Parkerizing room ➢ Former foundry ➢ Oakite tanks ➢ Welding shop						➢ Parkerizing room ➢ Former foundry ➢ Oakite tanks ➢ Welding shop						➢ Parkerizing room ➢ Former foundry ➢ Oakite tanks ➢ Welding shop					
Boring Location[1]	One of three borings spaced approximately 20 feet apart in central portion of Building 56B						One of three borings spaced approximately 20 feet apart in central portion of Building 56B						One of three borings spaced approximately 20 feet apart in central portion of Building 56B					
Purpose	Assess possible releases to shallow soil during previous building use						Assess possible releases to shallow soil during previous building use						Assess possible releases to shallow soil during previous building use					
Sampling Method	Hand auger						Hand auger						Hand auger					
COPC	VOCs, preservatives[4], acids, foundry wastes (project metals[3]), CrVI, SVOCs, PAHs						VOCs, preservatives[4], acids, foundry wastes (project metals[3]), CrVI, SVOCs, PAHs						VOCs, preservatives[4], acids, foundry wastes (project metals[3]), CrVI, SVOCs, PAHs					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]	x		x				x		x				x		x			
Copper 6010B																		
Lead 6010B																		
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A	x		x				x		x				x		x			
TPH extractable 8015B	x		x				x		x				x		x			
TPH volatile 8015B																		
PCBs 8082																		
VOCs 8260B	x		x				x		x				x		x			
SVOCs 8270C	x		x				x		x				x		x			
PAHs 8310	x		x				x		x				x		x			
Nitroaromatics and nitroamines 8330																		
pH 9040B	x		x				x		x				x		x			
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0																		
Alkalinity E310.1																		
TO-14									x									
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B057HA001 - B057HA003						B057HA004						B057HA005					
Attribute to Investigate	➢ Small arms test firing range in basement ➢ Three shooting ranges ending at an earthen berm						➢ Exposed soil along south wall and drainage in small arms test firing range ➢ Suspected Solvent drainage from degreaser and cleaning vats, B57						➢ Suspected solvent drainage from cleaning vats ➢ Small arms test firing range					
Boring Location[1]	B057HA001: Western range in earthen berm of basement B057HA002: Center range in earthen berm of basement B057HA003: Eastern range in earthen berm of basement						Approximately 10 feet east of entryway in patch of exposed soil in Building 57 basement						Approximately 10 feet west and midway along eastern wall of Building 57 basement in exposed soil					
Purpose	Assess shallow soils in areas with highest potential for potential impacts resulting from test firing						Assess shallow soils in areas with highest potential for impacts resulting from possible leakage on first floor into basement						Assess shallow soils in areas with potential of impact resulting from possible leakage on first floor into basement					
Sampling Method	Hand auger						Hand auger						Hand auger					
COPC	Copper[5] lead[5], arsenic[5], antimony[5], ammunition powders						VOCs, preservatives[4], acids, oils, copper[5], lead[5], arsenic[5], antimony[5], ammunition powders, kerosene, Cosmoline (petroleum distillate)						VOCs, preservatives[4], acids, copper[5], lead[5], arsenic[5], antimony[5], ammunition powders, kerosene, Cosmoline					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]																		
Copper 6010B	x	x					x		x				x		x			
Lead 6010B	x	x					x		x				x		x			
Antimony 7041	x	x					x		x				x		x			
Arsenic 7060A	x	x					x		x				x		x			
Hexavalent chromium 7196A																		
TPH extractable 8015B							x		x				x		x			
TPH volatile 8015B																		
PCBs 8082																		
VOCs 8260B							x		x				x		x			
SVOCs 8270C																		
PAHs 8310																		
Nitroaromatics and nitroamines 8330																		
pH 9040B							x		x				x		x			
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0	x	x					x		x				x		x			
Alkalinity E310.1																		
TO-14									x						x			
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B057AGR001						B057AHP001						B057AHP002					
Attribute to Investigate	➢ Possible disposal of industrial wastes associated with activities in Building 57A into 18-inch diameter pipe						➢ Suspected oil/water separator ➢ Suspected Building 57A solvents in groundwater ➢ Suspected cistern, Building 57A						➢ Suspected cistern, Building 55 ➢ Suspected Building 57A solvents in groundwater ➢ Former Building 66(A) oils ➢ Building 53 fuels in groundwater ➢ Former smoke stack/incinerator					
Boring Location[1]	Grab water sample from 18-inch diameter open pipe						Approximately 20 feet south of suspected oil/water separator north of Building 57A						Approximately 10 feet south of utility vault, near asphalt patches					
Purpose	Existing pipe is the only observed well-like feature in 55 Series buildings						Assess potential soil and groundwater impacts from oil/water separator and possible cistern. Perimeter location to assess groundwater impacts from B57A solvents. To be completed as temporary water level monitoring point						Assess soil and groundwater impacts from possible cistern. Perimeter location for groundwater impacts from Building 57A solvents					
Sampling Method	Grab						Hollow stem auger						Direct push or hollow stem auger					
COPC	VOCs, acids/alkalis, project metals[3], CrVI, general chemical parameters[6]						VOCs, oils, preservatives[4], project metals[3], acids/alkalis, CrVI, TDS, SVOCs (water only), and PAHs						VOCs, fuels, oils, preservatives[4], acids/alkalis, project metals[3], CrVI, explosives, black powder, TDS, SVOCs (water only), and PAHs					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]						x			x	x	x	x	x		x	x	x	x
Copper 6010B																		
Lead 6010B																		
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A						x			x	x	x	x	x		x	x	x	x
TPH extractable 8015B									x	x	x	x	x		x	x	x	x
TPH volatile 8015B																		x
PCBs 8082																		
VOCs 8260B						x			x	x	x	x	x		x	x	x	x
SVOCs 8270C												x						x
PAHs 8310									x	x	x	x	x		x	x	x	x
Nitroaromatics and nitroamines 8330													x		x	x	x	
pH 9040B									x	x	x		x		x	x	x	
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B						x						x						x
Anions E300.0						x						x	x		x	x	x	x
Alkalinity E310.1						x						x						x
TO-14																		
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B057AHP003						B057AHP004						B057AHP005					
Attribute to Investigate	➢ Suspected cistern, Building 56 ➢ Suspected Building 57A solvents in groundwater ➢ Fuels from USTs beneath Building 120 in groundwater						➢ Suspected cistern ➢ Suspected Building 57A solvents in groundwater ➢ Fuels from Building 154 USTs in groundwater						➢ Suspected Building 57A solvents in groundwater ➢ Fuels from Building 154 USTs in groundwater ➢ Fuels and oils from former Building 58 boiler house and former Building 65(A)					
Boring Location[1]	Approximately 30 feet north of Building 56B						Approximately 30 feet west of southwest corner of Building 57						Approx. 40 feet south and 60 feet east of southwest corner of Building 56A					
Purpose	Assess impacts from possible cistern location. Perimeter location for groundwater impacts from Building 57A solvents. To be advanced to approximately 75 feet bgs to obtain core to alluvium/bedrock contact						Assess impacts from possible cistern location. Perimeter location for groundwater impacts from 57A solvents						Perimeter location for groundwater impacts from 57A solvents. To be completed as temporary water level monitoring point					
Sampling Method	Hollow stem auger						Direct push or hollow stem auger						Hollow stem auger					
COPC	VOCs, fuels, preservatives[4], acids/alkalis, project metals[3], CrVI, TDS, SVOCs (water only), and PAHs						VOCs, fuels, preservatives[4], PAHs, acids/alkalis, project metals[3], CrVI, TDS, and SVOCs (water only)						VOCs, fuels, oils, preservatives[4], CrVI, PAHs, acids/alkalis, project metals[3],natural attenuation parameters*, TDS and SVOCs (water only)					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]			x	x	x	x			x	x	x	x			x	x		x
Copper 6010B																		
Lead 6010B																		
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A			x	x	x	x			x	x	x	x			x	x		x
TPH extractable 8015B			x	x	x	x			x	x	x	x			x	x		x
TPH volatile 8015B						x						x			x	x		x
PCBs 8082																		
VOCs 8260B			x	x	x	x			x	x	x	x			x	x		x
SVOCs 8270C						x						x						x
PAHs 8310			x	x	x	x			x	x	x	x			x	x		x
Nitroaromatics and nitroamines 8330																		
pH 9040B			x	x	x				x	x	x				x	x		
Grain size ASTM D422**															x	x		
TDS E160.3/Cations 6010B						x						x						x
Anions E300.0						x						x						x
Alkalinity E310.1						x						x			x	x		x
TO-14																		
TOC**															x	x		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B057AHP006						B057AHP007						B057AHP008					
Attribute to Investigate	➢ Suspected Building 57A solvents in groundwater ➢ Fuels from Building 53 USTs in groundwater and former Building 58 boiler house ➢ Oils from former Building 59(A) and Building 58 boiler house						➢ Continuous degreaser in Building 57 ➢ Suspected Building 57A solvents in groundwater						➢ Building 57A parkerizing room ➢ Magnitude of soil gas concentrations in area of previously recorded elevated VOC concentrations					
Boring Location[1]	Approximately 40 feet south and 50 feet west of southeast corner of Building 56A						Approximately 10 feet west and 20 feet south of northwest corner of Building 57						One boring located between the clearing vats, approximately 40 feet from the north wall of Building 57A					
Purpose	Perimeter location for groundwater impacts from 57A solvents and Building 53 USTs. To be completed as shallow temporary monitoring well						Assess extent of possible impacts to soil and groundwater from degreaser in Building 57 and solvents from Building 57A						Assess vertical and lateral extent of known VOC-impacted area by collecting soil gas, soil and groundwater samples					
Sampling Method	Hollow stem auger						Direct push or hollow stem auger						Direct push or hollow stem auger					
COPC	VOCs, fuels, oils, preservatives[4], PAHs, acids/alkalis, project metals[3], CrVI, TDS, and SVOCs (water only)						VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI, TDS and SVOCs (water only)						SVOCs, PAH, VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI, anions, TDS (water only)					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]			x	x		x			x	x	x	x			x	x	x	x
Copper 6010B																		
Lead 6010B																		
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A			x	x		x			x	x	x	x			x	x	x	x
TPH extractable 8015B			x	x		x			x	x	x	x			x	x	x	x
TPH volatile 8015B			x	x		x												
PCBs 8082																		
VOCs 8260B			x	x		x			x	x	x	x			x	x	x	x
SVOCs 8270C						x						x			x	x	x	x
PAHs 8310			x	x		x			x	x	x	x			x	x	x	x
Nitroaromatics and nitroamines 8330																		
pH 9040B			x	x					x	x	x				x	x	x	
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B						x						x						x
Anions E300.0						x						x			x	x	x	x
Alkalinity E310.1						x						x						x
TO-14															x			
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B057ASB001						B057BHA001						B065BHA001					
Attribute to Investigate	➢ Parkerizing room ➢ Magnitude of soil gas concentrations in area of previously recorded elevated VOC concentrations						➢ Building 57A solvents ➢ Utility tunnel beneath parkerizing room in Building 57A						➢ Suspected USTs ➢ Suspected boiler room					
Boring Location[1]	One boring located near previous soil boring B-4						Basement: Midway in utility tunnel beneath Building 57A						Approximately 10 feet from the northeast corner of the Building 65(B)					
Purpose	Assess vertical and lateral extent of known VOC-impacted areas by collecting soil gas and soil samples						Assess potential release of VOCs beneath Buildings 57A and 57B						Assess potential impacts to soil in probable location of former UST					
Sampling Method	Direct push or hollow stem auger						Hand auger						Hand auger					
COPC	SVOCs, PAH, VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI						VOCs, preservatives[4], acids/alkalis, project metals[3], CrVI						Fuels, oils, lead, PAHs					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]			x	x	x		x		x									
Copper 6010B																		
Lead 6010B													x		x			
Antimony 7041																		
Arsenic 7060A																		
Hexavalent chromium 7196A			x	x	x		x		x									
TPH extractable 8015B			x	x	x		x		x				x		x			
TPH volatile 8015B													x		x			
PCBs 8082																		
VOCs 8260B			x	x	x		x		x				x		x			
SVOCs 8270C			x	x	x		x		x									
PAHs 8310			x	x	x		x		x				x		x			
Nitroaromatics and nitroamines 8330																		
pH 9040B			x	x	x		x		x									
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0																		
Alkalinity E310.1																		
TO-14			x															
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B065BHA002						B065BHA003						B066ASB001					
Attribute to Investigate	Small arms weapons testing						Suspected location of soil removed from Building 65(B) boiler room						➢ Former storage of oils at Building 66(A) ➢ Former smokestack/ incinerator					
Boring Location[1]	In the middle of existing concrete pads in Courtyard						In middle of suspected location of stockpiled soil, east of Building 56						Approximately 10 feet west of suspected smokestack/ incinerator footprint					
Purpose	Assess shallow soil in room with highest probability of impacts from small arms testing						Likely location of excavated soil from Building 65 boiler room						Assess potential impacts from petroleum storage and incinerator					
Sampling Method	Hand auger						Hand auger						Direct push or hollow stem auger					
COPC	Copper, lead, arsenic, antimony, ammunition powders						Fuels, oils, lead, PAHs						Oils, project metals[3], unspecified explosives, nitrate residue					
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]
Project metals list[3]													x		x	x		
Copper 6010B	x		x															
Lead 6010B	x		x				x	x										
Antimony 7041	x		x															
Arsenic 7060A	x		x															
Hexavalent chromium 7196A																		
TPH extractable 8015B							x	x					x		x	x		
TPH volatile 8015B							x	x										
PCBs 8082																		
VOCs 8260B							x	x										
SVOCs 8270C																		
PAHs 8310							x	x										
Nitroaromatics and nitroamines 8330													x		x	x		
pH 9040B																		
Grain size ASTM D422**																		
TDS E160.3/Cations 6010B																		
Anions E300.0	x		x										x		x	x		
Alkalinity E310.1																		
TO-14																		
TOC**																		

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

Boring Name	B120SB001 – B120SB002						B053SB004						Total Analyses
Attribute to Investigate	Suspected USTs and pipelines beneath Building 120						➢ Building 53 fuels ➢ Former Building 59(A) oils						
Boring Location[1]	Approximately 5 to 10 feet north of Building 120						See FSIP for Building 53						
Purpose	Assess potential release of fuels from USTs												
Sampling Method	Direct push or hollow stem auger						Direct push or hollow stem auger						
COPC	Fuels, oils, lead, PAHs						Diesel and leaded gasoline, lead, PAHs, oils						
Depth (ft-bgs)[1]	0	3	5	10	20	GW[2]	0	3	5	10	20	GW[2]	
Project metals list[3]							See FSIP for Building 53 for sampling depths and analyses						82
Copper 6010B													15
Lead 6010B			x	x	x	x							29
Antimony 7041													15
Arsenic 7060A													15
Hexavalent chromium 7196A													73
TPH extractable 8015B			x	x	x	x							101
TPH volatile 8015B			x	x	x	x							37
PCBs 8082													4
VOCs 8260B			x	x	x	x							99
SVOCs 8270C													52
PAHs 8310			x	x	x	x							94
Nitroaromatics and nitroamines 8330													7
pH 9040B													73
Grain size ASTM D422**													2
TDS E160.3/Cations 6010B													9
Anions E300.0													30
Alkalinity E310.1													11
TO-14													12
TOC**													2

See Notes on last page of Table I5-5.

Table I5-5 (Continued)
Sampling and Analysis Matrix
Field Specification for the 50 Series Complex

* Natural attenuation (NA) parameters include: Total Organic Carbon (TOC) by Walkey-Black method, alkalinity by E310.1, and grain size distribution by ASTM D422 for soil. Groundwater NA parameters include: Total Dissolved Solids (TDS) by E160.3, pH by SW9040B/9045C, general minerals (alkalinity, chloride, hardness, pH, potassium, sodium, specific conductance, sulfate, surfactants, and TDS).
** NA samples should be collected from different lithologies in the same boring (if possible).

1. Sampling points, locations, depths, and analytical methods to be determined in the field. The sampling points, locations, depths, and analytical methods listed for this table are only a guide.
2. All groundwater samples analyzed for metals will be filtered using a 0.45 µm filter in the field.
3. Project metals list consists of: barium, beryllium, total chromium, cobalt, copper, manganese, molybdenum, nickel, silver, tin, vanadium, and zinc by 6010B; cadmium and lead by 6010B (ICP trace); antimony (7041); arsenic (7060A); selenium (7740); thallium (7841); and mercury (7471A). This metals list incorporates the eight RCRA metals and the 13 priority pollutant metals.
4. Historical records have indicated that preservatives are composed of one or more of the following chemicals:
   A. "White Lead"
   B. Heavy (thick, almost hard) petroleum based oil
   C. Light petroleum based oil
   D. Thin petroleum based oil
   E. Lubricating oil
   F. Hydraulic oil
5. A #10 (0.0787 inch opening) sieve will be used according to USACE methods for sieving bullets and bullet fragments from soil samples. Bullets will be saved out of sample and analysis will be conducted on residual fine grained material according to USACE procedures.
6. Based on the nature of liquid in the pipe, general chemical parameters for sodium, potassium, magnesium, calcium, total dissolved solids, alkalinity, nitrate, chloride, and sulfate may be added to the analyte list.

Notes:

- Field QC samples, including trip blanks, equipment rinsate blanks, filter blanks, source water blanks, splits and field duplicates, will be taken at the minimum frequency specified in the QAPP. See Table I5-7 for frequency and location of QC samples.
- Procedures to be used for proper collection, characterization, storage, containerization, transport, and disposal of the Arsenal's IDW will be in accordance with the IDW Plan in the Arsenal-wide Investigation Workplan.

Anions = nitrate, chloride, sulfate
Cations = calcium, magnesium, sodium potassium
CrVI = Hexavalent chromium
IDW = Investigation derived waste
GW = Groundwater
PAHs = Polyaromatic hydrocarbons
PCBs = Polychlorinated biphenyls
SVOCs = Semi-volatile organic compounds
TDS = Total dissolved solids
TOC = Total organic carbon
UST = Underground storage tank
VOCs = Volatile organic compounds

Table I5-6
Applicable SOPs for 50 Series Complex

SOP No.	SOP Title	Applicable	Not Applicable	Specific Aspects of SOP to be Implemented for This FSIP
1.0	Field Logbook	✓		All
2.0	Boring Log Development	✓		All
3.0	Field Classification and Description of Soils	✓		All
4.0	Sample Management	✓		All
5.0	Field Measurement of Organic Vapors	✓		1. A photoionization detector (PID) Model 580B OVM or equivalent will be used instead of a flame ionization detector (FID). 2. Direct reading colorimetric indicator tubes for benzene (fuel only sites) and TCE (VOC related sites) will be used to speciate contaminant exposures for assessment of PPE.
6.0	Utility Clearance	✓		All except, no lock-out/tag-out procedures necessary for this FSIP
7.0	Collection of Soil Samples	✓		1. Surface, subsurface, and depth-discrete soil samples will be collected using scoop/trowels, thin-walled tubes, and ring-lined samplers, as appropriate. 2. Surface soil samples will be collected within the first 6 inches below base rock and/or asphalt and concrete. 3. A #10 sieve will be used to remove bullets/bullet fragments from soil samples collected from the small arms testing range.
8.0	XRF Soil Analysis		✓	
9.0	Packing and Shipping of Environmental Samples	✓		All
10.0	Sample Preservation and Analysis Methods	✓		Subcontracting laboratories will provide preserved sample containers. Preserved groundwater samples from previous investigations have been checked for proper pH. These results indicate that correct pH aliquots are provided in the sample containers. Therefore, only periodic pH checks will be conducted. Preservatives are available at the site and will be added, if necessary.
11.0	Sampling Equipment Decontamination	✓		All
12.0	Immunoassay		✓	
13.0	*In Situ* Groundwater Sampling	✓		Hydropunch® samples will be collected as part of this investigation.
14.0	Borehole Abandonment	✓		Only boreholes are planned for this FSIP and will be "plugged" according to this SOP.

Table I5-6
Applicable SOPs for 50 Series Complex

SOP No.	SOP Title	Applicable	Not Applicable	Specific Aspects of SOP to be Implemented for This FSIP
15.0	Well Development	✓		Development of static water level measuring points shall be performed using the procedures for Microwell/Monitoring Wells (Section 7.6 of this SOP).
16.0	Surface Water Sampling		✓	
17.0	Groundwater Purging and Sampling	✓		Disposable bailers attached to industrial-type twine will be used to collect groundwater samples from wells.
18.0	Geophysical Testing	✓		For this investigation, ground penetrating radar, terrain conductivity, and electromagnetic line locating methods will be used.
19.0	Soil Gas Sampling	✓		Drive probes will be used to collect soil gas samples as part of this FSIP.
20.0	Sludges and Sediments		✓	
21.0	Well and Piezometer Installation	✓		All
22.0	Field Measurement of pH	✓		A digital or analog pH tester will be used.
23.0	Field Measurement of Temperature	✓		All
24.0	Field Measurement of Specific Conductance	✓		All
25.0	Field Measurement of Water Levels	✓		All
26.0	Photographic/Video Documentation	✓		All
27.0	Drilling	✓		Direct push or hollow stem auger drilling methods will be implemented for this investigation. Direct push methods may be limited in depth due to shallow bedrock or very cohesive soils. As a result, based on field results, hollow stem auger drilling may be used to replace direct push methods.
28.0	Cone Penetrometer Drilling and Sampling Procedures		✓	
29.0	Trenching		✓	
30.0	Methanol Preservation for Volatile Organic Compounds in Soils		✓	
31.0	Field Classification and Description of Rocks	✓		All
32.0	Field Sampling with EnCore™	✓		All

SOP = Standard Operating Procedure

XRF = X-Ray Fluorescence

Table I5-7

Summary of Anticipated Investigation Derived Waste Volume

Boring Name	Anticipated Total Depth	Matrix	IDW Quantity		Number of 55-gallon drums		Notes
			Soil (cu ft)	Water (gallons)	Soil	Water	
B056SB001	20	Soil	0.5	--	0.1	--	A
B056SB002	20	Soil	0.5	--	0.1	--	A
B056SB003	20	Soil	0.5	--	0.1	--	A
B056SB004	20	Soil	0.5	--	0.1	--	A
B057AHP001 (temporary sampling point)	20	Soil	7	--	1	--	B
B057AHP001 (Hydropunch® sampling)	20	Water	--	1	--	0.02	
B057AHP002	20	Soil	0.5	--	0.1	--	A
B057AHP003	75	Soil	26	--	4	--	B
B057AHP004	20	Soil	0.5	--	0.1	--	A
B057AHP005 (temporary sampling point)	20	Soil	7	--	1	--	B
B057AHP005 (Hydropunch® sampling)	20	Water	--	1	--	0.02	
B057AHP006 (temporary sampling point)	20	Soil	7	--	1	--	B
B057AHP006 (Hydropunch® sampling)	20	Water	--	1	--	0.02	
B057AHP007	20	Soil	0.5	--	0.1	--	A
B057AHP008	20	Soil	0.5	--	0.1	--	A
B057ASB001	20	Soil	0.5	--	0.1	--	A
B120SB001	20	Soil	0.5	--	0.1	--	A
B120SB002	20	Soil	0.5	--	0.1	--	A
Decontamination of soil sampling and down-hole drilling equipment with direct push drilling rig	--	Water	--	120	--	3	C
Decontamination of soil sampling and down-hole drilling equipment with hollow stem auger drilling rig	--	Water	--	185	--	4	D
Totals (18 borings)	415		53	308	9	8	

Notes:

A. Assumed direct push drilling
B. Assumed hollow stem auger drilling
C. Assumed one 55-gallon drum per 100 feet of direct push drill pipe (approximately 220 feet of drilling)
D. Assumed one 55-gallon drum per 40 feet of hollow stem auger (approximately 135 feet of drilling)

Table I5-8
IDW Transport, Treatment and Disposal Information for 50 Series Complex

Company	Location	Media	Level	Tests [a, b]
Transporters				
Integrated Waste Management (IWM)	San Jose	soil groundwater	all levels	
Nielson Construction	Napa	soil concrete and asphalt	clean	
Landfills				
Kettleman Hills	Kettleman City	soil	TSDF Soil must meet organic treatment standards.	- TTLC for SVOCs (8270C)[c] - TTLC for CAM 17 metals (6010B)[c] - TPH for all ranges of hydrocarbons - BTEX (8260B) - VOCs (8260B) - PCBs (8082) - testing depends on desired waste classification (i.e., non-RCRA for direct landfill, RCRA for direct landfill, or RCRA for stabilization)
BFI Vasco Road Sanitary Landfill	Livermore	soil	low levels some TCE acceptable	- TPH for all ranges of hydrocarbons (8015B) - BTEX (8260B) - lead (TTLC) (6010B) - CAM 17 metals (6010B) - LUFT 5 metals (6010B) - SVOCs (8270C) - solvents (8260B) - 96 hour aquatic toxicity biosassy and/or RCI in some instances
B&J Landfill	Vacaville	soil	low levels petroleum hydrocarbons no TCE	- TTLC for CAM 17 metals[d]; and total analyses for TPH for all ranges of hydrocarbons[d] (8015M) - BTEX (8260B) - VOCs (8260B) - SVOCs (8270C) - PCBs[d] (8082)
Potrero Hills Landfill	Suisun City	soil	clean	- Visual inspection (no grass, weeds, large rocks, concrete or asphalt)
Recylers				
Syar Industries, Incorporated	Vallejo	concrete asphalt		- Visual inspection

Table I5-8 (Continued)
IDW Transport, Treatment and Disposal Information for 50 Series Complex

Company	Location	Media	Level	Tests [a, b]
Groundwater Treatment				
Seaport Environmental	Redwood City	groundwater	Low levels	Tests for pH; flashpoint; total analyses for gasoline, diesel, oil (8015B), chlorinated solvents (8260B) and CAM 17 metals (6010B)
Safety Kleen	Sacramento	groundwater	California hazardous RCRA	Safety Kleen will conduct internal analysis of composite samples for each disposal event. Safety Kleen analysis will be based on site characterization data and could include - TTLC for CAM metals (6010B) - VOCs (8260B) - SVOCs (8270C) - pesticides (8081) - PCBs (8082) - BTEX (8260B) - flashpoint
Soil Treatment				
Romic Environmental	San Jose	soil	California hazardous RCRA	Romic will conduct internal analysis of samples for the waste profile. The number of samples will be dependent on volume of waste. Romic analyses will be based on characterization data including - TTLC for CAM metals (6010B) - VOCs (8260B) - SVOCs (8270C) - pesticides (8081) - PCBs (8082) - BTEX (8260B) - percent moisture

BTEX= benzene, toluene, ethylbenzene, xylenes
CAM 17 Metals = antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc, mercury
LUFT 5 metals = cadmium, chromium, lead, nickel, zinc
PCBs = polychlorinated biphenyls
RCI = reactivity, corrosivity, and ignitability
RCRA = Resource Conservation Recovery Act
STLC = soluble threshold limit concentration
TCE = trichloroethene
TTLC = total threshold limit concentration
TPH = total petroleum hydrocarbons
VOCs = volatile organic compounds
[a] Soil testing for waste profiting will be conducted using one 4-point composite sample per 150 cubic yards. Water testing will be conducted by one composite sample per disposal event.
[b] Specific testing required for disposal or treatment of any waste will depend on suspected contaminant source and characterization results from investigative activities.
[c] STLC and TCLP required if these values are too high.
[d] Additional testing required if these values exceed specified limits.

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
BUILDING 55											
B055HA001											
B055HA001-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 8015B/3550B/3630C, 8310/3550B/3630C*	*Project Metals List*, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B055HA001-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP	x			
B055HA001-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B055HA001-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 8015B/3550B/3630C, 8310/3550B/3630C*	*Project Metals List*, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B055HA001-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP			x	x
B055HA001-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B055HA001-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP	x			
B055HA002											
B055HA002-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C*	*Project Metals List, extractable TPH, PAHs, pH*	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B055HA002-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B055HA002-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B055HA002-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C*	*Project Metals List, extractable TPH, PAHs, pH*	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B055HA002-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B055HA002-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B055HA003											
B055HA003-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8082/3550B*	*Project Metals List, extractable TPH, PAHs, pH, PCBs*	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B055HA003-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP		x		
B055HA003-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B055HA003-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8082/3550B*	*Project Metals List, extractable TPH, PAHs, pH, PCBs*	6-in long x 2-in diameter stainless steel sleeve	1	NP	PCB x			
B055HA003-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B055HA003-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B055HA003-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
BUILDING 50 B056HA001											
B056HA001-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	CrVI x			
B056HA001-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056HA001-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056HA001-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056HA002											
B056HA002-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056HA002-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056HA002-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B056HA002-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B056HA003											
B056HA003-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056HA003-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056HA003-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B056HA003-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B056HA003-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B056SB001											
B056SB001-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB001-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB001-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B056SB001-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B056SB001-S03A	10	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B056SB001-S03B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B056SB001-S04A	20	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB001-S04B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB002											
B056SB002-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB002-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB002-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB002-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB002-S03A	10	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB002-S03B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB002-S04A	20	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB002-S04B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B056SB003											
B056SB003-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B056SB003-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B056SB003-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B056SB003-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B056SB003-S03A	10	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	CrVI x			
B056SB003-S03B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB003-S04A	20	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB003-S04B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB004											
B056SB004-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB004-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB004-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			SVOCs x	SVOCs x
B056SB004-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB004-S03A	10	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB004-S03B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056SB004-S04A	20	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B, 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B*	*Project Metals List*, CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056SB004-S04B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
BUILDING 56A											
B056AGR001											
B056AGR001-S01A	0	Soil	6010B/3050B, 7060A/3050A, 7041/3050A, E300.0	copper, lead, arsenic, antimony, anions	8 oz jar	1	NP		x		
B056AHA001											
B056AHA001-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B056AHA001-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP	x			
B056AHA001-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B056AHA001-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA001-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA001-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056AHA001-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				
B056AHA002											
B056AHA002-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA002-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA002-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056AHA002-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA002-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA002-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056AHA002-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				
B056AHA003											
B056AHA003-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA003-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA003-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B056AHA003-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B056AHA003-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP			x	x
B056AHA003-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B056AHA003-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				
B056AHA004											
B056AHA004-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, E300.0	copper, lead, arsenic, antimony, extractable TPH, PAHs, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA004-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA004-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056AHA004-S02A	5	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, E300.0	copper, lead, arsenic, antimony, extractable TPH, PAHs, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA004-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA004-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056AHA005											
B056AHA005-S01A	0	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, 8082/3550B	lead, extractable TPH, PAHs, PCBs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056AHA005-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B056AHA005-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056AHA005-S02A	5	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C, 8082/3550B	lead, extractable TPH, PAHs, PCBs	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B056AHA005-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP		x		
B056AHA005-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
BUILDING 50											
B056BHA001											
B056BHA001-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056BHA001-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056BHA001-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	CrVI x			
B056BHA001-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056BHA001-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B056BHA002											
B056BHA002-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056BHA002-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056BHA002-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056BHA002-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056BHA003											
B056BHA003-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B056BHA003-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B056BHA003-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B056BHA003-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B056BHA003-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				
B056BHA004											
B056BHA004-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056BHA004-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B056BHA004-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7471A, 7060A/3050B, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B056BHA004-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
BUILDING 57											
B057HA001											
B057HA001-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B057HA001-S02A	3	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B057HA002											
B057HA002-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057HA002-S02A	3	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B057HA003											
B057HA003-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057HA003-S02A	3	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057HA004											
B057HA004-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, 8015B/3550B/3630C, E300.0, 9045C	copper, lead, arsenic, antimony, extractable TPH, anions, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057HA004-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057HA004-S02A	5	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, 8015B/3550B/3630C, E300.0, 9045C	copper, lead, arsenic, antimony, extractable TPH, anions, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B057HA004-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B057HA004-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				
B057HA005											
B057HA005-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, 8015B/3550B/3630C, E300.0, 9045C	copper, lead, arsenic, antimony, extractable TPH, anions, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057HA005-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057HA005-S02A	5	Soil	6010B/3050B, 7060A/3050B, 7041/3050B, 8015B/3550B/3630C, E300.0, 9045C	copper, lead, arsenic, antimony, extractable TPH, anions, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B057HA005-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B057HA005-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
BUILDING 57A											
B057AGR001											
B057AGR004-W01A	0	SW	8260B/5030B	VOCs	40 ml VOAs	3	HCL				
B057AGR004-W01B	0	SW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F				
B057AGR004-W01C	0	SW	7196A	CrVI	1 liter poly	1	NP/F				
B057AGR004-W01D	0	SW	7196A, E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
B057AHP001											
B057AHP001-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP001-S01B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP001-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP		CrVI x		
B057AHP001-S02B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP001-S03A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP001-S03B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP001-W01A	20+	GW	8015B/5030B, 8260B/5030B	VOCs	40 ml VOAs	3	HCL	x			
B057AHP001-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP	x			
B057AHP001-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F	x			
B057AHP001-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F	x			
B057AHP001-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F	x			

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B057AHP002											
B057AHP002-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP002-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP002-S01C	0	Soil	8330, E300.0	Nitroaromatics and nitroamines, anions	8 oz jar	1	NP				
B057AHP002-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP002-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP002-S02C	5	Soil	8330, E300.0	Nitroaromatics and nitroamines, anions	8 oz jar	1	NP				
B057AHP002-S03A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B057AHP002-S03B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B057AHP002-S03C	10	Soil	8330, E300.0	Nitroaromatics and nitroamines, anions	8 oz jar	1	NP		x		
B057AHP002-S04A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP002-S04B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP002-S04C	20	Soil	8330, E300.0	Nitroaromatics and nitroamines, anions	8 oz jar	1	NP				
B057AHP002-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL			x	x
B057AHP002-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP			x	x
B057AHP002-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F			x	x
B057AHP002-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F			x	x
B057AHP002-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F			x	x

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B057AHP003											
B057AHP003-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP003-S01B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP003-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B057AHP003-S02B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B057AHP003-S03A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP003-S03B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP003-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL			x	x
B057AHP003-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP			x	x
B057AHP003-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F			x	x
B057AHP003-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F			x	x
B057AHP003-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F			x	x
B057AHP004											
B057AHP004-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP004-S01B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP004-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP004-S02B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP004-S03A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B057AHP004-S03B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B057AHP004-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
B057AHP004-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP				
B057AHP004-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F				
B057AHP004-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F				
B057AHP004-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B057AHP005											
B057AHP005-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, E310.1	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, alkalinity	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP005-S01B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B057AHP005-S01C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP005-S01D	5	Soil	ASTM D422	Grain size	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP005-S01E	5	Soil	9045C, E310.1, Walkley-Black	pH, alkalinity, TOC	8 oz jar	1	NP				
B057AHP005-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, E310.1	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, alkalinity	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP005-S02B	10	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B057AHP005-S02C	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP005-S02D	10	Soil	ASTM D422	Grain size	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP005-S02E	10	Soil	9045C, E310.1, Walkley-Black	pH, alkalinity, TOC	8 oz jar	1	NP				
B057AHP005-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL		x		
B057AHP005-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP		x		
B057AHP005-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F		x		
B057AHP005-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F		x		
B057AHP005-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F		x		
B057AHP006											
B057AHP006-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B057AHP006-S01B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP	x			
B057AHP006-S01C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B057AHP006-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP006-S02B	10	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B057AHP006-S02C	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP006-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL			x	x
B057AHP006-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP			x	x

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B057AHP006-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F			x	x
B057AHP006-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F			x	x
B057AHP006-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F			x	x
[illegible]											
B057AHP007-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP007-S01B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP007-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP007-S02B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP007-S03A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C	*Project Metals List,* CrVI, extractable TPH, PAHs, pH	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B057AHP007-S03B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B057AHP007-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL			x	x
B057AHP007-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP			x	x
B057AHP007-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F			x	x
B057AHP007-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F			x	x
B057AHP007-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F			x	x
[illegible]											
B057AHP008-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B, E300.0	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057AHP008-S01B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP008-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP				
B057AHP008-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B, E300.0	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B057AHP008-S02B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B057AHP008-S03A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B, E300.0	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
B057AHP008-S03B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057AHP008-W01A	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
B057AHP008-W01B	20+	GW	8015B/3520C/3630C, 8270C/3520C, 8310/3520C/3630C	extractable TPH, SVOCs, PAHs	1 liter amber	6	NP				
B057AHP008-W01C	20+	GW	*6010B/3010A, 7041/3020A, 7060A/3020A, 7471A, 7740/3020A, 7841/3020A*	*Project Metals List*/Cations	1 liter poly	1	HNO3/F				
B057AHP008-W01D	20+	GW	7196A	CrVI	1 liter poly	1	NP/F				
B057AHP008-W01E	20+	GW	E160.3, E300.0, E310.1	TDS, anions, alkalinity	1 liter poly	1	NP/F				
B057ASB001											
B057ASB001-S01A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B057ASB001-S01B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B057ASB001-G01	5	Soil gas	TO-14	VOCs	6 liter summa cannister	1	NP	x			
B057ASB001-S02A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B057ASB001-S02B	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B057ASB001-S03A	20	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057ASB001-S03B	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
[illegible]											
B057BHA001-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B057BHA001-S01B	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B057BHA001-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 7196A/3060A, 8015B/3550B/3630C, 8310/3550B/3630C, 9045C, 8270C/3550B	*Project Metals List,* CrVI, extractable TPH, PAHs, pH, SVOCs	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B057BHA001-S02B	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
BUILDING 65B											
B065BHA001											
B065BHA001-S01A	0	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B065BHA001-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B065BHA001-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B065BHA001-S02A	5	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B065BHA001-S02B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B065BHA001-S02C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B065BHA002											
B065BHA002-S01A	0	Soil	6010B/3050B, 7060A/3050B, 7041/3050A, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B065BHA002-S02A	5	Soil	6010B/3050B, 7060A/3050B, 7041/3050A, E300.0	copper, lead, arsenic, antimony, anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B065BHA003											
B065BHA003-S01A	0	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP	x			
B065BHA003-S01B	0	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP	x			
B065BHA003-S01C	0	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP	x			
B065BHA003-S02A	3	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B065BHA003-S02B	3	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B065BHA003-S02C	3	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
BUILDING 66A											
B066ASB004-S01A	0	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 8015B/3550B/3630C, E300.0	*Project Metals List*, extractable TPH, Anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B066ASB004-S01B	0	Soil	8330	Nitroaromatics and nitroamines	8 oz jar	1	NP				
B066ASB004-S02A	5	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 8015B/3550B/3630C, E300.0	*Project Metals List*, extractable TPH, Anions	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B066ASB004-S02B	5	Soil	8330	Nitroaromatics and nitroamines	8 oz jar	1	NP			x	x
B066ASB004-S03A	10	Soil	*6010B/3050B, 7041/3050B, 7060A/3050B, 7471A, 7740/3050B, 7841/3050B,* 8015B/3550B/3630C, E300.0	*Project Metals List*, extractable TPH, Anions	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B066ASB004-S03B	10	Soil	8330	Nitroaromatics and nitroamines	8 oz jar	1	NP				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
BUILDING 120											
B120SB001											
B120SB001-S01A	5	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP			x	x
B120SB001-S01B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP			x	x
B120SB001-S01C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP			x	x
B120SB001-S02A	10	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP		x		
B120SB001-S02B	10	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP		x		
B120SB001-S02C	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP		x		
B120SB001-S03A	20	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B120SB001-S03B	20	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B120SB001-S03C	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B120SB001-W01A	20+	GW	6010B/3010A	lead	500 ml poly	1	HNO3/F				
B120SB001-W01B	20+	GW	8015B/3520C/3630C, 8310/3520C/3630C	extractable TPH, PAHs	1 liter amber	4	NP				
B120SB001-W01C	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL				
B120SB002											
B120SB002-S01A	5	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B120SB002-S01B	5	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B120SB002-S01C	5	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B120SB002-S02A	10	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B120SB002-S02B	10	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B120SB002-S02C	10	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B120SB002-S03A	20	Soil	6010B/3050B, 8015B/3550B/3630C, 8310/3550B/3630C	lead, extractable TPH, PAHs	6-in long x 2-in diameter stainless steel sleeve	1	NP				
B120SB002-S03B	20	Soil	8015B/5030B	volatile TPH	5g Encore samplers	2	NP				
B120SB002-S03C	20	Soil	8260B/5035	VOCs	5g Encore samplers	4	NP				
B120SB002-W01A	20+	GW	6010B/3010A	lead	500 ml poly	1	HNO3/F				
B120SB002-W01B	20+	GW	8015B/3520C/3630C, 8310/3520C/3630C	extractable TPH, PAHs	1 liter amber	4	NP				
B120SB002-W01C	20+	GW	8015B/5030B, 8260B/5030B	volatile TPH, VOCs	40 ml VOAs	6	HCL				

Table I5-9
Analytical Method, Container, and QC Specification Matrix

Sample ID	Est. Depth (feet bgs)	Matrix	Analysis	Analytes	Container type	# of containers	Preserv	Dup	Split	MS	MSD
QC SUMMARY											
		Matrix		Analytes							
		Soil	QC	As applicable							
		Soil Gas		Volatile TPH							
				VOCs							
				Polychlorinated biphenyls							
				Cations							
				Anions							
Notes:											
1. *Project Metals List* consists of:											
	6010B	aluminum, barium, beryllium, cadmium (trace ICP), chromium, cobalt, copper, iron, lead (trace ICP), magnesium, manganese,									
		molybdenum, nickel, silver, tin, vanadium, and zinc.									
	7041	antimony									
	7060A	arsenic									
	7740	selenium									
	7841	thallium									
	7471A	mercury									
This list covers the 8 RCRA metals and the 13 Priority Pollutant Metals.											
2. All groundwater samples analyzed for metals will be filtered using a 0.45 m filter in the field, designated by the "F" in the Preservative column.											
3. MS/MSD samples marked on this table are to be used only as a guide. Actual MS/MSD assignments will be coordinated with the laboratory on a daily basis.											
and follow QAPP requirements											
CrVI = Hexavalent chromium		ml = milliliter		PCBs = Polychlorinated biphenyls			TPH = Total petroleum hydrocarbons				
F = Field filtered		MS = Matrix Spike		QC = Quality Control			TOC = Total organic carbon				
GW = Groundwater		MSD = Matrix Spike Duplicate		RCRA = Resource Conservation Recovery Act			VOCs = Volatile organic compounds				
HCL = Hydrochloric acid		NP = Not preserved		SVOCs = Semi volatile organic compounds			Cations = Ca, Mg, Na, K				
HNO3 = Nitric acid		PAHs = Polyaromatic hydrocarbons		SW = Static water			Anions = No_3, Cl, So_4				
				TDS = Total dissolved solids							

Table I5-10
Quality Control Assessment for 50 Series Complex

Assessment Criteria	Quality Control Sample	Applicable Methods	Frequency	Anticipated Number of QC samples
Matrix component of measurement performance and laboratory performance	Matrix spike (MS)	Organic	One per batch of samples (up to a maximum of 20 samples per batch) by matrix	10 – Soil 4 – Groundwater
	Matrix spike duplicate (MSD)	Inorganic/organic	One per batch of samples (up to a maximum of 20 samples per batch) by matrix	10 – Soil 4 – Groundwater
	Surrogate spikes	Organic	As required by the analysis	
	Laboratory duplicates	Inorganic	One per batch of samples (up to a maximum of 20 samples per batch)	10 – Soil 4 – Groundwater 4 – Soil gas
	Performance evaluation samples	Inorganic/organic	Semi-annual basis	None
Field sampling techniques	Field duplicate samples	Inorganic/organic	10 percent of all matrices	10 – Soil 2 – Groundwater 2 – Soil gas
	Split samples	Inorganic/organic	10 percent of all matrices	10 – Soil 2 – Groundwater 2 – Soil gas
	Trip blanks	Organic	One set per cooler with VOAs	40
	Equipment rinsate blanks		One per sampling crew per day if non-dedicated equipment is used for aqueous samples	8
	Filter blanks	Inorganic	One per lot of filters	1
	Source water samples	Inorganic/organic	One per lot of rinsate water	1
	Field ambient blanks		One per sampling crew per day	6 (soil gas vapor tips)

Table I5-11

Readiness Review Checklist 50 Series Complex

Date: _____

Activity: Site Investigation

Location: Buildings 55 through 59, 65, and 66 – 950 Tyler Street, Benicia, California

FSIP/SSHP Title: Field Site Investigation Plan – 50 Series Complex

1. Does BC have Notice to Proceed on this task from USACE?

Yes NA Will Be When: _____

2. Have appropriate USACE personnel been notified of the Schedule of Activities?

Yes NA Will Be When: _____

3. Is the FSIP Approved and Final?

Yes NA Will Be When: _____

4. List the appropriate parcels requiring Rights of Entry and have they been signed?

Parcel Number: 080-280-030 Location: 50 Series Complex

Yes NA Will Be When: _____

Parcel Number: 080-280-040 Location: Building 120

Yes NA Will Be When: _____

Are Rights of Entry on-file in field office?

Yes NA Will Be When: _____

5. Has the property owner been notified in writing of scope and schedule of activities?

Yes NA Will Be When: _____

6. Subcontractor(s)

A. Is *Norcal Geophysical* under contract?

Yes NA Will Be When: _____

Table I5-11 (Continued)

Readiness Review Checklist 50 Series Complex

Is task order signed for this subcontractor?

Yes NA Will Be When:_____

B. Is ___*Gregg Drilling*_____ under contract?

Yes NA Will Be When:_____

Is task order signed for this subcontractor?

Yes NA Will Be When:_____

7. Laboratory (stationary)

Is _____*EMAX*_____ under contract?

Yes NA Will Be When:_____

Is the analytical laboratory ready to receive samples?

Yes NA Will Be When:_____

Are all appropriate sample containers on-site?

Yes NA Will Be When:_____

8. Laboratory (mobile) *Not Applicable*

9. Laboratory (QA)

Has QA lab been selected? Name:____*APPL*_____

Yes NA Will Be When:_____

Is the QA laboratory ready to receive samples?

Yes NA Will Be When:_____

10. Laboratory (specialized samples)

Is ___*Air Toxics Laboratories*_____ under contract?

Yes NA Will Be When:_____

Is the analytical laboratory ready to receive samples?

Yes NA Will Be When:_____

Table I5-11 (Continued)

Readiness Review Checklist 50 Series Complex

Are all appropriate sample containers on-site?

Yes NA Will Be When:_____

11. Trip blanks on-site from _____*EMAX*_____(analytical laboratory name)?

Yes NA Will Be When:_____

12. Is the courier set-up to pick-up samples (if applicable)?

Yes NA Will Be When:_____

13. Field Office

Is field office equipment (e.g., refrigerator, phone) working properly?

Yes NA Will Be When:_____

Are field supplies (e.g., coolers, vermiculite, shipping labels, bubble wrap) on-site?

Yes NA Will Be When:_____

Are decon chemical on-site with MSDS sheets on-file in field office?

Yes NA Will Be When:_____

Are sample labels prepared?

Yes NA Will Be When:_____

14. Documentation

Are field notebooks prepared?

Yes NA Will Be When:_____

Are sample documentation forms prepared and on-site?

Yes NA Will Be When:_____

Is database ready to receive sample information?

Yes NA Will Be When:_____

15. Personnel

Do appropriate FA/BC personnel have copies of QAPP, General SSHP, FSIP, and site-specific SSHP?

Yes NA Will Be When:_____

Table I5-11 (Continued)

Readiness Review Checklist 50 Series Complex

Have the QAPP and appropriate SOPs been reviewed?

Yes NA Will Be When:_____

Has the FSIP been reviewed?

Yes NA Will Be When:_____

Are all FA/BC personnel current on H&S training?

Yes NA Will Be When:_____

Are all subcontractor personnel current on H&S training (if applicable)?

Yes NA Will Be When:_____

Have subcontractors been briefed on QAPP requirements?

Yes NA Will Be When:_____

Is medical surveillance documentation for FA/BC personnel and subcontractors on file in field office?

Yes NA Will Be When:_____

Who are the competent persons in charge *Wendy Linck and Paul Lopez*

16. List the tenants that will be impacted from the field work.

Contact Name: *Bill Scattergood*

Business Name: *Benicia Arsenal Park*

Location: *50 Series Complex*

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When:_____

List any special ROE requirements.

Mr. Scattergood will coordinate access to Buildings 55, 56B, 56, 57A, and 65B

Contact Name: *Jenny Chapel*

Business Name: *Narcissus Beauty Salon*

Location: *Building 56A*

Table I5-11 (Continued)

Readiness Review Checklist 50 Series Complex

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When:_____

List any special ROE requirements.

Notify Ms. Chapel of schedule for drilling at locations directly outside her business.

Contact Name: *Jan Maline*

Business Name: *Clinic*

Location: *Building 120*

Has the above tenant been notified when and where work will be conducted?

Yes NA Will Be When:_____

List any special ROE requirements.

Notify Ms. Maline of schedule for drilling at locations directly outside her business.

(repeat for any additional tenants on back)

Has the investigation area been cleared for UXO?

Yes NA Will Be When:_____

Have invasive locations been cleared for underground utilities?

Yes NA Will Be When:_____

17. Has FA/BC marked the sample locations?

Yes NA Will Be When:_____

18. Has USA been contacted with regard to underground utilities?

Yes NA Will Be When:_____

Date: _____

Ticket number(s): _____

Date Expires: _____

Table I5-11 (Continued)

Readiness Review Checklist 50 Series Complex

19. Has site walk for public utilities been scheduled?

Yes NA Will Be When:_____

Conducted?

Yes NA Will Be When:_____

20. Have utilities been marked by all providers?

Yes NA Will Be When:_____

If not, who? _____

21. List all required field equipment. Is equipment on site and in working condition?

Hand auger

Drive sampler

PID

Calibration gas within date? PID calibrated?

Calibration log on-site?

pH/EC/temperature meter(s)

pH calibration fluids in date? EC calibration fluids in date?

Meter(s) calibrated? Calibration log on-site?

Other equipment (list)

Equipment: *Soil gas sampling equipment: tubing, drive points, sampler, pump*

Equipment: *Encore sampling equipment and containers*

Equipment: *Health and safety personal air monitors and draeger tubes*

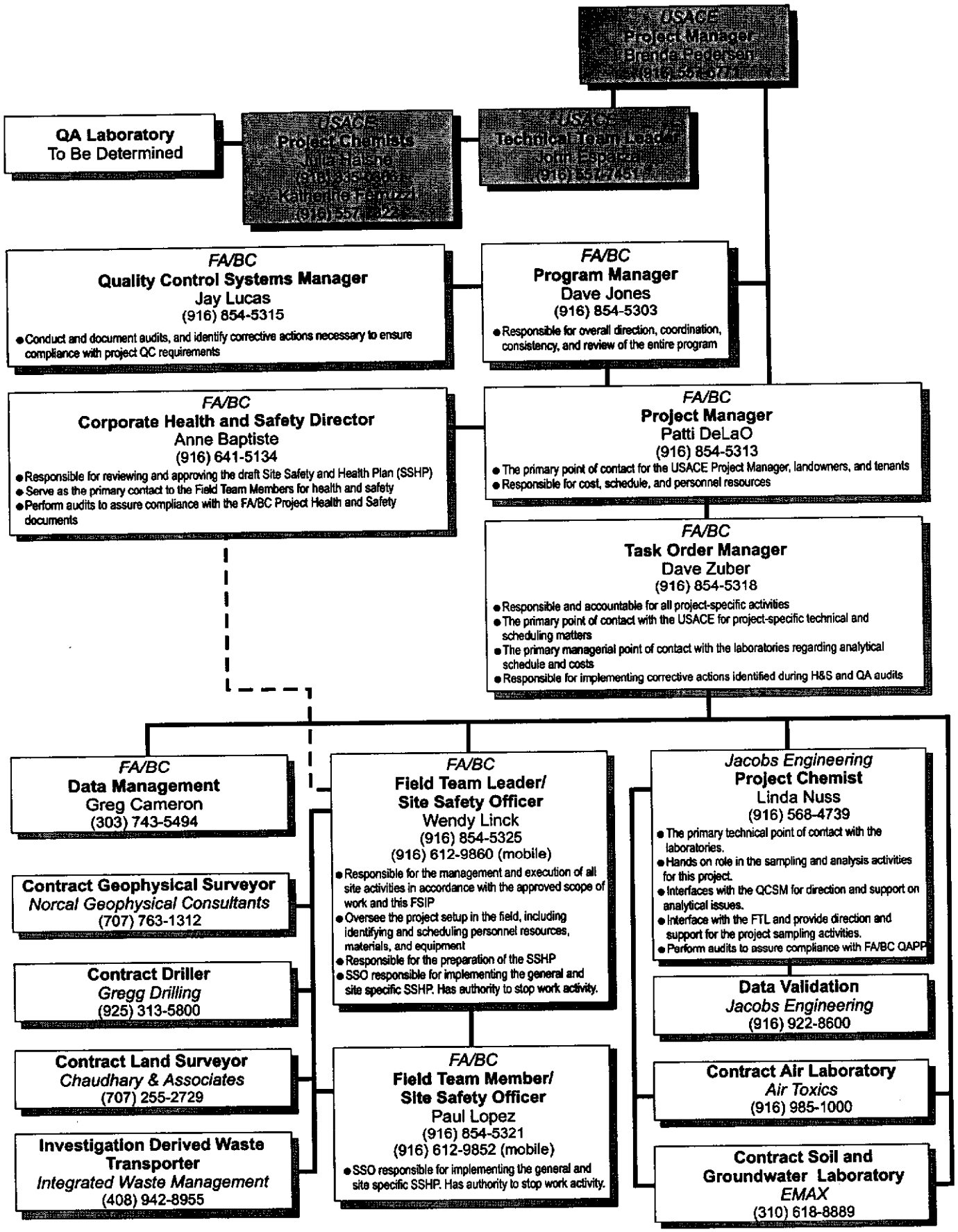
Equipment: *Water level indicator*

Equipment: *Filters*

Equipment: *Noise exposure monitor*

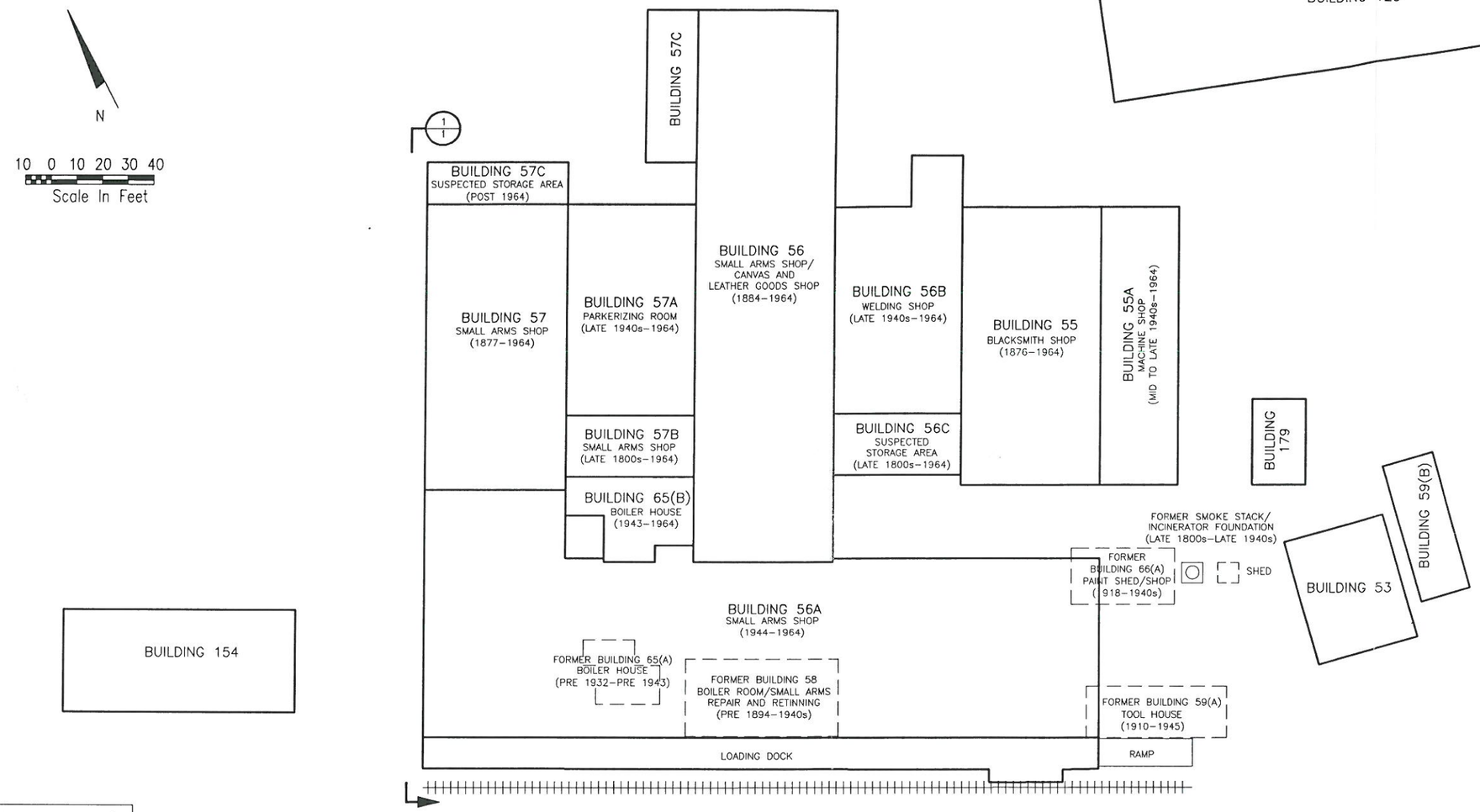
Equipment: _____

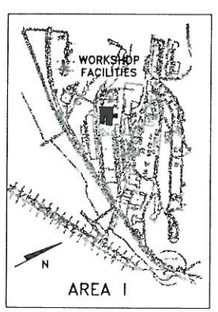
(repeat for any additional equipment on back)

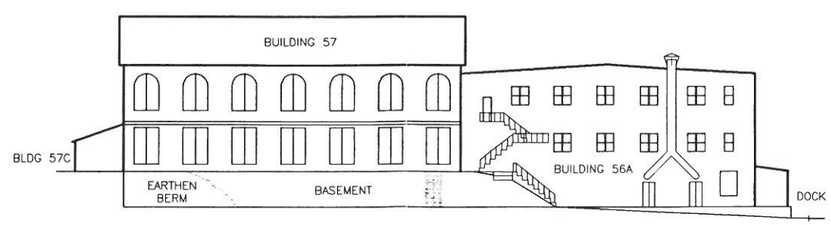


Organizational and Responsibility Chart

Field Site Investigation Plan
Benicia Arsenal







SECTION 1/1

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Floorplan and Historic Uses
50 Series Complex
Area I - Field Site Investigation Plan
Benicia Arsenal

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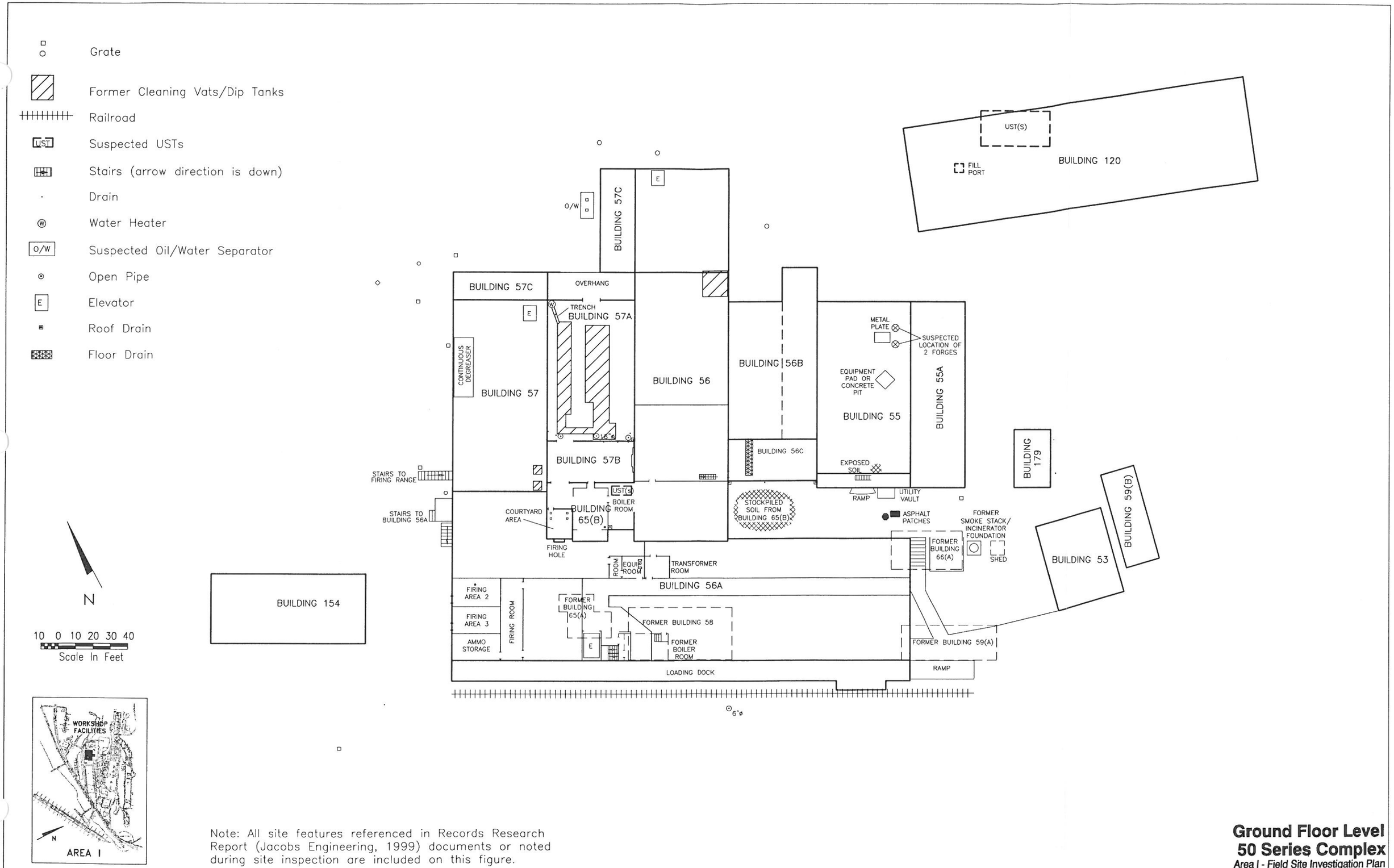
FIGURE I5-2



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Ground Floor Level
50 Series Complex
Area I - Field Site Investigation Plan
Benicia Arsenal

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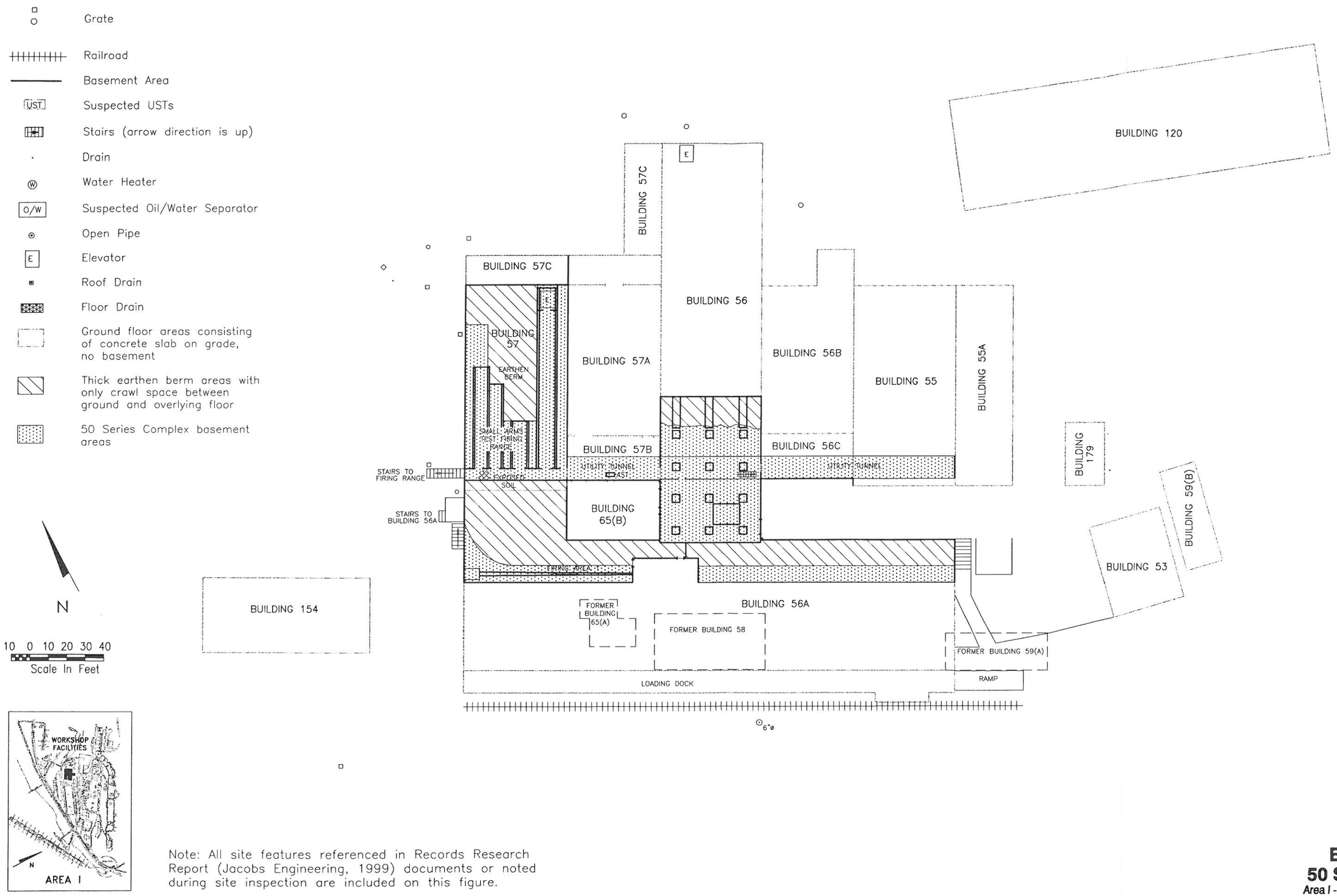
FIGURE I5-3



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Basement Areas
50 Series Complex
Area I - Field Site Investigation Plan
Benicia Arsenal

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FIGURE I5-4

B1	Depth (ft bgs)	Method	Analyte	Concentration
	2	8010	All results	ND
		418.1	All results	ND
		6000/7000	Barium	58 mg/kg
			Chromium	7.8 mg/kg
			Cobalt	16 mg/kg
			Copper	7.1 mg/kg
			Lead	3.5 mg/kg
			Nickel	20 mg/kg
			Vanadium	12 mg/kg
			Zinc	28 mg/kg

B2	Depth (ft bgs)	Method	Analyte	Concentration
	2	8010	All results	ND
		418.1	All results	ND
		6000/7000	Barium	48 mg/kg
			Chromium	9.7 mg/kg
			Cobalt	3.8 mg/kg
			Copper	4.8 mg/kg
			Lead	4.2 mg/kg
			Nickel	7.2 mg/kg
			Vanadium	13 mg/kg
			Zinc	20 mg/kg

B3	Depth (ft bgs)	Method	Analyte	Concentration
	10	8010	Trichloroethene	335 ug/kg
	15	8010	Trans 1,2 Dichloroethene	120 ug/kg
			Trichloroethene	9880 ug/kg

B4	Depth (ft bgs)	Method	Analyte	Concentration
	10	8010	Chlorobenzene	220 ug/kg
			Trans 1,2 Dichloroethene	960 ug/kg
			Trichloroethene	23000 ug/kg
	15	8010	Trans 1,2 Dichloroethene	1000 ug/kg
			Methylene Chloride	12200 ug/kg
			Trichloroethene	84500 ug/kg
	20	8010	Methylene Chloride	750 ug/kg
			Trichloroethene	85000 ug/kg
	25	8010	Trichloroethene	7400 ug/kg

B5	Depth (ft bgs)	Method	Analyte	Concentration
	6	8010	Chlorobenzene	7780 ug/kg

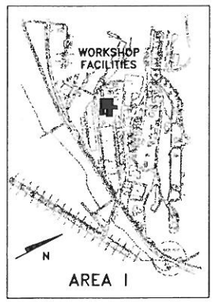
B7	Depth (ft bgs)	Method	Analyte	Concentration
	10	8010	Trichloroethene	184 ug/kg
	15	8010	Trichloroethene	424 ug/kg

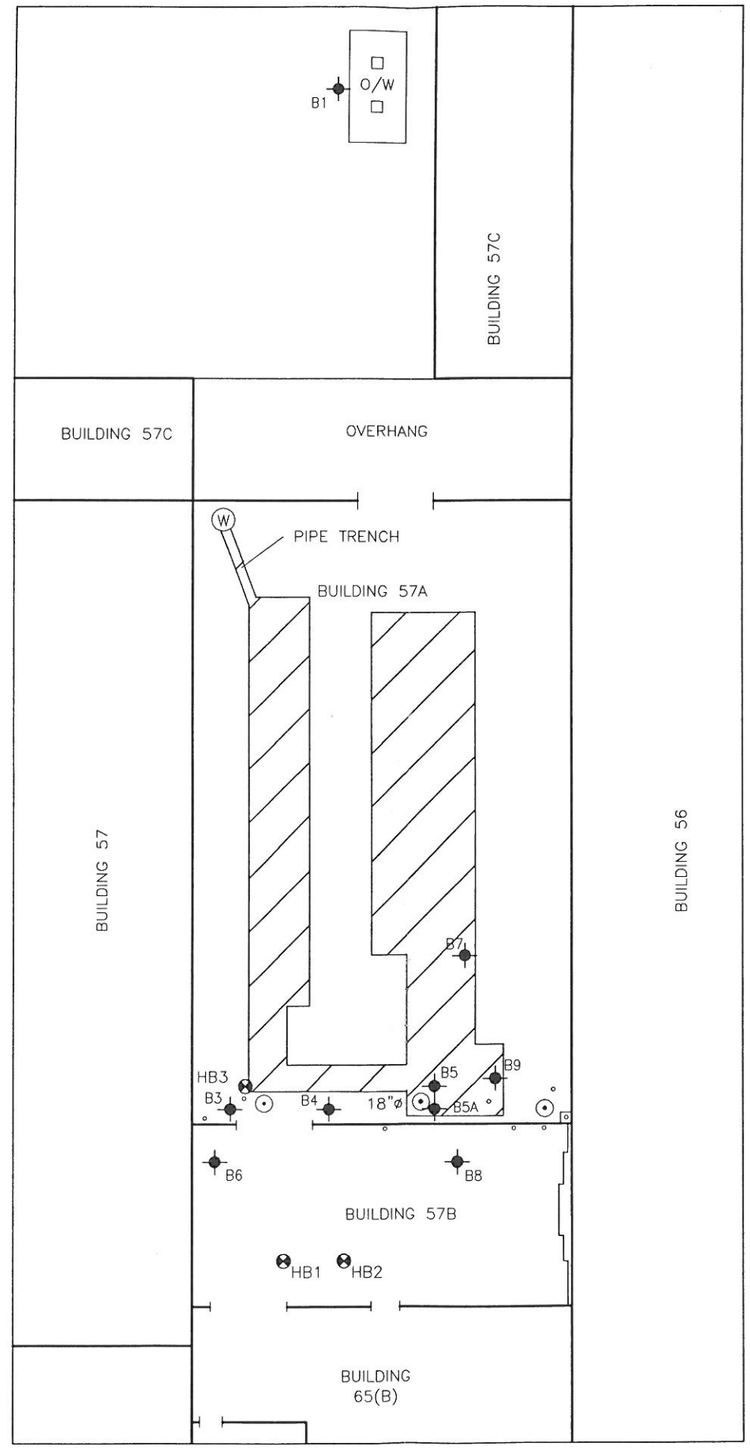
B8	Depth (ft bgs)	Method	Analyte	Concentration
	10	8010	Trichloroethene	469 ug/kg
	15	8010	Trans 1,2 Dichloroethene	79 ug/kg
			Trichloroethene	3180 ug/kg

HB1	Depth (ft bgs)	Method	Analyte	Concentration
	2	8010	Trichloroethene	63 ug/kg
		418.1	TRPH	25 mg/kg
		6000/7000	Arsenic	1.4 mg/kg
			Barium	160 mg/kg
			Cadmium	0.90 mg/kg
			Chromium	15 mg/kg
			Cobalt	6.3 mg/kg
			Copper	20 mg/kg
			Lead	970 mg/kg
			Nickel	12 mg/kg
			Vanadium	16 mg/kg
			Zinc	210 mg/kg
		STLC 7420	Lead	51 mg/L
	5	7420	Lead	9.6 mg/kg
		8010	Trichloroethene	145 ug/kg

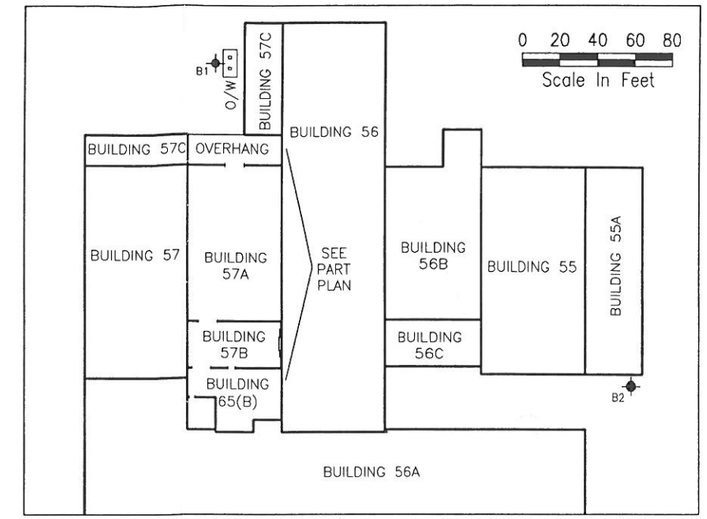
HB2	Depth (ft bgs)	Method	Analyte	Concentration
	2	8010	All results	ND
		418.1	All results	ND
		6000/7000	Arsenic	1.0 mg/kg
			Barium	130 mg/kg
			Chromium	13 mg/kg
			Cobalt	4.7 mg/kg
			Copper	9.5 mg/kg
			Lead	8.4 mg/kg
			Nickel	16 mg/kg
			Vanadium	17 mg/kg
			Zinc	30 mg/kg

HB3	Depth (ft bgs)	Method	Analyte	Concentration
	2	8010	All results	ND
		418.1	All results	ND
		6000/7000	Arsenic	2.5 mg/kg
			Barium	140 mg/kg
			Chromium	14 mg/kg
			Cobalt	5.6 mg/kg
			Copper	11 mg/kg
			Lead	8.4 mg/kg
			Nickel	17 mg/kg
			Vanadium	18 mg/kg
			Zinc	18 mg/kg





PART PLAN



Legend

- Former Cleaning Vats
- Drain
- Water Heater
- Suspected Oil/Water Separator
- Open Pipe
- Roof Drain
- HB3 Existing Hand Auger Location
- B3 Existing Soil Boring Location

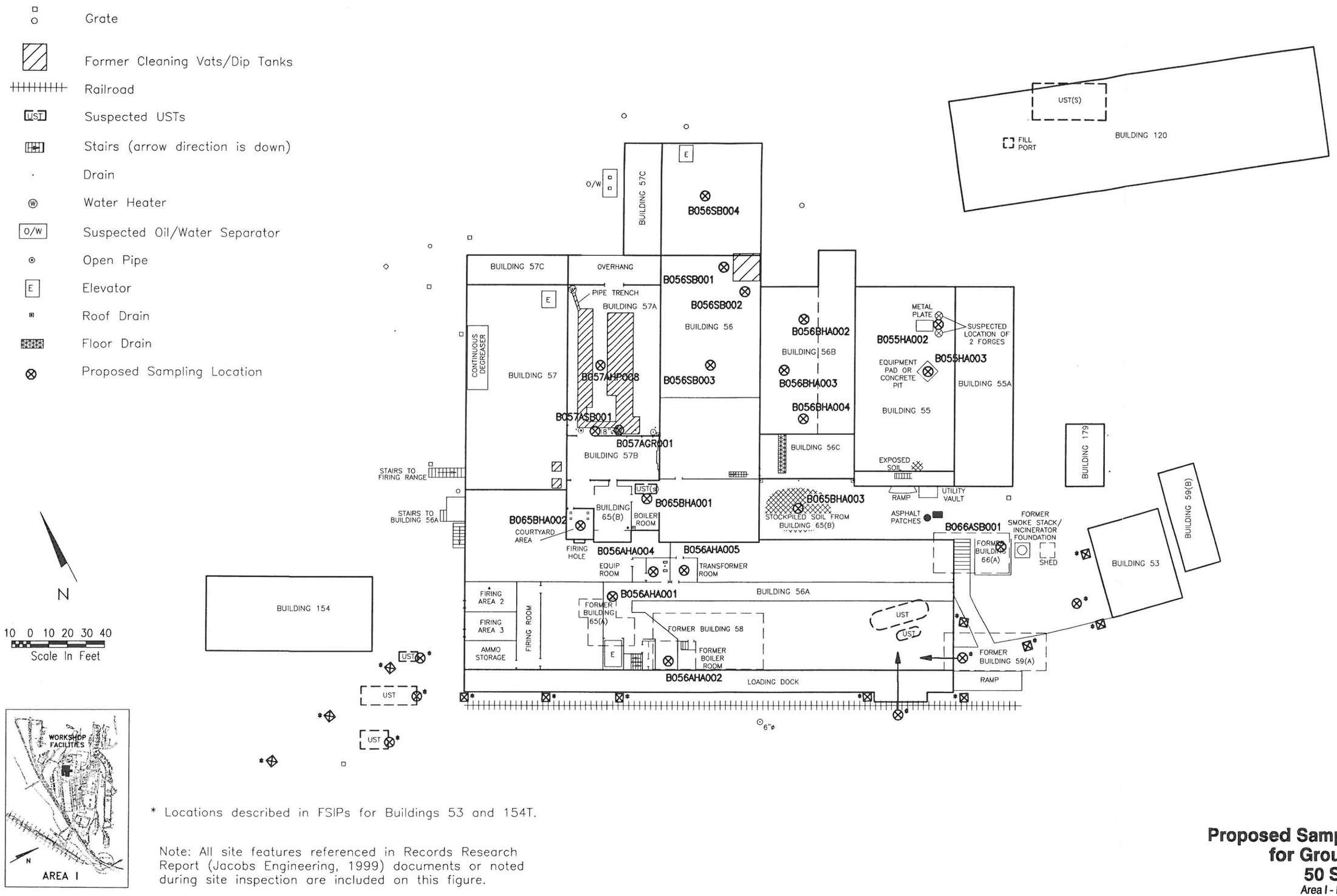
Note:
Analytical results from Meredith/Boli & Associates, June 22, 1994. Soil samples for boring B6 were not analyzed according to the June 1994 document. Borings B5A and B9 terminated at 5.5 feet bgs and samples were not collected.

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Contaminant Concentration In Soil at Building 57A 50 Series Complex

Area I - Field Site Investigation Plan

Benicia Arsenal



* Locations described in FSIPs for Buildings 53 and 154T.

Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Proposed Sampling Locations for Ground Floor Level 50 Series Complex

Area I - Field Site Investigation Plan

Benicia Arsenal

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FIGURE I5-6

Grate

Railroad

Basement Area

Suspected USTs

Stairs (arrow direction is up)

Drain

Water Heater

Suspected Oil/Water Separator

Open Pipe

Elevator

Roof Drain

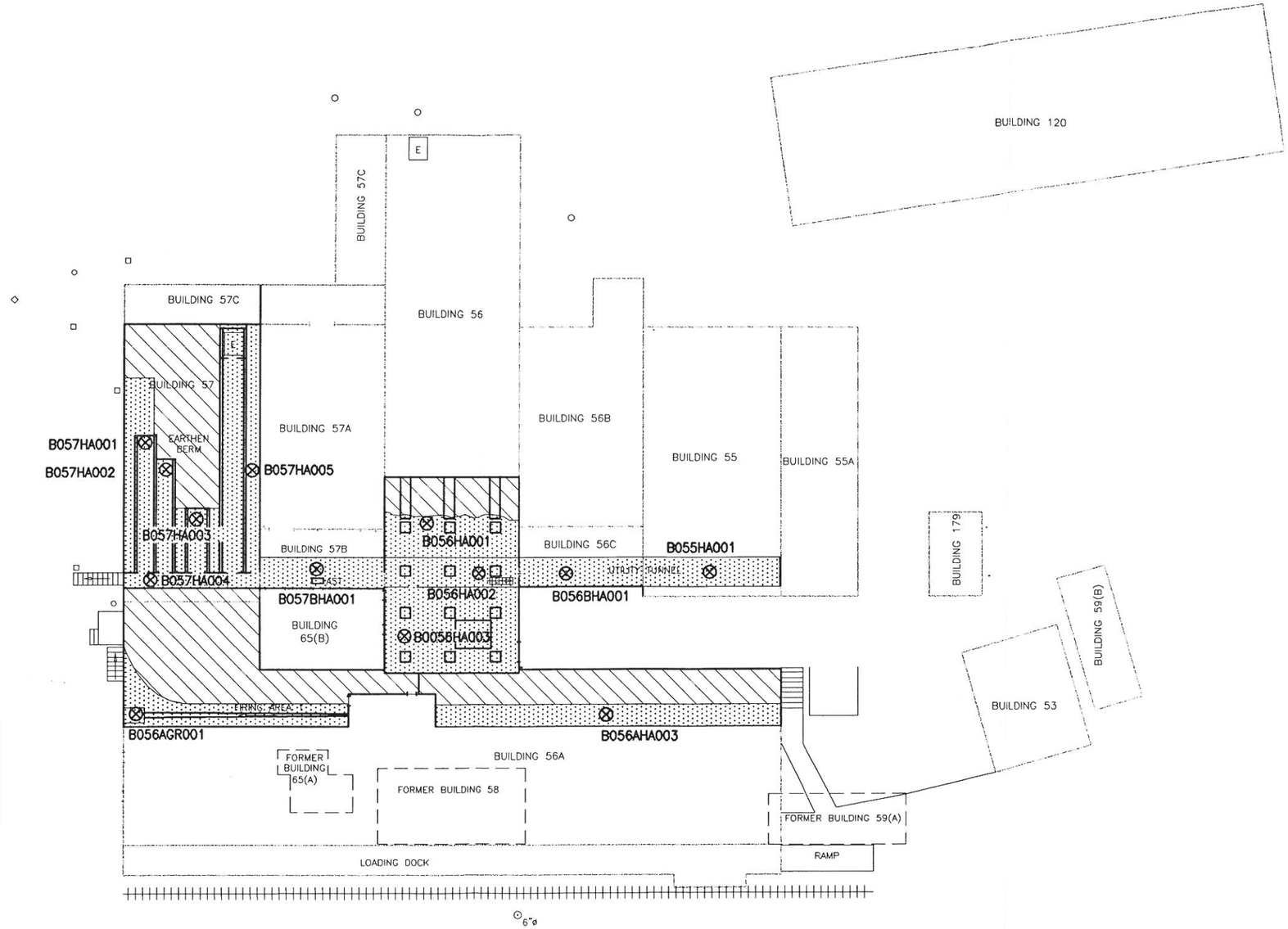
Floor Drain

Ground floor areas consisting of concrete slab on grade, no basement

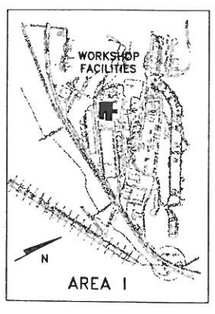
Thick earthen berm areas with only crawl space between ground and overlying floor

50 Series Complex basement areas

Proposed Sampling Location



10 0 10 20 30 40
Scale In Feet



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Proposed Sampling Locations for Basement Level 50 Series Complex

Area I - Field Site Investigation Plan

Benicia Arsenal

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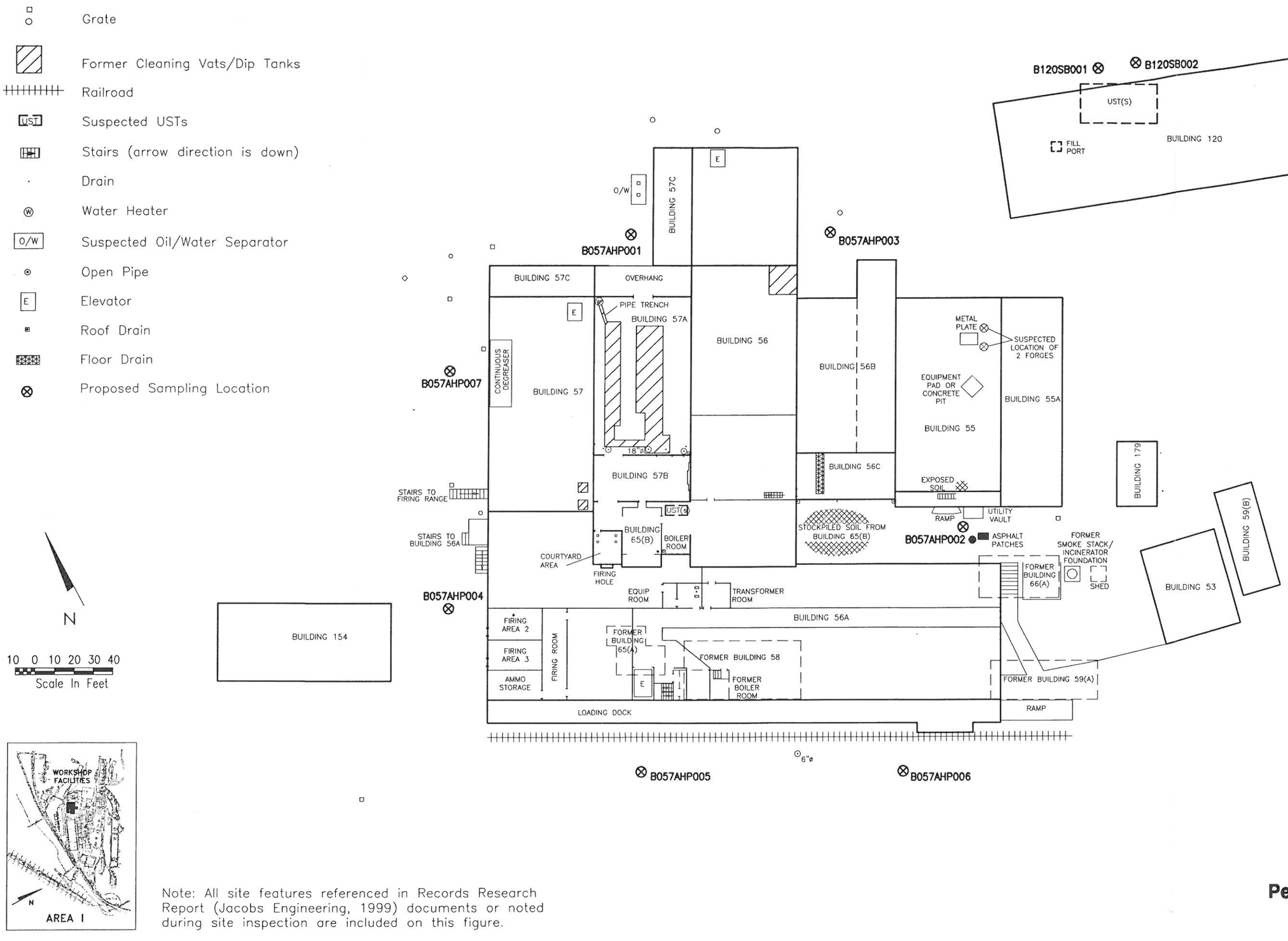
FIGURE I5-7



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999) documents or noted during site inspection are included on this figure.

Perimeter Sampling Locations
50 Series Complex
Area I - Field Site Investigation Plan
Benicia Arsenal

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FIGURE I5-8

APPENDIX A

SITE SAFETY AND HEALTH PLAN

FOR

50 SERIES COMPLEX
(AREA I WORKSHOP FACILITIES AND SURROUNDING STRUCTURES AT BUILDINGS 55 THROUGH 59, 65, AND 66)

BENICIA ARSENAL

Brown and Caldwell

Site Safety and Health Plan

for

50 Series Complex
(Area I Workshop Facilities and Surrounding Structures at Buildings 55 through 59, 65, and 66)

Benicia Arsenal

Prepared by: _____ Date: 8/6/99
Ms. Wendy Linck
Site Safety Officer

Reviewed/Approved by: _____ Date: 8/6/99
Ms. Anne Baptiste, CIH
Health and Safety Director

Reviewed/Approved by: _____ Date: 8/6/99
Ms. Wendy Linck
Site Safety Officer

Effective Dates: September 1, 1999 to September 1, 2001

Brown and Caldwell

Site Safety and Health Plan

Preface

Forsgren Associates/Brown and Caldwell (FA/BC) has prepared a Health and Safety Program Manual, dated August 1998 (H&S Manual) and a Benicia Arsenal General Site Safety and Health Plan dated February 1999 (General SSHP) for the Benicia Arsenal (Arsenal) Formerly Used Defense Site (FUDS), which will be referenced throughout this site specific Site Safety and Health Plan (SSHP). The FA/BC H&S Manual will be referenced by using the appropriate 100 series number followed by the page number. For example, (203.5; p.2-13) represents the 200 series, Section 203.5, page 2-13.

PROJECT SUMMARY

This work will be conducted within and around Buildings 55 through 59, 65, 66, and the Smoke Stack/Incinerator in Area I (50 Series Complex). Historical use of the workshop facilities reportedly included ammunition handling and storage, blacksmith/welding shops, a leather and canvas shop, small arms renovation shops, and small arms firing ranges. Facilities included boilers, acid baths, dip tanks, continuous degreasers and underground storage tanks (USTs).

The purpose of this project is to investigate suspected and confirmed features on the basement or ground levels of the workshop buildings. This project also addresses potential structures (i.e., cisterns, smoke stack/incinerator, and USTs) that are located outside the workshop complex. Activities planned include invasive drilling techniques with subsurface soil, soil gas, and/or groundwater sampling.

Chemicals that may be encountered during this investigation are: fuels, oils, lubricants, polynuclear aromatic hydrocarbons (PAHs), oxygenated and halogenated solvents, heavy metals, polychlorinated biphenyls (PCBs), and/or explosives.

The tasks for this investigation include a geophysical survey, subsurface investigation (utility clearance, hand augering, and drilling), and groundwater and soil sampling.

KEY PERSONNEL

The key personnel for this site specific SSHP are:

- Program Manager: Mr. Dave Jones.
- Health and Safety Director: Ms. Anne Baptiste, Certified Industrial Hygienist,
- Project Manager: Ms. Patti DeLaO
- Task Order Manager: Mr. Dave Zuber
- Site Safety Officers: Ms. Wendy Linck and Mr. Paul Lopez.

Descriptions of responsibilities for each key personnel and subcontractor are included in the Benicia Arsenal General SSHP.

PROJECT CONTACTS

A reference list of project contacts is located in the Benicia Arsenal General SSHP.

HAZARD ANALYSIS

The site specific potential hazards to personnel working have been identified as chemical hazards, physical hazards, and biological hazards. Each potential hazard, the potential for exposure, and recommended control for this site is presented in Table A-1.

CHEMICAL HAZARDS

The chemical related health hazards of this project are primarily from POLs (specifically benzene and total petroleum hydrocarbons), PAHs, acids, and VOCs (specifically trichloroethene) found in soils at the 50 Series Complex. Exposure to heavy metals (i.e., arsenic, chromium and lead), PCBs, and nuisance (explosive) dusts may also occur but are limited to specific areas for this project, while benzene and TCE may be found throughout the project area. The primary routes for exposure from benzene and TCE at this site may result from inhalation and skin contact. Worker exposures to metal dusts are commonly a result of inhalation. The primary route of work exposure to residual acids, PAHs, and PCBs is skin contact. For this project, soil sampling is the only intrusive technique proposed, which will limit the dust created to a minimum. Because of the potential for elevated lead and arsenic, worker exposure monitoring will be performed specifically for lead and arsenic within former firing range areas of the basement.

Potential chemical hazards, exposure limits and chemical characteristics for key chemicals that may be present at the site are listed in Table A-2.

Benzene. Benzene is regulated by Cal/OSHA as an occupational carcinogen and has been associated with leukemia. Acute health effects include irritation to the eyes, nose and respiratory system, headache, giddiness, nausea, and anorexia. Benzene exposure can also lead to disturbances in gait, dermatitis, and bone marrow depression.

The other BTEX compounds (toluene, ethylbenzene, and xylenes) may cause irritation to the eyes, nose and respiratory system, and dermatitis. Acute exposure can lead to central nervous system effects including headache, dizziness, confusion, and irritability. Exposure to toluene may also result in pupil dilatation, nervousness, reproductive toxicity, and insomnia. Elevated concentrations of xylene isomers may lead to corneal damage, and gastrointestinal symptoms including abdominal pain, nausea and vomiting.

Total Petroleum Hydrocarbons (TPH). TPH refers to heavy hydrocarbons that may present a fire hazard in extreme circumstances, such as the presence of flame, excessive heat or strong oxidizers. An exposure limit for TPH has not been established due to the varied chemical composition. Presently, there are no known chronic health hazards associated with TPH.

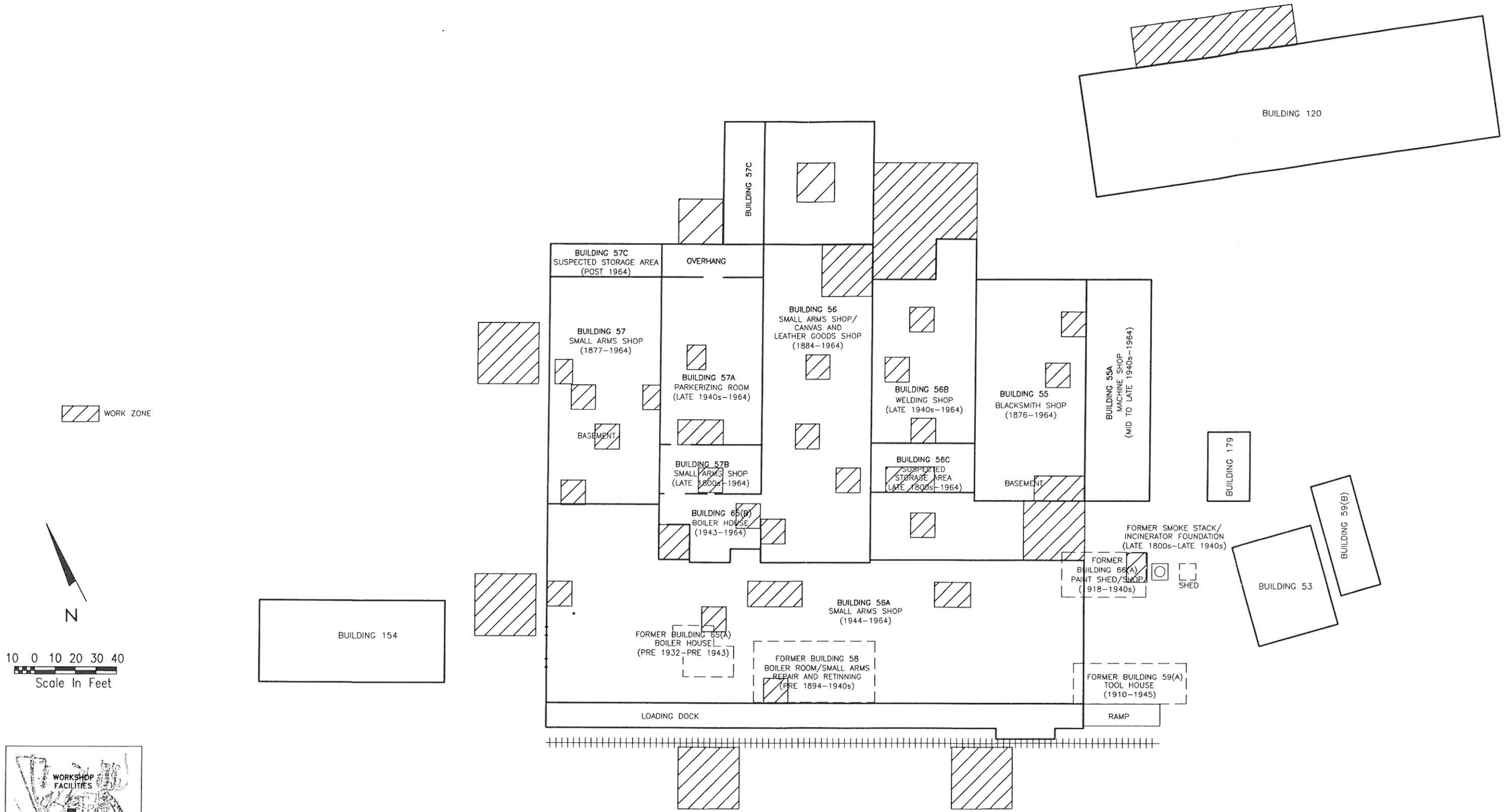
Oils. Oils are not considered flammable, only combustible. Because of their low vapor pressure, they do not typically constitute an inhalation hazard unless working conditions include extremely hot temperatures or create excessive airborne oil-contaminated dust. These conditions are not anticipated.

Oxygenated Solvents. Oxygenated solvents are flammable liquids such as acetone and methyl ethyl ketone (MEK). In high concentrations, inhalation of these materials can cause anesthesia with dizziness being the usual symptom. They do not display serious chronic effects (acetone is found in the human body). These materials are very flammable. They cannot be readily detected by PID, but are easily detected by FID. These materials have considerable odor and can be readily recognized by smell at levels well below those requiring protection.

Table A-1

Potential Hazards and Recommended Controls for 50 Series Complex

Potential Hazards	Recommended Controls
Chemical Exposure	The minimum level of proper Personal Protective Equipment (PPE) during activities is Level D. In test firing range areas, PPE will be upgraded to Level C to protect against lead and arsenic. This level is adequate to protect individuals from exposure to petroleum hydrocarbon constituents. Dust control will be employed for protection from metals and particulate borne contaminants. Skin protection and decon will protect from PAH and PCB exposures via skin entry. Air monitoring will be performed with an Organic Vapor Monitor and personal sampling pumps or equivalent to monitor the air quality in and around the work zone.
Back Injury	There are several heavy pieces of equipment anticipated for this project that would require lifting and possible back injuries. Use proper lifting techniques, specialized lifting, and automated equipment (i.e. vacuum bailing and 2 person teams when necessary). Proper lifting techniques may also vary with task. Therefore, these techniques will also be addressed in the daily site safety briefings. Refer to the Ergonomics Program of the FA/BC H&S Manual (103;p. 7-9).
Noise	Heavy equipment is anticipated for this project (i.e., drilling rig and backhoe), such that hearing protection may be necessary. A hearing conservation program will be implemented to determine exposure to workers for each piece of equipment that commonly require hearing protection (drilling rig and concrete/asphalt coring). Noise exposure monitoring will be conducted initially by the Site Safety Officer (SSO) with assistance from the Health and Safety Director to determine correct hearing protection for this type of equipment to be used for the rest of the project. Refer to the Noise/Hearing Conservation section in the FA/BC H&S Manual (210; p. 44-45). In general, use hearing protection whenever the noise levels are such that conversation is impaired without raising the voice level.
Drum Handling	Drums may be used to store soil or water as a result of drilling or excavation operations. Utilize appropriate drum handling equipment (dollies, lift gates, etc.) and avoid manual lifting of filled or partially filled drums. Follow the drum handling requirements of CFR 1910.120.
Migration of Contamination	A work zone will be delineated before start of work. An area within the work zone will be established for decontamination prior to exiting the site. The decontamination area must be away from the actual working area. Figure A-1 is provided in this SSHP to show the area of the work zone.
Exposure to potentially contaminated soil/water	Level D PPE is the minimum level required for this project. All personnel will don the appropriate level of PPE upon entering the work area and then use proper decontamination procedures before exiting the work zone. Workers will exit the work zone before eating.
Slips, Trips, and Falls	The proper footwear for this project will include steel-toed boots upon entering the work zone. Wear proper footwear and anticipate footing hazards (i.e., steep slopes, potholes, and uneven surfaces).



Note: All site features referenced in Records Research Report (Jacobs Engineering, 1999 documents or noted during site inspection are included on this figure.

Work Zone Map
50 Series Complex
Area I - Site Safety and Health Plan
Benicia Arsenal

FIGURE A-1

Table A-1 (continued)

Potential Hazards and Recommended Controls for 50 Series Complex

Potential Hazards	Recommended Controls
Utilities	Have all utilities (underground and overhead) located and documented prior to the initiation drilling or excavation activities. Maintain a minimum distance of 20 feet clearance between any energized line and any part of a drill rig, boom, or other piece of equipment at all times. This in compliance with a high-voltage line of 37 kilovolts (kv) or less. If voltage is between 37 kv and 55 kv, then maintain a minimum distance of 27 feet. If voltage is between 55 kv and 100 kv, then maintain a minimum distance of 42 feet (8 CCR Division 1, Chapter 4, Subchapter 5, Group 2, Article 37, Section 2946). Refer to electrical safety and lock-out/tag-out sections of the FA/BC H&S Manual (206; p. 28-33 and 207; p. 34-38, respectively).
Heavy Equipment	Drilling and excavating equipment maybe necessary for this project. Personnel communication and wearing proper PPE during work activities is essential for the protection of workers at the site. Refer to heavy equipment section of the FA/BC H&S Manual (505; p. 14-15)
Unexploded ordnance (UXO)	There are no hazards associated with UXO anticipated for this project.
Biological Hazards	The project is in an area where animals, insects, or animal droppings may be present. Level D PPE will be donned for this project, unless conditions indicate an infestation of insects, mold, or animal droppings. Be aware of spiders inside well boxes or insect swarms on buildings or in trees. These types of biological hazards are not anticipated for this project.
Radiological Hazards	There are no radiological hazards anticipated for this project.

SSHP = Site Safety and Health Plan
PCB = polychlorinated biphenyls
FA/BC = Forsgren Associates/Brown and Caldwell
PAH = poly aromatic hydrocarbons

Table A-2
Chemical Exposure Limits and Characteristics Controls for 50 Series Complex

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	PEL[D] 8-hour TWA	IDLH[e] level	Flammable range percent	Odor threshold, ppm	Notes[f]	Potential symptoms of exposure[g]
Benzene	9.24	150	0.5 ppm	1 ppm	500 ppm	1.3-7.9	4.68	Ca, F, 65	Irritation to eyes, nose, respiratory system, giddiness, headache, nausea, staggered gait, fatigue, anorexia, lassitude, dermatitis, bone marrow, depression
Toluene	8.82	110	50 ppm	200 ppm	500 ppm	1.2-7.1	0.17-40	T,F,65	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lassitude, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis
Ethylbenzene	8.76	100	100 ppm	100 ppm	800 ppm	1.0-6.7	0.25-200	T,F	Irritation to eyes, muscle membranes, headache, dermatitis, narcosis, coma
Xylene	8.56	111	100 ppm	100 ppm	900 ppm	1.0-7.0	0.05-200	T,F	Dizziness, drowsiness, excitement, incoherence, staggered gait, irritation to eyes, nose, throat, corneal vacuolization, anorexia, nausea, vomiting, abdominal pain, dermatitis
Chlorobenzene	9.07	179	10 ppm	75 ppm	1000 ppm	1.3-9.6	NA		Irritation to skin, eyes, nose, drowsiness, incoherence
Stoddard solvent	NA	Approx 40	100 ppm	500 ppm	20,000 mg/m^3	unknown	NA		Irritation to eyes, nose, throat, dizziness, dermatitis
Trichloroethene	9.5	54	50 ppm	25 ppm	1000 ppm	8-10.5	NA	Ca,65	Headache, vertigo, visual disturbance, tremors, somnolence, nausea, vomiting, irritation to eyes, dermatitis, cardiac arrhythmias, parasthesia

Table A-2 (continued)
Chemical Exposure Limits and Characteristics Controls for 50 Series Complex

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	PEL[D] 8-hour TWA	IDLH[e] level	Flammable range percent	Odor threshold, ppm	Notes[f]	Potential symptoms of exposure[g]
Metals									
Antimony	NA	NA	0.5 mg/m^3	0.5 mg/m^3	50 mg/m^3	NC	NA		Irritation to nose, throat, mouth, coughing, dizziness, headache, nausea, vomiting, diarrhea, stomach cramps, insomnia, anorexia, irritation to skin, unable to smell properly, cardiac abnormalities in antimony trichloride exposures
Arsenic	NA	NA	0.01 mg/m^3	0.01 mg/m^3	5 mg/m^3	NC	NA	Ca,65	Ulceration of the nasal septum, dermatitis, gastro-intestinal disturbance, peripheral neuropathy, respiratory irritation, hyperpigmentation of the skin
Chromium III	(h)	NA	0.5 mg/m^3	0.5 mg/m^3	25 mg/m3	NC	NA	Ca,65	Histologic fibrosis of the lungs, lung cancer, nexochrome; ulceration and perforation of the nasal septum
Copper	NA	NA	1 mg/m^3	1 mg/m^3	100 mg/m^3	NC	NA		Irritation to nasal and mucous membrane, pharynx, nasal perforation, irritation to eye, metallic taste, dermatitis
Lead	NA	NA	0.05 mg/m^3	0.05 mg/m^3	100 mg/m^3	NC	NA	C,T,65	Immediate irritation to eyes, insomnia, facial pallor, anorexia, weight-loss, abdominal pain, constipation, colic, anemia
Nickel	NA	NA	1 mg/m^3	1 mg/m^3	10 mg/m^3	unknown combustible solid	NA	C	Headache, vertigo, nausea, vomiting, epigastric pain, subsernal pain, coughing, hyperpnea, cyanosis, weakness, leukocytosis, pneuitis, delirium, convulsions

Table A-2 (continued)
Chemical Exposure Limits and Characteristics Controls for 50 Series Complex

Chemical	IP[a]	OVA[b] relative response percent	TLV[c] 8-hour TWA	PEL[D] 8-hour TWA	IDLH[e] level	Flammable range percent	Odor threshold, ppm	Notes[f]	Potential symptoms of exposure[g]
Zinc Chloride	NA	NA	NA	1 mg/m^3	50 mg/m^3	unknown	NA		(as zinc chloride fumes) conjunctivitis, irritation to nose, throat, coughing, copious sputum, dyspnia, chest pain, pulmonary edema, bronchopneumonia, pulmonary fibrosis, corpulmonale, fever, cyanosis, tachypnea, burns to skin, irritation to eyes, skin
Carbon black	NA	NA	3.5 mg/m^3	3.5 mg/m^3	1,750 mg/m^3	unknown	NA	Ca,65	(in the presence of polycyclic aromatic hydrocarbons) cough, eye irritation
PAHs	NA	NA	50 mg/m^3	0.2 mg/m^3 (coal tar pitch)	500 ppm	0.9%-5.9%	NA		Irritation to eyes, skin, respiratory system. Carcinogen: lung, skin
Polychlorinated biphenyls	NA	NA	Skin, 0.5 mg/m^3	Skin, 0.5 mg/m^3	5 mg/m^3	NC	NA	Ca,65	Nausea, lethargy, chloracne, dermal lesions, dec. pulmonary function, hepotic injury

[a] Ionization potential in electron-volts (eV).

[b] Century Organic Vapor Analyzer relative response to the compound in percent.

[c] Threshold Limit Value as the airborne 8-hour time-weighted average (TWA) established by the American Conference of Governmental Industrial Hygienist (ACGIH), 1999.

[d] Permissible Exposure as the airborne 8-hour time-weighted average (TWA) established by the Occupational Safety and Health Administration (OSHA).

[e] Immediately Dangerous to Life and Health level as published in the National Institute for Occupational Safety and Health (NIOSH), Pocket Guide to Chemical Hazards, 1994 edition.

[f] Hazard category; Ca-Carcinogen; C-Ceiling; F-Flammable; S-Skin absorption; T-Toxic; 65 – Proposition 65 chemicals known to the State of California to cause cancer or reproductive harm.

[g] Sources: NIOSH Pocket Guide to Chemical Hazards, June, 1994; Amdur, Mar O; Doull, John; Klaassen, Curtis, D., Toxicology, The Basic Science of poisons, fourth Edition, 1993; and Merk & Co. Inc. The Merk Index, 1996.

[h] IP varies with chromium compound.

Notes: NA = Not Applicable or not available
NC = Noncombustible
NE = Not established
NF = Non-flammable
PAHs = Poly Aromatic Hydrocarbons

PAHs. PAHs are common components of diesel fuel, fuel oil, and other oils and lubricants. Routes of entry include inhalation, ingestion, and skin contact. PAHs are not typically very volatile. Therefore, unless they are known to be in significant concentrations, such as when strong odors are evident or dust clouds are present, the primary method of protection is by avoiding skin contact.

Halocarbon Solvents. Halocarbon solvents are non-flammable liquids such as methylene chloride, trichloroethylene (TCE), perchloroethylene (PCE), carbon tetrachloride, and chloroform. In high concentration, inhalation of these materials can cause acute liver and kidney damage. In lesser concentrations, they may cause acute effects such as dizziness or sleepiness related to their anaesthetic ability. The main chronic effect of these materials is their potential to cause liver disease. They are potential carcinogens as demonstrated by animal studies. Because of the potential of these materials to cause liver disease and cancer, exposure should be minimized. These materials are volatile and will evaporate if left in the open air. They can be detected by PID and/or FID detectors.

Arsenic. Arsenic has toxic health effects, which include dermatitis, gastrointestinal upset, peripheral neuritis, irritation to the respiratory system, and discoloration of the skin. Arsenic is associated with skin cancer and lung cancer due to chronic exposure. Arsenic is an occupational carcinogen, and is regulated by OSHA through a comprehensive occupational health standard. The current PEL for arsenic is 0.01 mg/m^3 as an 8-hour time-weighted average (TWA) airborne dust concentration. The regulatory action level is 0.005 mg/m^3 TWA dust concentration. No employee may be exposed to any skin or eye contact with arsenic trichloride or to skin or eye contact likely to cause skin or eye irritation.

Chromium. Chromium has toxic health effects that can range from allergic skin reactions to mild, and eventually severe, respiratory system irritation. Chromium may exist in one of three valence states in compounds (+2, +3, or +6). Toxic health effects are primarily associated with Cr+6 (hexavalent chromium) exposure. It is a suspect carcinogen as Cr+6. Symptoms of acute exposure include coughing, wheezing, painful deep inspiration, and fever. Pulmonary edema may persist after other symptoms subside. Other effects include dermatitis, ulceration of the skin, conjunctivitis and asthma. Chronic exposure may be associated with lung cancer. The current exposure limit for chromium as Cr+6 is 0.05 mg/m^3 as an 8-hour TWA airborne dust concentration.

Inorganic Lead. To present a health hazard, lead must be in such a form as to gain entrance into the body or tissue in measurable quantities. The primary mode of entry that is of concern is inhalation of lead dust, and secondary, is ingestion if poor personal hygiene is practiced. Lead is a cumulative poison. It is stored in the body and acts as a cellular poison to all organ systems before symptoms and disability is evident. Lead poisoning creates a red cell anemia and damages organs and tissues of the body such as kidneys, liver, blood vessels, nervous system and reproductive organs. Chemical and physical properties may vary depending upon the specific lead compound.

Lead is considered a carcinogen and reproductive toxin and has an airborne permissible exposure level (PEL) of 0.05 mg/m^3. The blood lead action level for adults is equal to or less than 30 micrograms per deciliter (g/dl) of blood. There is no safe level of lead exposure for children. Therefore, decontamination of adults and their clothing is a primary concern.

Particulates not Otherwise Regulated (PNOC). PNOC is a generic term given to a variety of dusts that may not cause fibrosis or systemic effects. At high

concentrations, otherwise nontoxic particulates have been associated with the occasionally fatal condition know as alveolar proteinosis. High concentration of finely divided dusts and powders can also be explosive. At lower concentrations, the dust can inhibit the clearance of dust from the lung by decreasing the mobility of the alveolar macrophages. The airborne permissible exposure limit (PEL) for PNOC total dust is 10 mg/m^3 and 5.0 mg/m^3 for dust small enough to enter the lower respiratory tract.

PCBs. PCBs are colorless to light yellow, viscous liquids (above 50 F) that can be detected by their mild hydrocarbon odor. PCBs are non-flammable but are strong oxidants. The routes of exposure for PCBs are inhalation, ingestion, and skin and eye contact leading to absorption. PCBs exposure is known to target the skin, eyes and liver. The primary effect of exposure to PCBs is a type of dermatitis known as chloracne associated with skin contact. The current PELs for PCBs are 0.5 mg/m^3 and 1.0 mg/m^3 for 54% chlorine and 42% chlorine substitution, respectively. These compounds are suspected carcinogens based on animal studies.

Other chemical related materials may be required for use during the project may include glues, adhesives, insect repellents, etc. The relative hazard of each of these materials will be described by their respective Material Safety Data Sheets to be retained on-site per the hazard communication operating procedure given below. If additional chemical contaminants are uncovered in the course of this project an SSHP addendum will be developed to address potential exposure concerns.

TRAINING REQUIREMENTS

There are no special training requirements anticipated for this site. However, site briefings will include hazard communication training on the chemical contaminants including lead and arsenic. There will be routine briefings between on-site employers regarding health and safety practices for cross-contamination and planning purposes. General training requirements for all FA/BC staff working on-site is described in the Benicia Arsenal General SSHP.

PERSONAL PROTECTIVE EQUIPMENT

The minimum level of personal protection required at all times is Level D. Level D includes safety boots/shoes, safety glasses, and a hard hat. In addition to this protection, Tyvek© coveralls (preferably blue or brown) and nitrile gloves for PAH/PCB or equivalent will be worn at all times inside the work zone.

Level C protection will be the minimal level of protection for exclusion zones within former firing range areas located in the basement. This section has been added to PPE: Exposures to personnel in the firing range include organic vapors and particulates. As a result, additional monitoring and upgrade to Level C PPE will be conducted to protect personnel working in this area. Monitoring will include organic vapor monitors and detector tubes (if necessary) for organic vapors, as well as, personnel air monitoring pumps and filters for lead and arsenic in Level C PPE. These items are also listed on Table A-3. Field Equipment Descriptions of other levels of PPE are described in the FA/BC H&S Manual (301 and 302; p. 1-24) and the Benicia Arsenal General SSHP.

ENVIRONMENTAL MONITORING PLAN

The following is the anticipated environmental monitoring plan necessary for this site. Equipment anticipated for environmental monitoring is listed on Table A-3. Environmental monitoring will be in accordance with the Site Worker Air Monitoring Response criteria outlined in Table A-4. Generally, all projects will include monitoring of air quality in and around the work area and heat or cold stress.

Table A-3
Anticipated Field Equipment for 50 Series Complex

Equipment	Purpose and Description
Personal Protective Equipment (PPE)	
Nitrile disposable gloves	Prevents exposure to potentially contaminated soil or groundwater.
Tyvek© coveralls or equivalent	Prevents exposure to potentially contaminated soil or groundwater.
Respirators and cartridges	If necessary, half face or full face respirator will be used if the level of PPE is upgraded during work. Respiratory equipment must be in working condition and fit-tested for that person. In the firing area, a combination cartridge/filter with a high-efficiency filter will be used to protect personnel from suspected arsenic or lead particulates. All other areas, an organic vapor cartridge should be adequate protection for the contaminants expected in these areas. A cartridge of this type should be changed out daily or when the cartridge end of service life (as determined by the HSD) occurs, whichever comes first. All personnel wearing respiratory protection will be in compliance with fit-testing requirements as specified in the FA/BC H&S Manual Section 302.
Steel-toed boots or shoes and a hard hat	Required PPE for Level D.
Environmental Monitoring Equipment	
Organic Vapor Monitor (OVM) or equivalent	An OVM or equivalent is required to monitor air quality in and around the work zone. The OVM must be calibrated before and after each workday. A calibration data sheet will be maintained. A periodic response check will be performed during the workday to determine that it is functioning properly.
Lead and Arsenic Air Monitoring Pumps and Filters	Lead air monitoring is required to monitor air quality in the work zone in the areas of the former firing ranges. The air samples will be collected in accordance with the National Institute or Occupational Safety and Health (NIOSH) Method 7082.
Benzene Detector Tubes (0.5 –10ppm)	Detector tubes, benzene specific, is required to monitor air quality in the work zone.
Trichloroethene (TCE) Detector Tubes (2-250 ppm)	Detector tubes, TCE specific, is required to monitor air quality in the work zone.
Site Control Measures	
Traffic Cones and Safety tape	All work areas will be delineated with traffic cones and/or safety tape to prevent people from entering the work zone. Distances to barriers and taper angles to be determined by the guidelines of the Traffic Control section in the FA/BC H&S Manual (511; p. 31-33)

Table A-3 (continued)
Anticipated Field Equipment for 50 Series Complex

Equipment	Purpose and Description
Decontamination Equipment	
Wash buckets and soap	Necessary for proper decontamination of small equipment and non-disposable PPE (i.e. work boots).
Other Equipment	
Water level probe	There is a possibility during drilling that groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
Interface probe	There is a possibility during drilling that free-phase petroleum hydrocarbons in groundwater may be encountered. All equipment will be checked prior to use to determine if it is working properly.
pH/Electrical conductance (EC) meter	If groundwater is encountered, physical properties (such as pH, EC, color, odor, and relative clarity) will be noted in the field logbook. This equipment will be calibrated before use and calibration notes will be logged in the field notebook.
Sampling Containers (soil and water)	If necessary, appropriate containers for soil and groundwater samples will be required.
Sample labels, chain-of custody forms, Zip-lock bags, cooler, ice (if necessary), custody seals	Necessary for any soil or groundwater sampling. Proper chain-of custody forms, labels, and custody seals will be completed for proper quality control. Samples will be stored in a clean cooler (with ice, if necessary for specified analysis) for delivery to an analytical laboratory. If ice is used, all samples will be sealed around the end caps, lids, or caps to prevent water from invading the sample. Then the samples will be double-bagged and sealed for an additional protective barrier from melt water.
Hand auger or post hole digger	Prior to using power drilling equipment, a hand auger or hand operated post hole digger will be used to explore the upper 3 to 5 feet for underground utilities and other obstructions. In addition, the hand auger may be used for the collection of shallow subsurface soil samples.
Thermometer	Monitor air temperature when ambient temperature is above 70 degrees F. Thermometer should be placed in a shady area.
Illumination	All work activities will be conducted in daylight hours to provide adequate lighting for outside activities. Indoor activities are planned and proper illumination using halogen light stands (11,000 foot-candles per light) will be provided to meet requirements 8 CCR Division 1, Chapter 4, Subchapter 7, Group 16, Article 109 Section 5192(m)
Potable Water and Sanitation	Drinking water and toilets are located at the site for use by all workers

Table A-4
Site Worker Air Monitoring Response Criteria

	Sampling Frequency	Action Taken
Organic Vapor Concentrations in Breathing Zone[a]		
0 less than 1 ppm	At a minimum of every 15 minutes, whenever active excavation or drilling is being conducted, upon initial approach to surface water and sediment sampling sites where contamination is anticipated.	Continue work with required minimum PPE for the field activity.
1 ppm to 10 ppm for more than 2 minutes	Every 15 minutes until organic vapor concentration levels decrease less than 1 ppm.	Collect benzene (only at fuel related sites) and TCE (only at VOC related sites) detector tubes (DTs) at borehole: • If DTs reveal no detectable concentrations then, continue work with required minimum PPE for the field activity. • If DTs reveal detectable concentrations greater than 1 ppm, then upgrade to Level C PPE. • If DTs for benzene reveal detectable concentrations greater than 10 ppm, then stop work.
10 to 100 ppm for more than 2 minutes	Every 15 minutes.	Level C PPE required
100 ppm for more than 2 minutes with ½-face respirator (500 ppm with full-face respirator)	Every 10 minutes.	• Stop work. • Work crews position themselves upwind of site. • Re-evaluate in 15 minutes. • Contact Health and Safety Director and Project Manager. • Evacuate
Inorganic Lead Concentrations in Breathing Zone[a]		
Less than 0.03 mg/m^3	Sample for TWA on initial workday and whenever operations change	• All work will require Level C PPE with continuous personal sampling. • Personal sampling filters will be analyzed to determine exposure concentrations for possible future sampling activities in this area.
0.03 to 0.3 mg/m^3	Every 15 minutes until levels decrease less than 0.03 mg/m^3.	• Upgrade to Level C and continue to monitor.
Greater than 0.3 mg/m^3	Every 10 minutes.	• Suspend work • Evacuate • Evaluate source and mitigation measures • Contact Health and Safety Director and Project Manager.

[a] OVM calibrated to methane (concentrations will be less if calibrated to isobutylene)

Work will be conducted in areas that were former degreasers, former firing ranges and fuel sites. Exposures to lead are not anticipated in the areas of USTs. However, there is a potential exposure to lead and arsenic in the areas of the former firing ranges. Particulate dust control is not anticipated for this project, except for work conducted in test firing areas. These areas will be monitored vial personal air monitors to determine exposure to personnel. Lead safety is described in the FA/BC H&S Manual (409; p. 38-41). All personnel performing sampling of or working around lead will receive lead awareness training.

Representative sampling of all work areas potentially containing lead or arsenic will be initially monitored with personal sampling pumps. Down grade to Level D can be accomplished following receipt of air sampling results from the lab or confirmatory soil samples with mass loading calculations. Copies of air sampling data will be forwarded to the HSD for inclusion in personnel safety records.

MEDICAL SURVEILLANCE REQUIREMENTS

There are no special medical surveillance requirements anticipated for this site. The Benicia Arsenal General SSHP describes the general medical surveillance requirements.

SITE CONTROL MEASURES

A map of the site is included as Figure A-1, showing the approximate work zones. Zone locations are subject to change based on work activities, site access, and wind direction. The basement area below Building 55 is considered a confined space due to limited ingress/egress. As a result, investigation personnel will not enter the basement and sampling will be conducted remotely by using extensions to a hand auger. Equipment necessary for site control measures is listed on Table A-3. Further details regarding site control measures can be found in the FA/BC H&S Manual (406; p.25-28).

Sampling will be mostly conducted in areas that are currently unoccupied. For those areas that are occupied, arrangements will be made with the business to minimize or eliminate employee exposure, or, if necessary, conduct field activities during times when the business is closed.

DECONTAMINATION

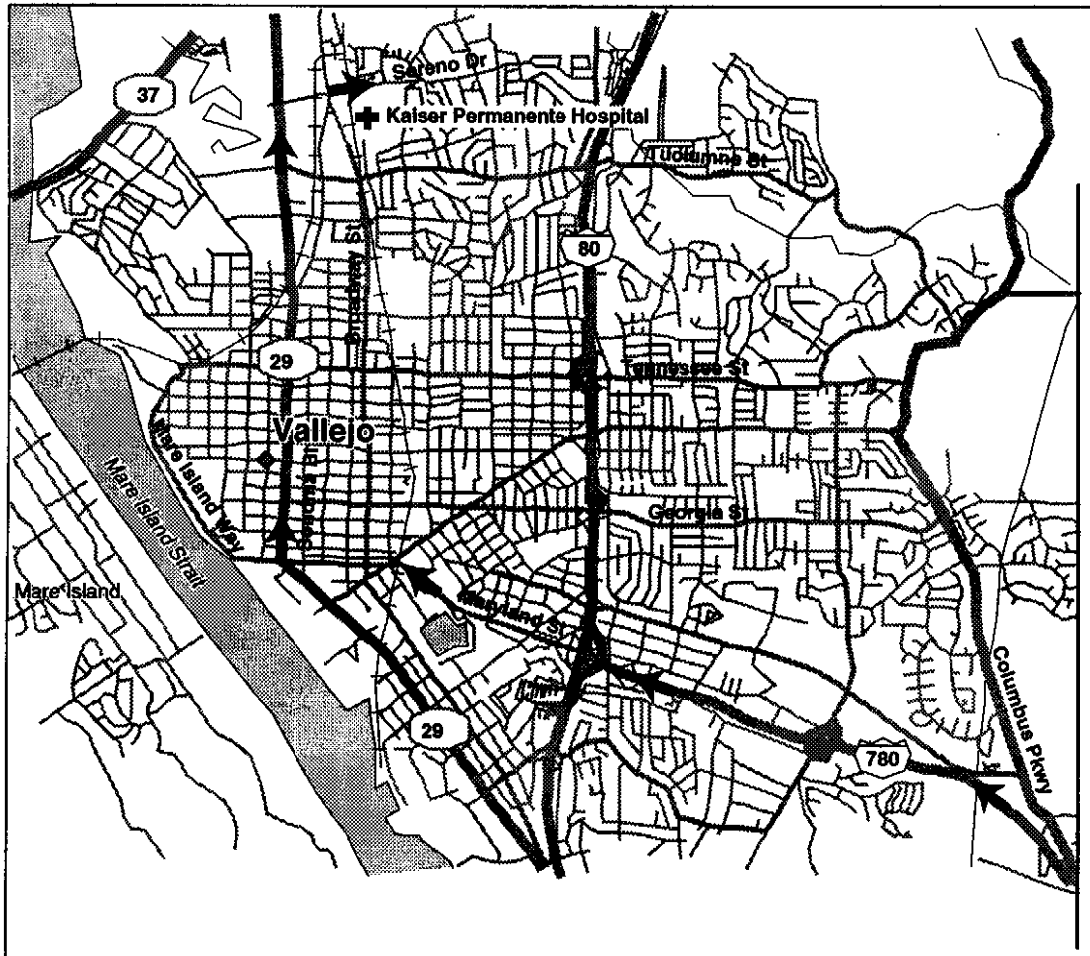
Decontamination will take place within the work zone identified on-site and shown on Figure A-1. A sample decontamination set-up can be found in the FA/BC H&S Manual (405; p.23). Diligent washing of face and hands is required for decon from PAH and PCB containing areas. There are no special emergency decontamination procedures anticipated for this project. General decontamination equipment necessary for this project is listed on Table A-3.

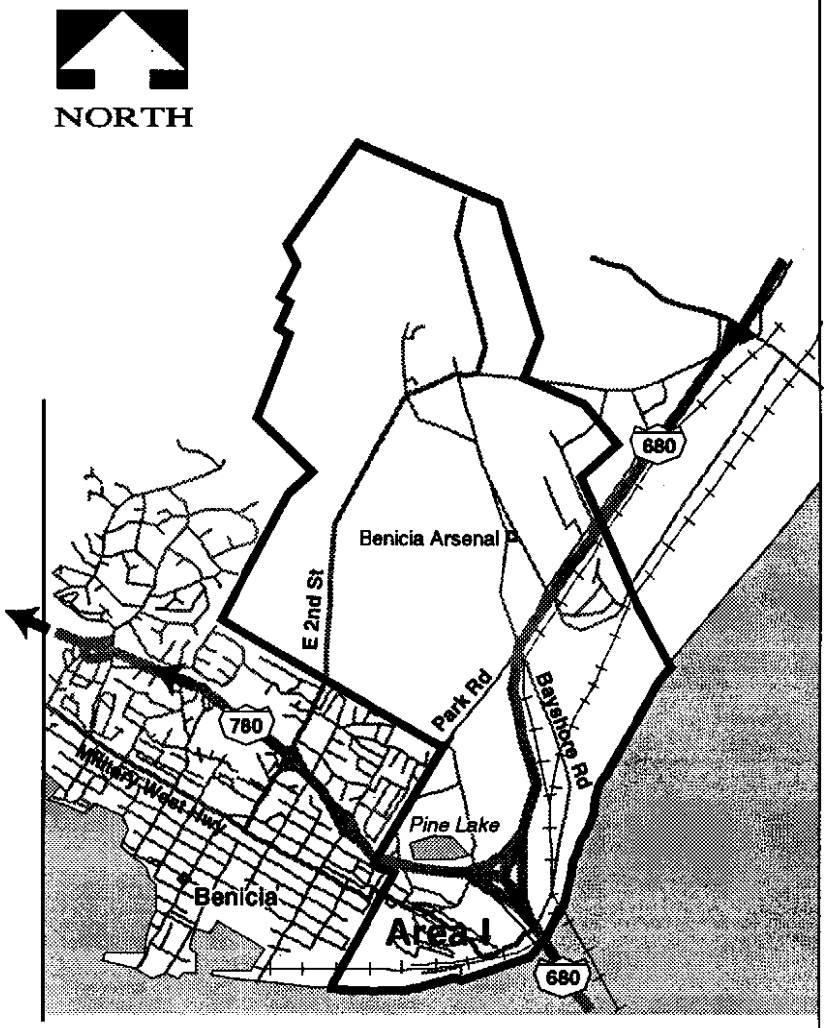
EMERGENCY PROCEDURES

The nearest medical assistance center is **Kaiser Permanente Hospital located at 975 Sereno Dr., Vallejo, CA., telephone number: (707)-651-1000.** Directions from this site to the nearest hospital is presented below and shown on the route to hospital map included in this document as Figure A-2.

Directions to **Kaiser Permanente Hospital** from the buildings and surrounding structures for this project:

- From **Lincoln Street** heading northwest to Jackson Street
- Right on **Jackson Street** head east to Polk Street
- Left on **Polk Street** heading northwest until it becomes Grant Street





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FROM **LINCOLN STREET** HEADING NORTHWEST TO JACKSON STREET
RIGHT ON **JACKSON STREET** HEADING EAST TO POLK STREET
LEFT ONTO **POLK STREET** HEADING NORTHWEST UNTIL IT BECOMES GRANT STREET
CONTINUE NORTHWEST ON **GRANT STREET** WHICH BECOMES MILITARY EAST
CONTINUE NORTHWEST ON **MILITARY EAST** TO EAST 5th STREET
RIGHT ONTO **EAST 5th STREET** HEADING NORTHEAST
LEFT ONTO ON-RAMP TO **I-780** HEADING WEST
TRAVEL ON **I-780** WEST FOR APPROXIMATELY 5.4 MILES
CONTINUE WEST ONTO **MARYLAND STREET** FOR 1.6 MILES
RIGHT ON **SONOMA BOULEVARD** HEADING NORTH FOR 2.1 MILES
RIGHT ON **SERENO DRIVE** HEADING EAST FOR 0.4 MILES TO 975 SERENO DRIVE

TOTAL TRAVEL TIME TO **KAISER PERMANENTE HOSPITAL** FROM B55
IS APPROXIMATELY 10 MILES TAKING 20 MINUTES.

Route to Hospital
50 Series Complex

Area I - Site Safety and Health Plan
Benicia Arsenal

P:\US Army Corps\Benicia Arsenal\FSIPs\Bldg50 series\Hospital55.al

FIGURE A-2

- Continue northwest on **Grant Street** which becomes Military East
- Continue northwest on **Military East** to East 5th Street
- Right onto **East 5th Street** heading northeast
- Left onto on-ramp to **I-780** heading west
- Travel on **I-780 West** for approximately 5.4 miles
- Continue west onto **Maryland Street** for 1.6 miles
- Right on **Sonoma Boulevard** heading north for 2.1 miles
- Right on **Sereno Drive** heading east for 0.4 miles to 975 **Sereno Drive**

Total travel time **to Kaiser Permanente Hospital** from the project area is approximately 10 miles taking 20 minutes.

The nearest telephone is located in the work zone. The emergency telephone numbers to be used to call for assistance are listed in the section on Key Personnel and Responsibilities in the FA/BC H&S Manual (Forward; p. F-5). **In the event of a medical emergency, 911 will be dialed first.**

DOCUMENTATION

Proper completion of standard Attachments A through E is required health and safety documentation for this site. Attachments A through E are located at the end of this Workplan. The procedures and frequency in which each Attachment must be completed is described in Table A-5.

Table A-5

Attachments A – E Investigation Activities

Attachment	Procedures	Frequency
Attachment A – Site Safety & Health Plan Acknowledgement Form	Attachment A will be completed and signed by all contractors and subcontractors involved with the field effort. An emergency contact for each contractor and subcontractor will also be required on Attachment A.	Once, prior to the start of the field project
Attachment B – Site Safety & Health Plan Site Activity and Safety Briefing	A safety briefing will be held every day prior to start of work. Attachment B will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily
Attachment C – Site Safety & Health Plan Safety Plan Implementation Checklist	Attachment C will be completed prior to the start of each field project and all items listed and their respective status will be reviewed every day of the field effort.	Once, prior to the start of the field project
Attachment D – Unsafe Conditions	Attachment D will be completed, if necessary, for every occurrence of an unsafe condition. If an Attachment D is completed for an unsafe condition, the Project Manager and the Health and Safety Director will be notified immediately and all work at the job site will stop until the unsafe condition is corrected.	When necessary
Attachment E – Site Safety & Health Plan Safety Plan Environmental Monitoring Documentation	Attachment E is a sheet to record daily air monitoring data. This attachment will be included with all other daily sheets (i.e. field notes, boring logs) submitted by the contractor at the end of the day.	Daily