# Kennedy/Jenks Consultants

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9 February 2001

Mr. Barney M. Chan
Hazardous Materials Specialist
Environmental Health Service Administration
Alameda County Health Care Services Agency
1131 Harbor Bay Parkway, Suite 250
Alameda, CA 94502-6577

Subject: Subsurface Characterization Work Plan
901 Embarcadero, Oakland, California
K/J 000128.00

Dear Mr. Chan:

The enclosed Subsurface Characterization Work Plan is submitted by Kennedy/Jenks Consultants on behalf of Praxair, Inc. This Work Plan is submitted in accordance with your letter to Praxair dated 4 December 2000. This Work Plan was developed in cooperation with the Port of Oakland and their environmental consultant. The Work Plan focuses on evaluation of potential impacts to soil and groundwater related to historical and current chemical management areas exterior to the buildings. The Work Plan does not address current compliance with environmental programs, as this is the responsibility of Alliance Gas Products, the present site operator.

We apologize for the delay in submitting this Work Plan. We had intended to submit it to you by the end of January 2001. We welcome the opportunity to discuss the Work Plan with you either in a meeting or by telephone. If you have any questions regarding this Work Plan, please call either Nick DiFranco of Praxair at (732) 738-3424 or me at (415) 243-2534.

Very truly yours,

KENNEDY/JENKS CONSULTANTS

Meredith G. Durant

e-mail - conditional wp approval to MeredithGDurant@KennedyJenks.com

Meredith G. Durant, P.E.
Senior Engineer

Enclosure

cc: Nick DiFranco, Praxair
Doug Herman, Port of Oakland
Leroy Griffin, Oakland Fire Services
Marvin Rodgers, Alliance Gas Products
John Sibley, Praxair
Jeriann Alexander, Subsurface Consultants
Jonathan Redding, Wendel Rosen Black & Dean

**Kennedy/Jenks Consultants**

622 Folsom Street
San Francisco, California 94107

# Subsurface Characterization Work Plan for 901 Embarcadero, Oakland, California

9 February 2001

Prepared for

**Praxair, Inc.**
P.O. Box 237
Keasbey, New Jersey 08832

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# Section 1: Introduction and Background

This Subsurface Characterization Work Plan is submitted to the Alameda Health Care Services Agency (County) by Praxair, Inc. The Work Plan was prepared by Kennedy/Jenks Consultants on behalf of Praxair, Inc. The Work Plan is submitted in response to the 4 December 2000 letter from the County to Praxair.

The Work Plan describes proposed subsurface investigation activities at the facility located at 901 Embarcadero in Oakland, California (the Site). The location of the Site is shown on Figure 1.

The subsurface investigation activities are proposed to characterize soil and/or groundwater within historical and former potential chemical management areas exterior to the buildings.

## 1.1 Site Description

The Site is located within an industrial area of Oakland that was historically and is currently used for mixed commercial, industrial manufacturing, warehousing and shipping. The Site is located in an area of level topography with an elevation of approximately 10 feet above mean sea level. The Site is located adjacent to the south side of the Embarcadero, a major surface street/truck route. Immediately north of the Embarcadero is US Interstate 880 and the Union Pacific railroad tracks. The estuary between Oakland and Alameda Island is approximately 300 feet south of the Site.

The Site is approximately 7.7 acres in size. The Site is owned by the Port of Oakland.

Praxair is the successor to the former Liquid Carbonic Corporation, which in approximately 1954-1955, entered into a 50-year lease with the Port. Since 1998, Praxair has subleased the Site to Alliance Gas Products, a subsidiary of International Gas & Cryogenics.

## 1.2 Site History

The Site was initially used by Liquid Carbonic for the manufacture of liquid and solid carbon dioxide (dry ice). Gaseous carbon dioxide was apparently generated through the combustion of natural gas. Various processes were employed to collect and purify the carbon dioxide gas and compressors were utilized to create liquid carbon dioxide.

In the early 1970s, an alternate local source of gaseous carbon dioxide made its onsite generation no longer economical. The carbon dioxide gas generating equipment was removed from the Site. Within a few years, the facility was converted to produce acetylene gas, which is still generated at the Site. The production of acetylene gas typically results in the generation of lime as a coproduct. The available information indicates that the lime slurry generated at the Site was (and still is) accumulated in onsite holding tanks and belowgrade sumps until the lime slurry is removed by a third party for reuse.

## 1.3 Summary of Previous Subsurface Investigations and Remediation

Four underground storage tanks (USTs) were removed from the Site during 1989 and 1990 (Subsurface Consultants 1991). These USTs included:

- One 200-gallon diesel UST
- One 4,000-gallon diesel UST
- One 1,000-gallon gasoline UST
- One 2,000-gallon acetone UST

Diesel and gasoline contaminated soils were encountered at the diesel dispenser and gasoline tank excavations respectively. No acetone-contaminated soils were encountered at the former acetone tank. Diesel and gasoline contaminated soils with total petroleum hydrocarbon (TPH) concentrations greater than 100 milligrams per kilogram (mg/kg, or parts per million, ppm) were removed. The resulting excavations were backfilled with imported fill material. The excavated soils were disposed of at Class III landfills. Groundwater samples collected from the excavation beneath the gasoline tank indicated the presence of hydrocarbons in water (Subsurface Consultants 1991).

Clayton Environmental Consultants (Clayton) installed three groundwater monitoring wells at the Site in September 1992. Two monitoring wells were installed within approximately 10 feet of the former gasoline and diesel storage tanks (MW-1 and MW-2, respectively) (Clayton 1993). The locations of the former USTs and monitoring wells are provided in Figure 2. Clayton performed groundwater monitoring at the Site for Liquid Carbonic in June 1995, September 1995, December 1995, and March 1996 (Clayton 1996). Additionally, Golden Gate Tank Removal performed groundwater monitoring at the Site for Liquid Carbonic in August and September 1996 (Golden Gate Tank Removal 1996).

Analytical results from groundwater samples collected during 1995 and 1996 indicated that chemicals of concern including TPH in the diesel range (TPHd), TPH in the gasoline range (TPHg), and benzene had decreased (Golden Gate Tank Removal 1996). The residual concentrations in groundwater were sufficiently low and the Alameda County Department of Environmental Health Department (ACDEH) granted a verbal no further remedial action required/conditional case closure, contingent upon destruction of the monitoring wells. The three monitoring wells were subsequently destroyed by pressure grouting (Golden Gate Tank Removal 1997), and ACDEH issued a "Remedial Action Completion Certification" letter to Liquid Carbonic and the Port (Alameda County 1997).

# Section 2: Proposed Subsurface Investigation Activities

The proposed subsurface investigation activities include the collection and analysis of samples of surface soil, subsurface soil and groundwater. The proposed sampling locations are identified in Figure 3 and described in Table 1.

## 2.1 Permitting and Utility Locating

On behalf of Praxair, Kennedy/Jenks will prepare and submit a Drilling Permit application to the Alameda County Public Works Agency for advancement of the soil borings and collection of reconnaissance groundwater samples.

Prior to performing the subsurface investigation activities, a search for underground utilities and other subsurface obstructions will be performed by a private utility location subcontractor at the proposed sampling locations. Kennedy/Jenks will also notify Underground Service Alert.

A focused Site Health and Safety Plan will be prepared to address the proposed sampling activities.

## 2.2 Collection of Soil and Reconnaissance Groundwater Samples

Surface soil samples will be collected in accordance with the procedures set forth in Appendix A. A hydraulic drive sampling rig (such as GeoProbe) will be used to facilitate evaluation of soils and collection of reconnaissance groundwater samples. The general procedures for collection of soil and groundwater samples are presented in Appendix B. In addition, a sediment sample will be collected from one storm drain inlet in accordance with the procedures presented in Appendix C.

Temporary groundwater monitoring wells will be installed at four locations (KB-1, KB-8, KB-15 and KB-18) to allow measurement of depth to groundwater and estimation of the shallow groundwater flow direction. The temporary monitoring wells will be properly destroyed following completion of the monitoring activities.

## 2.3 Sampling and Analysis

Samples will be collected for analysis from the various locations in accordance with the sampling plan summarized in Table 2. Samples will be analyzed for VOCs using EPA Method 8260. Samples will be analyzed for semi-volatile organic compounds (semi-VOCs) using EPA Method 8270. Petroleum hydrocarbons will be analyzed using EPA Method 8015 modified, and PCBs will be analyzed using EPA Method 8082. Metals will be analyzed using EPA Series 6000 Methods and pH will be analyzed using EPA Method 9045.

At this time, it is anticipated that the samples will be submitted to Chromalab in Pleasanton, California. Chromalab is a state-certified laboratory.

Following collection, samples will be preserved in the containers prepared and provided by the analytical laboratory. The samples will be labeled and placed into a chilled container. The samples will be submitted in the chilled container to the analytical laboratory under chain-of-custody procedures to document the sampling handling process.

A trip blank and duplicate groundwater samples will be collected and analyzed for VOCs using EPA Method 8260. The trip blank will be filled at the laboratory with purified water and will accompany the samples to and from the field unopened. There will be one trip blank per sample container. The trip blank will be used to assess the potential for contamination of the samples during sample handling, storage and transport to the laboratory. A duplicate sample will be collected from one of the reconnaissance groundwater sampling locations. The duplicate will be collected immediately after collecting the original sample. The duplicate sample will measure consistency in sampling and analysis.

The analytical laboratory will observe its customary internal QA/QC procedures during analysis of the samples.

## 2.4 Residuals Management

Residuals generated as a result of these subsurface investigation activities are anticipated to include soil cuttings from the drilling activities and water from steam-cleaning of down-hole equipment. These residuals will be appropriately contained, labeled, characterized and disposed of following receipt of laboratory analytical results. The residuals will be stored in sealed containers until disposed. The container labels will identify the container contents, collection date and name of the responsible party.

## Section 3: Report Preparation and Submittal

Following completion of the subsurface investigation activities described above, and evaluation of the resulting data, Praxair will prepare and submit a report to the ACDEH. The report will include the following:

- Soil boring logs
- Tabulated summaries of analytical data
- Laboratory analytical data reports and chain of custody forms
- Quality assurance/quality control summary and evaluation
- Findings, conclusions and recommendations

## References

Alameda County Department of Environmental Health, Hazardous Materials Division, Remedial Action Certification letter sent to Liquid Carbonic and the Port of Oakland dated 24 January 1997.

Clayton 1993. *Subsurface Investigation at Liquid Carbonic Corporation, 901 Embarcadero, Oakland, California*. Prepared for Liquid Carbonic by Clayton Environmental Consultants. 22 February 1993.

Golden Gate Tank Removal 1996. *Groundwater Monitoring Report for Three Months Ending August 31, 1996*. Prepared for Praxair – Liquid Carbonic, 901 Embarcadero. 11 September 1996.

Golden Gate Tank Removal 1997. Letter from Mr. John Carver, PE, C57, to Ms. Cordelia Clark, Liquid Carbonic, RE: Completion of Well Abandonments dated 22 January 1997.

Subsurface Consultants 1991. *Closure Report, Four Underground Storage Tanks, Liquid Carbonic, 901 Embarcadero, Oakland, California*. Prepared for Liquid Carbonic by Subsurface Consultants, Inc.

# Tables

## Table 1: Summary of Proposed Soil and Groundwater Sampling Locations

| Boring Name | Location | Sampled Media | Rationale |
|---|---|---|---|
| KB-1 | Northeast corner of site | Surface Soil<br>Subsurface Soil<br>Groundwater | Edge of site near storm drain (drainage for parking lot/loading docks area). |
| KB-2 | Adjacent to PG&E transformer pad | Surface Soil | Collect surface soil samples from three sides of the concrete pad and composite prior to analysis. |
| KB-3 | Center of loading docks (on northeast side of Building 1) | Subsurface Soil | Heavily used area for transportation, staining seen in several aerial photos (1985 – 1990). |
| KB-4 | Next to hydraulic lift (eastern end of loading dock) | Subsurface Soil<br>Groundwater | Hydraulic lift no longer functioning and location of hydraulic fluid reservoir not known. |
| KB-5 | Adjacent to Building 1, next to rail spur (towards northeastern corner) | Subsurface Soil<br>Groundwater | Near building sewer line prior to leaving site. Also at point where tank cars were parked, as seen in aerial photos. |
| KB-6 | Adjacent to rail spur, next to fence (at southeastern corner of Building 1) | Subsurface Soil<br>Groundwater | Above pipe labeled as oil-separator drain in site plans. In vicinity of stained area seen in aerial photos and near location where tank cars were parked. |
| KB-7 | Adjacent to Building 2 | Surface Soil<br>Subsurface Soil | Marked as location of dumping of waste in 1981 inspection (may be location referred to in 1980 inspection). Extensive staining seen in numerous aerial photos. |
| KB-8 | Adjacent to storm drain inlet #6 in southwest corner of site. | Subsurface Soil<br>Groundwater | Edge of site near storm drain. Drainage for south-west corner of site. |
| KB-9 | Adjacent to settling tanks | Surface Soil<br>Groundwater | Extensive staining seen in numerous aerial photos. |
| KB-10 | Adjacent to high pH water pit | Surface Soil | Several overflows of waste water pit reported (1980, 1981 inspections). |
| KB-11 | Adjacent to lime slurry pit | Surface Soil | Site listed in Cal-Sites database due to overflowing of acetylene pond (probably the lime slurry pit?). |
| KB-12 | Between Buildings 1 and 2 | Surface Soil | Marked as monkey dust area on maps from 1989 – 1991 (indicated as unpaved area in drawings). |
| KB-13 | Behind dust bin for paint (next to Building 1) | Surface Soil<br>Subsurface Soil<br>Groundwater | Dust bin emptied into bags – potential for paint dust to reach soil below. Site of former paint thinner storage. At edge of paved area behind Building 1. |

depths OK

PCB's?

## Table 1: Summary of Proposed Soil and Groundwater Sampling Locations

| Boring Name | Location | Sampled Media | Rationale |
|---|---|---|---|
| KB-14 | Adjacent to storm drain inlet #4 | Subsurface Soil | Evaluate potential releases from compressor to storm drain |
| KB-15 | Adjacent to storm drain inlet #2 | Subsurface Soil<br>Groundwater | Staining of soil seen in some aerial photos. Near storage area of calcium carbide. Erosion around storm drain indicated in inspection reports. Storm drain inlet #2 was responsible for 1999 spill to bay. |
| KB-16 | Adjacent to storm drain inlet #3 | Subsurface Soil | In vicinity of soil staining visible in aerial photo (1976). Near storm drain inlet where waste was reportedly disposed. |
| KB-17 | Center of loading docks (northwest side of Building 1) | Subsurface Soil | Area used for vehicle loading over many years. Soil staining visible in aerial photos (1979). |
| KB-18 | Adjacent to fence, northwestern portion of site | Surface Soil<br>Groundwater | Storage area for cylinders, tanks, etc. Soil staining seen in vicinity in aerial photo (1970). |
| KB-19 | Western portion of unpaved area of site | Surface Soil | Storage area for cylinders. |
| KB-20 | Center of unpaved area of site | Surface Soil<br>Subsurface Soil | Storage area for cylinders. Also used for parking of vehicles. Above 6" pipe reported to run through site. |
| KB-21 | Eastern portion of unpaved area of site. | Surface Soil | Storage area for cylinders. Also used for parking of vehicles. |
| KB-22 | Adjacent to fence, northern portion of site | Surface Soil<br>Groundwater | Storage area for cylinders, tanks, etc. Also used for parking of vehicles. |
| KB-23 | Near former diesel USTs and pumps. Adjacent to former truck maintenance shed | Subsurface Soil<br>Groundwater | Location of previous vehicle maintenance. |
| SS-1 | Storm drain inlet #1 | Sediment in drain inlet | Evaluate sediment in storm drain system. |

## Table 2: Proposed Sampling and Analysis Plan

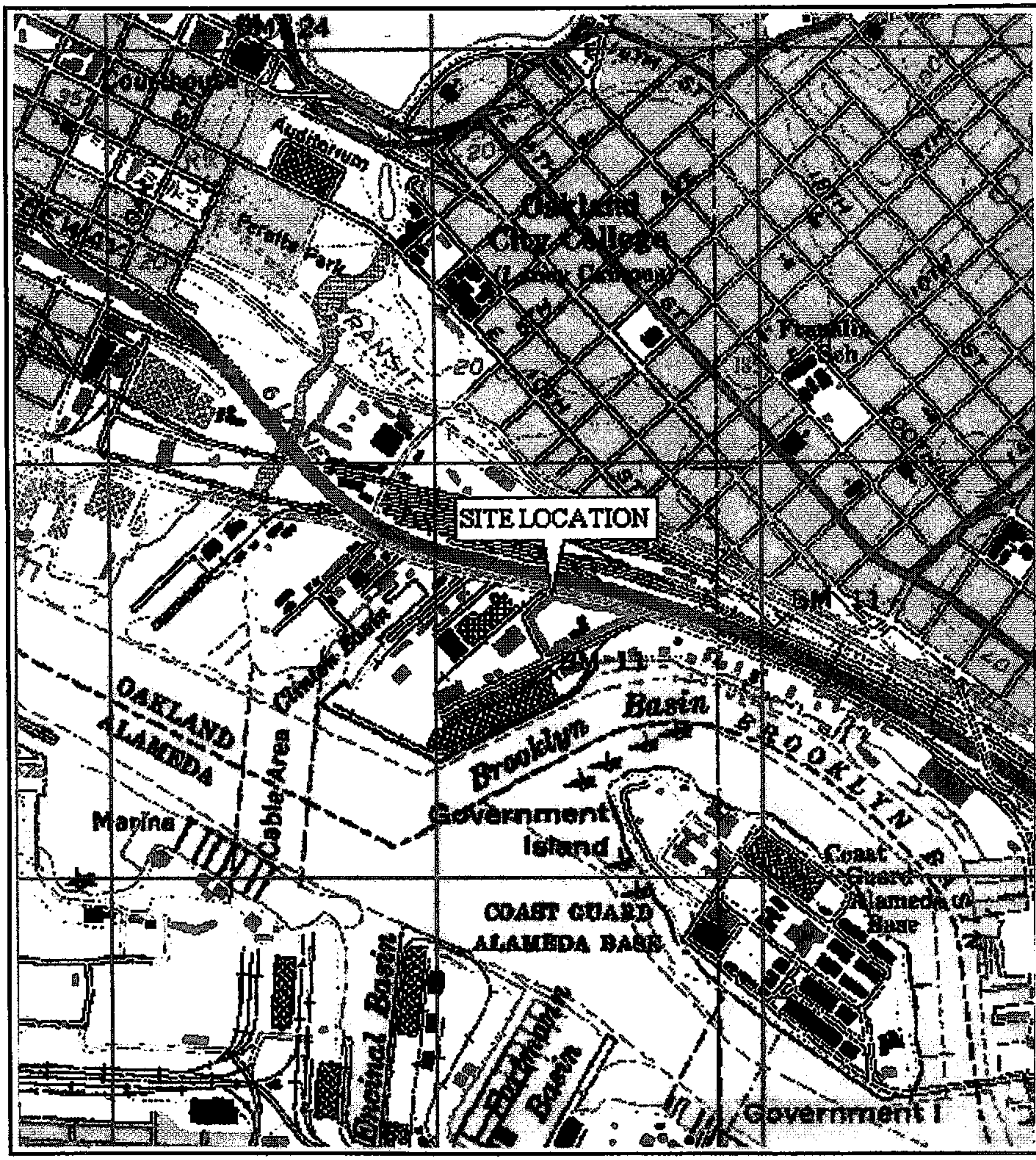
| Boring Name | Media | Depth | VOCs[a] | SVOCs[b] | TPHd[c] | TPHg, BTEX[d] | Metals[e] | PCBs[f] | pH[g] | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|
| KB-1 | Soil | 0 – 6" | X | | X | | X | | | Vehicle activities (gasoline, diesel, oil, etc.) |
| | Soil | 3' – 5' | X | | X | | X | | | Reference point (edge of site) |
| | GW | NA | X | | X | | X | | | |
| KB-2 | Soil | 0 – 6" | | | | | | X | | Potential release from former PG&E transformer |
| KB-3 | Soil | 3' – 5' | X | | X | | | | | Vehicle activities (gasoline, diesel, oil, etc.) |
| KB-4 | Soil | 3' – 5' | X | | X | | | X | | Hydraulic fluid (PCBs?) |
| | GW | NA | X | | X | | | X | | Vehicle activities (gasoline, diesel, oil, etc.) |
| KB-5 | Soil | 3' – 5' | X | | X | | | | | Sewer line (solvents?) |
| | GW | NA | X | | X | | | | | Rail car activities |
| KB-6 | Soil | 3' – 5' | X | X | X | X | | | | Oil-water separator drain? |
| | GW | NA | X | X | X | X | | | | |
| KB-7 | Soil | 0 – 6" | X | X | X | X | X | | X | Waste dumping(?) |
| | Soil | 3' – 5' | X | X | X | X | X | | X | |
| KB-8 | Soil | 3' – 5' | X | | X | | | | X | Vehicle activities (gasoline, diesel, oil, etc.) |
| | GW | NA | X | | X | | | | X | Reference point (edge of site) |
| KB-9 | Soil | 0 – 6" | | | | | X | | X | Lime spill |
| | GW | NA | X | | | | | | X | |
| KB-10 | Soil | 0 – 6" | | | | | | | X | Lime spill |
| KB-11 | Soil | 0 – 6" | X | X | X | | X | | X | Lime slurry pit<br>Monkey Dust |
| KB-12 | Soil | 0 – 6" | X | | | | X | | X | Lime spill<br>Monkey Dust |
| KB-13 | Soil | 0 – 6" | X | X | X | | X | | | Site activities (compressor leaks, paint thinner storage, etc.) |
| | Soil | 3' – 5' | X | X | X | | X | | | |
| | GW | NA | X | X | X | | X | | | Paint dust (metals) |
| KB-14 | Soil | 3'-5' | | | X | | | | | Evaluate potential release from compressor to storm drain |
| KB-15 | Soil | 3' – 5' | X | | X | | | | X | Lime spill |
| | GW | NA | X | | X | | | | X | Site activities |
| KB-16 | Soil | 3' – 5' | X | X | X | | X | | X | Vehicle activities (gasoline, diesel, oil, etc.)<br>Waste disposal (?) |
| KB-17 | Soil | 3' – 5' | | | X | X | | | | Vehicle activities (gasoline, diesel, oil etc.) |

## Table 2: Proposed Sampling and Analysis Plan

| Boring Name | Media | Depth | VOCs(a) | SVOCs(b) | TPHd(c) | TPHg, BTEX(d) | Metals(e) | PCBs(f) | pH(g) | Rationale |
|---|---|---|---|---|---|---|---|---|---|---|
| KB-18 | Soil | 0 – 6" | X | | X | | X | | | Vehicle activities (gasoline, diesel, oil, etc.) |
| | GW | NA | X | | X | | X | | | Cylinder/tank storage (metals) |
| KB-19 | Soil | 0 – 6" | | | | | X | | | Cylinder storage (metals) |
| KB-20 | Soil | 0 – 6" | X | | X | | X | | | Vehicle activities (gasoline, diesel, oil, etc.) |
| | Soil | 3' – 5' | X | | X | | X | | | Cylinder/tank storage (metals) |
| KB-21 | Soil | 0 - 6" | | | | | X | | | Cylinder storage (metals) |
| KB-22 | Soil | 0 – 6" | X | | X | | X | | X | Vehicle activities (gasoline, diesel, oil, etc.) |
| | GW | NA | X | | X | | X | | X | Cylinder/tank storage (metals) |
| KB-23 | Soil | 3' – 5' | X | | | | | | | Vehicle activities and maintenance (gasoline, diesel, oil, etc.) |
| | GW | NA | X | X | X | | | | | |
| SS-1 | Sediment | SDI invert | | X | | | X | | X | Evaluate sediment in storm drain |

(a) VOCs = volatile organic compounds using EPA Method 8260.
(b) SVOCs = semivolatile organic compounds using EPA Method 8270.
(c) TPHd = total petroleum hydrocarbons, analyzed as diesel using EPA Method 8015.
(d) TPHg, BTEX = total petroleum hydrocarbons, analyzed as gasoline and benzene, toluene, ethylbenzene, and xylenes using EPA Method 8015/8020.
(e) Analyzed for total metals using EPA 6000 series.
(f) PCBs = polychlorinated biphenyls using EPA Method 8082.
(g) Analyzed according to EPA Method 9040A, for high pH.

# Figures




BASE MAP: USGS 7.5' QUADRANGLE TOPOGRAPHIC SERIES; OAKLAND, WEST

N

0 500 1000
SCALE IN FEET

**Kennedy/Jenks Consultants**

901 EMBARCADERO, OAKLAND, CALIFORNIA

SITE LOCATION MAP

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**Figure 1**

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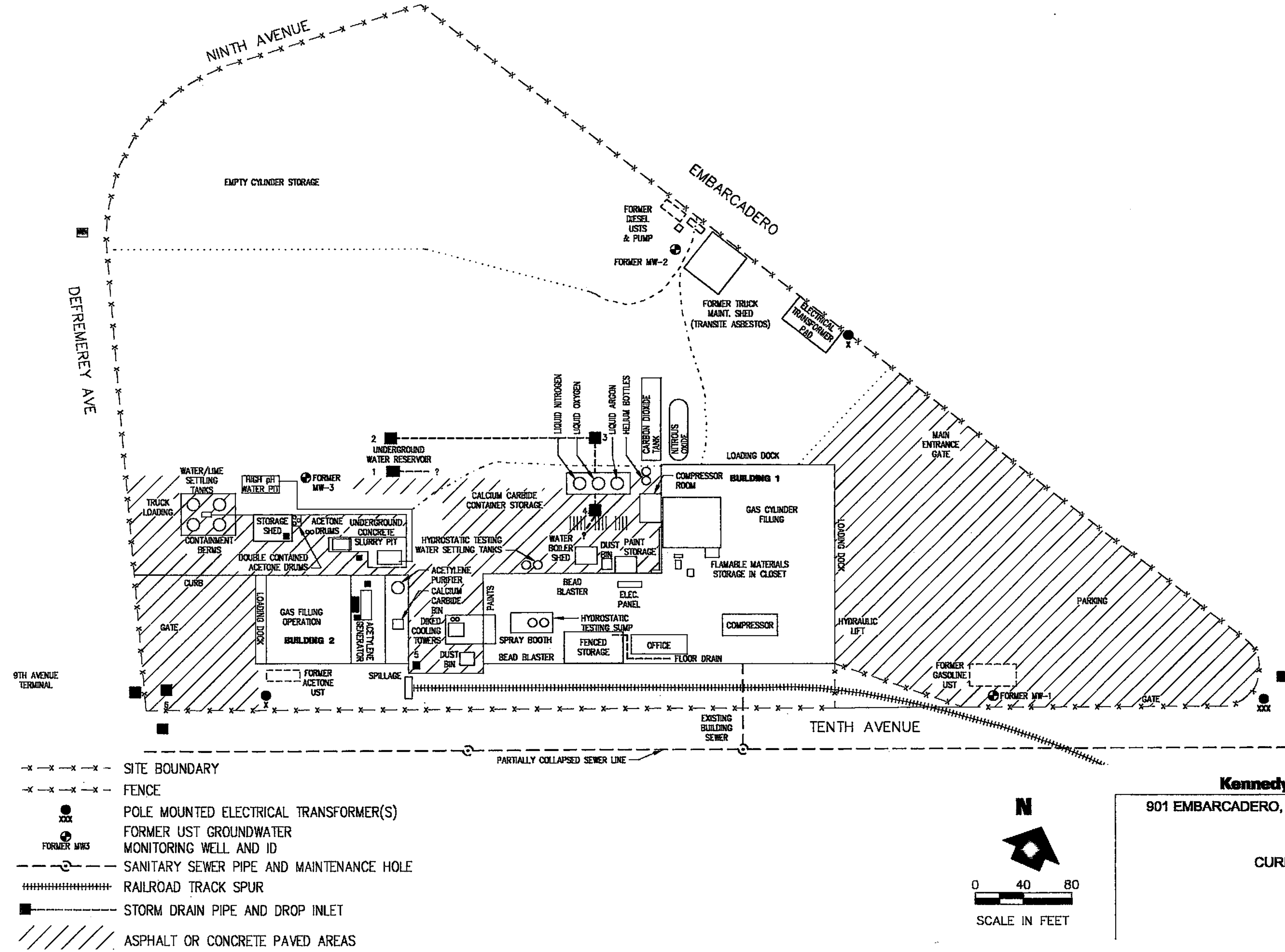


**Kennedy/Jenks Consultants**

901 EMBARCADERO, OAKLAND, CALIFORNIA

SITE FEATURES AND CURRENT CONFIGURATION

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JANUARY 2001

**Figure 2**

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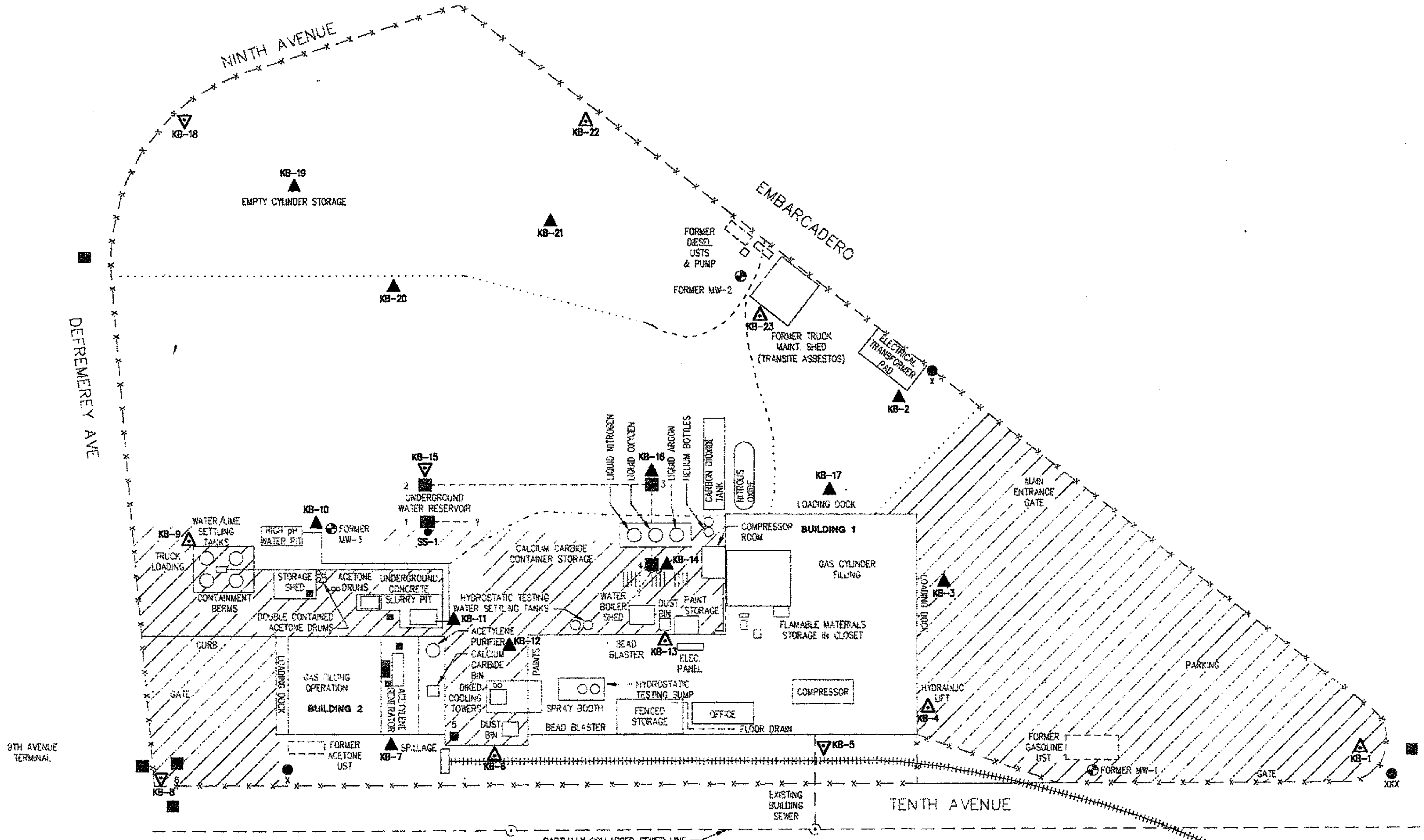


SITE BOUNDARY

FENCE

POLE MOUNTED ELECTRICAL TRANSFORMER(S)

FORMER UST GROUNDWATER MONITORING WELL AND ID

SANITARY SEWER PIPE AND MAINTENANCE HOLE

RAILROAD TRACK SPUR

STORM DRAIN PIPE AND DROP INLET

ASPHALT OR CONCRETE PAVED AREAS

▲ PROPOSED SOIL SAMPLING LOCATION

△ PROPOSED SOIL AND GROUNDWATER SAMPLING LOCATION

▽ PROPOSED SOIL AND GROUNDWATER SAMPLING LOCATION AND TEMPORARY MONITORING WELL

● PROPOSED SEDIMENT SAMPLE FROM STORM DRAIN

N

0 40 80

SCALE IN FEET

**Kennedy/Jenks Consultants**

**901 EMBARCADERO, OAKLAND, CALIFORNIA**

**PROPOSED SOIL AND GROUNDWATER SAMPLING LOCATIONS**

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FEBRUARY 2001

**Figure 3**

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# Appendix A

Surface and Shallow Soil Sampling

# APPENDIX A

# SURFACE AND SHALLOW SOIL SAMPLING

## INTRODUCTION

This guideline describes the equipment and procedures that are used by Kennedy/Jenks Consultants personnel for collecting surface and shallow soil samples.

## EQUIPMENT

- Stainless steel or plastic scoops
- Hand auger
- Split-spoon drive sampler (2.5-inch or 2.0-inch I.D.) and associated drill rods, wrench and other tools needed to break down equipment
- Slide hammer
- 2.5-inch or 2.0-inch brass liners and sealing materials (plastic end caps, Teflon seals, silicon tape, zip-lock plastic bags)
- Shovel
- Post hole digger
- Pick
- Breaker bar
- Foxboro FID-Organic Vapor Analyzer (OVA)
- HNU PID-Organic Vapor Analyzer
- OVM
- Measuring tape or measuring wheel
- Stakes or spray paint for sampling grid
- Sampler cleaning equipment
  - Steamcleaner (if available)
  - Generator (if available)
  - Stiff-bristle brushes
  - Buckets
  - High priority phosphate-free liquid soap, such as Liquinox
  - Trisodium phosphate (TSD) for use if samples are oily
  - Methanol (if necessary)
  - 0.1N nitric acid (if necessary)

  - Deionized water
  - Potable water
- Insulated sample storage and shipping containers
- Personal protective equipment (as specified in site safety plan)

**TYPICAL PROCEDURE**

1. Obtain applicable drilling and well construction permits, prior to mobilization, if necessary.
2. Clear locations for underground utilities and structures by Underground Service Alert (USA) and subcontractors, if necessary.
3. Measure and mark sampling locations prior to initiation of the sampling program, as specified in the sampling and analysis plan. If sampling locations are based on a grid pattern, stakes can be used to define the grid layout.
4. Collect soil samples for chemical analysis by using precleaned scoops or a hand auger, or by driving a split-spoon drive sampler.
5. If overlying soil is to be removed (as specified in the sampling and analysis plan), use shovels, picks, or post-hole diggers, as needed.
6. Collect soil samples for lithologic logging purposes.
7. If applicable, as described in the site safety plan, use an OVA to analyze *in situ* air samples from the breathing zone and other locations as necessary.
8. Have the soils classified in the field in approximate accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D 2488-90) and the Munsell Color Classification.
9. Prior to each sampling event, wash sampling equipment (scoops, hand auger, split-spoon drive sampler, and brass liners) with high purity phosphate-free soap. Double-rinse it with deionized water and methanol, and/or 0.1N nitric acid, as appropriate.
10. At each sampling interval, collect soil and place it in the appropriate sampling container. Fill the sample container and compact the soil to minimize air space. Minimize handling of the soil, especially if it is being collected for analysis of volatile compounds.
11. If a split-spoon drive sampler is being used, select one brass liner for potential laboratory analysis. Cover the ends of this sample in Teflon sheets, seal it with plastic caps, and wrap it with silicon or Teflon tape. Place a completed sample label on the brass liner.
12. Place the selected samples in appropriate containers and store them at approximately 4 °C.
13. As a field screening procedure (if applicable), for each sampling interval, place soil not selected for chemical analysis in an airtight container (e.g., plastic bag or jar) and allow it to equilibrate. After this, monitor the headspace in the container using either a HNU, OVM or OVA. Record the headspace concentration in the field notes.

14. Complete chain-of-custody forms in the field and transport the selected samples in insulated containers, at an internal temperature of approximately 4°C, to the analytical laboratory.

## EQUIPMENT CLEANING

Prior to collection of each soil sample, the sampling equipment should be either steamcleaned or hand washed. If the sampling equipment is hand washed, wash excavation equipment with a brush, in a solution of high purity phosphate-free soap and potable water. Rinse the equipment with potable water and methanol, and/or 0.1N nitric acid, as appropriate. Follow this with double-rinsing using distilled water.

## INVESTIGATION-DERIVED RESIDUALS

If sufficient volumes of soil cuttings and other residuals are generated, contain the material in appropriately labeled containers for disposition by the client. All soil samples transported to the laboratory must be returned to the client for disposition if required by the laboratory. Kennedy/Jenks Consultants is available to assist the client with options for disposition of residuals.

# Appendix B

Typical Hydraulic Push/Drive Sampling Procedures

# APPENDIX B

# TYPICAL HYDRAULIC PUSH/DRIVE SAMPLING PROCEDURES

## INTRODUCTION

This guideline describes the equipment and procedures typically used by Kennedy/Jenks Consultants personnel for collecting soil and reconnaissance groundwater samples with a hydraulic push/drive system.

## EQUIPMENT

- Portable, hydraulic push/drive sampling system
- 6-inch long, 1.75-inch O.D. stainless steel or brass liners and liner sealing materials (Teflon sheets, plastic end caps, Ziploc plastic bags)
- Type II Portland cement
- 1-inch O.D. Schedule 40 PVC screen (0.010-inch slot size)
- 1-inch O.D. Schedule 40 PVC blank casing
- 0.75-inch diameter stainless steel or Teflon bailer
- FID or PID organic vapor analyzer
- Water level indicator
- Temperature, specific conductivity and pH meters
- Equipment cleaning materials
  - Steam cleaner
  - Generator
  - Stiff-bristle brushes
  - Buckets
  - High-purity phosphate-free liquid soap
  - Deionized water
  - Rinsate collection system
- Personal protective equipment
- Appropriate groundwater sample containers
- Chain-of-custody forms
- Insulated sample storage container and ice substitute

**TYPICAL PROCEDURES**

1. Applicable drilling permits will be obtained prior to mobilization.
2. Sample locations will be cleared for underground utilities.
3. All downhole equipment will be steam cleaned prior to use at each location.
4. Soil borings will be advanced using a portable, hydraulic push/drive sampling system that simultaneously drives two nested, steel sampling rods into the ground to collect continuous soil cores.
5. As the sampling rods are advanced, the soil core will be collected in a 1-7/8-inch diameter, 3-foot long sample barrel, which is attached to the end of the inner rods. After being advanced 3 feet, the inner rods will be removed from the borehole with a hydraulic winch. The sampler (containing new stainless steel liners) and inner rods will then be lowered back into the borehole to the previous depth and the rods are driven another 3 feet. This process will be repeated until the desired depth is reached.
6. The soil samples will be retained for lithologic logging and chemical analyses, if appropriate.
7. The soils will be classified in the field in approximate accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D-2488-93), and the Munsell Color Classification.
8. If required, soil samples will be collected at selected intervals for laboratory analysis. At these intervals, the ends of one or more of the soil sample liners will be covered with Teflon end sheets and plastic end caps, and labeled. Labels will document the sample designation, type, date and time of collection, collector(s), location, and any additional information.
9. If groundwater samples will not be collected, the soil borings will be grouted to the ground surface with a neat cement grout (Type II Portland cement) using the tremie method.
10. Upon encountering the uppermost groundwater surface during sampling, the sample barrel and inner rods will be removed and the well screen and casing will be installed within the outer drive casing to facilitate collection of a groundwater sample. The drive casing will be pulled up approximately 3 feet to expose the slotted PVC casing. Groundwater samples will then be collected from within the PVC casing with a 0.75-inch diameter Teflon or stainless steel bailer.
11. The depth to groundwater will be measured prior to groundwater sampling.
12. The sample will be drained directly from the bailer into sample containers. The containers will be labeled to document the sample designation, type, date and time of collection, collector(s), location, and any additional information.
13. After collecting the reconnaissance groundwater sample, decant groundwater into a clean container and record the following field parameters/observations:

    a. Temperature (°C)

    b. pH

c. Specific conductivity (μmhos/cm)

d. Depth to water

e. Color

f. Other observations (odors, free-phase product)

14. After sample collection, the boring will be grouted to ground surface with a neat cement grout (Type II Portland cement) using the tremie method.

## EQUIPMENT CLEANING

1. Downhole equipment (rods, sampler) will be steam cleaned prior to each borehole.
2. Sampling equipment (sampler) will be steam cleaned or washed with a brush in a solution of high-purity phosphate-free soap and potable water, then rinsed with potable water followed by double rinsing with deionized water prior to each sampling run.
3. Downhole equipment and vehicles which warrant it, will be steam cleaned prior to leaving site at completion of sampling.

## INVESTIGATION-DERIVED RESIDUALS

Soil cuttings will be placed in labeled 5-gallon DOT-approved pails with bolt-on covers. Decontamination water and groundwater residuals will be contained in labeled 55-gallon DOT-approved drums with bolt-on covers. All residuals generated during sampling activities will be stored at the site.

# Appendix C

Storm Drain Sediment Sampling

# APPENDIX C

# STORM DRAIN SEDIMENT SAMPLING

## INTRODUCTION

This guideline describes procedures typically followed by Kennedy/Jenks Consultants personnel during storm drain sediment sampling.

The location of stormwater sediment sampling and the parameters to be sampled depends on the Scope of Work. This information is described in the project-specific sampling and analysis plan or work plan. Storm drain sediment sampling requires the same precautions and sampling location considerations as stormwater sampling.

## EQUIPMENT

Proper equipment for sampling by hand is listed below:

- Decontaminated collection containers (one for each sampling location) and sampling labels
- Cooler and ice
- Field notebook
- Organic Vapor Analyzer/Meter (OVA/OVM)
- Hydrogen sulfide meter
- Oxygen meter
- Stopwatch
- Explosimeter
- Marking pens
- Personal protective equipment (as necessary)
- Rain gear and rubber boots
- Any special equipment required due to site conditions (such as traffic control items)

For field parameter measurements (if required), the following equipment is required:

- pH meter
- Conductivity meter
- Thermometer
- DO meter

## LOCATION CONSIDERATIONS

A sampling location is selected on the basis of data needs, accessibility for equipment, and crew safety considerations. Data needs are described in the scope of work and the sampling and analysis plan. Placement of sampling equipment requires a safe environment for the work crew. During field investigation, traffic control (using cones, barricades, and vehicle lights) may be required. To determine if a manhole is safe for entry, the crew must test the atmosphere in the confined manhole space for oxygen deficiency, explosive and toxic gases, and organic vapor concentrations. If traffic cannot be controlled or if the manhole is not safe to enter, measures to correct the problems must be developed or an alternative location must be selected.

## TYPICAL PROCEDURES

### Sediment Sampling

1. Clean a disposable plastic or stainless steel trowel prior to initial use.
2. Using the clean trowel, collect a sample of sediment from the storm drain, midstream in the drain line if possible and avoiding the collection of dirt or debris from the manhole area. Place this sample in an appropriate container.
3. Cap, label, seal, and ice the sample for shipment to the laboratory for analysis.
4. Repeat Steps 1 through 3 to sample all storm drains as designated in the Work Plan.
5. Record in field log where sediment was collected; the quantity of sediment from each location; characteristics of sample (color, moisture content); collection date and time.

## SAMPLE CUSTODY

Chain-of-custody procedures should be followed from initial sampling through completion of laboratory analyses. Guideline procedures for field sampling operations include:

- Attachment of a prepared label to each sample.
- Maintenance of field sample chain-of-custody records during sampling.
- Sample preservation by the appropriate EPA method.

To ensure sampling integrity, each sample received by the laboratory is assigned a laboratory sample number, corresponding to the order in which the sample was received. The sample number is assigned in numerical sequence, written on all sample bottles comprising the sample, and recorded on the chain-of-custody form. Laboratory personnel are responsible for the care and custody of the sample until analyses are completed.

## QUALITY ASSURANCE/QUALITY CONTROL

For each day of sampling, the following sampling QA/QC checks **may** be performed (check with project-specific sampling and analysis plan):

1. Travel blanks ensure that clean water samples are returned unopened in each shipping container.

2. Field blanks ensure that clean water samples are taken to the site, then opened to simulate field conditions, sealed, and placed with the other samples.

3. Field spikes make sure that water samples are spiked in the field with known amounts of chemicals of interest.

4. Field replicates ensure that sequential samples are collected in separate VOC vials for water samples from the same storm drain (or separate sediment aliquots from the same sediment sample).

One travel blank should be prepared for each shipping container. Field blanks and spikes are collected and analyzed for ten percent of the samples, or at least one per day if fewer than ten samples are collected. Replicates (e.g., sequential VOC vials for a given sample) are collected for each sample to protect against loss of the entire sample through breakage or other accidents. Also, replicates from ten percent of the samples are analyzed as duplicates in the laboratory. If required, split samples are taken to another laboratory for analysis.

These methods provide information concerning unwanted sample contamination (blanks), precision (replicates), and accuracy (spikes). Resulting measurements reflect sampling variability and sample matrix variability resulting from actual field conditions. No standards have been established for the acceptability of precision and accuracy determined from such field measurements. No field sediment blanks or field sediment spikes are collected.