Levine·Fricke·Recon
ENGINEERS, HYDROGEOLOGISTS & APPLIED SCIENTISTS

November 20, 1997 5109.00-001

Sheryl Lauth
United States Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, California 94105-3901

Subject: Response to EPA Comments for the Work Plan, Parcel C Treatability Study Dated October 22, 1997, Hunters Point Shipyard, San Francisco, California

Dear Ms. Lauth:

On behalf of the Navy, Levine·Fricke·Recon Inc. has enclosed two copies of Amendment A, Response to EPA Comments for the Work Plan for implementation of the treatability study at Parcel C, Hunters Point Shipyard. Tables and figures are included as Attachments A and B, which reflect revisions to the treatability study approach, based on the response to comments. Attachment C is a Report of Emissions Testing for a HD CatOx™ System.

A Revised Final Work Plan will not be issued, as agreed to in the November 13, 1997 BCT meeting, because of the time-critical nature of the Work Plan, and submittal of the Technical Memorandum and Draft Final Parcel C Feasibility Study. Instead, please attach the enclosed Amendment A, Response to EPA Comments, to the Work Plan.

If you have any questions or comments, please call Glenna Clark at the Navy at (415) 244-2659, or me at (510) 652-4500.

Sincerely,

Michael B. Marsden
Senior Hydrogeologist

Enclosures

cc: Glenna Clark, Navy (two copies)
Richard McMurtry, RWQCB (one copy)
Kent Morey, Tetra Tech EM Inc. (two copies)
Chein Ping Kao, Department of Toxic Substances Control (one copy)
Karia Brasmaele, Roy F. Weston (one copy)

DRAFT WORK PLAN PARCEL C TREATABILITY STUDY

DATED 22 OCTOBER 1997

IS ENTERED IN THE DATABASE AND FILED AT ADMINISTRATIVE RECORD NO. **N00217.003723**

Amendment A

Response to EPA Comments
Hunters Point Shipyard, Parcel C, Treatability Study
Dated October 22, 1997

CORRECTIONS TO DRAFT WORK PLAN

Section 3.5, Paragraph 3. Revise last sentence to read: "A Navy/Tetra Tech EM Inc. (TtEMI) approved laboratory will analyze soil-vapor samples for VOCs using EPA Method TO-14."

EPA COMMENTS RECEIVED BY FAX

GENERAL COMMENTS:

Comment 1: **Additional discussion is needed to describe how the effectiveness of AS/SVE performance will be assessed, particularly how the stripping of VOCs by AS and their capture by the SVE will be estimated. For each technology, the Work Plan indicates how the radius of influence (ROI) and physical operation of the various wells/vents will be assessed, however, it is not clear how the VOCs mobilized by the AS will be assessed, or how the SVE measurements will show that VOCs result from the AS rather than from SVE alone. Please also consider and discuss whether there is vadose zone contamination that will result in VOC capture by the SVE even if the AS is ineffective.**

Response: Data gathered during the SVE portion of the pilot test, including mass balances calculated based on the flowrate and VOC concentration data, will be used to assess the effectiveness of SVE in treating vadose zone contamination. The soil-vapor surveys at RU-2, RU-4, and RU-6 will also be used to estimate vapor contamination in the vadose zone that may be captured by operation of the SVE wells without AS. VOC concentrations in the samples collected at the blower/treatment unit influent during the SVE system test will be compared to those collected during the AS/SVE system test. A comparison of these data can be used to distinguish VOCs mobilized as a result of the AS from VOCs mobilized from the vadose zone due to SVE alone.

Comment 2: **It is not apparent how the spread of VOCs through soils (if they are not captured by the SVE) will be detected. Please clarify whether a second soil gas survey during the combined AS/SVE test will be conducted to show that the lateral distribution of VOCs is similar to the baseline, thereby supporting the inference that the SVE system is capturing the mobilized VOCs.**

Response: To verify that the AS/SVE system is not spreading VOCs laterally through the vadose zone, baseline, and post-AS/SVE, soil-vapor samples will be collected from select soil-vapor probes and analyzed for VOCs, O_2, and CO_2. The select probes are indicated on revised Figures 2 through 4. In addition, groundwater samples will be collected from either additional ¾-inch monitoring points or existing monitoring wells located at the perimeter of groundwater plumes at RU-2, RU-4, and RU-6. Groundwater samples will be collected from these locations before and after the AS/SVE tests to determine if AS resulted in the spreading of the contaminant plume. The groundwater samples will be analyzed for VOCs and DO.

Comment 3: **Please discuss how, if at all, the uneven airflow through conduits in the fill areas can be assessed. It appears that the potential presence of such material presents the possibility for preferential channeling of contaminants to the atmosphere.**

Response: Vapor pressure and vacuum will be monitored in the vapor probes and SVE wells during the AS/SVE tests. This parameter will be used to assess air flow through the unsaturated zones and assist in determination of whether channeling is occurring. In addition, the duration of this test is such that the quantity of contaminants that might migrate to the atmosphere via preferential channeling is not significant. The test data will be used to assess if full scale implementation of this technology is appropriate, or if heterogeneities in the fill material would result in preferential

channeling of contaminants such that SVE wells would reduce the effectiveness of the system to capture VOCs.

Comment 4: **All objectives for all aspects of the treatability study should be clearly stated and discussed in Section 1. For example, the objective of the soil, soil-vapor, and groundwater sampling at RU-5 is not discussed. It is also inappropriate to present a new objective (refining the indoor air model) in Section 6.2.**

Response: Section 2 presents descriptions and objectives of the pilot test and field activities. Section 2.2, Soil Sampling, addresses the objectives of soil sampling at RU-5 as well as at RU-2, RU-4, and RU-6. Section 2.3, Soil-Vapor Survey, addresses the soil-vapor survey objectives at RU-5 as well as at RU-2, RU-4, and RU-6. Section 2.4, Groundwater Sampling, addresses groundwater sampling objectives at RU-5 as well as at RU-2, RU-4, and RU-6. The second sentence of Section 6.2, ("The moisture content and bulk density data will be used to refine the indoor air model presented in the human health risk assessment (HHRA) of the Parcel C RI."), should be reworded to read as follows: "The moisture content and bulk density data will be used for modeling the migration of VOCs in groundwater through the vadose zone."

Comment 5: **Please consider using "The Guide for Conducting Treatability Studies Under CERCLA: Soil Vapor Extraction," Interim Guidance, September 1991 to define the criteria for success or failure of the test.**

Response: While specific criteria were not identified in this guidance document, the success or failure of the test will be determined based on an evaluation of several factors including the effects of the heterogeneous fill material on the distribution of sparged air (i.e., whether channeling occurs) and extraction of soil vapors. The mass of VOCs removed from the soil and groundwater during the pilot test, the optimal operating vacuum, and the ROI of the AS and SVE wells will also be used to determine design parameters and associated costs for a final system, if appropriate.

Comment 6: **A vertical gas profile in the areas of concern analyzing for not only the contaminant constituents but also CO_2, O_2, and organic carbon needs to be done to refine the placement of the wells and determine where the gas is coming from. A similar situation at Alameda NAS found a gas restricting layer at about 1 meter which was not visible from the soil logs (Lawrence Berkeley Lab LBL-37768, UC-402 Nov 1995), but at Hunters Point we don't know if this type of layer exists.**

Response: The soil-vapor survey was revised to include sampling over 2-foot intervals. Soil-vapor samples will be collected from 2, 4, 6, and 8 feet bgs at locations located along transects at RU-2, RU-4, RU-5, and RU-6 (see revised Figures 7 through 10 for locations). At the remainder of the locations, soil-vapor samples will be collected from approximately 4 feet bgs. All soil-vapor samples will be analyzed for CO_2 and O_2 in addition to VOCs. Soil samples will be collected from 2, 4, 6, and 8 feet bgs generally at alternate locations along the transects (see revised Figures 7 through 10 for locations); the soil samples will be analyzed for total organic carbon.

Comment 7: **The soil gas sampling should be done using Summa canisters to achieve the lowest detection limits. The first half of the report refers to Tedlar bags, the last to Summa canisters. It should read Summa canisters throughout.**

Response: All soil-vapor samples collected for laboratory analysis will be collected in Summa canisters. Tedlar bags are used only for collection of samples that will be analyzed in the field for oxygen content using a Gas Tech meter and for organics using a FID. Table 3 summarizes the samples that will be collected in Tedlar bags using a vacuum pump. These samples are collected more frequently than the samples collected for laboratory analysis in Summa canisters, and will be provide more timely, but qualitative results. Results of soil-vapor samples collected in Tedlar bags

and analyzed with a FID will be compared with the soil-vapor samples collected from the same location at the same time in Summa canisters for laboratory analysis in order to develop a correlation between the FID results and the laboratory VOC results.

Comment 8: **Finally, as the treatment of the removed gas is by catalytic oxidation, the details of the system should be provided to EPA so that the unit does not produce dioxins in the waste stream as was the problem with a SVE unit at Edwards AFB.**

Response: The vendor that has been selected to provide the vapor treatment system is King, Buck Technology. They will provide their model HD-5A(T) catalytic oxidizer for the destruction of chlorinated hydrocarbon vapor. Attached to these response to comments as Attachment A is a Report of Emissions Testing for a HD CatOx™ system. The tests were performed in June 1992 at a site in the South Coast Air Quality Management District. Based on the results of these tests, production of dioxins in the waste stream is not anticipated. King, Buck is currently re-testing the unit in use at Edwards AFB for dioxin production.

SPECIFIC COMMENTS

Section 2.4, Page 4, Paragraphs 1 and 2.

Comment: **The first paragraph indicates field monitoring of DO, pH, specific conductance, and temperature at "monitoring points" while the second paragraph indicates that groundwater samples will be analyzed in the field for DO, ORP, nitrite, sulfide, and ferrous iron at RU-4, RU-5, and RU-6, and a background location. Please clarify whether the monitoring points referred to in these two paragraphs are the same and explain why the analytical parameters are not the same for all such points.**

Response: The monitoring points referred to in the two paragraphs are the same. The analytical parameters are the same for all such points. Groundwater will be monitored hourly in the field during performance of the AS/SVE tests for DO, pH, specific conductance, and temperature. In addition, when groundwater samples are collected for laboratory analysis (VOC and general minerals), the following additional parameters will be analyzed in the field: ORP, ferrous iron, nitrite, and sulfide; these additional parameters will not be monitored hourly during the AS/SVE tests.

Section 3.3.1, Page 6, Paragraph 1.

Comment: **Please explain what will keep the Teflon tubing from collapsing either from soil pressure or as the grout hardens. Also explain how will the tubing be removed at the end of testing if it is grouted in place.**

Response: The designated Teflon tubing is rigid, sturdy, and is routinely used for this type of pilot testing. The tubing has been tested during similar shallow applications and is not expected to collapse because of the forces applied by soil or grout hardening. Because the tubing is installed to a depth of 5 feet bgs, the tubing can be pulled out of the ground from the surface, and the hole grouted (as required).

Section 3.3.1, Page 6, Paragraph 1.

Comment: **Section 3.3.1, Page 6, Paragraph 2. The text states that the spacing of the soil vapor probes is based upon the estimated radius of influence (ROI) of the SVE vents. Please discuss the basis for the estimated ROI. Likewise please indicate the basis for selection of piezometer locations for monitoring air sparging.**

EPA suggests that an additional soil vapor probe at a distance of 5 or 10 feet beyond the expected ROI be added.

Response: While the actual ROI of the SVE wells cannot be determined before performing the on-site pilot test, ROI estimates can be made based on published data obtained from other SVE tests conducted at similar sites. Using a steady-state radial flow solution for compressible flow, assuming an applied vacuum of approximately 0.2 atmospheres (less than 7 feet of water) and an average soil permeability of 1 darcy (the equivalent of a silty sand), then the estimated ROI would be approximately 30 feet. This estimated ROI is consistent with values published for relatively low-permeability soils (such as those at Parcel C) in U.S. EPA guidance documents (Guide for Conducting Treatability Studies Under CERCLA: Soil Vapor Extraction, September 1991). To ensure that there was an overlap in the coverage areas for each of the SVE wells, it has been proposed to install the wells on 25-foot centers at RU-4 and RU-6 and on 27-foot centers at RU-2 to prevent the escape of any sparged air and vapors.

At RU-4, two vapor probes are located approximately 5 and 15 feet outside the expected ROI. At RU-6, two vapor probes are located approximately 5 and 20 feet outside the expected ROI. The groundwater monitoring point locations were selected on the basis of the assumed groundwater flow direction, placing at least one location upgradient and one location downgradient. Groundwater monitoring points were also selected based on the estimated radius of influence of the air sparging wells, using existing monitoring wells or installing new groundwater monitoring points within and just outside the radius of influence. At RU-2, three vapor probes are located approximately 5, 10, and 25 feet outside the expected ROI.

Section 3.3.3, Page 8, Paragraph 3.

Comment: **Please be certain to cap the sawed-off vents, all vapor probes, and air sparging wells that remain in the ground so that the open conduits to the atmosphere will be eliminated. Otherwise, every time a low pressure system moves through, VOCs, including vinyl chloride, will be vented to the atmosphere or to the air within a building.**

Response: All vapor probes, AS wells, and SVE wells will be capped after completion of AS/SVE testing.

Section 3.3.4, Page 9, Paragraph 3.

Comment: **The text states that if the drilling indicates that the bedrock is inadequate for an AS well, a second attempt will be made at a new location. Please discuss the criteria for bedrock competency for purposes of the AS well and discuss who will make this determination.**

Response: The bedrock encountered will be evaluated for fracturing. If the bedrock contains large fractures, which may result in channeling of the sparged air, an AS/SVE test will not be performed. If the bedrock is highly fractured such that it is essentially a porous media, an AS/SVE test will be pursued. This determination will be made a California registered geologist with the input of an engineer experienced in AS/SVE.

Section 3.3.4, Page 9, Last Paragraph.

Comment: **The text indicates that at RU-6 subsurface clay layers may affect the air flow distribution. Please discuss the likelihood that these clay layers may direct contaminated air laterally outside of the SVE capture zone and result in discharge to the atmosphere.**

Response: The duration of the AS test is not long enough for considerable lateral spreading of volatilized VOCs to occur. Additionally, the AS wells are surrounded by a network of SVE wells. The ROI of the SVE wells was conservatively estimated so that there will be overlapping in the actual ROI

of the SVE wells. Thus, the network of SVE wells will likely capture all sparged vapors, including those that migrate beyond the anticipated ROI of the AS wells.

Section 3.4.2, Page 16.

Comment: **Please specify the purpose of soil sampling at RU-5 and discuss why the soil sampling method for RU-5 differs from that for RU-2, RU-4, and RU-6.**

Response: Section 2.2, Soil Sampling, addresses the soil sampling objectives at RU-5 as well as at RU-2, RU-4, and RU-6. The objectives include obtaining field data regarding porosity and soil moisture content in unsaturated zone soil for modeling the migration of VOCs in groundwater through the vadose zone, gathering field data regarding permeability in saturated soil, and obtaining field data regarding organic carbon content in unsaturated and saturated soil to determine partitioning coefficients. The soil sampling method for RU-5 differs from that for RU-2, RU-4, and RU-6 because an AS/SVE test will not be conducted at RU-5. At RU-2, RU-4, and RU-6, soil samples will be collected from pilot borings drilled using a hollow-stem auger for installation of AS wells. Because AS wells will not be installed at RU-5, soil samples will be collected from a Geoprobe boring.

Section 3.5, Page 17.

Comment: **According to the text, the soil vapor survey is intended to provide data "representative of current conditions". Please consider whether it would be appropriate to repeat this survey during the AS/SVE test to attempt to verify that the AS/SVE system is not spreading the VOCs laterally through the vadose zone. Also please clarify whether the soil gas monitoring points will remain in place after the survey.**

Response: To verify that the AS/SVE system is not spreading the VOCs laterally through the vadose zone, baseline and post-AS/SVE soil-vapor samples will be collected from select soil-vapor probes and analyzed for VOCs, O_2, and CO_2. These select probes are indicated on revised Figures 2 through 4. The probes installed for the soil-vapor survey (Figures 7 through 10) will not remain in place after the survey. The soil-vapor probes for monitoring during the AS/SVE tests will be abandoned at the completion of testing by removing the tubing and pouring cement-bentonite grout to fill the hole up to existing grade.

Section 3.6, Page 18.

Comment: **The second paragraph states that samples will be "poured" into sample containers, however samples collected by pumping are not "poured." Collecting VOC samples with a peristaltic pump will likely result in loss of VOCs, particularly vinyl chloride, which is extremely volatile. Please describe the sampling procedure which will be used to minimize loss of VOCs.**

Response: The fifth and sixth sentences of the second paragraph should be reworded to read as follows: "Groundwater samples will be collected in laboratory-supplied sample containers from new groundwater monitoring points and existing monitoring wells using a peristaltic pump. The groundwater sample containers will be capped, labeled..." A consistent groundwater sampling procedure is necessary for both new and existing groundwater monitoring points. Because the new groundwater monitoring points are ¾-inch wells, use of a bailer for sample collection would result in more disturbance of the sample. Groundwater samples will be collected using a peristaltic pump. The pump will be operated so as to maintain laminar flow through tubing to minimize volatilization of VOCs. In addition, the analytical results for the groundwater sample collected from the new groundwater monitoring point adjacent to SVE-2-5 at RU-2 will be compared with analytical results for existing monitoring well IR28MW136A; this monitoring well, located

approximately 10 feet from the new groundwater monitoring point, contains the highest concentrations of vinyl chloride at Parcel C.

Section 3.6, Page 18.

Comment: **Section 4.2, Page 20. It is true that Remedy Screening studies require less stringent QA/QC that Remedy Selection studies. It appears that these are Remedy Selection studies, therefore more stringent DQO's and QA/QC procedures may apply. Please indicate clearly what level applies to this study and how the appropriate QA/QC level will be achieved.**

Response: According to Section 2.2.3 of the "Guide for Conducting Treatability Studies under CERCLA," remedy selection studies provide quantitative data for use in determining whether a technology can meet the cleanup criteria and at what cost. The data collected during the treatability study will be quantitative in nature, and used to determine whether AS/SVE meet the cleanup criteria and help determine costs. Duplicate samples of groundwater and soil vapor will be collected in addition to field blanks, equipment blanks, and rinsate samples, as applicable. The data presented in the technical memorandum and draft final FS will have gone through the laboratory QA/QC process, but the schedule does not allow for data validation.

Sections 6.2 and 6.3.

Comment: **The refinement of the indoor air model is first mentioned as an objective of the study in these sections. This objective should be discussed in Section 1. Please clarify whether there is a concern that the AS/SVE operation will mobilize contaminants to basements/building spaces. If so, this heightens the potential significance of efforts to verify capture of VOCs by the SVE system. Also, please describe how moisture content and bulk density are key to refining this model.**

Response: The second sentence of Section 6.2 ("The moisture content and bulk density data will be used to refine the indoor air model presented in the human health risk assessment (HHRA) of the Parcel C RI.") should be reworded to read as follows: "The moisture content and bulk density data will be used for modeling the migration of VOCs in groundwater through the vadose zone." Total porosity can be calculated from moisture content and bulk density. For modeling the migration of VOCs in groundwater through the vadose zone after volatilization, the HHRA in the Parcel C RI used an U.S. EPA Region IX default value for the total soil porosity. Collection of moisture content and bulk density data will allow use of site-specific soil porosity values.

EPA COMMENTS RECEIVED BY ELECTRONIC MAIL

Comment 1: **The report mentioned an expected 25-foot radius of influence without any back-up calculations. EPA would like to see the pressure distribution vs. distance from well during the SVE portion of the test prior to jumping into AS.**

Response: The response to specific Comment 3 addresses how the 25-foot ROI was estimated. During the SVE step tests, the extraction rate will be progressively stepped up and vapor pressure readings will be measured in the vapor probes for the different vacuums applied. A constant-rate system test will then be conducted at a flowrate determined from the data collected during the step tests. A memorandum containing the field data and summarizing the data analysis can be prepared and sent to EPA at the completion of the SVE testing. If the analysis of the vapor pressure readings indicates that a minimum 25-foot ROI is achievable at a given flowrate, the pilot testing will proceed with the AS portion of the test to avoid stand-by costs.

Comment 2: **The groundwater elevations should be measured during the SVE and the AS portions of the test.**

Response: Groundwater elevations will be monitored hourly during the SVE and AS portions of the test.

Comment 3: **There should be more frequent samples for the parameter measurements when there is a change in the system (i.e. increased applied vacuum) and can be less frequent as the system stabilizes. This adjustment can be made in the field.**

Response: As indicated in Table 3, certain parameters will be monitored every 15 minutes during the first hour of each step or constant rate test. These parameters include vacuum/pressure, vapor flowrate, temperature, and concentration of organic vapors at the SVE wells and the blower treatment unit, and vacuum or pressure in the vapor probes. After the first hour, these parameters will be monitored hourly.

Comment 4: **The parameter measurements (especially O_2/CO_2) should be measured after the test has stopped.**

Response: Vapor samples will be collected from select soil-vapor probes prior to commencement of the AS/SVE testing and the day after completion of AS/SVE testing; the samples will be analyzed for VOCs in addition to O_2 and CO_2.

Comment 5: **Please clarify whether the SVE test would first step-test just one well, vs. step-test all SVE wells. It is recommend that one well be tested alone first to collect a good pressure distribution profile on a single well.**

Response: The draft work plan calls for a step-test of all SVE wells in conjunction. A step-test of a single well will provide information specific to only that well that is not necessarily applicable to the other SVE wells. The step-test of all SVE wells will provide more useful information that is relevant to how the system would in fact be operated. In any case, the SVE test has been revised to include a step-test of one SVE well individually at each RU prior to performing the step-test using all SVE wells.

Figure 12
Anticipated Field Work Schedule
Parcel C Treatability Study

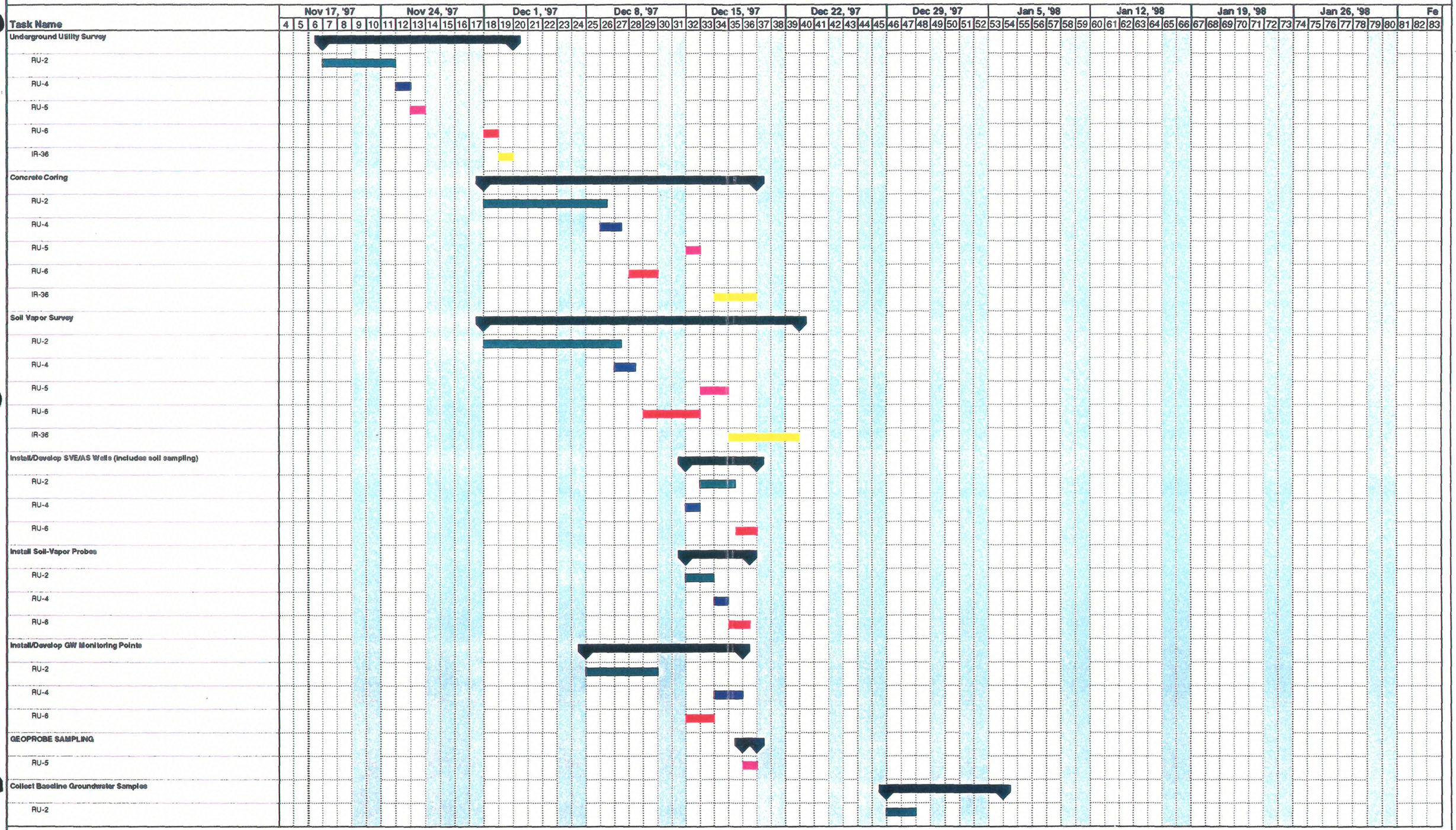
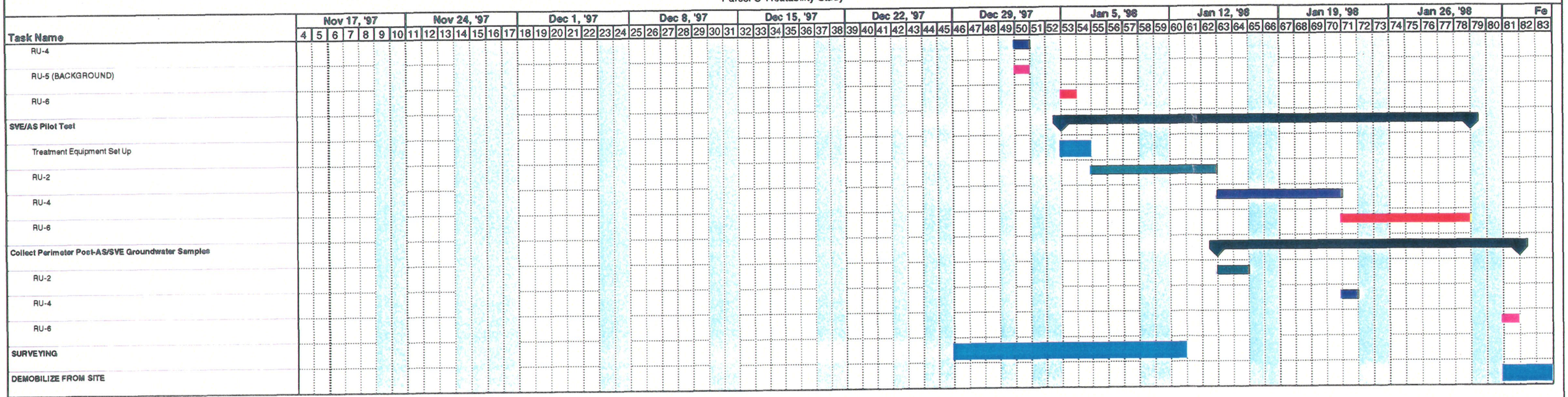
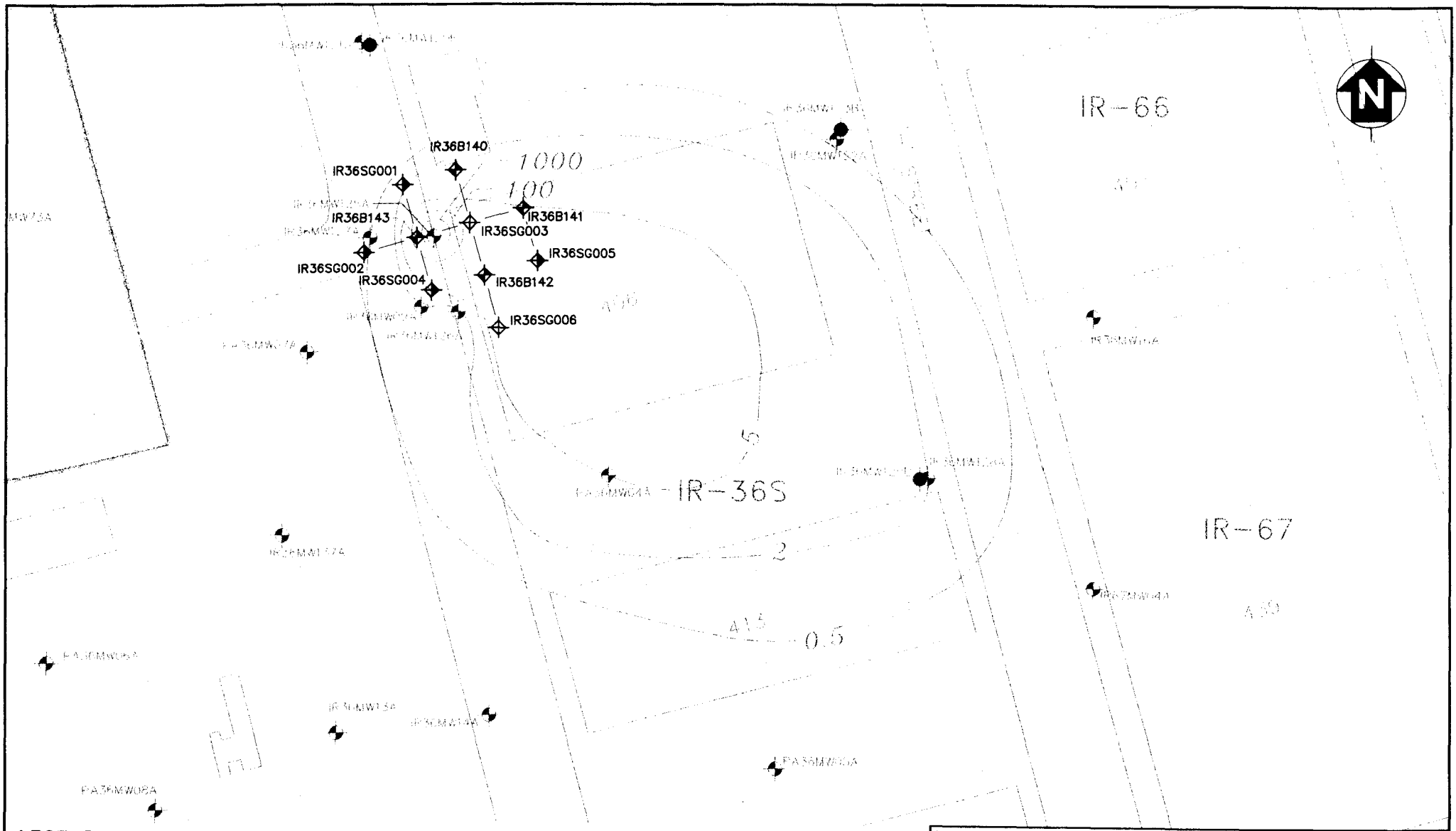


Figure 12
Anticipated Field Work Schedule
Parcel C Treatability Study





LEGEND

IR28MW170A	A–AQUIFER MONITORING WELL
IR28MW314B	B–AQUIFER MONITORING WELL
IR28MW356F	BEDROCK MONITORING WELL
IR36SG005	SOIL–VAPOR SAMPLE AT 4 FEET BELOW GROUND SURFACE
IR36B006	SOIL–VAPOR SAMPLES AT 2, 4, 6, AND 8 FEET BELOW GROUND SURFACE
IR36B142	SOIL AND SOIL–VAPOR SAMPLES AT 2, 4, 6 AND 8 FEET BELOW GROUND SURFACE

5 — TCE CONCENTRATIONS IN GROUNDWATER IN µg/L

50' 0 50' 100'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 13
LAYOUT OF SOIL–VAPOR SURVEY AT IR–36

PARCEL C TREATABILITY STUDY

Attachment A

Revised Tables for the Work Plan for Hunters Point Shipyard, Parcel C Treatability Study

TABLE 3
MONITORING PARAMETERS FOR SOIL-VAPOR EXTRACTION AND AIR SPARGING TESTS
PARCEL C TREATABILITY STUDY
HUNTERS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Parameter	Soil Vapor and Air Parameters					Groundwater Parameters				Equipment Parameters
	Oxygen Content	Vaccuum or Pressure	Vapor Flowrate and Temperature	Concentration of Organics in Vapors	VOC Concentration in Extracted Vapors (Laboratory)	Water Level	Dissolved Oxygen, pH, temp, conductivity	VOC Concentration in Groundwater (laboratory)	General Minerals in Groundwater (laboratory)	Pressures, Temperatures, Blower Speed
Method/Instrumentation	Gas Tech Meter [1]	Magnahelic gauges [4]	TSI Velocicalc meter [2]	FID [1]	TO-14	Solonist	LaMotte DO4000/ Hydac 910	EPA Method 8260A	Various [7]	Treatment System Instrumentation
Type of Test										
SVE Baseline Conditions (Day 1)										
SVE Wells	Every 2 Hours	Every 2 Hours	NA	Every 2 Hours	NA	NA	NA	NA	NA	NA
Vapor Probes	Every 2 Hours [3]	Every 2 Hours	NA	Every 2 Hours [3]	NA	NA	NA	NA	NA	NA
Groundwater Monitoring Points	NA	NA	NA	NA	NA	Every 2 hour	NA	NA	NA	NA
SVE Step and System Tests (Days 2, 3 & 4)										
SVE Wells	Hourly [5]	Hourly [5]	Hourly [5]	Hourly [5]	Samples of extracted vapor will be taken at the start, middle, and end of test	NA	NA	NA	NA	NA
Vapor Probes	Hourly [3,5]	Hourly [5]	NA	Hourly [3,5]	NA	NA	NA	NA	NA	NA
Groundwater Monitoring Points	NA	NA	NA	NA	NA	Hourly (5)	NA	NA	NA	NA
Blower/Treatment Unit	NA	Hourly [4] [5]	Hourly [4] [5]	Hourly [4] [5]	Influent and effluent samples will be taken at the start, middle, and end of test	NA	NA	NA	NA	Hourly [5]
SVE/Sparge Step and System Tests (Days 5 & 6)										
SVE Wells	Hourly [5]	Hourly [5]	Hourly [5]	Hourly [5]	None	NA	NA	NA	NA	NA
Vapor Probes	Hourly [3,5]	Hourly [5]	NA	Hourly [3,5]	NA	NA	NA	NA	NA	NA
Air Sparging Wells	NA	Hourly	Hourly	NA	NA	NA	NA	NA	NA	NA
Groundwater Monitoring Points	NA	NA	NA	NA	NA	Hourly[5]	Hourly [5] [6]	Start and End of The System Test	Start and End of The System Test	NA
Blower/Treament Unit	NA	Hourly [4] [5]	Hourly [4] [5]	Hourly [4] [5]	Influent and effluent samples will be taken at the start, middle, and end of test	NA	NA	NA	NA	Hourly [5]

Notes:
AS - Air sparging
FID - Flame ionization detector
NA - Test or sample not applicable
SVE - Soil-vapor extraction
VOC - Volatile organic compound

(1) Samples will be analyzed from Tedlar bag samples collected using vacuum pump.
(2) Parameters will be measured using in-line meter.
(3) Probe samples will be obtained after purging tubing for 30 seconds using vacuum pump.
(4) Blower influent readings will be taken at the manifold outlet.
(5) Parameters will be tested every 15 minutes during the first hour of each step or constant rate test.
(6) Samples will be collected using a peristaltic pump.
(7) General minerals analyses include hardness, alkalinity, TDS, tubidity, iron, manganese, and cations/anions.

TABLE 4a
PILOT TEST SOIL-VAPOR ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Remedial Unit	Location	Samples Required for SVE System			Samples Required for AS/SVE System		
		At start of step test[a]	At end of step test[b]	At end of system test[c]	At start of step test[a]	At end of step test[b]	At end of system test[c]
RU-2	IR28VW2-1A	1	1	1			
	IR28VW2-2A	1	1	1			
	IR28VW2-3A	1	1	1			
	IR28VW2-4A	1	1	1			
	IR28VW2-5A	1	1	1			
	IR28VW2-6A	1	1	1			
	IR28VW2-2A (Field Duplicate)		1				
	IR28VW2-6A (Field Duplicate)		1				
	Influent to Blower/Treatment Unit	1	1	1	1	1	1
	Effluent from Blower/Treatment Unit	1	1	1	1	1	1
	Effluent from Blower/Treatment Unit (Field Duplicate)					1	
RU-4	IR28VW4-1F	1	1	1			
	IR28VW4-2F	1	1	1			
	IR28VW4-2F (Field Duplicate)		1				
	Influent to Blower/Treatment Unit	1	1	1	1	1	1
	Influent to Blower/Treatment Unit (Field Duplicate)					1	
	Effluent from Blower/Treatment Unit	1	1	1	1	1	1
RU-6	IR25VW6-1A	1	1	1			
	IR25VW6-2A	1	1	1			
	IR25VW6-2A (Field Duplicate)		1				
	Influent to Blower/Treatment Unit	1	1	1	1	1	1
	Effluent from Blower/Treatment Unit	1	1	1	1	1	1

Notes:

All soil-vapor samples will be analyzed by method TO-14.

AS - Air sparging

RU - Remedial unit

SVE - Soil-vapor extraction

TABLE 5
SOIL ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERDS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Location	Remedial Unit	Zone	Approximate Depth (feet bgs)	Number of Samples	Analyses
IR28AW2-1A	RU-2	Unsaturated	2.5, 5	2	Bulk density, specific gravity, moisture content, total organic carbon
		Saturated	10,15	2	Bulk density, specific gravity, intrinsic permeability, total organic carbon
IR28AW2-2A	RU-2	Unsaturated	5	1	Bulk density, specific gravity, moisture content, total organic carbon
		Saturated	15	1	Bulk density, specific gravity, intrinsic permeability, total organic carbon
IR28B315	RU-2	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B316	RU-2	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B317	RU-2	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B318	RU-2	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B319	RU-2	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B320	RU-2	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28AW4-1F	RU-4	Unsaturated	5	1	Bulk density, specific gravity, moisture content, total organic carbon
		Saturated	12	1	Bulk density, specific gravity, intrinsic permeability, total organic carbon
IR28B321	RU-4	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B322	RU-4	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR28B323	RU-4	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR25VW6-1A	RU-6	Unsaturated	2.5, 5	2	Bulk density, specific gravity, moisture content, total organic carbon
		Saturated	10,15	2	Bulk density, specific gravity, intrinsic permeability, total organic carbon

TABLE 5
SOIL ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERDS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Location	Remedial Unit	Zone	Approximate Depth (feet bgs)	Number of Samples	Analyses
IR58B037	RU-5	Unsaturated	5	1	Bulk density, specific gravity, moisture content, total organic carbon
		Saturated	12	1	Bulk density, specific gravity, intrinsic permeability, total organic carbon
IR58B038	RU-5	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR58B039	RU-5	Unsaturated	2, 4, 6, 8	4	total organic carbon
IR58B040	RU-5	Unsaturated	2, 4, 6, 8	4	total organic carbon

Notes:

AS - Air sparging
bgs - below ground surface
RU - Remedial unit
SVE - Soil-vapor extraction

TABLE 7
GROUNDWATER ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Location	Remedial Unit	Existing or New	Number of Samples					Laboratory Analyses [e]	Field Parameters and Analyses [f]
			Not time-critical	Perimeter baseline[a]	Perimeter post-AS/SVE test [b]	Baseline for AS/SVE test[c]	At end of AS/SVE test [d]		
IR28MW324A	RU-2	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW325A	RU-2	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW326A	RU-2	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW327A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW328A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW329A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW330A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW331A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW332A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW333A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW334A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW335A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW336A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW337A	RU-2	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW338A	RU-2	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW339A	RU-2	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO

TABLE 7
GROUNDWATER ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Location	Remedial Unit	Existing or New	Number of Samples					Laboratory Analyses [e]	Field Parameters and Analyses [f]
			Not time-critical	Perimeter baseline[a]	Perimeter post-AS/SVE test [b]	Baseline for AS/SVE test[c]	At end of AS/SVE test [d]		
IR28MW340A	RU-2	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW340A (field duplicate)	RU-2	New		1	1			EPA Method 8260A	NA
IR28MW136A	RU-2	Existing				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW136A (field duplicate)	RU-2	Existing				1	1	EPA Method 8260A, general minerals	NA
Equipment Rinsate Blank	RU-2	NA				1	1	EPA Method 8260A, general minerals	NA
IR28MW341F	RU-4	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW342F	RU-4	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW343F	RU-4	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW344F	RU-4	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW345F	RU-4	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW346F	RU-4	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW347F	RU-4	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR28MW211F	RU-4	Existing				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR28MW211F (field duplicate)	RU-4	Existing					1	EPA Method 8260A, general minerals	NA
Equipment Rinsate Blank	RU-4	NA				1	1	EPA Method 8260A, general minerals	NA
IR58MW31A	RU-5	Existing	1					EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide

TABLE 7
GROUNDWATER ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Location	Remedial Unit	Existing or New	Number of Samples					Laboratory Analyses [e]	Field Parameters and Analyses [f]
			Not time-critical	Perimeter baseline[a]	Perimeter post-AS/SVE test [b]	Baseline for AS/SVE test[c]	At end of AS/SVE test [d]		
IR25MW18A	RU-6	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR25MW19A	RU-6	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR25MW20A	RU-6	New				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR25MW21A	RU-6	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR25MW22A	RU-6	New		1	1			EPA Method 8260A	pH, conductance, temperature, DO
IR25MW22A (field duplicate)	RU-6	New		1	1			EPA Method 8260A	NA
IR25MW15A1	RU-6	Existing				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR25MW15A2	RU-6	Existing				1	1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR25MW15A2 (field duplicate)	RU-6	Existing					1	EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
IR06MW44A	RU-6	Existing		1	1			EPA Method 8260A	pH, conductance, temperature, DO
Equipment Rinsate Blank	RU-6	NA				1	1	EPA Method 8260A, general minerals	NA
Background well (to be identified)	NA	Existing	1					EPA Method 8260A, general minerals	pH, conductance, temperature, DO; ORP, nitrite, ferrous iron, sulfide
Field Blank	NA	NA	1					EPA Method 8260A, general minerals	NA

TABLE 7
GROUNDWATER ANALYTICAL SAMPLES
PARCEL C TREATABILITY STUDY
HUNTERS POINT SHIPYARD - SAN FRANCISCO, CALIFORNIA

Location	Remedial Unit	Existing or New	Number of Samples					Laboratory Analyses [e]	Field Parameters and Analyses [f]
			Not time-critical	Perimeter baseline[a]	Perimeter post-AS/SVE test [b]	Baseline for AS/SVE test[c]	At end of AS/SVE test [d]		

Notes:

AS - Air sparging
DO - Dissolved oxygen
NA - Not applicable
ORP - Oxidation-reduction potential
RU - Remedial unit
SVE - Soil-vapor extraction

[a] Perimeter baseline samples will be collected prior to start of testing (prior to Day 1).

[b] Perimeter post-AS/SVE samples will be collected after completion of AS/SVE tests.

[c] Baseline samples will be collected at the start of Day 5 of AS/SVE tests.

[d] Post-AS/SVE samples will be collected at the end of the 6-hour constant rate AS test

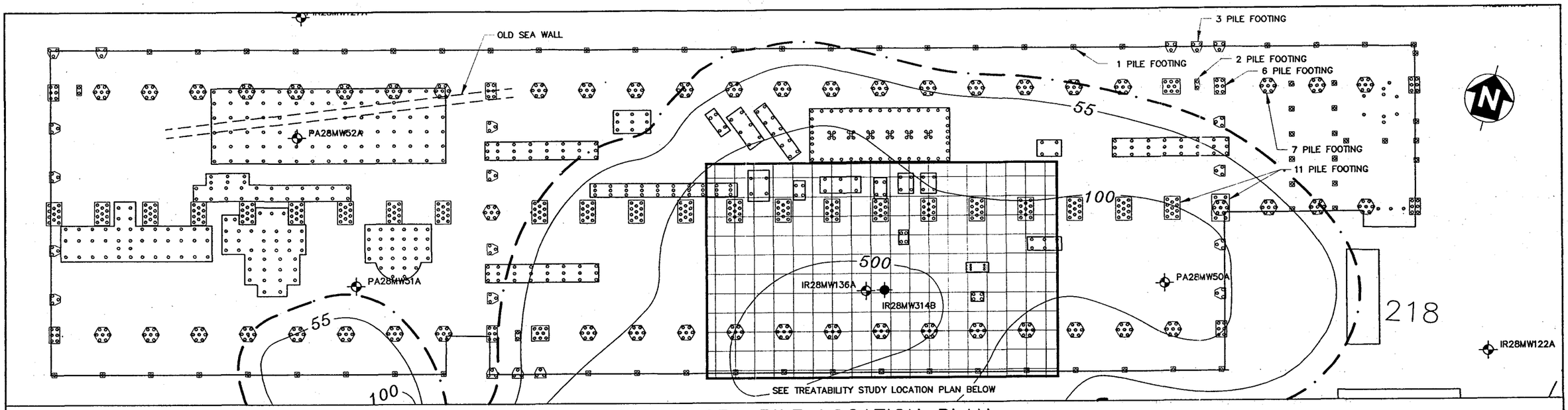
[e] The following general minerals: alkalinity; total dissolved solids; turbidity; iron; manganese; the cations calcium, magnesium, sodium, and potassium; hardness; and the anions nitrate, sulfate, phosphate and chloride.

[f] The parameters pH, conductance, termperature, and DO will be monitored during the SVE and AS tests as indicated in Table 3. ORP, nitrite, ferrous iron, and sulfide will also be sampled for in the field when groundwater samples are collected for general mineral analysis.

ATTACHMENT B - FIGURES

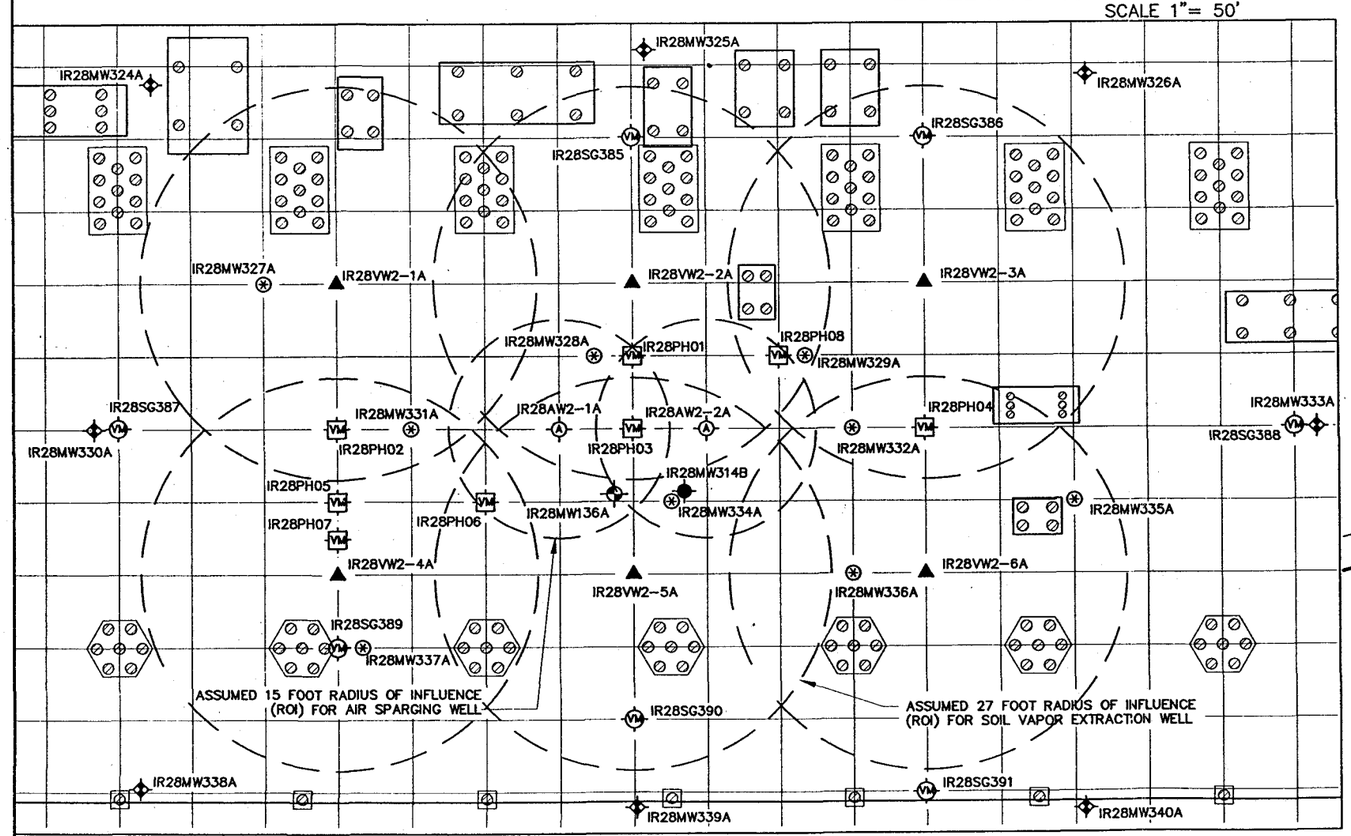
SUBMISSION OF AMENDMENT RESPONSE TO COMMENTS ON THE DRAFT WORK PLAN PARCEL C TREATABILITY STUDY ACTIVITIES

DATED 20 NOVEMBER 1997



BUILDING 231 PILE LOCATION PLAN

SCALE 1"= 50'

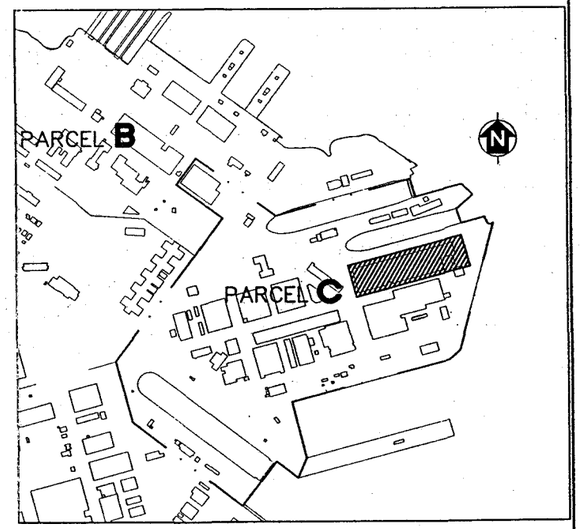


TREATABILITY STUDY LOCATION PLAN

SCALE 1"= 20'

LEGEND

- SVE-2-3 — SOIL VAPOR EXTRACTION WELL
- AS-2-2 — AIR SPARGING WELL
- IR28PH04 — SOIL VAPOR MONITORING POINT
- IR28SG388 — SOIL-VAPOR MONITORING POINT WHERE BASELINE AND POST AS/SVE VAPOR SAMPLES WILL BE COLLECTED
- IR28MW329A — GROUNDWATER MONITORING POINT
- IR28MW333A — PERIMETER GROUNDWATER MONITORING POINT
- IR28MW136A — A-AQUIFER MONITORING WELL
- IR28MW314B — B-AQUIFER MONITORING WELL
- IR28MW255F — BEDROCK MONITORING WELL
- 100 — VINYL CHLORIDE CONCENTRATION CONTOUR
- RU-2 BOUNDARY (SOUTHERN PORTION NOT SHOWN)



VIEW LOCATION

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

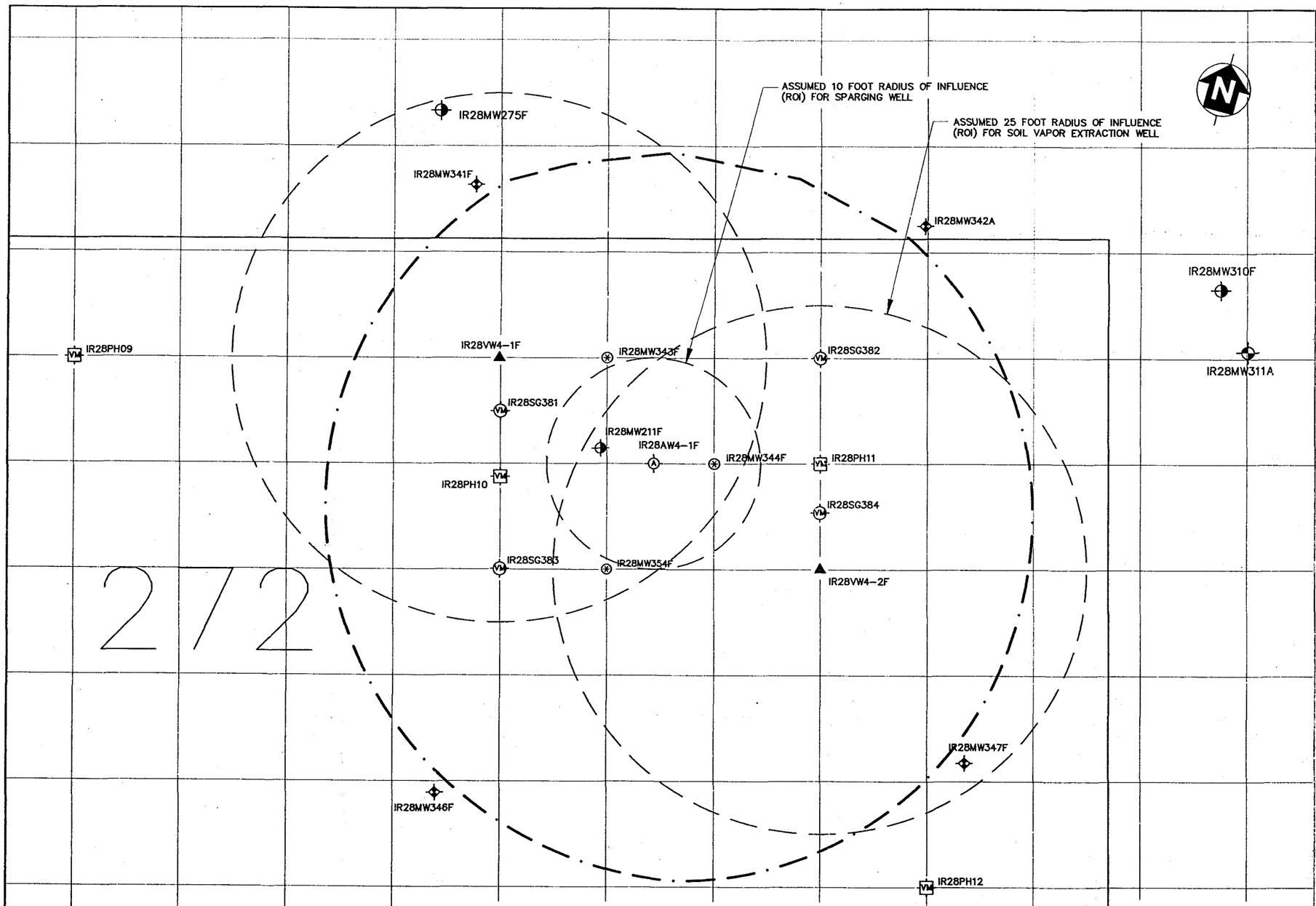
ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

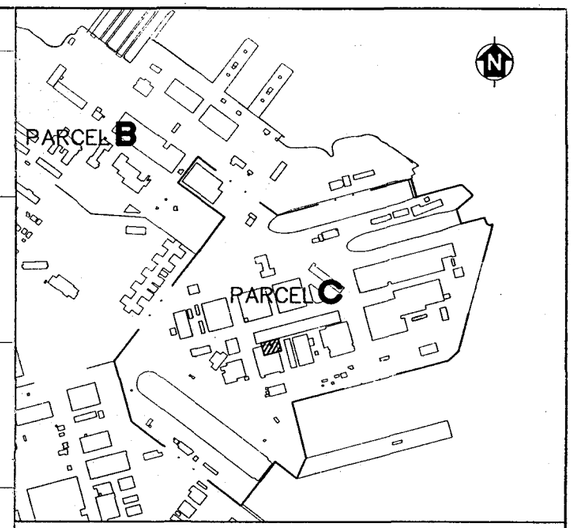
Figure 2

SOIL VAPOR EXTRACTION / AIR SPARGING PILOT TEST LAYOUT AT RU-2 PARCEL C TREATABILITY STUDY

DCB 11/20/199712:57 P.M. LTScale: 1.0000 Plot config file: 5109-003.PCP LFR Drawing File(.DWG): J:\ENGCAD\NAVY\5109\5109-00-002



TREATABILIITY STUDY LOCATION PLAN



VIEW LOCATION

LEGEND

- IR28MW346F — PERIMITER GROUNDWATER MONITORING POINT
- IR28PH11 — SOIL-VAPOR MONITORING POINT
- IR28MW345F — GROUNDWATER MONITORING POINT
- IR28SG381 — SOIL-VAPOR MONITORING POINT WHERE BASELINE AND POST AS/SVE SOIL-VAPOR SAMPLES WILL BE COLLECTED.
- RU-4 BOUNDARY
- SVE-4-1 — SOIL VAPOR EXTRACTION WELL
- AS-4-1 — AIR SPARGING WELL
- IR28MW273F — BEDROCK MONITORING WELL
- IR28MW311A — A-AQUIFER MONITORING WELL

5' 0 5' 10'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 3

SOIL VAPOR EXTRACTION / AIR SPARGING PILOT TEST LAYOUT AT RU-4 PARCEL C TREATABILITY STUDY

DCB 11/20/19971:05 P.M. LTScale: 1.0000 Plot config file: 5109-003.PCP LFR Drawing File(.DWG): J:\ENGCAD\NAVY\5109\5109-00-000

SUMP OUTSIDE BUILDING 134

DIP TANK / DEGREASER VAT

IR25SG033

IR25MW18A

IR28VW6-1

ASSUMED 15 FOOT RADIUS OF INFLUENCE (ROI) FOR AIR SPARGING WELL

IR25SG034

IR25PH01

IR25MW19A

IR25SG035

IR25MW15A1

ASSUMED 25 FOOT RADIUS OF INFLUENCE (ROI) FOR SOIL VAPOR EXTRACTION WELL

IR25PH02

IR25MW15A2

IR28AW6-1

IR25PH03

IR25MW20A

IR25MW21A

IR06MW44A

IR25PH04

IR28VW6-2

IR25MW16A

IR25MW11A

IR25SG036

IR25MW22A

SUMP OUTSIDE OF BUILDING 134

IR06MW40A

IR06MW41A

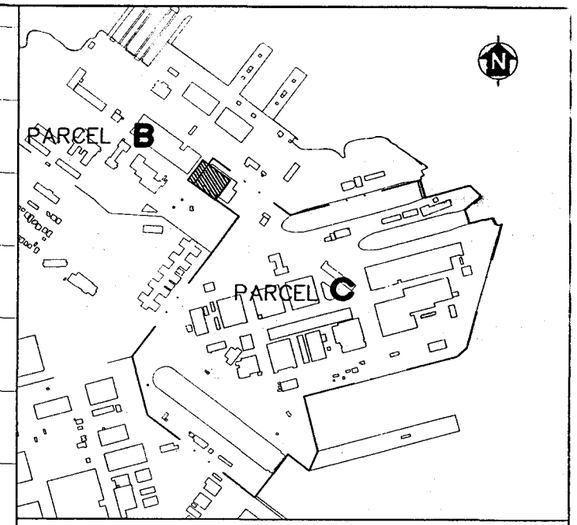
IR06MW34A

TREATABILIITY STUDY LOCATION PLAN

IR25

134

LOCKWOOD



VIEW LOCATION

LEGEND

IR25MW18A	PERIMETER GROUNDWATER MONITORING POINT
IR25PH03	SOIL VAPOR MONITORING POINT
IR25MW20A	GROUNDWATER MONITORING POINT
IR25SG036	SOIL-VAPOR MONITORING POINT WHERE BASELINE AND POST AS/SVE SOIL-VAPOR SAMPLES WILL BE COLLECTED.
	RU-6 BOUNDARY
SVE-4-1	SOIL VAPOR EXTRACTION WELL
AS-4-1	AIR SPARGING WELL
IR28MW273F	BEDROCK MONITORING WELL
IR28MW311A	A-AQUIFER MONITORING WELL

10' 0 10' 20'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

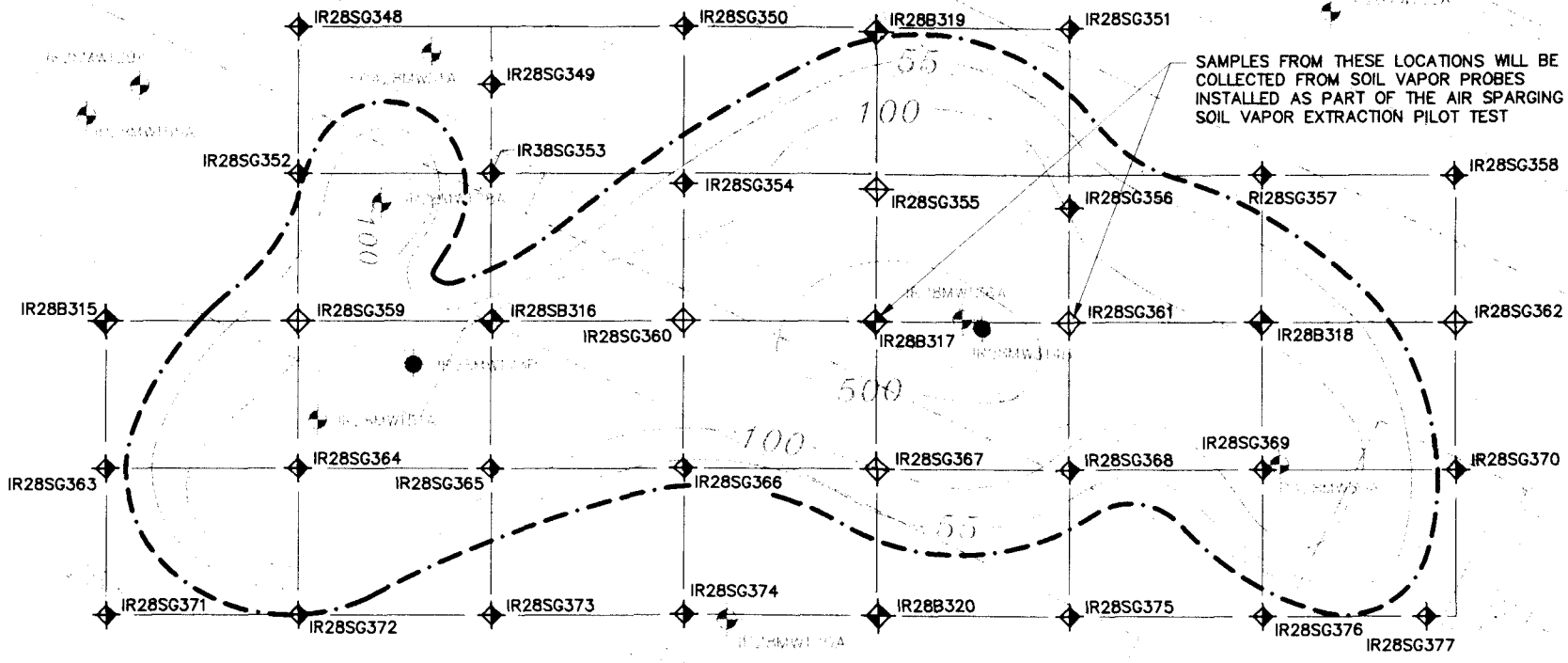
ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 4

SOIL VAPOR EXTRACTION / AIR SPARGING PILOT TEST LAYOUT AT RU-6 PARCEL C TREATABILITY STUDY

DCB 11/20/19971:15 P.M. LTScale: 1.0000 Plot config file: 5109-003.PCP LFR Drawing File(.DWG): J:\ENGCAD\NAVY\5109\5109-00-001



LEGEND

- A–AQUIFER MONITORING WELL
- B–AQUIFER MONITORING WELL
- BEDROCK MONITORING WELL
- IR29SG358 — SOIL–VAPOR SAMPLE AT 4' BELOW GROUND SURFACE
- IR28SG360 — SOIL–VAPOR SAMPLES AT 2, 4, 6, AND 8 FEET BELOW GROUND SURFACE
- IR28B318 — SOIL AND SOIL–VAPOR SAMPLES AT 2, 4, 6 AND 8 FEET BELOW GROUND SURFACE
- RU–2 BOUNDARY
- VINYL CHLORIDE CONCENTRATION CONTOUR IN µg/L

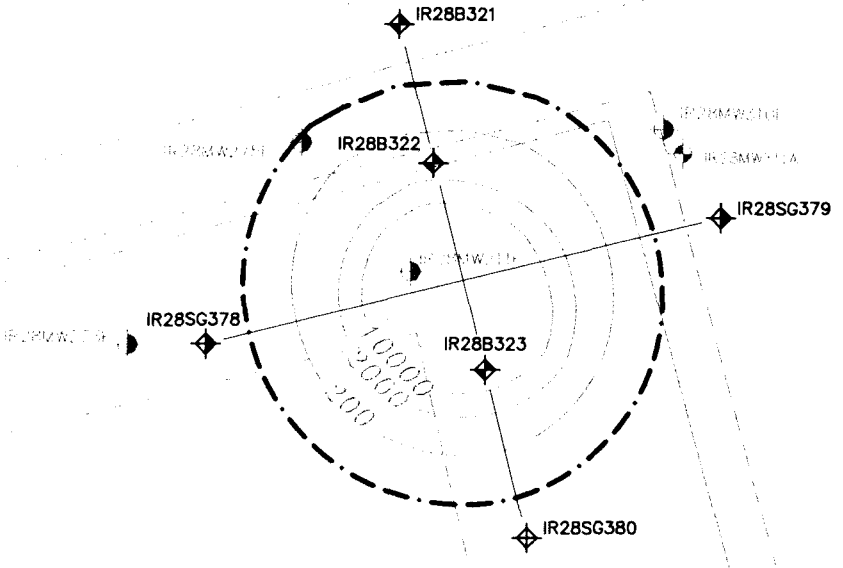
40' 0 40' 80'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 7
LAYOUT OF SOIL–VAPOR SURVEY AT RU–2
PARCEL C TREATABILITY STUDY



LEGEND

- A–AQUIFER MONITORING WELL
- B–AQUIFER MONITORING WELL
- BEDROCK MONITORING WELL
- IR28SG379 — SOIL–VAPOR SAMPLE AT 4 FEET BELOW GROUND SURFACE
- IR28SG380 — SOIL–VAPOR SAMPLES AT 2, 4, 6, AND 8 FEET BELOW GROUND SURFACE
- IR28B323 — SOIL AND SOIL–VAPOR SAMPLES AT 2, 4, 6 AND 8 FEET BELOW GROUND SURFACE
- RU–4 BOUNDARY
- 5.7 — VINYL CHLORIDE CONCENTRATION CONTOUR IN µg/L

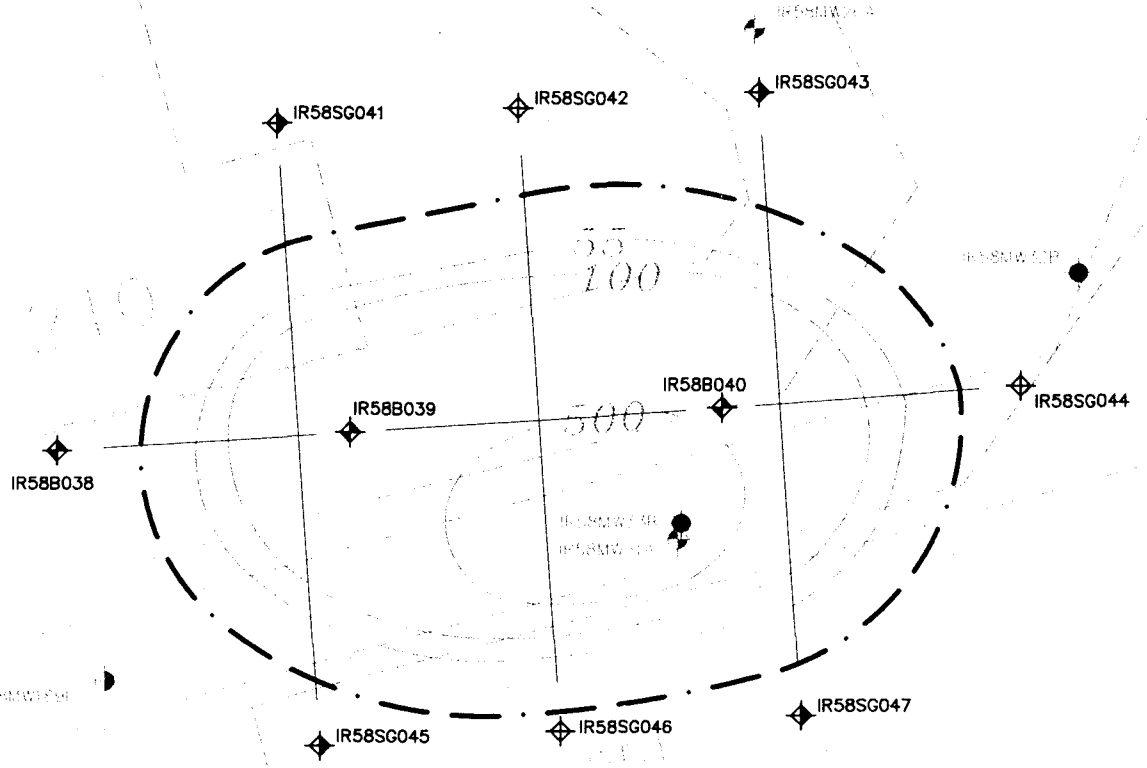
20' 0 20' 40'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 8
LAYOUT OF SOIL–VAPOR SURVEY
AT RU–4
PARCEL C TREATABILITY STUDY



LEGEND

- A–AQUIFER MONITORING WELL
- B–AQUIFER MONITORING WELL
- BEDROCK MONITORING WELL
- IR58SG045 — SOIL–VAPOR SAMPLE AT 4 FEET BELOW GROUND SURFACE
- IR58SG046 — SOIL–VAPOR SAMPLES AT 2, 4, 6, AND 8 FEET BELOW GROUND SURFACE
- IR58B039 — SOIL AND SOIL–VAPOR SAMPLES AT 2, 4, 6 AND 8 FEET BELOW GROUND SURFACE
- RU–5 BOUNDARY
- 55 — VINYL CHLORIDE CONCENTRATION CONTOUR IN µg/L

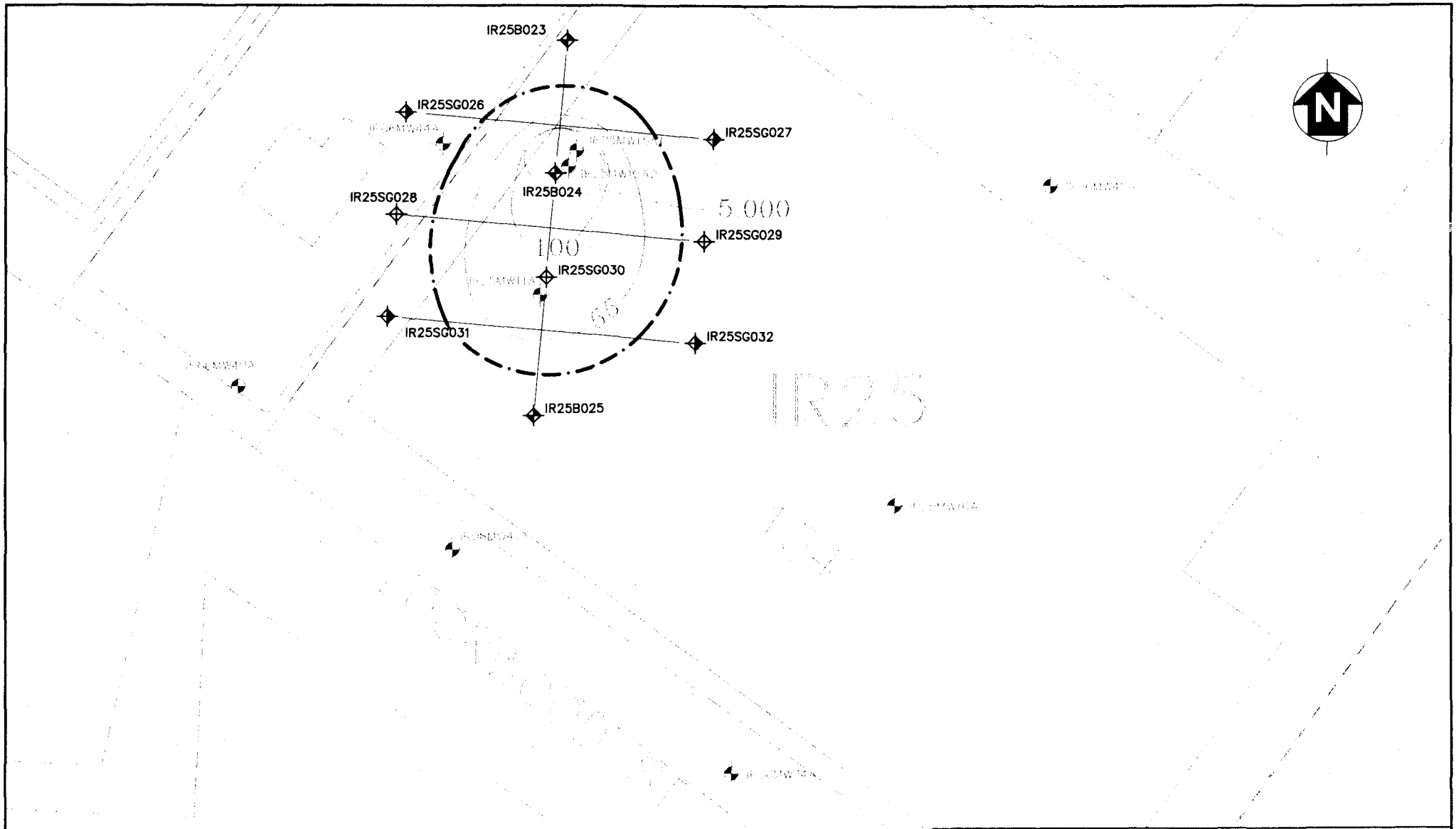
20' 0 20' 40'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 9
LAYOUT OF SOIL–VAPOR SURVEY AT RU–5 PARCEL C TREATABILITY STUDY



LEGEND

- A–AQUIFER MONITORING WELL
- B–AQUIFER MONITORING WELL
- BEDROCK MONITORING WELL
- IR25SG026 — SOIL–VAPOR SAMPLE AT 4 FEET BELOW GROUND SURFACE
- IR25SG029 — SOIL–VAPOR SAMPLES AT 2, 4, 6, AND 8 FEET BELOW GROUND SURFACE
- IR25B025 — SOIL AND SOIL–VAPOR SAMPLES AT 2, 4, 6 AND 8 FEET BELOW GROUND SURFACE
- RU–6 BOUNDARY
- VINYL CHLORIDE CONCENTRATION CONTOUR IN µg/L

20' 0 20' 40'
SCALE IN FEET

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

ENGINEERING FIELD ACTIVITY WEST

HUNTERS POINT SHIPYARD — SAN FRANCISCO, CALIFORNIA

FIGURE 10
LAYOUT OF SOIL–VAPOR SURVEY
AT RU–6
PARCEL C TREATABILITY STUDY

Attachment C

Report of Emissions Testing for a HD CatOx™ System

REPORT OF EMISSIONS SOURCE TESTING AT WHITTAKER CORPORATION'S BERMITE DIVISION SOLEDAD CANYON VAPOR RECOVERY SYSTEM

INTRODUCTION

On May 15, 1992, personnel from Engineering-Science (ES), Irwindale, California, conducted emissions source testing on a vapor recovery system operated by Whittaker Corporation's Bermite Division, located in Saugus, CA, and installed by King, Buck, and Associates. The purpose of the testing was to determine the concentrations of Polychlorinated Dibenzo-P-Dioxins and Polychlorinated Dibenzofurans at the inlet and outlet of an air pollution control device serving the vapor recovery system.

The testing program was coordinated by Mr. Joe Phillips of King, Buck and Associates, and Mr. Frank Myers of Allied Signal, Inc. The ES testing team was comprised of Messrs. Steven Falzarano and Cesario Mangaoang.

TEST METHODOLOGY

Exhaust Gas Velocity and Pressure

Exhaust gas flow rates were determined using California Air Resources Board Reference Method 1. One sampling port, located on the outlet side of the vapor recovery system, was used to determine the velocity pressure (delta p) within the exhaust duct. Exhaust gas stream velocity pressure was determined using a Standard type Pitot tube connected to inclined oil manometer. A Pitot tube correction factor of 0.99 was used for determining the volumetric flow rate.

Polychlorinated Dibenzo-P-Dioxins and Polychlorinated Dibenzofurans

Polychlorinated Dibenzo-P-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF) were collected in accordance with CARB Method 428, with the only exception being that sampling was conducted non-isokinetically. Sampling was conducted by using a permanently installed sampling taps, provided by Bermite Company, located directly in-line on the inlet and outlet of the catalyst. A Teflon sample line was connected on one side directly to the sampling tap via Swagelok fittings. The other end of the sampling line was connected directly to a glass condenser, which was used to

cool the gas stream to at least 20°C before entering the sorbent module. The condenser was directly connected to a sorbent module containing an XAD-2 Resin capable of adsorbing dioxins and furans. The sorbent module was then connected to four impingers in series. The first and second impingers each contained 100 mls of deionized water. The third impinger was empty, and the fourth impinger contained approximately 400 grams of indicating silica gel. The sampling train was then connected to a vacuum pump and dry gas meter capable of measuring the sampled gas in cubic feet. One test run, five hours in duration, was conducted.

All solvents used for preparing the sampling train for testing and field sample recovery were stored in glass bottles and were of spectrographic grade. The train components that came in contact with the sample were handled with clean, bare hands. They were free of all potential interfering materials, especially silicone grease.

QUALITY ASSURANCE

Field Testing Quality Assurance

Prior to field sampling the meter box dry gas meter and orifice for the PCDD/PCDF testing were calibrated against a secondary transfer standard traceable to an NIST prover. The results of the orifice calibration were expressed as the delta H@ at various pressure drops (in inches of water) to achieve 0.75 cfm as specified in EPA Publication APTD-0576. The dry gas meter accuracy was expressed as gamma (Y) and was determined as the ratio between the transfer standard and the meter box dry gas meter.

Stack gas temperature, meter temperature and impinger temperature were monitored using a type-K thermocouples connected to an Omega 601 digital readout. The thermocouples and readout were calibrated prior to and at the conclusion of field sampling. Stack gas velocity was determined using an S-type Pitot tube attached to the probe in the manner specified in CARB Method 2. The Pitot tube was measured for adherence to the dimensions as specified in CARB Method 2. A Pitot tube correction factor of 0.84 was used for determining gas velocity and volumetric flow through the exhaust gas stack after all construction specifications were met.

At the conclusion of each test run the sampling train was leak checked at a vacuum equal to or greater than the highest vacuum observed during the test run. The sampling train was considered leak free since the leak rate was less than 0.02 cfm/minute.

Table 1
POLYCHLORINATED DIBENZO-P-DIOXIN (PCDD) EMISSION DATA

The following test data are for dioxins in the influent and effluent streams of a King, Buck Technology HD CatOx™ during soil vapor extraction. Comparable test data are available also for polychlorinated dibenzofurans. The tests were performed in June 1992 at a site in the South Coast AQMD. Sampling and testing were performed by Engineering-Science, Inc.

Parameter	RESULTS Inlet	Outlet
2,3,7,8-TCDD		
ug/m³	$<1.37\times10^{-6}$	$<8.79\times10^{-7}$
lbs/hr	$<1.12\times10^{-12}$	$<7.24\times10^{-13}$
TCDD (Total)		
ug/m³	2.24×10^{-6}	$<8.79\times10^{-7}$
lbs/hr	1.85×10^{-12}	$<7.24\times10^{-13}$
1,2,3,7,8-PeCDD		
ug/m³	$<3.55\times10^{-6}$	$<2.81\times10^{-6}$
lbs/hr	$<2.93\times10^{-12}$	$<2.31\times10^{-12}$
PeCDD (Total)		
ug/m³	$<2.24\times10^{-5}$	$<2.06\times10^{-5}$
lbs/hr	$<1.85\times10^{-11}$	$<1.69\times10^{-11}$
1,2,3,4,7,8-HxCDD		
ug/m³	$<5.05\times10^{-6}$	$<4.49\times10^{-6}$
lbs/hr	$<4.16\times10^{-12}$	$<3.70\times10^{-12}$
1,2,3,6,7,8-HxCDD		
ug/m³	$<3.37\times10^{-6}$	$<2.99\times10^{-6}$
lbs/hr	$<2.77\times10^{-12}$	$<2.46\times10^{-12}$
1,2,3,7,8,9-HxCDD		
ug/m³	$<4.11\times10^{-6}$	$<3.74\times10^{-6}$
lbs/hr	$<3.39\times10^{-12}$	$<3.08\times10^{-12}$
HxCDD (Total)		
ug/m³	$<5.05\times10^{-6}$	$<4.49\times10^{-6}$
lbs/hr	$<4.16\times10^{-12}$	$<3.70\times10^{-12}$
1,2,3,4,6,7,8-HpCDD		
ug/m³	$<6.55\times10^{-6}$	$<3.74\times10^{-6}$
lbs/hr	$<5.39\times10^{-12}$	$<3.08\times10^{-12}$
HpCDD (Total)		
ug/m³	$<6.55\times10^{-6}$	$<3.74\times10^{-6}$
lbs/hr	$<5.39\times10^{-12}$	$<3.08\times10^{-12}$
OCDD		
ug/m³	$<1.44\times10^{-5}$	1.66×10^{-5}
lbs/hr	$<1.19\times10^{-11}$	1.37×10^{-11}