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Final Landfill Gas Monitoring Report For January – March 2009 Post Removal Action

Parcel E-2, Industrial Landfill
Hunters Point Shipyard
San Francisco, California

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ACRONYMS and ABBREVIATIONS

%	percent
§	Section
27 CCR	Title 27 of the California Code of Regulations
BAAQMD	Bay Area Air Quality Management District
BCT	BRAC Cleanup Team
bgs	below ground surface
BRAC	Base Realignment and Closure
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIWMB	California Integrated Waste Management Board
GMP	gas monitoring probe
HPS	Hunters Point Shipyard
IR-01/21	Installation Restoration Site 01/21
ITSI	Innovative Technical Solutions, Inc.
LEL	lower explosive limit
MCP	Monitoring and Control Plan
msl	mean sea level
NA	not applicable
Navy	U.S. Department of the Navy
NMOC	non-methane organic compound
PID	photoionization detector
ppmv	parts per million by volume
PV	passive vent
RCRA	Resource Conservation and Recovery Act
TCRA	time-critical removal action
Tetra Tech	Tetra Tech EM Inc.
UCSF	University of California, San Francisco

1 INTRODUCTION

Innovative Technical Solutions, Inc. (ITSI) received Task Order CTO-0012 from the U.S. Department of the Navy (Navy), Base Realignment and Closure Program Management Office, West, under Contract Number N68711-05-D-6403, to provide technical support at Hunters Point Shipyard (HPS) in San Francisco, California. Under CTO-0012, ITSI is monitoring and controlling migration of landfill gases at the Industrial Landfill in Installation Restoration Site 01/21 (IR-01/21) within Parcel E-2 at HPS (Figure 1). All monitoring is being conducted using the requirements of Title 27 of the California Code of Regulations (27 CCR), Section (§) 20921(a)(2) as guidance. This report contains the results of landfill gas and water level monitoring conducted in January, February, and March 2009.

Recent investigations at the landfill, the purpose and scope of the monthly monitoring events, and the organization of this report are discussed below. Additional information about the site background prior to 2002 is presented in the Final Monthly Landfill Gas Monitoring Report for January 2004 submitted by Tetra Tech EM Inc. (Tetra Tech; 2004a).

1.1 *Recent Investigations at the Landfill*

In 2002, the Navy conducted an evaluation to characterize and delineate landfill gases at the Industrial Landfill as part of the nonstandard data gaps investigation at Parcel E (Tetra Tech, 2003). Field personnel surveyed ambient air and soil gas and installed gas monitoring probes (GMPs) that were monitored on a weekly and quarterly basis. Figure 2 shows the locations, including GMPs, extraction wells, and passive vents (PVs), where landfill gas was monitored.

The monitoring results indicated that methane, the main component of landfill gas, was present at levels above the lower explosive limit (LEL; 5 percent by volume in air) at the following locations:

- Subsurface areas in the northern portion of the landfill;
- Above ground in ambient air at four areas within the University of California, San Francisco (UCSF) property (herein referred to as “the UCSF compound”).

Additionally, trace amounts of methane and non-methane organic compounds (NMOCs) were detected in the crawlspace of Building 830 in the UCSF compound. The concentrations of NMOCs detected were well below action levels, and did not pose a threat to human health (Tetra Tech, 2003). Methane was not detected at any of the GMPs along Crisp Avenue, indicating that landfill gases had not migrated northward beyond the UCSF compound to Crisp Avenue or non-Navy property.

From summer 2002 through May 2003, the Navy conducted a time-critical removal action (TCRA) to address the levels of methane above the LEL on the UCSF compound. The goals of the TCRA were (1) to reduce levels of methane within the UCSF compound to below the LEL of 5 percent, in accordance with the requirements at 27 CCR §20921(a)(2), and (2) to

prevent future migration of landfill gases to the UCSF compound. A landfill gas control system, which can be operated passively or actively, was installed to achieve the goals of the TCRA. The Draft Landfill Gas Time-Critical Removal Action Closeout Report (Tetra Tech, 2004b) describes these activities in more detail.

From May through November 2003, the Navy continued monitoring at PV-01 through PV-04 (PV-05 was installed after November 2003) and at GMP01A through GMP12, GMP20, and GMP21 along the fence immediately north of the landfill. The draft TCRA closeout report contains a detailed summary of monitoring results, potential migration pathways for landfill gases, and the response actions taken to address the gas migration scenarios, including installation of a grout curtain in selected areas (Tetra Tech, 2004b). On November 4, 2003, landfill gas monitoring and control activities were suspended. These activities were resumed on January 21, 2004, when a contract for continued activities was implemented. In September 2004, the Navy revised the Parcel E boundary, and the Industrial Landfill area was given the designation “Parcel E-2” (current parcel boundaries are shown on Figure 1).

In January 2005, the Navy transferred Parcel A to the City of San Francisco. The monthly report text and figures now designate this area as “Non-Navy Property.”

1.2 Purpose and Scope

This quarterly monitoring report presents and summarizes the evaluation of monitoring data collected in January, February, and March 2009, based on the modified program schedule proposed by the Navy and approved by DTSC on October 20, 2008 (see Section 2.3 below). This report was prepared using the requirements of 27 CCR §20934 as guidance. Specifically, this report provides the following information:

- Concentrations of methane measured at each GMP and within each on-site structure in the current program.
- Concentrations of oxygen, carbon dioxide, and non-methane organic compounds measured at each GMP and within each on-site structure in the current program.
- Documentation of the dates and times of monitoring activities, and the barometric pressures, atmospheric temperatures, general weather conditions, probe pressures, and water levels measured or recorded during the monitoring event.
- Names of sampling personnel, apparatus used, and a brief description of the methods employed.
- Documentation of the dates, extraction locations, periods of operation, and any maintenance issues or field work variances related to operation of the landfill gas control system.

The numbering/reference system used in the report text, tables, and figures correlates monitoring results with the corresponding GMPs and other locations monitored, as recorded in the landfill gas and water level monitoring logs (Appendix A).

1.3 Report Organization

This report is organized as follows:

- Section 1 provides an introduction to and an overview of the recent investigations that have occurred at the landfill.
- Section 2 presents the overall objectives and methodologies of the landfill gas monitoring/control program, as well as a brief overview of recent operating conditions.
- Section 3 presents the results of the January, February, and March 2009 monthly monitoring for landfill gases (including any required follow-up monitoring and/or response actions), as well as additional information relating to probe pressures, water levels, and meteorological data for this period.
- Section 4 presents an evaluation of the monthly monitoring results for this quarter.
- Section 5 is an overall summary of the monitoring report and current system status.
- Section 6 lists the documents used as background references for this report.

Tables and figures follow Section 6. The following appendices also are included with this report, following the figures:

- Appendix A presents landfill gas monitoring data for the January, February, and March 2009 monthly monitoring events and depth-to-water data for the March 2009 monitoring event (as recorded on the Landfill Gas Monitoring Logs and Water Level Monitoring Log).
- Appendix B provides a summary of other monitoring results (i.e., for landfill cap monitoring wells) for the current reporting period.

2 MONITORING PROGRAM OBJECTIVES AND METHODOLOGIES

This section discusses the objectives and methodologies of the landfill gas monitoring program at HPS Parcel E-2.

2.1 Objectives

The objective of monitoring landfill gas is to verify that the landfill gas control system at Parcel E-2 is effectively reducing levels of methane to below the LEL and preventing hazardous levels of landfill gas from migrating to the UCSF compound and non-Navy property. Title 27 CCR provides standards for monitoring and controlling combustible gases such as methane. Bay Area Air Quality Management District (BAAQMD) Regulation 8, Rule 34, addresses control of NMOC emissions from solid waste disposal sites.

The landfill gas monitoring and control requirements of 27 CCR and BAAQMD Rule 34 apply to landfills operating under state Resource Conservation and Recovery Act (RCRA) permits. These requirements can be applied to older, inactive, or closed landfills if they pose a potential threat to public health and safety or the environment. The applicability or relevance and appropriateness of 27 CCR requirements to the industrial landfill at IR-01/21 will be evaluated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process. BAAQMD Rule 34 does not regulate the landfill in Parcel E-2. However, both the 27 CCR and Rule 34 requirements were used as guidelines for development and implementation of the Final Interim Landfill Gas Monitoring and Control Plan (MCP) (Tetra Tech, 2004c), pending completion of the final CERCLA remedy for the landfill.

Title 27 CCR §20921 sets forth the following three performance standards for control of landfill gases at closed landfills:

1. Concentrations of methane gas must not exceed 1.25 percent by volume in air (25 percent of the LEL) within any on-site structure.
2. The concentration of methane gas migrating from the landfill must not exceed 5 percent by volume in air at the property boundary or an alternative boundary approved in accordance with 27 CCR §20925.
3. Trace gases (NMOCs) must be controlled to prevent adverse acute and chronic exposure to toxic and/or carcinogenic compounds.

The criteria for the first two requirements are clear, but the third requirement does not identify specific field monitoring limits for trace gas concentrations. As a result, action levels for field monitoring of NMOCs were established based on an evaluation of previous risk assessments and Tetra Tech EM Inc. health and safety criteria (Tetra Tech, 2002). Tetra Tech EM Inc.'s health and safety criterion limits NMOCs in the breathing zone to 5 parts per million by volume (ppmv). This criterion is applied to on-site structures and utilities

that are accessible to workers, and to surface locations in the UCSF compound where landfill gas has been historically detected. These locations include the crawlspace under Building 830.

Previous risk assessments described in the MCP show that subsurface trace gases found in GMPs within the UCSF compound and along Crisp Avenue do not pose an unacceptable health risk (Tetra Tech, 2004c). An action level of 500 ppmv was established for NMOCs in GMPs.

The 5-percent limit for methane at the property boundary (requirement 2 above) does not apply to either passive vents or to monitoring wells located on the landfill. Passive vents are part of the landfill gas migration control system, and frequently exceed 5 percent methane by design. The 5 percent limit does apply at the GMPs, which are located at various distances outside a Gundwall barrier that reduces the outward migration of landfill gases from the trench and passive vents.

The requirements for monitoring and reporting landfill gas, as set forth in 27 CCR, may be summarized as follows:

- Perimeter Monitoring Network (§20925): Gas monitoring probes will be located near the site property boundary, with lateral spacing of no more than 1,000 feet and at depths above groundwater and bedrock.
- Structural Monitoring (§20931): The design of the monitoring network will encompass on-site structures, including buildings, basements, manholes, pipelines, and utility vaults. Methods for on-site structural monitoring may include periodic monitoring using either permanently installed probes or gas surveys, or continuous monitoring systems.
- Monitored Parameters (§20932): All gas monitoring probes and on-site structures will be monitored for methane, and for trace NMOCs if required.
- Monitoring Frequency (§20933): At a minimum, quarterly monitoring is required. More frequent monitoring may be required at locations where monitoring results indicate that landfill gas is migrating or is accumulating in structures.
- Reporting (§20934): Results of landfill gas monitoring will be submitted to the California Integrated Waste Management Board (CIWMB) within 90 days, provided compliance levels are maintained. When compliance levels are exceeded, the results must be submitted within 5 days. A letter that describes the nature and extent of the problem and any immediate corrective actions that must be taken to protect public health and safety and the environment will be submitted within 10 days.

Portions of the landfill gas control system, and some of the current monitoring points, are on property that the Navy has transferred to UCSF. Negotiations between the Navy and UCSF regarding the property that contains the landfill gas control system resulted in the creation of an easement which allows the Navy to maintain and monitor its facilities on UCSF property. The easement was finalized on July 21, 2006.

2.2 Monitoring Methodologies

Landfill gases are monitored either monthly or quarterly—according to the program schedule for each current monitoring location—to evaluate migration from the landfill to verify that the landfill gas control system is achieving the regulatory requirements set forth in 27 CCR §20921 and BAAQMD Rule 34. This section briefly discusses the procedures used to monitor landfill gases during the January, February, and March 2009 monitoring events. The MCP (Tetra Tech, 2004c) provides a more detailed discussion of monitoring procedures.

A CES-LANDTEC GEM 2000 landfill gas meter was used to monitor concentrations of methane, oxygen, and carbon dioxide; the percentage of the methane LEL; and real-time temperatures and barometric pressures. A calibrated Mini-RAE Plus Classic photoionization detector (PID) with a 10.6 electron-volt lamp was used to monitor NMOCs. A Gilian GilAir air-sampling pump was used to purge the GMPs prior to monitoring. Pressure in the GMPs was measured using a Magnehelic pressure gauge.

Before soil gas readings were recorded at each GMP, pressure was measured using the Magnehelic pressure gauge with a scale of 0 to 10 inches of water. The air pump was then connected to the sampling port of the GMP and used to purge air from the GMP for at least one minute at 3,000 cubic centimeters per minute. After the GMP was purged, the GEM 2000 landfill gas meter was connected to the sampling port. Readings were recorded when the concentration of landfill gas was stable for at least 30 seconds. Background levels of NMOCs were recorded from the PID by recording the ambient air reading before the meter was connected to the sampling port. After the background level of NMOCs was recorded, the PID was connected to the sampling port to measure NMOCs. The concentration of NMOCs was recorded when the PID indicated a stable value for at least 30 seconds.

Table 1 identifies the personnel conducting the monitoring events and the equipment used during monitoring. Table 2 lists the monitored locations by category.

2.3 Field Work Variances

From the time monitoring and control activities were resumed in January 2004 until August 28, 2004, gas extraction along the landfill gas barrier wall (see Figure 2) was performed semi-continuously at PV-02 and PV-03, and occasionally at GMP24 as needed, under protocols differing from those in effect for the monitoring period covered in this report. Several modifications to these protocols have been implemented, according to the provisions of the MCP, to refine the program and develop the most effective method of controlling landfill gases in Parcel E-2. In addition to the procedures implemented in response to the variances described in this section, protocol modifications have included the following:

- From January 27, 2004, to August 28, 2004, active extraction was performed on a semi-continuous basis at PV-02 or PV-03 (24 hours a day for two to three weeks at a time), in an attempt to determine whether continual active extraction was truly necessary to control landfill gas. (As discussed below, several modifications to this approach have been implemented; and in February 2006 it was determined that, as

long as a permanent power source is in place, continuous extraction should not be interrupted for reasons other than periodic maintenance.)

- Initially, active extraction at PV-02 or PV-03 was not performed the day of the monitoring event, due to the concern that it might prevent landfill gas from reaching the PID or GEM-2000 while other passive vents were being monitored. This procedure was changed in July 2004, when it was determined that this method was not presenting a true snapshot of trench conditions under continuous active extraction (the predominant state of operation).
- The active extraction flow produced by the SVE blower motor initially was controlled by restricting the main inlet valve on the trailer instead of by opening the secondary bleed-off valve. This method created unnecessary vacuum pressure on the intake and significantly reduced the effectiveness of the extraction system. This operating procedure was changed in July 2004 and the bleed-off valve was utilized, significantly increasing extraction flow rates while reducing stress on the motor.

As documented in the August and September 2004 monthly reports (ITSI 2005a, 2005b), the landfill gas control system was without power from August 28, 2004, through September 28, 2004, due to damage to the electrical service drop caused by workers at the Golden Gate Railroad Museum yard. During this time, the system was passively venting from PV-01, PV-02, PV-04, and PV-05. PV-03 was not vented during this time. A mobile generator was brought on site on September 29, 2004, and was employed as the power source for active extraction until PG&E power was restored in March 2006.

Active gas extraction was resumed at PV-02 on September 29, 2004, and continued until October 7, 2004, along with extraction at GMP24 from September 30, 2004, to October 4, 2004 (ITSI 2005b, 2005c). In the months of October 2004 through February 2005, active extraction was performed continuously at PV-02 for one full week just prior to the monthly monitoring event.

Because of concerns that an extraction schedule limited to one week per month might allow landfill gas to migrate off the site during the time when extraction was not occurring, the active gas extraction schedule was changed in March 2005. The revised protocol called for active gas extraction to be performed for 40 consecutive hours each week.

Beginning in May 2005, monthly gas monitoring events were performed following a period of several days when only passive extraction occurred, just before the active extraction system was activated, so that the data collected represented the presumed worst-case conditions of the extraction schedule. This practice was replaced by the continuous (24 hours a day, 7 days a week) active extraction schedule adopted on February 8, 2006, after it was determined that the 40-hours-per-week active extraction schedule was no longer sufficient to control methane migration to the fence line GMPs, particularly GMP01A and GMP07A. Further discussion of the methane results observed at GMP01A and GMP07A during January and February 2006, and factors which may have contributed to these concentrations, can be found in the Final Monthly Landfill Gas Monitoring Report for December 2006 (ITSI, 2007a).

Beginning in October 2005, passive vents PV-01, PV-03, PV-04, and PV-05 were closed off during any active extraction at PV-02, to maximize the efficiency of methane extraction from the interception trench. These vents were re-opened when active extraction was concluded. This practice was discontinued in December 2005 because of concerns that closing the vents may put undue vacuum pressure on the interception trench. The vents are now left open at all times.

In June 2005, PG&E approved a revised power installation plan to provide temporary power for three years, under a permit that may be extended until a final remedy and the resultant power needs for the Parcel E-2 landfill are determined. The temporary plan included installing two power poles, coordinating a power drop and meter installation with PG&E, terminating unused lines and conduits, and removing an existing power pole that was no longer needed. Following Navy approval of the cost proposal for the performance of this work in December 2005, and PG&E approval of the final plan for the installation work in February 2006, the new power poles were installed on February 28, 2006. PG&E made the power connections on March 24, 2006, and power was restored to the active extraction system on March 27, 2006.

At some point between the April 2006 and May 2006 monitoring events, well IR74MW01A was damaged by construction crews working on the non-Navy property (formerly known as HPS Parcel A) along and north of Crisp Avenue, and this well subsequently was unavailable for water level measurement for several months. IR74MW01A was repaired on September 8, 2006.

At some point between 1100 hours on April 16, 2007, and 0730 hours on April 18, 2007, the electrical service drop for the active extraction system was damaged, presumably by high winds. The service drop was spliced and repaired by electrical crews, and active extraction was resumed at 1700 hours on April 19, 2007.

For unknown reasons, meteorological information for the period from 1000 hours on January 2, 2008 (the previous data-collection event), to approximately 1200 hours on Saturday, January 5, 2008, could not be retrieved from the data-logger for the HPS meteorological tower. (It is possible that severe weather during this period caused a data loss.) Therefore, a portion of the data for this interval presented in the tables and figures for the 2008 quarterly monitoring reports was obtained from the National Climatic Data Service archives for the San Francisco Airport, accessible at:

<http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwDI~StnSrch~StnID~10001448>.

A similar unexplained loss of data occurred in July 2007, and was discussed in the Quarterly Report covering the period from July 2007 through September 2007 (ITSI, 2007b).

Following a recommendation made by Gino Yekta of the CIWMB, the probe assemblies on all GMPs were modified during the week of April 21–25, 2008, to ensure that a continuous seal was maintained in between monitoring events. This was accomplished by replacing the original flex hose connections between the PVC risers and stopcock valves with PVC fittings.

Following discussions during a site visit by DTSC and CIWMB on September 16, 2008, the following changes in GMP monitoring locations and monitoring frequency were proposed by the Navy and subsequently approved by DTSC on October 20, 2008:

- **Compliance probes: GMP10, GMP11A, GMP13, GMP14, GMP15, GMP16, GMP17, GMP18, GMP19, GMP20, GMP21, GMP27, GMP28, GMP29, GMP30, GMP31, and GMP32**

The monitoring of these probes has been reduced from monthly to QUARTERLY. These probes have had no methane detections over the life of the monitoring program and, while NMOCs have been detected at significant levels, no NMOC action level exceedances have occurred.

- **Probes with recent detections: GMP01A, GMP07A, and GMP22**

The monitoring of these probes has been reduced from monthly to QUARTERLY. GMP01A and GMP07A had methane levels above the regulatory level of 5% in January/February of 2006, while GMP22 had an NMOC level above 100 ppm in September 2008.

- **Probes with no methane detections: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26**

The monitoring of these probes has been DISCONTINUED. These probes have had no methane detections over the life of the monitoring program, and no NMOC detections above 10 parts per million have been reported.

- **Probes with recurring methane detections: GMP08A, GMP23, and GMP24**

The monitoring of these probes is continuing MONTHLY. These probes have historically had recurring methane detections, although only GMP24 has had action level or regulatory exceedances.

The October 2008 monitoring event was the first monthly event to be performed under this modified monitoring program schedule. The first quarterly monitoring event under the reduced list of locations was performed in December 2008. Quarterly events will be conducted during the last month of each calendar quarter (i.e., March 2009, June 2009, etc.).

On Tuesday, February 17, 2009, following a significant storm event, it was discovered that the electrical service drop for the landfill gas active extraction system had been damaged, rendering the active extraction system inoperable. The service drop was replaced on Friday, February 20, 2009, and active extraction was not resumed until after the monthly monitoring event was completed, in order to assess the worst-case conditions at the monitoring probes. As an additional precaution, GMP01A and GMP07A were included in the February 2009 monitoring event, as these two locations have had exceedances in the past and are the probes most likely to be influenced negatively by the lack of active extraction on the collection trench. All methane detections during this event were below the 2.5% HPS action level.

2.3.1 Current Active Gas Extraction Schedule

During the current reporting period (January through March, 2009), active gas extraction was conducted at PV-02 as follows:

System On at PV-02	System Off at PV-02	Hours Run	Notes
April 19, 2007	February 15, 2009 (est.)		Electrical service drop damaged by high winds during a February 2009 storm event.
February 20, 2009	ongoing		Active extraction ongoing from restart through March 2009.
January Operating Hours:		744.0	
February Operating Hours:		552.0	Estimated hours.
March Operating Hours:		744.0	
Total Quarterly Operating Hours:		2,040.0	

2.4 Data Evaluation

Results of landfill gas monitoring for the January, February, and March 2009 events were evaluated against the performance standards and action levels for methane and NMOCs outlined in the MCP (Tetra Tech, 2004c), based in turn on the performance standards set forth in 27 CCR and BAAQMD Rule 34. Section 3 of this report summarizes the results of landfill gas monitoring during the first quarter of 2009.

2.5 Deviations

It was determined at the November/December 2006 BCT meeting that while monthly monitoring at HPS Parcel E-2 remained appropriate, formal reports are needed less frequently. Therefore, it was agreed that, under current conditions, the Final Monthly Landfill Gas Monitoring Report for December 2006 (ITSI, 2007a) would be the last monthly report, and that as of January 2007, monthly monitoring and BCT presentations would continue but formal reports would be issued quarterly.

It was further determined at the July 2007 BCT meeting that the quarterly reports would be submitted only as final reports. The first quarterly report submitted as such was issued in October 2007, and covered the third quarter of 2007. Final quarterly reports have been issued for each subsequent calendar quarter. This report, covering monitoring conducted in January, February, and March 2009 (first quarter 2009), has been prepared following the March 2009 monitoring event.

As discussed in Section 2.3 above, reductions in GMP monitoring locations and frequency were proposed by the Navy following discussions during a site visit by DTSC and CIWMB on September 16, 2008, and were approved by DTSC on October 20, 2008.

3 MONITORING RESULTS

This section presents the results for monthly monitoring at the landfill during January, February, and March 2009, based on monitoring measurements recorded on January 26, February 20, and March 24-25, 2009, and depth-to-water readings recorded on March 24, 2009. Appendix A contains the Landfill Gas Monitoring Logs and the Water Level Monitoring Log for the January, February, and March 2009 monitoring events. Appendix B summarizes the results of landfill gas monitoring at locations other than those specified in the MCP (Tetra Tech, 2004c). These locations (specifically the groundwater monitoring wells on the landfill cap) are being monitored quarterly to further evaluate the presence of methane in the landfill relative to methane concentrations observed in the GMPs. Documenting the fluctuation of methane levels observed in the landfill wells over time also helps to demonstrate the wide variability of methane presence with respect to seasonal conditions such as temperature and groundwater elevation.

3.1 Methane Results

This section summarizes the results of methane monitoring for the January, February, and March 2009 monitoring events. Figure 2 shows the locations that were monitored; the January, February, and March 2009 results for methane (excluding passive vents and the wells listed in Appendix B) are shown on Figure 3 and Figure 4. Table 3 presents the methane results for each MCP-specified monitoring location for the three sampling events. Note that all methane concentrations are provided in percentage of methane by volume.

The subsections below present the results for monitoring locations in the following areas:

- the fence line between the landfill and the UCSF compound;
- the UCSF compound;
- Crisp Avenue, beyond (north of) the UCSF compound;
- structural locations; and
- the landfill gas control system.

The fence line between the landfill and the UCSF compound is considered the property boundary for the landfill gas monitoring program (Tetra Tech, 2004c), which is of significance for reporting the monitoring results consistent with Title 27 CCR §20921 (see Section 2.1 above).

3.1.1 Fence Line

Concentrations of methane in the fence line GMPs along the northwestern and northeastern perimeter of the landfill (measured at GMP01A, GMP07A, GMP08A, GMP10, GMP11A, GMP20, and GMP21, per the modified monitoring program discussed in Section 2.3) are representative of concentrations of methane migrating beyond the site boundary. Methane

was not detected in any fence line GMPs monitored during the January or March 2009 events. As mentioned in Section 2.3, the February 2009 monitoring event occurred following the repair of the electrical service drop powering the landfill gas active extraction system. As a precautionary measure, GMP01A and GMP07A were included in the February 2009 monitoring round, as these two locations have had exceedances in the past and are the probes most likely to be influenced negatively by the lack of active extraction on the collection trench. On February 20, 2009, GMP01A had a methane detection of 1.2%, and GMP07A had a detection of 2.2%. The regulatory performance standard of less than 5 percent (%) methane by volume and the HPS site action level of 2.5% were therefore met at all fence line GMPs for all monitoring events, and no extraction or follow-up monitoring was necessary during the first quarter of 2009. Figure 3 and Table 3 show the results for methane at GMPs along the fence line.

3.1.2 UCSF Compound

GMPs monitored within the UCSF Compound (GMP22, GMP23, and GMP24, per the modified monitoring schedule) represent an area between the boundary of the landfill and the compliance probes on Crisp Avenue. On January 26, 2009, methane was detected in one UCSF compound GMP: GMP24 at 1.1%. On February 20, 2009, methane was detected in two UCSF compound GMPs: GMP23 at 0.5%, and GMP24 at 1.2%. On March 24, 2009, methane was not detected in any UCSF compound GMPs.

As all methane detections at the three GMPs monitored within the UCSF compound during the first quarter of 2009 met the regulatory performance standard of less than 5% and the HPS site action level of 2.5% methane by volume, no other field action was necessary. Figure 3 and Table 3 show the methane monitoring results for GMPs within the UCSF compound.

3.1.3 Crisp Avenue

Under the modified monitoring schedule, Crisp Avenue GMPs are monitored quarterly. During the March 2009 monitoring event, methane was not detected in any of the GMPs along Crisp Avenue (GMP13 through GMP19 and GMP27 through GMP32), thereby meeting both the regulatory performance standard of less than 5% and the HPS site action level of 2.5%. Figure 3 and Table 3 show the methane monitoring results for these GMPs.

3.1.4 Structural Locations

During the March 2009 monitoring event, methane was monitored at the crawlspace at Building 830 within the UCSF compound and at the remaining on-site utilities locations (i.e., catch basins DP1 and DP2). Methane was not detected in any of the on-site utilities or in the crawlspace at Building 830 in March 2009, and therefore the regulatory performance standard of less than 1.25 percent by volume in air (25 percent of the LEL) within on-site structures was met. (The crawlspace at Building 830 is being monitored by the Navy

because of its close proximity to the landfill.) Figure 4 and Table 3 show the methane monitoring results for these locations.

3.1.5 Ambient Air Locations

In accordance with MCP guidelines, three ambient air locations within the UCSF compound (Ambient Location A [fence line], Ambient Location B [basketball court], and the light pole) were removed from the monitoring program in 2006 based on the ongoing absence of methane or NMOC detections at these locations. However, if active gas extraction is interrupted for an extended period of time (i.e., more than one week), or if methane or NMOCs are detected at other locations within the UCSF compound at levels higher than those observed in the recent past, monthly monitoring will be resumed at these ambient locations.

3.1.6 Control System

During the March 2009 monitoring event, concentrations of methane at the landfill gas control system (passive vents PV-01 through PV-05) ranged from a high of 1.7% by volume at the PV-02 influent location, to 0.0 percent by volume at the PV-03 first carbon and Hydrosil locations and for all readings (i.e., influent, first carbon, and Hydrosil) collected at PV-01, PV-04, and PV-05.

When data indicate that the first carbon drums at the PVs are approaching saturation, these drums are replaced as a precautionary measure by moving the second-position (effluent) carbon drum to the first position and placing a new carbon drum in the second position. (The second carbon drum is present at each passive vent to further reduce the amount of NMOCs emitted to the environment by venting from the extraction system.) The first-position carbon drums at PV-01, PV-05, and the PV-02 active extraction trailer were replaced on June 19, 2006, and the first-position carbon drum at PV-04 was replaced on May 15, 2007. During the second and third quarters of 2007, methane was present at the carbon drums (most notably at PV-04) at concentrations higher than those seen at the influents. Consequently, the first carbon drum at PV-04 and both carbon drums at PV-03 were replaced on November 29, 2007.

3.2 Non-Methane Organic Compound Results

During the January, February, and March 2009 events, NMOCs were well below action levels at all monitoring locations. (Action levels are: 500 ppmv at GMPs, 5 ppmv within Building 830, 5 ppmv in on-site utilities, 5 ppmv in ambient air [recorded in the breathing zone], and 100 ppmv for two consecutive days from the outlet [effluent] of the control system.) Table 4 presents the monitoring results for NMOCs during January, February, and March 2009. Figures 10, 11, and 12 show the historical results for NMOCs in GMPs at the fence line, within the UCSF compound, and along Crisp Avenue, respectively, for each monitoring event from January 2008 through March 2009.

Due to a previous problem with the PID pump (as described in Section 3.2 of the March 2006 Monthly Report [ITSI, 2006]), pre-monitoring and post-monitoring field checks of the PID vacuum pressure are performed along with the regular field calibrations, to verify that the instrument's pump is functioning properly. For each monitoring event during the current reporting period, it was determined that the PID was creating sufficient vacuum to generate accurate readings. The PID also is serviced quarterly, regardless of instrument performance, to prevent any further problems. Quarterly servicing of the PID was performed following the December 2008 monitoring event, and will be performed again following the March 2009 event.

NMOCs were not detected in GMP23 or GMP24 during the routine January 2009 monitoring event. During the February 2009 event, NMOCs were detected in GMP23 (0.7 ppmv) and GMP24 (1.5 ppmv). During the March 2009 event, NMOCs were detected in GMP23 at 2.1 ppmv. NMOCs were not detected in any other UCSF GMPs during the first quarter of 2009. NMOCs were not detected in any fence line or Crisp Avenue GMPs during the first quarter of 2009. As all of the aforementioned NMOC concentrations are well below the HPS action level for GMPs (500 ppmv), no action or follow-up monitoring was necessary due to NMOC concentrations at GMPs during the period of January through March, 2009.

NMOCs are monitored at three locations at each of the PVs: at the influent, after the first carbon canister, and at the effluent sampling port (Hydrosil canister outlet). NMOCs were detected at levels as high as 9.6 ppmv in the PV-02 influent during the March 2009 event. NMOC concentrations at all active/passive PV Hydrosil (effluent) locations were at background levels. NMOCs were not detected above background in any of the structural monitoring locations during the March 2009 monitoring event. As all NMOC data were well below the corresponding HPS NMOC action levels, no further action or follow-up monitoring was necessary during the period of January through March 2009.

3.3 Trace Gas Results

During the January, February, and March 2009 routine monitoring events, oxygen concentrations in all GMPs within the UCSF compound and most of the GMPs along the fence line were significantly below the standard atmospheric concentration of 20.9 percent. Oxygen values in these areas during routine monitoring ranged from 0.0 to 1.8 percent by volume in the UCSF compound GMPs, and from 0.0 to 20.9 percent by volume along the fence line. Four of the seven fence line GMPs monitored had less than 18.5 percent oxygen during the March 2009 monitoring event. These low-oxygen conditions are consistent with influence from the Parcel E-2 landfill.

During the March 2009 monitoring event, concentrations of oxygen reported in the other monitoring areas were closer to the standard atmospheric concentration. Oxygen concentrations at GMPs along Crisp Avenue were between 15.5 and 20.9 percent by volume. Oxygen is not regulated under 27 CCR or BAAQMD Rule 34, but low concentrations of oxygen in soil may be associated with landfill gas. Table 5 presents the

monitoring results for oxygen during the January, February, and March 2009 monitoring events.

During the January, February, and March 2009 monitoring events, carbon dioxide concentrations in the GMPs closest to the landfill (i.e., those along the fence line and in the UCSF compound) ranged from 0.6 to 13.9 percent by volume, with most locations significantly above the standard atmospheric concentration of approximately 0.04 percent (400 ppmv). Carbon dioxide levels in the GMPs along Crisp Avenue, farther from the landfill, were lower, ranging from 0.3 to 2.5 percent by volume. Carbon dioxide is not regulated under 27 CCR or BAAQMD Rule 34, but carbon dioxide concentrations generally are elevated where landfill gas is present. Carbon dioxide monitoring results are presented in Table 6.

3.4 Probe Pressures

Measurement of air pressure at the GMPs helps assess whether landfill gas is accumulating, and can provide information about the influence of the extraction system on mitigating any increases in the presence of landfill gas. For the January, February, and March 2009 monitoring events, gauge pressure at the GMPs (pressure in the probes relative to atmospheric pressure) was measured using a Magnehelic pressure gauge. No probe pressure was detected in any of the GMPs during the January, February, or March 2009 events. Table 7 presents the probe pressure readings recorded at GMPs during these events.

3.5 Water Levels

Water level measurements are recorded primarily to confirm that the bottom of the landfill gas barrier wall is below the top of the saturated zone, preventing landfill gas from migrating underneath the barrier wall. Water level measurements also provide information about the thickness of the vadose zone, as the lower boundary of the vadose zone is determined by the elevation of the water table.

On March 24, 2009, water levels were measured at GMP27 through GMP32 along Crisp Avenue and at 11 additional groundwater monitoring wells and piezometers. Water levels were measured as depths below the tops of well casings. Subsequently, these measurements were converted to depths below ground surface and to elevations relative to mean sea level (msl) using surveyed elevations. Table 8 shows the measured water levels and the converted values for this event.

Figure 5 shows the groundwater potentiometric surface of the A-aquifer (shallow groundwater zone) on March 24, 2009, along with the elevation of the bottom of the landfill gas barrier wall at each of the measured locations. Groundwater generally flows to the east and southeast, from the non-Navy property north of Parcel E-2 toward San Francisco Bay and to a groundwater sink near the northern end of the boundary between Parcels D and E (east of the monitored area shown on Figure 5). The water level readings collected during the March 2009 monitoring event indicate that the bottom of the barrier wall, which ranges

in elevation from -1.2 feet above msl (i.e., 1.2 feet below msl) to 1.9 feet above msl, was submerged below the water table at all locations monitored.

As discussed in greater detail in Section 4, there appears to be an inverse relationship between methane concentrations and groundwater elevations at GMP24 (which tends to be the GMP with the highest methane concentrations). In general, the lower the groundwater elevation near GMP24, the higher the methane concentration at GMP24. Figure 13 illustrates this relationship.

3.6 Meteorological Data

Meteorological data are used qualitatively to evaluate whether changes in weather affect the behavior of landfill gas. For example, a rapid decrease in barometric pressure may affect the amount of landfill gas that is released, and temperature may affect the rate of landfill gas generation. In addition, precipitation and the elevation of the water table influence the volume of the vadose zone, and may influence the potential buildup of pressure behind submerged probe screens.

Meteorological data are collected from an on-site station located southeast of the landfill cap at an elevation of about 25 feet above msl (see Figure 2). The location of the meteorological station is considered representative of the HPS area because the station is located on flat terrain, and data collection is therefore not limited by proximity to complex topography or large structures. Sensors on the meteorological tower record wind speed, wind direction, air temperature, relative humidity, precipitation, dew point, and barometric pressure. Sensor readings of all parameters are recorded at one-second intervals, averaged, and stored as 15- and 60-minute averages in the data logger.

Tables 9a, 9b, and 9c present daily meteorological data collected for January, February, and March 2009, respectively. All daily meteorological data are averages of hourly data except daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

Table 10 summarizes monthly meteorological data for January 2008 through March 2009. All monthly meteorological data are averages of hourly data except monthly precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season to-date total at the end of each month.

Concentrations of methane may be affected by atmospheric variations, although other factors (e.g., groundwater elevation, soil saturation, or changes in the operation of the extraction system) may overshadow any such effects. Figures 6 and 7 show the daily barometric pressures and observed methane concentrations for each day that methane was monitored at GMPs at the fence line and within the UCSF compound. Similarly, figures 8 and 9 show the daily temperatures and the observed methane concentrations at the same GMPs. No definitive correlations between methane readings and meteorological parameters are apparent at this time; however, longer-term (seasonal) effects on GMPs appear to affect methane presence, as further discussed in Section 4.

4 EVALUATION OF RESULTS

The primary objective of landfill gas monitoring at HPS Parcel E-2 is to verify that the landfill gas control system is effective in preventing migration of landfill gas to the UCSF compound and adjacent non-Navy property. Monitoring locations include GMPs, the crawlspace at Building 830, the on-site utilities, and the landfill gas control system.

On January 26, 2009, methane was detected in one UCSF compound GMP: GMP24 at 1.1%. On February 20, 2009, methane was detected in two UCSF compound GMPs: GMP23 at 0.5%, and GMP24 at 1.2%. On February 20, 2009, GMP01A had a methane detection of 1.2%, and GMP07A had a detection of 2.2%. Methane was not detected in any other GMPs, or any structural locations, during the first quarter of 2009. Concentrations of methane at the landfill gas control system ranged from 0.0% to 1.7% by volume at the PV-02 influent location. As all methane detections in GMPs met the regulatory performance standard of less than 5% and the HPS site action level of 2.5% methane by volume, no field action was necessary.

Since regular monitoring was initiated in January 2004, activation of the active gas extraction system has been required on thirteen occasions when the methane concentration at GMP24 has exceeded 2.5 percent by volume. (Active extraction has followed the monthly monitoring events in May, July, and September of 2004; August and October of 2005; July of 2006; May, August, and October of 2007; and May, July, September, and November of 2008). All of these occasions have occurred when the groundwater table in the area along Crisp Avenue between GMP28 and IR74MW01A (based on GMP groundwater elevation monitoring results) has been less than 5.5 feet above mean sea level. Methane concentrations at GMP23 have followed a similar seasonal pattern, with methane peaks roughly coinciding with troughs in groundwater elevations during the dry season (see Figure 13).

One possible explanation for these elevated dry-season detections of methane is that lower groundwater levels, when combined with a dry and therefore less-constricted vadose zone, permit greater gas flow in the subsurface in this area. Monthly monitoring data are reviewed on an ongoing basis to identify possible seasonal and other influences on gas migration.

Continuous active extraction resumed at PV-02 on February 8, 2006, and the presence of methane in the control system passive vents has fluctuated greatly since that time. Low concentrations were reported in February, March, and April 2006 (peak methane concentrations at PV system monitoring points ranged from 0.0% to 8.1%), with much higher concentrations reported from May through November 2006 (PV concentrations up to 61.5%). Methane concentrations at the PVs subsided from December 2006 through April 2007 (concentrations did not exceed 13.8%), increased again from May 2007 through December 2007 (maximum PV concentrations were as high as 53.9%), and decreased once again from January 2008 through March 2008 (PV concentrations did not exceed 13.2%). As expected, methane concentrations again increased at the PVs from April to September

2008 (maximum PV concentrations were as high as 62.5%), and decreased from December 2008 through March 2009 (PV concentrations did not exceed 13.5%).

These fluctuations in methane at the PVs could be influenced by one or more of a variety of factors, including (1) rising or falling temperatures, which could in turn increase or decrease biological methane-generating activity; (2) seasonal fluctuations of groundwater levels, which could open or close seasonal migration pathways for methane; and (3) changes in surface moisture or soil moisture levels, which also could open or close various seasonal migration pathways.

During the February 2009 event, NMOCs were detected in GMP23 (0.7 ppmv) and GMP24 (1.5 ppmv). During the March 2009 event, NMOCs were detected in GMP23 at 2.1 ppmv. NMOCs were not detected in any other GMPs, or at any structural locations, during the first quarter of 2009. NMOCs were detected in the control system at levels as high as 9.6 ppmv at the PV-02 influent during the March 2009 event. As all of the aforementioned NMOC concentrations are well below the corresponding HPS action levels for GMPs (500 ppmv), no action or follow-up monitoring was necessary due to NMOC concentrations at GMPs during the period of January through March, 2009.

5 SUMMARY

Landfill gas monitoring and water level measurement activities took place on January 26, February 20, and March 24, 2009. Title 27 CCR limits concentrations of methane gas to 5 percent by volume at the site boundary and 1.25 percent by volume in on-site structures. All monitored methane concentrations in GMPs during the first quarter of 2009 were below the regulatory limit (5% by volume) and the HPS site action level (2.5% by volume) for methane in GMPs.

The action levels for NMOCs (established based on an evaluation of previous risk assessments and Tetra Tech EM Inc. health and safety criteria [Tetra Tech, 2002]) are 500 ppmv in GMPs; 5 ppmv within Building 830; 5 ppmv in on-site utilities; 5 ppmv in ambient air (recorded in the breathing zone); and 100 ppmv for two consecutive days from the outlet of the control system. During the February 2009 event, NMOCs were detected in GMP23 (0.7 ppmv) and GMP24 (1.5 ppmv). During the March 2009 event, NMOCs were detected in GMP23 at 2.1 ppmv. NMOCs were not detected in any other GMPs, or any structural locations, during the first quarter of 2009. NMOCs were detected in the control system at levels as high as 9.6 ppmv in the PV-02 influent during the March 2009 event. All of the aforementioned detections were well below the HPS NMOC action level for GMPs (500 ppmv). Therefore, no action or follow-up monitoring was necessary due to NMOC concentrations at GMPs during the period of January through March, 2009.

6 REFERENCES

Innovative Technical Solutions, Inc. (ITSI), 2004. Final Monthly Landfill Gas Monitoring Report for July 2004, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. October 25.

ITSI, 2005a. Final Monthly Landfill Gas Monitoring Report for August 2004, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. January 31.

ITSI, 2005b. Final Monthly Landfill Gas Monitoring Report for September 2004, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. January 31.

ITSI, 2005c. Final Monthly Landfill Gas Monitoring Report for October 2004, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. May 10.

ITSI, 2005d. Final Monthly Landfill Gas Monitoring Report for January 2005, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. April 22.

ITSI, 2006. Final Monthly Landfill Gas Monitoring Report for March 2006, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. June 8.

ITSI, 2007a. Final Monthly Landfill Gas Monitoring Report for December 2006, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. March 19.

ITSI, 2007b. Final Landfill Gas Monitoring Report for July–September 2007, Post-Removal Action, Parcel E-2, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. November 2.

Tetra Tech EM Inc. (Tetra Tech), 2002. Basewide Health and Safety Plan, Hunters Point Shipyard, San Francisco, California. March 21.

Tetra Tech, 2003. Final Parcel E Nonstandard Data Gaps Investigation, Landfill Gas Characterization, Hunters Point Shipyard, San Francisco, California. September 5.

Tetra Tech, 2004a. Final Monthly Landfill Gas Monitoring Report for January 2004, Post-Removal Action, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. August 13.

Tetra Tech, 2004b. Draft Landfill Gas Time-Critical Removal Action Closeout Report, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. March 19.

Tetra Tech, 2004c. Final Interim Landfill Gas Monitoring and Control Plan, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. August 13.

TABLES

TABLE 1: PERSONNEL AND EQUIPMENT

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

PERSONNEL		
Name	Responsibility	Company
Brett Womack	Task Manager	Innovative Technical Solutions, Inc.
EQUIPMENT		
Sampling Apparatus	Manufacturer/Model	Purpose
Landfill Gas Meter	CES-LANDTEC GEM-2000	Monitor methane, oxygen, carbon dioxide, and lower explosive limit
Photoionization Detector (10.6 electron-volt lamp)	Mini-RAE Plus Classic PGM-761S	Monitor non-methane organic compounds
Air Sampling Pump	Gilian GilAir-5	Purge GMPs
Pressure Gauge	Magnehelic	Measure pressure in GMPs

TABLE 2: LANDFILL GAS MONITORING LOCATIONS

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action, Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Monitoring Location ⁽¹⁾	Description
Fence Line GMPs	GMP01A, GMP07A, GMP08A, GMP10, GMP11A, GMP20, and GMP21
UCSF Compound GMPs	GMP22, GMP23, and GMP24
Crisp Avenue GMPs	GMP13, GMP14, GMP15, GMP16, GMP17, GMP18, GMP19, GMP27, GMP28, GMP29, GMP30, GMP31, and GMP32
Occupied Structure	Building 830 Crawlspace
On-Site Utilities ⁽²⁾	DP1 and DP2
Passive Vents ⁽³⁾	PV-01, PV-02 ⁽⁵⁾ , PV-03, PV-04, and PV-05
Extraction Wells ⁽⁴⁾	EX-5, EX-6, EX-7, and EX-8
Groundwater Elevation Locations	GMP27, GMP28, GMP29, GMP30, GMP31, GMP32, IR01MW02B, IR01MW03A, IR01MW05A, IR01MW10A, IR01MW11A, IR01MW12A, IR01P04A, IR01P03AA, IR01P03AB, IR74MW01A, and IR76MW13A
Additional Monitoring Locations	IR01MW16A, IR01MW18A, IR01MW366A, IR01MWI-5

Notes:

- (1) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations, which have therefore not been included in this table: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations will be monitored quarterly (see Section 2.3).
- (2) Three ambient air locations: Ambient Location A (fence line), Ambient Location B (basketball court), and the light pole, were removed from the monitoring program as of August 2006, pursuant to the MCP (see Section 3.1.5).
- (3) EW108, EW122, EV122, EW134, EV134, EW138, EV138, EW142, EV142, EW146, EV146, EW150, EV150, EW154, EW158, and EV158 were excavated and removed between September 2005 and January 2006, and are no longer monitored.
- (4) Monitoring at extraction wells is required only if the control system is actively extracting from these locations; however, they also may be included as part of response action monitoring.
- (5) Active extraction point

DP discharge point
 GMP gas monitoring probe
 IR Installation Restoration
 MW monitoring well
 PV passive vent
 UCSF University of California, San Francisco

TABLE 3: METHANE CONCENTRATIONS, JANUARY–MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Methane Concentration (percent by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Fence Line GMPs	GMP01A	6.0 to 13.5	--	1.2	0.0
	GMP07A	6.0 to 13.5	--	2.2	0.0
	GMP08A	4.5 to 9.5	0.0	0.0	0.0
	GMP10	4.0 to 6.5	--	--	0.0
	GMP11A	4.0 to 5.5	--	--	0.0
	GMP20	3.5 to 4.5	--	--	0.0
	GMP21	3.5 to 4.5	--	--	0.0
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	0.0
	GMP23	6.0 to 13.5	0.0	0.5	0.0
	GMP24	6.0 to 13.0	1.1	1.2	0.0
Crisp Avenue GMPs	GMP13	6.0 to 12.0	--	--	0.0
	GMP14	6.0 to 10.0	--	--	0.0
	GMP15	6.0 to 12.0	--	--	0.0
	GMP16	5.0 to 10.0	--	--	0.0
	GMP17	6.0 to 10.0	--	--	0.0
	GMP18	6.0 to 12.0	--	--	0.0
	GMP19	4.5 to 5.5	--	--	0.0
	GMP27	4.7 to 22.2	--	--	0.0
	GMP28	6.2 to 21.2	--	--	0.0
	GMP29	6.2 to 18.7	--	--	0.0
	GMP30	4.5 to 17.0	--	--	0.0
	GMP31	6.0 to 16.0	--	--	0.0
GMP32	4.75 to 14.75	--	--	0.0	
Occupied Structure	Building 830 Crawlspace	NA	--	--	0.0
On-Site Utilities	DP1	NA	--	--	0.0
	DP2	NA	--	--	0.0
Passive Vents ⁽³⁾	PV-01 Influent	NA	--	--	0.0
	PV-01 Carbon 1	NA	--	--	0.0
	PV-01 Hydrosil	NA	--	--	0.0
	PV-02 Influent	NA	--	--	1.7
	PV-02 Carbon 1 ⁽⁴⁾	NA	--	--	0.6
	PV-02 Hydrosil ⁽⁴⁾	NA	--	--	0.5
	PV-03 Influent	NA	--	--	0.2
	PV-03 Carbon 1	NA	--	--	0.0
PV-03 Hydrosil	NA	--	--	0.0	

TABLE 3: METHANE CONCENTRATIONS, JANUARY–MARCH 2009 (continued)

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Methane Concentration (percent by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Passive Vents ⁽³⁾	PV-04 Influent	NA	--	--	0.0
	PV-04 Carbon 1	NA	--	--	0.0
	PV-04 Hydrosil	NA	--	--	0.0
	PV-05 Influent	NA	--	--	0.0
	PV-05 Carbon 1	NA	--	--	0.0
	PV-05 Hydrosil	NA	--	--	0.0

Notes:

- (1) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations, which have therefore not been included in this table: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations will be monitored quarterly (see Section 2.3).
- (2) A double dash (--) indicates a location that was not monitored during the specified event, based on the revised monitoring schedule described in Note (1).
- (3) The regulatory limit of 5% methane does not apply to passive vents, which are part of the remedial system designed to collect and control migration of landfill gas.
- (4) The PV-02 Carbon 1 and Hydrosil drums are located on the active extraction trailer.

DP discharge point
 ft bgs feet below ground surface
 GMP gas monitoring probe
 NA not applicable
 PV passive vent
 UCSF University of California, San Francisco

Data from additional (landfill cap) monitoring locations are shown in Appendix B.

TABLE 4: NMOC CONCENTRATIONS, JANUARY–MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	NMOC Concentration (parts per million by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Fence Line GMPs	GMP01A	6.0 to 13.5	--	0.0	0.0
	GMP07A	6.0 to 13.5	--	0.0	0.0
	GMP08A	4.5 to 9.5	0.0	0.0	0.0
	GMP10	4.0 to 6.5	--	--	0.0
	GMP11A	4.0 to 5.5	--	--	0.0
	GMP20	3.5 to 4.5	--	--	0.0
	GMP21	3.5 to 4.5	--	--	0.0
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	0.0
	GMP23	6.0 to 13.5	0.0	0.7	2.1
	GMP24	6.0 to 13.0	0.0	1.5	0.0
Crisp Avenue GMPs	GMP13	6.0 to 12.0	--	--	0.0
	GMP14	6.0 to 10.0	--	--	0.0
	GMP15	6.0 to 12.0	--	--	0.0
	GMP16	5.0 to 10.0	--	--	0.0
	GMP17	6.0 to 10.0	--	--	0.0
	GMP18	6.0 to 12.0	--	--	0.0
	GMP19	4.5 to 5.5	--	--	0.0
	GMP27	4.7 to 22.2	--	--	0.0
	GMP28	6.2 to 21.2	--	--	0.0
	GMP29	6.2 to 18.7	--	--	0.0
	GMP30	4.5 to 17.0	--	--	0.0
	GMP31	6.0 to 16.0	--	--	0.0
GMP32	4.75 to 14.75	--	--	0.0	
Occupied Structure	Building 830 Crawlspace	NA	--	--	0.0
On-Site Utilities	DP1	NA	--	--	0.0
	DP2	NA	--	--	0.0
Passive Vents	PV-01 Influent	NA	--	--	0.5
	PV-01 Carbon 1	NA	--	--	0.0
	PV-01 Hydrosil	NA	--	--	0.0
	PV-02 Influent	NA	--	--	9.6
	PV-02 Carbon 1 ⁽³⁾	NA	--	--	5.1
	PV-02 Hydrosil ⁽³⁾	NA	--	--	2.7
	PV-03 Influent	NA	--	--	0.0
	PV-03 Carbon 1	NA	--	--	0.0
PV-03 Hydrosil	NA	--	--	0.0	

TABLE 4: NMOC CONCENTRATIONS, JANUARY–MARCH 2009 (continued)

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	NMOC Concentration (parts per million by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Passive Vents	PV-04 Influent	NA	--	--	0.0
	PV-04 Carbon 1	NA	--	--	0.0
	PV-04 Hydrosil	NA	--	--	0.0
	PV-05 Influent	NA	--	--	0.0
	PV-05 Carbon 1	NA	--	--	0.0
	PV-05 Hydrosil	NA	--	--	0.0

Notes:

- (1) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations, which have therefore not been included in this table: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations will be monitored quarterly (see Section 2.3).
- (2) A double dash (--) indicates a location that was not monitored during the specified event, based on the revised monitoring schedule described in Note (1).
- (3) The PV-02 Carbon 1 and Hydrosil drums are located on the active extraction trailer.

DP discharge point
ft bgs feet below ground surface
GMP gas monitoring probe
NA not applicable
PV passive vent
UCSF University of California, San Francisco

Data from additional (landfill cap) monitoring locations are shown in Appendix B.

TABLE 5: OXYGEN CONCENTRATIONS, JANUARY–MARCH 2009Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Oxygen Concentration (percent by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Fence Line GMPs	GMP01A	6.0 to 13.5	--	5.9	17.3
	GMP07A	6.0 to 13.5	--	0.0	20.5
	GMP08A	4.5 to 9.5	5.5	7.4	7.2
	GMP10	4.0 to 6.5	--	--	18.0
	GMP11A	4.0 to 5.5	--	--	13.6
	GMP20	3.5 to 4.5	--	--	20.9
	GMP21	3.5 to 4.5	--	--	19.8
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	0.4
	GMP23	6.0 to 13.5	0.2	0.0	1.8
	GMP24	6.0 to 13.0	0.0	0.0	0.0
Crisp Avenue GMPs	GMP13	6.0 to 12.0	--	--	16.4
	GMP14	6.0 to 10.0	--	--	20.1
	GMP15	6.0 to 12.0	--	--	20.3
	GMP16	5.0 to 10.0	--	--	20.2
	GMP17	6.0 to 10.0	--	--	20.8
	GMP18	6.0 to 12.0	--	--	16.9
	GMP19	4.5 to 5.5	--	--	15.5
	GMP27	4.7 to 22.2	--	--	17.1
	GMP28	6.2 to 21.2	--	--	19.8
	GMP29	6.2 to 18.7	--	--	20.9
	GMP30	4.5 to 17.0	--	--	20.6
	GMP31	6.0 to 16.0	--	--	17.3
	GMP32	4.75 to 14.75	--	--	20.5
Occupied Structure	Building 830 Crawlspace	NA	--	--	20.8
On-Site Utilities	DP1	NA	--	--	21.3
	DP2	NA	--	--	21.2
Passive Vents	PV-01 Influent	NA	--	--	20.9
	PV-01 Carbon 1	NA	--	--	21.1
	PV-01 Hydrosil	NA	--	--	21.2
	PV-02 Influent	NA	--	--	17.7
	PV-02 Carbon 1 ⁽³⁾	NA	--	--	19.6
	PV-02 Hydrosil ⁽³⁾	NA	--	--	19.6
	PV-03 Influent	NA	--	--	20.9
	PV-03 Carbon 1	NA	--	--	21.2
	PV-03 Hydrosil	NA	--	--	21.2

TABLE 5: OXYGEN CONCENTRATIONS, JANUARY–MARCH 2009 (continued)

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Oxygen Concentration (percent by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Passive Vents	PV-04 Influent	NA	--	--	19.7
	PV-04 Carbon 1	NA	--	--	20.8
	PV-04 Hydrosil	NA	--	--	21.3
	PV-05 Influent	NA	--	--	21.1
	PV-05 Carbon 1	NA	--	--	20.9
	PV-05 Hydrosil	NA	--	--	21.2

Notes:

- (1) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations, which have therefore not been included in this table: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations will be monitored quarterly (see Section 2.3).
- (2) A double dash (--) indicates a location that was not monitored during the specified event, based on the revised monitoring schedule described in Note (1).
- (3) The PV-02 Carbon 1 and Hydrosil drums are located on the active extraction trailer.

DP discharge point
ft bgs feet below ground surface
GMP gas monitoring probe
NA not applicable
PV passive vent
UCSF University of California, San Francisco

Data from additional (landfill cap) monitoring locations are shown in Appendix B.

TABLE 6: CARBON DIOXIDE CONCENTRATIONS, JANUARY–MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Carbon Dioxide Concentration (percent by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Fence Line GMPs	GMP01A	6.0 to 13.5	--	5.0	1.6
	GMP07A	6.0 to 13.5	--	8.1	0.7
	GMP08A	4.5 to 9.5	3.0	1.2	1.9
	GMP10	4.0 to 6.5	--	--	1.9
	GMP11A	4.0 to 5.5	--	--	5.4
	GMP20	3.5 to 4.5	--	--	0.6
	GMP21	3.5 to 4.5	--	--	1.4
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	10.7
	GMP23	6.0 to 13.5	13.9	12.7	12.7
	GMP24	6.0 to 13.0	11.5	11.7	11.7
Crisp Avenue GMPs	GMP13	6.0 to 12.0	--	--	2.0
	GMP14	6.0 to 10.0	--	--	0.5
	GMP15	6.0 to 12.0	--	--	0.4
	GMP16	5.0 to 10.0	--	--	0.5
	GMP17	6.0 to 10.0	--	--	0.3
	GMP18	6.0 to 12.0	--	--	1.6
	GMP19	4.5 to 5.5	--	--	2.5
	GMP27	4.7 to 22.2	--	--	1.6
	GMP28	6.2 to 21.2	--	--	0.7
	GMP29	6.2 to 18.7	--	--	0.3
	GMP30	4.5 to 17.0	--	--	0.4
	GMP31	6.0 to 16.0	--	--	1.6
	GMP32	4.75 to 14.75	--	--	0.7
Occupied Structure	Building 830 Crawlspace	NA	--	--	0.1
On-Site Utilities	DP1	NA	--	--	0.0
	DP2	NA	--	--	0.0
Passive Vents	PV-01 Influent	NA	--	--	1.0
	PV-01 Carbon 1	NA	--	--	0.5
	PV-01 Hydrosil	NA	--	--	0.1
	PV-02 Influent	NA	--	--	3.4
	PV-02 Carbon 1 ⁽³⁾	NA	--	--	1.6
	PV-02 Hydrosil ⁽³⁾	NA	--	--	1.5
	PV-03 Influent	NA	--	--	0.9
	PV-03 Carbon 1	NA	--	--	0.0
	PV-03 Hydrosil	NA	--	--	0.0

**TABLE 6: CARBON DIOXIDE CONCENTRATIONS, JANUARY–MARCH 2009
(continued)**

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Carbon Dioxide Concentration (percent by volume) ⁽²⁾		
			January 26	February 20	March 24-25
Passive Vents	PV-04 Influent	NA	--	--	7.3
	PV-04 Carbon 1	NA	--	--	2.4
	PV-04 Hydrosil	NA	--	--	0.0
	PV-05 Influent	NA	--	--	0.1
	PV-05 Carbon 1	NA	--	--	0.2
	PV-05 Hydrosil	NA	--	--	0.0

Notes:

- (1) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations, which have therefore not been included in this table: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations will be monitored quarterly (see Section 2.3).
- (2) A double dash (--) indicates a location that was not monitored during the specified event, based on the revised monitoring schedule described in Note (1).
- (3) The PV-02 Carbon 1 and Hydrosil drums are located on the active extraction trailer.

DP discharge point
ft bgs feet below ground surface
GMP gas monitoring probe
NA not applicable
PV passive vent
UCSF University of California, San Francisco

Data from additional (landfill cap) monitoring locations are shown in Appendix B.

TABLE 7: PROBE PRESSURES AT GMPS, JANUARY–MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location	Monitoring Location ID Number ⁽¹⁾	Screened Interval (ft bgs)	Probe Pressure (inches of water) ⁽²⁾		
			January 26	February 20	March 24-25
Fence Line GMPs	GMP01A	6.0 to 13.5	--	0	0
	GMP07A	6.0 to 13.5	--	0	0
	GMP08A	4.5 to 9.5	0	0	0
	GMP10	4.0 to 6.5	--	--	0
	GMP11A	4.0 to 5.5	--	--	0
	GMP20	3.5 to 4.5	--	--	0
	GMP21	3.5 to 4.5	--	--	0
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	0
	GMP23	6.0 to 13.5	0	0	0
	GMP24	6.0 to 13.0	0	0	0
Crisp Avenue GMPs	GMP13	6.0 to 12.0	--	--	0
	GMP14	6.0 to 10.0	--	--	0
	GMP15	6.0 to 12.0	--	--	0
	GMP16	5.0 to 10.0	--	--	0
	GMP17	6.0 to 10.0	--	--	0
	GMP18	6.0 to 12.0	--	--	0
	GMP19	4.5 to 5.5	--	--	0
	GMP27	4.7 to 22.2	--	--	0
	GMP28	6.2 to 21.2	--	--	0
	GMP29	6.2 to 18.7	--	--	0
	GMP30	4.5 to 17.0	--	--	0
	GMP31	6.0 to 16.0	--	--	0
GMP32	4.75 to 14.75	--	--	0	

Notes:

(1) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations, which have therefore not been included in this table: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations will be monitored quarterly (see Section 2.3).

(2) A double dash (--) indicates a location that was not monitored during the specified event, based on the revised monitoring schedule described in Note (1).

ft bgs feet below ground surface
GMP gas monitoring probe
UCSF University of California, San Francisco

TABLE 8: GROUNDWATER ELEVATIONS, MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Monitoring Location ID Number	TOC Elev. (ft above msl)	Ground Surface Elev. (ft above msl)	March 24		
			Depth to Water (ft btoc)	Depth to Water (ft bgs)	Groundwater Elevation (ft above msl)
GMP27	21.66	22.15	10.57	11.06	11.09
GMP28	20.17	20.71	14.64	15.18	5.53
GMP29	18.48	18.92	12.93	13.37	5.55
GMP30	16.62	17.06	11.39	11.83	5.23
GMP31	15.34	15.78	11.01	11.45	4.33
GMP32	14.02	14.59	10.02	10.59	4.00
IR01MW02B	20.61	19.16	14.03	12.58	6.58
IR01MW03A	19.89	19.46	13.41	12.98	6.48
IR01MW05A	22.56	20.44	16.59	14.47	5.97
IR01MW10A	13.75	13.93	8.40	8.58	5.35
IR01MW11A	17.96	15.9	12.41	10.35	5.55
IR01MW12A	18.25	16.28	12.56	10.59	5.69
IR01P03AA	21.86	19.7	15.82	13.66	6.04
IR01P03AB	19.87	20.47	13.17	13.77	6.70
IR01P04A	21.61	19.29	15.60	13.28	6.01
IR74MW01A	13.16	13.88	10.71	11.43	2.45
IR76MW13A	19.69	20.04	14.21	14.56	5.48

Notes:

bgs below ground surface
 btoc below top of casing
 ft feet
 GMP gas monitoring probe
 IR Installation Restoration
 msl mean sea level
 MW monitoring well
 TOC top of casing

TABLE 9a: DAILY METEOROLOGICAL DATA, JANUARY 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
1/1/2009	4.69	161.0	25.25	46.16	94.27	0.01	41.43	30.12	0.01
1/2/2009	8.49	225.4	16.40	48.80	90.19	0.01	42.93	29.95	0.02
1/3/2009	4.26	237.9	31.71	44.87	70.92	0.01	34.84	30.03	0.03
1/4/2009	3.38	212.7	22.05	43.59	73.31	0.02	34.19	30.15	0.05
1/5/2009	4.77	175.9	19.35	45.63	85.81	0.13	39.19	30.18	0.18
1/6/2009	3.48	170.0	31.69	47.97	90.25	0.03	42.29	30.25	0.21
1/7/2009	4.98	258.2	23.42	46.96	89.25	0.00	41.13	30.21	0.21
1/8/2009	4.31	225.2	24.72	47.67	91.10	0.00	42.17	30.17	0.21
1/9/2009	3.72	175.9	41.09	49.76	69.63	0.01	37.67	30.26	0.22
1/10/2009	5.89	160.7	26.35	54.27	47.88	0.00	36.23	30.46	0.22
1/11/2009	2.92	169.9	51.81	51.47	65.99	0.00	39.34	30.40	0.22
1/12/2009	4.15	185.6	45.13	59.81	53.32	0.00	42.56	30.26	0.22
1/13/2009	3.43	175.9	42.29	58.64	58.17	0.00	43.16	30.26	0.22
1/14/2009	2.32	125.6	44.06	55.29	65.71	0.00	42.17	30.17	0.22
1/15/2009	3.31	153.5	49.03	55.94	57.27	0.00	39.60	30.12	0.22

Notes:

Daily meteorological data are averages of hourly data except for daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

⁽¹⁾ Cumulative precipitation is based on a January–December season.

°F degrees Fahrenheit
% percent
in. inches
mph miles per hour

TABLE 9a: DAILY METEOROLOGICAL DATA, JANUARY 2009 (continued)

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
1/16/2009	2.23	150.3	42.27	55.99	57.97	0.00	40.42	30.20	0.22
1/17/2009	2.32	136.6	41.35	53.76	70.34	0.00	42.48	30.19	0.22
1/18/2009	2.45	164.3	38.13	53.89	70.02	0.00	42.42	30.23	0.22
1/19/2009	2.37	176.8	47.67	55.58	58.36	0.00	39.87	30.19	0.22
1/20/2009	2.12	172.9	44.62	54.59	61.17	0.00	40.32	30.09	0.22
1/21/2009	4.92	111.2	39.43	54.51	65.78	0.03	42.31	29.98	0.25
1/22/2009	4.20	141.5	25.09	52.17	98.35	0.21	47.64	29.98	0.46
1/23/2009	2.59	148.1	34.42	53.33	99.61	0.08	48.94	30.02	0.54
1/24/2009	9.08	266.8	12.95	51.57	89.32	0.00	45.24	30.12	0.54
1/25/2009	13.36	294.1	10.20	49.73	73.27	0.00	40.14	30.03	0.54
1/26/2009	5.24	220.5	20.49	47.84	64.41	0.00	35.89	30.10	0.54
1/27/2009	4.66	161.8	26.23	48.49	45.25	0.00	30.19	30.43	0.54
1/28/2009	4.05	189.2	40.38	49.11	75.40	0.00	39.54	30.39	0.54
1/29/2009	4.88	172.5	40.37	53.82	62.49	0.00	39.49	30.29	0.54
1/30/2009	5.79	160.6	17.56	52.80	73.80	0.00	42.33	30.24	0.54
1/31/2009	4.76	212.0	26.34	50.10	87.04	0.00	43.27	30.13	0.54

Notes:

Daily meteorological data are averages of hourly data except for daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

⁽¹⁾ Cumulative precipitation is based on a January–December season.

°F degrees Fahrenheit

% percent

in. inches

mph miles per hour

TABLE 9b: DAILY METEOROLOGICAL DATA, FEBRUARY 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
2/1/2009	2.42	211.6	46.35	53.44	66.67	0.00	39.58	30.17	0.54
2/2/2009	2.83	162.3	41.18	53.55	72.50	0.00	43.01	30.18	0.54
2/3/2009	3.03	227.9	38.40	54.67	71.66	0.00	43.13	30.03	0.54
2/4/2009	4.60	189.2	35.42	52.92	78.42	0.00	43.66	29.93	0.54
2/5/2009	8.24	163.7	13.94	53.37	85.16	0.02	46.03	29.89	0.56
2/6/2009	5.79	163.8	22.99	52.11	93.10	0.13	46.56	29.80	0.69
2/7/2009	5.96	202.6	26.97	52.81	78.98	0.00	44.00	29.84	0.69
2/8/2009	8.86	237.7	20.02	50.14	84.43	0.13	42.97	29.86	0.82
2/9/2009	10.43	300.4	15.32	46.75	67.64	0.01	35.83	29.94	0.83
2/10/2009	8.05	238.4	25.75	46.05	71.80	0.06	36.40	30.14	0.89
2/11/2009	6.70	247.8	23.37	48.34	84.96	0.06	41.44	30.09	0.95
2/12/2009	6.01	219.8	19.35	47.75	78.13	0.00	39.41	30.12	0.95
2/13/2009	8.74	199.7	28.74	47.03	78.53	0.36	38.83	29.95	1.31
2/14/2009	13.04	160.4	11.62	48.76	77.02	0.03	40.10	29.94	1.34

Notes:

Daily meteorological data are averages of hourly data except for daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

⁽¹⁾ Cumulative precipitation is based on a January–December season.

°F degrees Fahrenheit
% percent
in. inches
mph miles per hour

TABLE 9b: DAILY METEOROLOGICAL DATA, FEBRUARY 2009 (continued)

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
2/15/2009	15.99	133.3	12.74	48.83	87.16	0.96	42.37	29.70	2.30
2/16/2009	13.63	168.6	12.26	49.64	81.81	0.38	41.95	29.59	2.68
2/17/2009	11.76	204.5	16.60	50.71	81.94	0.18	43.00	29.88	2.86
2/18/2009	4.42	172.6	26.27	51.41	79.68	0.00	42.94	30.19	2.86
2/19/2009	3.26	173.0	33.95	52.54	72.23	0.00	41.76	30.16	2.86
2/20/2009	2.57	161.5	39.54	53.77	73.76	0.00	43.43	30.11	2.86
2/21/2009	5.30	126.1	38.59	53.90	78.67	0.00	44.90	30.01	2.86
2/22/2009	10.86	170.2	12.89	54.54	93.41	0.40	48.78	29.98	3.26
2/23/2009	13.29	186.2	11.08	56.16	91.41	0.10	49.81	30.05	3.36
2/24/2009	4.79	211.2	32.98	53.42	84.28	0.02	45.60	30.13	3.38
2/25/2009	7.22	188.4	13.97	54.15	83.68	0.01	46.37	30.11	3.39
2/26/2009	9.00	267.9	21.32	52.90	85.25	0.02	45.53	30.17	3.41
2/27/2009	5.23	174.9	27.92	50.69	66.29	0.00	39.10	30.16	3.41
2/28/2009	3.41	163.3	41.40	55.57	72.76	0.00	44.98	30.01	3.41

Notes:

Daily meteorological data are averages of hourly data except for daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

⁽¹⁾ Cumulative precipitation is based on a January–December season.

°F degrees Fahrenheit

% percent

in. inches

mph miles per hour

TABLE 9c: DAILY METEOROLOGICAL DATA, MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
3/1/2009	9.34	179.0	24.21	56.63	82.50	0.08	48.34	29.96	3.49
3/2/2009	15.43	204.6	13.41	56.24	84.38	0.25	48.33	29.90	3.74
3/3/2009	12.81	211.2	15.75	52.36	78.94	0.23	43.75	29.89	3.97
3/4/2009	7.34	217.1	23.67	50.20	68.59	0.01	39.26	29.98	3.98
3/5/2009	7.24	178.6	28.07	50.52	76.53	0.69	41.46	30.12	4.67
3/6/2009	8.83	270.2	17.25	50.40	74.02	0.00	40.87	30.11	4.67
3/7/2009	6.21	251.7	21.52	50.32	81.95	0.00	42.51	30.08	4.67
3/8/2009	9.28	259.0	15.15	51.29	70.97	0.00	40.85	29.99	4.67
3/9/2009	8.09	271.3	18.78	47.32	53.71	0.00	32.55	30.08	4.67
3/10/2009	5.87	201.7	24.20	47.84	59.94	0.00	34.62	30.12	4.67
3/11/2009	4.80	234.4	27.08	49.84	66.73	0.00	38.18	30.03	4.67
3/12/2009	8.78	275.6	17.19	50.84	82.51	0.00	43.13	30.09	4.67
3/13/2009	10.43	248.0	23.96	50.07	83.27	0.00	42.69	30.11	4.67
3/14/2009	12.28	274.2	13.11	49.94	72.11	0.00	40.03	30.04	4.67
3/15/2009	9.12	195.3	14.57	53.72	88.27	0.03	46.97	30.09	4.70

Notes:

Daily meteorological data are averages of hourly data except for daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

⁽¹⁾ Cumulative precipitation is based on a January–December season.

°F degrees Fahrenheit
% percent
in. inches
mph miles per hour

TABLE 9c: DAILY METEOROLOGICAL DATA, MARCH 2009 (continued)

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
3/16/2009	8.16	211.3	15.08	56.06	92.44	0.02	49.89	30.22	4.72
3/17/2009	6.64	232.2	15.41	55.43	88.83	0.00	48.55	30.26	4.72
3/18/2009	6.40	216.9	18.35	54.91	84.35	0.00	46.93	30.14	4.72
3/19/2009	8.80	275.3	15.56	56.09	80.34	0.00	47.23	29.98	4.72
3/20/2009	11.12	264.2	14.50	52.02	90.28	0.00	45.89	29.91	4.72
3/21/2009	12.19	241.0	12.37	52.82	81.87	0.06	44.82	29.93	4.78
3/22/2009	16.24	295.9	13.55	48.56	62.70	0.06	36.24	30.14	4.84
3/23/2009	9.55	307.6	13.86	49.14	53.09	0.00	33.77	30.30	4.84
3/24/2009	7.51	262.9	17.78	51.62	75.53	0.00	42.20	30.21	4.84
3/25/2009	9.31	266.2	16.24	53.22	80.68	0.00	44.70	30.11	4.84
3/26/2009	9.04	274.5	20.16	55.09	76.94	0.00	45.54	30.00	4.84
3/27/2009	8.69	273.1	16.79	57.11	73.11	0.00	45.94	29.98	4.84
3/28/2009	8.40	270.2	16.71	55.37	76.78	0.00	45.72	29.93	4.84
3/29/2009	10.95	287.6	15.13	54.68	60.01	0.00	39.74	29.93	4.84
3/30/2009	10.62	295.1	18.88	54.88	45.49	0.00	34.90	30.05	4.84
3/31/2009	10.12	250.0	16.45	53.50	72.68	0.00	42.86	30.04	4.84

Notes:

Daily meteorological data are averages of hourly data except for daily precipitation, which is the sum of hourly precipitation data, and cumulative precipitation, which is the season-to-date total at the end of each day.

⁽¹⁾ Cumulative precipitation is based on a January–December season.

°F degrees Fahrenheit

% percent

in. inches

mph miles per hour

TABLE 10: MONTHLY METEOROLOGICAL SUMMARIES, JANUARY 2008–MARCH 2009

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Standard Deviation of Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Monthly Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches) ⁽¹⁾
January 2008 ⁽²⁾	7.38	174.67	24.40	48.55	81.17	5.42	40.75	30.03	5.42
February 2008	7.32	226.49	24.77	50.80	78.99	0.84	41.86	30.08	6.26
March 2008	8.63	266.86	18.78	52.45	72.96	0.05	41.79	30.15	6.31
April 2008	10.92	262.79	16.70	53.40	67.62	0.05	41.25	30.08	6.36
May 2008	10.85	262.20	16.94	56.10	73.44	0.00	45.03	29.94	6.36
June 2008	11.65	269.29	15.18	58.40	71.91	0.00	46.12	29.94	6.36
July 2008	12.15	273.29	13.36	59.53	81.17	0.00	51.01	29.90	6.36
August 2008	11.40	270.95	14.54	60.39	82.13	0.00	51.42	29.86	6.36
September 2008	9.01	268.35	14.95	61.66	74.57	0.00	50.00	29.89	6.36
October 2008	7.57	250.37	22.82	60.84	68.40	0.16	46.97	30.02	6.52
November 2008	5.59	229.25	25.54	57.07	81.08	0.69	47.93	30.09	7.21
December 2008	5.82	198.16	27.06	49.06	80.09	0.67	40.91	30.08	7.88
January 2009	4.49	183.6	32.32	51.42	72.76	0.54	40.63	30.18	0.54
February 2009	7.34	193.8	25.39	51.64	79.33	2.87	42.91	30.00	3.41
March 2009	9.34	248.2	17.90	52.52	74.82	1.43	42.53	30.06	4.84

Notes:

Monthly meteorological data are averages of hourly measurements except for monthly precipitation, which is the sum of hourly precipitation data, and cumulative precipitation (based on a calendar-year season), which is the season-to-date total on the last day of each month.

⁽¹⁾ Cumulative precipitation is based on a calendar-year season.

⁽²⁾ Some data for January 2008 were obtained from the National Climatic Data Service archives for the San Francisco Airport (see Section 2.3).

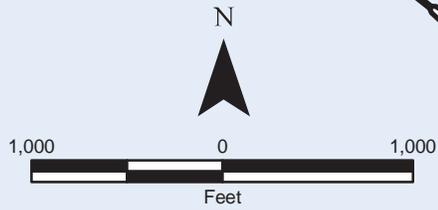
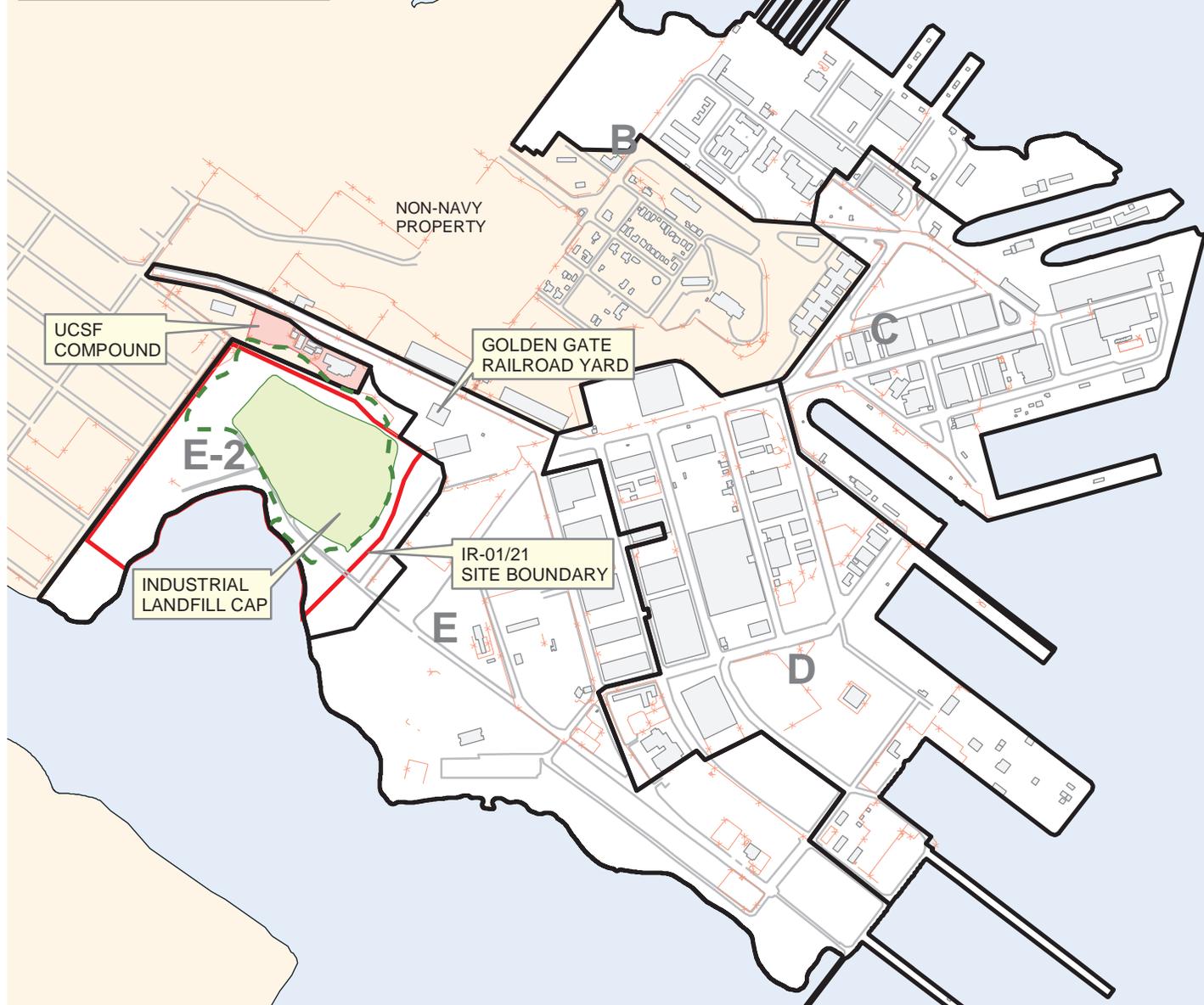
°F degrees Fahrenheit

% percent

in. inches

mph miles per hour

FIGURES



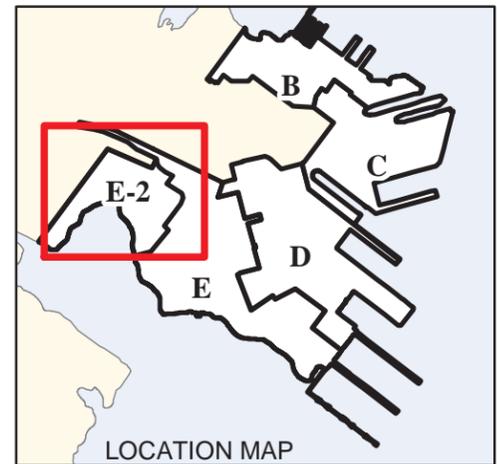
2002/02-125 Navy-HP/SCTO-0013 (15) Parcel E Landfill Gas/graphics/GIS/ITSI Figures/Site Location Map.mxd



Quarterly Landfill Gas Monitoring Report
Hunters Point Shipyard
San Francisco, California

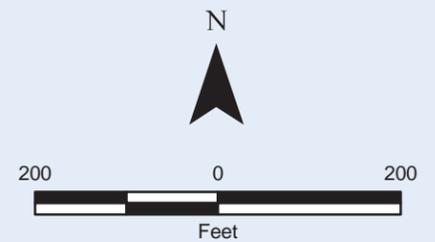
FIGURE 1
Site Location Map

2002/02-125 Navy HPS/CTO-0013 (1.9) Parcel E Landfill Gas/GIS/IT SI Figures/Landfill Gas.mxd



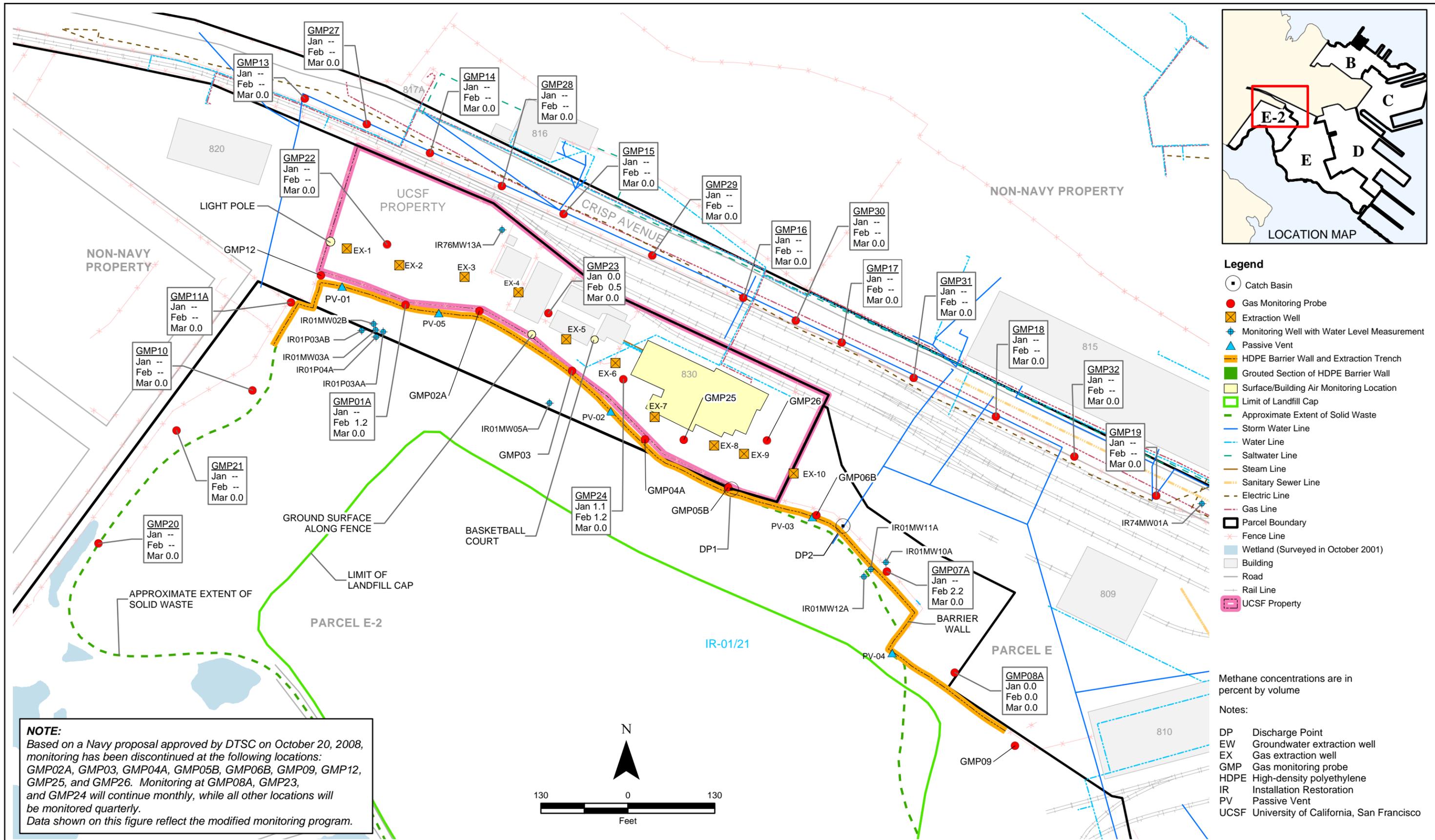
- Legend**
- Gas Monitoring Probe
 - ⊠ Gas Extraction Well
 - ⊕ Monitoring Well with Water Level Measurement
 - ⊕ Other Monitoring Well
 - ▲ Passive Vent
 - Catch Basin Discharge Point
 - ⊕ Former Location of Groundwater Extraction System Well/Vault
 - Grouted Section of HDPE Barrier Wall
 - ⊕ Groundwater Extraction System Piezometer
 - HDPE Barrier Wall and Extraction Trench
 - ⊕ Meteorological Station
 - Surface/Building Air Monitoring Location
 - Limit of Landfill Cap
 - Approximate Extent of Solid Waste
 - Sheet Pile Wall
 - Storm Water Line
 - Water Line
 - Saltwater Line
 - Steam Line
 - Sanitary Sewer Line
 - Electric Line
 - Gas Line
 - Fence Line
 - Parcel Boundary
 - Wetland (Surveyed in October 2001)
 - Building
 - Road
 - Rail Line
 - UCSF Property
 - Non-Navy Property
 - Industrial
 - Open Space
 - Research and Development
 - Residential

- Notes:**
- EX Gas extraction well
 - GMP Gas monitoring probe
 - HDPE High-density polyethylene
 - IR Installation Restoration
 - PV Passive Vent
 - UCSF University of California, San Francisco



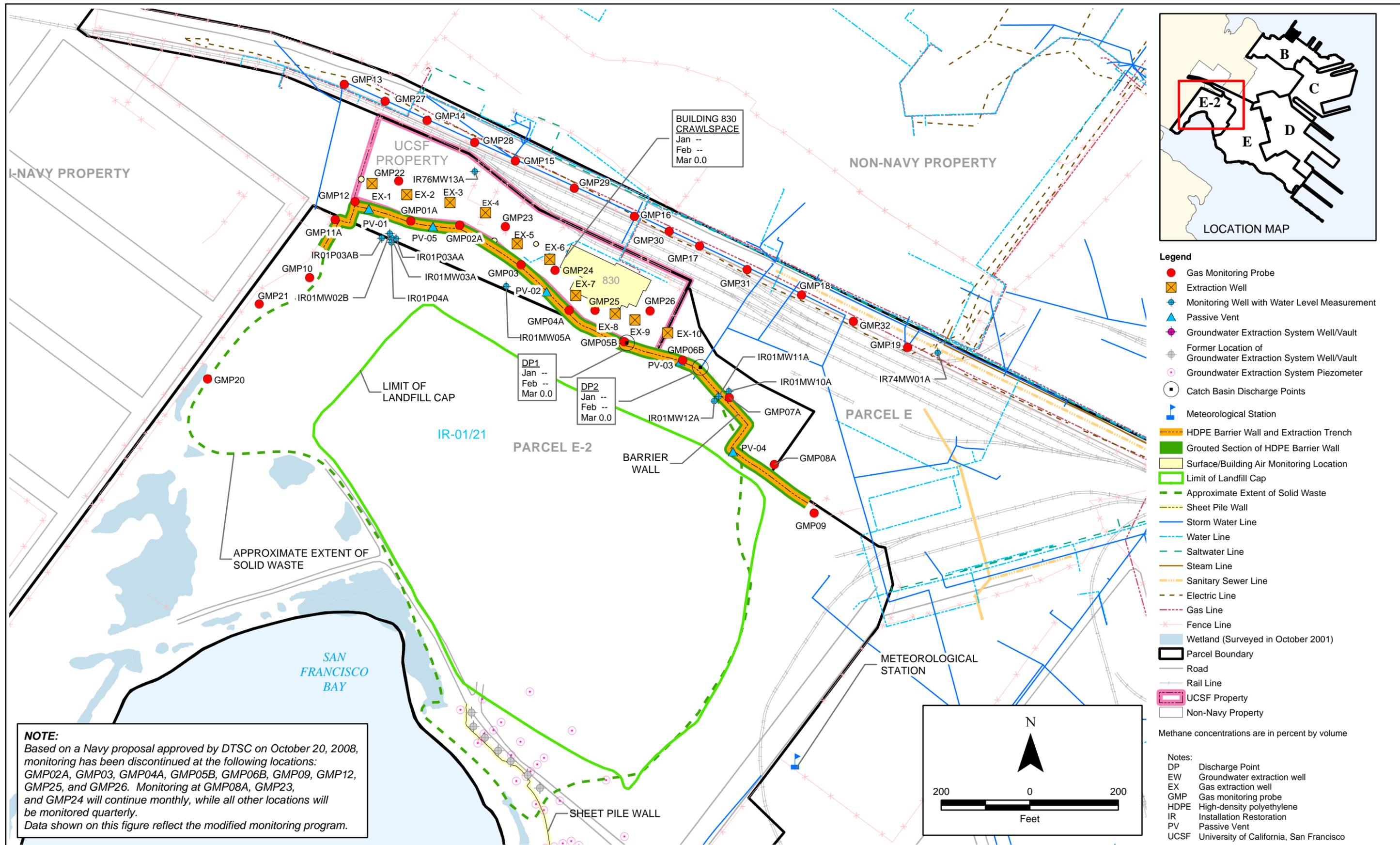
Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 2
 Site Map and
 Landfill Gas Monitoring Locations



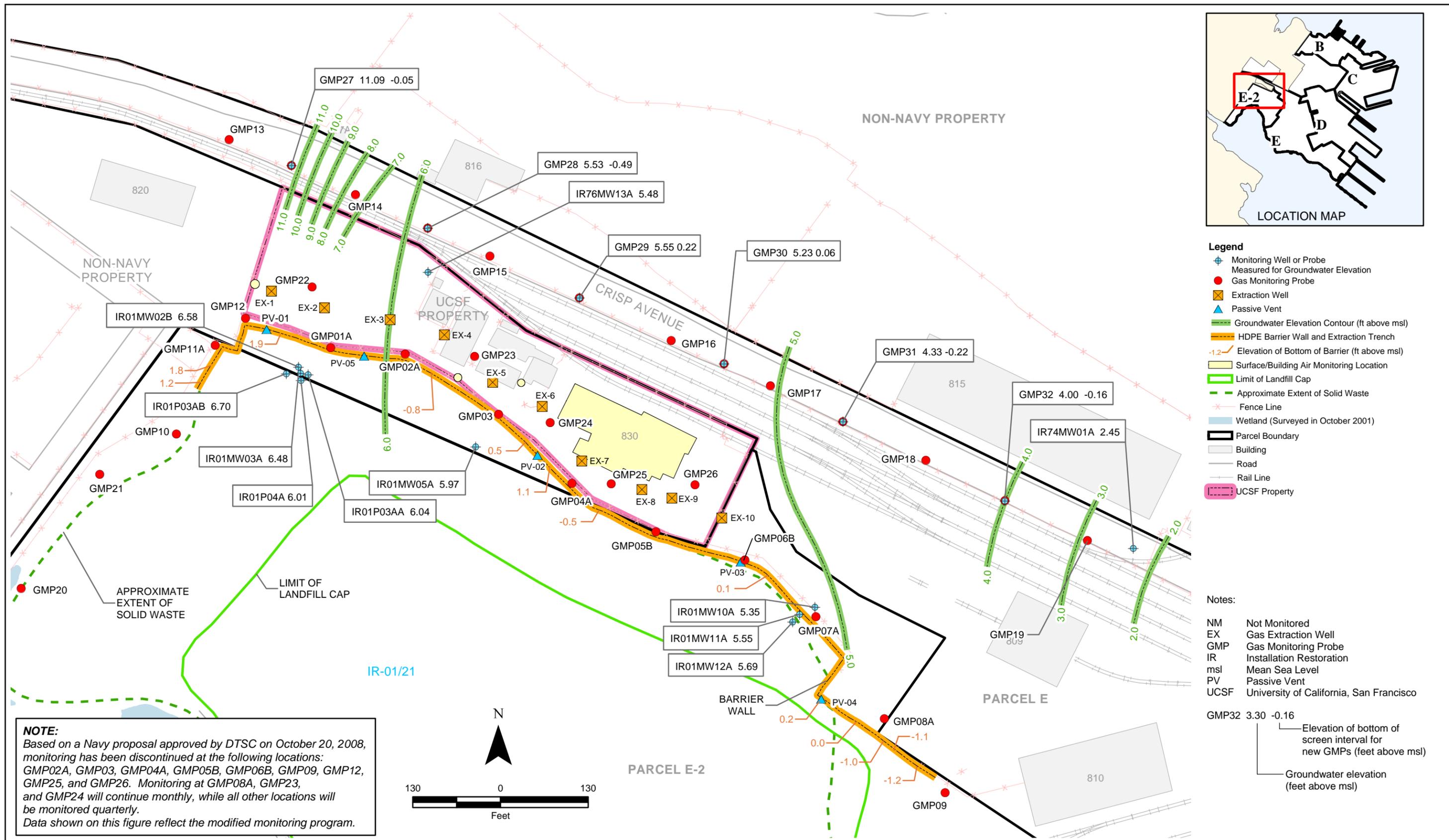
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Hunters Point Shipyard
San Francisco, California

FIGURE 3
Methane Concentrations at GMPs
January - March 2009



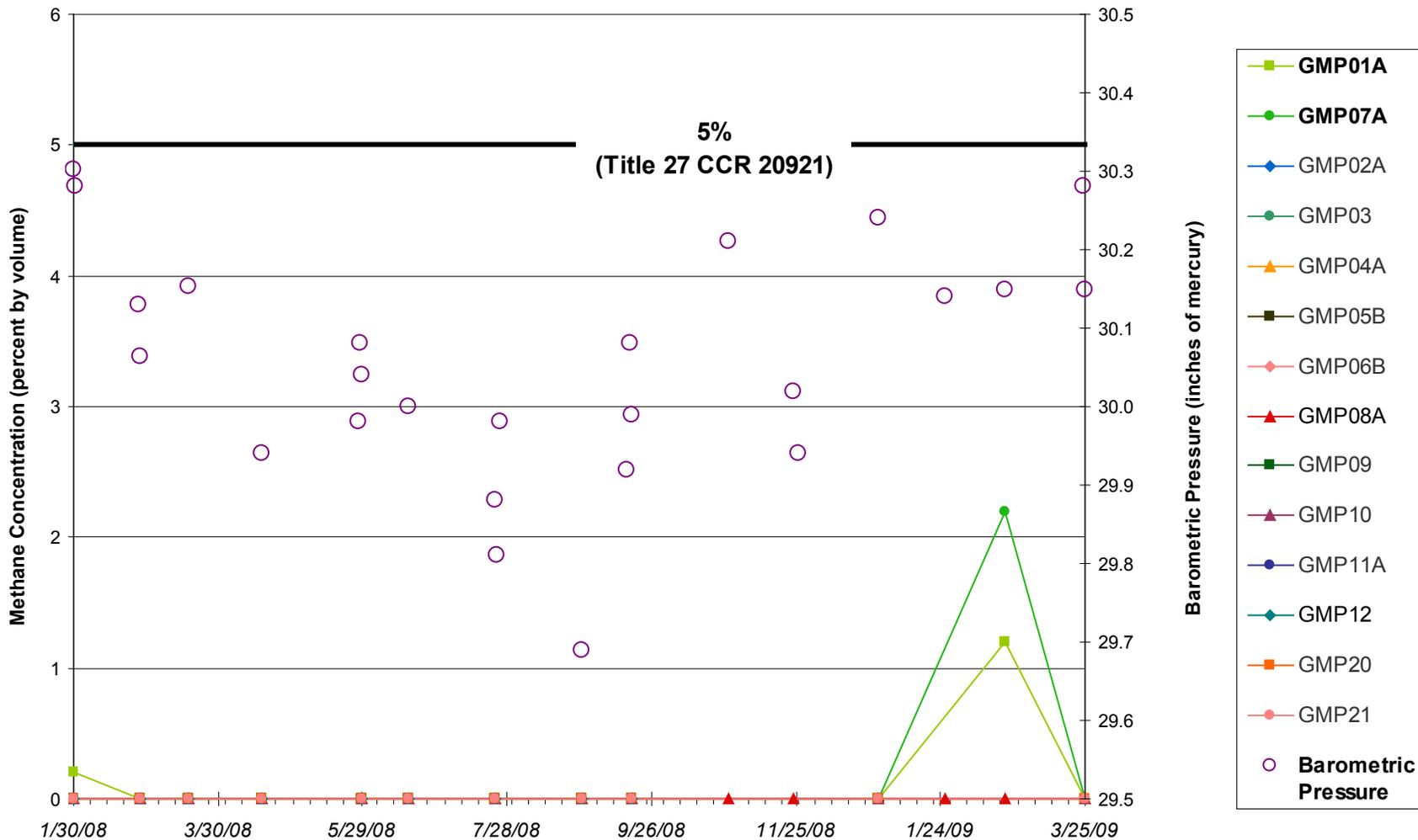
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 Hunters Point Shipyard
 San Francisco, California

FIGURE 4
 Methane Concentrations at Structural Locations
 January - March 2009



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Hunters Point Shipyard
San Francisco, California

FIGURE 5
Groundwater Potentiometric Surface Map
March 24, 2009



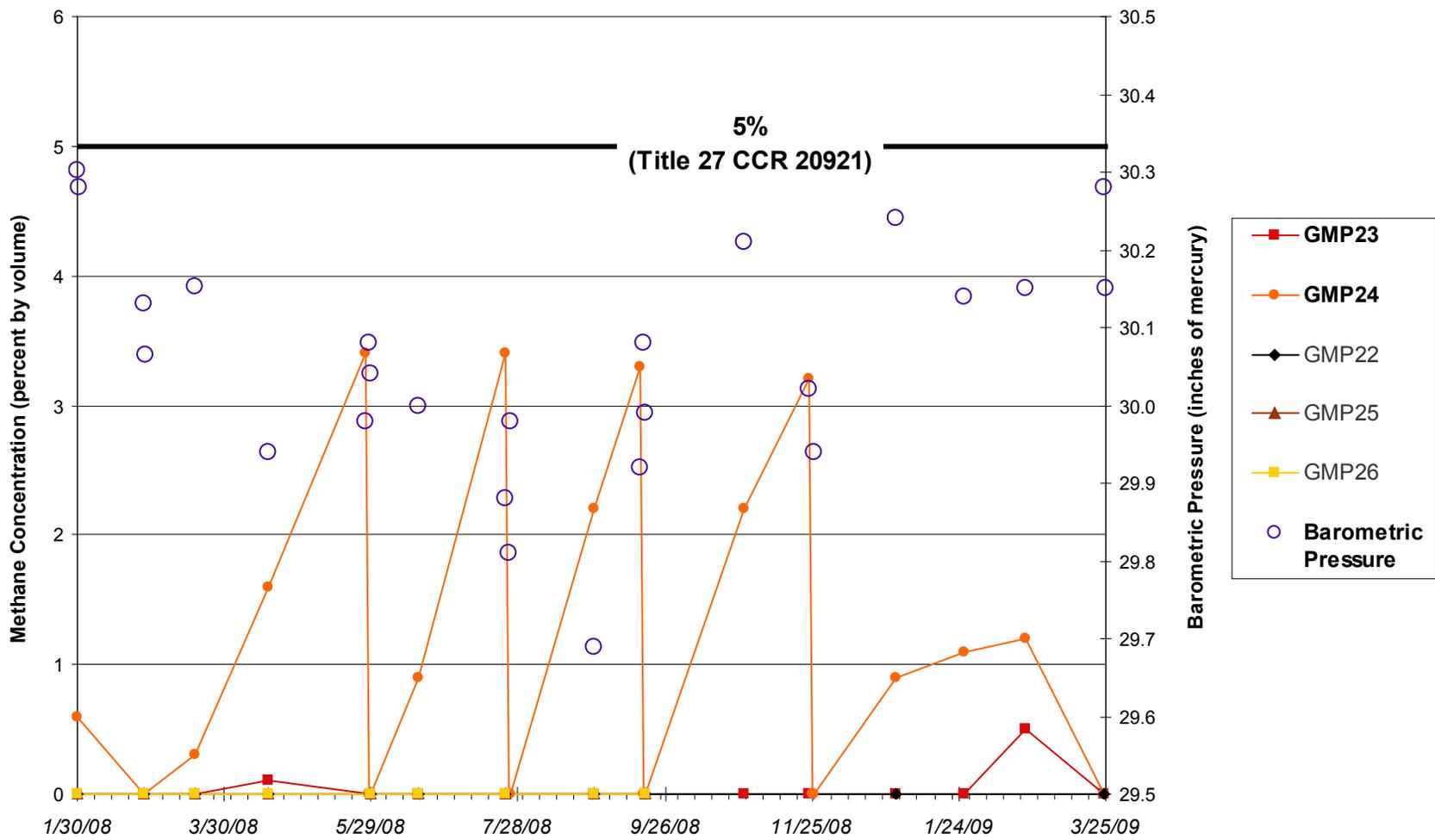
Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following. Fence Line locations: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, and GMP12. Monitoring at GMP08A will continue monthly, while all other locations will be monitored quarterly (see Section 2.3 of the report text). GMPs with methane detections during the indicated interval are shown with legend entries in bold. Periods of active gas extraction are specified in Section 2.3.1 of the report text.

27 CCR Title 27 of the California Code of Regulations
 GMP Gas monitoring probe



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 6
 Methane Concentrations and
 Barometric Pressures for GMPs
 at the Fence Line
 January 2008-March 2009



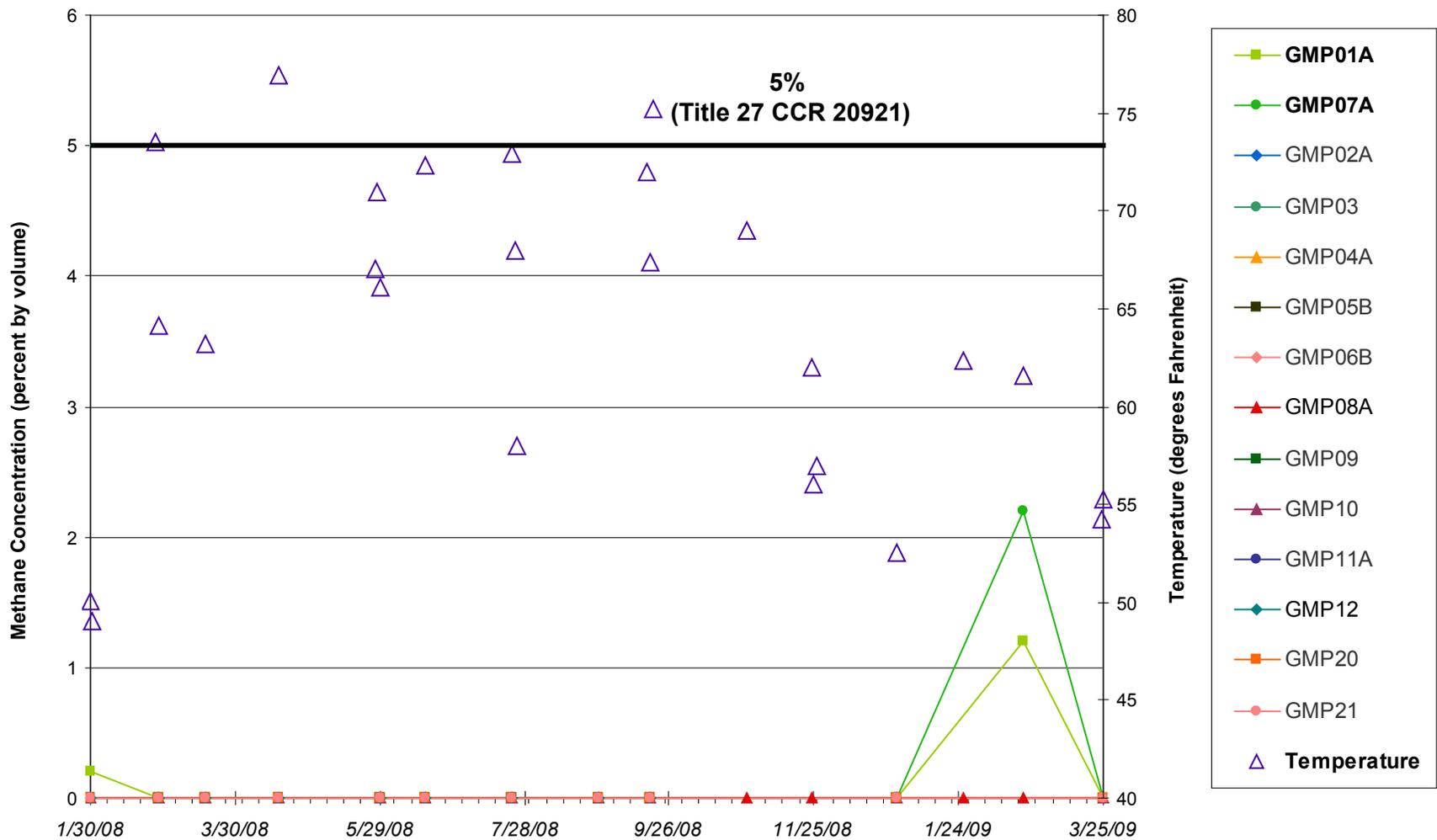
Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following UCSF locations: GMP25 and GMP26. Monitoring at GMP23 and GMP24 will continue monthly, while GMP22 will be monitored quarterly (see Section 2.3 of the report text). GMPs with methane detections during the indicated interval are shown with legend entries in bold. In addition to scheduled monitoring results, data shown on this figure reflect follow-up monitoring at GMP24 in October 2007, and May, July, September, and November 2008. Periods of active extraction are specified in Section 2.3.1 of the report text.

27 CCR Title 27 of the California Code of Regulations
 GMP Gas monitoring probe
 UCSF University of California, San Francisco



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 7
 Methane Concentrations and Barometric Pressures for GMPs at the UCSF Compound January 2008-March 2009



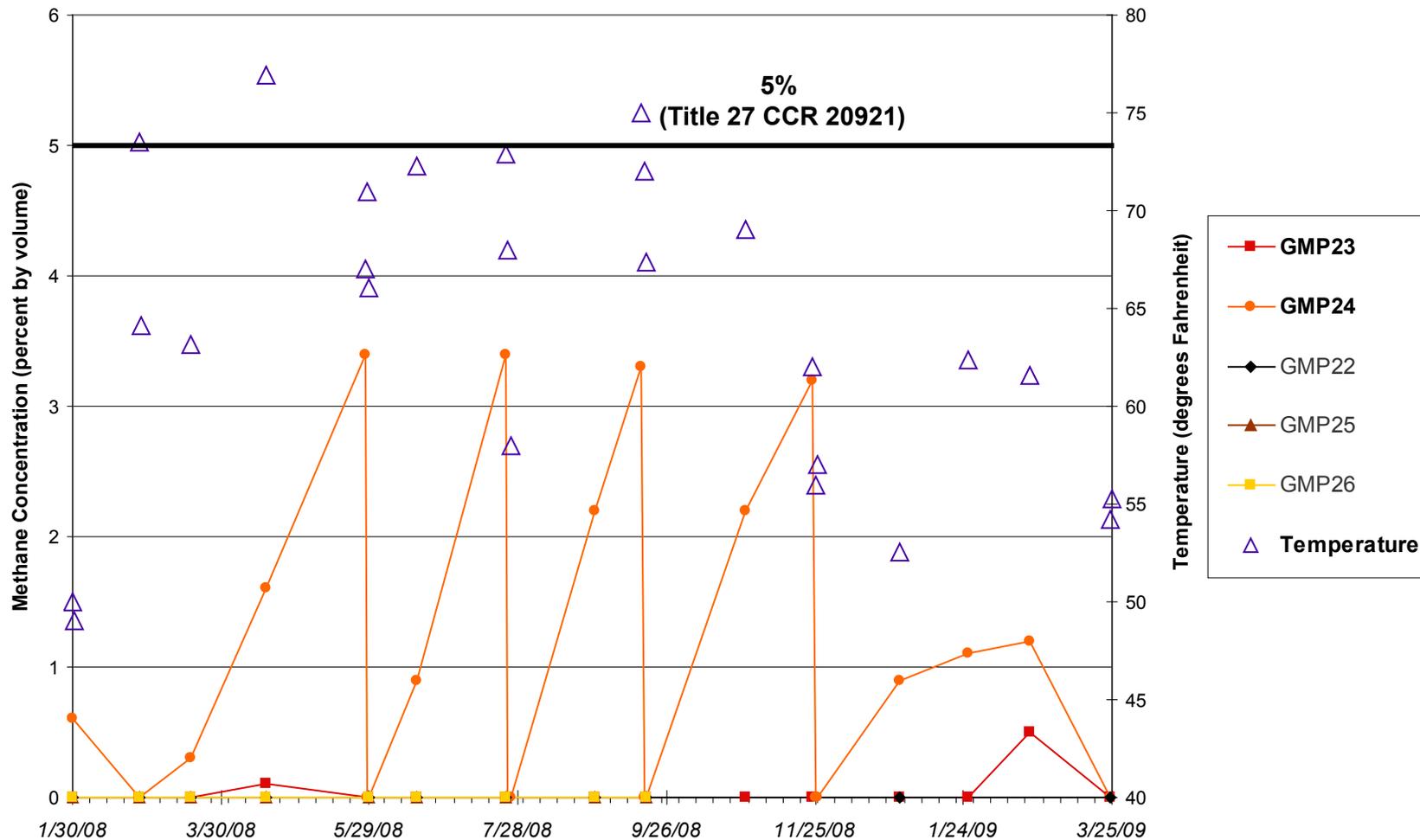
Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following Fence Line locations: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, and GMP12. Monitoring at GMP08A will continue monthly, while all other Fence Line locations will be monitored quarterly (see Section 2.3 of the report text). GMPs with methane detections during the indicated interval are shown with legend entries in bold. Periods of active gas extraction are specified in Section 2.3.1 of the report text.

27 CCR Title 27 of the California Code of Regulations
 GMP Gas monitoring probe



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 8
 Methane Concentrations and
 Temperatures for
 GMPs at the Fence Line
 January 2008-March 2009



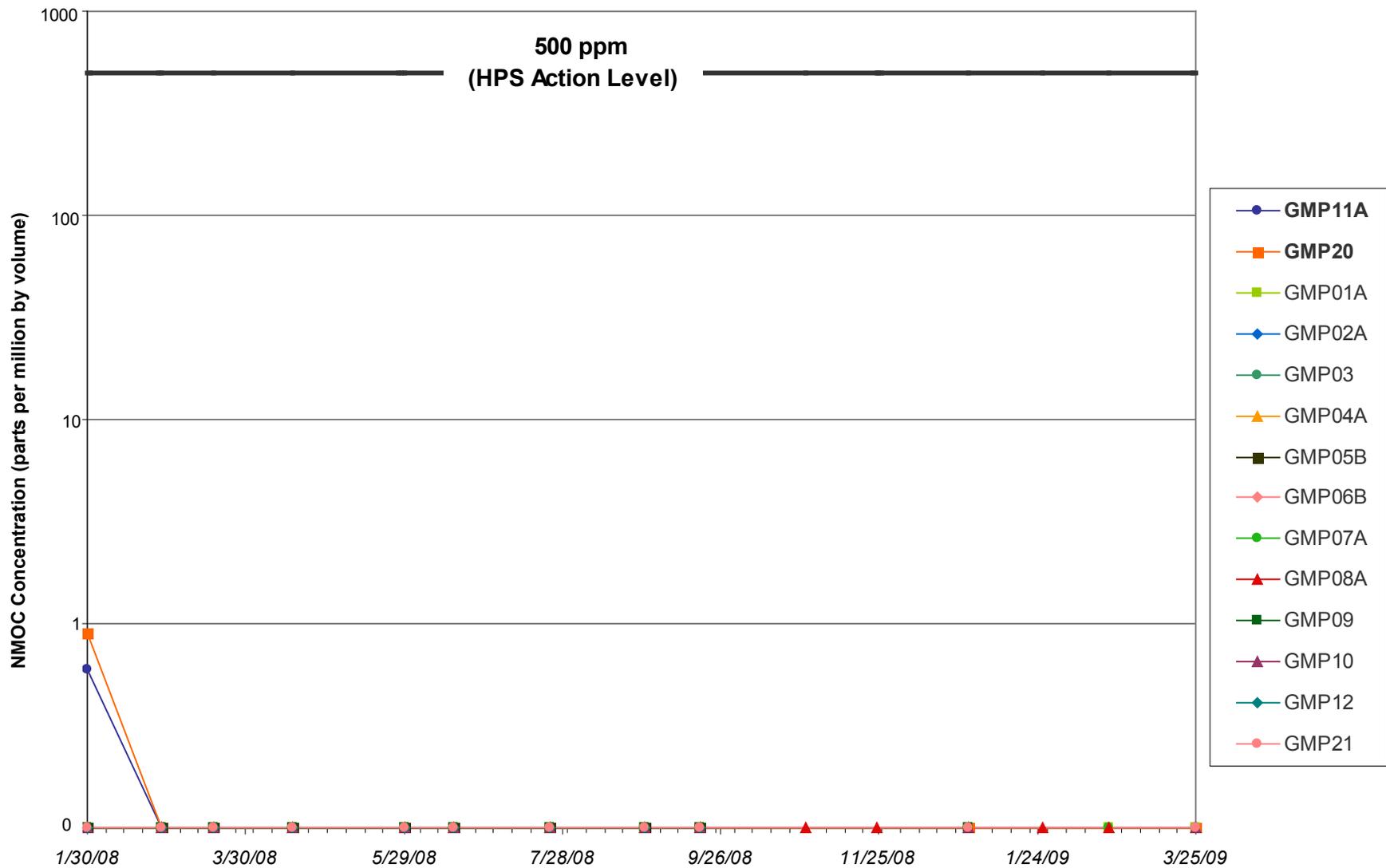
Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following UCSF locations: GMP25 and GMP26. Monitoring at GMP23 and GMP24 will continue monthly, while GMP22 will be monitored quarterly (see Section 2.3 of the report text). In addition to scheduled monitoring results, data shown on this figure reflect follow-up monitoring at GMP24 in October 2007, and in May, July, September, and November 2008. GMPs with methane detections during the indicated interval are shown with legend entries in bold. Periods of active extraction are specified in Section 2.3.1 of the report text.

27 CCR Title 27 of the California Code of Regulations
 GMP Gas monitoring probe
 UCSF University of California, San Francisco



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 9
 Methane Concentrations and
 Temperatures for GMPs
 at the UCSF Compound
 January 2008-March 2009



Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following Fence Line locations: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, and GMP12. Monitoring at GMP08A will continue monthly, while all other Fence Line locations will be monitored quarterly (see Section 2.3 of the report text). GMPs with NMOC detections during the indicated interval are shown with legend entries in bold.

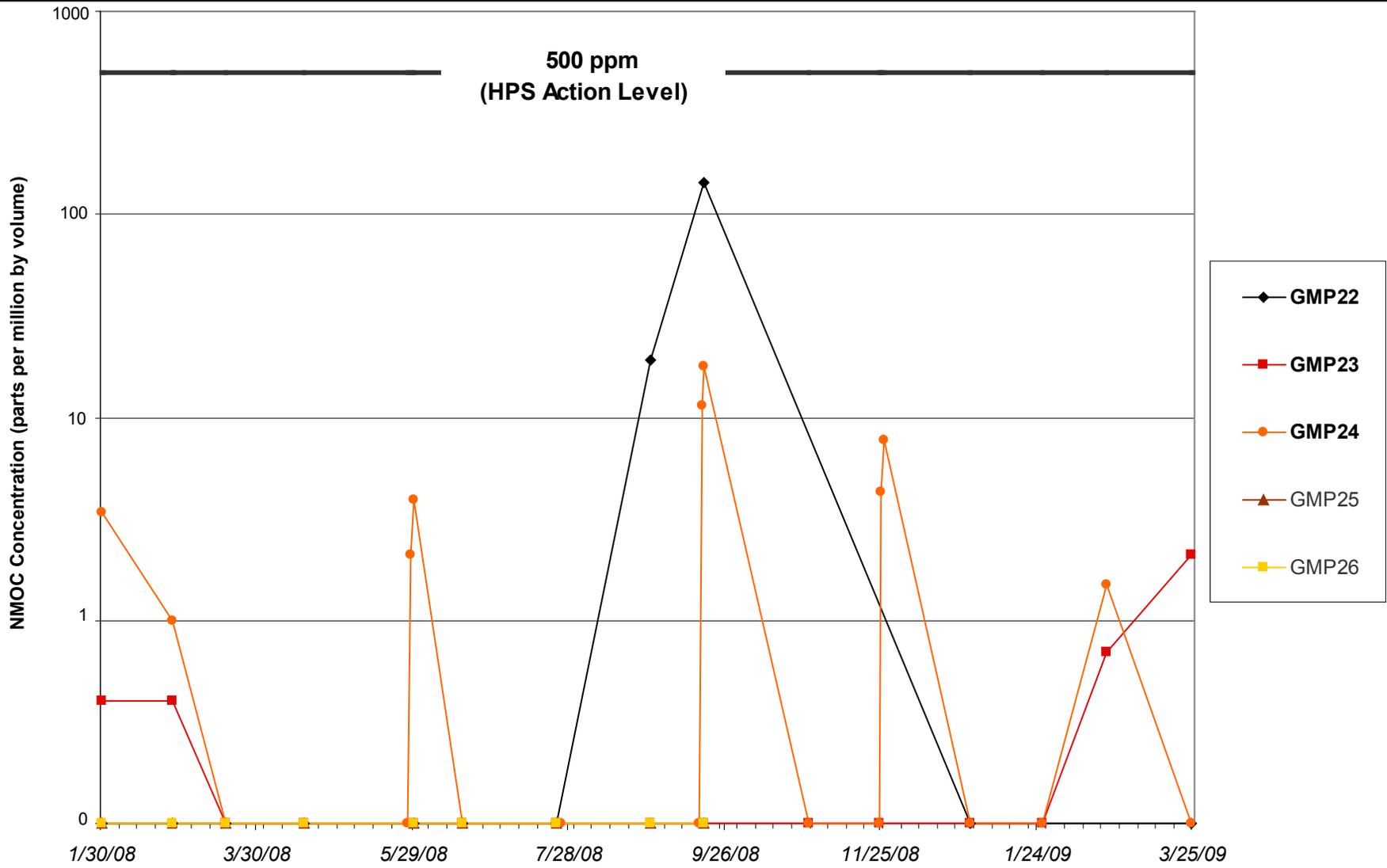
Periods of active gas extraction are specified in Section 2.3.1 of the report text.

GMP Gas monitoring probe
 NMOC Non-methane organic compound



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 10
 NMOC Concentrations for GMPs
 at the Fence Line
 January 2008-March 2009



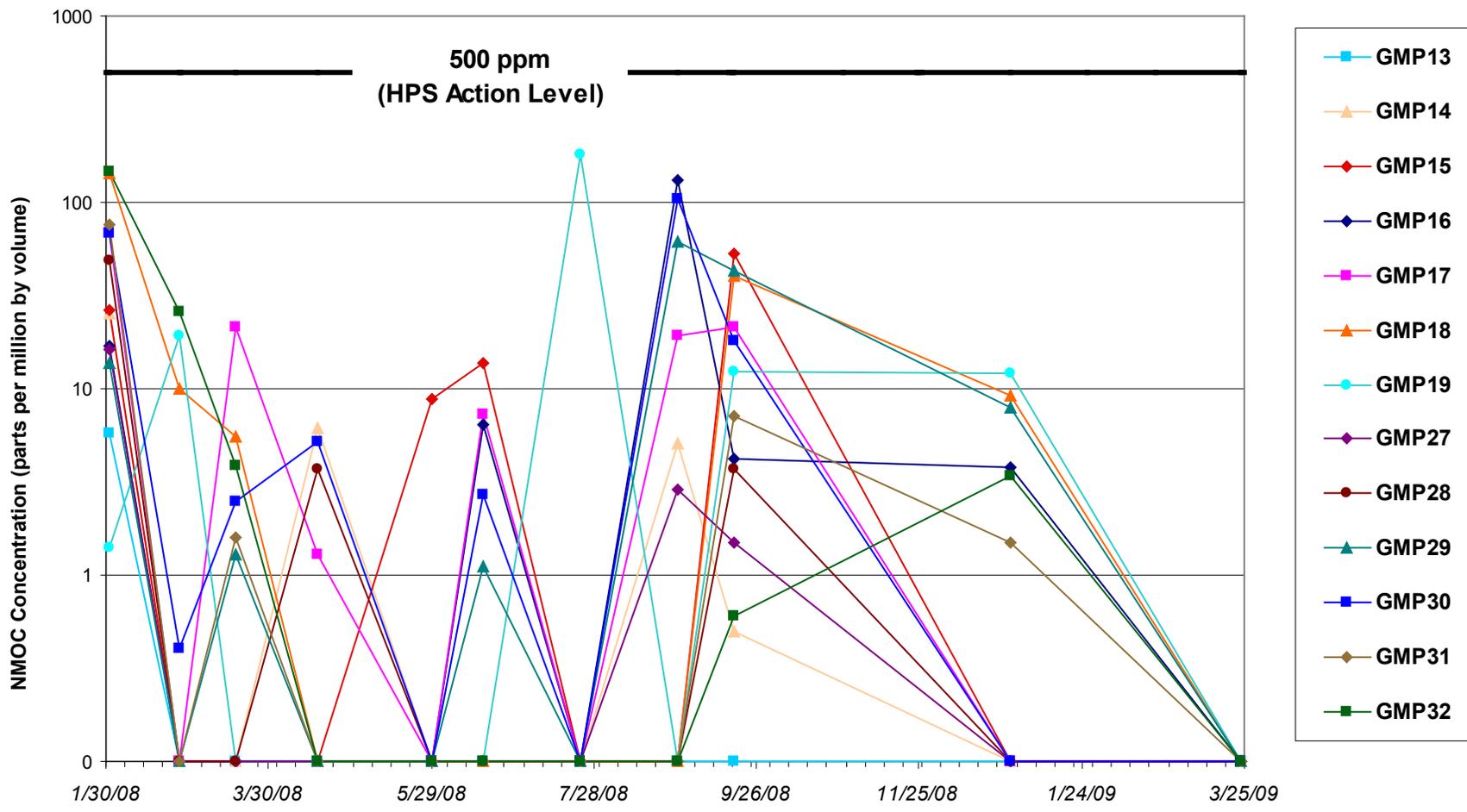
Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following UCSF locations: GMP25 and GMP26. Monitoring at GMP23 and GMP24 will continue monthly, while GMP22 will be monitored quarterly (see Section 2.3 of the report text). GMPs with NMOC detections during the indicated interval are shown with legend entries in bold. In addition to scheduled monitoring results, data shown on this figure reflect followup monitoring at GMP24 in October 2007, and in May, July, September, and November 2008. Periods of active gas extraction are specified in Section 2.3.1 of the report text.

GMP Gas monitoring probe
 NMOC Non-methane organic compound
 UCSF University of California, San Francisco



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 11
 NMOC Concentrations for GMPs
 at the UCSF Compound
 January 2008-March 2009



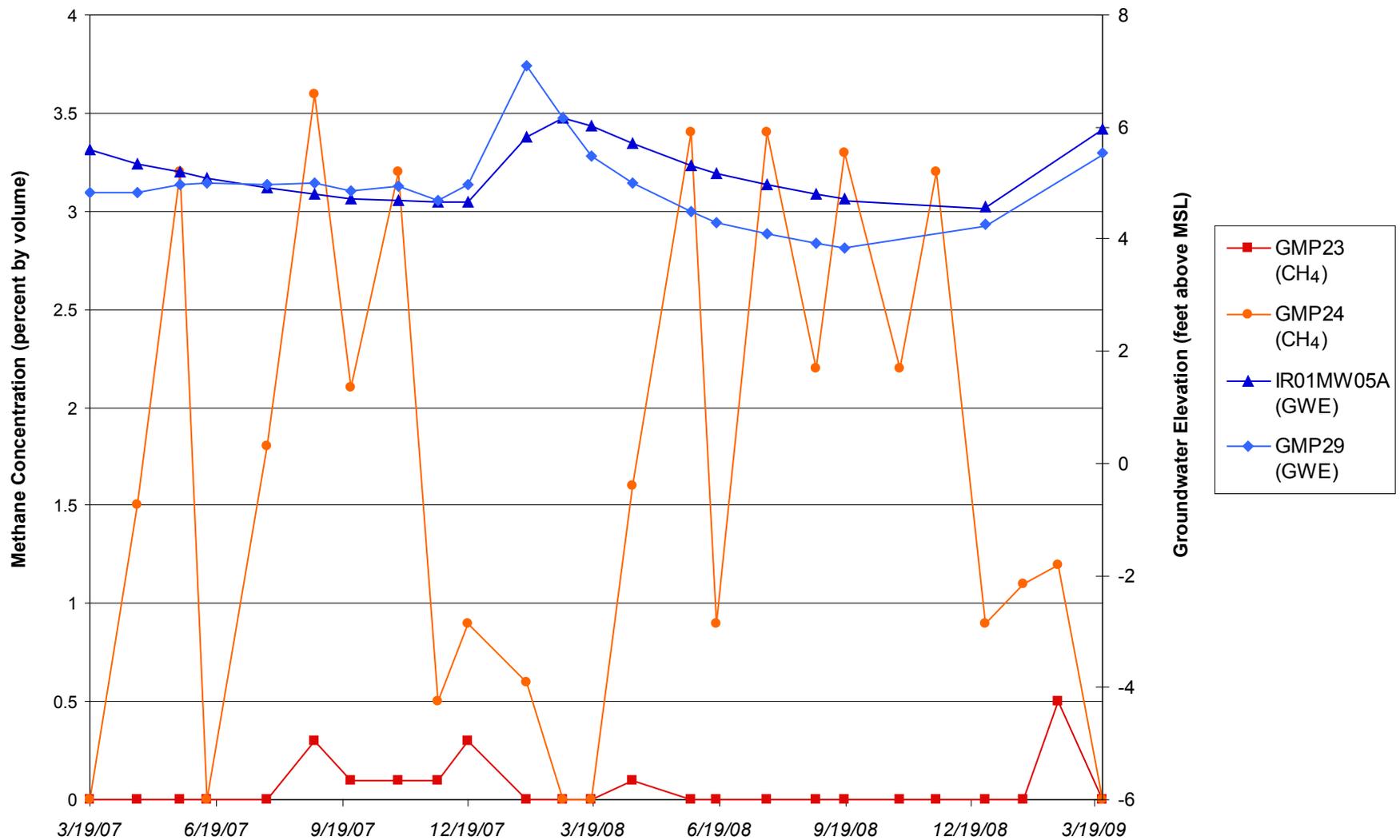
Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, all Crisp Avenue locations will be monitored quarterly rather than monthly (see Section 2.3 of the report text). GMPs with NMOC detections during the indicated interval are shown with legend entries in bold. Periods of active gas extraction are specified in Section 2.3.1 of the report text.

GMP Gas monitoring probe
 NMOC Non-methane organic compound



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 12
 NMOC Concentrations for
 GMPs on Crisp Avenue
 January 2008-March 2009



Notes: Based on a Navy proposal approved by DTSC on October 20, 2008, all water level measurements will be collected quarterly rather than monthly (see Section 2.3 of the report text). Groundwater elevations are shown in blue for the two groundwater monitoring locations nearest GMP23 and GMP24. Methane concentrations are shown in shades of red.

CH4 Methane
 GWE Groundwater elevation, feet above mean sea level
 GMP Gas monitoring probe



Quarterly Landfill Gas Monitoring Report
 Hunters Point Shipyard
 San Francisco, California

FIGURE 13
 Seasonal Patterns of Methane Concentrations
 and Groundwater Elevations near
 GMP23 and GMP24
 March 2007-March 2009

APPENDIX A

LANDFILL GAS AND WATER-LEVEL MONITORING LOGS

January 26, 2009, monthly gas monitoring

February 20, 2009, monthly gas monitoring

March 24-25, 2009, monthly gas monitoring and quarterly water-level monitoring

Landfill Gas Monitoring Log

Weather: clear, warm

Name: B. Womack

Sampling Location		Date / Time of Measurement	Temp (°F)	Barometric Pressure (in. Hg)	GEM-2000				PID		Soil Gas Pressure (in. H ₂ O)	Notes (e.g., active extraction, flow rate, probe damage instrument issues)
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)				Methane (%)	CO ₂ (%)	O ₂ (%)	Percent of LEL	Non-Methane VOCs (ppm)	Bckgrd. NMOCs (ppm)		
GMP08A	Gas Monitoring Probe	1/26/2009 12:46	63	30.17	0.0	3.0	5.5	0	0.0	0.0	0	
GMP23	Gas Monitoring Probe	1/26/2009 12:58	59	30.15	0.0	13.9	0.2	0	0.0	0.0	0	
GMP24	Gas Monitoring Probe	1/26/2009 13:04	65	30.11	1.1	11.5	0.0	22	0.0	0.0	0	

Legend:

- % percent by volume
- °F degrees Fahrenheit
- CO₂ carbon dioxide
- GEM-2000 CES-LANDTEC landfill gas meter
- in. Hg inches of mercury
- in. H₂O inches of water
- LEL lower explosive limit
- NMOC non-methane organic compound
- O₂ oxygen
- PID photoionization detector
- ppm parts per million
- VOC volatile organic compound
- [Shaded cell] denotes methane detection

Landfill Gas Monitoring Log

Weather: partly cloudy, cool

Name: B. Womack

Sampling Location		Date / Time of Measurement	Temp (°F)	Barometric Pressure (in. Hg)	GEM-2000				PID		Soil Gas Pressure (in. H ₂ O)	Notes (e.g., active extraction, flow rate, probe damage instrument issues)
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)				Methane (%)	CO ₂ (%)	O ₂ (%)	Percent of LEL	Non-Methane VOCs (ppm)	Bckgrd. NMOCs (ppm)		
GMP01A	Gas Monitoring Probe	2/20/2009 13:03	63	30.11	1.2	5.0	5.9	24	0.0	0.0	0	
GMP07A	Gas Monitoring Probe	2/20/2009 12:53	62	30.15	2.2	8.1	0.0	44	0.0	0.0	0	
GMP08A	Gas Monitoring Probe	2/20/2009 12:39	58	30.16	0.0	1.2	7.4	0	0.0	0.0	0	
GMP23	Gas Monitoring Probe	2/20/2009 12:24	61	30.17	0.5	12.7	0.0	10	0.7	0.0	0	
GMP24	Gas Monitoring Probe	2/20/2009 12:30	64	30.15	1.2	11.7	0.0	24	1.5	0.0	0	

Notes:

Based on a Navy proposal approved by DTSC on 20 October 2008, monitoring has been discontinued at GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. These locations are therefore not included in this table.

Legend:

- | | | | |
|-----------------------|--------------------------------|------------------|------------------------------|
| %: | percent by volume | NA: | not applicable |
| °F: | degrees Fahrenheit | NMOC: | non-methane organic compound |
| CO ₂ : | carbon dioxide | O ₂ : | oxygen |
| GEM-2000: | CES-LANDTEC landfill gas meter | PID: | photoionization detector |
| in. Hg: | inches of mercury | ppm: | parts per million |
| in. H ₂ O: | inches of water | VOC: | volatile organic compound |
| LEL: | lower explosive limit | | |

Landfill Gas Monitoring Log

Weather: clear, cool

Name: B. Womack

Sampling Location		Date / Time of Measurement	Temp (°F)	Barometric Pressure (in. Hg)	GEM-2000				PID		Soil Gas Pressure (in. H ₂ O)	Notes (e.g., active extraction, flow rate, probe damage instrument issues)
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)				Methane (%)	CO ₂ (%)	O ₂ (%)	Percent of LEL	Non-Methane VOCs (ppm)	Bckgrd. NMOCs (ppm)		
IR01MW366A	Landfill Cap Well	3/24/2009 12:26	71	30.27	12.8	5.1	10.1	256	0	0	0	
IR01MWI-5	Landfill Cap Well	3/24/2009 12:37	63	30.24	0.4	0.7	20.1	8	0	0	0	
IR01MW18A	Landfill Cap Well	3/24/2009 13:52	64	30.12	2.5	2.2	19.6	50	0	0	0	
IR01MW16A	Landfill Cap Well	3/25/2009 8:08	51	30.16	16.4	8.8	15.1	328	0	0	0	
GMP-20	Gas Monitoring Probe	3/25/2009 8:13	54	30.15	0	0.6	20.9	0	0	0	0	
GMP-21	Gas Monitoring Probe	3/25/2009 8:22	54	30.15	0	1.4	19.8	0	0	0	0	
GMP-10	Gas Monitoring Probe	3/25/2009 8:27	53	30.15	0	1.9	18.0	0	0	0	0	
GMP-11A	Gas Monitoring Probe	3/25/2009 8:31	50	30.15	0	5.4	13.6	0	0	0	0	
PV-01influent	Passive Sys. Influent	3/25/2009 8:33	51	30.14	0	1.0	20.9	0	0.5	0	NA	
PV-01carbon1	Passive Sys. 1st Carbon	3/25/2009 8:35	53	30.15	0	0.5	21.1	0	0	0	NA	
PV-01hydrosil	Passive Sys. Hydrosil	3/25/2009 8:36	53	30.14	0	0.1	21.2	0	0	0	NA	
GMP-01A	Gas Monitoring Probe	3/25/2009 8:40	56	30.14	0	1.6	17.3	0	0	0	0	
PV-05influent	Passive Sys. Influent	3/25/2009 8:42	56	30.14	0	0.1	21.1	0	0	0	NA	
PV-05carbon1	Passive Sys. 1st Carbon	3/25/2009 8:43	57	30.14	0	0.2	20.9	0	0	0	NA	
PV-05hydrosil	Passive Sys. Hydrosil	3/25/2009 8:44	57	30.15	0	0	21.2	0	0	0	NA	
PV-02influent	Active Sys. Influent	3/25/2009 8:47	62	30.14	1.7	3.4	17.7	34	9.6	0	NA	Active ext. on
PV-02carbon1	Active Sys. 1st Carbon	3/25/2009 8:49	56	30.14	0.6	1.6	19.6	12	5.1	0	NA	Ext. trailer port
PV-02hydrosil	Active Sys. Hydrosil	3/25/2009 8:50	55	30.14	0.5	1.5	19.6	10	2.7	0	NA	Ext. trailer port
DP1	Drainage Catch Basin	3/25/2009 8:54	67	30.15	0	0	21.3	0	0	0	NA	
PV-03influent	Passive Sys. Influent	3/25/2009 8:55	61	30.16	0.2	0.9	20.9	4	0	0	NA	
PV-03carbon1	Passive Sys. 1st Carbon	3/25/2009 8:56	60	30.13	0	0	21.2	0	0	0	NA	
PV-03hydrosil	Passive Sys. Hydrosil	3/25/2009 8:57	61	30.14	0	0	21.2	0	0	0	NA	
DP2	Drainage Catch Basin	3/25/2009 8:59	57	30.13	0	0	21.2	0	0	0	NA	
GMP-07A	Gas Monitoring Probe	3/25/2009 9:02	55	30.16	0	0.7	20.5	0	0	0	0	
PV-04influent	Passive Sys. Influent	3/25/2009 9:06	53	30.14	0	7.3	19.7	0	0	0	NA	
PV-04carbon1	Passive Sys. 1st Carbon	3/25/2009 9:07	54	30.14	0	2.4	20.8	0	0	0	NA	
PV-04hydrosil	Passive Sys. Hydrosil	3/25/2009 9:08	53	30.14	0	0	21.3	0	0	0	NA	
GMP-08A	Gas Monitoring Probe	3/25/2009 9:12	65	30.14	0	1.9	7.2	0	0	0	0	

Landfill Gas Monitoring Log

Weather: clear, cool

Name: B. Womack

Sampling Location		Date / Time of Measurement	Temp (°F)	Barometric Pressure (in. Hg)	GEM-2000				PID		Soil Gas Pressure (in. H ₂ O)	Notes (e.g., active extraction, flow rate, probe damage, instrument issues)
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)				Methane (%)	CO ₂ (%)	O ₂ (%)	Percent of LEL	Non-Methane VOCs (ppm)	Bckgrd. NMOCs (ppm)		
GMP-19	Gas Monitoring Probe	3/24/2009 7:44	47	30.3	0	0.3	20.8	0	0	0	0	
GMP-32	Gas Monitoring Probe	3/24/2009 7:51	48	30.3	0	0.4	20.6	0	0	0	0	
GMP-18	Gas Monitoring Probe	3/24/2009 7:58	51	30.29	0	0.5	20.2	0	0	0	0	
GMP-31	Gas Monitoring Probe	3/24/2009 8:08	48	30.28	0	0.3	20.9	0	0	0	0	
GMP-17	Gas Monitoring Probe	3/24/2009 8:16	48	30.29	0	0.4	20.3	0	0	0	0	
GMP-30	Gas Monitoring Probe	3/24/2009 8:23	50	30.29	0	0.7	19.8	0	0	0	0	
GMP-16	Gas Monitoring Probe	3/24/2009 8:31	52	30.28	0	0.5	20.1	0	0	0	0	
GMP-29	Gas Monitoring Probe	3/24/2009 8:38	57	30.29	0	1.6	17.1	0	0	0	0	
GMP-15	Gas Monitoring Probe	3/24/2009 8:47	60	30.28	0	2.0	16.4	0	0	0	0	
GMP-28	Gas Monitoring Probe	3/24/2009 8:53	55	30.28	0	2.5	15.5	0	0	0	0	
GMP-14	Gas Monitoring Probe	3/24/2009 9:02	59	30.28	0	0.8	19.3	0	0	0	0	
GMP-27	Gas Monitoring Probe	3/24/2009 9:09	63	30.28	0	1.6	16.9	0	0	0	0	
GMP-13	Gas Monitoring Probe	3/24/2009 9:15	57	30.27	0	1.6	16.1	0	0	0	0	
GMP-22	Gas Monitoring Probe	3/24/2009 9:24	60	30.26	0	10.7	0.4	0	0	0	0	
GMP-23	Gas Monitoring Probe	3/24/2009 9:28	57	30.27	0	12.7	1.8	0	2.1	0	0	
830crawlspc	Bldg. 830 Ambient	3/24/2009 9:33	58	30.26	0	0.1	20.8	0	0	0	NA	
GMP-24	Gas Monitoring Probe	3/24/2009 9:32	56	30.26	0	11.7	0	0	0	0	0	

Notes: Based on a Navy proposal approved by DTSC on 20 October 2008, monitoring has been discontinued at GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. These locations are therefore not included in this table. Temperature data taken from on-site Hunters Point meteorological tower.

Legend:

%:	percent by volume	NA:	not applicable
°F:	degrees Fahrenheit	NMOC:	non-methane organic compound
CO ₂ :	carbon dioxide	O ₂ :	oxygen
GEM-2000:	CES-LANDTEC landfill gas meter	PID:	photoionization detector
in. Hg:	inches of mercury	ppm:	parts per million
in. H ₂ O:	inches of water	VOC:	volatile organic compound
LEL:	lower explosive limit		

Water Level Monitoring Log

Weather: clear, cool

Name: B. Womack

Location ID	Description (for example, GMP / Well / Carbon / Hydrosil)	Date/Time	Water Level (feet below top of casing)	Depth to Water (feet below ground surface)	Groundwater Elevation (feet above mean sea level)
IR74MW01A	Well	3/24/2009 7:27	10.71	11.43	2.45
GMP-32	Gas Monitoring Probe	3/24/2009 7:58	10.02	10.59	4.00
GMP-31	Gas Monitoring Probe	3/24/2009 8:12	11.01	11.45	4.33
GMP-30	Gas Monitoring Probe	3/24/2009 8:28	11.39	11.83	5.23
GMP-29	Gas Monitoring Probe	3/24/2009 8:42	12.93	13.37	5.55
GMP-28	Gas Monitoring Probe	3/24/2009 8:57	14.64	15.18	5.53
GMP-27	Gas Monitoring Probe	3/24/2009 9:12	10.57	11.06	11.09
IR76MW13A	Well	3/24/2009 9:25	14.21	14.56	5.48
IR01MW02B	Well	3/24/2009 14:09	14.03	12.58	6.58
IR01MW03A	Well	3/24/2009 14:10	13.41	12.98	6.48
IR01P03AA	Well	3/24/2009 14:11	15.82	13.66	6.04
IR01P04A	Well	3/24/2009 14:12	15.60	13.28	6.01
IR01P03AB	Well	3/24/2009 14:13	13.17	13.77	6.70
IR01MW05A	Well	3/24/2009 14:18	16.59	14.47	5.97
IR01MW12A	Well	3/24/2009 14:20	12.56	10.59	5.69
IR01MW11A	Well	3/24/2009 14:21	12.41	10.35	5.55
IR01MW10A	Well	3/24/2009 14:35	8.40	8.58	5.35

APPENDIX B

OTHER MONITORING RESULTS

**TABLE B-1: METHANE, NMOC, OXYGEN, AND CARBON DIOXIDE
CONCENTRATIONS AT LANDFILL CAP WELLS, MARCH 2009**

Landfill Gas Monitoring Report for January–March 2009, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location ⁽¹⁾	Methane (% by volume)	NMOC (ppmv)	Oxygen (% by volume)	Carbon Dioxide (% by volume)
MARCH 25, 2009⁽²⁾				
IR01MW16A	16.4	0	15.1	8.8
IR01MW18A	2.5	0	19.6	2.2
IR01MW366A	12.8	0	10.1	5.1
IR01MWI-5	0.4	0	20.1	0.7

Notes:

- (1) The regulatory limit of 5% methane does not apply to these monitoring wells, which are located on the landfill (locations are shown on Figure 2).
- (2) Based on a Navy proposal approved by DTSC on October 20, 2008, monitoring has been discontinued at the following locations: GMP02A, GMP03, GMP04A, GMP05B, GMP06B, GMP09, GMP12, GMP25, and GMP26. Monitoring at GMP08A, GMP23, and GMP24 will continue monthly, while all other locations, including the landfill cap wells reported in this table, will be monitored quarterly (see Section 2.3).

IR Installation Restoration
 MW Monitoring well
 NMOC Non-methane organic compound
 ppmv parts per million by volume
 % percent