LANDFILL GAS MONITORING REPORT FOR OCTOBER-DECEMBER 2015

Post-Removal Action, Parcel E-2, Industrial Landfill
Hunters Point Naval Shipyard, San Francisco, California

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Acronyms and Abbreviations

%	percent
^{o}F	degrees Fahrenheit
§	Section 27 CCRTitle 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
btoc	below top of casing
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIWMB	California Integrated Waste Management Board
CKY	CKY Inc.
DP	discharge point
DTSC	Department of Toxic Substances Control
ft	feet
GMP	gas monitoring probe
HPNS	Hunters Point Naval Shipyard
in.	inches
IR	Installation Restoration
IR-01/21	Installation Restoration Site 01/21
ITSI	Innovative Technical Solutions, Inc.
LEL	lower explosive limit
MCP	Final Interim Landfill Gas Monitoring and Control Plan
mph	miles per hour
msl	mean sea level
MW	monitoring well
NA	not applicable
Navy	U.S. Department of the Navy
NMOC	non-methane organic compound
PG&E	Pacific Gas and Electric
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
VOC	volatile organic compound

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1 Introduction

CKY Inc. (CKY) received Task Order CTO-0007 from the U.S. Department of the Navy (Navy), Base Realignment and Closure Program Management Office, West, under Contract Number N6243-09-D-2626, to provide technical support at Hunters Point Naval Shipyard (HPNS) in San Francisco, California. Under Task Order CTO-0007, CKY is monitoring and controlling migration of landfill gas at the Industrial Landfill in Installation Restoration (IR) Site 01/21 (IR-01/21) within Parcel E-2 at HPNS (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 October, November, and December 2015.

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).

Routine monitoring is performed with handheld field equipment that is calibrated for the constituents of concern prior to monitoring. Values of zero that are reported in this report are from the handheld equipment and not from a fixed laboratory and may be skewed low based on limitations of handheld field equipment. However, the detection limit of the handheld field equipment is low enough to correlate to the action levels at the Parcel E-2 landfill and is appropriate for the compliance monitoring being conducted at Parcel E-2.

1.1 Historical Investigations at the Landfill

In 2002, the Navy conducted an evaluation to characterize and delineate landfill gas 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. The 2002 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 within 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 gas 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%, in accordance with the requirements at 27 CCR §20921(a)(2), and (2) to prevent future migration of landfill gas 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 passive vents (PVs) PV-01 through PV-04 (PV-05 was installed after November 2003), at GMP01A through GMP12 along the

fence immediately north of the landfill, and at GMP20 and GMP21 along the western edge of the landfill. The draft TCRA closeout report contains a detailed summary of monitoring results, potential migration pathways for landfill gas, 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."

Figure 2 shows the Site Map and Landfill Gas Monitoring Locations.

1.2 Purpose and Scope

This quarterly monitoring report presents and summarizes the evaluation of monitoring data collected in October, November, and December, 2015, based on the modified program schedule proposed by the Navy and approved by the Department of Toxic Substances Control (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 monitored GMP and within each on-site structure.
- Concentrations of oxygen, carbon dioxide, and NMOCs measured at each GMP and within each on-site structure in the current program.
- 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 events.
- Names of monitoring personnel, and a brief description of the sampling apparatus and 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 (included in 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 monthly monitoring for landfill gas (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 monthly monitoring events and depth-to-water data for the last month in the reporting period (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 monitoring period.

2 Monitoring Program Objectives and Methodologies

This section discusses the objectives and methodologies of the landfill gas monitoring program at HPNS 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 are 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 gas at closed landfills:

- Concentrations of methane gas must not exceed 1.25% by volume in air (25% of the LEL) within any on-site structure.
- The concentration of methane gas migrating from the landfill must not exceed 5% by volume in air at the property boundary or an alternative boundary approved in accordance with 27 CCR §20925.
- 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). The 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 NMOCs 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% limit for methane at the property boundary (requirement 2 above) does not apply either to 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% methane by design. However, the 5% limit does apply at the GMPs, which are located at various distances outside the Gundwall barrier that reduces the outward migration of landfill gas from the trench and passive vents.

The requirements for monitoring and reporting landfill gas, as set forth in 27 CCR, are 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 that 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 gas monitoring locations are sampled either monthly or quarterly, as specified in the program schedule for each current monitoring location, to evaluate migration from the landfill and 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 gas. The MCP 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 RAE 2000 photoionization detector (PID) 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 Fieldwork Variances

There have been many fieldwork variances as the monitoring and control activity protocols were being established after the TCRA in 2003. Monitoring and control activities began on a consistent basis in January 2004. From that time until August 28, 2004, gas extraction along the landfill gas barrier wall was performed semi-continuously at the points where the highest methane concentrations were observed, PV-02 and PV-03, and occasionally at GMP24 as needed. The control system was operated under non-standardized protocols until the MCP was finalized in August 2004. Several modifications to the initial protocols have been implemented, in accordance with the provisions of the MCP, to refine the program and develop the most effective method of controlling landfill gas 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 was not performed at PV-02 or PV-03 on the day of the monitoring event, due to the concern that this might prevent landfill gas from reaching the PID or the GEM-2000 while other passive vents were being monitored. The 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. The 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.
- From 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.

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 Pacific Gas and Electric (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).

Beginning in May 2005, monthly gas monitoring events were conducted following a period of several days when only passive extraction occurred, and 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 could 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 HPNS Parcel A) along and north of Crisp Avenue, and water level measurements could not be taken at this well 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.

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 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, GMP32, GMP33, GMP34, and GMP35

  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. As of the June 2011 quarterly event, GMPs 17 through GMP21, and GMPs 27 through GMP31 have been replaced by GMP33, GMP34, and GMP35. These replacement probes will be monitored quarterly.

- **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 ppmv 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 historically have had recurring methane detections, although only GMP24 has had action level or regulatory exceedances.

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

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% HPNS action level.

For unknown reasons, meteorological information for the period from 1000 hours on October 26, 2009 (the previous data-collection event), to approximately 0800 hours on November 16, 2009, could not be retrieved from the data-logger for the HPNS meteorological tower. Similar losses of data have occurred since and portions of the data for these instances were obtained from the National Climatic Data Service archives for the San Francisco Airport, accessible at:

http://www.ncdc.noaa.gov/cdo-web/search

At approximately 0500 hours on April 14, 2010, power to the active extraction system was interrupted by PG&E crews working along Crisp Avenue. As an additional precaution, GMP01A and GMP07A were included in the April 2010 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% HPNS action level. Power was reinstated and active extraction resumed at 0930 hours on April 15, 2010.

Except for GMP32, all of the Crisp Avenue GMPs and groundwater monitoring locations (GMP13, GMP14, GMP15, GMP16, GMP17, GMP18, GMP19, GMP27, GMP28, GMP29, GMP30, GMP31, and IR74MW01A) were removed by sewer line removal trenching activities on Crisp Avenue in 2010. These probes were replaced on June 29-30, 2011, by GMP33, GMP34, and GMP35, which were installed to specifications prescribed by the MCP, and incorporated suggestions from the California Department of Resources, Recycling, and Recovery–Closure & Facility Engineering Unit. In addition, water level monitoring locations IR01P03AA and IR01P03AB have been pressure-grouted by the basewide well decommissioning contractor, and are therefore no longer monitored.

At some point between 1300 hours on March 20, 2015, and 0800 hours on March 23, 2015, the electrical line to the active extraction system was severed, presumably by vandalism. The line was repaired and maintenance was performed on the unit. Active extraction resumed at 1500 hours on March 26, 2015.

2.3.1 Current Active Gas Extraction Schedule

During the current monitoring period, active gas extraction was conducted at PV-02 as follows:

System On at PV-02	System Off at PV-02	Hours Run	Notes
April 15, 2010	Ongoing		Active extraction ongoing continuously.
October Operating Hours:		744	
November Operating Hours:		720	
December Operating Hours:		744	
Total Quarterly Operating Hours:		**2,208**	

2.4 Data Evaluation

Results of landfill gas monitoring were evaluated against the performance standards and action levels for methane and NMOCs outlined in the MCP, 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 this reporting period.

2.5 Deviations

It was determined at the November/December 2006 Base Realignment and Closure Cleanup Team (BCT) meeting that while monthly monitoring at HPNS Parcel E-2 remained appropriate, formal reports were 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.

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 representatives of 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 the reporting period based on monitoring measurements recorded in October, November, and December, 2015. This report also includes depth-to-water readings recorded in December, 2015. Appendix A contains the Landfill Gas Monitoring Logs and the Water Level Monitoring Log for this monitoring period. Appendix B summarizes the results of landfill gas monitoring at locations other than those specified in the MCP. These locations (specifically, the groundwater monitoring wells on the landfill cap) are being monitored quarterly to 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 during this reporting period. The 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 location monitored for the three sampling events. Note that all methane concentrations are reported as 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;
- 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, as specified in the modified monitoring program discussed in Section 2.3) are representative of concentrations of methane migrating beyond the site boundary. All fence line GMP readings were below the action level during this monitoring period. The regulatory performance standard of less than 5% methane by volume and the HPNS site action level of 2.5% were therefore met at all fence line GMPs for all monitoring events during the monitoring period. 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) represent an area between the boundary of the landfill and the compliance probes on Crisp Avenue. All UCSF Compound GMP readings were below the action level during this monitoring period. The regulatory performance standard of less than 5% methane by volume and the HPNS site action level of 2.5% were therefore met at all UCSF GMPs for all monitoring events during the monitoring period. Table 3 shows the results for methane at the GMPs in the UCSF Compound.

3.1.3 Crisp Avenue

GMPs located along Crisp Avenue are scheduled to be monitored quarterly. All Crisp Avenue GMP readings were below the action level during this monitoring period. The regulatory performance

standard of less than 5 percent (%) methane by volume and the HPNS site action level of 2.5% were met at all locations. Table 3 shows the results for methane at the GMPs at Crisp Avenue.

3.1.4 Structural Locations

Monitoring for methane was performed in the crawlspace at Building 830 within the UCSF compound and at the remaining on-site utilities locations (catch basins DP1 and DP2). All structural location readings were below the action level during this monitoring period; 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 monitoring event, concentrations of methane at the landfill gas control system (passive vents PV-01 through PV-05) ranged from a high of 9.2% by volume at the PV-01 first carbon location to 0.0 percent by volume for all readings (i.e., influent, first carbon, and hydrosil) collected at PV-03 and PV-05.

3.2 Non-Methane Organic Compound Results

During this monitoring period, 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 this monitoring period. 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 October 2014 through December 2015.

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 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 monitoring period, it was determined that the PID was creating sufficient vacuum to generate accurate readings. A calibrated Mini-RAE 2000 PID was used to attain the NMOC readings. The PID is serviced quarterly, regardless of instrument performance, to prevent any further problems. Quarterly servicing of the PID was performed prior to this monitoring event and will be performed before the next scheduled monitoring event.

During this monitoring period, NMOCs were not detected by the field monitoring instrument in any fence line GMPs.

NMOCs are monitored at three locations at each of the control system PVs: at the influent, after the first carbon canister, and at the effluent sampling port (Hydrosil canister outlet). During this monitoring period, NMOCs were not detected by the field monitoring instrument at any PV monitoring location. NMOC concentrations at all active/passive PV Hydrosil (effluent) locations were below the

corresponding Hunters Point action level (100 ppmv). Similarly, NMOCs were not detected by the field monitoring instrument in the structural monitoring locations DP1, DP2, and Building 830 crawlspace.

When NMOC data indicate that a PV location is approaching saturation (consistent rise in NMOC results), the drum may be 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 carbon and Hydrosil (potassium permanganate) drums also may require occasional replacement due to corrosion of the drum exteriors after several years in operation. The drums were inspected and none of the drums were required to be replaced during this monitoring event.

As all NMOC concentrations were below the corresponding HPNS NMOC action levels, no further action or follow-up monitoring was necessary during this monitoring period.

3.3 Trace Gas Results

Oxygen is not regulated under 27 CCR or BAAQMD Rule 34, but this parameter is monitored because low concentrations of oxygen in soil may be associated with landfill gas. During this monitoring period oxygen concentrations in all GMPs monitored within the UCSF compound and the GMPs along the fence line ranged from well below to slightly below the standard atmospheric concentration of 20.9 percent. Oxygen values in these areas during routine monitoring ranged from 0.0 to 3.3 percent by volume in the UCSF compound GMPs, and from 0.3 to 20.3 percent by volume along the fence line. Three of the seven fence line GMPs monitored had less than 18.0 percent oxygen and all were less than the 20.9 standard atmospheric concentration during this monitoring event. Low-oxygen conditions are consistent with influence from the Parcel E-2 landfill. Table 5 presents the monitoring results for oxygen during the monitoring period.

Carbon dioxide is not regulated under 27 CCR or BAAQMD Rule 34, but carbon dioxide concentrations generally are elevated where landfill gas is present. During the monitoring period, carbon dioxide concentrations in the GMPs closest to the landfill (i.e., those along the fence line and in the UCSF compound) ranged from 0.0 to 17.2 percent by volume, with all but one location (GMP11A) above the standard atmospheric concentration of approximately 0.04 percent (400 ppmv). Carbon dioxide concentrations at probe locations on Crisp Avenue, which are farther away from the landfill, ranged from 0.6 to 4.5 percent by volume. 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. During this monitoring period, gauge pressure at the GMPs (pressure in the probes relative to atmospheric pressure) was measured using a Magnehelic pressure gauge. Pressure was not detected in any of the GMPs monitored during this period. 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, thus 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 December 15, 2015, water levels were measured at twelve locations consisting of groundwater monitoring wells, piezometers, and gas monitoring probes. 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 the surveyed elevations for these locations. 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 December 15, 2015. 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 this monitoring event indicate that the bottom of the barrier wall, which ranges in elevation from -1.2 feet msl (i.e., 1.2 feet below msl) to 1.9 feet 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 historically 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. If for any reason weather data is not available for the on-site station the data is collected from the National Climatic Data Service's closest location to the Site. The location of the on-site meteorological station is considered representative of the HPNS area because the station is located on flat terrain, and data collection is 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 the daily meteorological data collected for October, November, and December 2015, 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 October 2014 through December 2015. 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 illustrate 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 illustrate the daily temperatures and the observed methane concentrations at the same GMPs. Long-term (seasonal) effects on GMPs appear to influence the presence of methane, as further discussed in Section 4.

4 Evaluation of Results

The primary objective of landfill gas monitoring at HPNS 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.

During the October, November, and December 2015 monitoring events, there were no exceedances of methane at any location monitored. Since regular monitoring was initiated in January 2004, activation of the active gas extraction system at GMP24 has been required on twenty-four occasions when methane concentrations at GMP24 have met or exceeded the project action level. In most of the instances for which concurrent groundwater and landfill gas data are available, the groundwater table in the area between IR01MW05A and GMP32 was less than 5.5 feet msl (see Figure 13 for correlation between USCF compound GMPs and water levels). 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.

During this monitoring period, NMOCs were not detected by the field monitoring instrument in any GMPs monitored. Since all NMOC concentrations were below the corresponding action levels, no action or follow-up monitoring was necessary due to NMOC concentrations during the monitoring period.

5 Summary

Landfill gas monitoring and water level measurement activities took place in October, November, and December, 2015.

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.

There were no exceedances of methane at any monitoring location during this monitoring event.

The action levels for NMOCs (established based on an evaluation of previous risk assessments and 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 a control system outlet.

All NMOC results during the monitoring period were below the corresponding NMOC action levels; therefore, no action or follow-up monitoring was necessary due to NMOC concentrations during this period.

6 References

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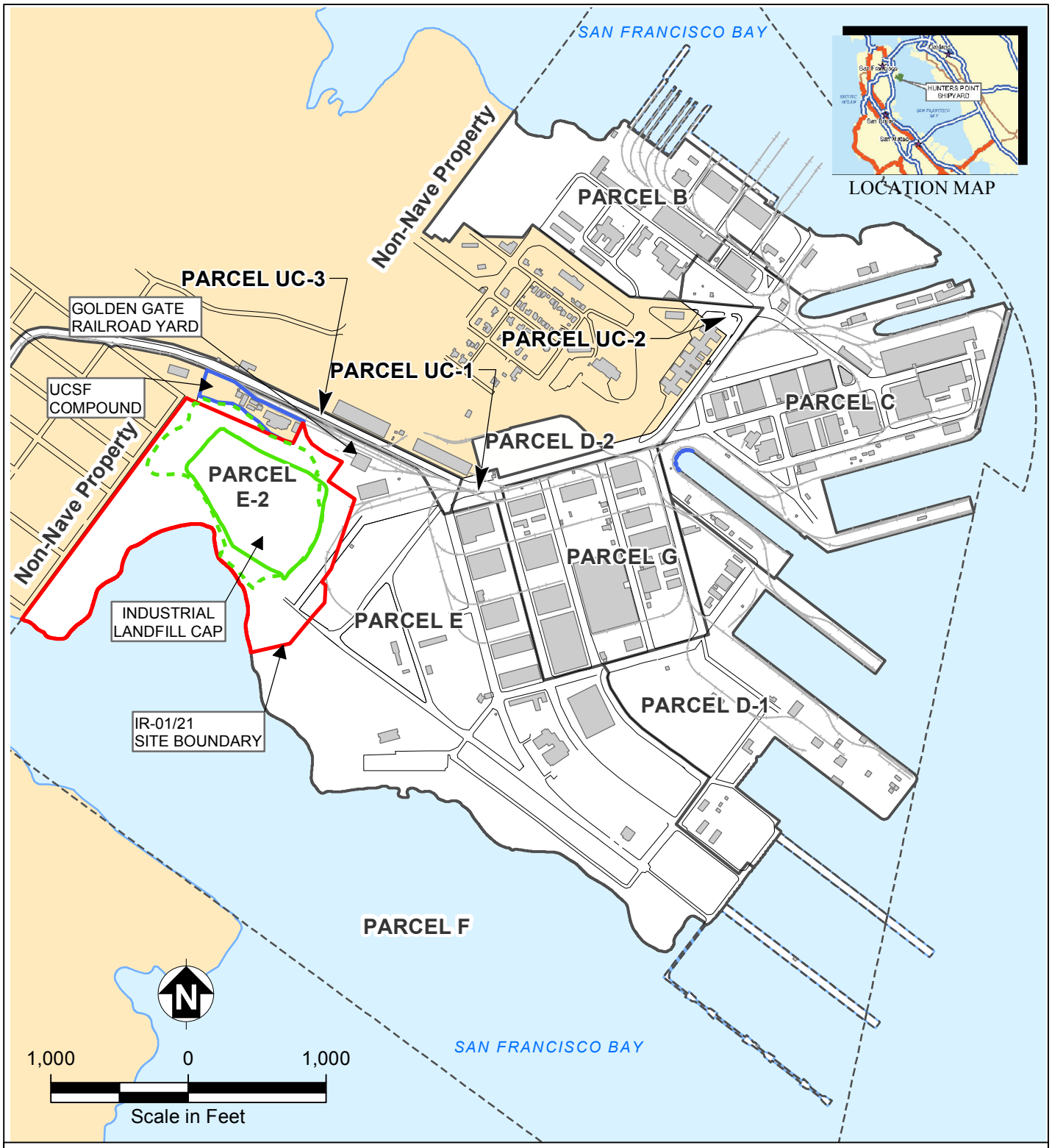
Tetra Tech, 2004c. Final Interim Landfill Gas Monitoring and Control Plan, Parcel E, Industrial Landfill, Hunters Point Shipyard, San Francisco, California. August 13.

FIGURES

Figure 1	Site Location Map
Figure 2	Site Map and Landfill Gas Monitoring Locations
Figure 3	Methane Concentrations at GMPs
Figure 4	Methane Concentrations at Structural Locations
Figure 5	Groundwater Potentiometric Surface Map
Figure 6	Methane Concentrations and Barometric Pressures for GMPs at the Fence Line
Figure 7	Methane Concentrations and Barometric Pressures for GMPs at the UCSF Compound
Figure 8	Methane Concentrations and Temperatures for GMPs at the Fence Line
Figure 9	Methane Concentrations and Temperatures for GMPs at the UCSF Compound
Figure 10	NMOC Concentrations for GMPs at the Fence Line
Figure 11	NMOC Concentrations for GMPs at the UCSF Compound
Figure 12	NMOC Concentrations for GMPs on Crisp Avenue
Figure 13	Methane Concentrations and Groundwater Elevations near GMP23 and GMP24



Parcel Boundary
University of California, San Francisco Compound
Parcel F Boundary
Non-Navy Property
Building
Rail Line
Road
Parcel E-2 Boundary
Parcel F Boundary
Estimate of Solid Waste Extent
Interim Landfill Cap Extent

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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 1

SITE VICINITY MAP

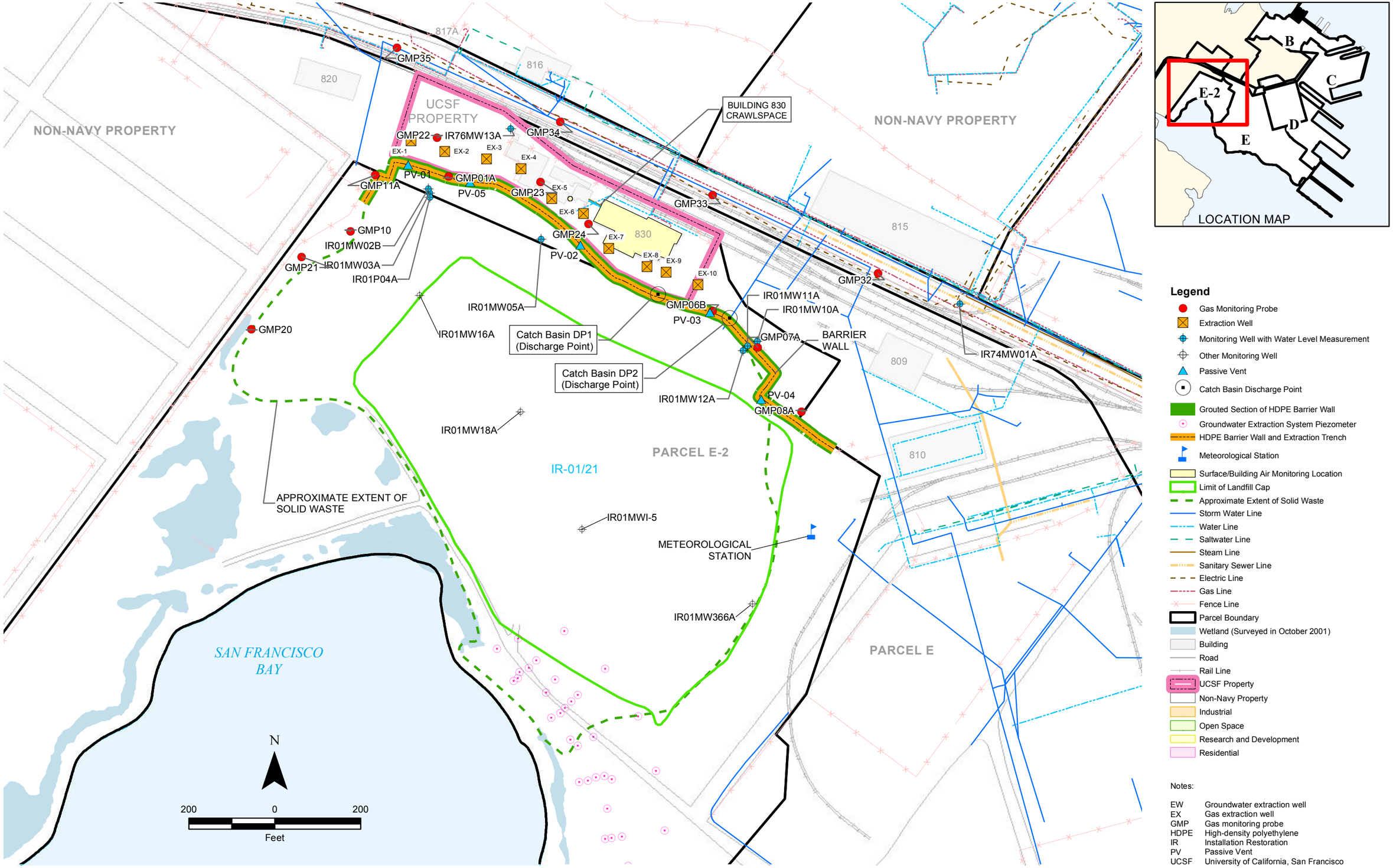

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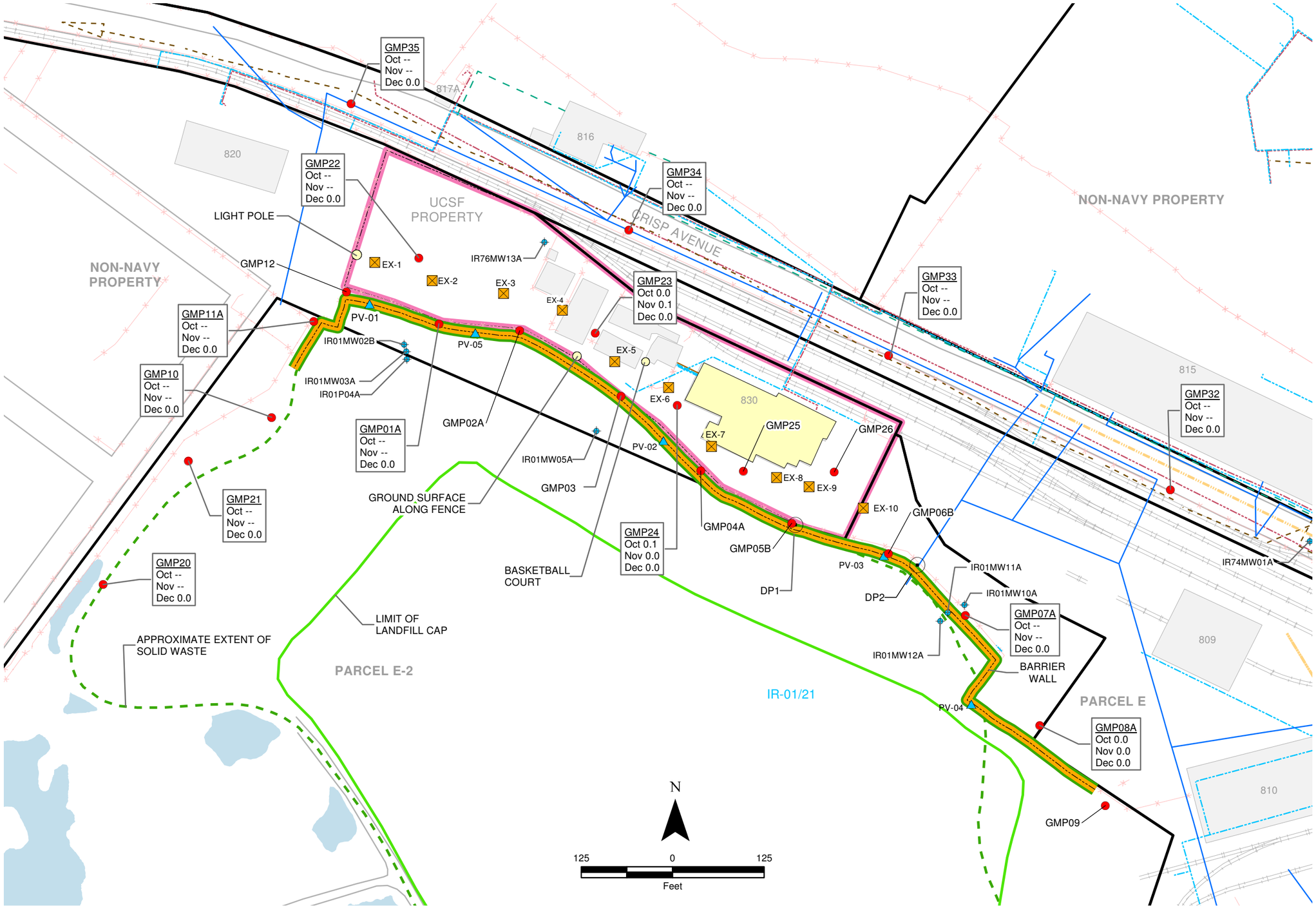
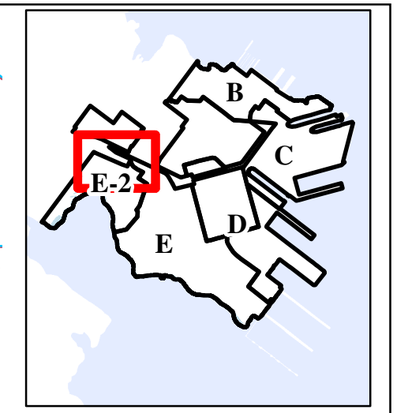
FIGURE 2
Site Map and
Landfill Gas Monitoring Locations





Legend

- Catch Basin
- Gas Monitoring Probe
- Extraction Well
- Monitoring Well with Water Level Measurement
- Passive Vent
- HDPE Barrier Wall and Extraction Trench
- Grouted Section of HDPE Barrier Wall
- Surface/Building Air Monitoring Location
- Limit of Landfill Cap
- Approximate Extent of Solid Waste
- Storm Water Line
- Water Line
- Saltwater Line
- Steam Line
- Sanitary Sewer Line
- Electric Line
- Gas Line
- Parcel Boundary
- Fence Line
- Wetland (Surveyed in October 2001)
- Building
- Road
- Rail Line
- UCSF Property

Methane concentrations are in percent by volume

Notes:

DP	Discharge Point
EW	Groundwater extraction well
EX	Gas extraction well
GMP	Gas monitoring probe
HDPE	High-density polyethylene
IR	Installation Restoration
PV	Passive Vent
UCSF	University of California, San Francisco

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San Francisco, California

FIGURE 3
Methane Concentrations at GMPs
October - December 2015

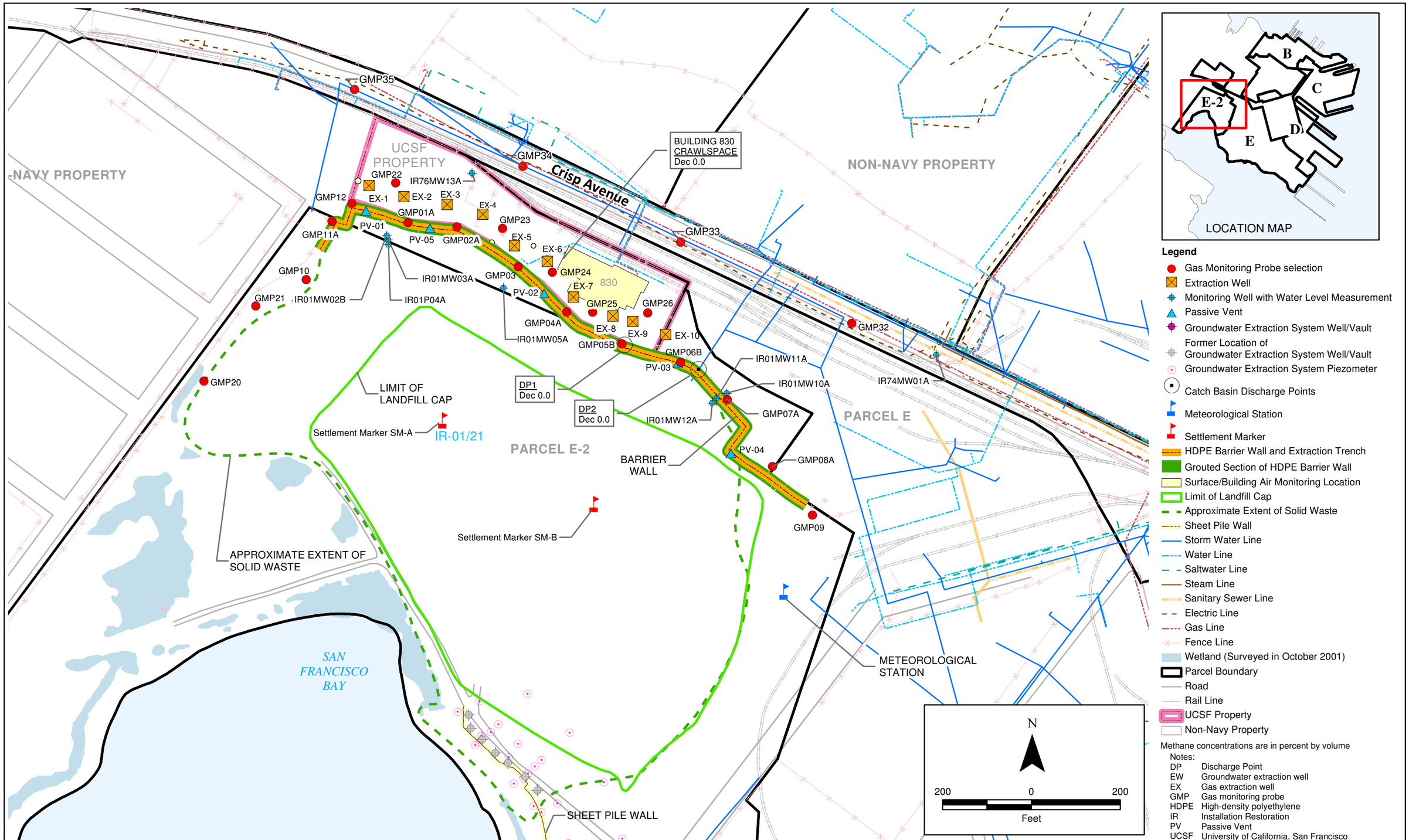

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FIGURE 4
Methane Concentrations at Structural Locations
December 2015

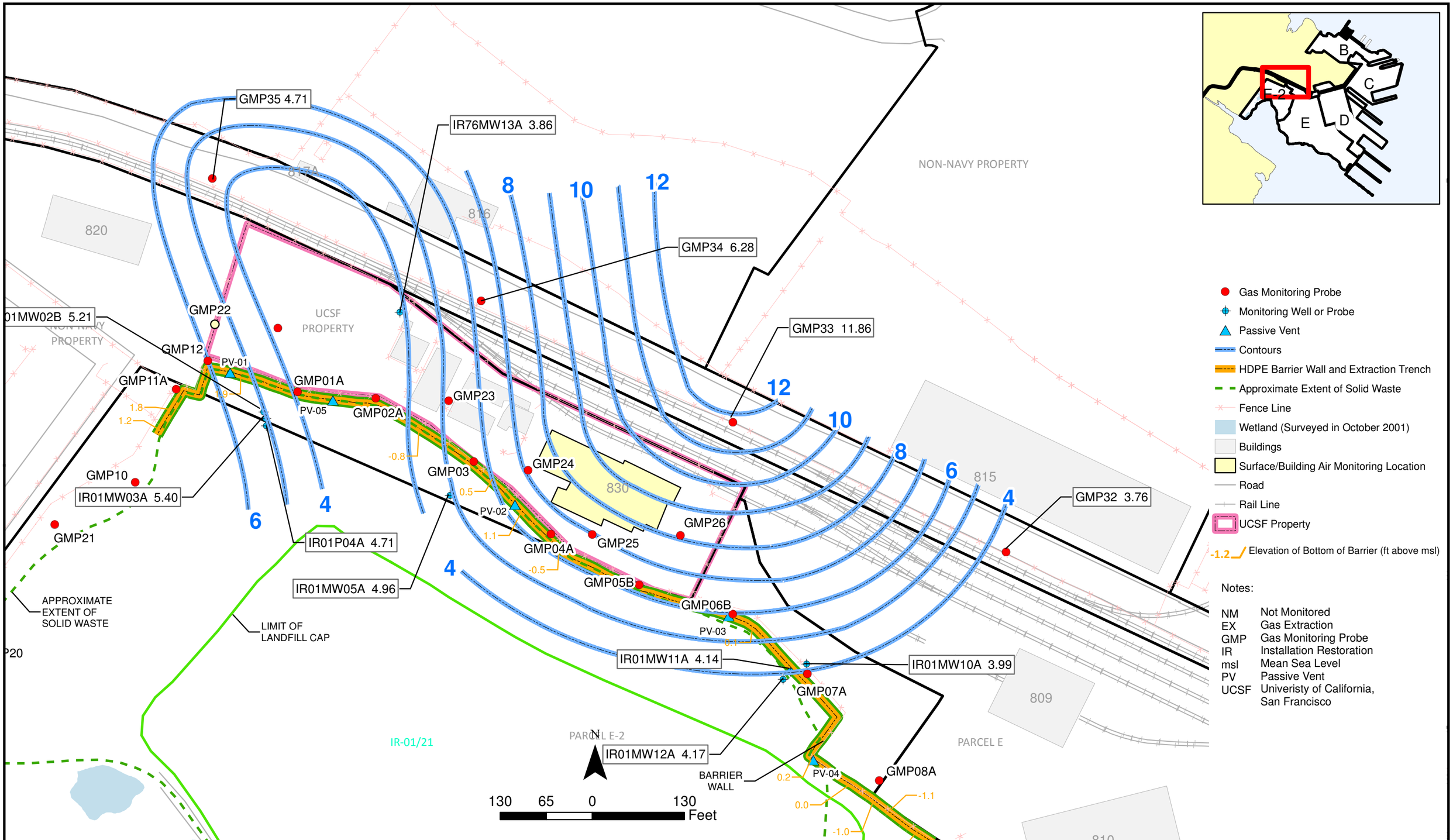

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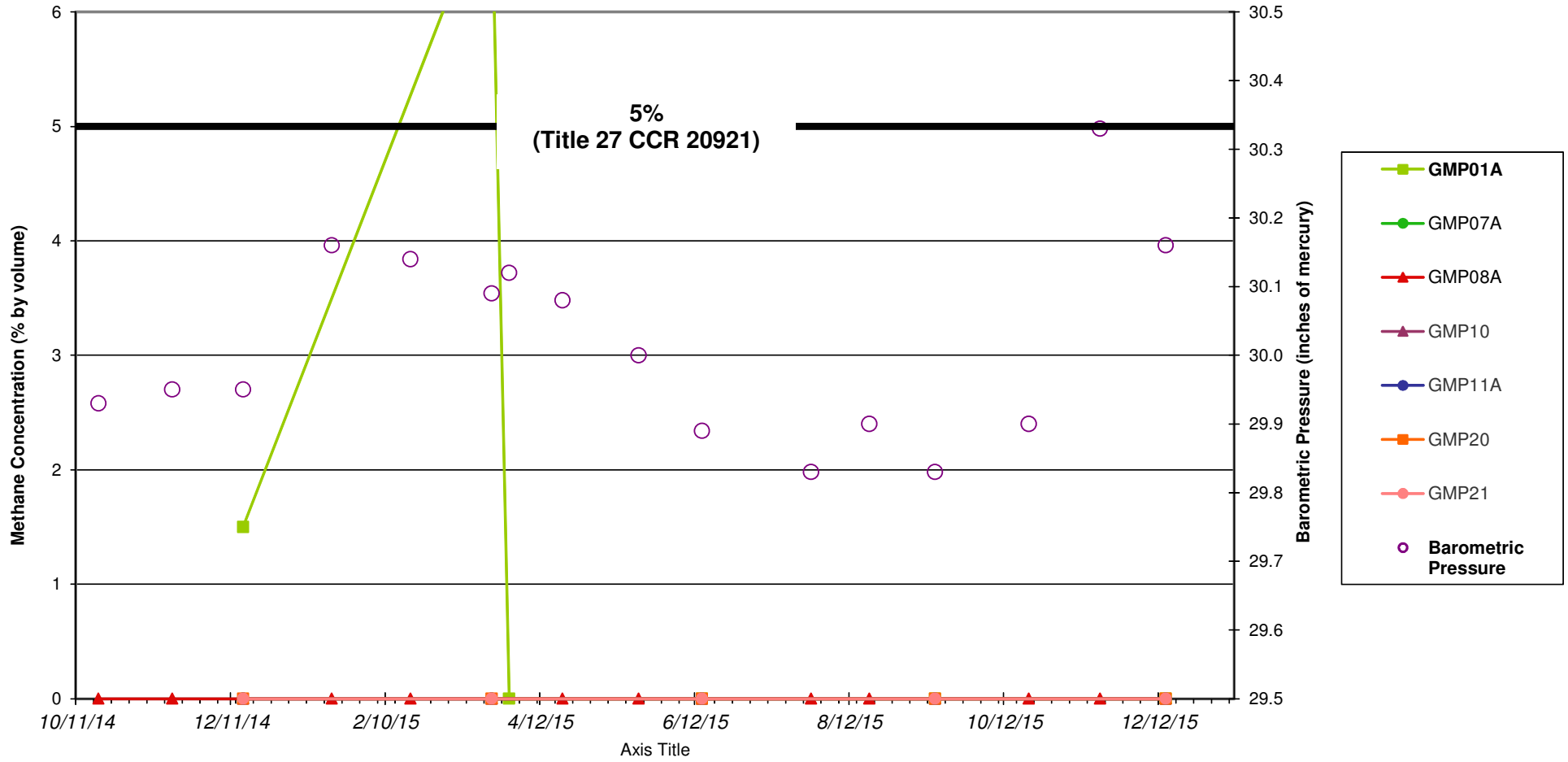
FIGURE 5
Groundwater Potentiometric Surface Map
December 2015



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.

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

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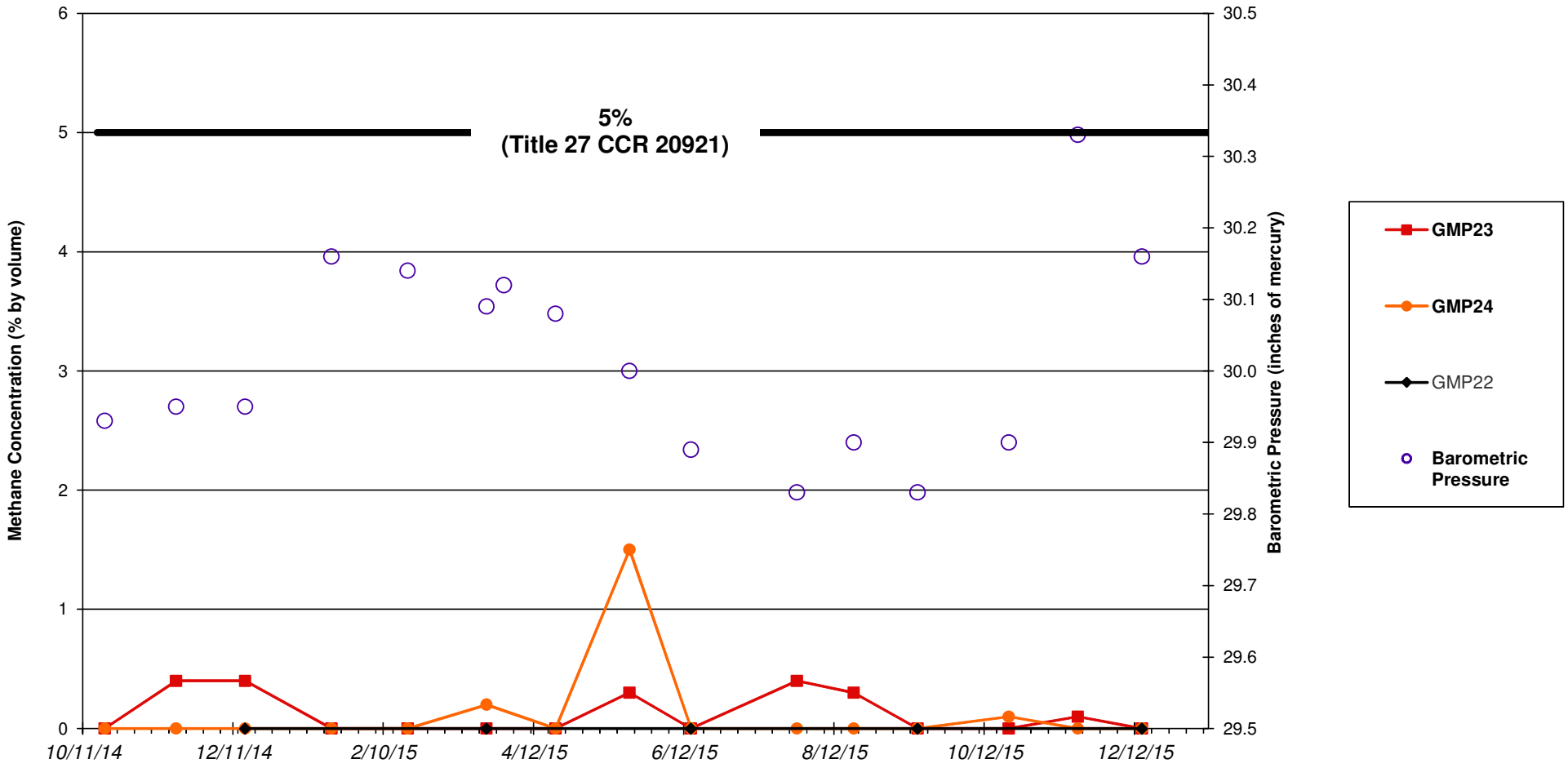
Figure 6
Methane Concentrations and Barometric Pressure for GMPs at the Fence Line
October 2014 - December 2015



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 the results for scheduled monitoring events, data shown on this figure reflect follow-up monitoring for any exceedances.
GMPs with methane detections during the indicated interval are shown with legend entries in bold.

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

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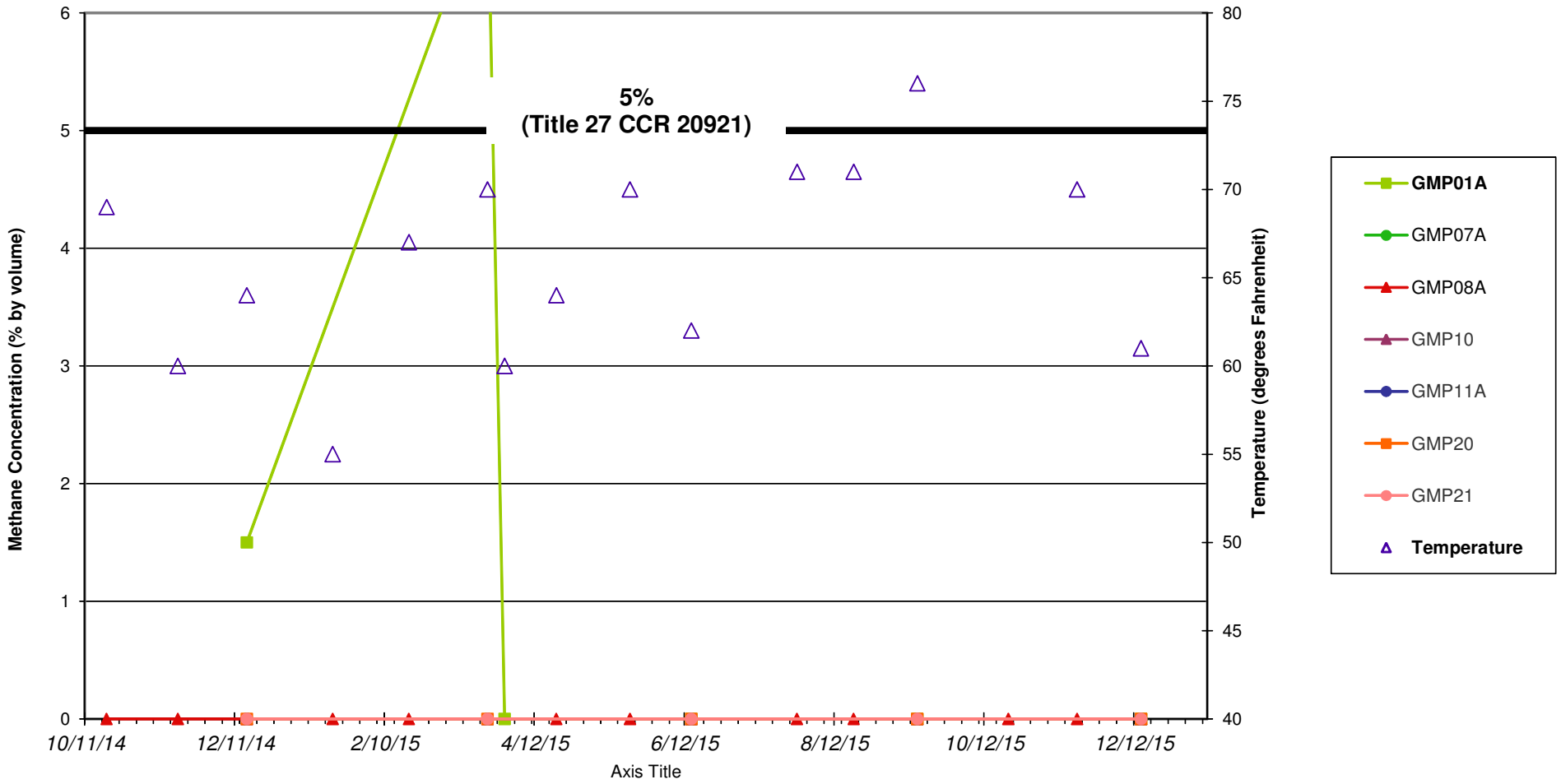
Figure 7
Methane Concentrations and
Barometric Pressure for
GMPs at the UCSF Compound
October 2014 - December 2015



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.

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

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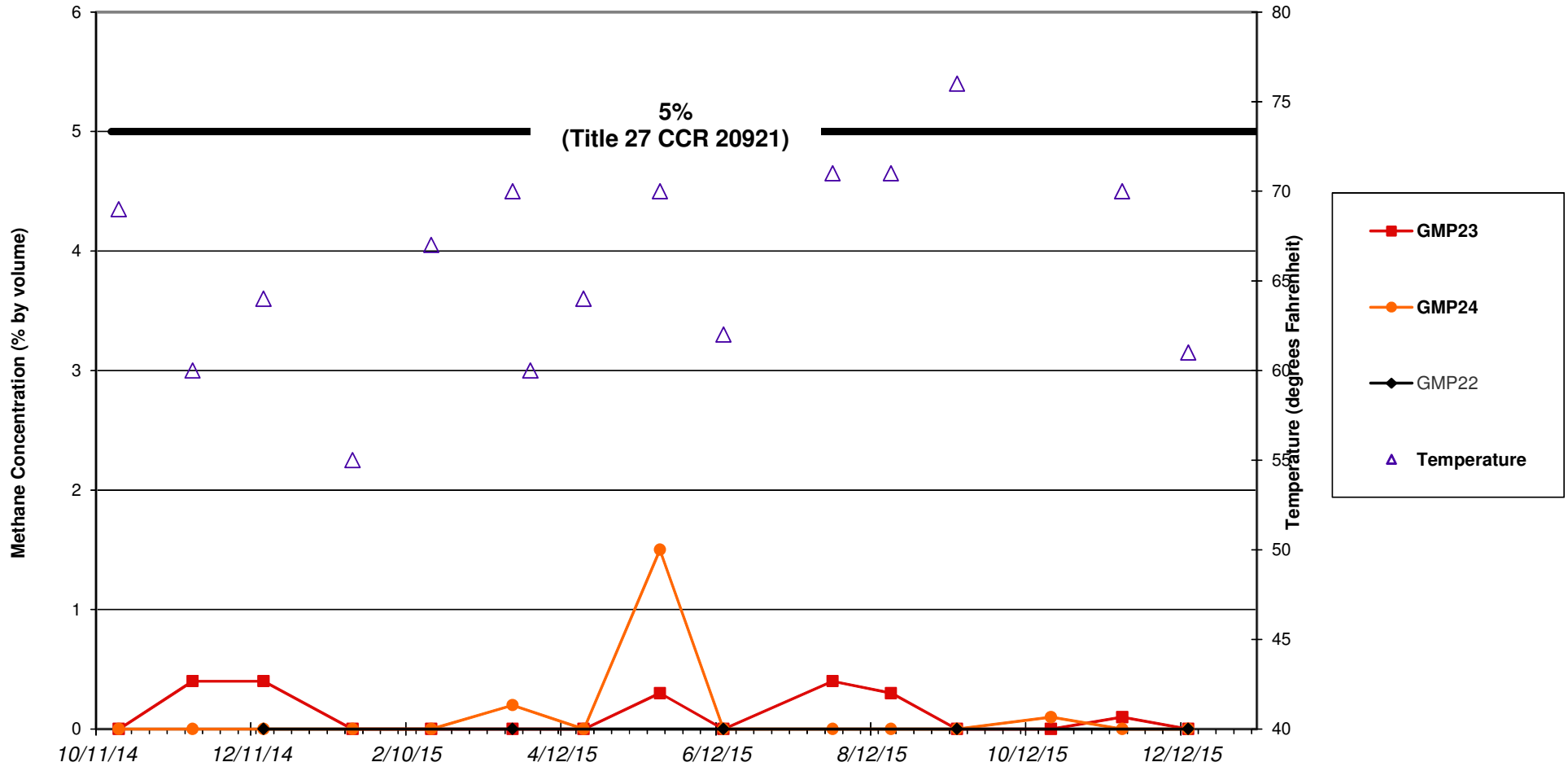
Figure 8
Methane Concentrations and Temperatures for GMPs at the Fence Line
October 2014 - December 2015



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 the results for scheduled monitoring events, data shown on this figure reflect follow-up monitoring for any exceedances.
GMPs with methane detections during the indicated interval are shown with legend entries in bold.

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

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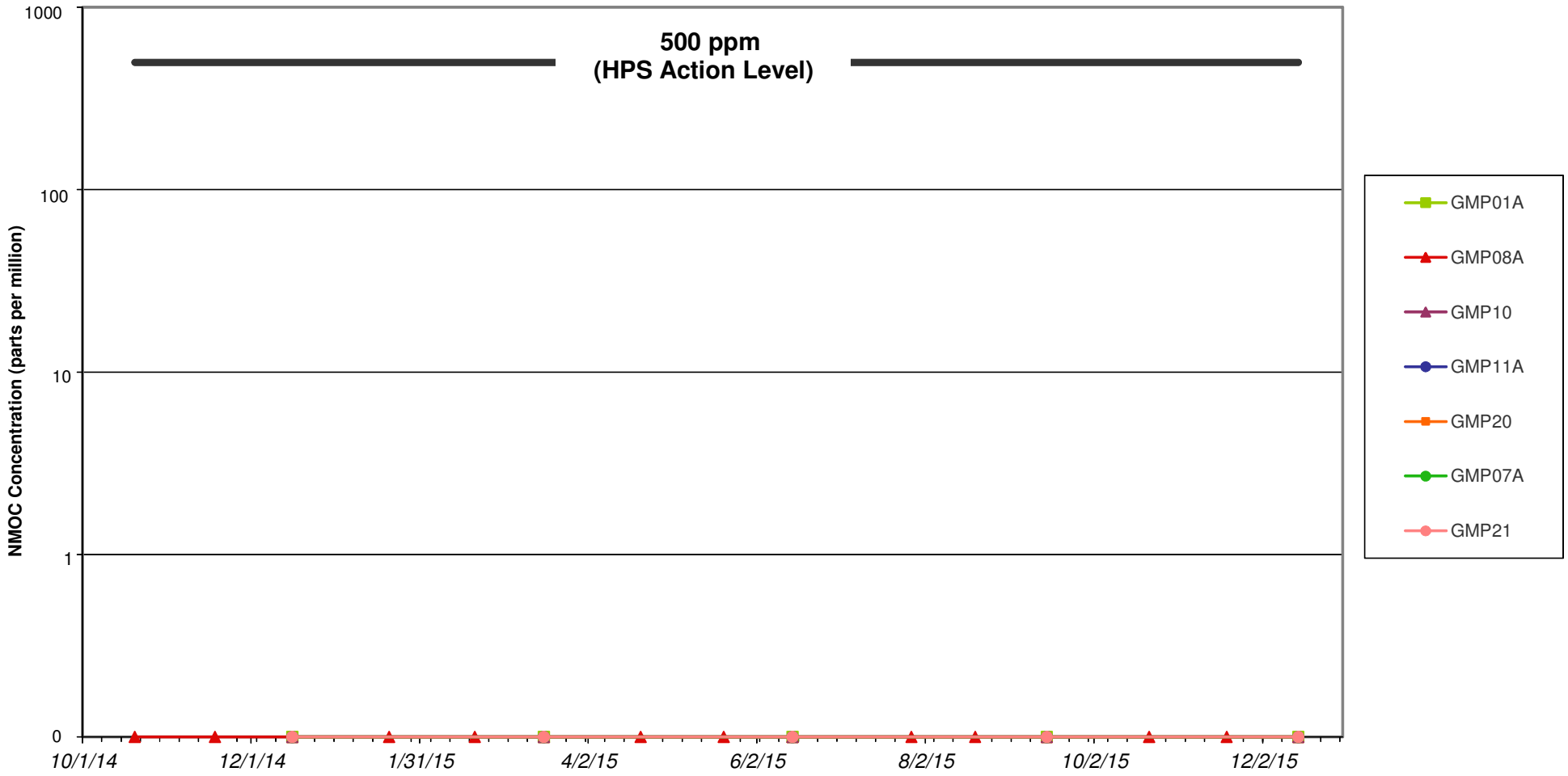
Figure 9
Methane Concentrations and Temperatures for GMPs at the UCSF Compound
October 2014 - December 2015



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

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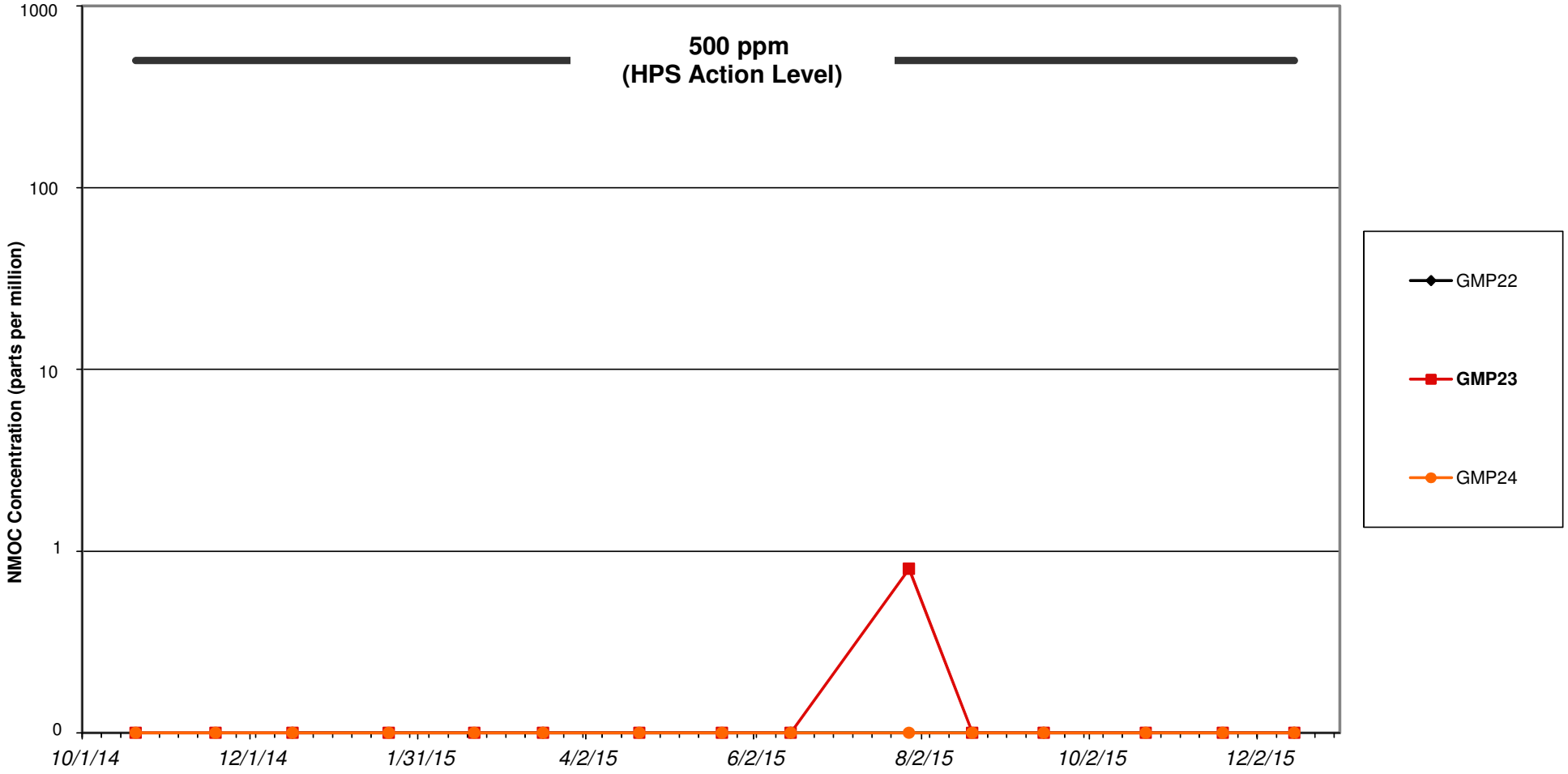
Figure 10
NMOC Concentrations for
GMPs at the Fence Line
October 2014 - December 2015



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.
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

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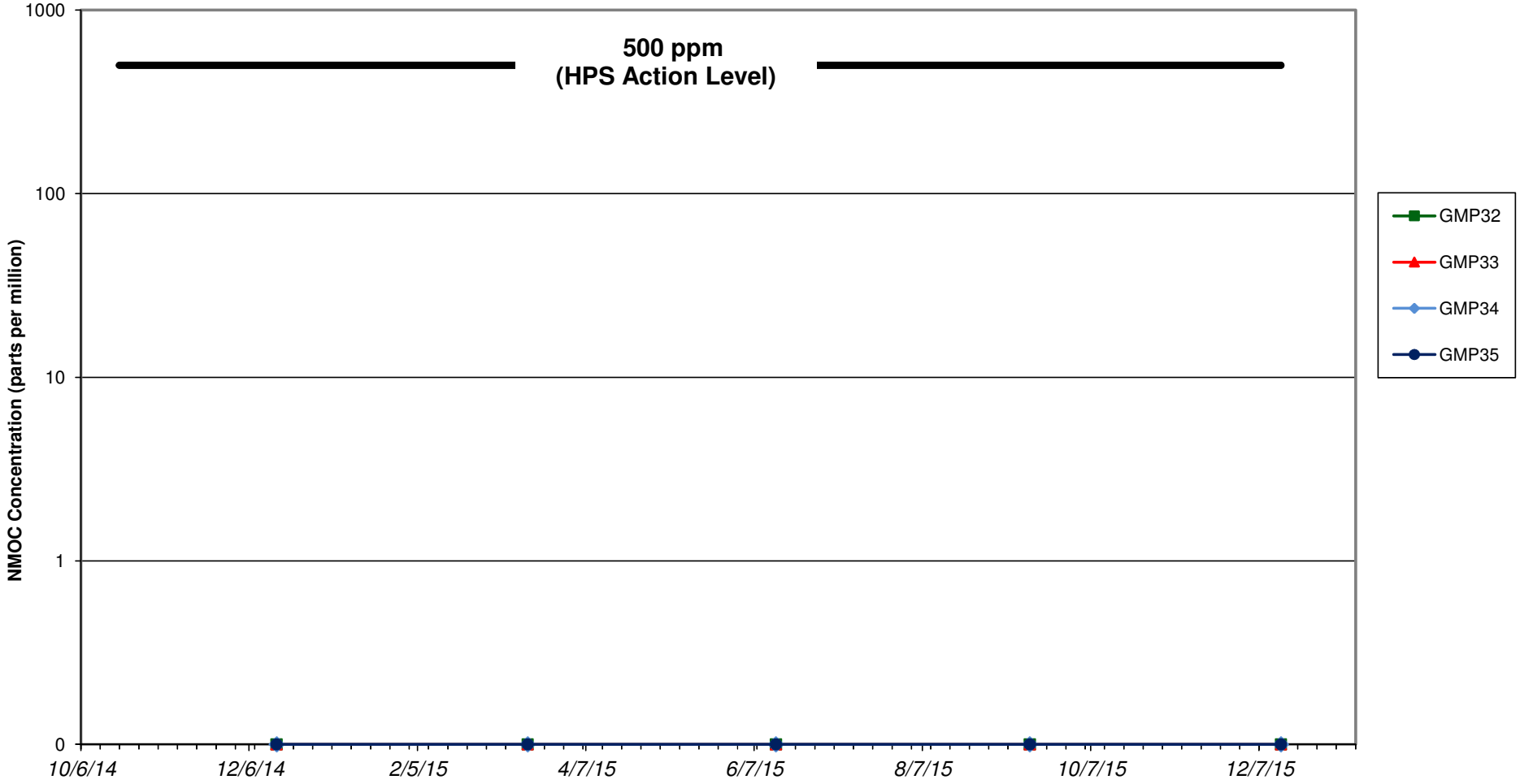
Figure 11
NMOC Concentrations for
GMPs at the UCSF Compound
October 2014 - December 2015



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.
GMP32 was temporarily accessible due to trenching activities, and was not monitoried from September 2010 through January 2011. June 2011 was the first monitoring event including GMP33, GMP34, and GMP35.

GMP Gas monitoring probe
NMOC Non-methane organic compound

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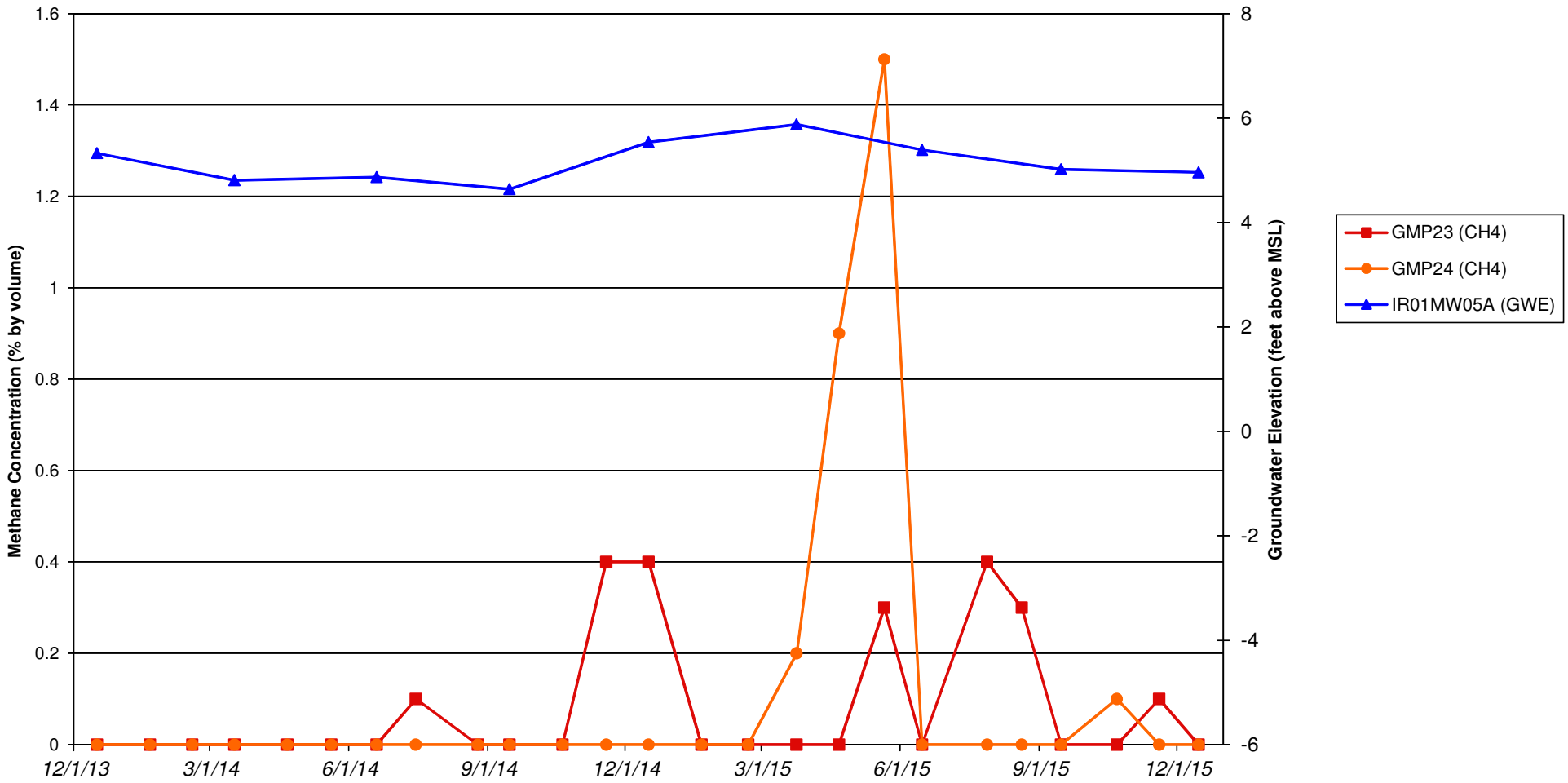
Figure 12
NMOC Concentrations for
GMPs on Crisp Avenue.
October 2014 - December 2015



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 groundwater monitoring location nearest GMP23 and GMP24. Results shown are for routine events only; no follow-up monitoring is displayed.

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

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Figure 13
Seasonal Patterns of Methane Concentrations and Groundwater Elevations near GMP23 and GMP24.
December 2013 - December 2015

TABLES

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TABLE 1: PERSONNEL AND EQUIPMENT

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

PERSONNEL		
Name	**Responsibility**	**Company**
Larry Pennock	Site Supervisor	CKY Incorporated
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 2000 PGM-7600	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 October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval 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	GMP32, GMP33, GMP34, and GMP35
Occupied Structure	Building 830 Crawlspace
On-Site Utilities	DP1 and DP2
Passive Vents	PV-01, PV-02[2], PV-03, PV-04, and PV-05
Extraction Wells[3]	EX-5, EX-6, EX-7, and EX-8
Groundwater Elevation Locations	GMP32, GMP33, GMP34, GMP35, IR01MW02B, IR01MW03A, IR01MW05A, IR01MW10A, IR01MW11A, IR01MW12A, IR01P04A, and IR76MW13A
Additional Monitoring Locations	IR01MW16A, IR01MW18A, IR01MW366A, IR01MWI-5

Notes:

(1) Based on a Navy proposal approved by the Department of Toxic Substances Control on October 20, 2008, monitoring was discontinued at the following locations, which therefore are not 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) Active extraction point

(3) 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.

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

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Location	Monitoring Location ID Number[1]	Screened Interval (ft bgs)	Methane Concentration (percent by volume)[2]		
			October	November	December
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	0.0	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	0.1	0.0
	GMP24	6.0 to 13.0	0.1	0.0	0.0
Crisp Avenue GMPs	GMP32	4.75 to 14.75	--	--	0.0
	GMP33	5.0 to 17.0	--	--	0.0
	GMP34	6.0 to 21.0	--	--	0.0
	GMP35	5.0 to 23.0	--	--	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	--	--	5.9
	PV-01 Carbon 1	NA	--	--	9.2
	PV-01 Hydrosil	NA	--	--	0.0
	PV-02 Influent	NA	--	--	4.8
	PV-02 Carbon 1[4]	NA	--	--	3.6
	PV-02 Hydrosil[4]	NA	--	--	3.2
	PV-03 Influent	NA	--	--	0.0
	PV-03 Carbon 1	NA	--	--	0.0
	PV-03 Hydrosil	NA	--	--	0.0
	PV-04 Influent	NA	--	--	0.8
	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

TABLE 3: METHANE CONCENTRATIONS (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Notes:

(1) Based on a Navy proposal approved by the Department of Toxic Substances Control on October 20, 2008, monitoring was discontinued at the following locations, which therefore are not 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) Results are compared to the 5% regulatory limit, from Title 27 CCR §20921, and the 2.5% site action limit per the MCP. (Action levels are discussed in Section 2.1. The 5% limit does not apply either to passive vents or to monitoring wells located on the landfill.) A double dash (--) indicates a location that was not monitored during the specified event. Results are from the handheld equipment identified in Table 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 sampling points 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

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Location	Monitoring Location ID Number[1]	Screened Interval (ft bgs)	NMOC Concentration (parts per million by volume)[2]		
			October	November	December
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	0.0	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	0.0	0.0
	GMP24	6.0 to 13.0	0.0	0.0	0.0
Crisp Avenue GMPs	GMP32	4.75 to 14.75	--	--	0.0
	GMP33	5.0 to 17.0	--	--	0.0
	GMP34	6.0 to 21.0	--	--	0.0
	GMP35	5.0 to 23.0	--	--	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	--	--	0.0
	PV-01 Carbon 1	NA	--	--	0.0
	PV-01 Hydrosil	NA	--	--	0.0
	PV-02 Influent	NA	--	--	0.0
	PV-02 Carbon 1[3]	NA	--	--	0.0
	PV-02 Hydrosil[3]	NA	--	--	0.0
	PV-03 Influent	NA	--	--	0.0
	PV-03 Carbon 1	NA	--	--	0.0
	PV-03 Hydrosil	NA	--	--	0.0
	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

TABLE 4: NMOC CONCENTRATIONS (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Notes:

(1) Based on a Navy proposal approved by the Department of Toxic Substances Control on October 20, 2008, monitoring was discontinued at the following locations, which therefore are not 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) Results for NMOCs are compared to the action levels of 500 ppmv for NMOCs in GMPs, and the limit of 5 ppmv for NMOCs in the breathing zone (applied to on-site structures and utilities, and to surface locations in the UCSF compound where landfill gas has been historically detected), and 100 ppm at control system outlet, based on Tetra Tech EM Inc., health and safety criteria. (Action levels are discussed in Section 2.1.) A double dash (--) indicates a location that was not monitored during the specified event. Results are from the handheld equipment identified in Table 1.

(3) The PV-02 Carbon 1 and Hydrosil sampling points 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

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Location	Monitoring Location ID Number[1]	Screened Interval (ft bgs)	Oxygen Concentration (percent by volume)[2]		
			October	November	December
Fence Line GMPs	GMP01A	6.0 to 13.5	--	--	14.9
	GMP07A	6.0 to 13.5	--	--	19.7
	GMP08A	4.5 to 9.5	3.6	0.3	1.0
	GMP10	4.0 to 6.5	--	--	18.8
	GMP11A	4.0 to 5.5	--	--	20.3
	GMP20	3.5 to 4.5	--	--	16.3
	GMP21	3.5 to 4.5	--	--	18.8
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	3.3
	GMP23	6.0 to 13.5	0.6	1.0	1.5
	GMP24	6.0 to 13.0	0.0	0.0	0.3
Crisp Avenue GMPs	GMP32	4.75 to 14.75	--	--	19.5
	GMP33	5.0 to 17.0	--	--	16.7
	GMP34	6.0 to 21.0	--	--	16.4
	GMP35	5.0 to 23.0	--	--	14.2
Occupied Structure	Building 830 Crawlspace	NA	--	--	20.4
On-Site Utilities	DP1	NA	--	--	20.5
	DP2	NA	--	--	20.5
Passive Vents	PV-01 Influent	NA	--	--	12.3
	PV-01 Carbon 1	NA	--	--	8.6
	PV-01 Hydrosil	NA	--	--	19.6
	PV-02 Influent	NA	--	--	15.6
	PV-02 Carbon 1[3]	NA	--	--	16.7
	PV-02 Hydrosil[3]	NA	--	--	17.0
	PV-03 Influent	NA	--	--	19.5
	PV-03 Carbon 1	NA	--	--	19.4
	PV-03 Hydrosil	NA	--	--	19.9
	PV-04 Influent	NA	--	--	16.7
	PV-04 Carbon 1	NA	--	--	18.0
	PV-04 Hydrosil	NA	--	--	19.3
	PV-05 Influent	NA	--	--	18.7
	PV-05 Carbon 1	NA	--	--	19.0
	PV-05 Hydrosil	NA	--	--	19.1

TABLE 5: OXYGEN CONCENTRATIONS (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Notes:

(1) Based on a Navy proposal approved by the Department of Toxic Substances Control on October 20, 2008, monitoring was discontinued at the following locations, which therefore are not 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. Results are from the handheld equipment identified in Table 1.

(3) The PV-02 Carbon 1 and Hydrosil sampling points 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

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Location	Monitoring Location ID Number[1]	Screened Interval (ft bgs)	Carbon Dioxide Concentration (percent by volume)[2]		
			October	November	December
Fence Line GMPs	GMP01A	6.0 to 13.5	--	--	4.2
	GMP07A	6.0 to 13.5	--	--	0.4
	GMP08A	4.5 to 9.5	6.8	7.6	6.3
	GMP10	4.0 to 6.5	--	--	1.2
	GMP11A	4.0 to 5.5	--	--	0.0
	GMP20	3.5 to 4.5	--	--	3.4
	GMP21	3.5 to 4.5	--	--	1.4
UCSF Compound GMPs	GMP22	6.0 to 13.5	--	--	11.6
	GMP23	6.0 to 13.5	17.2	16.9	15.4
	GMP24	6.0 to 13.0	16.5	15.8	13.6
Crisp Avenue GMPs	GMP32	4.75 to 14.75	--	--	0.6
	GMP33	5.0 to 17.0	--	--	1.7
	GMP34	6.0 to 21.0	--	--	3.7
	GMP35	5.0 to 23.0	--	--	4.5
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	--	--	9.3
	PV-01 Carbon 1	NA	--	--	14.5
	PV-01 Hydrosil	NA	--	--	0.3
	PV-02 Influent	NA	--	--	5.9
	PV-02 Carbon 1[3]	NA	--	--	4.6
	PV-02 Hydrosil[3]	NA	--	--	4.2
	PV-03 Influent	NA	--	--	0.7
	PV-03 Carbon 1	NA	--	--	0.9
	PV-03 Hydrosil	NA	--	--	0.3
	PV-04 Influent	NA	--	--	3.5
	PV-04 Carbon 1	NA	--	--	3.0
	PV-04 Hydrosil	NA	--	--	1.1
	PV-05 Influent	NA	--	--	1.1
	PV-05 Carbon 1	NA	--	--	0.7
	PV-05 Hydrosil	NA	--	--	0.4

TABLE 6: CARBON DIOXIDE CONCENTRATIONS (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Notes:

(1) Based on a Navy proposal approved by the Department of Toxic Substances Control on October 20, 2008, monitoring was discontinued at the following locations, which therefore are not 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. Results are from the handheld equipment identified in Table 1.

(3) The PV-02 Carbon 1 and Hydrosil sampling points 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

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Location	Monitoring Location ID Number[1]	Screened Interval (ft bgs)	Probe Pressure (inches of water)[2]		
			October	November	December
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	0.0	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	0.0	0.0
	GMP24	6.0 to 13.0	0.0	0.0	0.0
Crisp Avenue GMPs	GMP32	4.75 to 14.75	--	--	0.0
	GMP33	5.0 to 17.0	--	--	0.0
	GMP34	6.0 to 21.0	--	--	0.0
	GMP35	5.0 to 23.0	--	--	0.0

Notes:

(1) Based on a Navy proposal approved by the Department of Toxic Substances Control on October 20, 2008, monitoring was 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 will be monitored quarterly (see Section 2.3).

(2) A double dash (--) indicates a location that was not monitored during the specified event.

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

TABLE 8: GROUNDWATER ELEVATIONS

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action, Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Monitoring Location ID Number	TOC Elev. (ft above msl)	December 15, 2015	
		Water Level (ft btoc)	Groundwater Elevation (ft above msl)
GMP32	14.02	10.26	3.76
GMP33	24.59	12.73	11.86
GMP34	22.28	16.00	6.28
GMP35	19.11	14.40	4.71
IR01MW02B	20.61	15.40	5.21
IR01MW03A	19.89	14.49	5.40
IR01MW05A	22.56	17.60	4.96
IR01MW10A	13.75	9.76	3.99
IR01MW11A	17.96	13.82	4.14
IR01MW12A	18.25	14.08	4.17
IR01P04A	21.61	16.90	4.71
IR76MW13A	19.69	15.83	3.86

Notes:

btoc below top of casing
ft feet
GMP gas monitoring probe
ID identification
msl mean sea level
TOC top of casing

TABLE 9a: DAILY METEOROLOGICAL DATA, October 2015

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
10/1/2015	9	295	67	69	0.00	55	29.98	3.66
10/2/2015	9	315	66	73	0.00	55	30.00	3.66
10/3/2015	12	270	63	72	0.00	52	29.63	3.66
10/4/2015	7	275	63	62	0.00	50	29.60	3.66
10/5/2015	7	205	66	61	0.00	53	29.86	3.66
10/6/2015	8	290	67	69	0.00	56	30.07	3.66
10/7/2015	10	265	66	71	0.00	55	30.12	3.66
10/8/2015	8	315	69	62	0.00	55	30.07	3.66
10/9/2015	12	295	63	55	0.00	55	30.05	3.66
10/10/2015	13	295	66	83	0.00	59	30.01	3.66
10/11/2015	11	285	66	77	0.00	57	29.99	3.66
10/12/2015	6	320	69	66	0.00	56	29.95	3.66
10/13/2015	7	300	75	54	0.00	57	29.98	3.66
10/14/2015	8	295	70	60	0.00	56	29.97	3.66
10/15/2015	10	290	66	78	0.00	57	29.94	3.66

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, October 2015 (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
10/16/2015	11	295	66	76	0.00	56	29.93	3.66
10/17/2015	8	250	65	75	0.01	56	29.97	3.67
10/18/2015	15	265	65	74	0.01	56	29.98	3.68
10/19/2015	12	275	64	79	0.01	56	30.01	3.69
10/20/2015	9	295	68	65	0.00	55	29.96	3.69
10/21/2015	8	290	65	67	0.00	53	29.94	3.69
10/22/2015	7	295	64	67	0.00	53	29.94	3.69
10/23/2015	8	315	62	78	0.00	54	30.00	3.69
10/24/2015	9	295	62	78	0.00	55	29.98	3.69
10/25/2015	10	260	64	77	0.00	56	29.99	3.69
10/26/2015	7	280	64	73	0.00	56	29.98	3.69
10/27/2015	5	305	63	67	0.01	52	29.99	3.70
10/28/2015	10	285	65	75	0.01	56	30.03	3.71
10/29/2015	13	255	64	67	0.00	52	30.00	3.71
10/30/2015	7	305	66	61	0.00	51	30.02	3.71
10/31/2015	8	295	64	70	0.00	55	30.09	3.71

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, November 2015

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
11/1/2015	7	265	64	74	0.03	57	30.07	3.74
11/2/2015	13	295	59	75	0.41	51	29.84	4.15
11/3/2015	8	270	58	60	0.00	45	29.92	4.15
11/4/2015	11	300	57	59	0.00	40	30.05	4.15
11/5/2015	5	295	56	65	0.00	45	30.23	4.15
11/6/2015	6	275	58	59	0.00	43	30.24	4.15
11/7/2015	6	270	57	69	0.00	47	30.12	4.15
11/8/2015	7	240	56	77	0.03	49	30.01	4.18
11/9/2015	10	220	52	72	0.36	45	29.97	4.54
11/10/2015	7	320	53	67	0.00	42	30.23	4.54
11/11/2015	4	275	54	72	0.00	44	30.36	4.54
11/12/2015	5	290	54	69	0.00	45	30.21	4.54
11/13/2015	2	310	57	64	0.00	45	30.07	4.54
11/14/2015	5	230	55	74	0.00	46	29.92	4.54
11/15/2015	23	270	55	74	0.31	44	29.90	4.85

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, November 2015 (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (^oF)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (^oF)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
11/16/2015	12	295	54	50	0.00	34	30.26	4.85
11/17/2015	9	305	56	71	0.00	48	30.32	4.85
11/18/2015	7	280	56	80	0.00	49	30.21	4.85
11/19/2015	5	325	58	71	0.00	49	30.15	4.85
11/20/2015	5	290	60	78	0.00	51	30.08	4.85
11/21/2015	3	30	59	69	0.00	49	30.06	4.85
11/22/2015	1	310	58	71	0.00	48	29.97	4.85
11/23/2015	8	260	54	80	0.00	47	29.94	4.85
11/24/2015	10	235	53	71	0.25	46	29.91	5.10
11/25/2015	6	265	48	69	0.03	37	29.96	5.13
11/26/2015	8	20	48	59	0.00	31	30.09	5.13
11/27/2015	6	345	49	46	0.00	29	30.12	5.13
11/28/2015	6	100	49	49	0.00	27	30.15	5.13
11/29/2015	3	145	46	51	0.00	31	30.18	5.13
11/30/2015	4	95	45	67	0.01	35	30.20	5.14

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.

^oF degrees Fahrenheit
% percent
in. inches
mph miles per hour

TABLE 9c: DAILY METEOROLOGICAL DATA, December 2015

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
12/1/2015	3	90	50	61	0.00	37	30.22	5.14
12/2/2015	1	120	52	67	0.00	41	30.16	5.14
12/3/2015	10	200	52	74	0.20	47	30.01	5.34
12/4/2015	4	230	52	84	0.00	47	30.22	5.34
12/5/2015	2	135	50	80	0.00	44	30.25	5.34
12/6/2015	5	105	57	70	0.01	49	30.27	5.35
12/7/2015	2	100	56	90	0.00	53	30.28	5.35
12/8/2015	3	50	56	87	0.00	53	30.22	5.35
12/9/2015	4	175	60	87	0.01	54	30.09	5.36
12/10/2015	13	230	56	74	0.47	50	29.90	5.83
12/11/2015	11	270	51	73	0.12	44	29.92	5.95
12/12/2015	6	155	52	74	0.00	45	30.15	5.95
12/13/2015	19	245	53	79	0.76	46	30.00	6.71
12/14/2015	10	310	50	53	0.00	35	30.13	6.71
12/15/2015	8	315	49	59	0.00	33	30.18	6.71

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, December 2015 (continued)

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (°F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (°F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
12/16/2015	3	315	47	65	0.00	36	30.24	6.71
12/17/2015	1	80	53	75	0.00	42	30.24	6.71
12/18/2015	8	170	52	78	0.22	47	30.04	6.93
12/19/2015	11	295	52	76	0.04	44	30.01	6.97
12/20/2015	9	125	48	81	0.24	45	30.16	7.21
12/21/2015	14	200	55	88	0.92	53	30.03	8.13
12/22/2015	21	260	55	81	0.13	52	29.85	8.26
12/23/2015	19	275	52	66	0.01	39	30.00	8.27
12/24/2015	13	270	49	71	0.13	40	29.99	8.40
12/25/2015	7	355	46	67	0.00	37	30.24	8.40
12/26/2015	6	70	46	57	0.00	29	30.40	8.40
12/27/2015	4	160	41	71	0.01	34	30.22	8.41
12/28/2015	5	55	45	77	0.11	37	30.06	8.52
12/29/2015	3	240	45	67	0.00	36	30.12	8.52
12/30/2015	7	15	45	80	0.01	40	30.24	8.53
12/31/2015	8	85	45	66	0.00	34	30.21	8.53

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, October 2014–December 2015

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Naval Shipyard, San Francisco, California

Date	Wind Speed (mph)	Wind Direction (degrees)	Air Temperature (^{o}F)	Relative Humidity (%)	Daily Precipitation (inches)	Dew Point (^{o}F)	Barometric Pressure (in. mercury)	Cumulative Precipitation (inches)[1]
October 2014	8	275	69	66	0.01	55	29.97	8.33
November 2014	6	220	60	77	0.07	52	30.10	10.33
December 2014	7	170	57	81	0.37	51	30.07	21.01
January 2015	3	160	54	80	0.00	48	30.17	0.0
February 2015	8	225	59	79	0.08	52	30.05	2.01
March 2015	10	275	61	75	0.00	51	30.10	2.07
April 2015	12	275	59	70	0.04	47	30.02	3.24
May 2015	13	265	59	71	0.00	48	29.97	3.26
June 2015	12	290	63	72	0.01	52	29.92	3.52
July 2015	12	285	74	71	0.00	56	29.95	3.58
August 2015	11	270	79	70	0.00	56	29.95	3.61
September 2015	10	285	76	64	0.00	53	29.90	3.66
October 2015	9	285	66	70	0.00	55	29.97	3.71
November 2015	7	250	55	67	0.05	43	30.09	5.14
December 2015	8	185	51	73	0.12	43	30.13	8.53

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 January–December season.

^{o}F degrees Fahrenheit
% percent
in. inches
mph miles per hour

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APPENDIX A

LANDFILL GAS AND WATER-LEVEL MONITORING LOGS

October 2015, monthly monitoring

November 2015, monthly monitoring

December 2015, quarterly monitoring

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Landfill Gas Monitoring Log

Weather: clear

Name: Brian Weeks

Sampling Location						GEM-2000				PID			
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)	Date	Time	Temp (°F)	Barometric Pressure (in. Hg)	Methane (%)	CO_2 (%)	O_2 (%)	Percent of LEL	Non-Methane VOCs (ppmv)	Bckgrd. NMOCs (ppmv)	Soil Gas Pressure (in. H_20)	Notes (e.g., active extraction, flow rate, probe damage, instrument issues)
GMP08A	Gas Monitoring Probe	10/22/15	1440	85	29.87	0.0	6.8	3.6	0.0	0.0	0.0	0.0	
GMP23	Gas Monitoring Probe	10/22/15	1412	82	29.90	0.0	17.2	0.6	0.0	0.0	0.0	0.0	
GMP24	Gas Monitoring Probe	10/22/15	1400	81	29.90	0.1	16.5	0.0	0.0	0.0	0.0	0.0	

Legend:

%: percent by volume in air
°F: degrees Fahrenheit
CO_2: carbon dioxide
GEM-2000: CES-LANDTEC landfill gas meter
in. Hg: inches of mercury
in. H_20: inches of water
LEL: lower explosive limit
NA: not applicable
NMOC: non-methane organic compound
O_2: oxygen
PID: photoionization detector
ppmv: parts per million by volume
VOC: volatile organic compound

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CKY INC.

Landfill Gas Control System, Parcel E-2, Hunters Point Shipyard
Contract N62473-09-D-2626 CTO 0007

Landfill Gas Monitoring Log

Weather: clear

Name: Brian Weeks

Sampling Location						GEM-2000				PID			
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)	Date	Time	Temp (°F)	Barometric Pressure (in. Hg)	Methane (%)	CO_2 (%)	O_2 (%)	Percent of LEL	Non-Methane VOCs (ppmv)	Bckgrd. NMOCs (ppmv)	Soil Gas Pressure (in. H_20)	Notes (e.g., active extraction, flow rate, probe damage, instrument issues)
GMP08A	Gas Monitoring Probe	11/19/15	846	60	30.35	0.0	7.6	0.3	0.0	0.0	0.0	0.0	
GMP23	Gas Monitoring Probe	11/19/15	811	52	30.36	0.1	16.9	1.0	0.0	0.0	0.0	0.0	
GMP24	Gas Monitoring Probe	11/19/15	821	54	30.36	0.0	15.8	0.0	0.0	0.0	0.0	0.0	

Legend:

%: percent by volume in air
°F: degrees Fahrenheit
CO_2: carbon dioxide
GEM-2000: CES-LANDTEC landfill gas meter
in. Hg: inches of mercury
in. H_20: inches of water
LEL: lower explosive limit
NA: not applicable
NMOC: non-methane organic compound
O_2: oxygen
PID: photoionization detector
ppmv: parts per million by volume
VOC: volatile organic compound

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Landfill Gas Monitoring Log

Weather: clear

Sampling Location						GEM-2000				PID			Notes (e.g., active extraction, flow rate, probe damage, instrument issues)
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)	Date	Time	Temp (°F)	Barometric Pressure (in. Hg)	Methane (%)	CO_2 (%)	O_2 (%)	Percent of LEL	Non-Methane VOCs (ppmv)	Bckgrd. NMOCs (ppmv)	Soil Gas Pressure (in. H_20)	
FENCE LINE													
GMP01A	Gas Monitoring Probe	12/15/2015	1241	59	30.16	0.0	4.2	14.9	0	0.0	0.0	0.0	
GMP07A	Gas Monitoring Probe	12/15/2015	1140	62	30.16	0.0	0.4	19.7	0	0.0	0.0	0.0	
GMP08A	Gas Monitoring Probe	12/15/2015	1020	55	30.20	0.0	6.3	1.0	0	0.0	0.0	0.0	
GMP10	Gas Monitoring Probe	12/15/2015	1250	60	30.16	0.0	1.2	18.8	0	0.0	0.0	0.0	
GMP11A	Gas Monitoring Probe	12/15/2015	954	51	30.17	0.0	0.0	20.3	0	0.0	0.0	0.0	
GMP20	Gas Monitoring Probe	12/15/2015	1300	59	30.16	0.0	3.4	16.3	0	0.0	0.0	0.0	
GMP21	Gas Monitoring Probe	12/15/2015	1255	58	30.16	0.0	1.4	18.8	0	0.0	0.0	0.0	
UCSF COMPOUND													
GMP22	Gas Monitoring Probe	12/15/2015	930	54	30.17	0.0	11.6	3.3	0	0.0	0.0	0.0	
GMP23	Gas Monitoring Probe	12/15/2015	910	56	30.18	0.0	15.4	1.5	0	0.0	0.0	0.0	
GMP24	Gas Monitoring Probe	12/15/2015	850	56	30.18	0.0	13.6	0.3	0	0.0	0.0	0.0	
CRISP AVE													
GMP32	Gas Monitoring Probe	12/15/2015	1050	62	30.20	0.0	0.6	19.5	0	0.0	0.0	0.0	
GMP33	Gas Monitoring Probe	12/15/2015	1042	60	30.20	0.0	1.7	16.7	0	0.0	0.0	0.0	
GMP34	Gas Monitoring Probe	12/15/2015	1035	60	30.20	0.0	3.7	16.4	0	0.0	0.0	0.0	
GMP35	Gas Monitoring Probe	12/15/2015	1030	60	30.20	0.0	4.5	14.2	0	0.0	0.0	0.0	
STRUCTURAL LOCATIONS													
830crawlspace	Bldg. 830 Ambient	12/15/2015	856	55	30.18	0.0	0.0	20.4	0	0.0	0.0	0.0	
DP1	Drainage Catch Basin	12/15/2015	902	55	30.18	0.0	0.0	20.5	0	0.0	0.0	0.0	
DP2	Drainage Catch Basin	12/15/2015	1145	60	30.16	0.0	0.0	20.5	0	0.0	0.0	0.0	
CONTROL SYSTEM													
PV-01influent	Passive Sys. Influent	12/15/2015	940	51	30.17	5.9	9.3	12.3	100	0.0	0.0	0.0	
PV-01carbon1	Passive Sys. 1st Carbon	12/15/2015	945	51	30.17	9.2	14.5	8.6	100	0.0	0.0	0.0	
PV-01hydrosil	Passive Sys. Hydrosil	12/15/2015	949	51	30.17	0.0	0.3	19.6	0	0.0	0.0	0.0	
PV-02influent	Active Sys. Influent	12/15/2015	1203	61	30.16	4.8	5.9	15.6	87	0.0	0.0	1.2	Active extraction
PV-02carbon1	Active Sys. 1st Carbon	12/15/2015	1208	61	30.16	3.6	4.6	16.7	66	0.0	0.0	10.0	Active extraction
PV-02hydrosil	Active Sys. Hydrosil	12/15/2015	1212	61	30.16	3.2	4.2	17.0	58	0.0	0.0	4.4	Active extraction

Landfill Gas Monitoring Log

Weather: clear

Sampling Location						GEM-2000				PID			Notes (e.g., active extraction, flow rate, probe damage, instrument issues)
Location ID	Description (for example, GMP, Well, Carbon, Hydrosil)	Date	Time	Temp (°F)	Barometric Pressure (in. Hg)	Methane (%)	CO_2 (%)	O_2 (%)	Percent of LEL	Non-Methane VOCs (ppmv)	Bckgrd. NMOCs (ppmv)	Soil Gas Pressure (in. H_20)	
CONTROL SYSTEM													
PV-03influent	Passive Sys. Influent	12/15/2015	1150	61	30.16	0.0	0.7	19.5	0	0.0	0.0	0.0	
PV-03carbon1	Passive Sys. 1st Carbon	12/15/2015	1154	60	30.16	0.0	0.9	19.4	0	0.0	0.0	0.0	
PV-03hydrosil	Passive Sys. Hydrosil	12/15/2015	1157	61	30.16	0.0	0.3	19.9	0	0.0	0.0	0.0	
PV-04influent	Passive Sys. Influent	12/15/2015	1120	61	30.16	0.8	3.5	16.7	15	0.0	0.0	0.0	
PV-04carbon1	Passive Sys. 1st Carbon	12/15/2015	1124	62	30.16	0.0	3.0	18.0	0	0.0	0.0	0.0	
PV-04hydrosil	Passive Sys. Hydrosil	12/15/2015	1128	63	30.16	0.0	1.1	19.3	0	0.0	0.0	0.0	
PV-05influent	Passive Sys. Influent	12/15/2015	1225	64	30.16	0.0	1.1	18.7	0	0.0	0.0	0.0	
PV-05carbon1	Passive Sys. 1st Carbon	12/15/2015	1228	60	30.16	0.0	0.7	19.0	0	0.0	0.0	0.0	
PV-05hydrosil	Passive Sys. Hydrosil	12/15/2015	1231	58	30.16	0.0	0.4	19.1	0	0.0	0.0	0.0	
OTHER MONITORING LOCATIONS													
IR01MW366A	Landfill Cap Well	12/15/2015	1320	60	30.16	2.9	6.5	11.5	62	0.0	0.0	0.0	
IR01MWI-5	Landfill Cap Well	12/15/2015	1316	59	30.16	48.3	32.9	1.0	100	0.0	0.0	0.2	
IR01MW18A	Landfill Cap Well	12/15/2015	1312	61	30.16	2.7	6.3	16.0	37	0.0	0.0	0.0	
IR01MW16A	Landfill Cap Well	12/15/2015	1307	62	30.16	47.8	33.6	0.0	100	0.0	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. GMP13, GMP14, GMP15, GMP16, GMP17, GMP18, GMP19, GMP27, GMP28, GMP29, GMP30, and GMP31 have been removed by trenching activities on Crisp Avenue, and were therefore not monitored.

Legend:

%: percent by volume
°F: degrees Fahrenheit
CO_2: carbon dioxide
GEM-2000: CES-LANDTEC landfill gas meter
in. Hg: inches of mercury
in. H_20: inches of water
LEL: lower explosive limit
NA: not applicable
NMOC: non-methane organic compound
O_2: oxygen
PID: photoionization detector
ppmv: parts per million by volume
VOC: volatile organic compound

Water Level Monitoring Log

Weather: clear

Name: Corey Kilpatrick

Location ID	Description (for example, GMP / Well / Carbon / Hydrosil)	Date	Time	TOC (ft above msl)	Water Level (feet below top of casing)	Groundwater Elevation (feet above mean sea level)
GMP32	Gas Monitoring Probe	12/15/2015	1050	14.02	10.26	3.76
GMP33	Gas Monitoring Probe	12/15/2015	1042	24.59	12.73	11.86
GMP34	Gas Monitoring Probe	12/15/2015	1035	22.28	16.00	6.28
GMP35	Gas Monitoring Probe	12/15/2015	1030	19.11	14.40	4.71
IR01MW02B	Well	12/15/2015	1234	20.61	15.40	5.21
IR01MW03A	Well	12/15/2015	1236	19.89	14.49	5.40
IR01MW05A	Well	12/15/2015	1218	22.56	17.60	4.96
IR01MW10A	Well	12/15/2015	1024	13.75	9.76	3.99
IR01MW11A	Well	12/15/2015	1137	17.96	13.82	4.14
IR01MW12A	Well	12/15/2015	1134	18.25	14.08	4.17
IR01P04A	Well	12/15/2015	1237	21.61	16.90	4.71
IR76MW13A	Well	12/15/2015	916	19.69	15.83	3.86

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APPENDIX B

OTHER MONITORING RESULTS

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

Landfill Gas Monitoring Report for October-December 2015, Post-Removal Action,
Parcel E-2 Industrial Landfill, Hunters Point Shipyard, San Francisco, California

Location[1]	Methane (% by volume) [3]	NMOCs (ppmv) [3]	Oxygen (% by volume) [3]	Carbon Dioxide (% by volume) [3]
December 15, 2015[2]				
IR01MW366A	2.9	0.0	11.5	6.5
IR01MWI-5	48.3	0.0	1.0	32.9
IR01MW18A	2.7	0.0	16.0	6.3
IR01MW16A	47.8	0.0	0.0	33.6

Notes:

(1) The regulatory limit of 5% methane by volume 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 the Department of Toxic Substances Control 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).

(3) Results are from the handheld equipment identified in Table 1.

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

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