PHASE II SOIL VAPOR MONITORING REPORT

SOUTHERN CALIFORNIA GAS COMPANY
PLAYA DEL REY STORAGE FACILITY
PLAYA DEL REY, CALIFORNIA

Prepared for

Southern California Gas Company
8141 Gulana Avenue
Playa Del Rey, California 90293-7930

29868671.50000
July 18, 2011

URS Corporation
2020 East First Street, Suite 400
Santa Ana, California 92705

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This Phase II Soil Vapor Monitoring Report for the Southern California Gas Company Playa Del Rey Storage Facility located at 8141 Gulana Avenue in the City of Playa Del Rey, California was prepared by URS Corporation on behalf of the Southern California Gas Company (Client). This report is for the sole use and benefit of the Client. The scope of services performed in execution of this characterization may not be appropriate to satisfy the needs of other users, and any use or reuse of this document or the findings, conclusions, or recommendations presented herein is at the sole risk of user. Given that conditions may vary between the points explored, it is possible that currently unrecognized subsurface conditions may be present at the Site. No express or implied representation or warranty is included or intended in this report except that the work was performed within the limits prescribed by the Client with the customary thoroughness and competence of professionals working in the same area on similar projects. This report was prepared by the undersigned, who is a California registered engineer.

URS Corporation

Allen E. Blodgett, PE, Project Manager
California PE No. C34356

9-30-11

7/19/11
Date

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ACRONYMS

bgs	Below ground surface
CPUC	California Public Utilities Commission
DOT	Department of Transportation
DTSC	Department of Toxic Substances Control
ECUs	Equivalent Concentration Units
EPA	Environmental Protection Agency
ETI	Exploration Technology Inc.
Facility	Playa Del Rey Storage Facility
ft	Feet
GPR	Ground penetrating radar
HSP	Health and Safety Plan
LARWQCB-WIP	Los Angeles Regional Water Quality Control Board-Well Investigation Program
Microbac	Microbac Analytical Laboratories
mL	Milliliter
PPE	Personal protective equipment
ppmv	Parts per million by volume
pv	Purge volume
RWQCB	Regional Water Quality Control Board
SoCalGas	Southern California Gas Company
URS	URS Corporation
USA	Underground Service Alert
µg/L	Micrograms per liter
pmc	Percent Modern Carbon

1.0 INTRODUCTION

URS Corporation (URS) has prepared this Phase II Soil Vapor Monitoring Report (Report) on behalf of the Southern California Gas Company (SoCalGas), a Sempra Energy Utility, to present the findings from the second phase of soil vapor exploration activities for the Playa Del Rey Storage Facility (Facility) located in Playa Del Rey, California. The location of the primary area of the Facility is shown on Figure 1.

The soil vapor monitoring program was performed under the supervision of Mr. Allen E. Blodgett, P.E., and Mr. Tom Zdeb, P.G., C.I.H., with URS. Mr. Blodgett is licensed as a civil engineer in the state of California and has over 20 years of directly applicable experience in the environmental field. Mr. Zdeb is licensed as a professional geologist in the state of California and an industrial hygienist certified by the American Board of Industrial Hygienists and has over 30 years of directly applicable experience in the environmental field.

The Facility background, location and description, and a discussion of sampling and analysis methodologies, findings, and conclusions are presented in the following sections.

1.1 BACKGROUND

The Facility is located at 8141 Gulana Avenue in Playa Del Rey, California (Figure 1). The geographic area where the Facility is located spans the Ballona Wetlands, which are at an elevation near sea level, and a bluff located on the south side of the wetlands. The top of the bluff is at an approximate elevation of 150 ft mean sea level. The Facility is a natural gas storage field consisting of a compressor plant (located at the top of the bluff), a tank farm (located at the toe of the bluff), a number of injection and extraction well sites that are located outside of the primary areas of the Facility, and the storage field which is located in a sandstone formation at a depth of approximately 6,100 feet below ground surface (bgs). The approximate boundaries (provided by SoCalGas on 10/14/09) of the storage field extend beyond the property lines of the ground surface footprint of the Facility (i.e., the compressor plant and tank farm). The approximate boundaries of the storage field are from Bora Bora Way to Fiji Way on the north, along Manchester Avenue on the south, along Berger Avenue and Berger Place from Manchester Avenue north through State owned lands on the east, and from Manchester Avenue north along Pershing Drive through state owned lands on the west (Figure 2). The Playa Del Rey storage field was originally an oil field that produced during the 1930s. In 1942, after oil production had dropped due to decreasing pressure in the geologic formation, the United States government initiated underground storage of natural gas. SoCalGas purchased the Facility in 1955, and continues to operate it today. The Facility includes 57 wells which are used for various functions: injection/withdrawal of gas, fluid production, brine injection, and reservoir observation. Three compressors are used to inject the gas underground.

On December 20, 2007, the California Public Utilities Commission (CPUC) approved a settlement agreement of complaint cases relating to the Facility. As part of this settlement agreement, SoCalGas agreed to have a soil vapor monitoring program performed. Phase I of the soil vapor monitoring program

for SoCalGas was implemented in response to that agreement and is detailed in a report dated Jan 13, 2010 (URS 2010). Phase II of the soil vapor monitoring program for SoCalGas was implemented in response to the agreement mentioned above and is summarized in this report.

1.2 REPORT ORGANIZATION

The scope of work, findings and summary/conclusions for the second phase of soil vapor monitoring activities are presented in this report which has been organized into the following sections:

Section 1.0	Introduction
Section 2.0	Objectives, Rationale and Scope of Phase II Soil Vapor Monitoring
Section 3.0	Summary of Monitoring Activities and Methods
Section 4.0	Soil Vapor Findings
Section 5.0	Summary and Conclusions
Section 6.0	References

2.0 OBJECTIVES, RATIONALE, AND SCOPE OF PHASE ONE SOIL VAPOR MONITORING

2.1 OBJECTIVES

The objective of the second phase of work was to install and sample multi-interval soil vapor monitoring probes at locations identified during the first phase of work as having gaseous anomalies (i.e., methane concentrations greater than 5,000 parts per million by volume [ppmv]). Each soil vapor sample was to be analyzed for C1-C7 hydrocarbons. Depending on the methane concentrations measured in the second phase soil vapor samples, the samples were also to be analyzed for helium and carbon isotopes delta 13C and delta 14C from methane. The goal of these analyses was to provide an evaluation as to whether the methane was from current sources (biogenic methane) or from sources that are approximately 50,000 years or more in age (thermogenic or petroleum sources).

2.2 SCOPE OF PHASE TWO MONITORING

The scope of work that was developed to meet the objectives of Phase II is summarized below:

- Prepare a site-specific Health and Safety Plan (HSP) for field operations to be conducted at the Facility;
- Collect samples of soil vapor at a depth of five feet bgs, or as deep as possible above groundwater;
- Analysis of soil vapor samples using both a mobile and fixed laboratory; and
- Prepare this report summarizing the soil vapor sampling activities and sample analyses with conclusions.

3.0 SUMMARY OF MONITORING ACTIVITIES AND METHODS

3.1 PRE-FIELD MOBILIZATION ACTIVITIES

3.1.1 Health and Safety Plan Implementation

Pursuant to Health and Safety Code 1910.120, URS prepared and implemented a Site-specific HSP for field operations conducted at the Facility. The HSP:

- Identifies and describes potentially hazardous materials that may be encountered during field operations;
- Specifies personal protective equipment (PPE) and clothing for onsite activities; and
- Outlines measures to be implemented in the event of an emergency.
- URS field personnel and onsite subcontractors reviewed the requirements of the HSP and signed an acknowledgment form prior to commencement of field work.

3.1.2 Utility Clearance

Underground Services Alert (USA) was notified of our intent to conduct subsurface explorations at least 48 hours prior to initiation of intrusive field tasks. Proposed locations of subsurface exploration were clearly marked with white paint and surveyors flagging as required by USA. USA contacted utility owners of record within the vicinity and notified them of our intention to conduct subsurface explorations in proximity to buried utilities. The utility owners of record, or their designated agents, were expected to clearly mark the position of their utilities on the ground surface throughout the area designated for exploration. In addition, the probe locations were reviewed in the field with representatives of the Facility to help identify conflicts with known locations of subsurface utilities and structures.

Surface geophysics were also used in an effort to identify subsurface lines and obstructions in the exploration areas. Geophysical methods included magnetic, electromagnetic, and ground penetrating radar (GPR) line location. Geophysical surveys were conducted for all probe locations on September 13, 2011. During the surveys no probe locations had to be removed, but some probe locations were relocated approximately 1 to 5 ft from the proposed locations based on the discovery of subsurface lines and obstructions.

3.2 SOIL VAPOR SAMPLING AND ANALYSIS

Soil vapor sampling was conducted in accordance with the *Advisory for Active Soil Gas Investigations*, DTSC and RWQCB, January 28, 2003. A description of probe installation and sample collection procedures is provided below.

Soil vapor sampling was conducted by URS, and field analysis of soil vapor samples was conducted by Microbac Analytical Laboratories (Microbac) of Riverside, California, under subcontract to URS.

Additional analysis for carbon isotopes, delta ^{13}C and ^{14}C, was conducted by Isotech Laboratories located in Champagne, Illinois. Soil gas samples were analyzed for helium by the SoCalGas Laboratory located in Pico Rivera, California.

Microbac is a Los Angeles Regional Water Quality Control Board-Well Investigation Program (LARWQCB-WIP)-approved and Los Angeles City certified methane soil vapor contractor. The soil vapor monitoring was conducted at the Facility on November 16 and 17, 2010. Soil vapor samples were collected and analyzed for C1-C6+ straight chain hydrocarbons as described in the Work Plan (URS 2009). Samples contained methane at concentrations greater than 25,000 parts per million by volume (ppmv), as required by the settlement agreement, aromatic hydrocarbons, when present, were identified and quantified in the manner presented in the Exploration Technologies Inc. (ETI) report dated January 5, 2000. In particular, aromatic hydrocarbons, as reported in the ETI report, refer to the following four categories of aromatic hydrocarbons: C6 – benzene; benzene – toluene; toluene – xylene; and xylene plus, where C6 – benzene includes the hydrocarbons identified using EPA Method 8015M with a boiling point greater than C6 (hexane) and less than benzene. Similarly, the other three categories each include hydrocarbons with boiling points greater than the first member and less than the second, with the exception of xylene plus where the hydrocarbons identified with boiling points greater than xylene, as detected by the analytical techniques used are summed. All four categories of aromatic hydrocarbons are reported in benzene equivalent concentration units (ECUs), similar to that presented in ETI, 2000.

In accordance with the settlement agreement, at the multi-depth soil vapor probe locations, based on the analyses of C1-C6+ hydrocarbons, additional samples were required at each location. These samples were collected in Tedlar bags for the analysis of helium by the SoCalGas Laboratory and Cali-Bond 5-layer bags, similar to Tedlar bags, supplied by Isotech for carbon isotopes as follows:

- When methane concentrations exceeded 25,000 ppmv, samples were analyzed for delta ^{13}C.
- When methane concentrations exceeded 50,000 ppmv, samples were analyzed for helium.
- When methane concentrations exceeded 250,000 ppmv, samples were subjected to ^{14}C determination.

All soil vapor samples collected during Phase II were analyzed for all of the parameters mentioned above, since methane concentrations exceeded 250,000 ppmv at all six probe locations.

3.2.1 Sample Locations and Depths

Phase II Soil Vapor Sample Locations

The Phase II soil vapor probes were installed using a 3.25-inch diameter hand-auger to the desired depths (i.e., approximately 4, 4.5, 5 or 9 ft bgs). The soil vapor probes were installed in the open borehole which was continuously measured to ensure probe construction materials were placed at the correct depth and that the borehole stayed open and did not collapse while the probes were being set. The probes were constructed of a measured section of ¼-inch outside diameter semi-rigid Teflon® tubing attached to a vapor sampling implant (soil gas probe), which is constructed of double woven stainless-steel wire screen approximately 6 inches in length. The tubing with vapor sampling implant was suspended within the

borehole at the desired depth, and granular filter pack material (sand) was placed around the screen. The soil vapor probe was completed with a hydrated bentonite annular seal and a flush-mounted surface completion well vault. Probe installation procedures are provided below.

The soil vapor probe construction materials (sand, vapor sampling implant, and granular bentonite) were installed through an open borehole while continuous depth verification was obtained using a measuring tape. The filter pack surrounding the vapor sampling implant consisted of #2/12 sand (or similar) introduced into the open borehole to approximately 3 inches above/below the vapor sampling implant. The filter pack was approximately 12 inches long in each of the probe installations. The annular seal material consisted of #8 bentonite crumbles (or similar). The bentonite placement was conducted simultaneously as water was poured into the borehole from the surface. Water was poured slowly and at 8 to 12-inch intervals that allowed a continuous supply of water to hydrate the bentonite annular seal. Bentonite hydration commenced approximately 12 inches above the filter pack, which left the lowest portion of bentonite dry.

The procedure described above was repeated at depths of approximately 5 ft at SG-151, 9 ft at SG-152, 4.5 ft at SG-153, and 4 ft at each of SG-154, SG-155, and SG-156, in separate borings. Although soil vapor probes were planned to be installed at depths of 5, 10, and 20 ft bgs, probes could not be installed at a depth deeper than 4 ft to 9 ft due to encountering shallow groundwater and refusal at shallower depths as described below. The soil vapor probes were completed at the ground surface inside 6-inch diameter well vaults secured with rapid-set concrete.

Stewart, Covington and Riegle Probe Locations

Groundwater was encountered as shallow as 4.3 ft bgs in a test boring that was hand augured to 5 ft bgs on November 10, 2010 before installation of soil vapor probes SG-154, SG-155, and SG-156. As a result, these probes were subsequently set at 4 ft bgs. SG-154 was located approximately 1 foot from Phase I soil gas probe SG-141, SG-155 was located approximately 1 foot from Phase I soil vapor probe SG-140, and SG-156 was located approximately 1 foot from Phase I soil vapor probe SG-139, as recommended in the Phase I Report (URS 2010).

Del Rey- 10 Probe Locations

Soil vapor probes SG-151, SG-152 and SG-153 were installed on November 12, 2010, following the procedure described above. Groundwater was not encountered in any of the boreholes, however refusal was encountered at 9 ft bgs at SG-152, which is the depth at which the probe was set, and at a depth of approximately 1 foot from the Phase I soil vapor probe SG-064A. SG-151 was installed at a depth of 5 ft bgs, next to SG-152, and approximately 1 foot from Phase I soil vapor probe SG-064. SG-153 was installed to 4.5 ft bgs since refusal was encountered at that depth. Two other borings within a foot of SG-153 were hand-augured and refusal was encountered at 4.5 ft bgs in those borings as well.

3.2.2 Soil Vapor Sample Collection and Analysis

Purge Testing: To ensure that stagnant or ambient air was adequately purged from the sampling system prior to sample collection and to look at phenomena whereby the concentrations of certain gasses may increase or decrease as a variable depending on the amount of gas purged and the type of geological material the sample is collected from, a purge volume versus concentration test was conducted. One "purge volume (pv)" was estimated from a summation of the sample container volume, internal volume of tubing used, and volume of space at the probe tip. Soil vapor samples were collected in vapor-tight sampling bulbs using 1, 3 and 7 purge volumes, and each sample was analyzed for C_1-C_6+ hydrocarbons by the mobile laboratory. The purge volume that yielded the highest concentration of C_1-C_6+ hydrocarbons was used for subsequent samples.

Due to the potential for differences in material properties between soil encountered at Del Rey 10 versus Stewart, Covington and Riegle, a purge volume test was conducted for the locations at Del Rey 10 and a second test was conducted for the locations at Stewart, Covington and Riegle. The purge test performed at Del Rey 10 was conducted at SG-151 (Figure 3), and the purge test performed at Stewart, Covington and Riegle was conducted at SG-154. For both purge tests, seven purge volumes yielded the highest concentration of C_1-C_6+ hydrocarbons. Thus, seven purge volumes were used for vapor sampling.

Leak Testing: Leak testing was conducted to confirm that leakage did not occur during soil vapor sampling that would result in sample dilution with ambient air. A tracer gas (isopropyl alcohol) was used to test for atmospheric breakthrough. The tracer gas was released near the ground surface adjacent to the probe and covered with a plastic bucket surrounding the borehole, as well as near the top of the sampling rod that was protruding from the ground. The soil vapor samples collected from the probes were analyzed for the tracer gas. Tracer gas was not detected above the laboratory reporting limit of 10 micrograms per liter (µg/L) in any of the samples collected during this phase of monitoring.

Sampling and Analysis Procedures: The installed probe and tubing, with a valve closed at the surface, was allowed to equilibrate for a minimum of 24 hours after the bentonite seal was hydrated. A magnehelic or similar pressure gauge with a sensitivity of no less than 0.01 inches of water was used to measure pressure that might have been present in the probe. This was accomplished by attaching the pressure sensing gauge to the valve and opening the valve to see if any pressure was evident. This value was recorded in the field sampling logs. Initial pressure or vacuum was not detected in any of the probes.

The soil vapor samples were then collected in 125 (ml) glass vapor sample bulbs supplied by the onsite mobile laboratory. This was accomplished by drawing samples from the tubing through the stopcock located at each end of the glass sample bulbs, using a pump set at a flow rate of 200 ml/minute or less. After purging seven purge volumes, the sample was collected by closing the stopcock next to the pump followed by the one located closest to the probe, or simultaneously when possible.

After the soil vapor sample was collected in the 125 ml glass sample bulb, the glass bulb was labeled with the sample identification number (consisting of the letters SG followed by a sequential sample number), date and time of sample collection, and sampler's initials, and then transferred to the onsite mobile laboratory under chain-of-custody documentation. Samples were analyzed within 30 minutes of

collection for C_1-C_6+ straight-chain hydrocarbons per Environmental Protection Agency (EPA) Method 8015(M) with carbon chain breakdown. In addition to methane, analyses included n-butane, ethane, ethene, n-hexane, isobutane, pentane, propane, propene, n-hexane-benzene, benzene-toluene, toluene-xylene, xylene+, C_6+ hydrocarbons, and isopropanol (Table 1). To quantify the individual hydrocarbons, gas standards were used that included the individual straight chain hydrocarbons up to and including C_6 (hexane) and also included a separate standard for ethene, propene, and isobutane.

Based on the mobile lab results obtained in the field, methane concentrations in all of the samples exceeded 250,000 ppmv and were subsequently analyzed for delta ^{13}C and helium, and were also subjected to ^{14}C determination. Helium samples were collected in Tedlar bags using a hand actuated vacuum pump that was purged with ambient air between samples. Samples for isotopic analysis were collected in Cali-Bond 5-layer bags, similar to Tedlar bags, using the same hand actuated vacuum pump. Samples were submitted for analysis for carbon isotopes, delta ^{13}C and ^{14}C (Table 2), to Isotech Laboratories and to SoCalGas Laboratory located in Pico Rivera, California for helium analysis (Table 1).

3.2.3 Equipment Decontamination

Equipment used during probe installation and sampling was decontaminated prior to use at each boring and sampling point to reduce the potential for the introduction of contamination and cross-contamination in accordance with the guidelines and procedures discussed below. These procedures were necessary to ensure quality control in decontamination of field equipment and to serve as a means to identify and correct potential errors in the sample collection and sample handling procedures.

Sampling equipment that came into contact with potentially contaminated soil or water was decontaminated consistently to assure the quality of samples collected. Decontamination occurred prior to and after each use of a piece of equipment. Sampling devices used were decontaminated using the following procedures:

- Non-phosphate detergent and tap water wash, using a brush as necessary;
- Initial deionized/distilled water rinse; and
- Final deionized/distilled water rinse.

Equipment was decontaminated onsite in a pre-designated area on plastic sheeting, and clean bulky equipment was stored on plastic sheeting in uncontaminated areas. Decontaminated small equipment was stored in plastic bags. Equipment stored more than a few hours was covered. Decontamination water produced was placed in a Department of Transportation (DOT)-approved 55-gallon drum and labeled as decontamination water with the date. Drummed decontamination fluids and soil cuttings from vapor probe installation were evaluated and disposed of by SoCalGas.

4.0 SOIL VAPOR FINDINGS

4.1 SOIL VAPOR FINDINGS

Soil vapor samples were collected at six locations based on the results from the Phase I monitoring. Samples were collected on November 16 and 17, 2010. A site plan showing sampling locations and methane detections is provided on Figure 3. Vapor samples were collected as described in Section 3.2.1. The findings of the soil vapor analysis program are described in the following sections. Summaries of soil vapor analytical results are presented in Tables 1 and 2. Laboratory analytical reports are provided in Appendix A.

4.1.1 Methane

Methane was detected in all 6 the primary samples collected at concentrations ranging from 630,000 ppmv in sample SG-151-7PV to 1,100,000 ppmv in sample SG-155. A concentration of 25,000 ppmv for methane is a criterion that was established in the settlement agreement that, if exceeded, would require additional analysis during the second phase for C_1-C_6+ straight chain and aromatic hydrocarbons following Method 8015(M) and for delta ^{13}C, as described in the Work Plan (URS 2009). All six of these samples also exceeded the 50,000 ppmv criterion established in the settlement agreement that would require collection of samples for analysis of helium during this phase of work at these locations. The six samples also exceeded the 250,000 ppmv criterion established in the settlement agreement that would require collection of samples, during this phase of work, for the measurement of delta ^{14}C at these locations. Figure 3 shows the distribution of subsurface soil vapor concentrations of methane.

4.1.1.1 Ethane

Ethane was detected in three of the six samples at concentrations ranging from 11,000 ppmv in sample SG-154-7PV to 15,000 ppmv in sample SG-155. These three samples are associated with the SoCalGas storage facility probes located near well sites Stewart, Covington and Riegle. Ethane was not detected above the laboratory reporting limit of 3.0 ppmv or as an estimated value (J) in any of the samples associated with probes located near well Del Rey-10.

4.1.1.2 Propane

Propane was detected in all six of samples at concentrations ranging from 11 ppmv in sample SG-151-7PV to 3,600 ppmv in sample SG-156.

4.1.1.3 Isobutane

Isobutane was detected in all 6 samples at concentrations ranging from 1.9 ppmv in sample SG-151-7PV to 610 ppmv in sample SG-156.

4.1.1.4 N-Butane

N-Butane was detected in 3 of the 6 samples at concentrations ranging from 210 ppmv in sample SG-154-7PV to 480 ppmv in sample SG-156. These three samples are associated with the SoCalGas storage facility probes located near well sites Stewart, Covington and Riegle. N-Butane was not detected above the laboratory reporting limit of 1.5 ppmv or as an estimated value (J) in any of the samples associated with probes located near well Del Rey-10.

4.1.1.5 C6+ Hydrocarbons

C6+ Hydrocarbons were detected in 3 of the 6 samples at concentrations ranging from 35 ppmv in sample SG-154-7PV to 320 ppmv in sample SG-156. These three samples are associated with the SoCalGas storage facility probes located near well sites Stewart, Covington and Riegle. C6+ Hydrocarbons were not detected above the laboratory reporting limit of 15 ppmv or as an estimated value (J) in any of the samples associated with probes located near well Del Rey-10.

4.1.1.6 Pentane

Pentane was detected in 3 of the 6 samples at concentrations ranging from 52 ppmv in sample SG-154-7PV to 140 ppmv in sample SG-156. These three samples are associated with the SoCalGas storage facility probes located near well sites Stewart, Covington and Riegle. Pentane was not detected above the laboratory reporting limit of 1.5 ppmv or as an estimated value (J) in any of the samples associated with probes located near well Del Rey-10.

4.1.1.7 N-Hexane

N-Hexane was detected in 3 of the 6 samples at concentrations ranging from 2 ppmv in sample SG-154-7PV to 23 ppmv in sample SG-156. These three samples are associated with the SoCalGas storage facility probes located near well sites Stewart, Covington and Riegle. N-Hexane was not detected above the laboratory reporting limit of 1.5 ppmv or as an estimated value (J) in any of the samples associated with probes located near well Del Rey-10.

4.1.1.8 Propene

Propene was detected in 1 of the 6 samples at a concentration of 14 ppmv in sample SG-156.

4.1.1.9 Ethene

Ethene was not detected above the laboratory reporting limit of 3.0 ppmv or as an estimated value (J) in any of the 6 samples analyzed.

4.1.1.10 Helium

Helium was detected in 4 of the 6 samples at concentrations ranging from 7 ppmv in sample SG-153 to 69 ppmv in sample SG-156. Three of the four samples are associated with the SoCalGas storage facility probes located near well sites Stewart, Covington and Riegle. Helium was not detected above the laboratory reporting limit of 1.5 ppmv or as an estimated value (J) in any of the samples associated with probes located near well Del Rey-10.

4.1.1.11 Pressure

Pressure was not detected in any of the probes prior to sampling. Pressure data is presented in Table 1.

4.1.1.12 Isotopic Analysis delta ^{13}C and ^{14}C Determination

Delta ^{13}C values ranged from -39.34 in sample SG-156 to -67.39 in sample SG-152. ^{14}C pMC values ranged from <0.2 in sample SG-151-7PV to 11.0 in sample SG-154-7PV. Isotopic analysis data is presented in Table 2.

4.2 QUALITY ASSURANCE / QUALITY CONTROL

Field duplicate soil vapor samples were to be collected at a frequency of one per 10 samples. Since only five samples were collected a day, field duplicates were not necessary. To quantify the individual hydrocarbons, gas standards were used that included the individual straight chain hydrocarbons up to and including C_6 (hexane). Ethene, propene, and isobutene were quantified against the ethane, propane and butane standards, respectively.

5.0 SUMMARY AND CONCLUSIONS

SUMMARY AND CONCLUSIONS

Sources of Methane

Methane typically is formed from decomposition of organic material which can occur in a variety of environments. For examples these environments can include relatively deep geologic formations typically associated with petroleum formation (natural gas), sewers, landfills, and swamps.

Distinguishing Methane Sources – Isotopic Composition

Methane from different sources can differ in its isotopic composition. Natural gas methane is formed deep underground from ancient organic matter at high pressures and temperatures, through a thermogenic process. Methane formed in sewers or landfills is formed from modern carbon at ambient pressures and temperatures through a fermentation process. These two processes result in methane with different relative amounts of the heavier isotopes of hydrogen and carbon, ^{2}H and ^{13}C (Coleman, et al, 1995).

Fermentation and thermogenic methane can be differentiated by plotting ^{2}H *vs* ^{13}C (Figure 4). ^{2}H and ^{13}C data are expressed in per mill (‰) as 'delta' (δ) values[1] relative to a standard: PeeDee Belemnite (PDB), a limestone, for ^{13}C and Venice Standard Mean Ocean Water (VSMOW) for ^{2}H. Because the ^{2}H and ^{13}C isotopic contents of methane are usually less than the standards, δ-^{2}H and δ ^{2}H values are usually less than zero (Pizzino, et al, 2007).

The isotopic composition of the materials the methane is formed from, or processes in the soil such as oxidation of the methane, can alter the isotopic composition. These factors can result in variations in expected ^{2}H and ^{13}C content of the methane. Based on comparison of vapor sample analytical results collected in this Phase II investigation with the data on Figure 4, methane detected from probes at Del Rey 10 (SG-151-7PV, SG-152, and SG-153) may be described as microbial or fermentation gas while methane detected from probes at Stewart, Covington Riegle (SG-154-7PV, SG-155, and SG-156) may be described as thermogenic gas.

The radioactive isotope of carbon, ^{14}C, can sometimes be more definitive in methane source evaluation than ^{2}H and ^{13}C data. ^{14}C decays with time, so it can be used as a measure of the age of carbon. Because natural gas methane is formed from geologically old carbon, it has negligible ^{14}C, while methane formed from modern carbon may have over 100 percent modern carbon (pmc) (100 pmc corresponds to the ^{14}C content that would be present in modern vegetation without above-ground nuclear testing in the 1960s). Methane formed from modern carbon includes sewer and landfill gas as well as decaying buried vegetation (Coleman, et al, 1995). The ^{14}C results from the Phase II samples from Stewart, Covington,

[1] δ-^{13} (‰) = 1000 x { ($^{13}C/^{12}C$) $_{sample}$ / ($^{13}C/^{12}C$) $_{standard}$ – 1 }
δ-^{13} (‰) = 1000 x { ($^{2}H/^{1}H$) $_{sample}$ / ($^{2}H/^{1}H$) $_{standard}$ – 1 }

Riegle (SG-154-7PV, SG-155, and SG-156) may likely be a mixture of microbial or fermentation gas and thermogenic gas.

Distinguishing Methane Sources – Other Parameters

Other parameters can also be used to differentiate methane based on how it was formed. Thermogenic production of methane in natural gas also produces other hydrocarbons ($C_2 - C_6$) at concentrations that decline as the carbon number (subscript) of the hydrocarbon increases (fewer long chained hydrocarbons than short chained hydrocarbons). Sewer gas and swamp gas typically have none of these compounds and landfill gas shows increasing concentrations with increasing carbon number (Pizzino, et al, 2007). As shown in Table 1, in samples from Del Rey 10 (SG-151-7PV, SG-152, and SG-153) the $C_2 - C_6$+ hydrocarbons were either not detected or were detected at low concentrations, indicating that this gas is likely from microbial sources. The samples from Stewart, Covington, Riegle (SG-154-7PV, SG-155, and SG-156) did not have detectable concentrations of most of the $C_2 - C_6$+ hydrocarbon range.

The ratio of carbon dioxide to methane can be an indicator of the source of methane. Methane from fermentation often has approximately equal amount of carbon dioxide. Thermogenic formation of methane does not generally produce carbon dioxide. Because of that, fermentation gas typically has concentration ratios of carbon dioxide/methane of approximately 1 to 1.5, whereas the ratio is typically close to zero for thermogenic gas. However, the expected ratio can be altered by contact of methane with water. Because carbon dioxide is significantly more water-soluble than methane, it can be preferentially dissolved, resulting in a lower than expected ratio. Conversely, weathering of methane through biodegradation can cause the ratio to be increased (Coleman, et al, 1995). All of the samples analyzed from Del Rey 10 and Stewart, Covington, Riegle had concentration ratios of carbon dioxide/methane close to zero. This may be attributable to a number of factors such as the shallow groundwater conditions in the area, precipitation, and/or landscape irrigation that may cause the carbon dioxide to be reduced in the gaseous phase from dissolution.

δ-^{13}C and Methane/Ethane Ratio

Figure 5 shows a plot of the methane/ethane ratio and δ-^{13}C data for the samples along with the anticipated ranges of the two parameters for methane from numerous sources based on Pizzino *et al*. [2007]. The data for Del Rey 10 (SG-151-7PV, SG-152, and SG-153) fall close to the approximate range consistent with fermentation methane. The data for Stewart, Covington, Riegle (SG-154-7PV, SG-155, and SG-156) fall close to the approximate range consistent with thermogenic methane.

Helium Content

Based on information obtained from Sempra, natural gas stored in the Play Del Rey Storage Field typically has a helium concentration greater than approximately 50 ppmv. For reference, the concentration of helium in the atmosphere is approximately 5 ppmv. The soil gas samples analyzed from Stewart, Covington, Riegle (SG-154-7PV, SG-155, and SG-156) all had helium concentrations above 50 ppmv. The soil gas samples analyzed from Del Rey 10 (SG-151-7PV, SG-152, and SG-153) had little to no helium (two non-detects and one sample at the analytical detection limit of 7 ppm), suggesting that the primary source of the gas is not from the Storage Field.

Conclusion

The isotopic analysis coupled with the hydrocarbon analysis suggests that at least two different sources/types of gas were found in samples collected at the site. The isotopic analyses of gas samples collected from the Del Rey 10 probe locations appear to likely have been originated, primarily or completely, from subsurface microbial activity and samples collected from the Stewart, Covington and Riegle probe locations appear to be primarily or completely of thermogenic origin, i.e. "natural gas." The hydrocarbon detections in the gas from the Stewart, Covington and Riegle probes also supports the presence of natural gas as a source while the hydrocarbon detections in the gas samples collected from Del Rey 10 support the presence of microbial gas as a source. In addition to the above, the concentrations of helium suggest that the gas samples collected from the Stewart, Covington and Riegle probe locations supports natural gas as a source.

6.0 REFERENCES

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Tables

TABLE 1
SUMMARY OF SOIL VAPOR ANALYTICAL RESULTS
Sempra Energy - Playa Del Rey, CA

		ANALYTE	N-Butane	Ethane	Ethene	N-Hexane	Isobutane	Methane	Pentane	Propane	Propene	Hydrocarbons C6+	N-Hexane - Benzene	Benzene - Touluene	Toluene - Xylene+	Xylene+	Helium
Sample ID:	**Sample Date:**	**Units**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**	**ppmv**
SG-151-1PV*	11/16/2010	**CONC**	ND (<1.5)	ND (<3.0)	ND (<3.0)	ND (<1.5)	1.7	650,000	ND (<1.5)	9.5	ND (<1.5)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	--
SG-151-3PV*	11/16/2010	**CONC**	ND (<1.5)	ND (<3.0)	ND (<3.0)	ND (<1.5)	1.5	620,000	ND (<1.5)	9.0	ND (<1.5)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	--
SG-151-7PV	11/16/2010	**CONC**	ND (<1.5)	ND (<3.0)	ND (<3.0)	ND (<1.5)	1.9	630,000	ND (<1.5)	11	ND (<1.5)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<7)
SG-152	11/16/2010	**CONC**	ND (<1.5)	ND (<3.0)	ND (<3.0)	ND (<1.5)	2.0	820,000	ND (<1.5)	12	ND (<1.5)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<7)
SG-153	11/16/2010	**CONC**	ND (<1.5)	ND (<3.0)	ND (<3.0)	ND (<1.5)	2.0	660,000	ND (<1.5)	12	ND (<1.5)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	ND (<15)	7
SG-154-1PV*	11/17/2010	**CONC**	210	9900	ND (<3.0)	ND (<1.5)	330	810,000	35	1600	ND (<1.5)	ND (<1900)	ND (<1900)	ND (<1900)	ND (<1900)	ND (<1900)	--
SG-154-3PV*	11/17/2010	**CONC**	190	9100	ND (<3.0)	1.7	300	760,000	44	1500	ND (<1.5)	41	20	ND (<15)	ND (<15)	ND (<15)	--
SG-154-7PV	11/17/2010	**CONC**	210	11000	ND (<3.0)	2	340	900,000	52	1800	ND (<1.5)	35	21	11	ND (<15)	ND (<15)	60
SG-155	11/17/2010	**CONC**	360	15000	ND (<3.0)	15	490	1,100,000	120	3500	ND (<1.5)	280	120	110	13	ND (<15)	68
SG-156	11/17/2010	**CONC**	480	14000	ND (<3.0)	23	610	1,000,000	140	3600	14	320	190	120	33	ND (<15)	69

Notes:
ppmv = parts per million by volume
ND (<1.5) = Not detected above indicated detection limit
-- = Not Analyzed
CONC = Concentration
* = Seven purge volumes yielded the highest concentrations of C_1-C_{6+} hydrocarbons, thus seven purge volumes were used for vapor sampling.

TABLE 2
SUMMARY OF SOIL VAPOR ISOTOPIC ANALYTICAL RESULTS
Sempra Energy - Playa Del Rey, CA

		$\delta^{13}CO_2$	$\delta^{13}C_1$	δDC_1	$^{14}C_1$
Sample ID:	**Sample Date:**	**‰**	**‰**	**‰**	**pMC**
SG-151-1PV	11/16/2010	--	--	--	--
SG-151-3PV	11/16/2010	--	--	--	--
SG-151-7PV	11/16/2010	-57.20	-65.97	-224.5	< 0.2
SG-152	11/16/2010	-41.01	-67.39	-224.5	0.5
SG-153	11/16/2010	-59.85	-60.84	-219.8	< 0.4
SG-154-1PV	11/17/2010	--	--	--	--
SG-154-3PV	11/17/2010	--	--	--	--
SG-154-7PV	11/17/2010	-24.08	-41.51	-206.0	11.0
SG-155	11/17/2010	-22.87	-39.87	-195.5	3.3
SG-156	11/17/2010	-21.24	-39.34	-198.1	1.6

$\delta^{13}CO_2$	Carbon isotope ratio of Carbon Dioxide
$\delta^{13}C_1$	Carbon isotope ratio of methane
δDC_1	Hydrogen isotope ratio of methane
$^{14}C_1$	Radiocarbon (C-14) content of methane
--	Not Analyzed

Figures

Source: Thomas Bros. Maps, Los Angeles Street Guide, 2006.

0 2400' 4800'

Scale in Feet

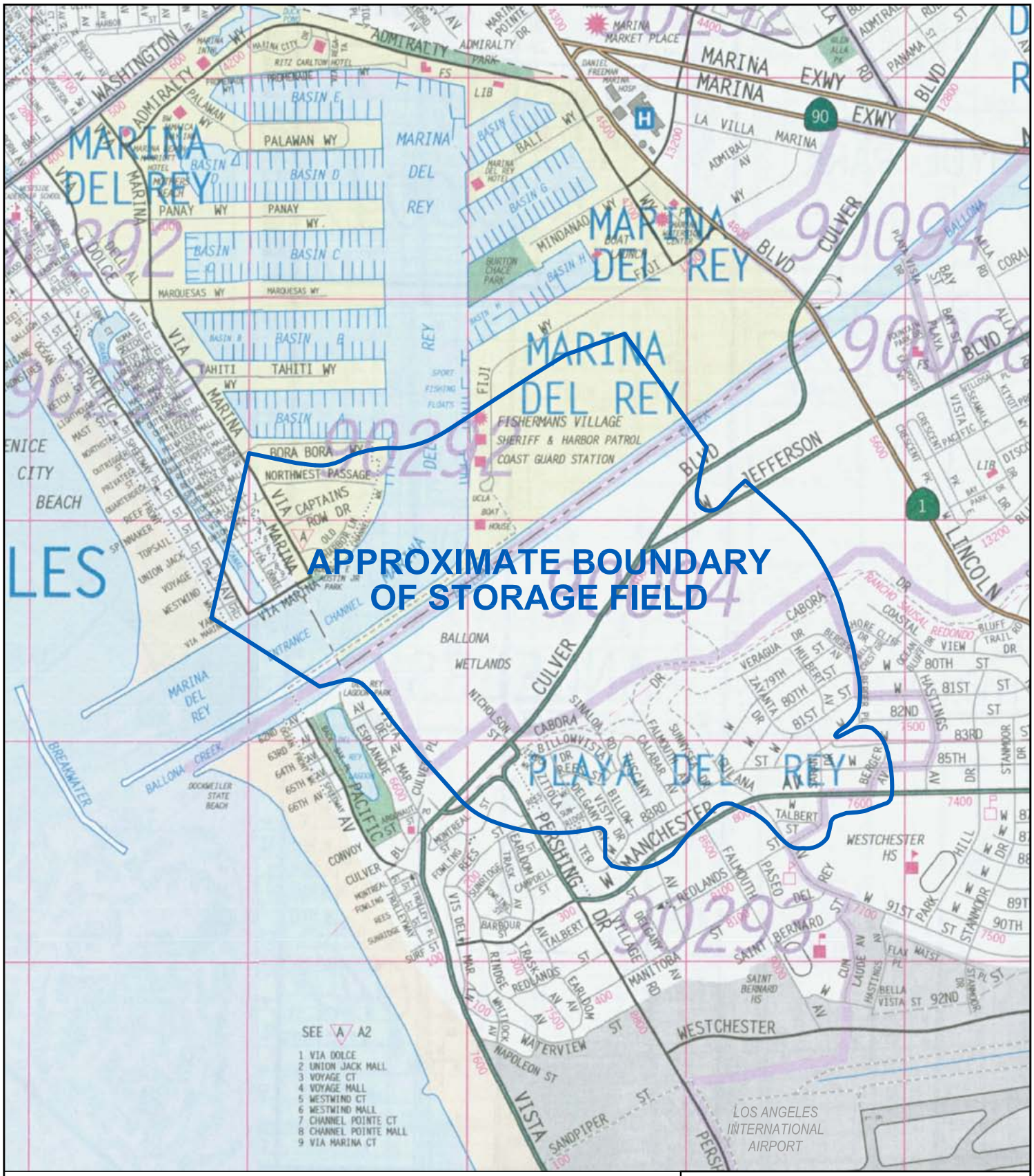
N

URS Corporation

FACILITY LOCATION MAP

Proj. No.: 29868671	Date: MAR 2009
Project: SoCal Gas Playa Del Rey Storage Facility	Figure: 1

S:\Gabriel Negrete\So Cal Gas - Playa Del Rey\Figure 01 - Facility Location Map.dwg , File date: 3/4/2009 3:28 PM, Print date: 3/4/2009 3:29 PM by: Gabriel Negrete



Source: Thomas Bros. Maps, Los Angeles Street Guide, 2006.

Note: Limits of approximate boundary of storage field provided by SoCal Gas on 10/14/2009.

0 1600' 3200'

Scale in Feet

N

URS Corporation

SITE PLAN

Proj. No.:	29868671	Date:	MAR 2009
Project:	SoCal Gas Playa Del Rey Storage Facility	Figure:	2

T:\2008\29868671 Playa Del Rey\Work Plan\Figures\Fac Loc Map And Site Plan.dwg , File date: 10/20/2009 2:51 PM, Print date: 10/20/2009 2:52 PM by: Gabriel Negrete

EXPLANATION

- SEMI PERMANENT VAPOR SAMPLING PROBE LOCATION

ALL CONCENTRATIONS IN ppmv (PARTS PER MILLION VOLUME).

0 250 500

SCALE IN FEET

N

URS Corporation

SOIL VAPOR SAMPLING LOCATIONS AND METHANE CONCENTRATIONS

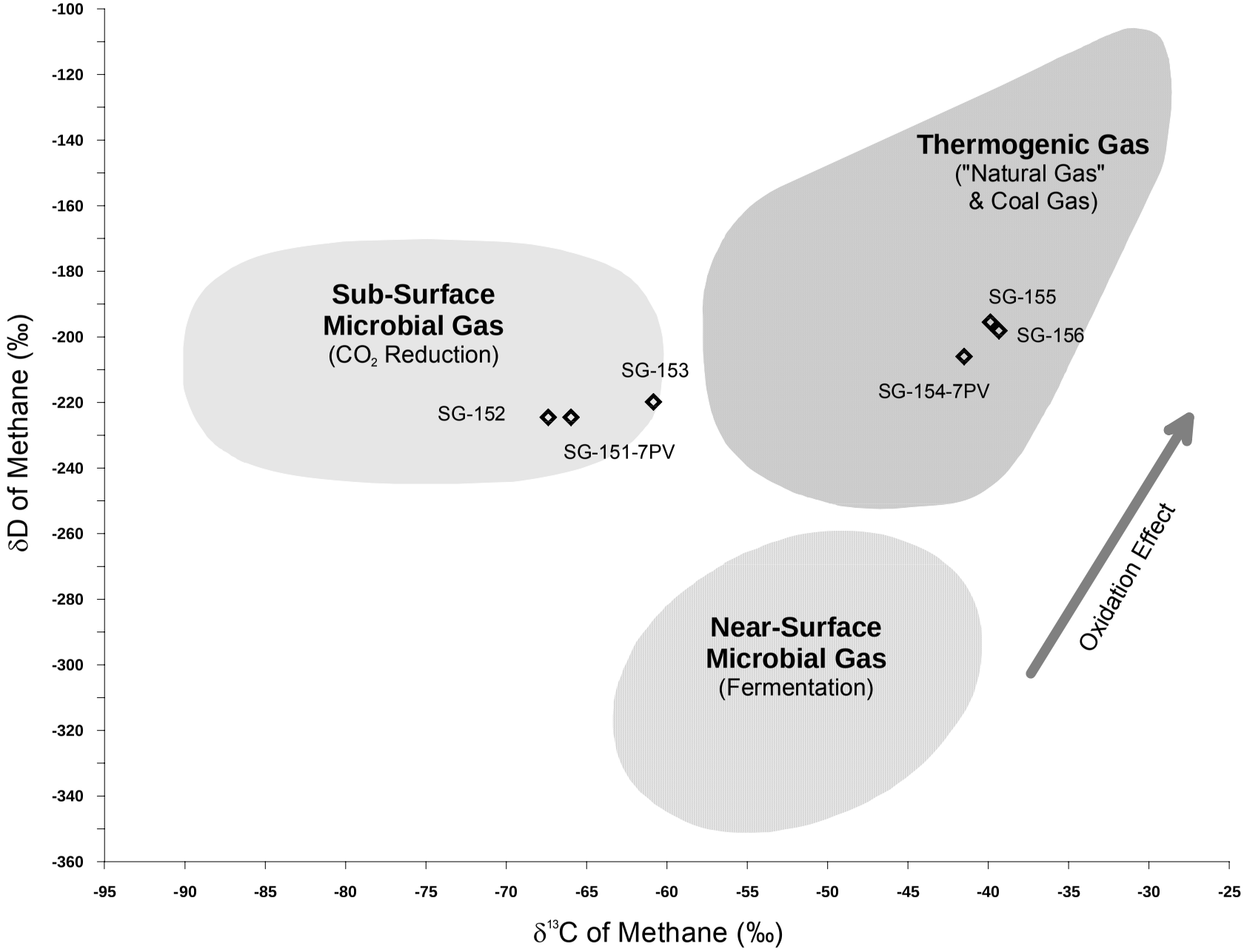
Proj. No.: 29868671	Date: NOVEMBER 2010
Project: Southern California Gas Company Playa del Rey Storage Facility	Figure: 3

T:\2008\29868671 Playa Del Rey\Phase II Report\Figures\Figure 03 - Soil Vapor Sampling - Methane Nov 2010.dwg , File date: 2/8/2011 2:38 PM, Print date: 2/8/2011 2:38 PM by: Jessica Volk

Figure 4

δ^2H *vs* $\delta^{13}C$ Data and Approximate Ranges of Methane from Various Potential Sources

Project: SoCalGas / Playa Del Rey

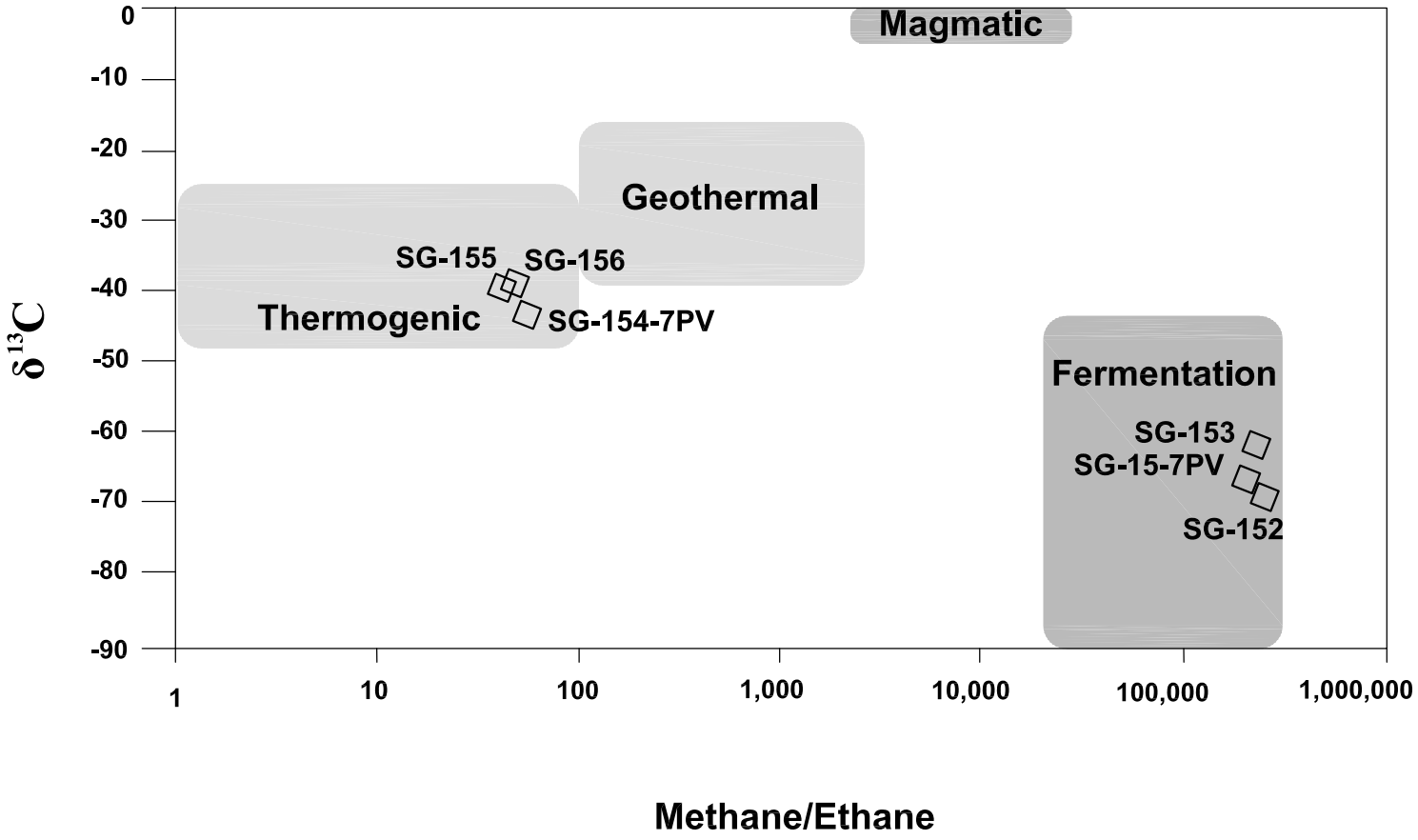


Coleman, et al, 1995

Figure 5

$\delta^{13}C$ and Methane Ratio for Samples along with Approximate Ranges for Various Methane Sources

Project: SoCalGas / Playa Del Rey



Pizzino, et al, 2007

Appendix A

Soil Vapor Laboratory Analytical Reports

ISOTECH
ISOTECH LABORATORIES INC
www.isotechlabs.com

Isotech Gas Data

Job 14212

So Cal Gas - Playa Del Rey

Isotech Lab No.	Sample Name	Sample Date	He %	H_2 %	Ar %	O_2 %	CO_2 %	N_2 %	C_1 %	C_2 %	C_3 %	iC_4 %	nC_4 %	iC_5 %	nC_5 %	C_{6+} %	$\delta^{13}CO_2$ ‰	$\delta^{13}C_1$ ‰	δDC_1 ‰	$^{14}C_1$ pMC	Std. Dev.
198801	SG-151-7PV	11/16/2010	nd	nd	0.213	1.11	2.67	17.50	78.48	0.0306	0.0012	nd	nd	nd	nd	nd	-57.20	-65.97	-224.5	< 0.2	
198802	SG-152	11/16/2010	nd	nd	0.149	1.22	1.63	12.05	84.92	0.0327	0.0013	nd	nd	nd	nd	nd	-41.01	-67.39	-224.5	0.5	0.1
198803	SG-153	11/16/2010	nd	nd	0.27	0.54	3.38	23.00	72.78	0.0311	0.0013	nd	nd	nd	nd	nd	-59.85	-60.84	-219.8	< 0.4	
198804	SG-154-7PV	11/17/2010	0.0064	nd	0.124	0.34	6.22	10.12	81.29	1.66	0.168	0.033	0.0217	0.0089	0.0038	0.0038	-24.08	-41.51	-206.0	11.0	0.1
198805	SG-155	11/17/2010	0.0074	nd	0.0634	0.28	2.99	4.83	89.33	2.06	0.304	0.0561	0.0433	0.0159	0.0082	0.0120	-22.87	-39.87	-195.5	3.3	0.1
198806	SG-156	11/17/2010	0.0076	nd	0.0619	0.50	1.26	4.71	90.82	2.15	0.337	0.0613	0.0506	0.0174	0.0088	0.0129	-21.24	-39.34	-198.1	1.6	0.1

Chemical analysis based on standards accurate to within 2%

Legend:

He:	Helium
H_2	Hydrogen
Ar	Argon
O_2	Oxygen
CO_2	Carbon Dioxide
N_2	Nitrogen
C_1	Methane
C_2	Ethane
C_3	Propane
iC_4	isobutane
nC_4	n-Butane
iC_5	isopentane
nC_5	n-Pentane
C_{6+}	Hexanes +
$\delta^{13}CO_2$	Carbon isotope ratio of Carbon Dioxide
$\delta^{13}C_1$	Carbon isotope ratio of methane
δDC_1	Hydrogen isotope ratio of methane
$^{14}C_1$	Radiocarbon (C-14) content of methane
Std. Dev.	Standard Deviation associated with C-14 measurement

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CASE NARRATIVE

Authorized Signature Name / Title (print)	Cynthia Olson, Division Manager
Signature / Date	Cynthia Olson, Division Manager 02/11/2011 16:53:09
Laboratory Job No. (Certificate of Analysis No.)	1011-00226
Project Name / No.	Playa Del Rey Storage Facility
Dates Sampled (from/to)	11/16/10 To 11/16/10
Dates Received (from/to)	11/16/10 To 11/16/10
Dates Reported (from/to)	11/29/10 To 02/11/11
Chains of Custody Received	Yes

Comments:

This report is a re-issue. The data herein is a revised reporting of the results for these analyses and supersedes any other version issued previously.

Subcontracting

Organic Analyses

No analyses sub-contracted

Sample Condition(s)

All samples intact

Positive Results (Organic Compounds)

Sample	Analyte	Result	Qual	Units	RL	Sample	Analyte	Result	Qual	Units	RL
SG-151-1PV	Isobutane	**1.7**		ppmv	1.5	SG-151-1PV	Methane	**650000**		ppmv	15
SG-151-1PV	Propane	**9.5**		ppmv	1.5	SG-151-3PV	Isobutane	**1.5**		ppmv	1.5
SG-151-3PV	Methane	**620000**		ppmv	15	SG-151-3PV	Propane	**9.0**		ppmv	1.5
SG-151-7PV	Isobutane	**1.9**		ppmv	1.5	SG-151-7PV	Methane	**630000**		ppmv	15
SG-151-7PV	Propane	**11**		ppmv	1.5	SG-152	Isobutane	**2.0**		ppmv	1.5
SG-152	Methane	**820000**		ppmv	15	SG-152	Propane	**12**		ppmv	1.5
SG-153	Isobutane	**2.0**		ppmv	1.5	SG-153	Methane	**660000**		ppmv	15
SG-153	Propane	**12**		ppmv	1.5						

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CERTIFICATE OF ANALYSIS

1011-00226

URS CORPORATION
Tom Zdeb
2020 E. 1ST ST., STE. 400
SANTA ANA, CA 92705

Date Reported	11/29/10
Date Received	11/16/10
Invoice No.	62531
Cust #	1930
Permit Number	
Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 001 **SG-151-1PV**						Date & Time Sampled:		11/16/10	@ 9:45	
Purge Volume Sampled: **1**										
[ETI Benzene Categories]										
N-Hexane - Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	10:58	HXE
Benzene - Toluene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	10:58	HXE
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	10:58	HXE
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/16/10	10:58	HXE
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/16/10	10:29	HXE
[C1-C6]										
Methane	**650000**		ppmv	EPA 8015B	1	10	15	11/16/10	10:58	HXE
Ethane	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	10:58	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	10:58	HXE
Propane	**9.5**		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	10:58	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	10:58	HXE
Isobutane	**1.7**		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	10:58	HXE
N-Butane	<1.5		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	10:58	HXE
Pentane	<1.5		ppmv	EPA 8015B	1	0.36	1.5	11/16/10	10:58	HXE
N-Hexane	<1.5		ppmv	EPA 8015B	1	0.40	1.5	11/16/10	10:58	HXE
TPH C6+ as Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	10:58	HXE
Sample: 002 **SG-151-3PV**						Date & Time Sampled:		11/16/10	@ 10:40	
Purge Volume Sampled: **3**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/16/10	11:04	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	11:46	HXE
Benzene - Toluene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	11:46	HXE
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	11:46	HXE
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/16/10	11:46	HXE
[C1-C6]										
Methane	**620000**		ppmv	EPA 8015B	1	10	15	11/16/10	11:46	HXE

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Permit Number	
Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 002 **SG-151-3PV**						Date & Time Sampled:		11/16/10	@ 10:40	
Purge Volume Sampled: **3**										
.....continued										
Ethane	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	11:46	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	11:46	HXE
Propane	**9.0**		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	11:46	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	11:46	HXE
Isobutane	**1.5**		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	11:46	HXE
N-Butane	<1.5		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	11:46	HXE
Pentane	<1.5		ppmv	EPA 8015B	1	0.36	1.5	11/16/10	11:46	HXE
N-Hexane	<1.5		ppmv	EPA 8015B	1	0.40	1.5	11/16/10	11:46	HXE
TPH C6+ as Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	11:46	HXE
Sample: 003 **SG-151-7PV**						Date & Time Sampled:		11/16/10	@ 11:38	
Purge Volume Sampled: **7**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/16/10	12:04	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	12:40	HXE
Benzene - Toluene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	12:40	HXE
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	12:40	HXE
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/16/10	12:40	HXE
[C1-C6]										
Methane	**630000**		ppmv	EPA 8015B	1	10	15	11/16/10	12:40	HXE
Ethane	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	12:40	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	12:40	HXE
Propane	**11**		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	12:40	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	12:40	HXE
Isobutane	**1.9**		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	12:40	HXE
N-Butane	<1.5		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	12:40	HXE
Pentane	<1.5		ppmv	EPA 8015B	1	0.36	1.5	11/16/10	12:40	HXE
N-Hexane	<1.5		ppmv	EPA 8015B	1	0.40	1.5	11/16/10	12:40	HXE
TPH C6+ as Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	12:40	HXE

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CERTIFICATE OF ANALYSIS

1011-00226

URS CORPORATION
Tom Zdeb
2020 E. 1ST ST., STE. 400
SANTA ANA, CA 92705

Date Reported	11/29/10
Date Received	11/16/10
Invoice No.	62531
Cust #	1930
Permit Number	
Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 004 **SG-152**								Date & Time Sampled: 11/16/10 @ 14:36		
Purge Volume Sampled: **7**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/16/10	2:59	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	3:40	HXE
Benzene - Toluene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	3:40	HXE
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	3:40	HXE
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/16/10	3:40	HXE
[C1-C6]										
Methane	**820000**		ppmv	EPA 8015B	1	10	15	11/16/10	3:40	HXE
Ethane	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	3:40	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	3:40	HXE
Propane	**12**		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	3:40	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	3:40	HXE
Isobutane	**2.0**		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	3:40	HXE
N-Butane	<1.5		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	3:40	HXE
Pentane	<1.5		ppmv	EPA 8015B	1	0.36	1.5	11/16/10	3:40	HXE
N-Hexane	<1.5		ppmv	EPA 8015B	1	0.40	1.5	11/16/10	3:40	HXE
TPH C6+ as Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	15:40	HXE
Sample: 005 **SG-153**								Date & Time Sampled: 11/16/10 @ 15:34		
Purge Volume Sampled: **7**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/16/10	3:57	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	4:39	HXE
Benzene - Toluene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	4:39	HXE
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	4:39	HXE
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/16/10	4:39	HXE
[C1-C6]										

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Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 005 **SG-153**						Date & Time Sampled:		11/16/10	@ 15:34	
Purge Volume Sampled: **7**										
.....continued										
Methane	**660000**		ppmv	EPA 8015B	1	10	15	11/16/10	4:39	HXE
Ethane	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	4:39	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/16/10	4:39	HXE
Propane	**12**		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	4:39	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/16/10	4:39	HXE
Isobutane	**2.0**		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	4:39	HXE
N-Butane	<1.5		ppmv	EPA 8015B	1	0.37	1.5	11/16/10	2:39	HXE
Pentane	<1.5		ppmv	EPA 8015B	1	0.36	1.5	11/16/10	4:39	HXE
N-Hexane	<1.5		ppmv	EPA 8015B	1	0.40	1.5	11/16/10	2:39	HXE
TPH C6+ as Benzene	<15		ppmv	EPA 8015B	1	10	15	11/16/10	16:39	HXE

Respectfully Submitted:

Cynthia Olson, Division Manager

QUALIFIERS

B = Detected in the associated Method Blank at a concentration above the routine RL.
B1 = BOD dilution water is over specifications . The reported result may be biased high.
D = Surrogate recoveries are not calculated due to sample dilution.
E = Estimated value; Value exceeds calibration level of instrument.
H = Analyte was prepared and/or analyzed outside of the analytical method holding time
I = Matrix Interference.
J = Analyte concentration detected between RL and MDL.
Q = One or more quality control criteria did not meet specifications. See Comments for further explanation.
S = Customer provided specification limit exceeded.

ABBREVIATIONS

DF = Dilution Factor
RL = Reporting Limit, Adjusted by DF
MDL = Method Detection Limit, Adjusted by DF
Qual = Qualifier
Tech = Technician

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate federal, state, or local authorities before acting in reliance on the regulatory limits provided.

For any feedback concerning our services, please contact Cynthia Olson, Division Manager at 951.779.0310. You may also contact both James Nokes, President and Robert Morgan, Chief Operating Officer at president@microbac.com.

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QUALITY CONTROL DATA REPORT

1011-00226

URS CORPORATION
SANTA ANA, CA 92705

Date Reported	**11/29/2010**
Date Received	**11/16/2010**
Date Sampled	**11/16/2010**
Invoice No.	**62531**
Customer #	**1930**
Customer P.O.	

Project: Playa Del Rey Storage Facility

Method # EPA 8015B
QC Reference # 26533 **Date Analyzed:** 11/16/10 **Technician:** HXE
Samples 001 002 003 004 005

Results	LCS %REC	LCS %DUP	Control Ranges LCS %REC
Ethene	83	85	70 - 130
Propene	92	93	70 - 130

Method # EPA 8260B
QC Reference # 26525 **Date Analyzed:** 11/16/10 **Technician:** HXE
Samples 001 002 003 004 005

No QC recoveries reported.

Method blank results

Ref	Test Name	Result	Qualif	Units	MDL	Ref	Test Name	Result	Qualif	Units	MDL
26525	Isopropanol (IPA)	<0.50		µg/L	0.50						
26533	Methane	**640**		ppmv	10						
	Ethane	<1.26		ppmv	1.26						
	Ethene	<1.26		ppmv	1.26						
	Propane	<0.43		ppmv	0.43						
	Propene	<0.43		ppmv	0.43						
	Isobutane	<0.37		ppmv	0.37						
	N-Butane	<0.37		ppmv	0.37						
	Pentane	<0.36		ppmv	0.36						
	N-Hexane	<0.40		ppmv	0.40						

Respectfully Submitted:

Cynthia Olson, Division Manager

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A & R Laboratories

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CASE NARRATIVE

Authorized Signature Name / Title (print)	Christopher Rattray, Laboratory Director
Signature / Date	Christopher Rattray, Laboratory Director 05/19/2011 14:19:34
Laboratory Job No. (Certificate of Analysis No.)	1011-00270
Project Name / No.	Playa Del Rey Storage Facility
Dates Sampled (from/to)	11/17/10 To 11/17/10
Dates Received (from/to)	11/17/10 To 11/17/10
Dates Reported (from/to)	11/29/10 To 05/19/11
Chains of Custody Received	Yes

Comments:

This report is a re-issue. The data herein is a revised reporting of the results for these analyses and supersedes any other version issued previously.

Q FLAG: The reported value for methane in samples 4 (SG-155) and 5 (SG-156) exceeds the theoretical limit due to dilution effects and rounding.

Subcontracting

Organic Analyses

No analyses sub-contracted

Sample Condition(s)

All samples intact

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Laboratory Job# 1011-00270

Positive Results (Organic Compounds)

Sample	Analyte	Result	Qual	Units	RL	Sample	Analyte	Result	Qual	Units	RL
SG-154-1PV	Ethane	**9900**		ppmv	3.0	SG-154-1PV	Isobutane	**330**		ppmv	1.5
SG-154-1PV	Methane	**810000**		ppmv	15	SG-154-1PV	N-Butane	**210**		ppmv	1.5
SG-154-1PV	Pentane	**35**		ppmv	1.5	SG-154-1PV	Propane	**1600**		ppmv	1.5
SG-154-3PV	Ethane	**9100**		ppmv	3.0	SG-154-3PV	Isobutane	**300**		ppmv	1.5
SG-154-3PV	Methane	**760000**		ppmv	15	SG-154-3PV	N-Butane	**190**		ppmv	1.5
SG-154-3PV	N-Hexane	**1.7**		ppmv	1.5	SG-154-3PV	N-Hexane - Benzene	**20**		ppmv	15
SG-154-3PV	Pentane	**44**		ppmv	1.5	SG-154-3PV	Propane	**1500**		ppmv	1.5
SG-154-3PV	TPH C6+ as Benzene	**41**		ppmv	15	SG-154-7PV	Benzene - Toluene	***11***	J	ppmv	15
SG-154-7PV	Ethane	**11000**		ppmv	3.0	SG-154-7PV	Isobutane	**340**		ppmv	1.5
SG-154-7PV	Methane	**900000**		ppmv	15	SG-154-7PV	N-Butane	**210**		ppmv	1.5
SG-154-7PV	N-Hexane	**2**		ppmv	1.5	SG-154-7PV	N-Hexane - Benzene	**21**		ppmv	15
SG-154-7PV	Pentane	**52**		ppmv	1.5	SG-154-7PV	Propane	**1800**		ppmv	1.5
SG-154-7PV	TPH C6+ as Benzene	**35**		ppmv	15	SG-155	Benzene - Toluene	**110**		ppmv	15
SG-155	Ethane	**15000**		ppmv	3.0	SG-155	Isobutane	**490**		ppmv	1.5
SG-155	Methane	**1100000**	Q	ppmv	15	SG-155	N-Butane	**360**		ppmv	1.5
SG-155	N-Hexane	**15**		ppmv	1.5	SG-155	N-Hexane - Benzene	**120**		ppmv	15
SG-155	Pentane	**120**		ppmv	1.5	SG-155	Propane	**3500**		ppmv	1.5
SG-155	TPH C6+ as Benzene	**280**		ppmv	15	SG-155	Toluene - Xylene	***13***	J	ppmv	15
SG-156	Benzene - Toluene	**120**		ppmv	15	SG-156	Ethane	**14000**		ppmv	3.0
SG-156	Isobutane	**610**		ppmv	1.5	SG-156	Methane	**1000000**	Q	ppmv	15
SG-156	N-Butane	**480**		ppmv	1.5	SG-156	N-Hexane	**23**		ppmv	1.5
SG-156	N-Hexane - Benzene	**190**		ppmv	15	SG-156	Pentane	**140**		ppmv	1.5
SG-156	Propane	**3600**		ppmv	1.5	SG-156	Propene	**14**		ppmv	1.5
SG-156	TPH C6+ as Benzene	**320**		ppmv	15	SG-156	Toluene - Xylene	**33**		ppmv	15

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1011-00270

URS CORPORATION
Tom Zdeb
2020 E. 1ST ST., STE. 400
SANTA ANA, CA 92705

Date Reported	11/29/10
Date Received	11/17/10
Invoice No.	62537
Cust #	1930
Permit Number	
Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 001 **SG-154-1PV**							Date & Time Sampled:		11/17/10 @ 9:29	
Purge Volume Sampled: **1**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/17/10	9:42	HXE
[C1-C6]										
Methane	**810000**		ppmv	EPA 8015B	1	10	15	11/17/10	10:34	HXE
Ethane	**9900**		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	10:34	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	10:34	HXE
Propane	**1600**		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	10:34	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	10:34	HXE
Isobutane	**330**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	10:34	HXE
N-Butane	**210**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	10:34	HXE
Pentane	**35**		ppmv	EPA 8015B	1	0.36	1.5	11/17/10	10:34	HXE
N-Hexane	<1.5		ppmv	EPA 8015B	1	0.40	1.5	11/17/10	10:34	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	<1900		ppmv	EPA 8015B	125	1,250	1900	11/17/10	10:58	CMR
Benzene - Toluene	<1900		ppmv	EPA 8015B	125	1,250	1900	11/17/10	10:58	CMR
Toluene - Xylene	<1900		ppmv	EPA 8015B	125	1,250	1900	11/17/10	10:58	CMR
Xylene+	<1900		ppmv	EPA 8015B	125	1,250	1900	11/17/10	10:58	CMR
TPH C6+ as Benzene	<1900		ppmv	EPA 8015B	125	1,250	1900	11/17/10	10:58	HXE
Sample: 002 **SG-154-3PV**							Date & Time Sampled:		11/17/10 @ 9:59	
Purge Volume Sampled: **3**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/17/10	10:19	HXE
[C1-C6]										
Methane	**760000**		ppmv	EPA 8015B	1	10	15	11/17/10	11:29	HXE
Ethane	**9100**		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	11:29	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	11:29	HXE
Propane	**1500**		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	11:29	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	11:29	HXE
Isobutane	**300**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	11:29	HXE

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Date Reported	11/29/10
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Invoice No.	62537
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Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 002 **SG-154-3PV**						Date & Time Sampled:		11/17/10	@	9:59
Purge Volume Sampled: **3**										
.....continued										
N-Butane	**190**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	11:29	HXE
Pentane	**44**		ppmv	EPA 8015B	1	0.36	1.5	11/17/10	11:29	HXE
N-Hexane	**1.7**		ppmv	EPA 8015B	1	0.40	1.5	11/17/10	11:29	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	**20**		ppmv	EPA 8015B	1	10	15	11/17/10	11:29	CMR
Benzene - Toluene	<15		ppmv	EPA 8015B	1	10	15	11/17/10	11:29	CMR
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/17/10	11:29	CMR
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/17/10	11:29	CMR
TPH C6+ as Benzene	**41**		ppmv	EPA 8015B	1	10	15	11/17/10	11:29	HXE
Sample: 003 **SG-154-7PV**						Date & Time Sampled:		11/17/10	@	11:30
Purge Volume Sampled: **7**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/17/10	11:37	HXE
[C1-C6]										
Methane	**900000**		ppmv	EPA 8015B	1	10	15	11/17/10	12:33	HXE
Ethane	**11000**		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	12:33	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	12:33	HXE
Propane	**1800**		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	12:33	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	12:33	HXE
Isobutane	**340**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	12:33	HXE
N-Butane	**210**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	12:33	HXE
Pentane	**52**		ppmv	EPA 8015B	1	0.36	1.5	11/17/10	12:33	HXE
N-Hexane	**2**		ppmv	EPA 8015B	1	0.40	1.5	11/17/10	12:33	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	**21**		ppmv	EPA 8015B	1	10	15	11/17/10	12:33	CMR
Benzene - Toluene	***11***	J	ppmv	EPA 8015B	1	10	15	11/17/10	12:33	CMR
Toluene - Xylene	<15		ppmv	EPA 8015B	1	10	15	11/17/10	12:33	CMR
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/17/10	12:33	CMR
TPH C6+ as Benzene	**35**		ppmv	EPA 8015B	1	10	15	11/17/10	12:16	HXE

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Date Reported	11/29/10
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Invoice No.	62537
Cust #	1930
Permit Number	
Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 004 **SG-155**								Date & Time Sampled:	11/17/10 @	13:28
Purge Volume Sampled: **7**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/17/10	1:33	HXE
[C1-C6]										
Methane	**1100000**	Q	ppmv	EPA 8015B	1	10	15	11/17/10	2:30	HXE
Ethane	**15000**		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	2:30	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	2:30	HXE
Propane	**3500**		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	2:30	HXE
Propene	<1.5		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	2:30	HXE
Isobutane	**490**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	2:30	HXE
N-Butane	**360**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	2:30	HXE
Pentane	**120**		ppmv	EPA 8015B	1	0.36	1.5	11/17/10	2:30	HXE
N-Hexane	**15**		ppmv	EPA 8015B	1	0.40	1.5	11/17/10	2:30	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	**120**		ppmv	EPA 8015B	1	10	15	11/17/10	2:30	CMR
Benzene - Toluene	**110**		ppmv	EPA 8015B	1	10	15	11/17/10	2:30	CMR
Toluene - Xylene	***13***	J	ppmv	EPA 8015B	1	10	15	11/17/10	2:30	CMR
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/17/10	2:30	CMR
TPH C6+ as Benzene	**280**		ppmv	EPA 8015B	1	10	15	11/17/10	14:30	HXE
Sample: 005 **SG-156**								Date & Time Sampled:	11/17/10 @	14:29
Purge Volume Sampled: **7**										
[VOCs by GCMS]										
[VOC Vapor Sampling Tracer]										
Isopropanol (IPA)	<10		µg/L	EPA 8260B	10	5.0	10	11/17/10	2:42	HXE
[C1-C6]										
Methane	**1000000**	Q	ppmv	EPA 8015B	1	10	15	11/17/10	3:37	HXE
Ethane	**14000**		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	3:37	HXE
Ethene	<3.0		ppmv	EPA 8015B	1	1.3	3.0	11/17/10	3:37	HXE
Propane	**3600**		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	3:37	HXE
Propene	**14**		ppmv	EPA 8015B	1	0.43	1.5	11/17/10	3:37	HXE

A & R Laboratories

Formerly Microbac Southern California

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951-779-0310 FAX 951-779-0344
www.arlaboratories.com office@arlaboratories.com

FDA#	2030513
LA City#	10159
ELAP#'s	2746
	2750
	2747
	2122

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CERTIFICATE OF ANALYSIS

1011-00270

URS CORPORATION
Tom Zdeb
2020 E. 1ST ST., STE. 400
SANTA ANA, CA 92705

Date Reported	11/29/10
Date Received	11/17/10
Invoice No.	62537
Cust #	1930
Permit Number	
Customer P.O.	

Project: Playa Del Rey Storage Facility

Analysis	Result	Qual	Units	Method	DF	MDL	RL	Date	Time	Tech
Sample: 005 **SG-156**						Date & Time Sampled:		11/17/10	@	14:29
Purge Volume Sampled: **7**										
.....continued										
Isobutane	**610**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	3:37	HXE
N-Butane	**480**		ppmv	EPA 8015B	1	0.37	1.5	11/17/10	3:37	HXE
Pentane	**140**		ppmv	EPA 8015B	1	0.36	1.5	11/17/10	3:37	HXE
N-Hexane	**23**		ppmv	EPA 8015B	1	0.40	1.5	11/17/10	3:37	HXE
[ETI Benzene Categories]										
N-Hexane - Benzene	**190**		ppmv	EPA 8015B	1	10	15	11/17/10	3:37	CMR
Benzene - Toluene	**120**		ppmv	EPA 8015B	1	10	15	11/17/10	3:37	CMR
Toluene - Xylene	**33**		ppmv	EPA 8015B	1	10	15	11/17/10	3:37	CMR
Xylene+	<15		ppmv	EPA 8015B	1	10	15	11/17/10	3:37	CMR
TPH C6+ as Benzene	**320**		ppmv	EPA 8015B	1	10	15	11/17/10	15:37	HXE

Respectfully Submitted:

Christopher Rattray - Laboratory Director

QUALIFIERS

B = Detected in the associated Method Blank at a concentration above the routine RL.
B1 = BOD dilution water is over specifications . The reported result may be biased high.
D = Surrogate recoveries are not calculated due to sample dilution.
E = Estimated value; Value exceeds calibration level of instrument.
H = Analyte was prepared and/or analyzed outside of the analytical method holding time
I = Matrix Interference.
J = Analyte concentration detected between RL and MDL.
Q = One or more quality control criteria did not meet specifications. See Comments for further explanation.
S = Customer provided specification limit exceeded.

ABBREVIATIONS

DF = Dilution Factor
RL = Reporting Limit, Adjusted by DF
MDL = Method Detection Limit, Adjusted by DF
Qual = Qualifier
Tech = Technician

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate federal, state, or local authorities before acting in reliance on the regulatory limits provided.

For any feedback concerning our services, please contact Christopher Rattray, Laboratory Director at 951.779.0310. You may also contact Ken Zheng, President at arlab@arlaboratories.com.

A & R Laboratories

Formerly Microbac Southern California
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951-779-0310 FAX 951-779-0344
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FDA#	2030513
LA City#	10159
ELAP#'s	2373
	2562
	2665
	2479
	2122

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QUALITY CONTROL DATA REPORT

1011-00270

URS CORPORATION
SANTA ANA, CA 92705

Date Reported	**11/29/2010**
Date Received	**11/17/2010**
Date Sampled	
Invoice No.	**62537**
Customer #	**1930**
Customer P.O.	

Project: Playa Del Rey Storage Facility

Method # EPA 8015B
QC Reference # 26535 **Date Analyzed:** 11/17/10 **Technician:** HXE
Samples 001 002 003 004 005

Results	LCS %REC	LCS %DUP	Control Ranges LCS %REC
Ethane	76		70 - 130
Isobutane	107	108	70 - 130
Methane	97	97	70 - 130
N-Butane	86		70 - 130
N-Hexane	87		70 - 130
Pentane	90		70 - 130
Propane	77		70 - 130

Method # EPA 8260B
QC Reference # 26537 **Date Analyzed:** 11/17/10 **Technician:** HXE
Samples 001 002 003 004 005

No QC recoveries reported.

Method blank results

Ref	Test Name	Result	Qualif	Units	MDL	Ref	Test Name	Result	Qualif	Units	MDL
26535	Methane	**43**		ppmv	10						
	Ethane	<1.26		ppmv	1.26						
	Ethene	<1.26		ppmv	1.26						
	Propane	<0.43		ppmv	0.43						
	Propene	<0.43		ppmv	0.43						
	Isobutane	<0.37		ppmv	0.37						
	N-Butane	<0.37		ppmv	0.37						
	Pentane	<0.36		ppmv	0.36						
	N-Hexane	<0.40		ppmv	0.40						
26537	Isopropanol (IPA)	<0.50		µg/L	0.50						

Respectfully Submitted:

Christopher Rattray - Laboratory Director

For any feedback concerning our services, please contact Christopher Rattray, Laboratory Director at 951.779.0310. You may also contact Ken Zheng, President at arlab@arlaboratories.com.

Southern California Gas Company

A Sempra Energy utility®

Interoffice Memo

To: Maritza Pacheco

From: Marianne Guirguis MG

Date: November 22, 2010

EAC PROJECT NO.: TC2010-C023

EAC ACCOUNT NO.: 814GP

Subject: Helium analysis for the Soil Vapor Sampling Project

THIS REPORT IS YOUR RECORD. THE EAC WILL DISCARD THIS REPORT ON 11/22/2015.

SCOPE

Assist Storage Operations in characterizing gas from a leak investigation by analyzing samples taken from multiple bar holes at Playa Del Rey for helium. The purpose of the gas characterization was to determine if the gas from the bar holes located at Del Rey 10 and the Tank Farm contained helium. This will help identify if gas is leaking from the wells.

RESULTS

The Engineering Analysis Center (EAC) helium reports are attached.

Table 1. Summary of Helium results

Location:	**Del Rey 10**				**Tank Farm**			
Sample ID:	SG-151-7PV	SG-152	SG-153	Ambient Air	SG-154-7PV	SG-155	SG-156	Ambient Air
Helium Conc. (ppm):	ND[1]	ND	7	ND	60	68	69	ND

[1] Non Detectable (ND) < 7ppm of helium.

Gas samples from Del Rey 10 contained 7 ppm or lower of Helium. Gas samples from the Tank Farm contained an average of 66 ppm of Helium. At both locations ambient air was non-detectable for helium.

METHODS

Outside contractors, URS Corporation collected the gas samples according to their procedures. Samples were collected in Tedlar Bags on November 17 and 18, 2010. The Engineering Analysis Center analyzed gas samples for helium content using the Shimadzu GC-2014.

MG/Project No 1939 & 1941.doc/Attachments

cc: (w/o attachments)
Shahid Razzak

Southern California Gas Company
Engineering Analysis Center
8101 South Rosemead Boulevard
Pico Rivera, CA 90660
Tel: (562) 806-4344

November 18, 2010

Certificate of Analysis

We received 4 gas samples for Helium analysis on November 17, 2010.

SG-151-7PV
SG-152
SG-153
Ambient Air

The job was logged in as: EAC Job #: 1939

The samples were analyzed by a Shimadzu GC with TCD using Nitrogen as a Carrier gas.

Your sample(s) were analyzed by: RM

Principal Analyst :

QA Coordinator :

Laboratory Director:

Engineering Analysis Center

Results of Analysis

Date Sampled: 11/16/10

SAMPLE ID	*LAB ID*	*Date Analyzed*	*Helium Concentration*	*Detection Limit*	*Units*
Method Blank		11/17/10	ND	7	ppm
SG-151-7PV	01B	11/17/10	ND	7	ppm
SG-152	02B	11/17/10	ND	7	ppm
SG-153	03B	11/17/10	7	7	ppm
Ambient Air	04B	11/17/10	ND	7	ppm

*ND : The analyte is not detected at or above the stated limit. Unless otherwise noted, the method detection limit for each analyte is as listed in the "Detection Limit" column.

Quality Control Summary

Helium Standard	Date Analyzed	Standard Concentration (ppm)	Reported Concentration (ppm)	% Difference
Initial Standard	11/17/10	100	98.91	1
Final Standard	11/17/10	100	97.92	2

Southern California Gas Company
Engineering Analysis Center
8101 South Rosemead Boulevard
Pico Rivera, CA 90660
Tel: (562) 806-4344

November 18, 2010

Certificate of Analysis

We received 5 gas samples for Helium analysis on November 18, 2010.

SG-154-7PV
SG-155
SG-156
Ambient Air

The job was logged in as: EAC Job #: 1941

The samples were analyzed by a Shimadzu GC with TCD using Nitrogen as a Carrier gas.

Your sample(s) were analyzed by: MG

Principal Analyst :

QA Coordinator :

Laboratory Director:

Results of Analysis

Date Sampled: 11/17/10

SAMPLE ID	*LAB ID*	*Date Analyzed*	*Helium Concentration*	*Detection Limit*	*Units*
Method Blank		11/18/10	ND	7	ppm
SG-154-7PV	01B	11/18/10	60	7	ppm
SG-155	02B	11/18/10	68	7	ppm
SG-156	03B	11/18/10	69	7	ppm
Ambient Air	04B	11/18/10	ND	7	ppm

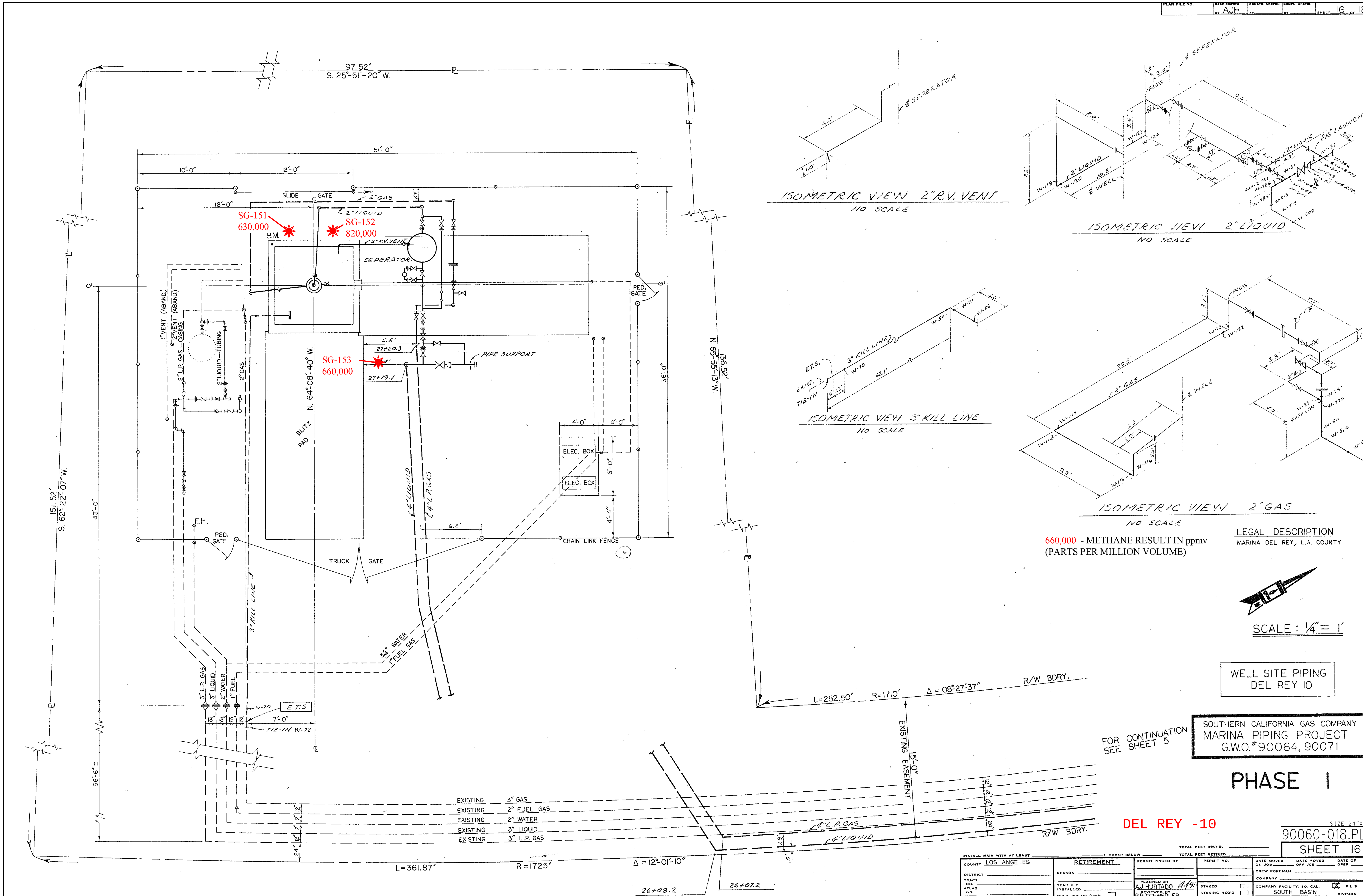
*ND : The analyte is not detected at or above the stated limit. Unless otherwise noted, the method detection limit for each analyte is as listed in the "Detection Limit" column.

Quality Control Summary

Helium Standard	Date Analyzed	Standard Concentration (ppm)	Reported Concentration (ppm)	% Difference
Initial Standard	11/18/10	100	98.54	1
Final Standard	11/18/10	100	98.23	2

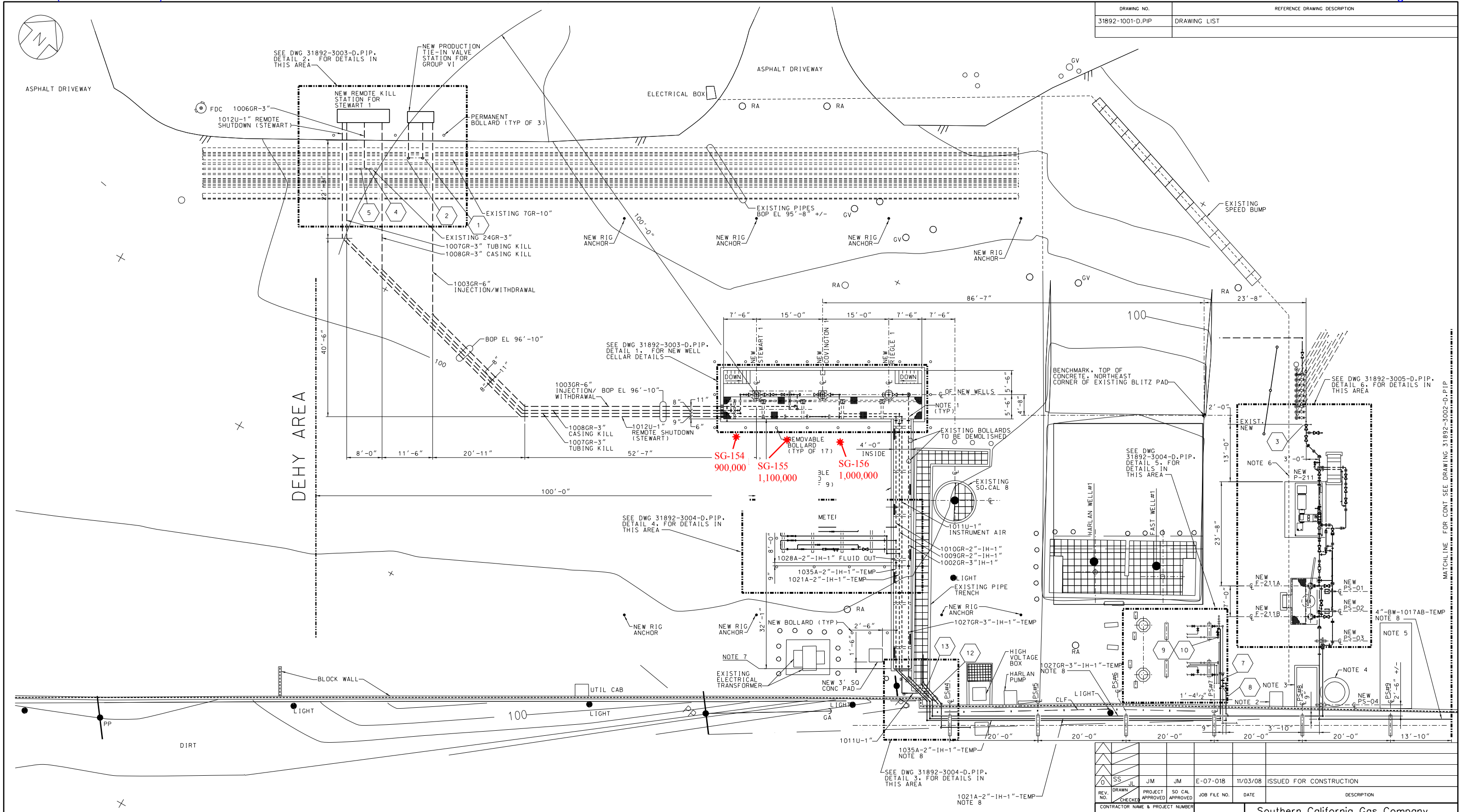
Appendix B

Southern California Gas Company Well Maps



97.52′
S. 25°-51′-20″ W.
151.52′
S. 62°-22′-07″ W.
136.52′
N. 65°-55′-13″ W.
N. 64°-08′-40″ W.
51′-0″
10′-0″
12′-0″
18′-0″
36′-0″
43′-0″
66′-6″±
SLIDE
GATE
2″ GAS
2″ LIQUID
2″ R.V. VENT
SEPERATOR
SG-151
630,000
SG-152
820,000
SG-153
660,000
B.M.
PED. GATE
PIPE SUPPORT
27+20.3
27+19.1
BLITZ PAD
1″ VENT (ABAND.)
2″ VENT (ABAND.)
2″ L.P. GAS—CASING
2″ LIQUID—TUBING
3″ KILL LINE
4″ LIQUID
4″ L.P. GAS
3/4″ WATER
1″ FUEL GAS
ELEC. BOX
ELEC. BOX
CHAIN LINK FENCE
TRUCK
GATE
F.H.
3″ L.P. GAS
3″ LIQUID
2″ WATER
1″ FUEL
W-70
E.T.S.
7′-0″
TIE-IN W-72
EXISTING 3″ GAS
EXISTING 2″ FUEL GAS
EXISTING 2″ WATER
EXISTING 3″ LIQUID
EXISTING 3″ L.P. GAS
L=252.50′
R=1710′
Δ = 08°-27′-37″
R/W BDRY.
15′-0″ EXISTING EASEMENT
L=361.87′
R=1725′
Δ = 12°-01′-10″
26+08.2
26+07.2
ISOMETRIC VIEW 2″ R.V. VENT
NO SCALE
ISOMETRIC VIEW 2″ LIQUID
NO SCALE
PIG LAUNCHER
ISOMETRIC VIEW 3″ KILL LINE
NO SCALE
ISOMETRIC VIEW 2″ GAS
NO SCALE
660,000 - METHANE RESULT IN ppmv
(PARTS PER MILLION VOLUME)
LEGAL DESCRIPTION
MARINA DEL REY, L.A. COUNTY
SCALE : 1/4″ = 1′
WELL SITE PIPING
DEL REY 10
FOR CONTINUATION SEE SHEET 5
SOUTHERN CALIFORNIA GAS COMPANY
MARINA PIPING PROJECT
G.W.O. # 90064, 90071
PHASE I
DEL REY -10
SIZE 24″X36″
90060-018.PLN
SHEET 16
SHEET 16 OF 18
AJH
COUNTY LOS ANGELES
RETIREMENT
PLANNED BY A.J. HURTADO
REVIEWED BY R.R. SCHWEDLER
COMPANY FACILITY: SO. CAL. SOUTH BASIN
SOUTHERN CALIFORNIA GAS CO.—2956-5F

DRAWING NO.	REFERENCE DRAWING DESCRIPTION
31892-1001-D.PIP	DRAWING LIST



NOTES:

1. ALIGNMENT OF NEW PIPE TRENCH MAY NOT BE PERPENDICULAR TO NEW WELL CELLAR. ROTATE PIPING AT ELBOWS AS REQUIRED.
2. FAST #1 ESP P-1 CONTROL PANEL.
3. TRANSFORMER.
4. PORTABLE CHEMICAL STORAGE TANK. FIELD RELOCATE AS REQUIRED TO INSTALL NEW PIPING AND SUPPORTS.
5. ELECTRICAL SWITCH BOARD.
6. (1) 1/2" RGS AND (1) 3/4" RGS EXISTING CONDUIT. RELOCATE AS REQUIRED TO ACCOMMODATE NEW PIPING AND EQUIPMENT.
7. INSIDE OF NEW PIPE TRENCH.
8. U-BOLT PIPE TO UNDERSIDE OF EXISTING SUPPORTS PS#4 THRU PS#20.

9000,000 - METHANE RESULT IN ppmv (PARTS PER MILLION VOLUME)

STEWART -1, COVINGTON -1 & RIEGLE -1

ISSUED FOR CONSTRUCTION

0 1 2 3 4 5 10 15 20 25 30 35 40
1"=10'

REV. NO.	DRAWN / CHECKED	PROJECT APPROVED	SO CAL APPROVED	JOB FILE NO.	DATE	DESCRIPTION
0	SS / JL	JM	JM	E-07-018	11/03/08	ISSUED FOR CONSTRUCTION

CONTRACTOR NAME & PROJECT NUMBER

	BY	DATE
DESIGNED	J. MYERS	11/03/08
DRAWN	S. SALAZAR	11/03/08
CHK'D.	J. MYERS	11/03/08
APPR'D.	J. MYERS	11/03/08
JOB FILE NO.	E-07-018	
W.O.A.	96744/96745/96746	
DIST.	113	
CLASS	98	

Southern California Gas Company
GAS ENGINEERING LOS ANGELES

PLAYA DEL REY STORAGE FIELD 2008 WELLSITE EXPANSION STEWART 1, COVINGTON 1 & RIEGLE 1 PIPING SITE PLAN SHEET 1

SCALE 1"=10'-0

DRAWING NO. 31892-3001-D.PIP REV. 0

$$$$$$$$$$dgnspec$$$$$$$$$$$$$$ $$$$$$$$$$$$sytime$$$$$$

Appendix C

Isotopic Data Interpretation

ISOTECH®
ISOTECH LABORATORIES INC
www.isotechlabs.com

1308 Parkland Court Champaign, IL 61821-1826 | 877.362.4190 217.398.3490 217.398.3493 Fax

February 9, 2011

Jordan Mandel
URS Corporation
2020 E First Street
Suite 400
Santa Ana, CA 92705

Dear Jordan,

Enclosed are the hard copy analysis reports for the samples submitted from your So Cal Gas - Playa Del Rey project. These samples were assigned to Isotech job number 14212, and were subjected to compositional analysis, stable isotopic analysis of methane and carbon dioxide, and also carbon-14 analysis of methane. To help illustrate the data, I have enclosed our template figure showing stable isotope distribution for methane, and included on the figure are the data points for these 6 gases. This figure is a plot of the carbon isotope ratio ($\delta^{13}C$) of methane on the x-axis versus the hydrogen isotope ratio (δD) of methane on the y-axis. This figure has been presented in numerous publications, including one titled "Isotopic Identification of Landfill Methane", which I am enclosing as reference material. The shaded areas on this figure represent the typical isotopic fingerprint of methane from each of the three identified sources, but it should be noted that the boundaries are not rigidly defined, and some gases will plot outside of the shaded areas.

Based on the data, there are 2 distinct sets of gases present among these 6 gas samples. Samples SG-151, 152, and 153 represent one source of gas, and these gases are typical of some native gases found in this area. Although these gases are predominantly composed of methane and nitrogen, and they plot in the Sub-Surface Microbial Gas region on the stable isotope figure, due to the presence of ethane and propane, these gases may be an early stage thermogenic gas rather than a microbial gas. These gases contain low levels of C-14: the concentration was too low to report a finite value for samples SG-151 and SG-153, while SG-152 contained 0.5 pMC (percent modern carbon). When analyzing methane, the convention is to report the C-14 data as pMC, rather than to convert to an age date. This is due to the fact that the analysis is of a gas rather than a solid compound, and the gas could be a mixture. Thus, even though sample SG-152 contains some C-14, the value of 0.5 pMC may not represent the composite amount of C-14 in the gas, but rather could be showing that there is a small amount of bacterial methane in this particular sample.

The three gases from SG-154, 155, and 156 represent the other occurrence of gas in this area, and these gases do not appear to be related to the other samples. These gases are predominantly thermogenic in origin, with significant levels of ethane, propane, butanes, and pentanes, and they fall in the Thermogenic Gas zone on the figure. However, C-14 data shows that these gases must contain some amount of microbial gas, because pure thermogenic gas would not contain detectable levels of C-14. Sample SG-154 contains the highest concentration of C-14, and as shown on the figure this gas is shifted more toward the Near-Surface Microbial Gas zone, which indicates the type of microbial gas that is mixing with these gases. Microbial gas of this type is formed by the decomposition of organic material, and depending on the source of the material, the C-14 concentration could be over 100 pMC, and thus it would only require a small amount of microbial gas mixed with thermogenic gas to give the C-14 concentrations measured. For instance, landfill gases are near-surface microbial gas, and most landfill gases contain approximately 125-140 pMC, which means that mixing 8-9% landfill methane with thermogenic gas would be enough to

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elevate the C-14 content of sample SG-154 to 11.0 pMC. The source of the microbial gas is not clear based on the data, but options to consider would include presence of microbial gas (swamp gas) in the area where the samples were collected, or possibly the gas storage company has mixed some amount of landfill methane with their gas.

I hope this information is useful to you, and if you have any questions or if there is anything else we can do for you, please do not hesitate to contact us.

We will hold the samples until 03/13/2011 in case you would want any additional analyses carried out, and will then dispose of the remaining sample material. If you need us to hold the samples longer, please contact us.

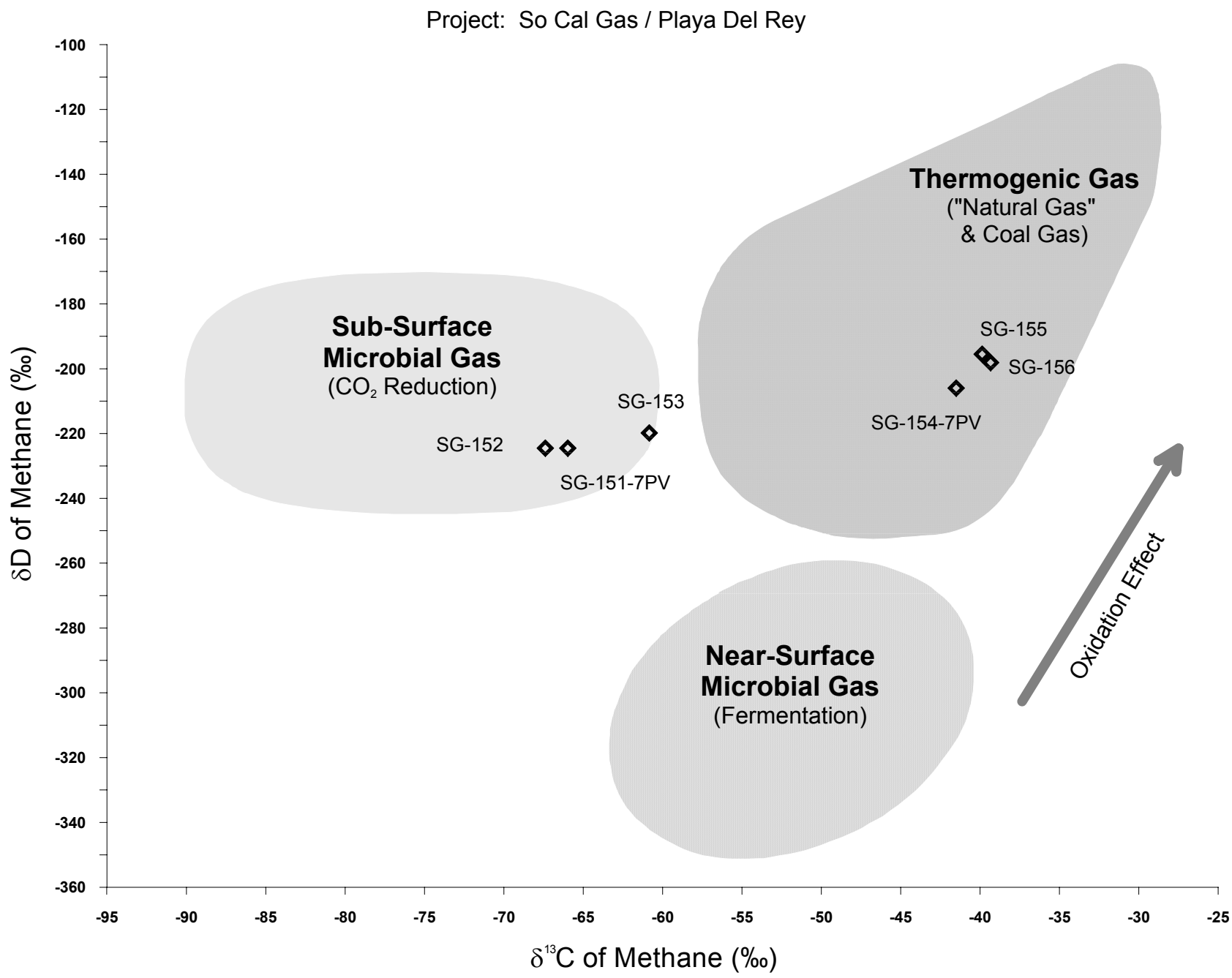
Thank you for choosing Isotech for your analysis needs, we appreciate your business.

Sincerely,

Steven R. Pelphrey

Steven R. Pelphrey
Laboratory Manager

Enclosures (7)


Project: So Cal Gas / Playa Del Rey
δD of Methane (‰)
-100
-120
-140
-160
-180
-200
-220
-240
-260
-280
-300
-320
-340
-360
-95
-90
-85
-80
-75
-70
-65
-60
-55
-50
-45
-40
-35
-30
-25
δ13C of Methane (‰)
Thermogenic Gas
("Natural Gas"
& Coal Gas)
Sub-Surface
Microbial Gas
(CO2 Reduction)
Near-Surface
Microbial Gas
(Fermentation)
SG-155
SG-156
SG-154-7PV
SG-153
SG-152
SG-151-7PV
Oxidation Effect