

# ALISO CANYON GAS LEAK

*Results from*

*Expanded Air Monitoring*

*January 31, 2016*

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## Overview and Purpose

- The Los Angeles County Department of Public Health (Public Health) has implemented an Expanded Air Monitoring Plan (EAMP) to comprehensively evaluate air quality in the Porter Ranch area in response to a natural gas leak which began on October 23, 2015 at the Aliso Canyon natural gas storage facility.
- Implementation of the EAMP represents an ongoing effort to consolidate and evaluate data collected by multiple parties, including Los Angeles County Fire Department (LACoFD), Southern California Gas Company (SoCalGas), South Coast Air Quality Management District (SCAQMD), Los Angeles Unified School District (LAUSD), and California Air Resources Board (ARB).
- The purpose of this report is to provide the community and various stakeholders an update on the results of the EAMP.

## Response Background

- Shortly after the natural gas leak began on October 23, 2015, SoCalGas began daily air monitoring of the chemicals of concern.
- Various other agencies have also collected samples.
- When Public Health was informed that the gas leak could take several months to repair, Public Health began coordinating with other agencies and SoCalGas Company to implement expanded testing.
- Public Health oversaw development of the EAMP to improve monitoring efforts, including more strategic community locations, stricter laboratory reporting limits and longer sample collection times.
- The EAMP will continue until Public Health determines it is no longer necessary.

## Chemicals of Health Concern

- Natural gas consists of 93% methane, which is a hydrocarbon. The other 7% of natural gas consists primarily of other hydrocarbons which have all been undetectable in the community air samples.
- Other compounds, including odorants and benzene are present in very small amounts.
- The chemicals of concern in the leaking gas are:
  - Methane
  - Sulfur odorants (Mercaptans)
  - Benzene and related compounds

### 1. Methane

- Methane is an odorless and colorless gas.
- At very high concentrations methane can displace oxygen, which is essential for life. The levels found in the community are far below the concentrations that would cause oxygen displacement.
- The primary hazard associated with methane is flammability. The levels found in the community samples are substantially lower than flammable limits (50,000 ppm).
- Methane does not pose a health concern to residents in the area.

## 2. Sulfur Odorants (Mercaptans)

- Mercaptans are sulfur compounds that have a strong “rotten-egg,” “garlicky,” or “skunk-like” odor and are added to natural gas, at a very low level, as a safety precaution to quickly identify natural gas leaks.
- Mercaptans, even at very low levels, can be irritating to the eyes, skin, and respiratory system.
- The natural gas leak is releasing very low levels of mercaptans into the air. To date, the levels of mercaptans have been so low that it is not detectable by analytical methods. However, these low level exposures may have an odor and may cause eye, nose and throat irritation, coughing, nasal congestion, shortness of breath, nausea, stomach discomfort, dizziness, and headaches.
- Symptoms vary depending on the frequency and duration of exposure to the odor and will go away once the odor exposure has diminished. Odors are not associated with long-term health effects, but they may still cause short-term symptoms, as described above, in some individuals as long as the odors remain.

## 3. Benzene and Other Chemicals

- Benzene and other chemicals are present in trace amounts in the environment and in the Aliso Canyon Storage Facility. As a result, small amounts of these chemicals are present in the natural gas.
- The chemical of highest concern is benzene, a known human carcinogen associated with leukemia and other bone marrow disorders.
- Based on these concerns, Public Health deemed it necessary to monitor for benzene and other trace compounds.
- Results of benzene testing are described later in this report. Recent air concentrations of benzene in the community are comparable with benzene levels that are routinely recorded in outdoor air in the Los Angeles Air Basin.
- Air concentrations of other compounds (toluene, ethylbenzene, xylene, polycyclic aromatic hydrocarbons, and metals) have been very low and do not pose a short-term or long-term risk at this time.

## Collective Air Monitoring Overview

- SoCalGas collects air samples for testing from three areas: within the Aliso Canyon facility, at the Aliso Canyon property/community boundary, and within the community.
- SCAQMD and ARB are also collecting independent samples.
- Sampling sites were selected to represent broad distribution within the community and to include locations associated with highest complaints of odor.
- Various agencies work together to oversee the SoCalGas sampling plan and activities.
- LA County Fire HazMat and Public Health conduct random spot checks of the SoCalGas Company’s field sampling techniques to assure these are in compliance with standard protocols.
- Public Health evaluates all available data from SoCalGas and the air quality agencies to perform ongoing health assessment activities.
- As more air monitoring data becomes available, Public Health will keep the public updated.

### SoCalGas Daily Sampling Activities

1. **Within the Aliso Canyon Facility:** From October 30, 2015 thru January 11, 2016, nine locations on the facility collected instantaneous “grab” samples two times per day. A “grab” sample provides a snapshot of the chemical concentrations and identifies short-term peak levels. Beginning on January 12, 2016, the “grab” sampling in six of the nine locations was discontinued. In the three remaining locations, sampling was changed to 12-hour “integrated” sampling two-times per 24-hour period. An “integrated” sample includes samples collected continuously across each 12-hour period and provides a more precise estimate of the average concentration over the entire 12-hour period.
2. **Aliso Canyon Property/Community Boundary:** Beginning on January 12, 2016, six new locations along the boundary of the Aliso Canyon Storage Facility were identified and twelve-hour integrated samples are being collected two times per 24-hour period. The six new locations are adjacent to the residential community.
3. **Community:**
  - Eleven “grab” samples are taken throughout the community, strategically located where odor complaints are most frequent. These samples are collected two times per 24-hour period.
  - Three additional 12-hour integrated samples are being added along the southern section of Porter Ranch (initiated on 1/29/16).

Samples are tested for various chemicals, including methane, benzene, toluene, ethylbenzene, xylenes, and sulfur compounds.

### Other SoCalGas Sampling Activities

1. In late January 2016, three locations within the facility were sampled for an expanded list of potential chemicals of concern:
  - Volatile and semi-volatile organic compounds
  - Metals
  - Polycyclic aromatic hydrocarbons
  - Radon gas
2. One other location on the facility, upwind from the gas leak, and additional community background sample locations were selected to measure levels of chemicals in the air from non-impacted areas.
3. Results from these additional SoCalGas sampling activities are pending.

## SCAQMD Sampling

SCAQMD conducts independent air sampling and monitoring activities, including:

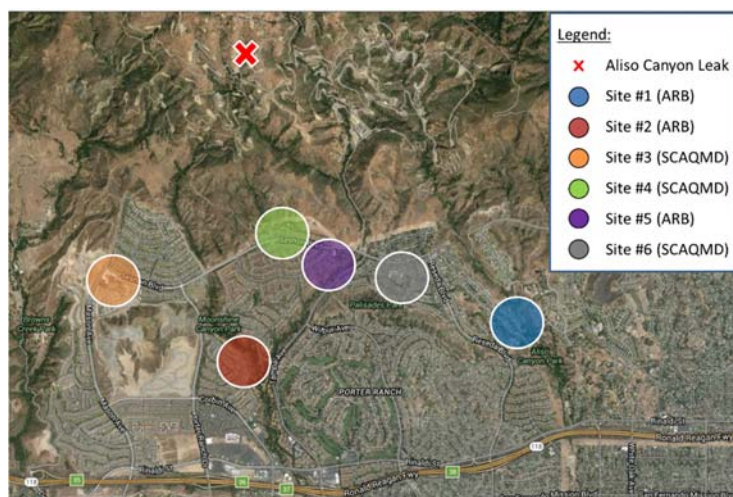
- Periodic “grab” samples in the community in response to odor complaints
- 24-hour sampling in the community every 3 days
- Samples are tested for methane and/or volatile organic compounds

Public Health reviews SCAQMD’s independent testing results to validate those provided by SoCalGas.

## SCAQMD and ARB Real-time Community Methane Monitoring

To supplement the collection of “grab” samples and 12-hour integrated samples, ARB and SCAQMD have teamed up to provide a total of 6 real-time methane monitors in the community. These automated monitoring systems perform continuous methane measurements and provide an estimate of how much methane is in the community at any given time.

**FIGURE 1**



## Los Angeles Unified School District (LAUSD)

1. LAUSD has contracted with an environmental consultant to conduct two types of air quality tests at Porter Ranch Community School and Castlebay Lane Charter School. The air sampling activities included:
  - Real-time methane measurements
  - 8-hour samples collected over the course of the school day and tested for methane, sulfur compounds, benzene and other compounds
  - Radon monitoring
2. LAUSD has expanded its air monitoring plan to include nearby schools in northern Chatsworth and Northridge areas.
3. All results from November 30, 2015 thru January 28, 2016 have been below actionable levels.

Los Angeles County Department of Public Health

<http://publichealth.lacounty.gov>

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## Monitoring Results

### Within the Aliso Canyon Facility (Oct. 30, 2015 – Jan. 23, 2016)

- Since October 30, 2015, over 1,000 samples have been collected and analyzed for methane, volatile chemicals and sulfur odorants from the nine “grab” sample locations within the facility. Since January 12, 2016, three locations within the facility have continued to collect samples, but are now collecting 12-hour “integrated” samples.
- Elevated levels of chemicals have been measured within the facility boundary. Methane levels were detected up to 4,340 ppm and benzene up to 31 ppb from the facility sample locations.
- While the methane level is well above that measured in the community, it is below the flammable limit of 50,000 ppm. Similarly, benzene levels are below the occupational exposure limit (1000 ppb).
- Sulfur odorant additives have not been detected in any of the facility samples.

**TABLE 1**

<b>Chemical*</b>	<b>Number / Total Detected Samples</b>	<b>% of Samples with a Detectable Level</b>	<b>Aliso Canyon Facility Range</b>	<b>Key Limits</b>	<b>Units</b>
Methane	435/1152	38%	1.3 – 4,340	50,000 (lower explosive limit)	ppm
Benzene	435/1151	38%	0.05 - 31	1,000 (occupational permissible exposure limit)	ppb
t-Butyl Mercaptan (sulfur odorant)	0/1116	0%	ND	NA	ppb
Tetrahydrothiophene (sulfur odorant)	0/1116	0%	ND	NA	ppb

ppm = parts per million; ppb = parts per billion; ND = non-detectable; NA = not available

\*Other volatile chemicals, hydrocarbons and sulfur compounds will be reported in this table if detected above background levels.

**Aliso Canyon Property/Community Boundary (Jan. 12, 2016 – Jan. 24, 2016)**

- 12-hour “integrated” sampling began on January 12, 2016 at six sample locations along the property boundary under the Expanded Air Monitoring Plan.
- Methane levels have ranged from 2 to 24 ppm, which are above background levels (2 ppm) and below the flammable limit (50,000 ppm).
- Benzene levels have ranged from 0.08 to 0.4 ppb (which is below an average level seen in other parts of Los Angeles County). This range is below the California Environmental Protection Agency’s (Cal EPA’s) long-term exposure limit of 1.0 ppb. These levels do not pose an increase in the risk of long-term health effects.

**TABLE 2**

<b>Chemical*</b>	<b>Number / Total Detected / Samples</b>	<b>% of Samples with a Detectable Level</b>	<b>Property/Community Boundary Range</b>	<b>LA County Background Range</b>	<b>Key Limits</b>	<b>Units</b>
Methane	149 / 149	100%	2 – 24	1.8 - 2.1	50,000 (lower explosive limit)	ppm
Benzene	149 / 149	100%	0.08 – 0.4	0.1 - 1.8	1.0 (chronic reference exposure limit)	ppb
t-Butyl Mercaptan (sulfur odorant)	0 / 149	0%	ND	NA	NA	ppb
Tetrahydrothiophene (sulfur odorant)	0 / 149	0%	ND	NA	NA	ppb

ppm = parts per million; ppb = parts per billion; ND = non-detectable; NA = not available

\*Other volatile chemicals, hydrocarbons and sulfur compounds will be reported in this table if detected above background levels.



**Community (Oct. 30 – Jan. 24)**

- Over 1,500 “grab” samples have been collected and analyzed for methane, volatile chemicals and sulfur odorants.
- Methane levels have ranged from 1.2 to 231 ppm, with an average of 10 ppm. These levels are above normal for the Los Angeles Air Basin, but remain well below flammability limits.
- Benzene levels have ranged from 0.06 to 5.6 ppb. All sample results have been below the Cal EPA’s short-term exposure limit of 8.0 ppb and do not pose an increase in the risk of short-term health effects.

**TABLE 3**

<b>Chemical*</b>	<b>Number / Total Detected / Samples</b>	<b>% of Samples with a Detectable Level</b>	<b>Community Range</b>	<b>LA County Background Range**</b>	<b>Key Limits</b>	<b>Units</b>
Methane	1602/1602	100%	1.2 - 231	NA	50,000 (lower explosive limit)	ppm
Benzene	695/1600	43%	0.06 - 5.6	NA	8.0 (acute reference exposure limit)	ppb
t-Butyl Mercaptan (sulfur odorant)	0/1524	0%	ND	NA	NA	ppb
Tetrahydrothiophene (sulfur odorant)	0/1524	0%	ND	NA	NA	ppb

ppm = parts per million; ppb = parts per billion; ND = non-detectable; NA = not available

\*Other volatile chemicals, hydrocarbons and sulfur compounds are being tested for and will be reported in this table if detected above background levels.

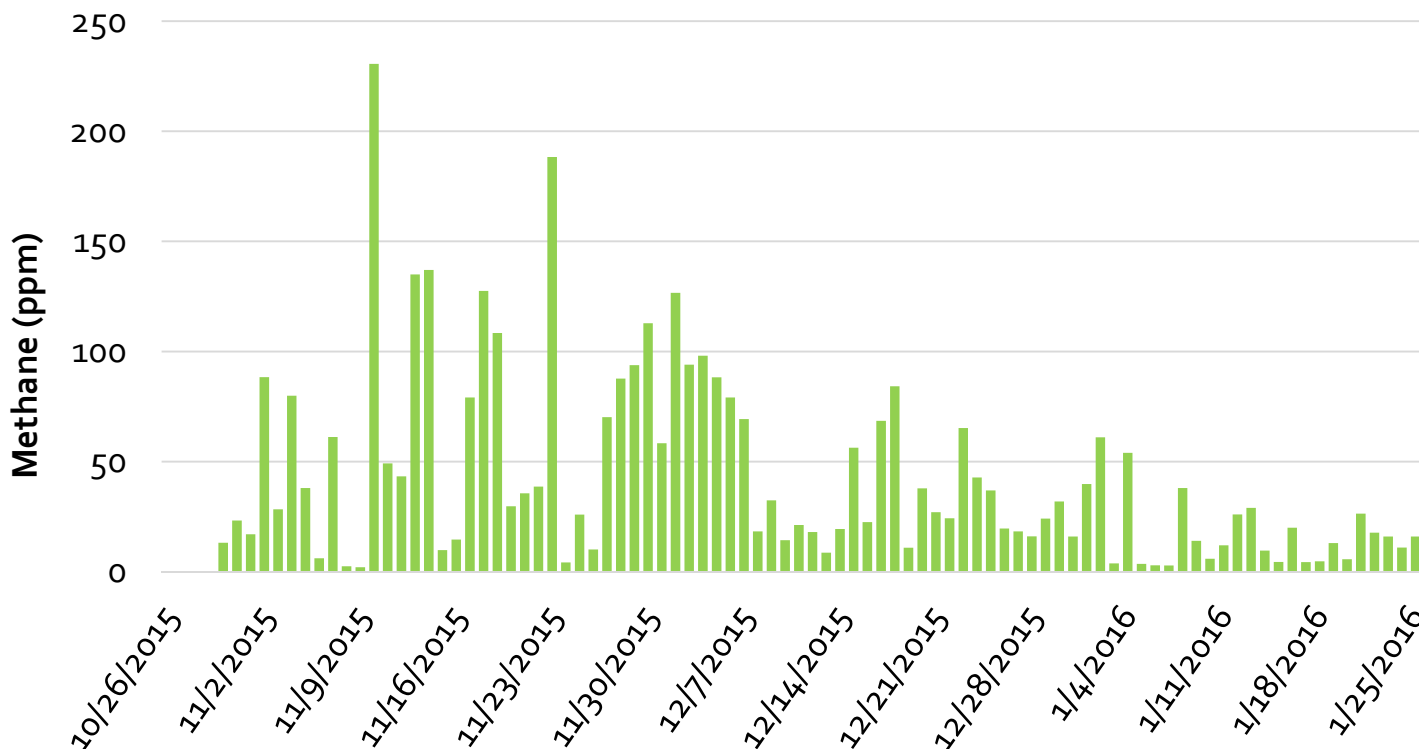
\*\*Comparable “grab” sample data from within LA County are not available.

**Community Sampling Summary**

**Daily Community Monitoring of Maximum Methane (ppm)**

- The bar graph below displays the maximum methane result from each day (days=88) from all daily samples (sample=1602) taken within the community by SoCalGas.
- Methane in the community remains above background levels (2 ppm) and below flammable limit (50,000 ppm). These levels do not pose an increase in health risk.
- There has been a trend of decreasing methane levels over time, with highest levels of methane measured in November 2015. This trend reflects a decreasing rate of emissions from the gas leak over time.

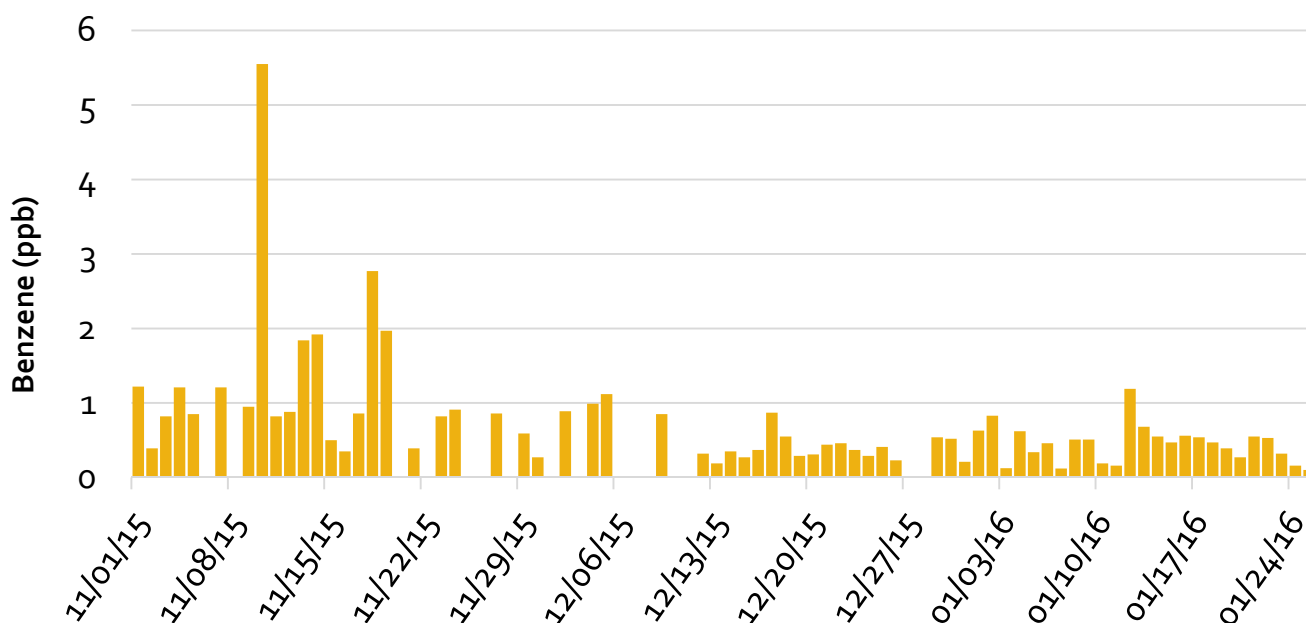
**FIGURE 2**



### Daily Community Monitoring of Maximum Benzene (ppb)

- The bar graph below reflects the maximum benzene result from each day (days=85) from all daily samples (samples=1600) taken within the community by SoCalGas.
- The average benzene levels from all “grab” samples is 0.3 ppb, which is within background range (0.1 – 1.8 ppb). The estimated average (0.3 ppb) is based solely on samples with a detectable level and therefore is higher than the true average.
- Between October 26, 2015 and January 17, 2016, SCAQMD has taken nearly 40 “grab” samples in the community. Results from these SCAQMD independent samples reveal benzene in a similar range as the SoCalGas samples, from 0.1 to 3 ppb (results not shown). SCAQMD continues to test for benzene when peak methane readings are found.

FIGURE 3

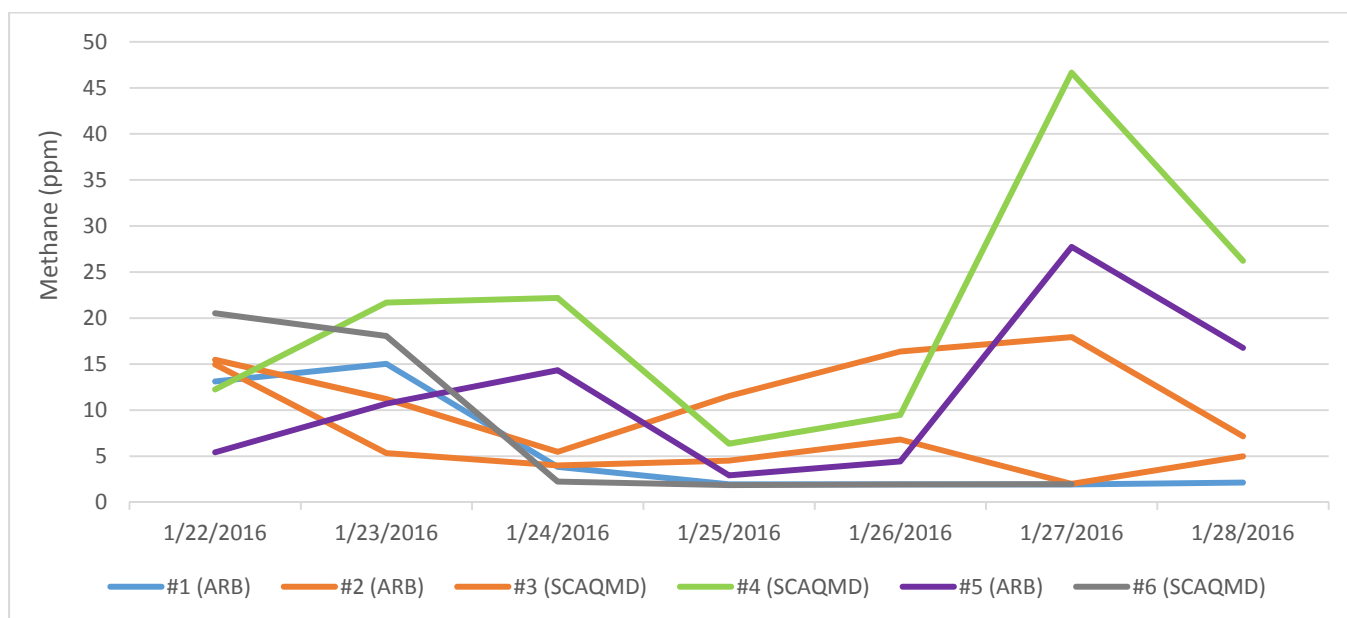


\*Non detectable levels are shown as zero (0). There are a total of 16 days that are shown as zero. The detection limits of the laboratory tests used for samples collected by SoCalGas in November and December 2015 were not as low (sensitive) as the laboratory tests performed after that time.

### Community Monitoring of Methane from SCAQMD and ARB

- The graph below displays average daily methane levels from continuous 24 hour monitoring.
- The average daily methane levels ranged from 2 ppm to 47 ppm, substantially lower than flammable limits (50,000 ppm), and do not pose a health concern to residents in the area.
- The apparent increase in methane concentration on 1/27/16 peaks at a level that is less than a thousandth of the action level (50,000 ppm) and does not represent a safety or health risk. Variations in daily concentrations are likely due to changing environmental conditions such as wind or temperature.
- When compared to SoCalGas community samples, the independent samples from SCAQMD and ARB show similar results for methane.

**FIGURE 4**



## Summary of Results

- Air monitoring began October 30, 2015, and has provided extensive information about possible health effects in affected communities. The Expanded Air Monitoring Plan has been in place since the beginning of January and has provided additional information.
- Measured levels of all chemicals have been decreasing over time since the onset of the incident due to a reduction in the rate of emissions at the site of the natural gas leak.
- Results of tests for chemicals show variations over time that may be related to changes in the weather (e.g., temperature, wind patterns, humidity).
- Measurements on the facility are generally higher than those within the community but are well below occupational exposure limits.
- Methane levels measured in the community are above those normally observed, but are below flammable levels and are not expected to cause any health effects.
- Odorants present in the gas are at very low levels (below the detection limits of existing analytical methods). However, even at these low levels, these odorants are known to cause the short-term symptoms that have been observed in affected community members.
- The average levels of benzene and other trace chemicals that have been measured in the community are currently at or below levels seen elsewhere in the county, and do not pose an increase in the risk of short-term or long-term health effects.