# Aliso Canyon Natural Gas Leak

## Preliminary Estimate of Greenhouse Gas Emissions

## (As of February 11, 2016)

On October 23, Southern California Gas (SoCalGas) informed the State of a natural gas leak at its Aliso Canyon natural gas storage facility. The Air Resources Board released an initial estimate of the leak rate on November 20. The leak rate from Aliso Canyon is expected to vary as attempts are made to stop the leak and as gas is withdrawn from the reservoir. It is therefore necessary to have ongoing measurements to ensure a robust estimate of the total emissions of the gas to the atmosphere can be made.

Periodic measurements are carried out by Scientific Aviation using small planes equipped with monitors to measure methane. This measurement approach is described in more detail in the report from November 20. These periodic measurements provide an emission rate at the time the flights are conducted and may vary considerably. They do however provide a sense of what is happening with the leak and can be used to develop a very rough estimate of the total methane leaked to date. The time series collected suggests the emission rate at the end of January 2016 has decreased by approximately 65% from its peak measured on 11/28/15, consistent with the notion of the leak decreasing as the reservoir is being depleted.

Continuous measurements are also being collected as part of the State's Greenhouse Gas Monitoring network and through other complimentary measurement efforts. Final results based on these measurements on the ground will take time to process and will not be available until several months after the leak has been plugged. Once completed, the estimate calculated from these data will be the most robust quantification of the overall leak.

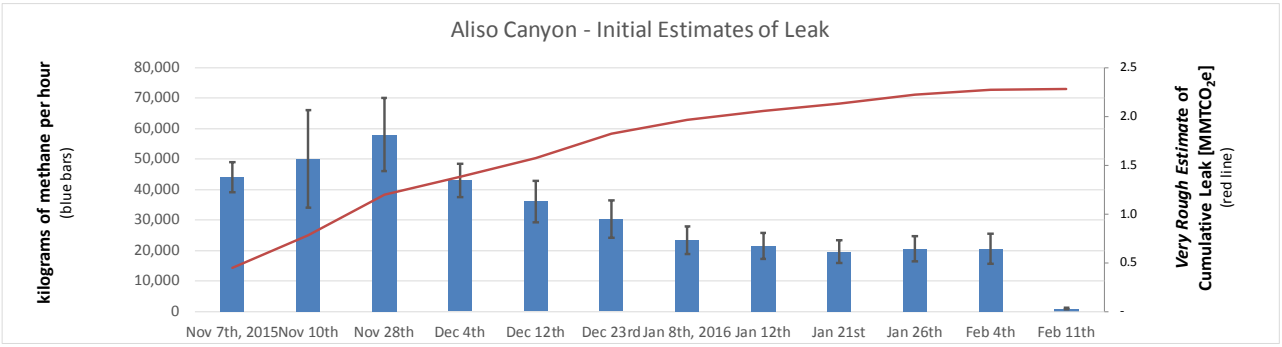
The table below provides the up-to-date history of estimates based on the measurements made from the plane flights. The estimate of methane that has leaked since the last flight and the cumulative amounts are calculated assuming that the leak rate is constant between flights. As a result, it is only a preliminary estimate at this time. It will be replaced with a more refined estimate once the leak is plugged and the computer models needed to process the continuous measurements described above are used.

| Date of Flight | Leak Rate Measured [kilogram methane per hour] | Expected Error in Measurement [kilogram methane per hour] | Assumed number of days at this leak rate | Estimate of leaked methane for this period* [kilogram methane] | *Very Rough Estimate of* Cumulative Leak** [billion cubic feet of natural gas, bcf] | *Very Rough Estimate of* Cumulative Leak*** [$MMTCO_2e$] |
|---|---|---|---|---|---|---|
| Nov 7th, 2015 | 44,000 | ±5,000 | 17 | 17,952,000 | 1.0 | 0.4 |
| Nov 10th | 50,000 | ±16,000 | 11 | 13,200,000 | 1.8 | 0.8 |
| Nov 28th | 58,000 | ±12,000 | 12 | 16,704,000 | 2.7 | 1.2 |
| Dec 4th | 43,000 | ±5,400 | 7 | 7,224,000 | 3.2 | 1.4 |
| Dec 12th | 36,000 | ±6,800 | 9 | 7,776,000 | 3.6 | 1.6 |
| Dec 23rd | 30,300 | ±6,100 | 14 | 10,180,800 | 4.2 | 1.8 |
| Jan 8th, 2016 | 23,400 | ±4,600 | 10 | 5,616,000 | 4.5 | 2.0 |
| Jan 12th | 21,500 | ±4,300 | 7 | 3,612,000 | 4.7 | 2.1 |
| Jan 21st | 19,600 | ±3,700 | 6 | 2,822,400 | 4.9 | 2.1 |
| Jan 26th | 20,700 | ±4,100 | 8 | 3,974,400 | 5.1 | 2.2 |
| Feb 4th | 20,600 | ±5,000 | 4 | 1,977,600 | 5.2 | 2.3 |
| Feb 11th | 950 | ±200 | 5 | 114,000 | 5.2 | 2.3 |

* This assumes a constant leak rate since the last measurement.

** Assumes natural gas from the leak is 94% methane, and methane has density of 0.01858 kg/cu-ft

*** Using the 100 year global warming potential for methane of 25. From the date of the leak through the day of the flight. This number will be updated based on continuous measurements once the leak is plugged




On 2/11/2016 SoCalGas temporarily controlled the leak by injecting mud from a relief well intersecting the bottom of the leaking well. The air flight measurement on 2/11/2016, made less than three hours after the control, suggests the leak rate had been drastically reduced