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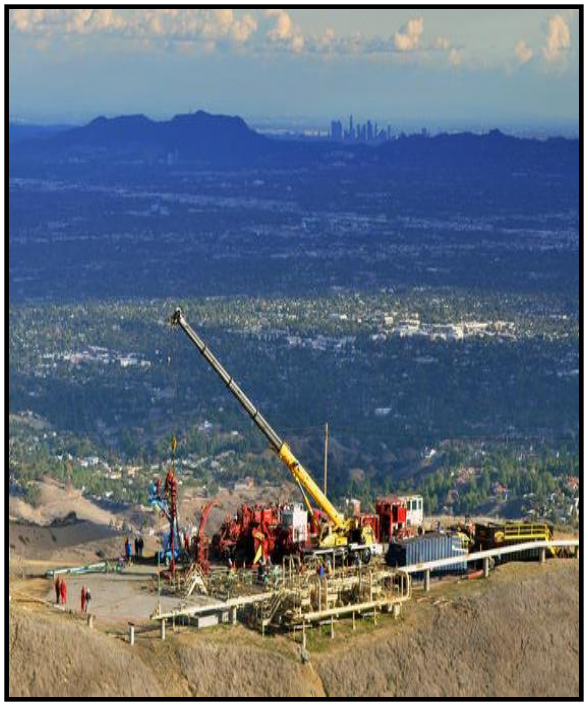
Air Resources Board

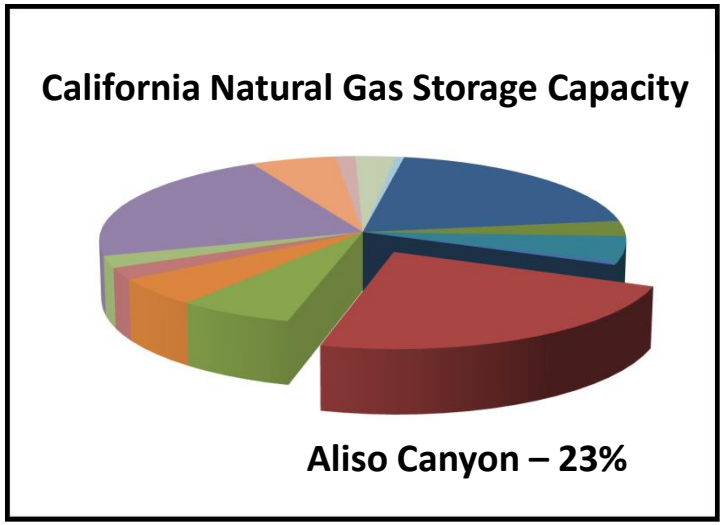
Update on Aliso Canyon Methane Leak

February 2016



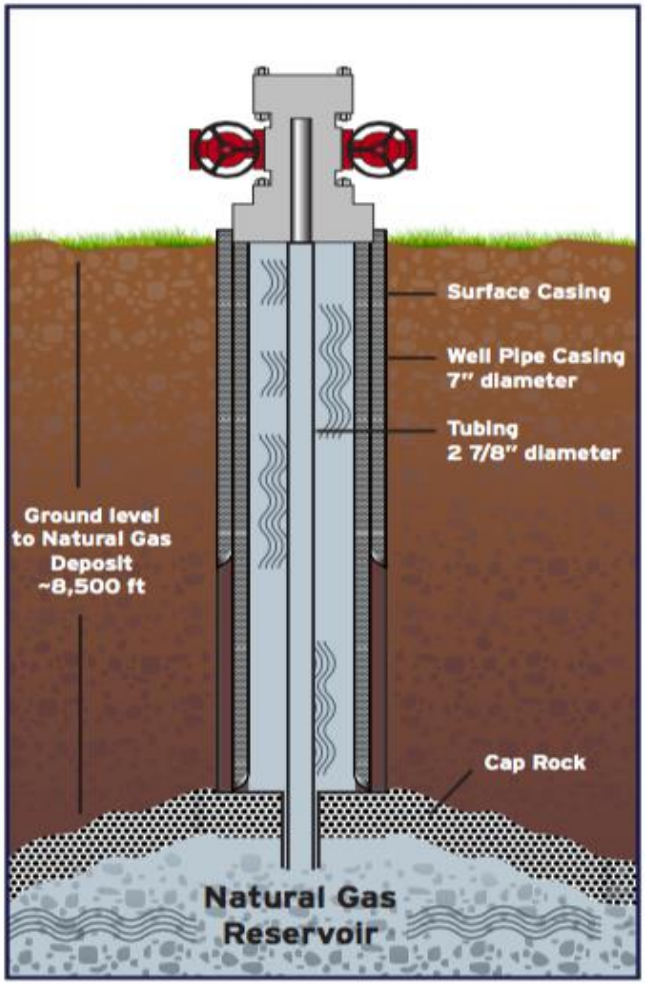
Aliso Canyon Natural Gas Storage Facility

- State's largest natural gas storage facility, located in Los Angeles county
- Spans over 3,600 acres, working storage capacity of 86 billion cubic ft. (BCF)
- Sufficient to provide natural gas for roughly 2 million households for a year
- Owned and operated by Southern California Gas Company (SoCalGas)



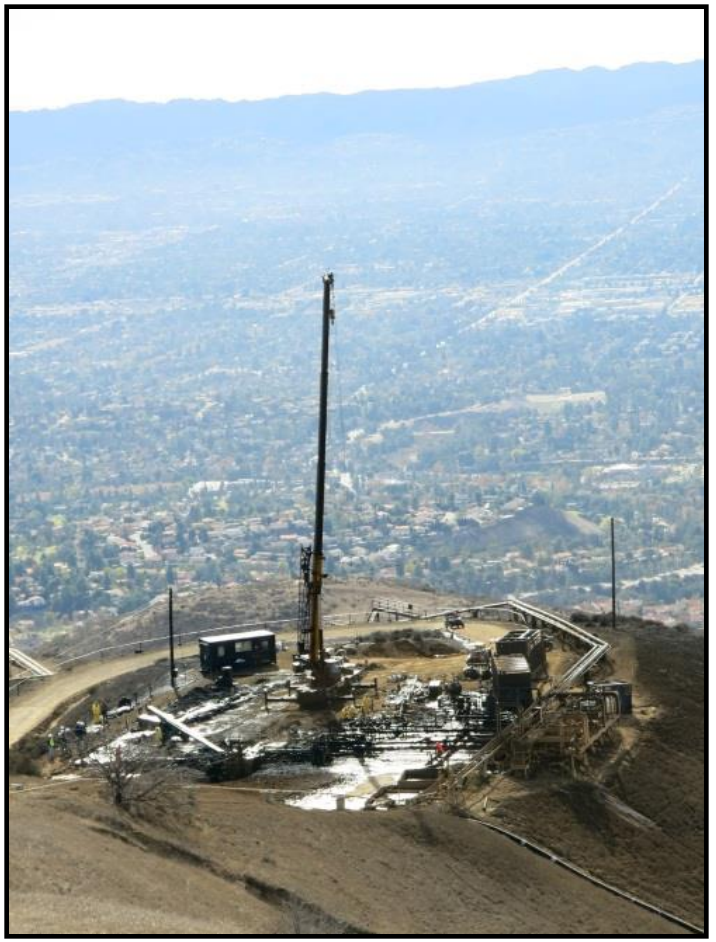
Aliso Canyon Operations

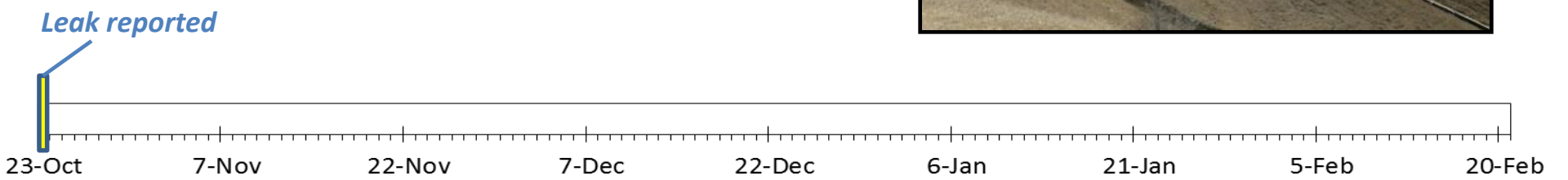
- Reservoir is filled with natural gas between April and October
- Withdrawn between November and March
- Facility comprised of 115 injection/withdrawal wells
- Wells draw from a reservoir located ~8,500 feet below ground level



Leak Overview

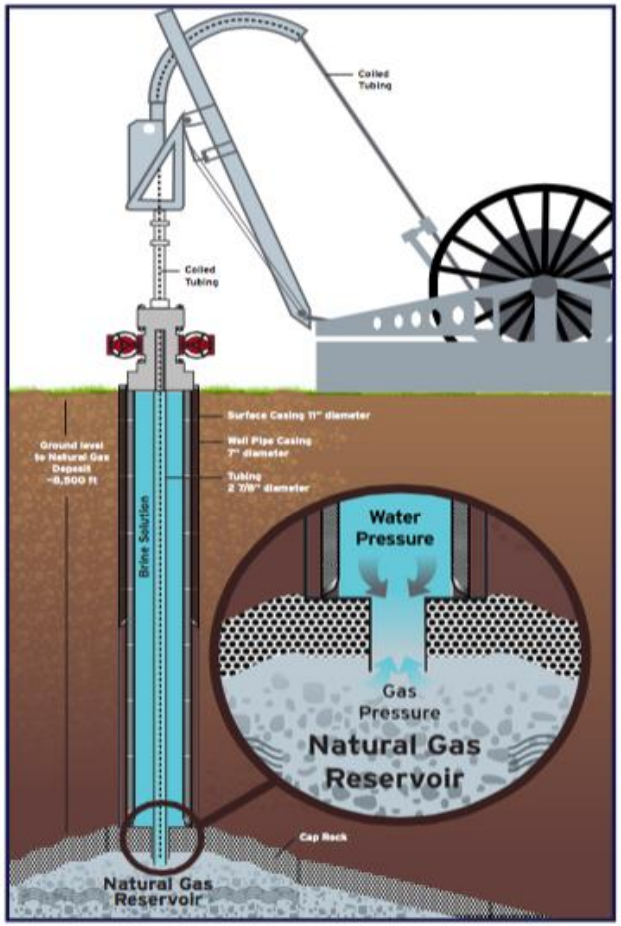
- Leak discovered at Well SS-25 during odor inspection on October 23, 2015
- Experts believe casing is leaking from the well ~500 feet below the surface

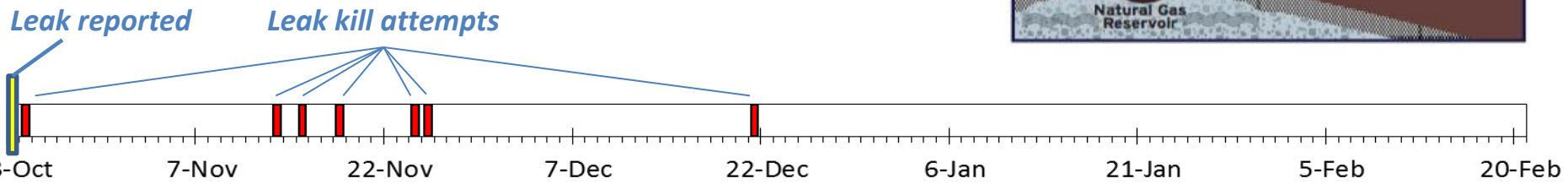




Initial Attempts to Stop the Leak

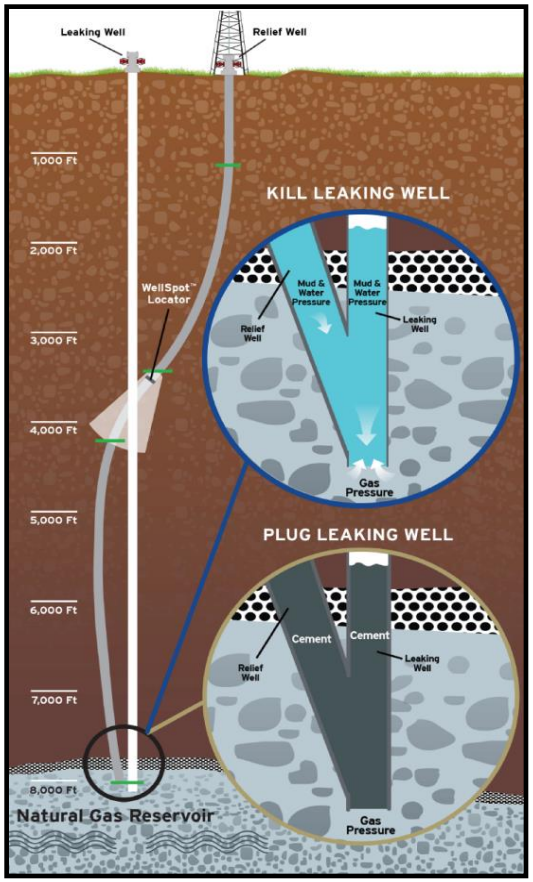
- First initiated efforts to stop the gas leak on October 24
- Pumped brine solution down the well to stop the leak
- Seven attempts to plug the leak from the top were unsuccessful

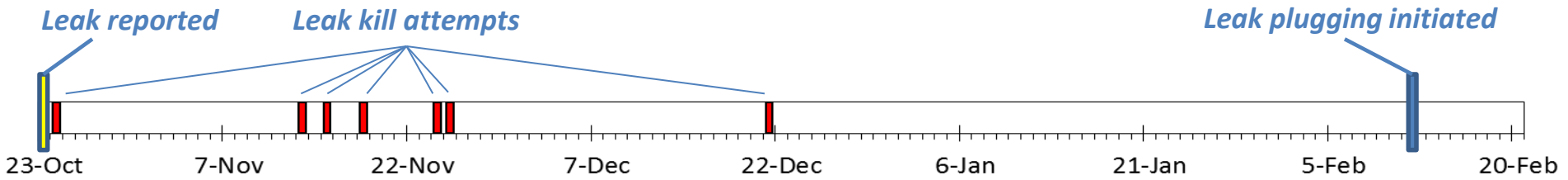




Relief Well

- Drill relief well to intercept and permanently cut off Well SS-25 from the reservoir
  - Work on first relief well started on Dec 4
  - Reached the base of the well on Feb 10
  - Pumped mud down the relief well on Feb 11
  - Cementing operations began on Feb 12
- State agencies are performing integrity test

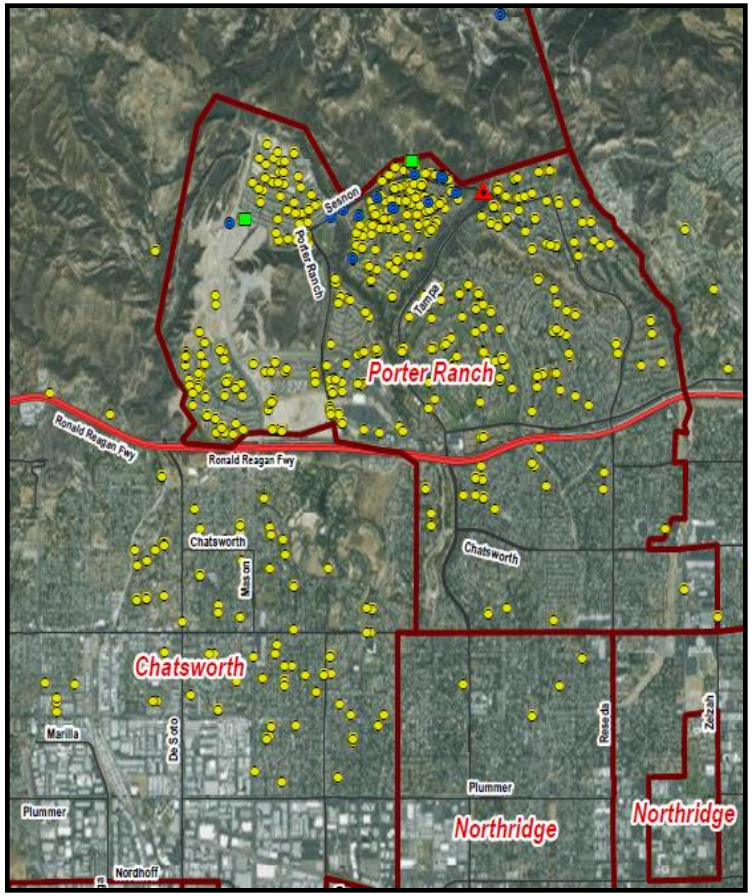




Stopping the Leak

Community Impacts

- SCAQMD received over 2,300 complaints through February 10
- Community concerns about benzene, mercaptans, oil residue, hydrogen sulfide, radon
- Reports of dizziness, headaches, nausea, nose bleeds
- Over 5,000 households, and two local schools relocated



SCAQMD map of odor complaints

Major Roles

State Agencies

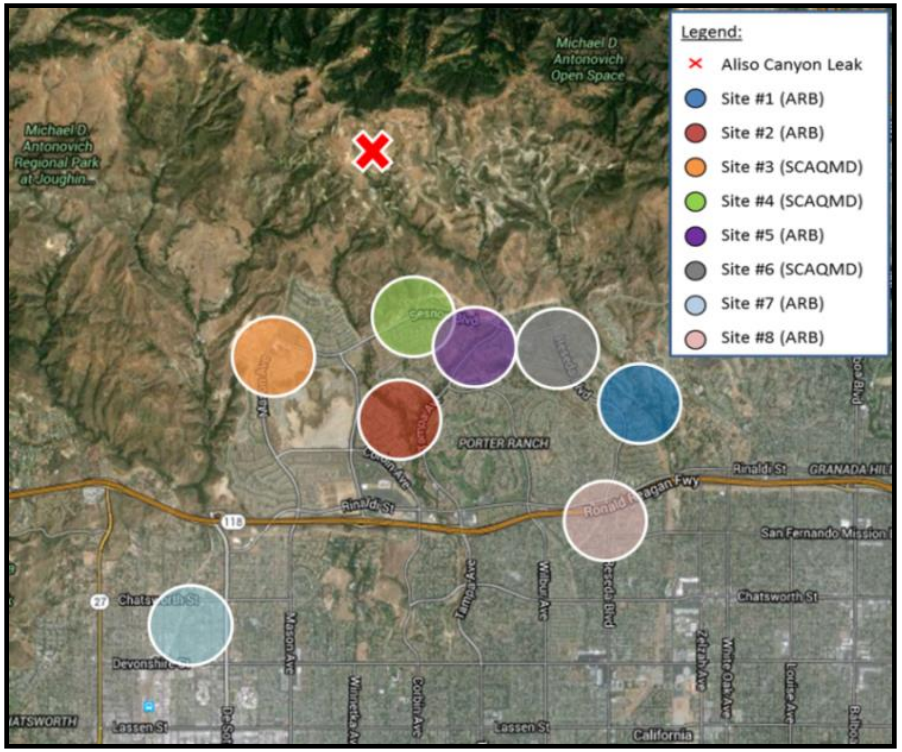
- CalOES, DOGGR, CPUC, CalFire: Incident command, site assessment, investigation
- Cal/OSHA, OEHHA: Community health impacts, worker safety, violations
- ARB: Community air monitoring, leak emission estimate, air filter recommendations

Local Agencies

- SCAQMD: Community air sampling, issued Order of Abatement
- LADPH: Issued Public Health Directive

ARB's Role

- Indoor air filtration guidance
- Community air monitoring
- Emissions estimate of leaked methane
- Climate Impacts Mitigation Program



Aliso Canyon - Community air monitoring sites

Indoor Air Filtration Guidance

- ARB identified air cleaners that can effectively remove mercaptans, benzene and other potentially harmful VOCs
- Over 10,000 air cleaners and filters installed by SoCalGas

More information at http://www.arb.ca.gov/research/indoor/aircleaners/air_cleaners_gas_leak.htm

Monitoring Resources

- Air Quality Monitoring
  - 10 real-time continuous monitors
  - Canisters measurements
  - Mobile platform
- Emissions Evaluation
  - Airborne measurements
  - Infrared (IR) camera

Community Air Monitoring

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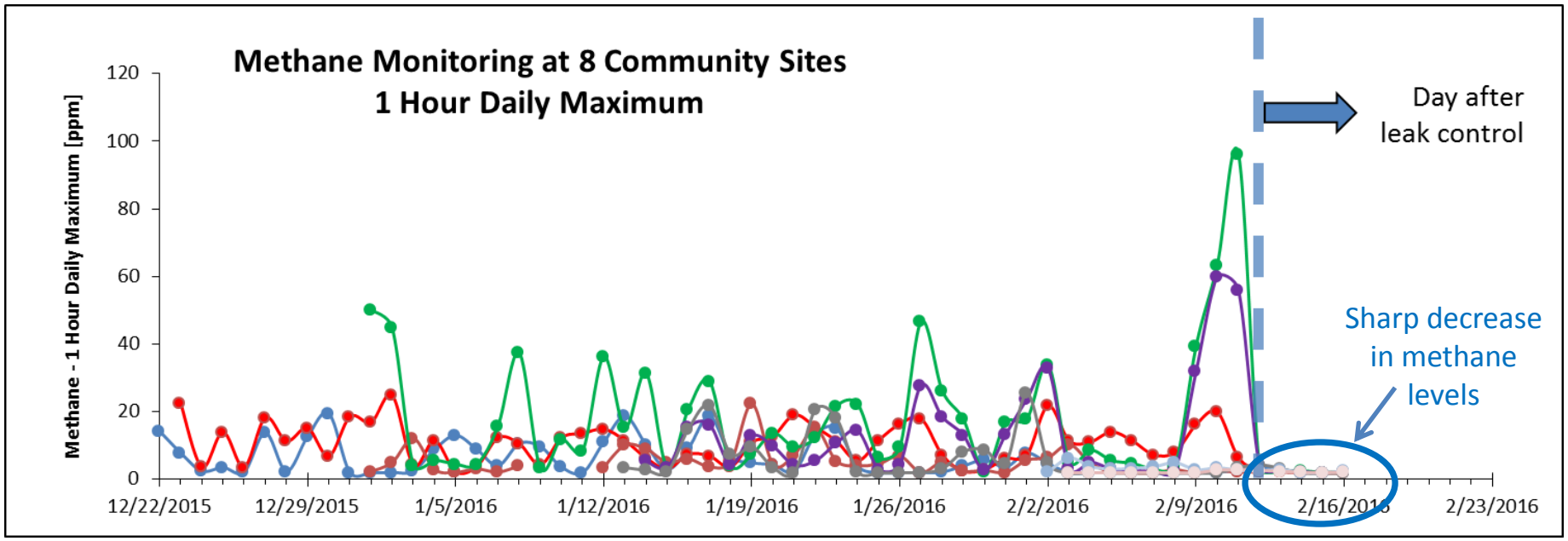

- Real-time notification of the methane and benzene levels in the community
- Data show a reduction in maximum hourly concentrations since February 11
- Additional analysis of oil droplets, and toxic air contaminants

More information at http://www.arb.ca.gov/research/aliso_canyon/community_methane_monitoring.htm

Air Quality Criteria to Evaluate Return to Normal

- Air quality and emissions monitoring to ensure leak is controlled, and ambient air concentrations of methane, benzene, hydrogen sulfide, and mercaptans have returned to typical levels

- Guiding principles:
  - Monitoring
  - Numerical thresholds
  - Typical levels for LA area

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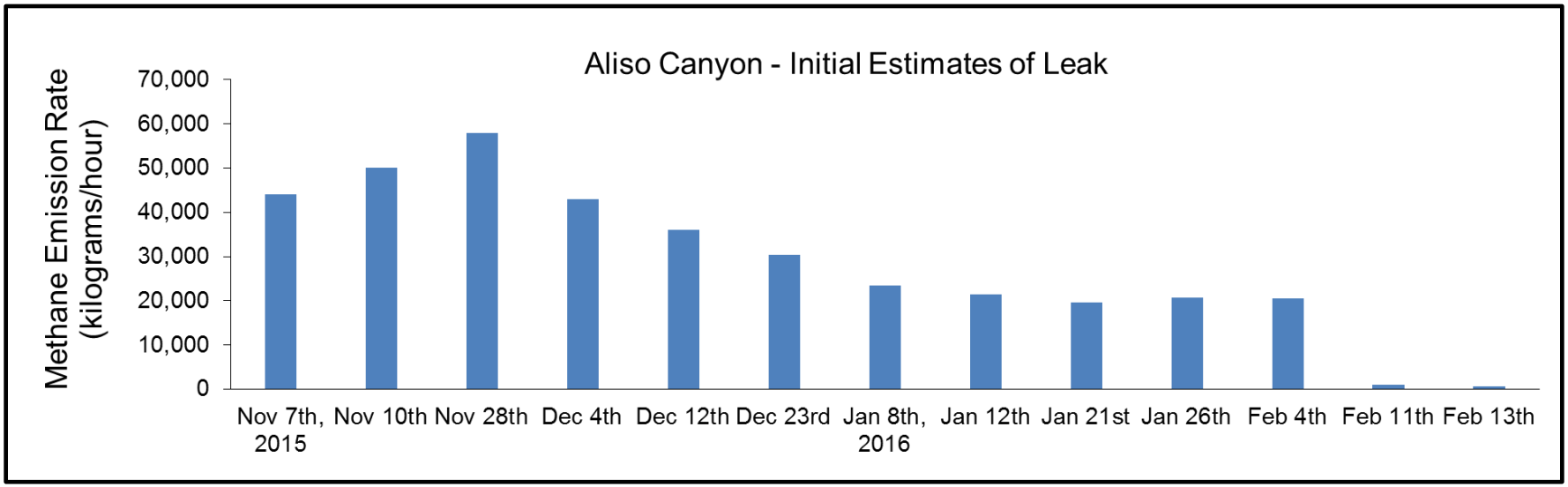
Preliminary Total Emissions Estimate

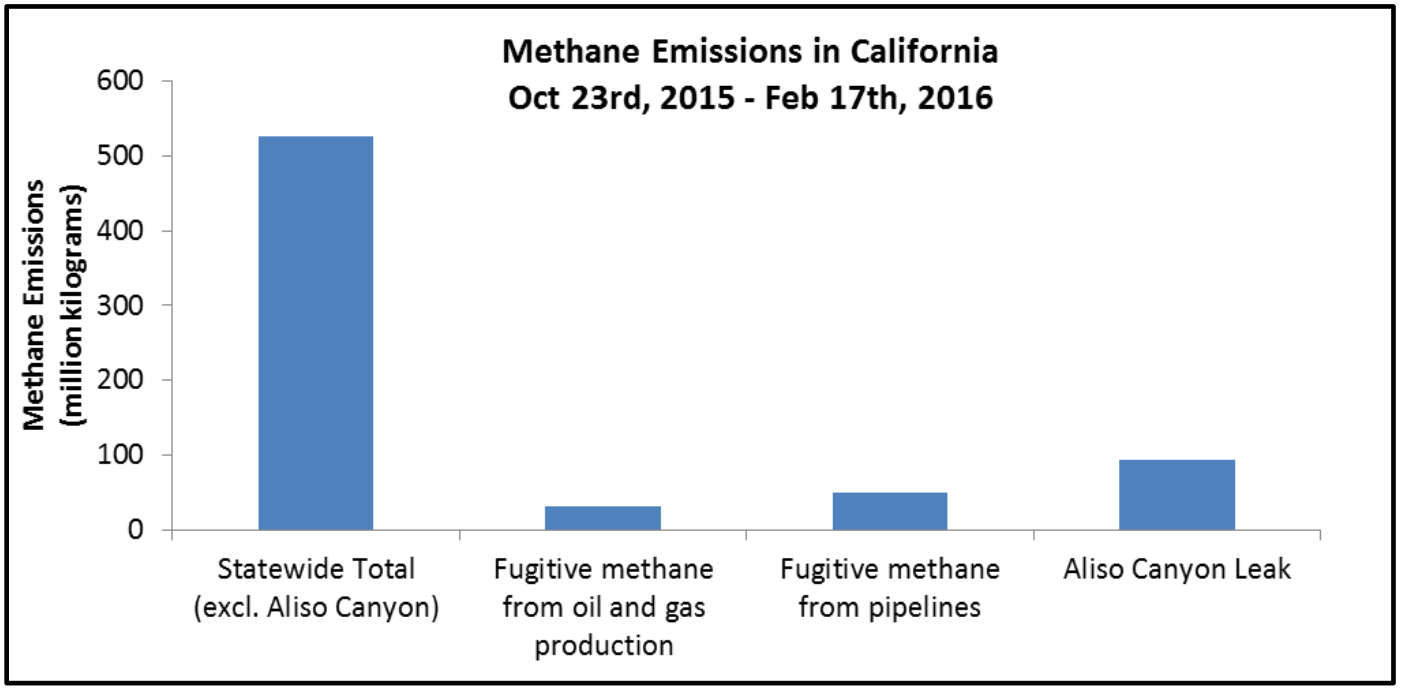
- Over 13 state-coordinated airborne measurements to estimate leaked methane emissions since Nov 7
- Highest methane leak rate: 58,000 kilograms/hour (Nov 28)
- As of Feb 13, facility wide emissions are 2% of the leak rate

SCIENTIFIC AVIATION



More information at http://www.arb.ca.gov/research/aliso_canyon_natural_gas_leak.htm

Implications for Statewide Emissions



- Preliminary estimates suggest incident resulted in 5.4 BCF of natural gas leak, equivalent to 94 million kilograms of methane
- Represents ~20% increase in statewide methane emissions for the duration of the leak

Refined Emissions Estimation

Current estimates are preliminary, and possibly a low estimate of leaked methane emissions

Refinement of current emissions estimate will be based on additional sources and research collaborations:

- ARB GHG Monitoring Network
- Megacities Carbon Project
- Remote sensing
- Aircraft
- Satellite
- Mobile platform
- Canister measurements

*Results expected Summer 2016

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Aliso Canyon - Going Forward

- ARB and SCAQMD continuing to take air quality measurements at and around the site assess progress
  - Infrared imaging
  - Aircraft measurements
  - Mobile monitoring
- ARB and SCAQMD will continue to monitor community methane levels for several months after leak is plugged
- Considering additional fence line monitoring requirements for facilities in the regulatory framework

Beyond Aliso Canyon

Natural Gas Storage Facilities:

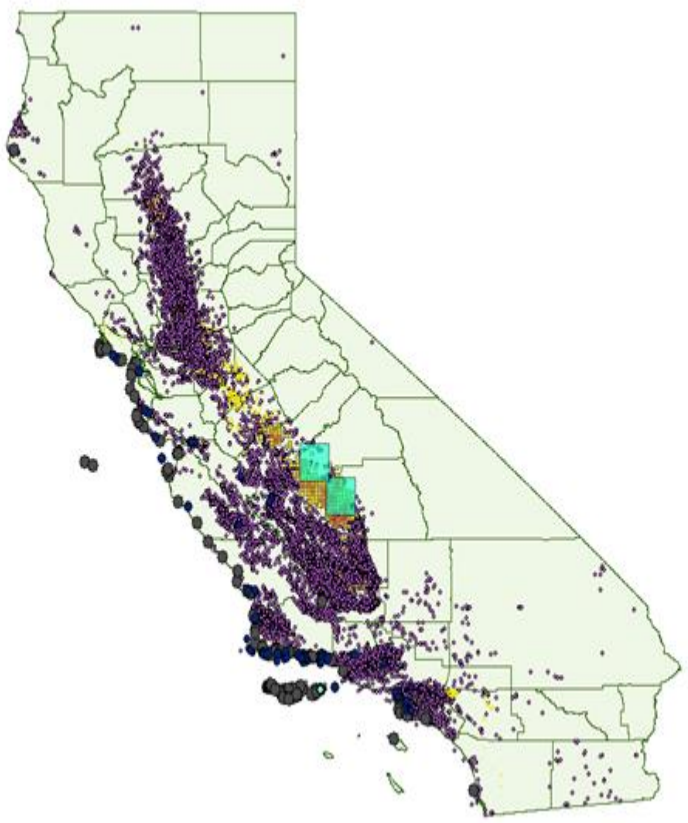
- Flight measurements to study all natural gas storage facilities in California

Oil and Gas Infrastructure:

- ARB/CEC/JPL research effort for statewide methane survey in 2016
- AB 1496 methane hotspot study, and life-cycle GHG emissions analysis of natural gas

Statewide Methane Sources:

- Inventory evaluation and inverse modeling
- Megacities Carbon Project



Map of statewide oil and gas wells

Rulemaking Efforts

DOGGR - Emergency Regulation requiring daily monitoring at natural gas storage facilities
- Permanent rulemaking for natural gas storage facilities underway

ARB - Methane Emissions from Oil and Gas Upstream Operations
- Consistent and more stringent than US EPA proposed rules

CPUC - GHG emissions from NG Transmission and Distribution
- Working closely with ARB

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ALISO CANYON: CLIMATE IMPACTS MITIGATION PROGRAM

Background

- Letter from SoCalGas to Governor (Dec. 18, 2015) – SoCalGas commits to:
  - "[M]itigate the environmental impact of the actual natural gas released from the leak"
  - "[W]ork[] with you and your staff to develop a framework that will help us achieve this goal"
- Governor's Aliso Canyon Proclamation (Jan. 6, 2016):
  - Directs ARB to produce a climate impacts mitigation program
  - Program to be funded by SoCalGas

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The Mitigation Program

- The Proclamation directs ARB to develop a program to "fully mitigate the leak's emissions of methane"
  - In consultation with other State agencies
  - Mitigation projects must be in California
  - Prioritize projects that reduce short-lived climate pollutants
  - Develop program by March 31, 2016

Full Mitigation

- Program must define and achieve "full mitigation"
- Minimum: CO_2e emission reductions commensurate with leak emissions
- Cap-and-Trade compliance instruments not eligible
- ARB seeks stakeholder input on topics relevant to "full mitigation," including:
  - Global warming potential
  - Timeframes
  - Discounting
  - Other approaches toward "full mitigation"

Key Principles

- For the program: full mitigation, achieved in an equitable and transparent manner
- Eligible projects would comport with several core principles, e.g.:
  - Focus on short-lived climate pollutants
  - Substantial nexus with climate impacts
  - Complementary
  - Additional
- Other relevant factors under consideration:
  - Co-benefits
  - Transformational qualities
  - Benefits to affected and economically disadvantaged communities

Project Categories

- Current focus: creating a process for identifying and implementing viable mitigation opportunities
- E.g., opportunities identified in ARB's Draft Short-Lived Climate Pollutant Reduction Strategy*:
  - Biomethane infrastructure (dairy manure, etc.)
  - Organic waste diversion from landfills
  - Anaerobic digestion at wastewater treatment plants
  - Incentive programs

* Available at: http://www.arb.ca.gov/cc/shortlived/2015draft.pdf

Program Implementation

- Implementation approach being considered:
  - Portfolio of project categories coupled with financial "backstop"
  - Oversight by third-party administrator
  - ARB would provide direction re: project selection and certify progress and compliance
- Ongoing judicial proceedings may offer avenues for implementation
  - *People v. Southern California Gas Company*

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Key Upcoming Dates

- Beginning today, comments can be posted and viewed on ARB's website*
- Draft to be posted on ARB's Aliso Canyon web page during week of March 7, 2016**
- Second comment period through March 21, 2016
- Final program description to be posted on ARB's Aliso Canyon web page by March 31, 2016

* at http://www.arb.ca.gov/lispub/comm/bclist.php
** at http://www.arb.ca.gov/research/aliso_canyon_natural_gas_leak.htm