DOCKETED

Docket Number:	17-IEPR-11
Project Title:	Southern California Energy Reliability
TN #:	217659
Document Title:	Independent Review of Hydraulic Modeling for Aliso Canyon
Description:	Presentation by Scott Backhaus of Los Alamos National Laboratory
Filer:	Stephanie Bailey
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	5/19/2017 2:35:13 PM
Docketed Date:	5/19/2017

Independent Review of Hydraulic Modeling for Aliso Canyon

Review of Summer 2017 Assessment

Scott Backhaus, Los Alamos National Laboratory
Rod Walker, Walker & Associates
Mary Ewers, Los Alamos National Laboratory

5/22/2017

UNCLASSIFIED

Los Alamos NATIONAL LABORATORY EST.1943

WALKER & ASSOCIATES CONSULTANCY

NNSA National Nuclear Security Administration

Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

Outline

- **Overview of IRT**
- **SCG Pipeline System and Gas Storage Overview**
- **Hydraulic Modeling**
- **IRT Findings**
  - Detailed Findings
  - Distillation of Findings
- **Recommendations**

Overview of IRT

Independent Review Team Formed

- CaISO contacted LANL for support
- CaISO contacted Walker & Associates for industry operational experience
- Coordinated with Aliso Canyon Technical Assessment Group (ACTAG)

Purpose

- Review Hydraulic Modeling for the Summer 2017 Assessment
- Aliso Canyon Technical Assessment Group (CaISO, CPUC, CEC, LADWP) requested independent review

Review Team Process

- Reviewed hydraulic modeling with SCG Engineers on site in LA
- Participated in ACTAG discussions
- Prepared report and presentation

Overview of IRT - Team Qualifications

Rod Walker, Principal – Walker & Associates Consultancy

- VP, Engineering, Construction, HSE & Strategic Planning at Westway Terminals
- Director, due diligence advisory and utility risk assessments at Black & Veatch
- Board of Directors, American Public Gas Association (APGA)
- Operations, Engineering & Management, Atlanta Gas Light 85-99 (BSE 85 Clemson)

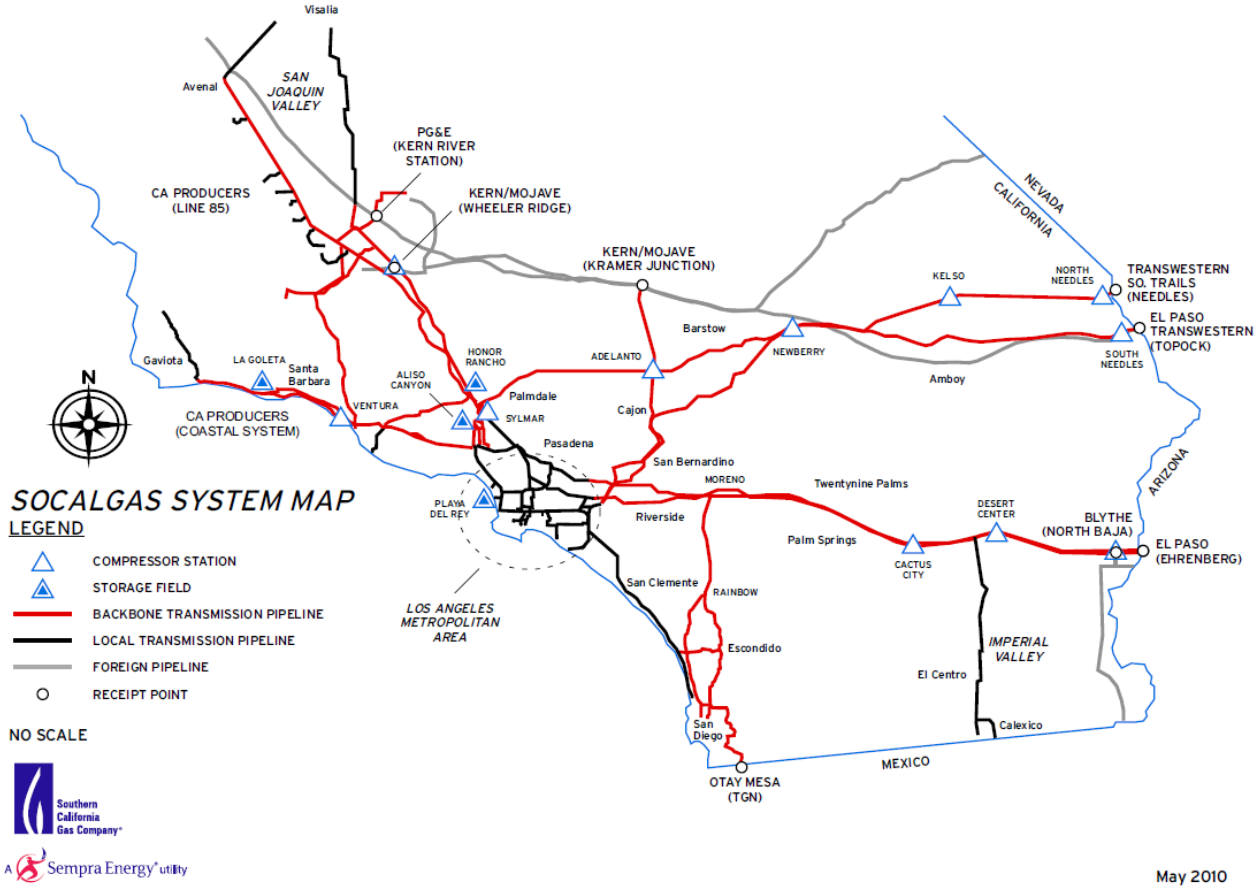
Scott Backhaus, PhD—Program Manager – Los Alamos National Laboratory

- Manager, DOE Office of Electricity & DHS Critical Infrastructure programs
- Team Leader, DHS National Infrastructure Simulation & Analysis Center (NISAC)
- Ph.D. in Physics (97) from University of California at Berkeley

Mary Ewers, PhD—Oil & Natural Gas Analyst – Los Alamos National Laboratory

- Lead Oil & Gas Infrastructure Analyst for NISAC
- Ph.D. in Economics (04) University of New Mexico

SCG Gas System Map – General Pipeline Properties



UNCLASSIFIED

Gas Storage Fields—General Properties

- **Playa del Rey**
  - Small storage capacity but a key peaking facility located with the LA Basin
- **La Goleta**
  - Limited pipeline transportation
  - Pipeline constraints limit ability to support peak gas loads in LA Basin
  - Used more for “base load” for overall recovery of the system
- **Honor Rancho**
  - Better access to pipeline transportation capacity
  - Closer to LA Basin to support peak gas loads
  - Limited withdrawal rate due to competing with Wheeler Ridge for pipeline capacity
  - May not achieve peak storage field capability due to pipeline constraint

Overview – Other Key Background Information

- SCG is operating with a major infrastructure component offline
- For the Summer 2017 Assessment, SCG performed a System Capacity analysis instead of the peak day analysis
- CPUC directed SCG to maintain system wide storage withdrawal capacity of 2.035 Bcfd
- SCG cannot maintain 2.035 Bcfd without the use of Aliso
- For the Summer 2017 Assessment, CPUC directed SCG to *not include* injections or withdrawals from Aliso in their modeling efforts
- CPUC directed SCG to model system capacity with 1.47 Bcfd w/d rate
- SCG Model result: the maximum gas sendout that can be supported without Aliso is 3.638 Bcfd, of this total, 2.2 Bcfd is available to support electric generation
- CPUC directed SCG to increase storage injections into remaining storage fields

Gas Pipeline Hydraulic Modeling—Overview

- **Accurate hydraulic modeling and simulation is key to accurately assessing system capacity**
- **What is included in hydraulic modeling?**
  - The flow and compression of gas in the individual pipe segments
  - The control of and flow in the interconnections and valves between the individual pipe segments
  - The control and operation of city gate/pressure reduction control stations
  - The control and operation of gas compression stations
  - The control and operation of gas storage fields
- **What are “boundary conditions” for hydraulic modeling?**
  - Gas storage reservoirs and the surrounding operational systems
  - Flowing gas supplies at the pipeline receipt points

IRT Detailed Findings (1)

- (IRT Agreement) Based on IRT observations, the IRT believes the transient hydraulic model to be sufficiently representative of the gas system network for the 2017 Summer Reliability Assessment.
- (IRT Agreement) Based on investigation of recent historical data under tighter gas balancing rules, the 2017 Summer Reliability Assessment estimates that actual gas receipts may fall short of SCG system capacity study receipts by 10%. Based on discussions with SCG and analysis of data during low operational flow orders on the SCG system, the IRT is in agreement with this approach.
- (IRT Agreement) Because neither the assessment team nor SCG know a priori where the gas supply will fall short of scheduled gas, the IRT agrees with the use of a 1:1 reduction in the assessment team's extrapolation of the 2017 Summer system capacity analysis.

IRT Detailed Findings (2)

- (IRT Agreement) For those gas storage fields that have not operated at gas inventories near to the targets assumed in the 2017 Summer system capacity study, the IRT is in agreement with the SCG approach to use a combination of simulation and historical data to estimate the maximum storage withdrawal capacity at the target gas storage inventories.
- (IRT Recommendation) The limited gas storage injection capacity and tighter balancing system-wide rules have resulted in reduced storage injections at the non-Aliso gas storage fields. The IRT recommends that a gas storage injection plan be developed and implemented that, at a minimum, includes:
  - Weekly and monthly gas storage injection goals that will achieve storage inventories consistent with the gas storage withdrawal rates used by the assessment team
  - Definition and an implementation plan for weekly and monthly monitoring of progress towards the gas storage inventory goals
  - A clearly identified party or organization responsible for achieving the injection goals

IRT Detailed Findings (3)

- (IRT Recommendation) The effect of unplanned gas pipeline and storage outages should be included in the 2017 Summer Reliability Assessment. Because neither the assessment team nor SCG know a priori where the pipeline or storage unplanned outages will occur, the IRT suggest that the impact of potential unplanned outages be assessed using the same 1:1 reduction in the assessment team extrapolation of the 2017 Summer system capacity analysis.
- (IRT Agreement) The deviations in daily gas load conditions from the 2017 Summer system capacity study are small enough that the IRT believes the assessment team's approach of scaling the supportable gas load by the same factor uniformly across each our the day is sufficiently representative of the response of the SCG gas system to these conditions.

IRT Findings—What Does This Mean? (1)

- The IRT finds that the hydraulic modeling and simulation of the SCG gas system and the modeling of SCG gas control operations are representative of the gas send out capability of the SCG gas system under the boundary conditions used in the 2017 Summer system capacity study performed by SCG and discussed in the 2017 Summer Reliability Assessment.

- The IRT also finds that the gas system boundary conditions used in the 2017 Summer system capacity study and discussed in the 2017 Summer Reliability Assessment are representative of the actual boundary conditions, assuming that the target storage inventories required to meet the CEC-required gas storage withdrawal rates can be achieved.

IRT Findings—What Does This Mean? (2)

- The IRT also finds that, under current operating conditions, the required gas storage levels to meet the CEC-required gas storage withdrawal rates are unlikely to be achieved.

- The IRT also finds that the effects of gas system unplanned outages should be included in the 2017 Summer Reliability Assessment to provide a more complete understanding of the risks to the combined CaISO and LADWP electrical system.

Recommendations (1)

- The IRT recommends a gas storage injection plan be developed and implemented that, at a minimum, includes:
  - Weekly and monthly gas storage injection goals that will achieve storage inventories consistent with the gas storage withdrawal rates used by the assessment team
  - Definition and an implementation plan for weekly and monthly monitoring of progress towards the gas storage inventory goals
  - A clearly identified party or organization responsible for achieving the injection goals

- SCG should consider ways to incorporate transient hydraulic modeling into gas control operations to improve their ability to support gas injections into their underground storage facilities

Recommendations (2)

- SCG should develop contingency plans that involve gas supplies alternative or in addition to drawing gas from Aliso Canyon to mitigate extreme gas system operating conditions

- The 2017 Summer Reliability Assessment should be updated to include the effect of SCG gas system unplanned outages on the combined CaISO and LADWP electrical systems.

Questions

Additional Back Up Slides

Impact of Pipeline and Storage Unplanned Outages on System Capacity

- **2017 Summer Reliability Assessment did not explicitly consider either pipeline or gas storage *unplanned* outages**
- **Unplanned pipeline outages in LA Loop**
  - Planned or unplanned outages may require curtailment, but network redundancy will likely enable gas to continue to be supplied and other EG facilities can make up the loss
  - Individual unplanned pipeline outages within the low pressure loop will have limited to no effect on joint system reliability

- *Based on this reasoning, the IRT believe that individual pipeline outages within the low pressure loop in the Los Angeles basin will have limited to no effect on joint system reliability.*

Impact of Pipeline and Storage Unplanned Outages on System Capacity

- **Unplanned pipeline outages in high pressure gas supply lines**
  - Modeled at full capacity, full or partial outages cannot be compensated by increased receipts on other high pressure lines, results in a 1:1 reduction in gas send out
  - Operation of city gates and timing of Playa del Rey withdrawals could partially offset losses due to outages…would require additional multi-day study
  - Honor Rancho could partially mitigate an outage on high pressure line between Wheeler Ridge and the La Basin if the max w/d rate is greater than what was usable in the simulation, although an overall supply shortfall could still be likely

- *In general, the IRT agrees with this analysis as a worst case impact of outages on these pipelines, however, certain mitigation measures are possible*

Impact of Pipeline and Storage Unplanned Outages on System Capacity

- **Storage outages**
  - Detailed transient hydraulic analysis is required to assess if potential mitigation from other storage facilities is possible
  - 1:1 reduction is reasonable worst case assumption

- *The effect of unplanned gas pipeline and storage outages should be included in the 2017 Summer Reliability Assessment. Since neither the assessment team nor SCG know a priori where the pipeline or storage unplanned outages will occur, the IRT suggest that the impact of potential unplanned outages be assessed using the same 1:1 reduction in the assessment team's extrapolation of the 2017 Summer system capacity analysis.*

Interface between SCG Analysis & CaISO/LADWP Assessment

- **Interface composed of two main approaches**
  - A gas system peak load factor that defines the ratio of hourly gas peak send out to average hourly has send out over the entire day, peak load factor used =1.47
  - If gas receipts fall short of scheduled gas at receipt points, there is a 1:1 reduction in daily total gas send out and in peak hourly gas supply capability
- **Peak load factor assumes certain shape for load profile**
  - SCG used historical data to develop the load profile
  - Peak load factor of 1.47
  - Fixed time profile was scaled up until the simulation was no longer successful
  - Final result was a supportable gas load curve included in the analysis
- *The deviations in daily gas load conditions from the 2017 Summer system capacity study are small enough that the IRT believes the assessment team's approach of scaling the supportable gas load by the same factor uniformly across each hour of the day is sufficiently representative of the response of the SCG gas system to these conditions.*