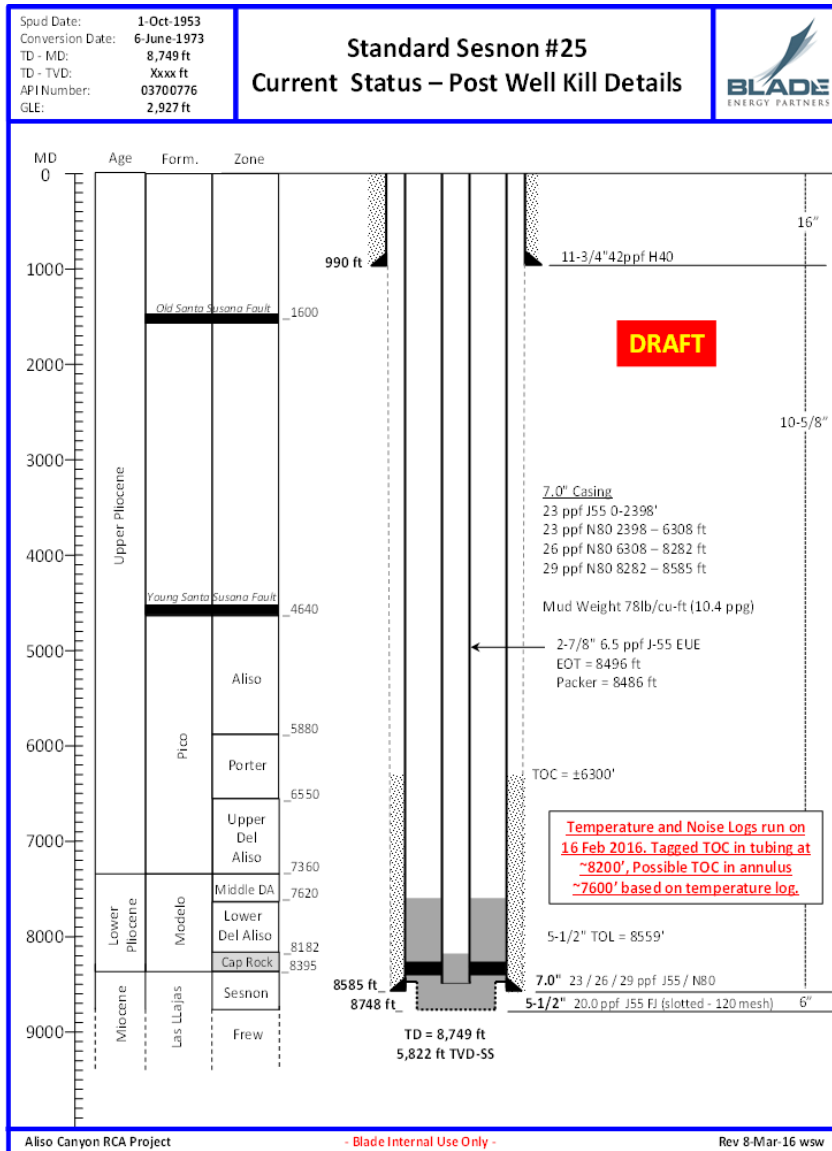

Aliso Canyon SS25 Investigation: Approach & Status

PHMSA Underground Storage Workshop
July 14th, 2016

Wellbore status



Up to 60 metric tonnes/hr of methane*

* Conley et al in *Science* AAAS 18th March 2016, Vol 351 Issue 6279

Technical RCA Objectives

- Root Cause and Contributing factors
 - Initial leak on SS 25
 - Initial leak growing to a larger leak; and then transitioning to a full fledged blow out.
- Data Driven Process
- Rationalize through data and analyses (modeling) obtained from observations: drilling/completion/workover reports, kill attempts, adjacent wells, logging and shallow geology results, laboratory observations.

Investigative Approach

- 1) Phase 0 – Data Collection & Collation & Analyses
- 2) Phase 1 – Aliso Canyon SS25 Site Evidence Collection & Documentation
- 3) Phase 2 – Aliso Canyon SS25 Site Restoration to Rig Readiness
- 4) Phase 3 – Aliso Canyon SS25 Tubing/Casing/Wellhead/Tree Direct Examination
- 5) Phase 4 – Aliso Canyon SS25 Non-Destructive & Laboratory Metallurgical Examination
- 6) Phase 5 – Aliso Canyon SS25: Integration & Interpretation-Final Report

Data Collection, Collation and Analyses

- SS25
 - Well file including drilling, completion, workover, production and injection history
 - Geologic information
 - Detail data on all the kill attempts (daily reports, recorded field data, fluid analyses, logging data)
- Complete well files for the relief well P39A
- General Withdrawal and Injection Procedures for Aliso Canyon
- Geological structure data for all wells including well paths, formation tops, fault blocks and reservoir zones
- Analyze wells with casing leaks

Phase 1: AC SS25 Site Evidence Collection & Documentation

- Site Evidence Collection
- Gas sampling from SS25 and other adjacent wells
- Water sampling from separators (multiple wells)
- Soil and Oil samples from locations
- Wellhead cleaning & Non-Destructive Evaluation
- Logging through the 2 7/8”
 - Caliper, Magnetic flux, High Precision Temperature, Spectral Noise Log and Magnetic Defectoscopy
- Shallow Geology Characterization

Ongoing & Upcoming Activities

- Site Restoration to Rig Readiness
- Tubing/Casing/Wellhead/Tree Examination
 - Logging through casing
 - Tubulars and Formation characterization
 - NDE evaluation of the tubulars
 - Laboratory evaluation of all anomalous indications
- Analyses, Modeling, Interpretation, Integration
- Final Report