Flowback Operations
Innovation
Reducing EHS Risk through Design and Planning

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About Bonanza Creek

- Independent energy company – publicly traded as BCEI since 2011
- Operations focused in Wattenberg (Niobrara) and Southern Arkansas (Cotton Valley)
Proper Management of Produced Water Critical

- BCEI operates in the South Platte River Basin
Flowback Operations - Risk

- Flowback operations pose an increased risk of environmental and safety impacts due to their temporary nature and variable flow rate conditions. Potential for:
  - Gas vapor release – explosion and emissions
  - Oil and produced water spills – impacts to surface
  - Static ignition – explosions, fires, injuries to workers
- BCEI conducted risk assessment
  - Resulted in modification of our operations to reduce these risks
Flowback Operations – Challenging Process

- Flowback operations
  - post frac
  - pre-permanent facility production
- 50 – 90 bbls of water/ hour
  - Completions fluid combined with reservoir water, gas and oil
- 1 – 2 weeks – changing conditions
- Temporary equipment
- Typically SIMOPS location
Process Safety Controls Implemented

- Process safety management resulted in significant reductions in risk.
- The technical innovations that made this successful were:
  - closed top tanks with pressure relief systems,
  - liquid and gaseous manifold systems to provide liquid/vapor balancing and capture,
  - chemical and tear resistant liners under all flowback tanks and piping,
  - routing closed top tank emissions to enclosed flares in lieu of venting or open flaring, and
  - extensive bonding and grounding of equipment, piping and loadout.
  - continuous monitoring of tank volumes and 24/7 hauling.
Modified Design Schematic

This is only an example and may not represent all situations
Risk Reduction

- Estimated benefits from the risk management process
  - 80% reduction in risk of tank overflow,
  - 80% reduction in risk of spill impacts to pad site soils and/or offsite release,
  - 95% reduction in volatile organic emissions, and
  - 80% reduction in catastrophic explosion from static and sparks.

- Costs of operation increase minor
  - Avoidance of one incident turns the rate of return to instant payback.
    - Used piping, ECDs obtained from decommissioning an old tank battery
    - Setup costs – 3hrs, 3 person crew
    - Welded seam non-slip liner - reusable
Pad Layout

Water Tanks

Oil Tanks
Oil Dump Lines Inside Containment

- Non-slip material
- Welded Seam Containment
High Pressure Line Protection

- Line Restraints
- Steel Line Trench Cover
- Flowline Support Blocks
Flowback Tanks Grounded with a Static Discharge Reel

Static Reel (50')
Grounding and Bonding of Flowback Tanks

8’ Copper Grounding Rod

Tank Bonding Cable
Common Grounding with Static Reel
Vapor Recovery Manifold

Dresser Sleeve Connections
Vapor Recovery Scrubber

Flame Arrestor
Well Head with High Pressure Warning Signs
Project Results

- Reduced environmental and safety risk achieved
  - no recent environmental or safety incidents
  - cost reduction efforts continue to make this less impactful to AFE costs

- Bonanza Creek Energy - Colorado Oil and Gas Conservation Commission 2014 Outstanding Oil and Gas Operations Award
Questions and Comments