



**BONANZA
CREEK**

Flowback Operations Innovation

Reducing EHS Risk through Design and Planning

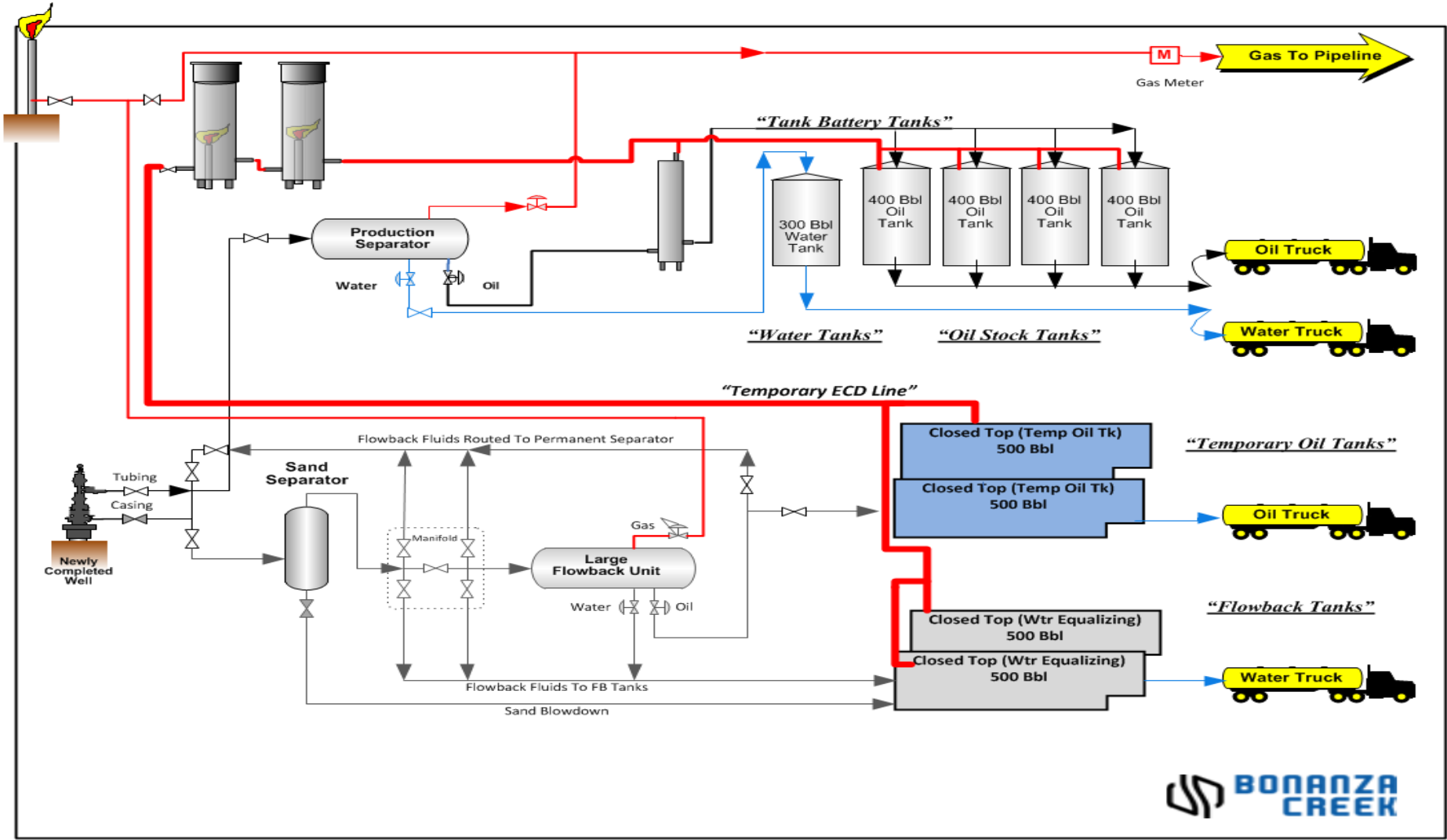
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Flowback Operations

- 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

Modified Design Schematic



This is only an example and may not represent all situations

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.

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 increased ~20%
 - ▣ Avoidance of one incident turns the rate of return to positive

Pad Layout



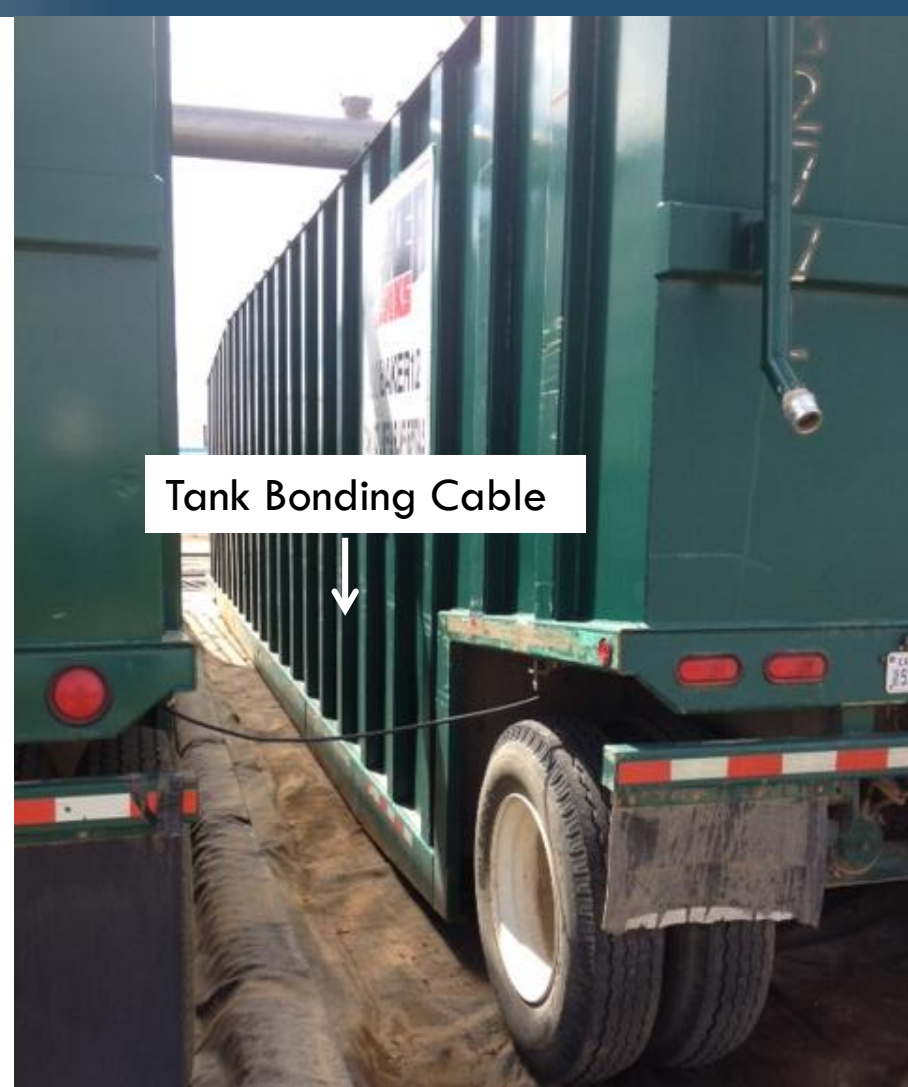
Water Tanks

Oil Tanks

Flowback Tanks Grounded with a Static Discharge Reel



Grounding and Bonding of Flowback Tanks



Common Grounding with Static Reel

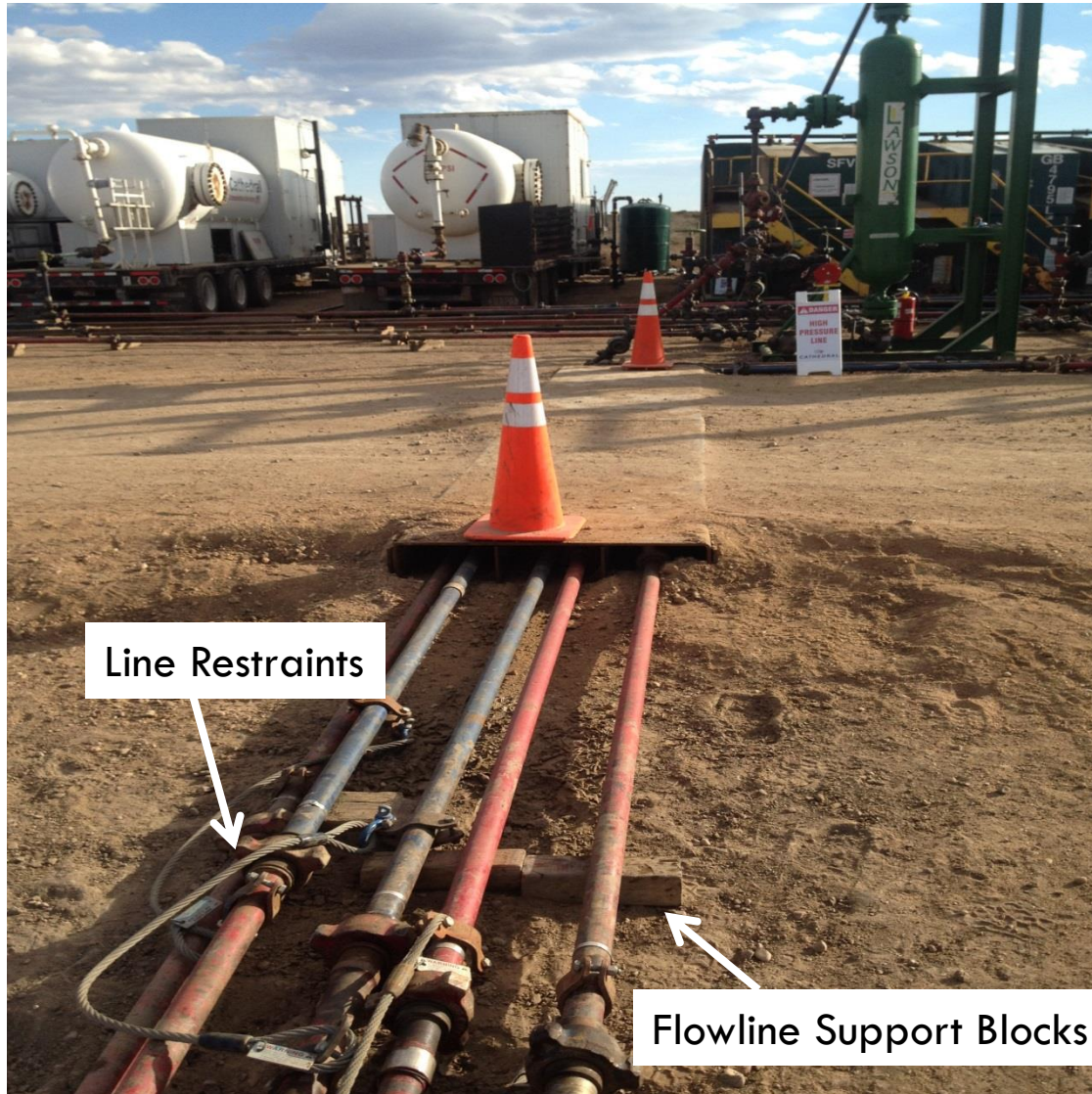


Grounding/Bonding Rod

Static Reel (50')

Fire Extinguisher

High Pressure Line Restraints



Vapor Recovery Manifold



Vapor Recovery Scrubber



Flame Arrestor

Oil Dump Lines Inside Containment



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