

An aerial photograph of a wide river valley. The river is a deep blue, winding through a landscape of brownish-green fields and patches of trees. In the distance, a range of mountains with snow-capped peaks is visible under a clear blue sky. The text is overlaid on the top half of the image.

Gas/Condensate Well Drilling, Completion & Production Equipment

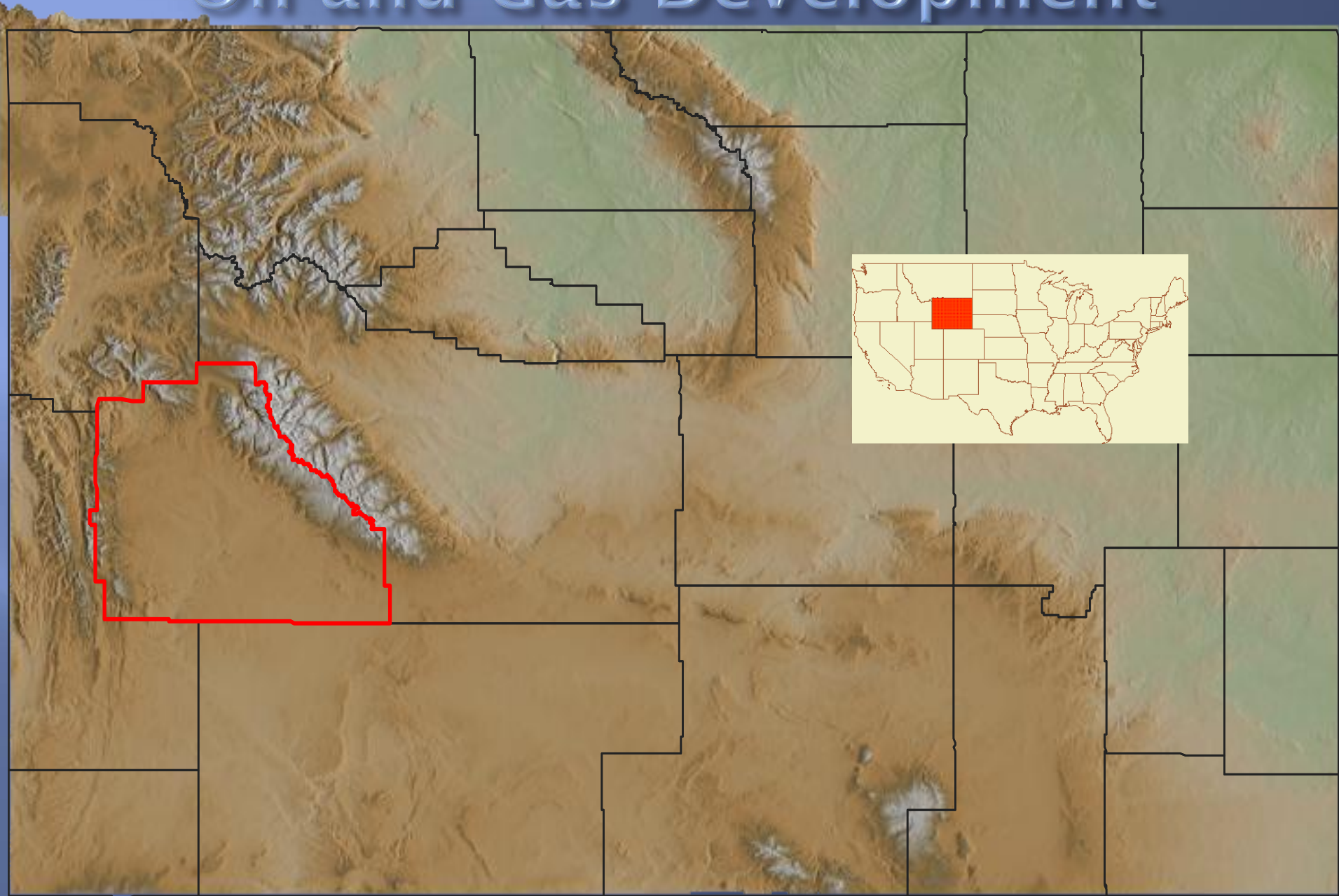
November 5, 2013 WDEQ-AQD/WRAP Presentation

Jonah Field

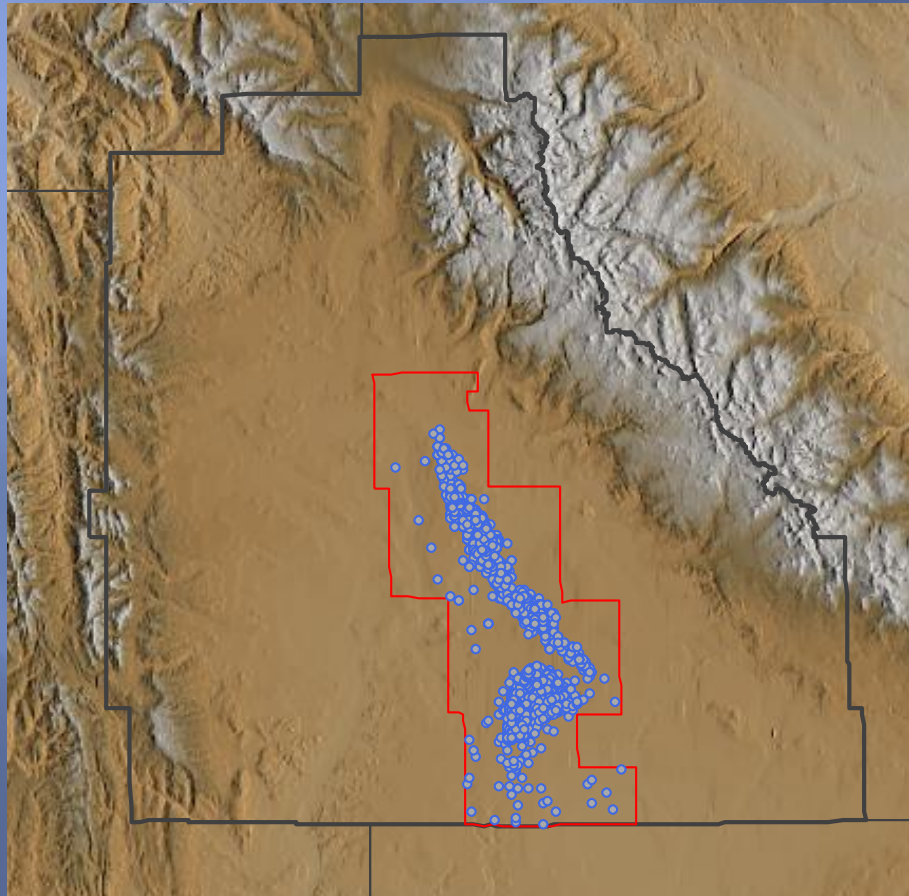
Brian R Bohlmann, P.E.
Emissions Inventory Supervisor
WY Department of Environmental Quality
Air Quality Division

Photos Taken August 10, 2011

Oil and Gas Development

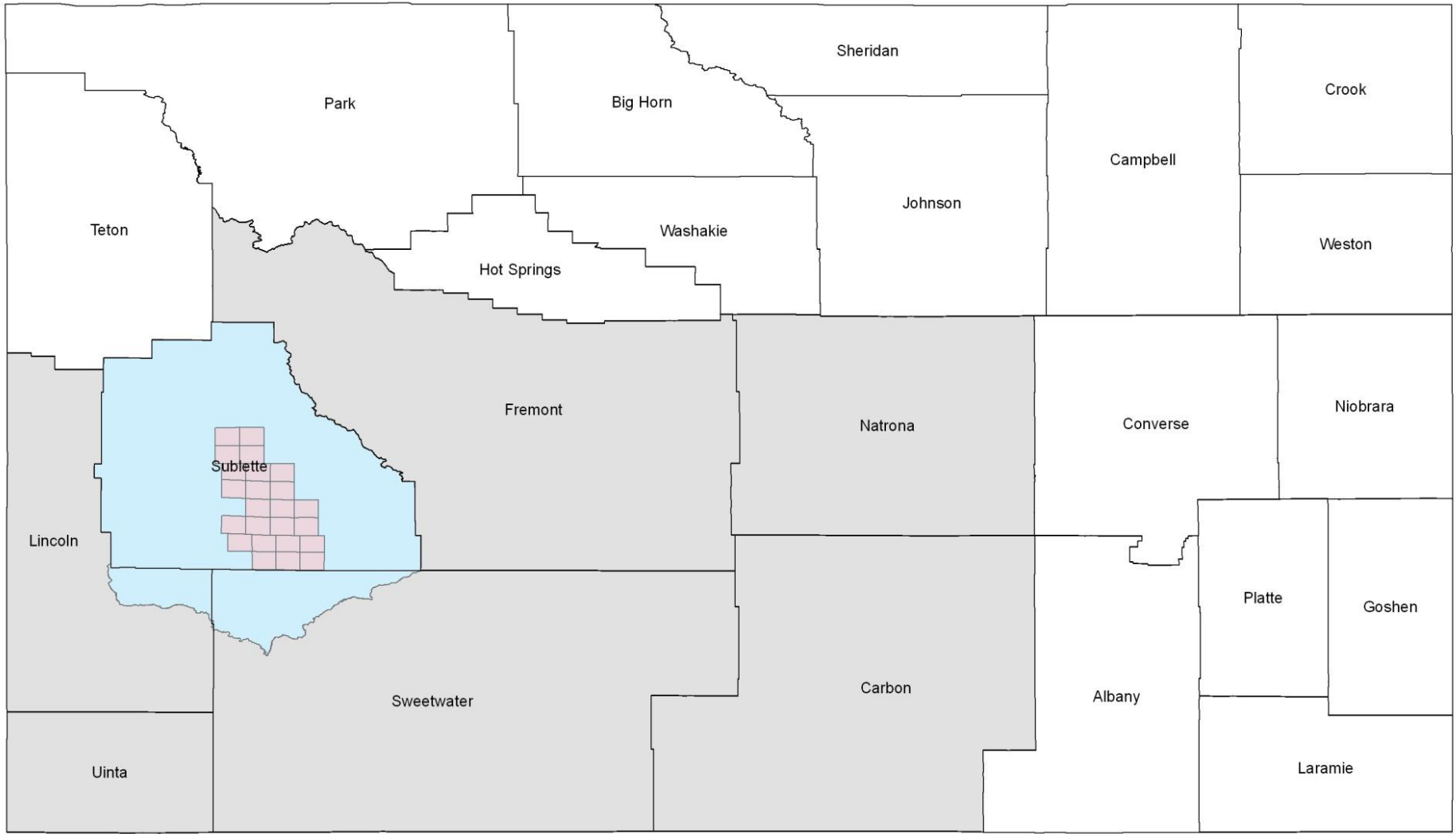


Oil and Gas Development



- ▣ Jonah Field and Pinedale Anticline Development (JPAD)

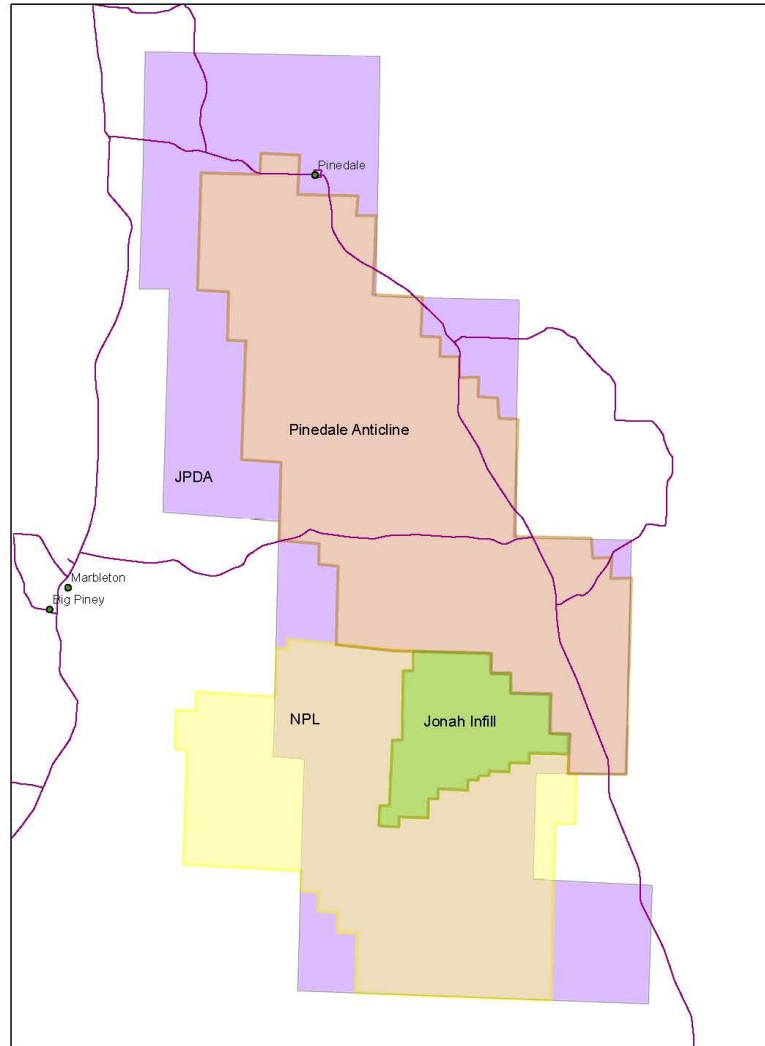
September, 2013 Permitting Guidance Update



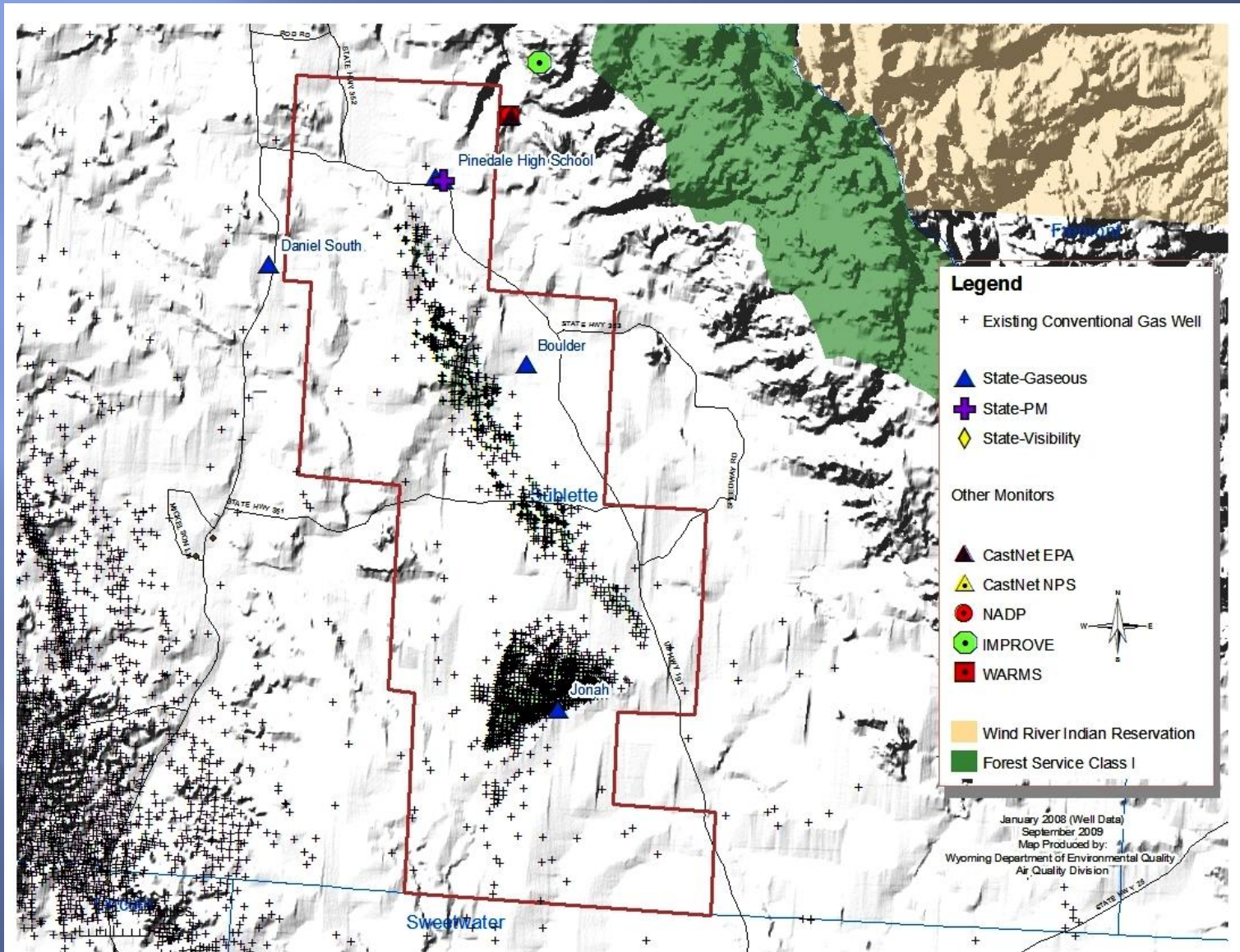
Legend

- JPAD/NPL
- UGRB
- CDA
- Statewide

Jonah-Pinedale Anticline Development (JPAD) & Normally Pressured Lance (NPL)



Jonah-Pinedale Anticline Development (JPAD) Area 2008 Well/Monitor Locations



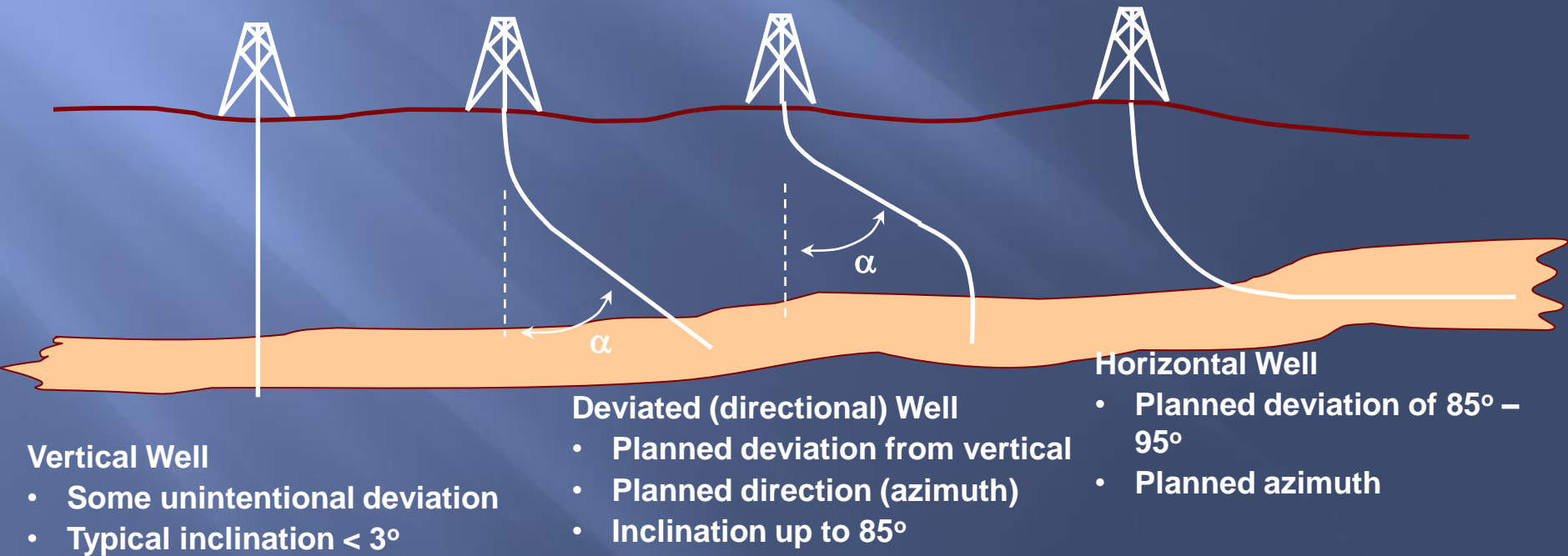
Jonah Field Development

- ▣ Jonah Environmental Assessment (EA) issued in 1994
 - 47 existing wells
- ▣ Jonah II ROD issued in April, 1998
 - 450 additional wells
- ▣ Jonah Infill ROD issued March 14, 2006
 - 3,100 additional wells
 - 16 acre down-hole well spacing
- ▣ Single well pads

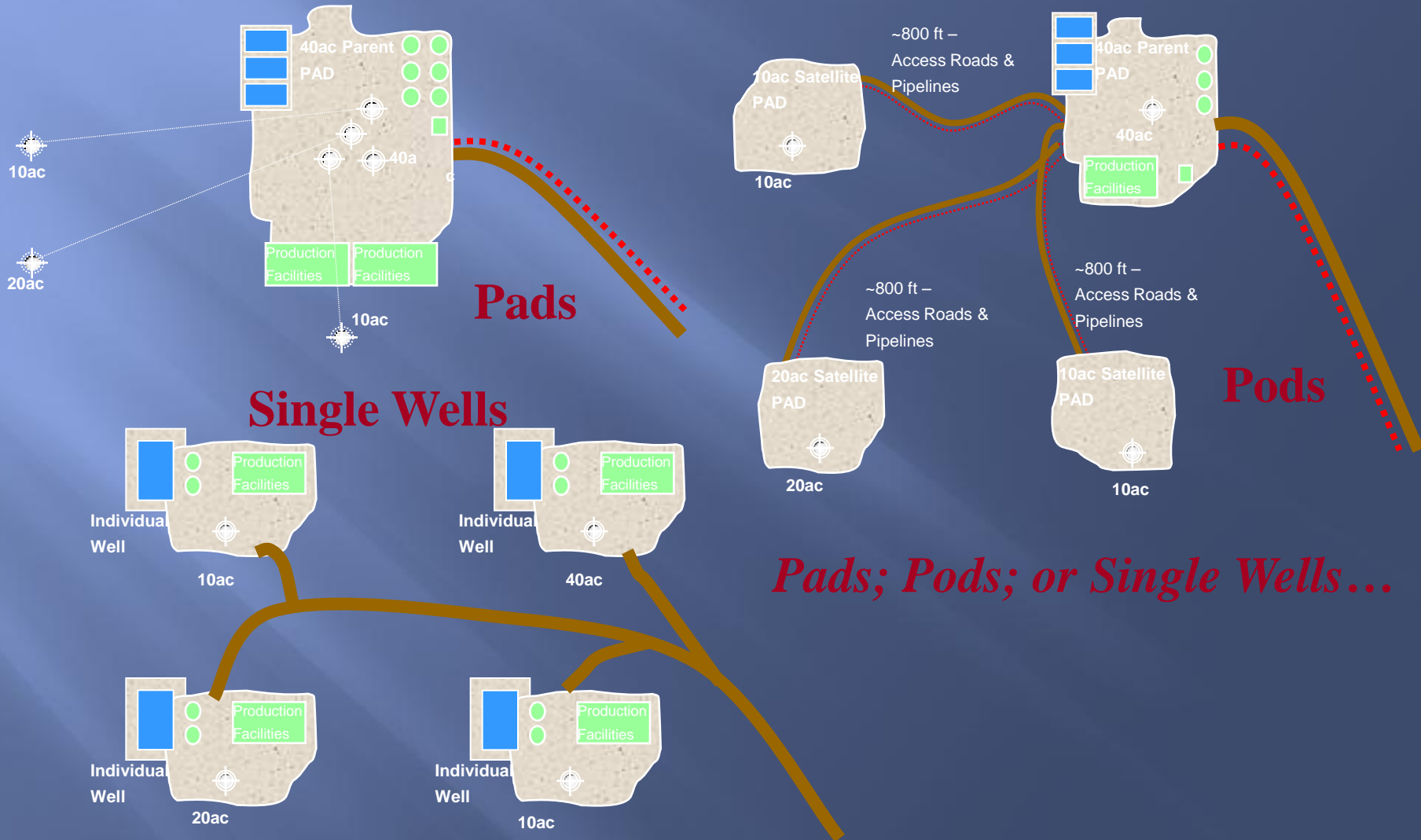
Directional Drilling

At the basic level:

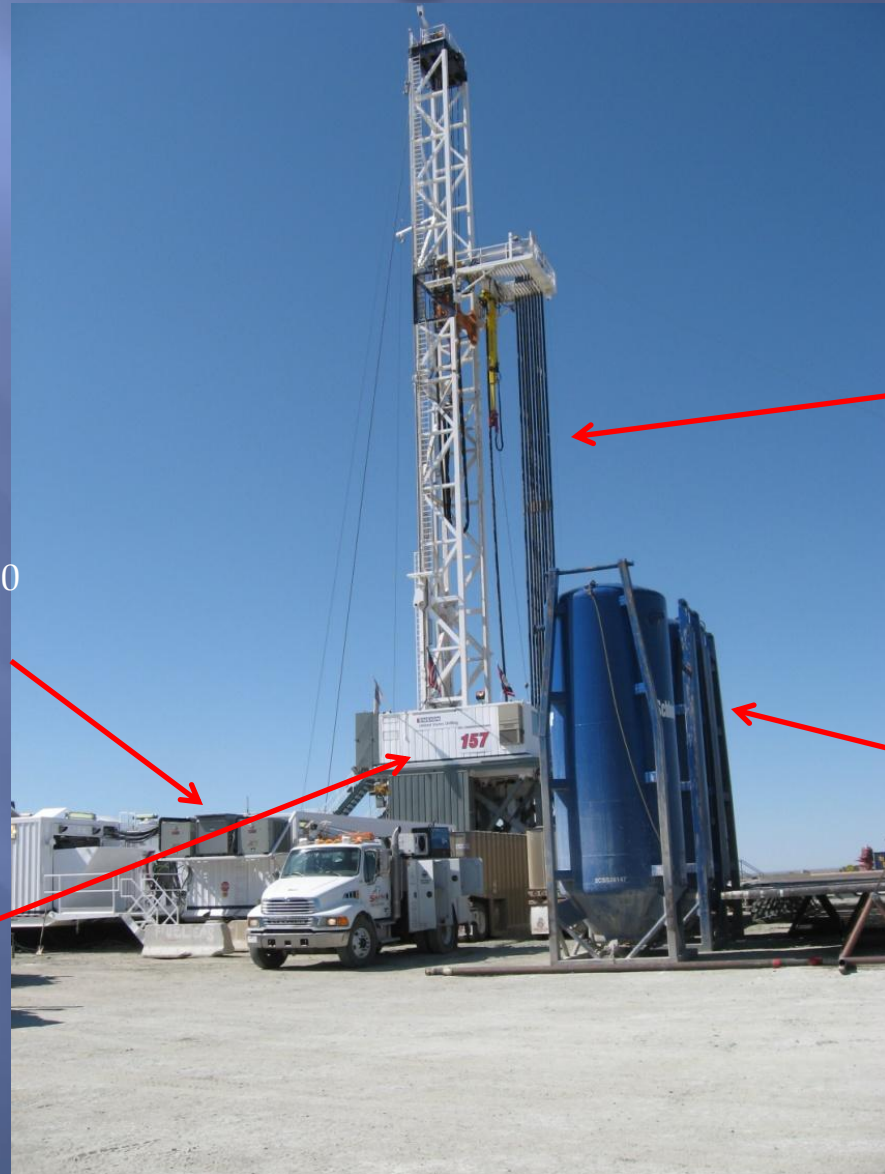
- A deviated (or directional) well is a well that has been intentionally deviated from vertical. The deviation (or inclination) is measured from the vertical.
- A horizontal well is a deviated well with an inclination at or near 90°



Development Options



Encana's Ensign 157 Drill Rig



90 feet long drill pipe

Chemical Tanks

Control Room

Jenbacher J320GS 1,818 Hp
natural gas fired engines w/1.0
g/Hp-hr NOx emissions

Drill Pipe (45 foot lengths)



Chemical Tanks



Natural Gas Meter Station for supplying gas to the rig engines



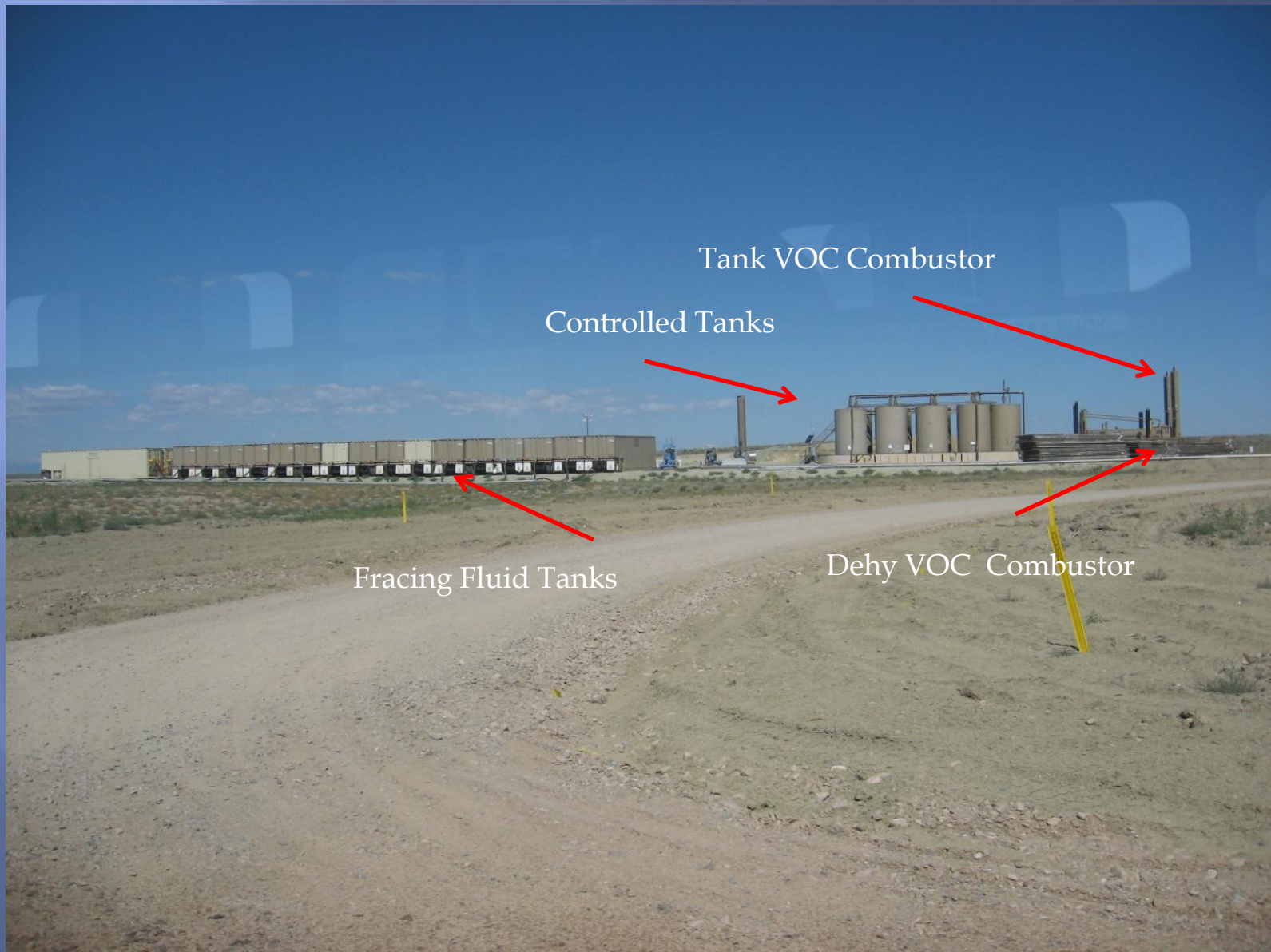
Jonah Field



Drill Rigs

Workover Rig

Multi-Well Production Site



Well Completion Operations



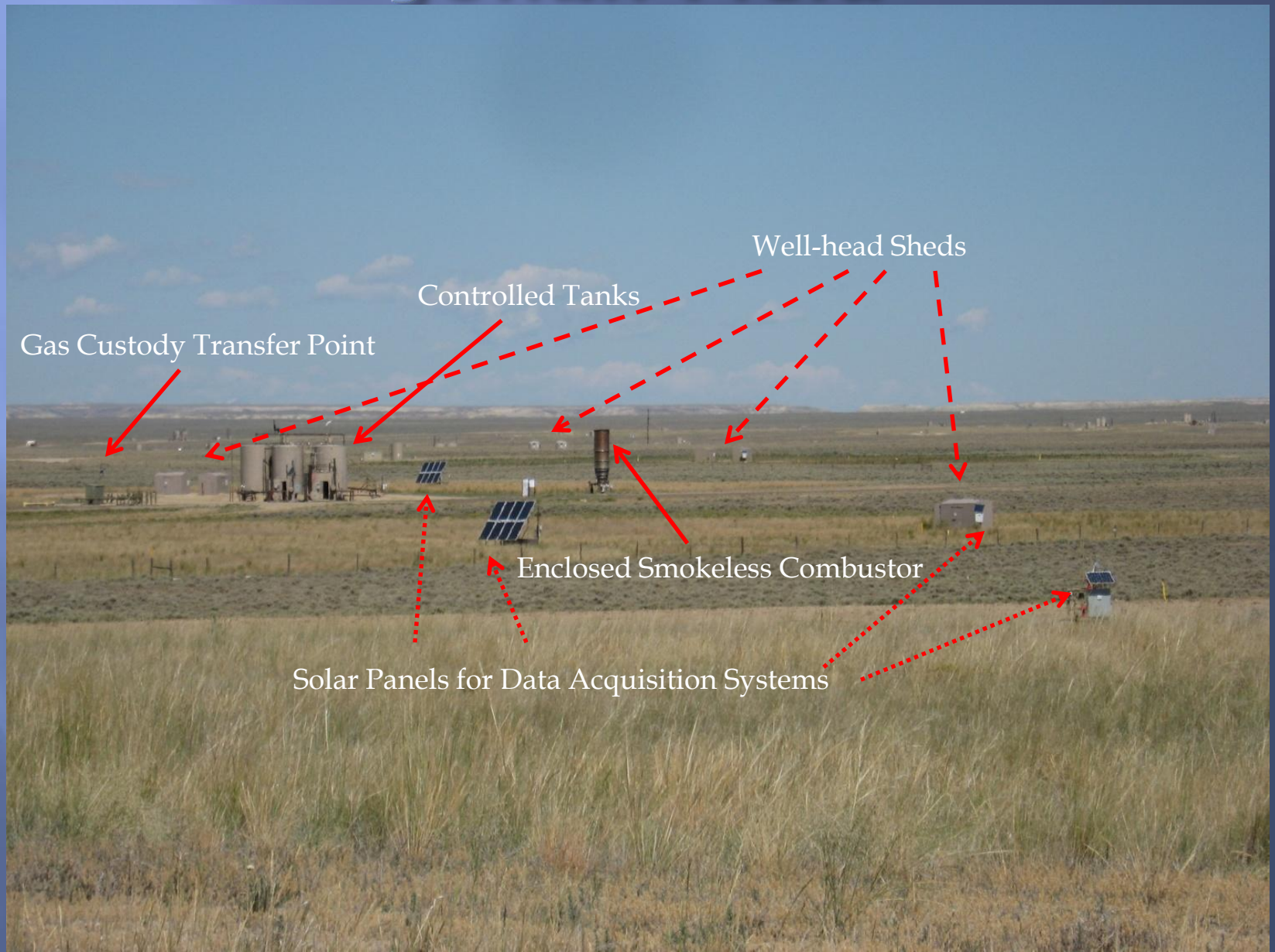
Well-Head Housing Sheds



Controlled Storage Tanks



Jonah Field



Jonah Field



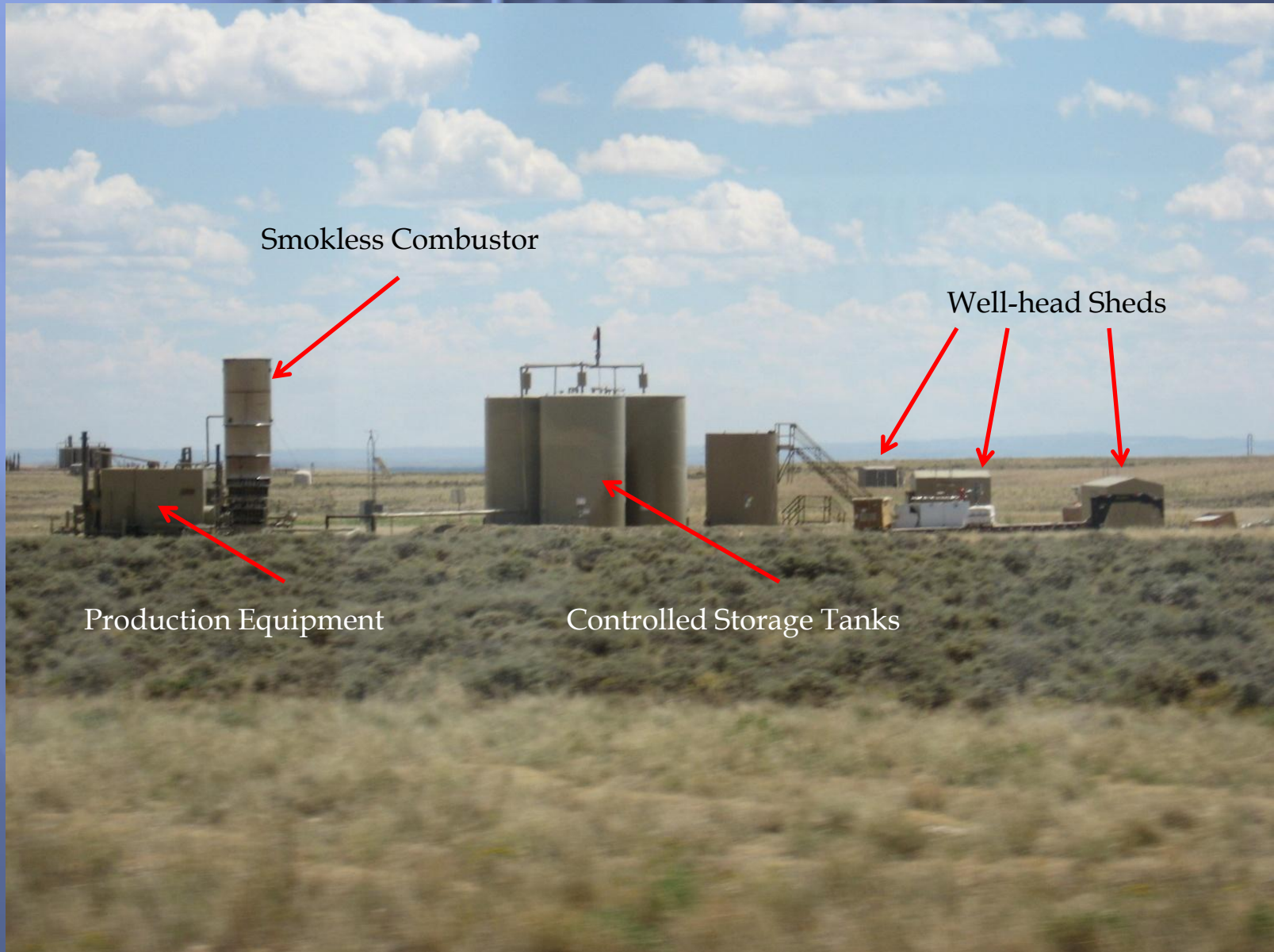
Produced Water Haul Truck

Work-over Rig

Single Well Pad



Multiple Well Pad



Smokless Combustor

Well-head Sheds

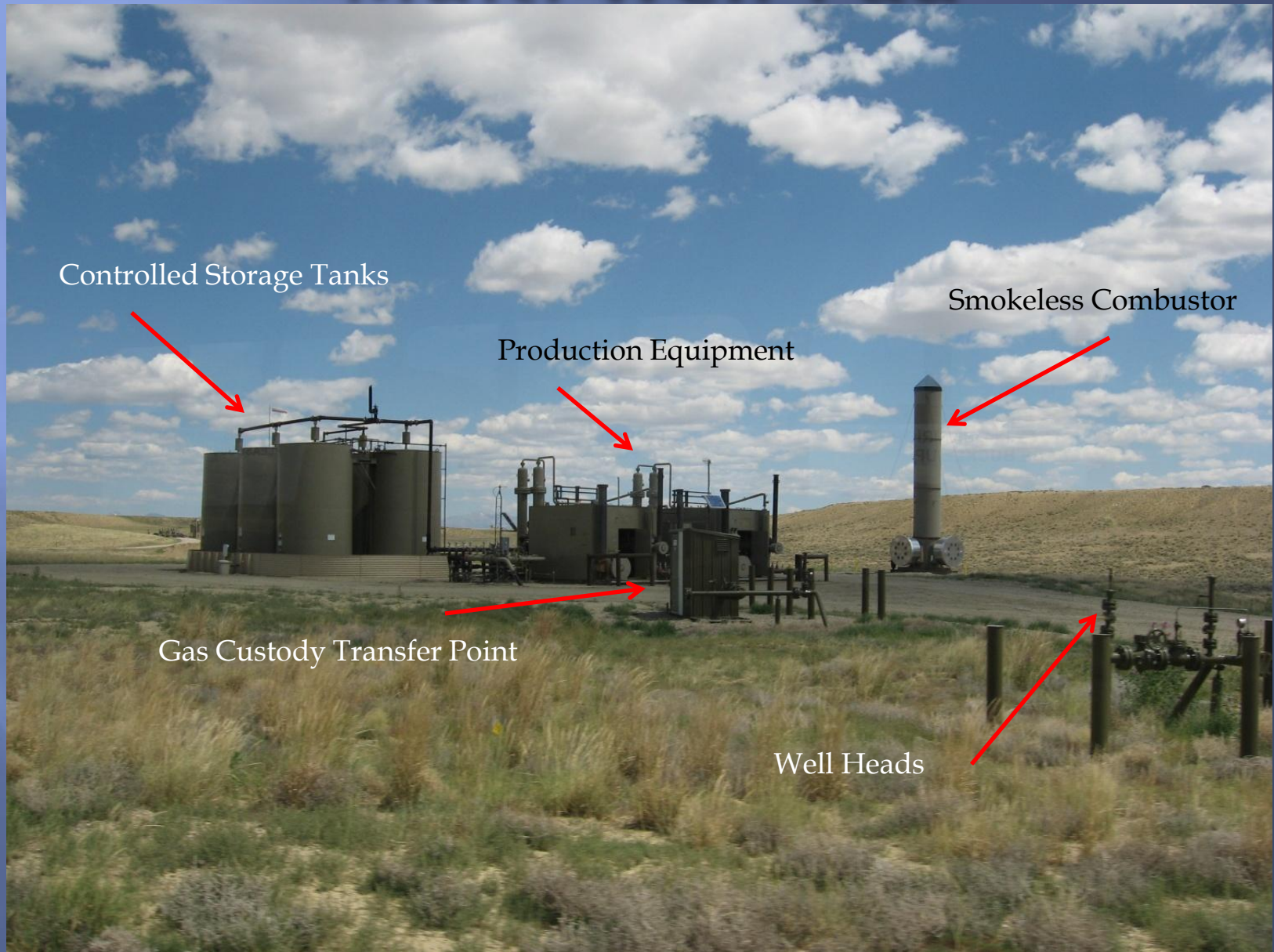
Production Equipment

Controlled Storage Tanks

4 Wells ~ 10 feet apart



Multi-Well Pad



Controlled Storage Tanks

Smokeless Combustor

Production Equipment

Gas Custody Transfer Point

Well Heads

Single Well (connected to multiwell pad)



Solar Panels for Control System

Gas Custody Transfer Building

Micro Turbine for electricity



Smokeless Combustor

Micro-Turbine Building

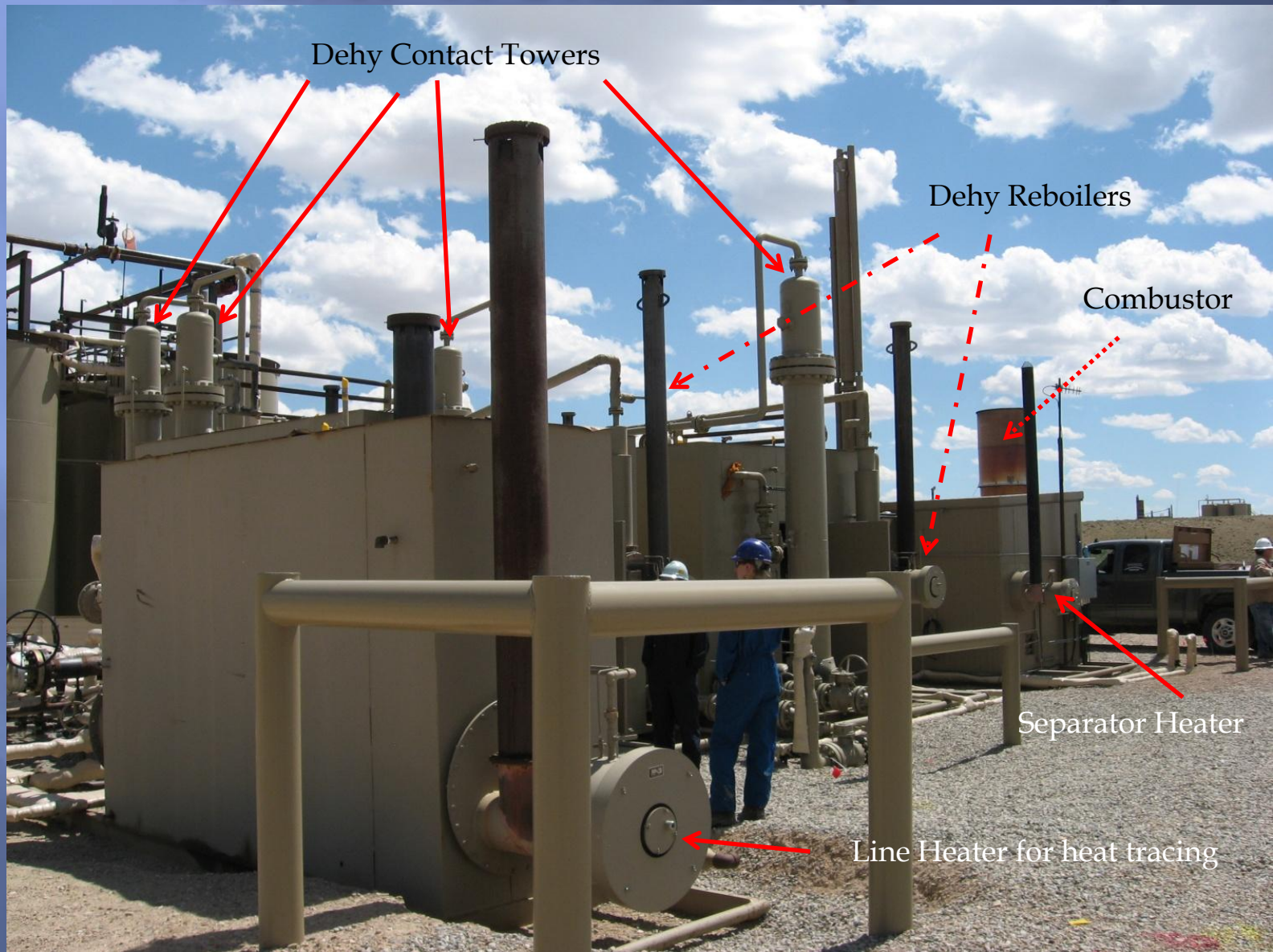
Multi-Well Pad (8 wells)



Well-Head Housing Sheds

8 Well Header

Multi-Well Pad (8 wells)



Multi-Well Pad



Enterprise-Jonah Gas Gathering's Bridger Compressor Station

14,000 Hp Solar Tital 130S
Turbine Compressors

Electric Compressor Engines

Over 77,000 total Hp from engines & turbines
at this natural gas compression station



Jonah Field

Bridger Compressor Station

Encana's Jonah Workforce Facility



Websites/Links

- Inventory Web Page:
<http://deq.state.wy.us/aqd/ei.asp>
- UGRB Ozone Non-Attainment Area Inventory Forms Web page:
<http://deq.state.wy.us/aqd/Annual%20and%20Winter%20Upper%20Green%20River%20Basin%20Emission%20Inventories.asp>
- Actual Emissions Web Page:
<http://deq.state.wy.us/aqd/Actual%20Emissions.asp>
- Oil & Gas forms & Guidance Documents Web page:
<http://deq.state.wy.us/aqd/oilgas.asp>
- Oil & Gas Production Facilities Guidance Document:
http://deq.state.wy.us/aqd/Oil%20and%20Gas/September%202013%20FINAL_Oil%20and%20Gas%20Revision_UGRB.pdf

Questions?

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<http://deq.state.wy.us/aqd/ei.asp>

<http://deq.state.wy.us/aqd/oilgas.asp>