Overview of Hydraulic Fracturing in New Mexico

New Mexico Legislative Finance Committee Meeting

July 9th, 2014

Presented by:
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And
Dean of Engineering

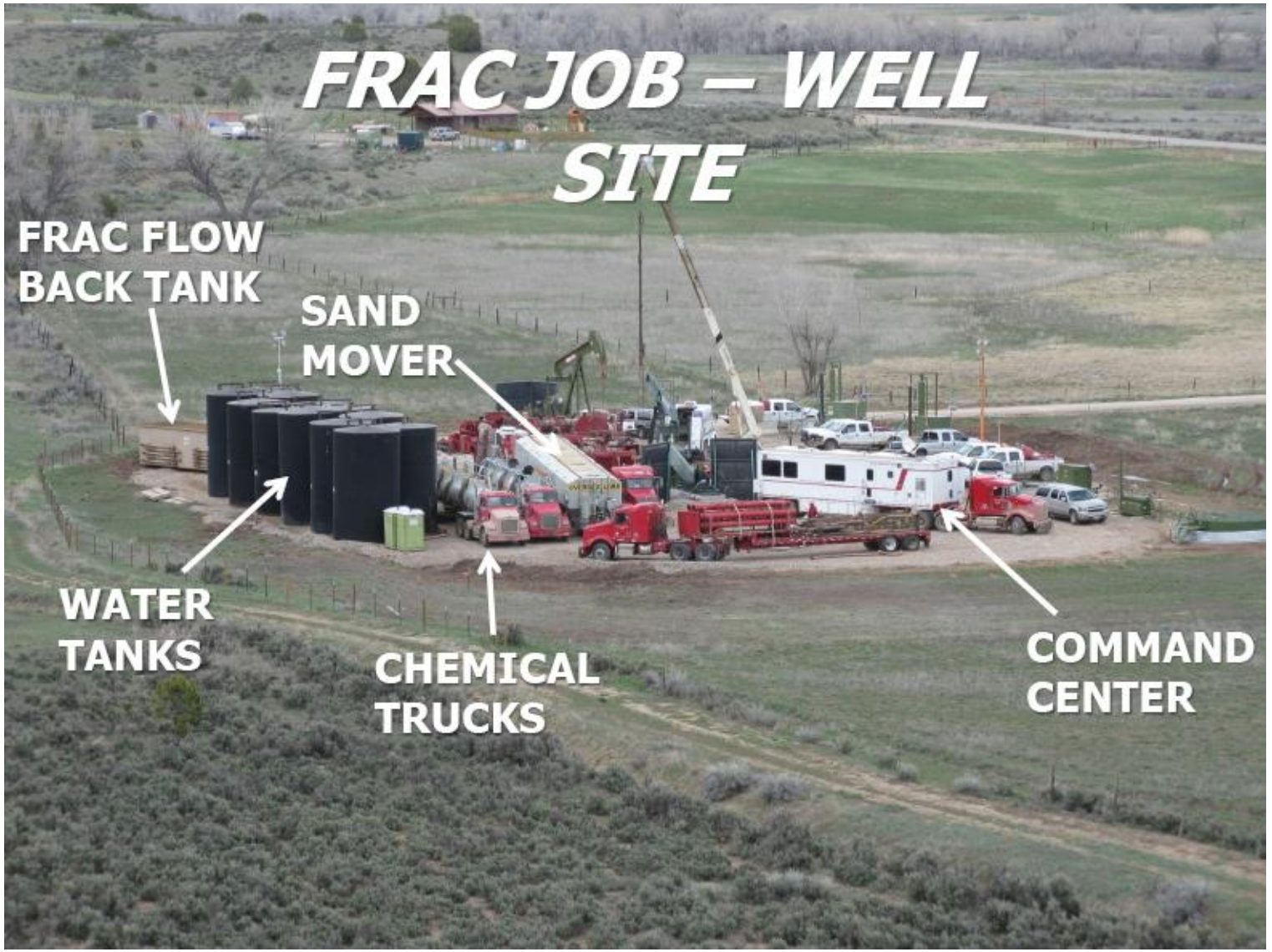
In the past….

(1890) to (1950) –

- openhole completions
- typical stimulation was liquid or solid **nitroglycerin.**
- Hazardous, but successful.
-
- **ZE**ro hour **B**ombing **CO**.

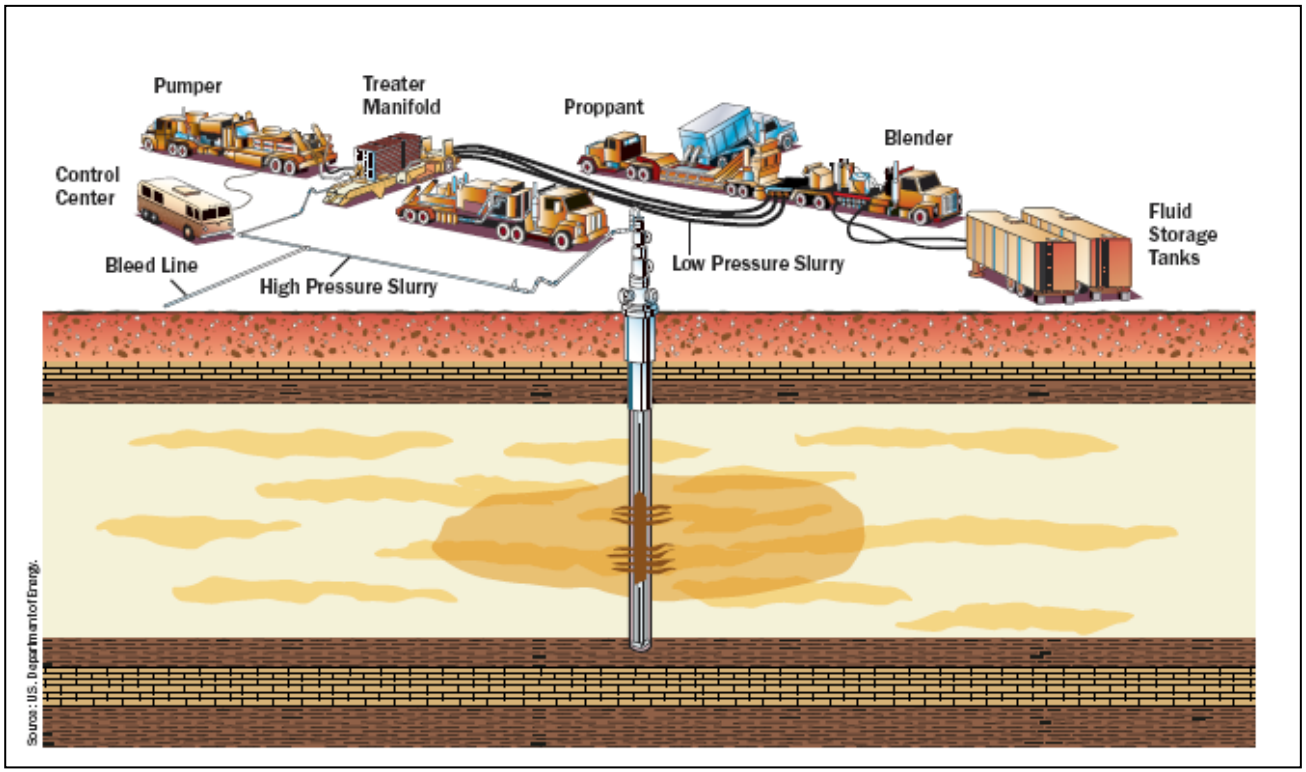
V2500010 [RM] © www.visualphotos.com

Today….


FRAC JOB – WELL SITE
FRAC FLOW BACK TANK
SAND MOVER
WATER TANKS
CHEMICAL TRUCKS
COMMAND CENTER

What is hydraulic fracturing?

- Hydraulic fracturing is the injection primarily of water and sand under high pressure into the producing formation, creating fissures in the rock that allows a pathway for oil and gas to migrate to the wellbore
- Hydraulic fracturing occurs at great depths, typically **5,000- 10,000 ft.**
- 90 percent of all wells drilled in the United States since 1947 have been fracked.

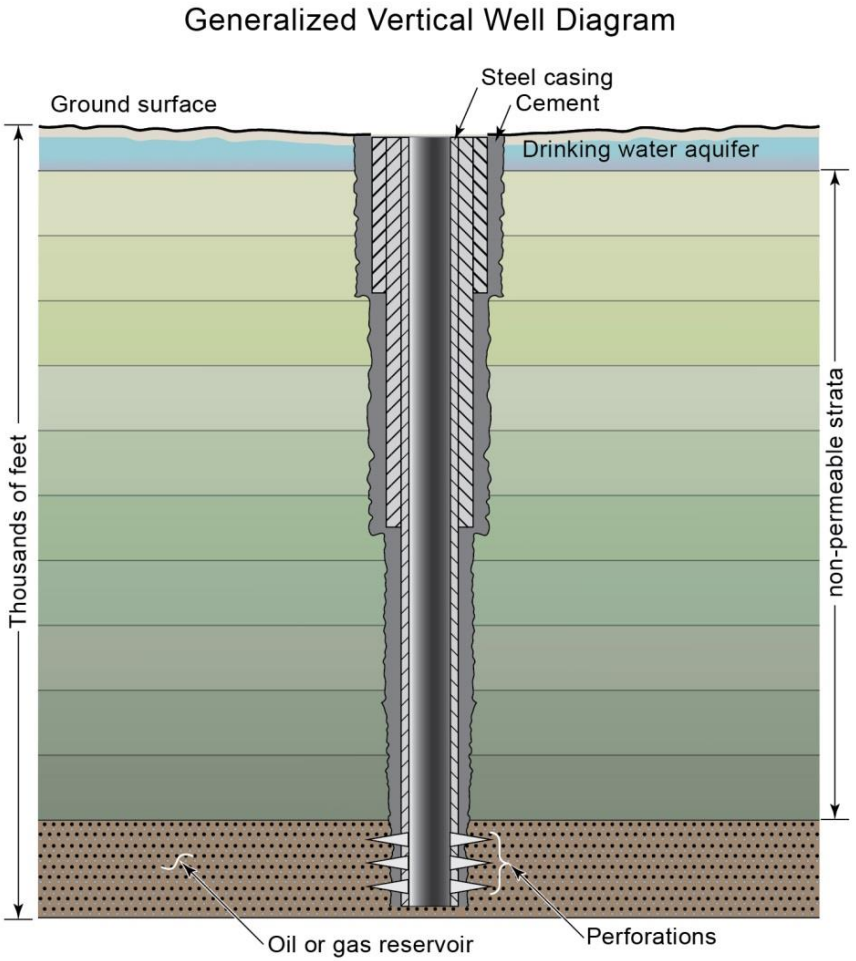


Simplified diagram of equipment for hydraulic fracturing
(source: U.S. D.O.E.)

How do you protect fresh water?

Well construction and integrity

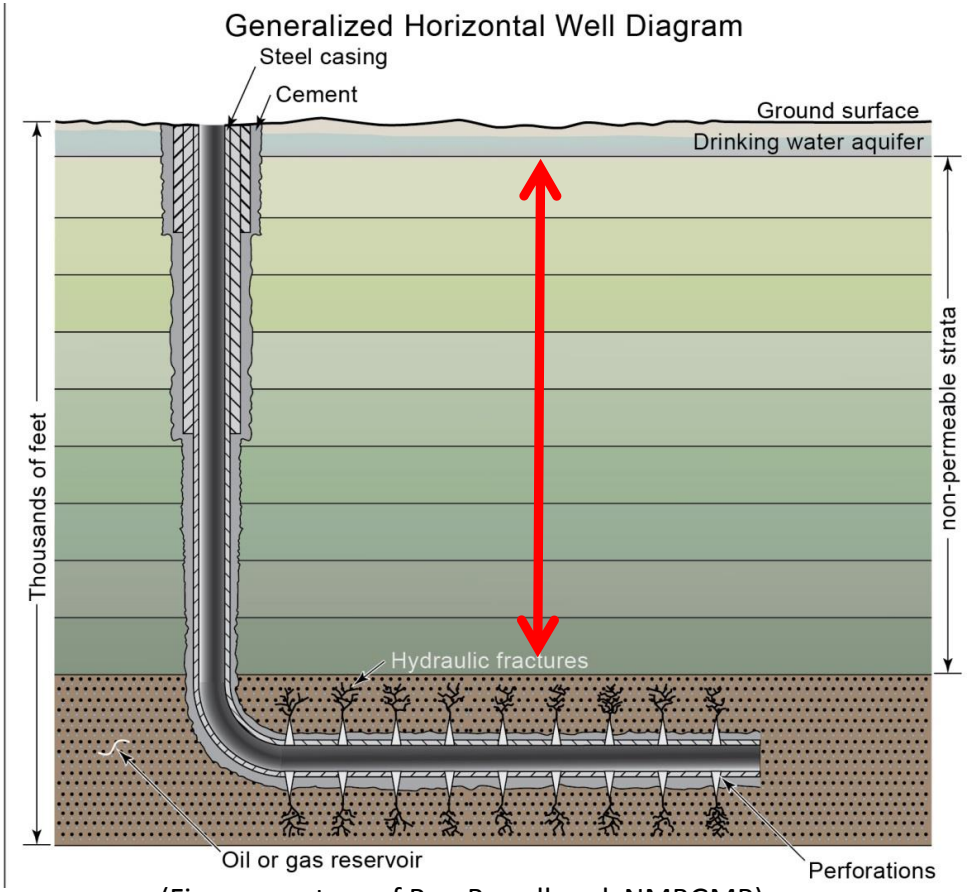
- To ensure containment and protection of fresh water
- Each well is encased in multiple layers of steel (casing)
- Each casing is surrounded by cement
- Approved, inspected & enforced by regulatory agencies



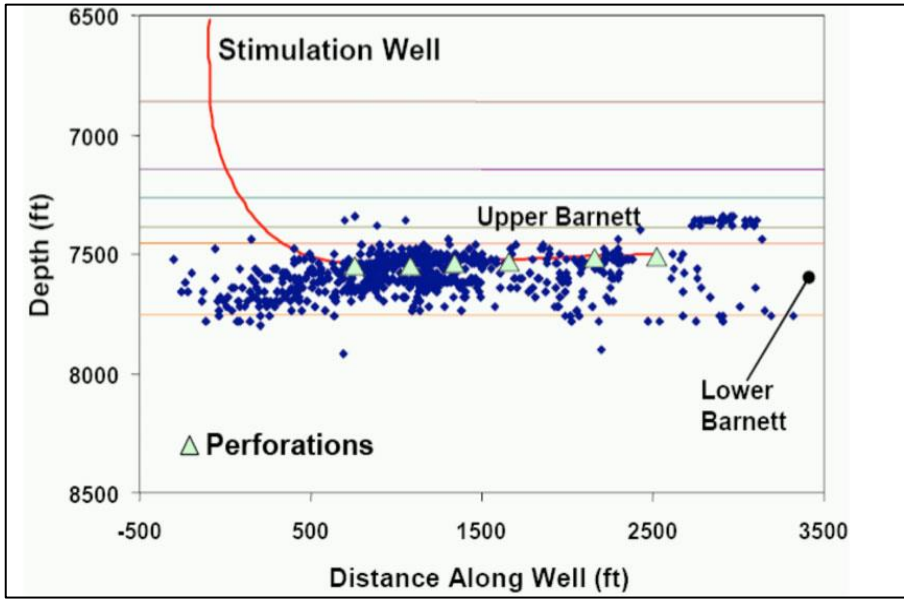
(Figure courtesy of Ron Broadhead, NMBGMR)

How do you protect fresh water?

The HC-bearing reservoirs are +5,000 feet in depth. Thus several thousand feet of impermeable rock lie between the aquifers and the frac interval.



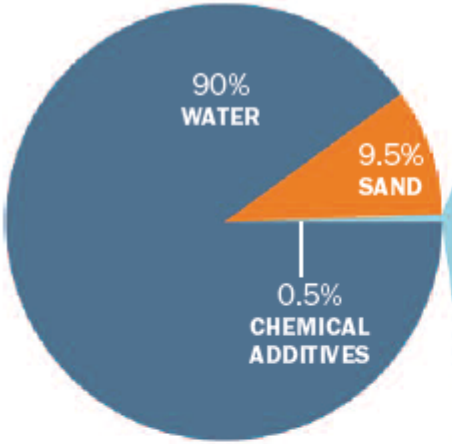
(Figure courtesy of Ron Broadhead, NMBGMR)



Example of recording microseismic events while fracing. Note containment of frac in zone of interest.

What is in a frac fluid?

Typical Fracturing Mixture Makeup



Typical Chemical Additives Used in Frac Water

Compound	Purpose	Common application
Acids	Helps dissolve minerals and initiate fissure in rock (pre-fracture)	Swimming pool cleaner
Sodium Chloride	Allows a delayed breakdown of the gel polymer chains	Table salt
Polyacrylamide	Minimizes the friction between fluid and pipe	Water treatment, soil conditioner
Ethylene Glycol	Prevents scale deposits in the pipe	Automotive anti-freeze, deicing agent, household cleaners
Borate Salts	Maintains fluid viscosity as temperature increases	Laundry detergent, hand soap, cosmetics
Sodium/Potassium Carbonate	Maintains effectiveness of other components, such as crosslinkers	Washing soda, detergent, soap water softener, glass, ceramics
Glutaraldehyde	Eliminates bacteria in the water	Disinfectant, sterilization of medical and dental equipment
Guar Gum	Thickens the water to suspend the sand	Thickener in cosmetics, baked goods, ice cream, toothpaste, sauces
Citric Acid	Prevents precipitation of metal oxides	Food additive; food and beverages, lemon juice
Isopropanol	Used to increase the viscosity of the fracture fluid	Glass cleaner, antiperspirant, hair coloring

Source: DOE, GWPC: Modern Gas Shale Development in the United States: A Primer (2009)

Disclosure

- ✓ Not only do individual states mandate disclosure, the federal government does as well. The Occupational Safety and Health Administration (OSHA) mandates this information be kept at every wellsite, and made readily available to response and medical personnel in case of an emergency.
- ✓ In addition, as of 2011, NMOCD passed a rule (accepted by industry) to provide a disclosure list of frac chemicals used.

Submit within 45 days of well completion

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

Revised November 6, 2013

1. WELL API NO.
2. Well Name:
3. Well Number: 115H

HYDRAULIC FRACTURING FLUID DISCLOSURE

☒ Original
☐ Amendment

4. Surface Hole Location:
Unit:P Lot:P Section:32 Township:24N Range:08W
Feet from:537 N/S Line:S
Feet from:329 E/W Line:E

5. Bottom Hole Location:
Unit:P Lot:P Section:32 Township:24N Range:08W
Feet from:537 N/S Line:S
Feet from:329 E/W Line:E

6. latitude: 0 longitude: 0

7. County: San Juan

8. Operator Name and Address:

9. OGRID: 120782

10. Phone Number:

11. Last Fracture Date: 11/8/2013 Frac Performed by: Halliburton

12. Production Type: O

13. Pool Code(s): 47540

14. Gross Fractured Interval: Confidential

15. True Vertical Depth (TVD): 5,538 ft

16. Total Volume of Fluid Pumped: 847,123 gals

17. Total Volume of Re-Use Water Pumped: 254,137 gals

18. Percent of Re-Use Water in Fluid Pumped: 30%

19. **HYDRAULIC FLUID COMPOSITION AND CONCENTRATION:**

Trade Name	Supplier	Purpose	Ingredients	(CAS #) Chemical Abstract Service #	Maximum Ingredient Concentration in Additive (% by mass)	Maximum Ingredient Concentration in HF Fluid (% by mass)
Fresh Water	Operator	Base Fluid	Water	7732-18-5	100%	50.74134%
SAND - PREMIUM WHITE	Halliburton	Proppant	Crystalline silica, quartz	14808-60-7	100%	22.67108%
LGC-36 UC	Halliburton	Liquid Gel Concentrate	Guar Gum	9000-30-0	100%	0%
BC-140	Halliburton	Crosslinker	Ethylene glycol	107-21-1	30%	0.00243%
			Monoethanolamine borate	26038-87-9	60%	0.00487%
LoSurf-300D	Halliburton	Non-Ionic Surfactant	1,2,4 Trimethylbenzene	95-63-6	1%	0.00023%
			Ethanol	64-17-5	60%	0.01384%
			Heavy aromatic petroleum naphtha	64742-94-5	30%	0.00692%
			Naphthalene	91-20-3	5%	0.00115%
			Poly(oxy)-1,2-ethanediyl), alpha-(4-nonylphenyl)-	127087-87-0	5%	0.00115%

16. Total Volume of Fluid Pumped:
847,123 gals

18. Percent of Re-Use Water in Fluid Pumped:
30%

How much water is used for fracing in the San Juan Mancos/Gallup horizontal well play?

- Frac water volume *(Source: FracFocus)*
  - 53 of 57 (93%) reported
  - Average: 1,016 mgals
    24 mbbls
    3.1 acre-feet/well

- In 2013…Total water use for fracing Mancos/Gallup HWs was 137 acre-feet

- Total annual withdrawals of ground water in the upper Colorado River Basin of NM is ~4,000 acre-feet *(Source: OSE)*

- Approximately 3% of the total is used for hydraulic fracturing

How much water is used?

Gallons of water used to produce one million thermal units of energy *(Source: SPE)*

Resource	Gallons (average)
Deep shale natural gas	3
Nuclear	11
Coal	23
Fuel ethanol from corn	15,800
Biodiesel from soy	44,500

or 3 acre-feet is roughly equal to the amount used by a Texas golf course every two days during the summer!

Modified from hillcountrywater.org

Steps to mitigate water use.

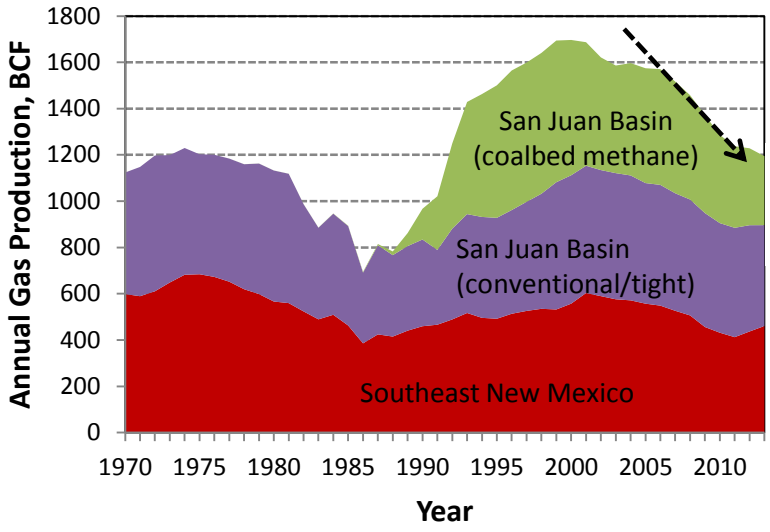
- ✓ Reduction efforts via Nitrogen foam fracing
  ~ 96% of Mancos/Gallup horizontal wells are foam fraced with 70Q foam

- ✓ In addition, an important shift here has been toward recycling frac fluids, ~30% in recent wells

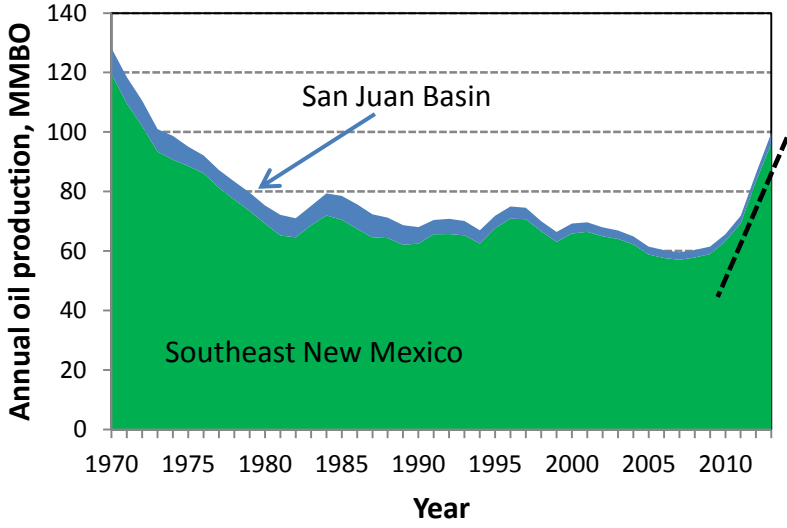
Frac flowback water → Distilled fresh water

- ✓ and companies are exploring other, more creative water reduction strategies, such as using deep, brackish to saline water usable for fracking

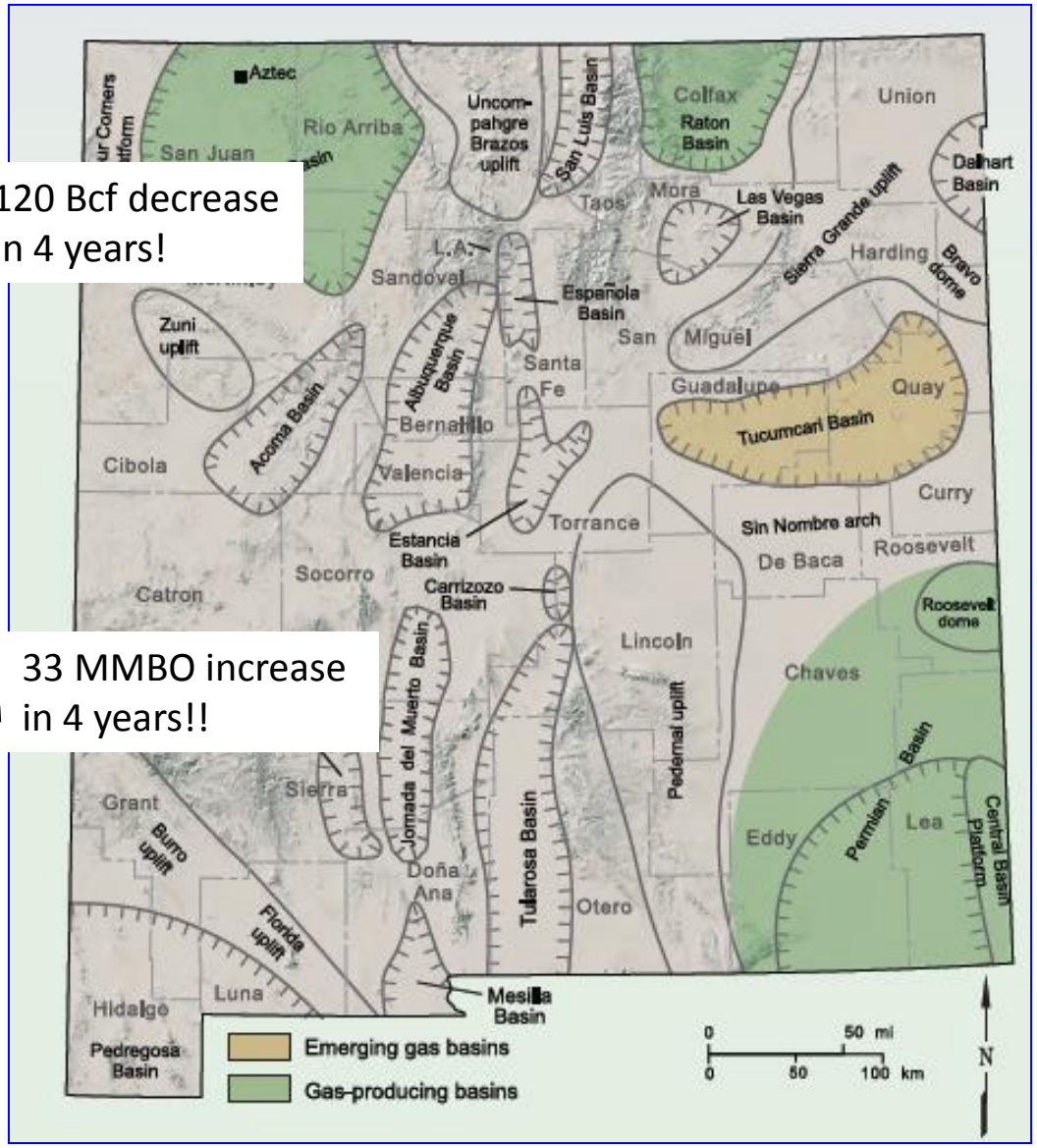
What this industry means to the State of New Mexico



120 Bcf decrease In 4 years!



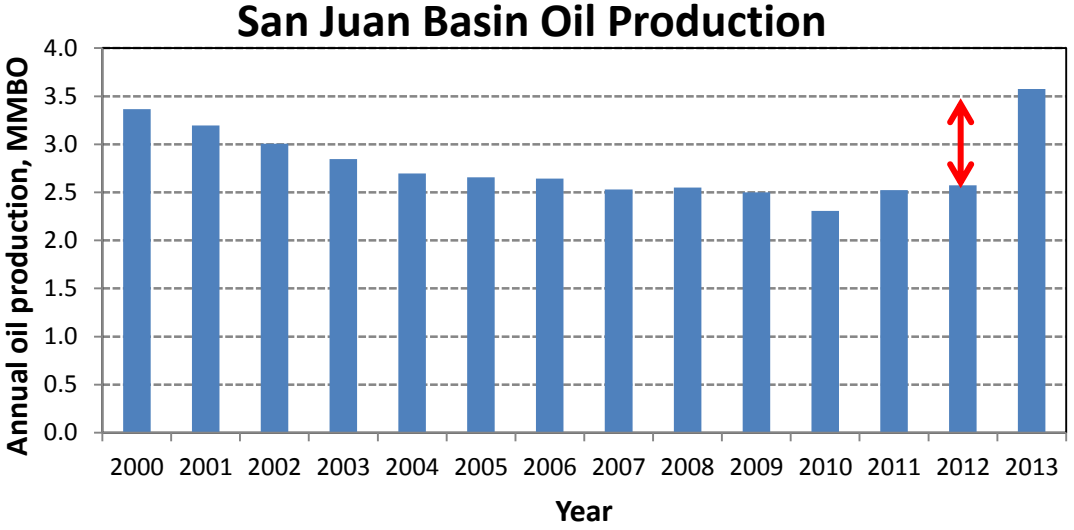
33 MMBO increase in 4 years!!



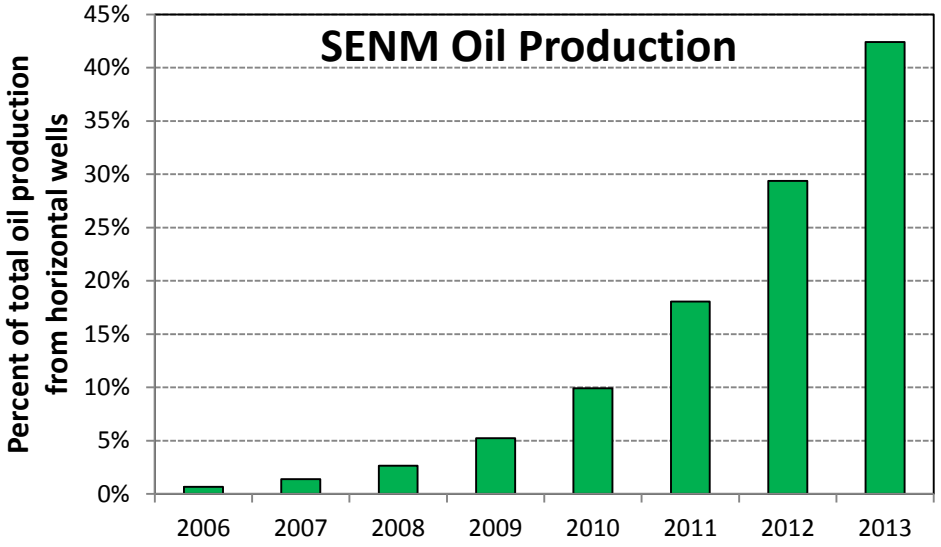
Basin and Uplifts in New Mexico

(Courtesy of NMBGMR)

How much crude oil and natural gas in New Mexico can be attributed to the use of horizontal drilling and hydraulic fracturing?



1 MMBO increase from recent horizontal (and fraced) Mancos/Gallup wells



In 2013, 42% of the total Oil production in SENM was From horizontal wells

What this industry means to the State of New Mexico

General Fund[1]

- Approximately 31% of the general fund attributed to oil and gas production

Land Grant Permanent Fund[1]

- $13.3 billion FY13 ending balance
- Oil and natural gas make up 96.6% of the revenue into this fund

Severance Tax Permanent Fund[1]

- $3.8 billion FY13 ending balance
- Oil and natural gas makes up 86%...

Employment[2]

- The industry provides more than 20,000 direct jobs with an average salary twice the state average (2013).

[1] Source: **NEW MEXICO TAX RESEARCH INSTITUTE**
Fiscal Impacts of Oil and Natural Gas Production in New Mexico
Preliminary Report - January, 2014

[2] Source: **A Publication of the Independent Petroleum Association of New Mexico**
Energy New Mexico - 2014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Thank you for your attention
Questions?
Contact info: engler@nmt.edu