

# Berexco KS and NE CO2 EOR Perspective

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- Berexco is both an oil producer and an ethanol producer.
- Berexco LLC – a private oil and gas company based in Wichita KS. Beren family company.
- Trenton Agri Products – private ethanol producer with 45 MMGPY plant near Trenton NE.

# Topics

1. Berexco's Wellington, Kansas CO2 EOR and Storage Projects
  - Well permitting and demise of CO2 storage portion of project
  - Successful CO2 EOR project
2. Berexco's pending Nebraska CO2 EOR Project
  1. 45Q and where we go from here in Kansas and Nebraska

# Wellington CO2 Overview

DOE-Funded, KGS/Berexco Project

1. Successful 20-acre EOR pilot test
  - CO2 injection in Mississippi formation (3600 ft).
  - Demonstrate oil recovery and CO2 retention
  - Completed. 83.3% of CO2 retained in reservoir. Good incremental oil recovery.
2. Deep CO2 storage in Arbuckle saline aquifer formation at 5100' depth.
  - Goal: demonstrate CO2 can be safely, permanently stored in the Arbuckle (5100 ft).
  - Never obtained Class 6 injection permit from USEPA despite 6 years of effort. Dropped.

# CO2 Injection Permits

## Class 2 permit

- Oilfield injection for EOR.
- KCC has primacy. Similar in NE, OK and TX.
- USEPA has oversight role but states issue permits.
- Well regulated process taking about a month.

## Class 6 permit

- CO2 injection for permanent storage.
- Modeled off Class 1 Hazardous Waste Permits.
- USEPA has Primacy in all states *except* North Dakota.
- Extremely arduous process. Only two permitted in US. KGS and Berexco worked on Class 6 permit over 6 years.
  - Work begun October 2012, Submitted 1468 page permit application May 2014, Suspended March 2018

# Class 2 Permit

- Protects Useable Drinking Water – surface casing covering USDW cemented to surface.
- Requires production casing be cemented well above injection perfs, but not necessarily to surface.
- Area of review completed by State regulators to confirm no improperly plugged wells or conduits
- MIT testing and Monitoring of annulus required. Well can be inspected by state regulators at any time
- You can actually get a Class 2 permit

## Wellington Injection Well Permit



THE STATE CORPORATION COMMISSION OF THE STATE OF KANSAS  
CONSERVATION DIVISION

### INJECTION PERMIT FOR ENHANCED RECOVERY

Oper. License #: 34318                      Permit #: E-32,147  
 Operator: Boreco LLC                      Pilot Well Name & No.: Wellington KGS #2-32  
 Address: 2020 N. Bramblewood              Location: 2700'FSL 750'FEL  
 City: Wichita                                  Sec. 32 Twp 31S Rge 1    (E)    (W)  
 State: KS    County: Sumner  
 Zip Code: 67206                                  Field Name: Wellington

Project Acreage: NE NW NE SE Section 32-31S-1W

After reviewing the operator's application for an Enhanced Recovery Injection Well Permit dated January 23<sup>rd</sup>, 2015, the Conservation Division grants a permit for the injection of produced saltwater or other fluids approved by the Conservation Division. Each additional permitted well is subject to the specifications and requirements of this permit including any attachments or any attached amendments.

- > The injection formation is known as the Mississippi.
- > The depth of the permitted injection interval is from 3662' to 3687',    (PF),    (OH)
- > The maximum authorized injection rate is 2000 barrels of fluid per day.
- > The maximum authorized injection pressure is 1200 PSIG.
- > The maximum authorized injection rate for CO2 is 4,000,000 scf per day.
- > The maximum authorized injection pressure for CO2 is 1500 PSIG.
- > Authorized rates and pressures are subject to temporary or permanent modification during or as the result of any investigation conducted by Commission Staff.
- > Attachment    YES,    NO.

Complete casing information for the Pilot well is as follows:

	SIZE	SEAT	INTERVAL	SACKS
		DEPTH	CEMENTED	CEMENT USED
Conductor	13.375"	120'	0' to 120'	135
Surface	8.625"	600'	0' to 600'	300
Production	5.5"	3815'	2450' to 3815'	235
Tubing	2.875"	3636'	' to '	


Additional Cementing: DV tool set at 2450 and cemented to surface with 400 sacks.

Packer type and setting depth: Arrowset set @ 3636'

In addition to the specific permit conditions and requirements set out above or on the attachment hereto, this permit is subject to all of the provisions of K.A.R. 83-3-400 et seq. Injection authority cannot be transferred without approval of the Conservation Division.

See attached for leases supplying fluid for disposal.

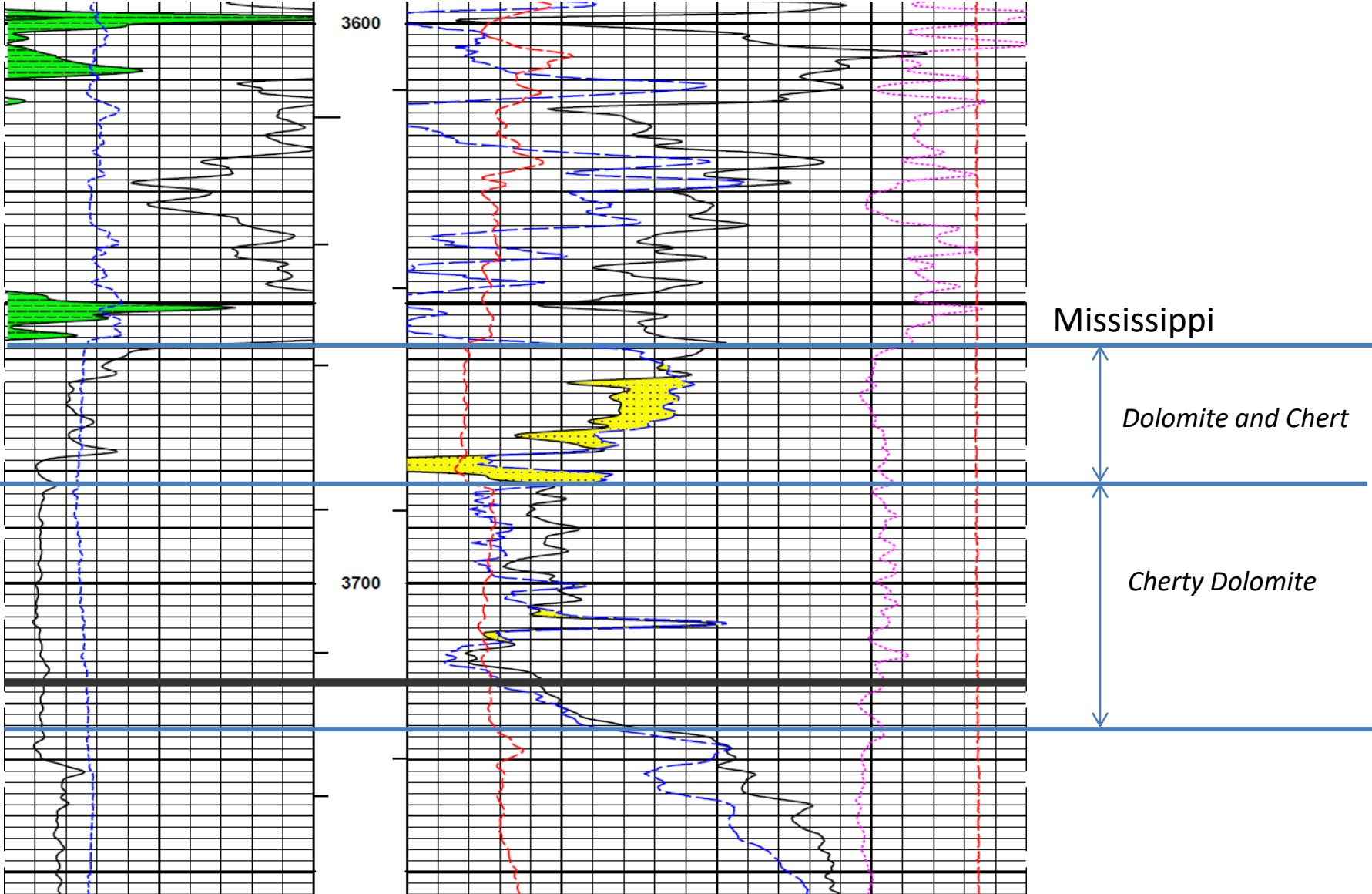
Date Approved: June 18, 2015

  
 Director, Underground Injection Control  
 Conservation Division





# Wellington KGS 2-32 Neut-Den Log





# Surface injection, production and monitoring equipment

CO2 Storage Tanks



Oil Well Configuration



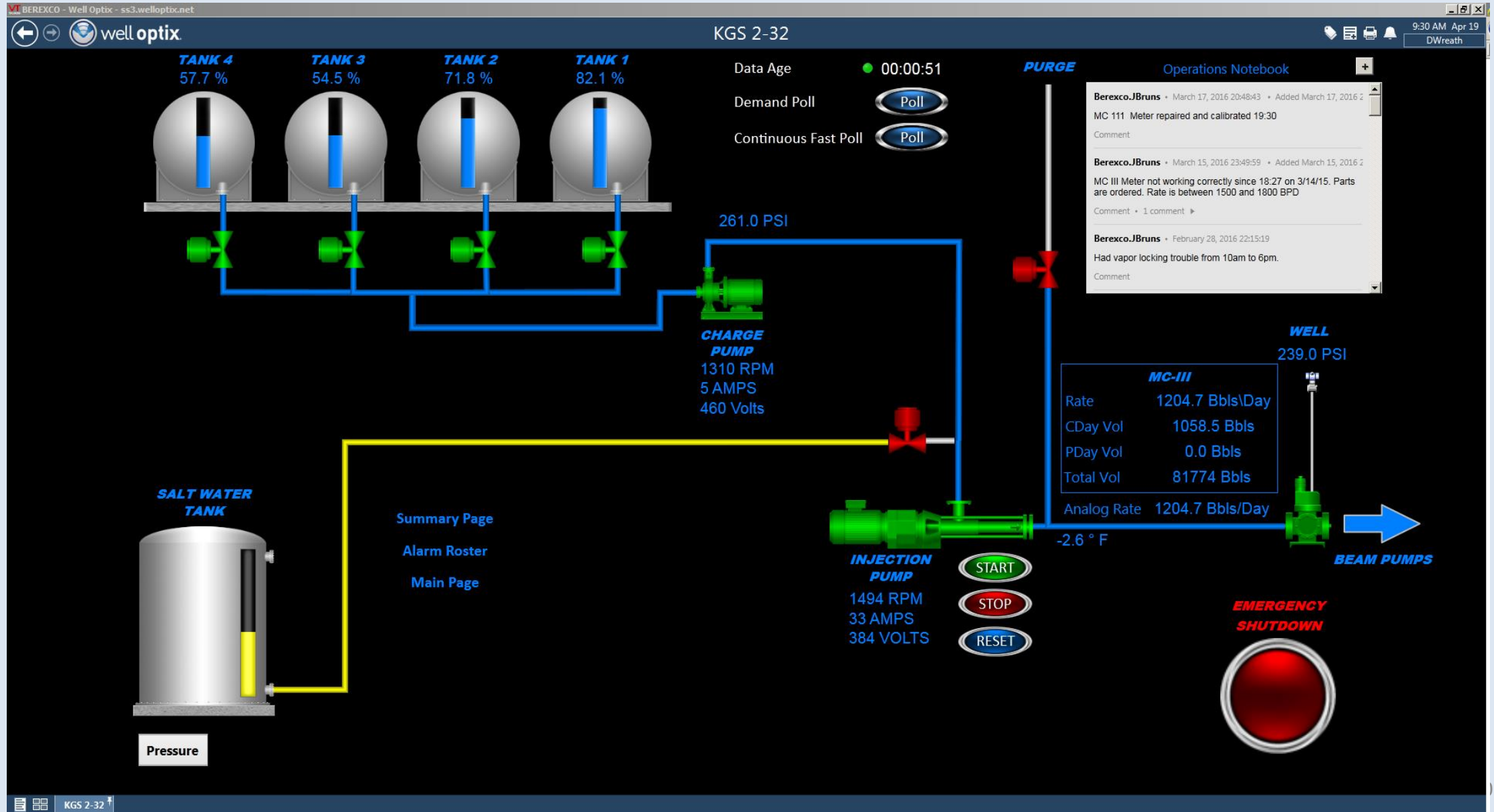
CO2 Vent Measurement



## CO2 Monitoring

- CO2 Flowmeter at injector wellhead.
- Temp. sensor at injector wellhead
- Water Flowmeter at injection wellhead
- CO2 Flowmeters at producing wells
- CO2 Flowmeter at tank battery

# Wellington Automation System

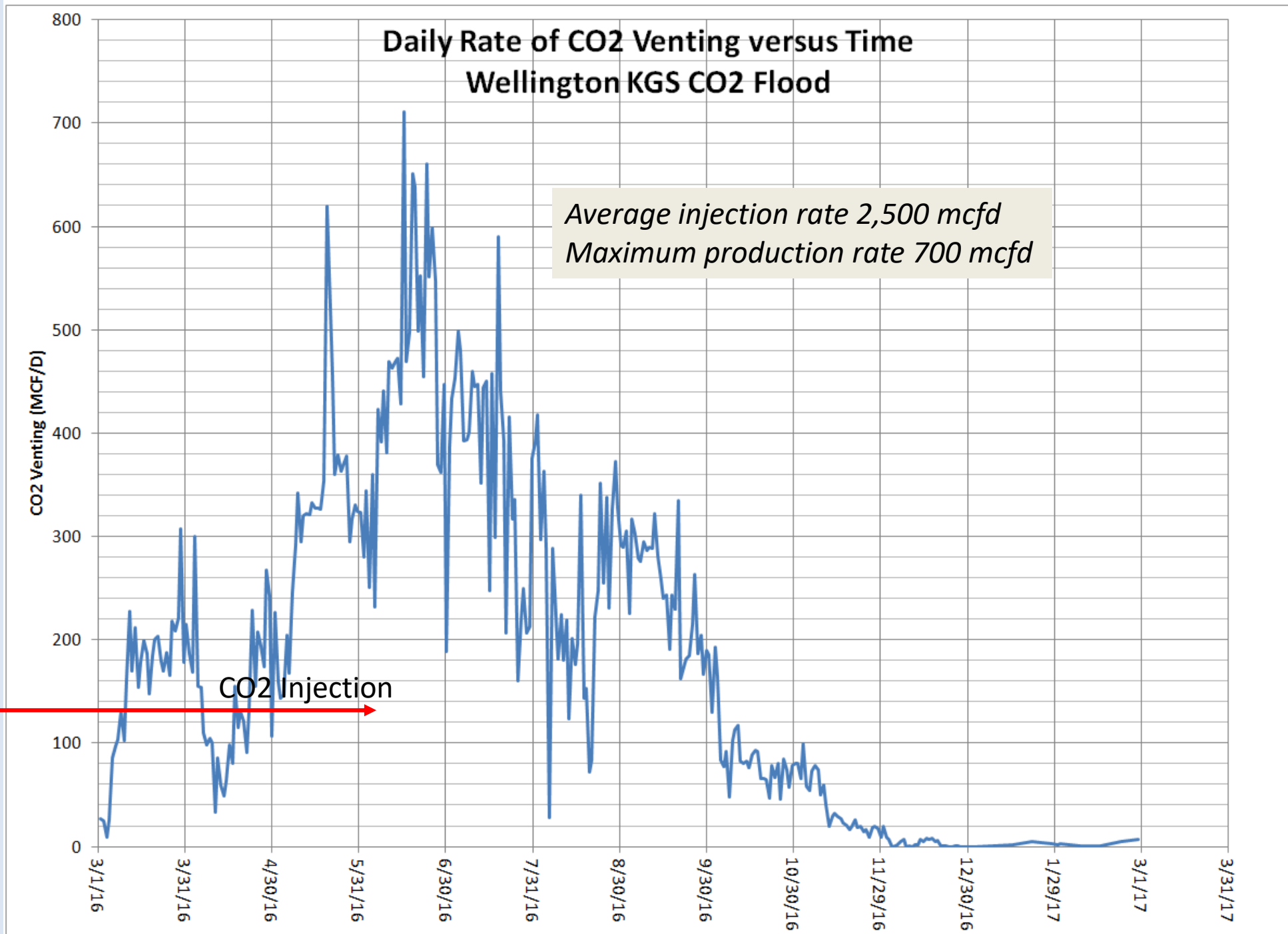


# Wellington CO2 Accounting

- 374,461 MCF Injected (21,784 US tons). 1,101 Truckloads, each about 20 US tons. Delivered cost \$90.16/US ton
- 62,355 MCF of CO2 injected was produced (vented) as of 7/1/2018 (16.7%)
- 83.3% of CO2 still in reservoir. “First pass sequestration efficiency”
- Estimated oil recovery 32,000 bbl. 11.7 MCF/bbl

# Incremental Oil Production Approx 16,000 bbl Oil as of 6/1/2018





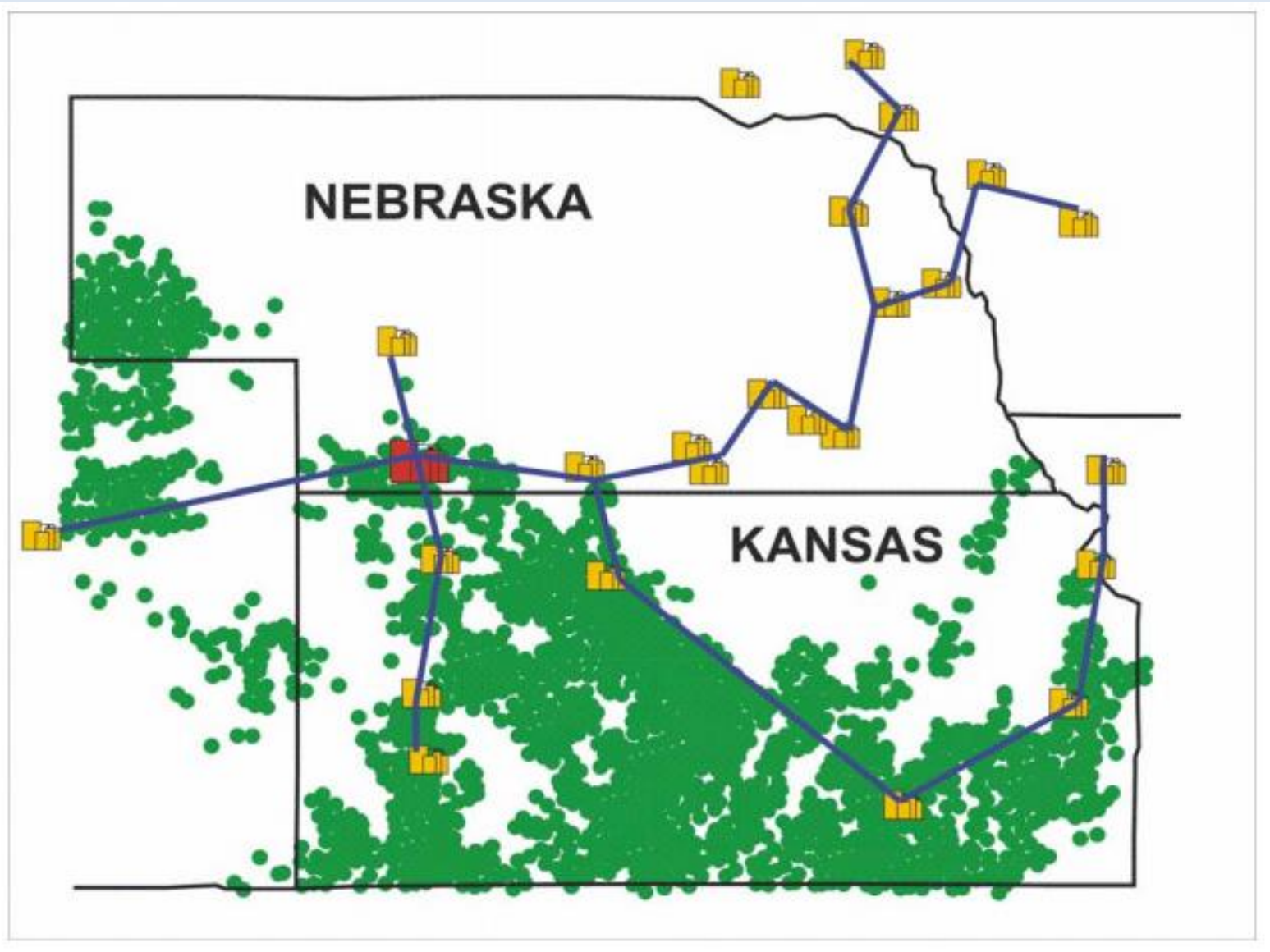
# Where do we go from here in Wellington?

- Class 6 Permit Unrealistic. Time and costs imposed by EPA not workable.
- Consider full field CO2 EOR, but need CO2 Source via rail or pipeline. 6-10 MMBO potential oil recovery.
- Will 4Q5 provide the incentive?
- CO2 EOR is the vehicle for CO2 Sequestration, not Class 6.

# Berexco Nebraska CO2 Project

- Multiple Waterfloods Operated by Berexco with CO2 EOR potential.
- Potential to use CO2 from Trenton Ethanol Plant (TAP) via pipeline to field. 7 MMCFD.
- Integrated rail delivery of CO2 to TAP siding and offload CO2 to pipeline to field.
- 4Q5 Incentives?

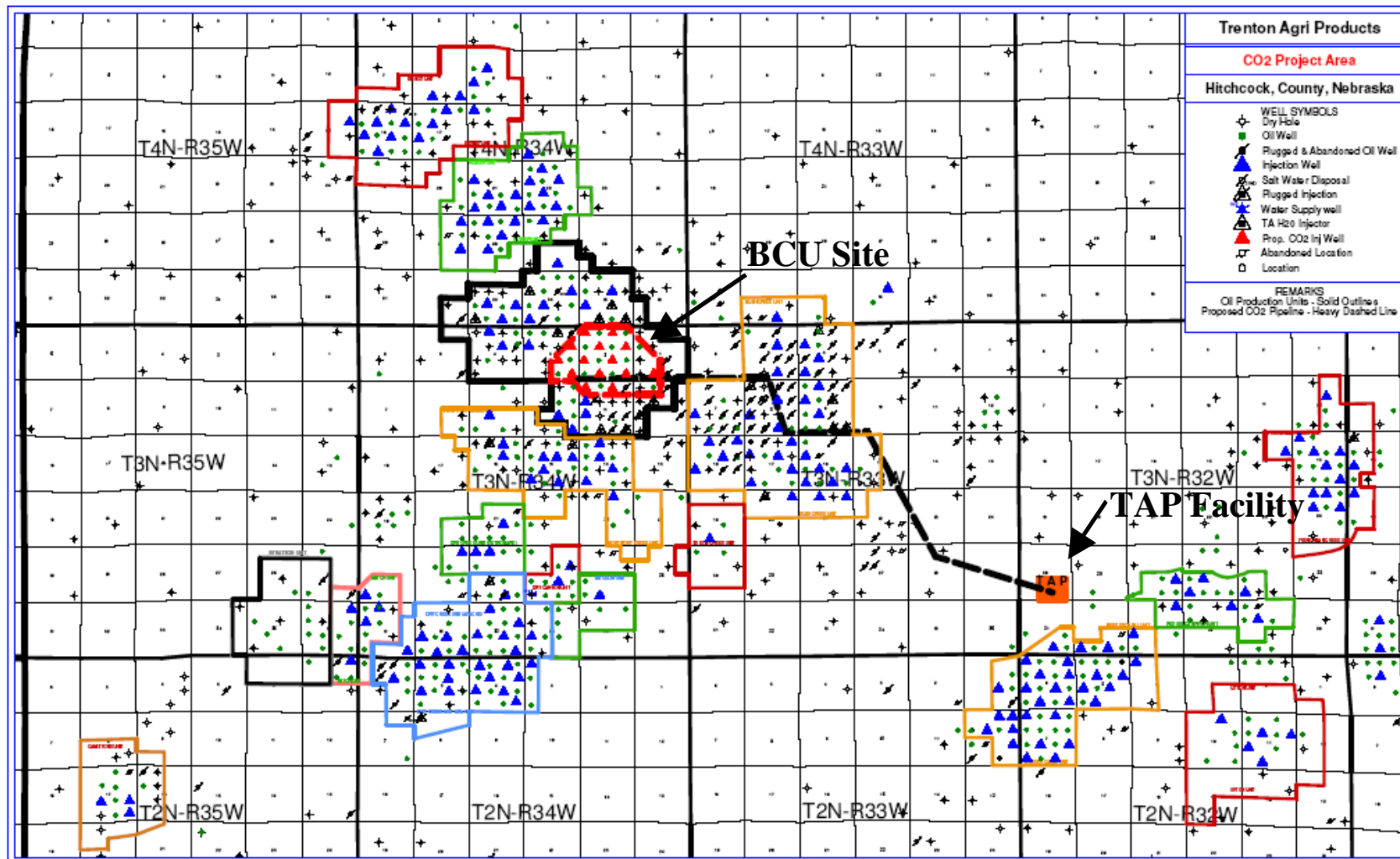
# Trenton NE Ethanol Location





# Hitchcock CO NE: LKC Zone Waterfloods

Area Cumulative Oil 33.6 MMBO, Current 1,000 bopd

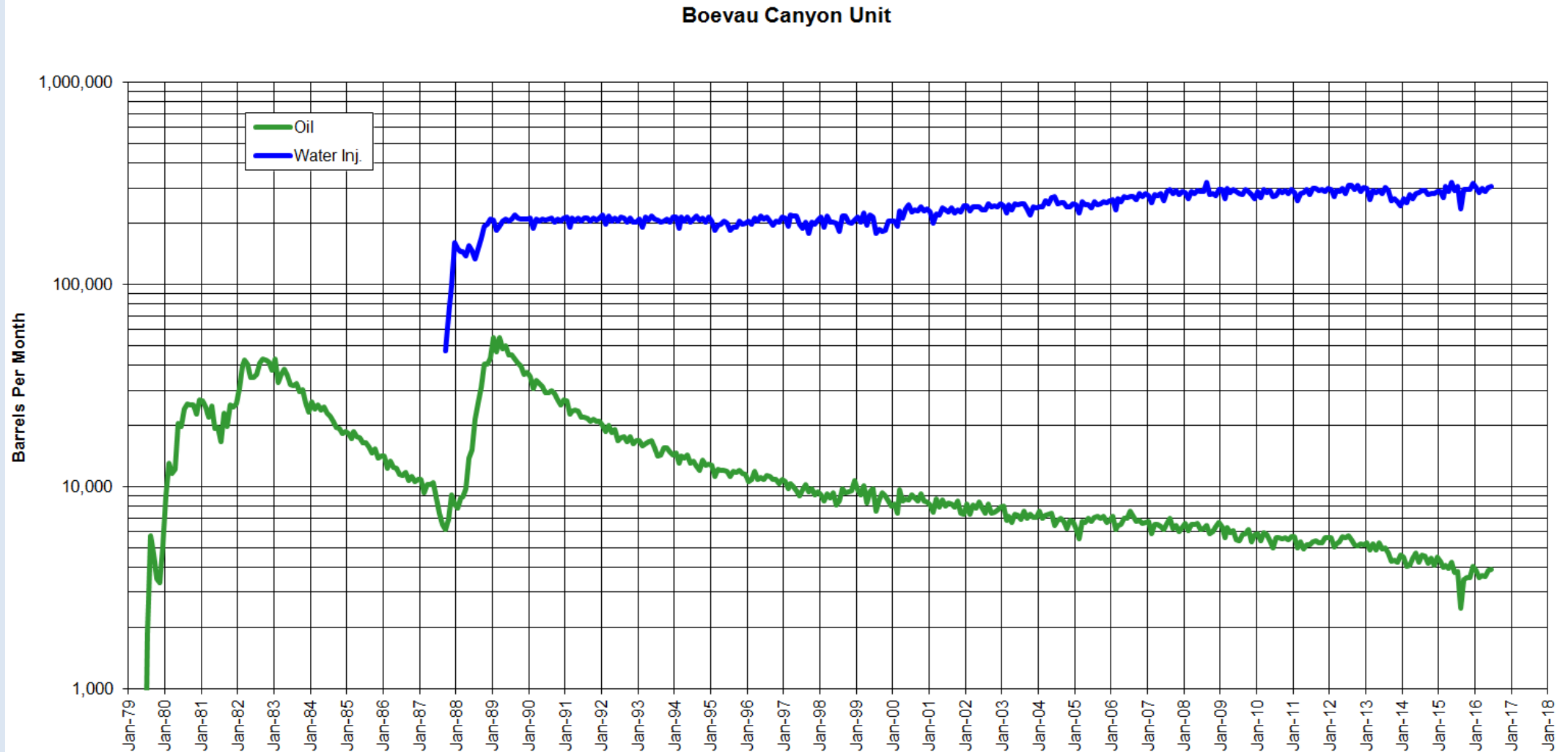


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5 mile (8 km)

# Boevau Canyon Unit

6 MMBO Primary + Secondary, MMP 1500 PSI



# Q45 Perspectives

- Crucial issue will be program rules required to obtain the tax credits.
- If rules are too onerous, the credit is not real and the program will fail.
- CARB experiences in California – super tough rules make it unworkable.
- Need bell cows to show industry the way.

# Why aren't we doing CO2 Floods in KS/NE???

- Need sustained high oil price.
- Costs are too high relative to recovery.
- No convenient, cost effective CO2.
- Oilfields are smaller than TX, dispersed
- Government incentives have not proven to be real – yet...

# One final thought...

- CO2 EOR and CO2 Sequestration can succeed in Kansas and Nebraska, but it takes:
  - a) Realistic Q45 program rules and credits that actually materialize and create CO2 availability.
  - b) A real opportunity for ethanol producers and oil companies to make money.