

2024 CUSP Annual Meeting: Your Future? What We Are Encountering Today In The Permian Basin.

Dr. Bob Trentham

University of Texas Permian Basin

Based in part on:

2023 CO₂ Conference presentation - Concerns with CO₂ Sequestration From the Mineral Owner Perspective.
Wade Caldwell, Attorney & Past President National Royalty Owners Association

2021 CO₂ Conference presentation - Acquiring Carbon Storage Rights: Permitting and Land Use, Regulatory Hurdles, and NGO Opposition. Marcella Burke, King & Spalding.

What Going On Today In The Permian Basin

- Injection of 20 Million Barrels of Produced Water a Day [+/- 4:1 Ratio]
- Best Storage Reservoirs For CO₂ Are Where Produced Water is Being Injected
- Seismic Exclusion Areas – Too Many Earthquakes
- Pressure Plumes – Shattered Basement
- Who Owns the Rights to Contract for Storage?
- Stacked Storage Sites.

Good News - New Mexico has stopped most Injection into the Delaware Mountain Group in the Delaware Basin
Bad News – More Injection into the San Andres on the Central Basin Platform

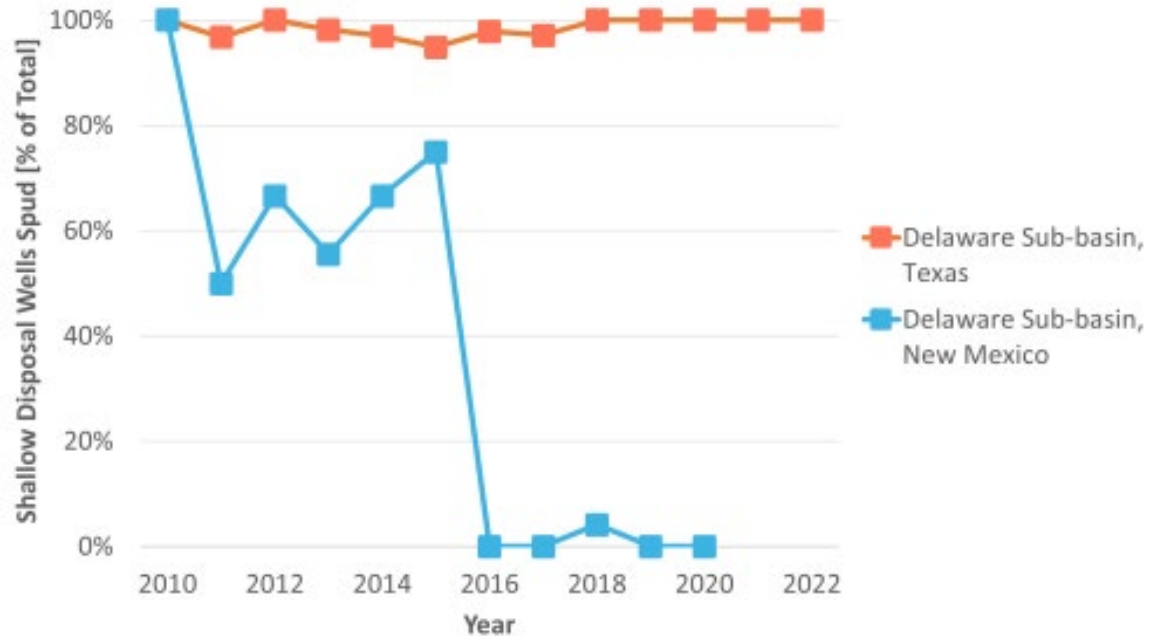
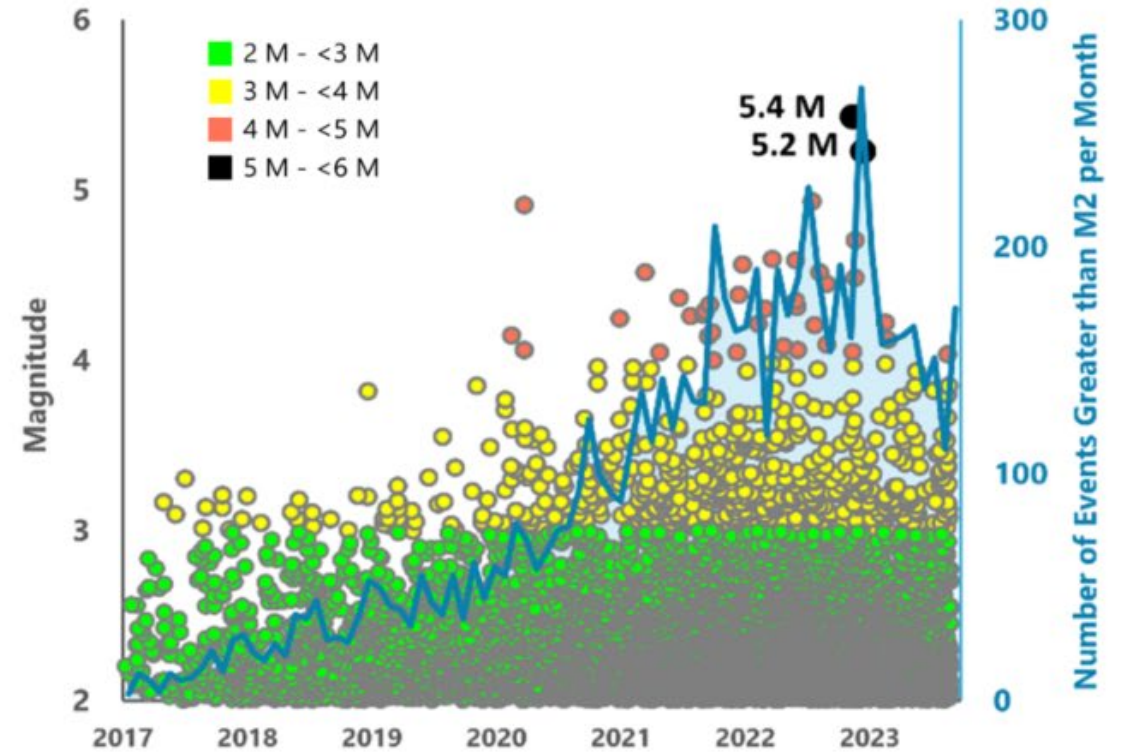
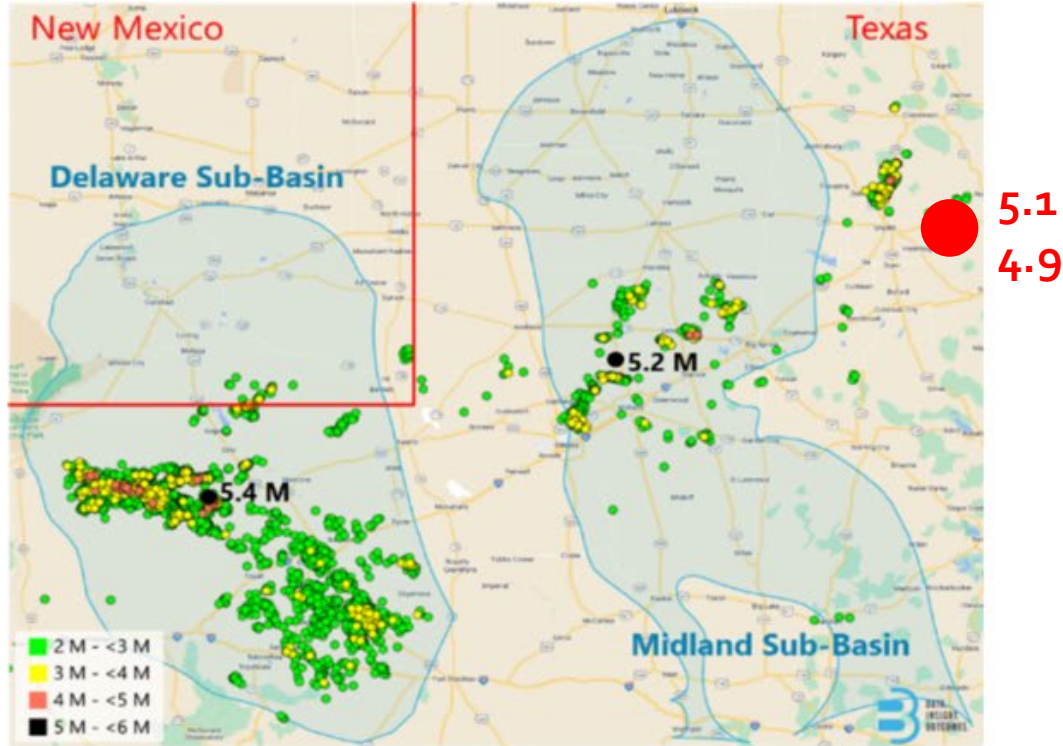


Figure 7. Percentage of new Delaware Sub-basin disposal wells drilled for shallow disposal, distinguished by State. Bruant, 2023

The San Andres is one of the top ROZ EOR/Utilization and potential Storage Targets across the Permian Basin and We're only just beginning to develop an understanding of the DMG ROZ Potential

Shallow SWD well: A disposal well permitted and completed above the base of the Wolfcamp Formation.
Deep SWD well: A disposal well permitted and completed below the base of the Wolfcamp Formation

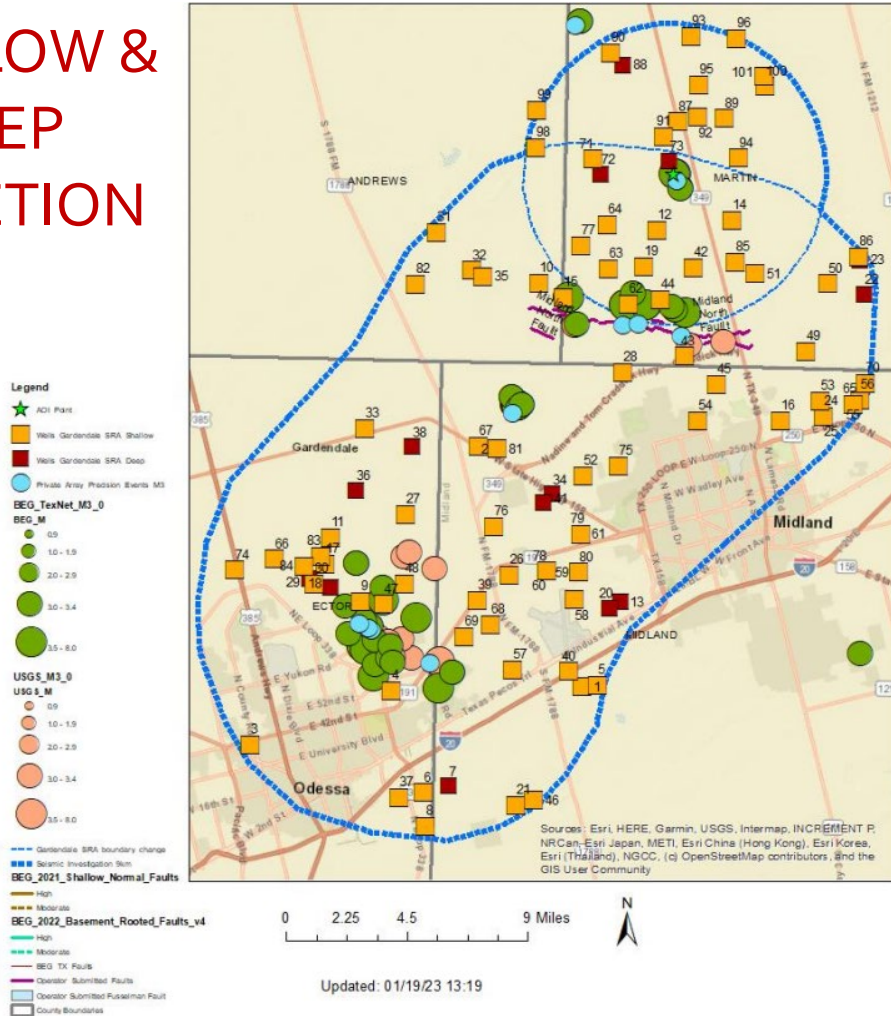
Why Seismic Response Areas?



Location, Magnitude, and frequency of Permian Basin Seismic Events, 2017 thru 2023

Gardendale & Stanton Seismic Response Areas (SRA) USGS & BEG TexNet Earthquakes M \geq 3.0. 1/1/2017 – 12/21/2022

SHALLOW & DEEP INJECTION

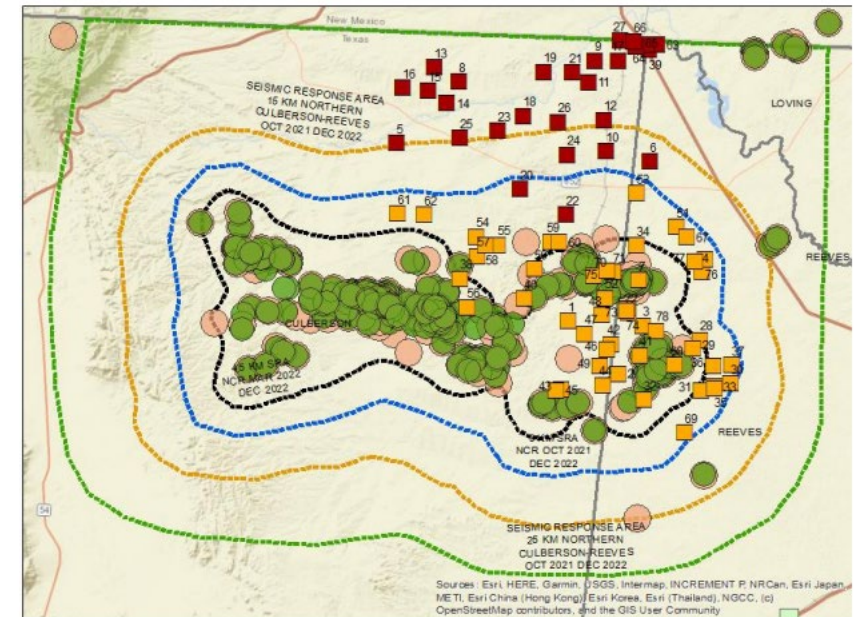


Northern Culberson-Reeves (NCR) Seismic Response Area (SRA) USGS & BEG TexNet Earthquakes M \geq 3.0. 1/1/2017 – 12/21/2022

SHALLOW INJECTION

Legend

- Green circle: BEG_Earthquakes M3.0+
- Orange circle: USGS_Earthquakes M3.0+
- Red square: NCR_SRA Deep Wells
- Orange square: NCR_SRA Shallow Wells
- Black dashed line: NCR_SRA 4.5 km Boundary
- Blue dashed line: NCR_SRA 9 km Boundary
- Yellow dashed line: NCR_SRA 15 km Boundary
- Green dashed line: NCR_SRA 25 km Boundary



Are we heading for another SRA?

- 5.1 17 km NNE of Hermleigh, Te...
2024-07-26 14:28:29 (UTC) 3.3 km
- 4.9 17 km NNE of Hermleigh, Te...
2024-07-23 03:38:42 (UTC) 3.2 km
- 4.5 13 km NNE of Hermleigh, Te...
2024-07-27 21:08:31 (UTC) 3.4 km
- 4.4 16 km NNE of Hermleigh, Tex...
2024-07-23 03:46:25 (UTC) 3.3 km
- 4.4 21 km N of Stanton, Texas
2024-04-10 18:46:45 (UTC) 4.7 km
- 4.0 16 km NNE of Hermleigh, Tex...
2024-07-25 02:57:42 (UTC) 3.0 km

SACROC Field



The base of the Ellenburger in this area is at depths of between 7500 to 8500' Earthquakes epicenters at depths >10,500' = PRESSURE PLUMES!



How sensitive a topic are earthquakes ?

Some of the Presentations made at 2023 Image in Houston.

- A Midland Basin operator's approach to data collection & current best practices for mitigating induced seismicity. Dighans¹, Kavanaugh¹, Davis, Quarles¹, ¹Endeavor Energy, & Hennings², ²BEG.
- Induced seismicity in Howard County I: The buried Grenville Front in the Midland Basin and its roll in localizing induced seismicity. Keene¹, Zawila¹, Lupo¹, Gibson¹, Huffman², Stoniolo³, ¹SM Energy, ²HighPeak Energy, ³Birch Resources.
- Induced seismicity in Howard County IV: Numerical investigation of wave propagation in a complex layered sedimentary basin velocity field and the impact on travel path and event locations. Fang¹, Chen¹, Brooks¹, Huffman², Lupo³, Stoniolo⁴, ¹SensorEra, ²HighPeak Energy, ³SM Energy, ⁴Birch Resources.
- Induced seismicity in Howard County V: Technical and regulatory challenges for reduced seismicity and deep disposal of fluids. Huffman¹, Lupo², Stoniolo³, Keene², Zawila², Fang⁴, Chen⁴, Brooks⁴. ¹HighPeak Energy, ²SM Energy, Birch Resources, ⁴SensorEra.

Storage Contracts - Send Lawyers, Guns and Money - Storage Rights

- CO₂ Storage Rights are totally different(?) than those for oil and gas CO₂ EOR projects.
- The lease/contract between the Mineral Owner and the oil/gas Producer is for the exploitation of the MINERALS [Including Oil & Gas] & ends when the last oil/gas is produced, or the last "Minerals" are extracted & the royalty owner gets last payment.
- In Texas, and other states, the Surface Owner owns the Pore Space & Rock.
- Therefore, for Storage, there needs to be a new/different contract than existed for Oil & Gas extraction. This Storage contract is between the "Sequester" and the "Pore Space" owner, read Surface Owner.
- Unless a single owner owns the surface and minerals (eg. University Lands) and the producer is going to be the sequester, there are entirely new players in CCS/CCUS.
- The operator of a CO₂ EOR project will "incidentally" sequester CO₂, but is that the same as a CCS project? No, not if you consider who regulates the project.
- And if the producer attempts to get tax credits for the CO₂ "Incidentally Stored" does there have to be a separate agreement with the land owner?
- So, when does the Surface Owner "take over"?



NATIONAL ASSOCIATION OF ROYALTY OWNERS

National Association of Royalty Owners
The Only National Organization Representing
Oil & Gas Royalty Owners Interest

California

[Visit the page.](#)

Rocky Mountain

(Representing Colorado, Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico)

[Visit the page.](#)

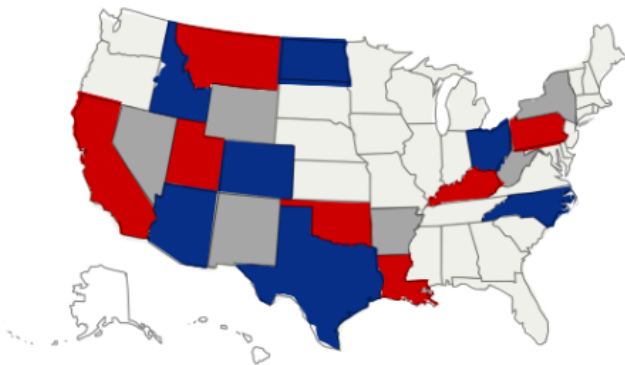
N. Dakota

[Visit the page.](#)

Texas

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NARO Chapters



Appalachia

(Representing Kentucky, West Virginia and North Carolina)

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Louisiana

[Visit the page.](#)

Ohio

[Visit the page.](#)

Oklahoma

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Pennsylvania

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Storage Rights

The surface owner typically owns the pore space below & in any underground reservoirs.

Mineral Rights

“Texas law establishes that the holder of a mineral estate has the right to exploit minerals, but does not own the subsurface mass.”

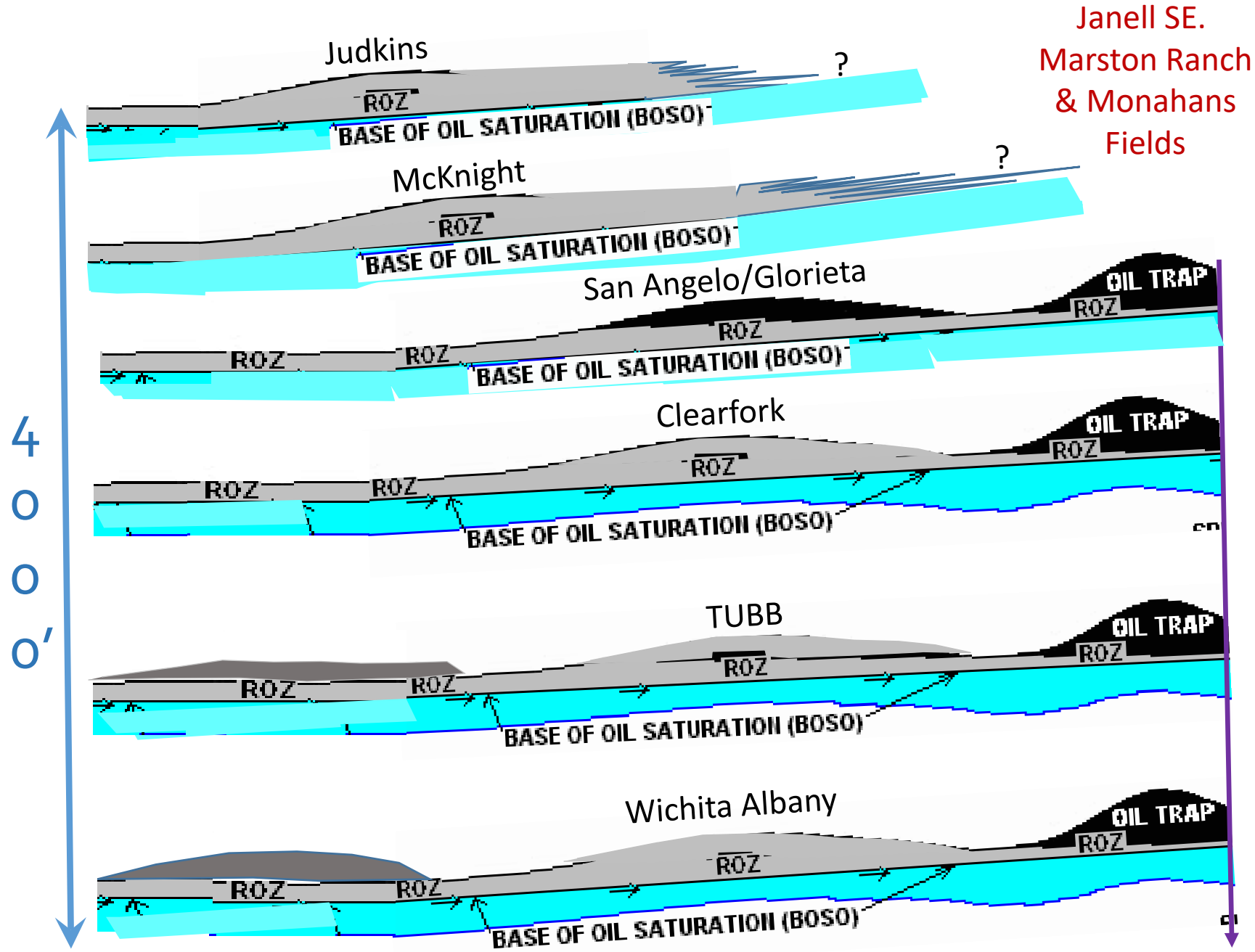
Key Takeaways from the Talk at the 2023 CO₂ Conference: NARO Believes It Is Not 100% Certain Surface Owners Own the Pore Space

- NARO TX fought and helped defeat the Bill in the 2023 TX Legislature to Develop Rules for CCS/CCUS.
- Storage Rights in Texas is Still Not Decided.....
- **Condemnation of Mineral Rights** in and near a Storage Facility is LIKELY.
- Federal Oversight of CCS/CCUS is NOT a Desired Position of NARO.
- NARO is AGAINST and Will RESIST Forced Pooling/Utilization whether for CCS or CCUS.
- NARO is supportive of CO₂ EOR with Incidental Storage if NOT accompanied by forced unitization.

Stacked Storage Multiple Formations with ROZ Utilization and/or Storage Potential

Stacked Storage opportunities are present on both the shelves and basins.

These are all ROZ CO₂ Utilization targets.



Janell SE.
Marston Ranch
& Monahans
Fields

A Tale of Two Cities

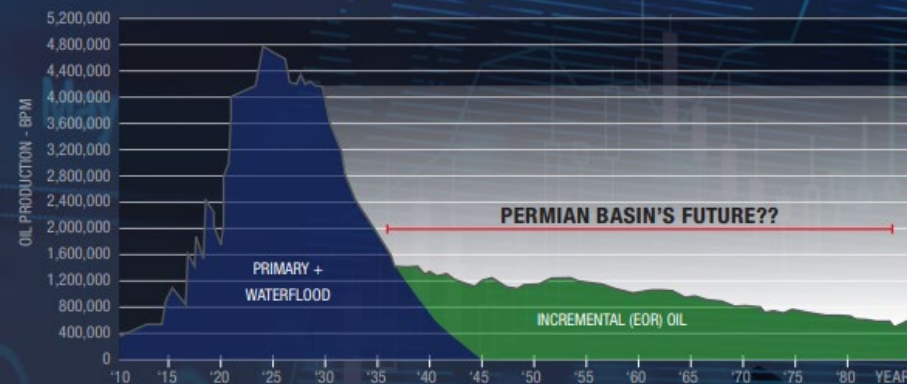
- FutureGen [2005]
- Odessa
- Man on the street interviews overwhelmingly positive.
- Tenaska – Trailblazer [2009]
- Abilene
- Town Hall overwhelmingly opposed.

2023 CO₂ CONFERENCE WEEK: MIDLAND, TEXAS

Barbara & George H.W. Bush Convention Center (BCC)

| | MONDAY DEC 4 | TUESDAY DEC 5 | WEDNESDAY DEC 6 | THURSDAY DEC 7 |
|---------|--|---|--|---|
| 7:00 am | | Refreshments and Networking Sponsored by Occidental Petroleum | Refreshments and Networking Sponsored by Occidental Petroleum | Refreshments and Networking Sponsored by White Rock Oil & Gas and Trimeric |
| 8 am | | Check-in: Bush Convention Center OPENING KEYNOTE Vello Kuuskra CEO, ARI | Check-in: Bush Convention Center OPENING: What to Expect | Check-in: Bush Convention Center Opening and Workshop Summary |
| 9 am | Check-in: Bush Convention Center | SESSION I CCS & CCUS Workshop State & Federal Policy Updates & Market Developments | SESSION III CCS & CCUS Workshop Insurance, Social & Environmental Considerations, Evolving Markets | SESSION V CO₂ EOR & CCUS Theme Sessions CCS/CCUS Workshop Summary, Permian Basin Horizontal Plays, Yates Transition Zone Oil Determination |
| 10 am | FIELD TRIP Goldsmith-Landreth CO₂ Flood and NGL Processing Plant, Ector County, TX Hosts: Kinder Morgan CO ₂ and Pilot Energy Systems | | | |
| 11 am | | NETWORKING BUFFET LUNCH | LUNCHEON KEYNOTE Dr. Mark Zoback Emeritus Faculty, Stanford University | NETWORKING BUFFET LUNCH |
| NOON | | | | |
| 1 pm | | SESSION II CCS & CCUS Workshop Funding Opportunities, Evolving CCS/CCUS, Regional Activities | SESSION IV CCS & CCUS Workshop Mineral vs. Storage Rights, Regulatory Landscape Discussion | SESSION VI CO₂ EOR & CCUS Theme Sessions Modeling CO ₂ Containment, Canadian CCS Projects, CO ₂ EOR Survey Update, Panel Discussion |
| 2 pm | | | | |
| 3 pm | | | | |
| 4 pm | | | | |
| 5 pm | | | | |
| 6 pm | No Evening Reception | EVENING RECEPTION Bush Convention Center, Sponsors: HGA & Denbury 6:00 - 7:30 | EVENING RECEPTION Permian Basin Petroleum Museum Sponsors: Oxy, Kinder Morgan CO ₂ & SPE Permian Basin Section 6:00 - 7:45 | CONFERENCE CONCLUSION Thank You for Attending |
| 7:30 pm | | | | |

All Reservoirs Decline.



So, what's next when your reservoir is depleted?
Plug & Abandon, Waterflood, EOR?
There's a better option.

Capture the CO₂ Opportunity. Produce Value.

When industrial sources capture CO₂ emissions, the emissions need a place to go. Depleted reservoirs in the Permian need a future. Don't leave your CO₂ education or your reservoir behind. Register now for cutting-edge information that adds value to declining oil assets.

DECEMBER 9-12, 2024
MIDLAND, TEXAS

CO₂CONFERENCE.NET

*A non-profit conference supporting SPE
and university engineering scholarships*



Thanks!