Oil Storage (UIC)

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July 2020

Welcome, everyone! Today were going to discuss oil storage in the state of Texas!

Oil Storage - Outline

- Oil Storage in Texas
- Permit Applications for:
  - Oil Storage in salt
  - Oil Storage **not** in salt

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Here's a broad outline for the talk today. I'm going to discuss the state of hydrocarbon storage, generally.

Then, we'll discuss how to apply for a permit to store oil in salt and how to apply for a permit to store oil in a non-salt formation pursuant to the Commission's May 5th, 2020 Order.

One last thing before we get started. This presentation is about underground storage of oil, but it is also generally applicable to storage of any liquid hydrocarbon under the Commission's jurisdiction.

Oil Storage in Texas

- Why are we here?
- SPR
- UIC Delegation
- Storage Well Locations in Texas
- No Storage Manual (yet)

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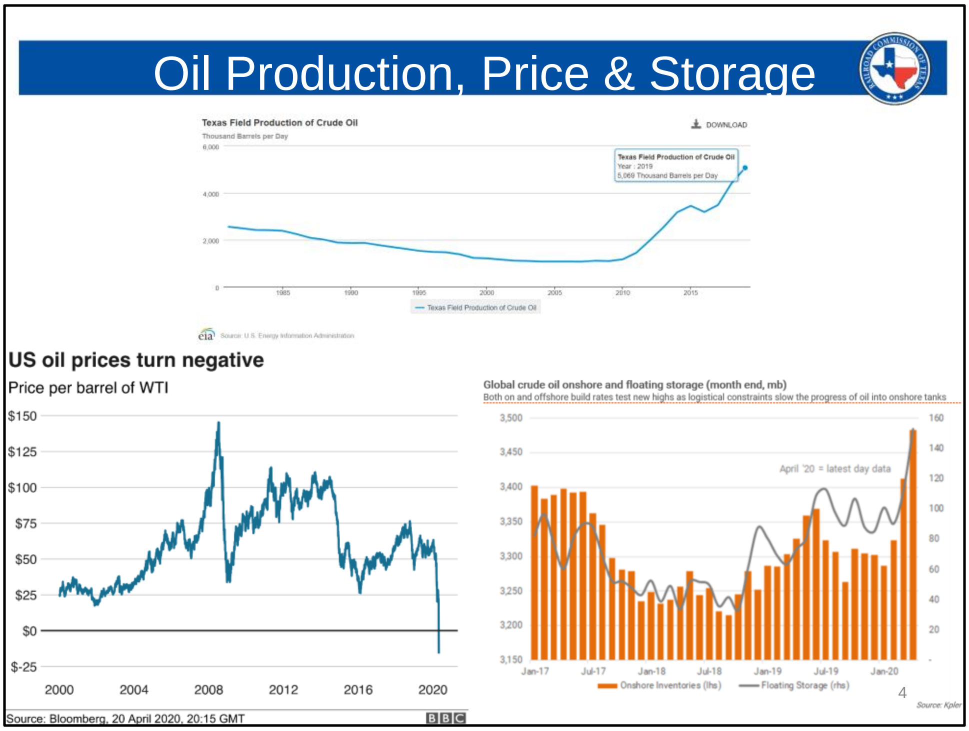
Over the next couple slides we will discuss why were talking about storage. This is the first storage-only presentation that we've given in recent history and maybe ever. I'll talk briefly about the history of oil storage and it's regulation. Then I'll show you the distribution of storage facilities in Texas.

And lastly, by now, I would normally have told you where you can find all this information on our website. But there is no storage manual on the web, sadly. I plan to rectify that situation, however, and update our online UIC manual and add more detailed storage information to it in the coming year!



So, why are we here?

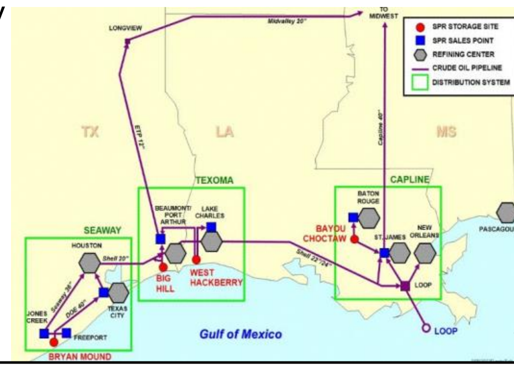
Well, it starts with the Texas Miracle. Up at the top, you can see Texas oil production has gone from a million barrels a day in 2010 (1.1MMbbls Jan 2010) to over three and a half million barrels a day in 2015 (3.6MMbbls/day Mar 2015) to nearly five and a half million barrels each day today (5.4MMbbls/day March 2020). There's much more capacity to produce oil in Texas than there ever has been before.

And, as you have undoubtedly heard, oil prices have slumped since the beginning of this year (2020). From near 150 dollar oil in 2008, to 50-60 dollar oil over the last couple years, to now having briefly gone to a negative price, which is dramatically shown in the graph on the bottom left. Now, that last financial phenomenon is just sort of sensational, but the overall trend is real and correlates with an increase in oil supply and storage that in the bottom right graph.

I do not claim to fully understand these complex economic systems. But, that's why the Commission has taken action and why need to talk about oil storage.

Strategic Petroleum Reserve (SPR)

- 1973-74 – Oil Embargo
- 1975 – Energy Policy and Conservation Act
- Bryan Mound and Big Hill in Texas and 2 salt domes in Louisiana
- 797 MMbbl Capacity
- Avg price paid
  $28.42 / bbl



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This is not the first time that Texas and the country has seen an economic or energy crisis. In 1973, the Oil Embargo decreased US oil supply and hiked oil and fuel prices. As a result, there were long lines at gas stations, gas rationing, oil price control and the search for energy independence.

Shortly thereafter, the Energy Policy and Conservation Act was passed which authorized, among other things, the creation of the Strategic Petroleum Reserve or SPR. The SPR is the largest reserve of crude oil in the world. It’s a system of pipelines and underground storage for crude oil, including Bryan Mound and Big Hill domes in Texas and two other salt domes in Louisiana.

The SPR currently has a 797 million barrel capacity with a current inventory of 635 million (April 17, 2020) at an average price paid of about 28 dollars per barrel. During my career, I’d normally say 28 dollars a barrel is a pretty good deal unless it’s April 2020.

Federal Delegation of Storage

- Underground Injection Control
  - Includes storage of liquids
  - Does not include storage of gas
- Pipeline and Hazardous Materials Safety Administration (PHMSA)
  - RRC does not have delegation for gas storage, however RRC still has state authority and permitting for storage of gas

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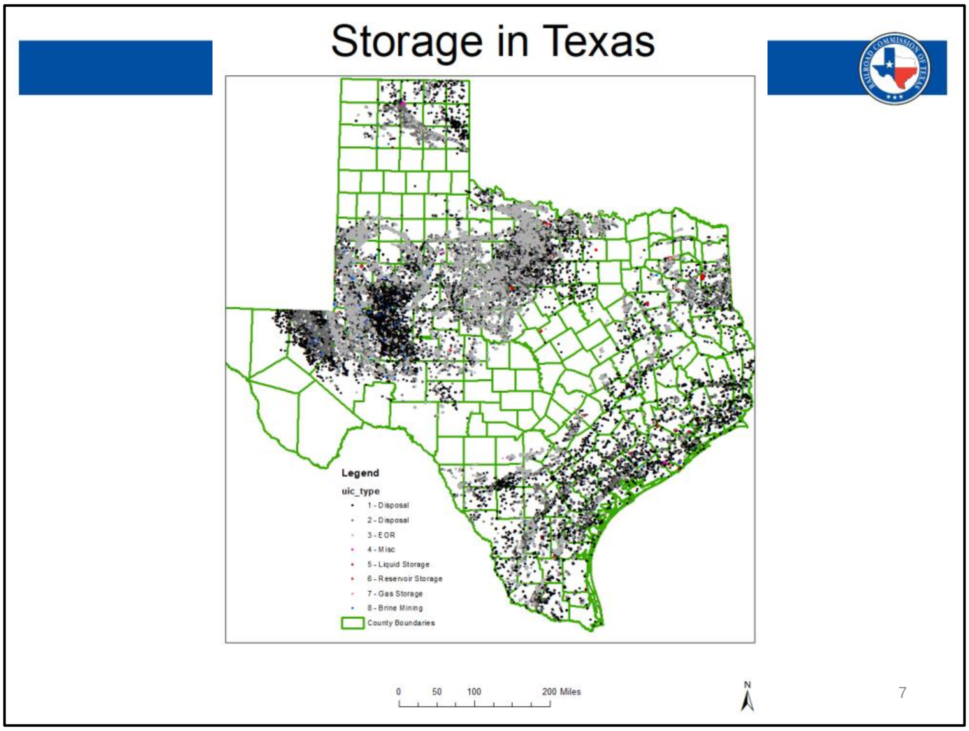
Now, on to federal regulations!

In our earlier presentation on Injection/Disposal well permitting, you would've heard about the Safe Drinking Water Act and, specifically, about the Underground Injection Control part of that act. Well, UIC covers underground storage of liquids, but it does not cover the underground storage of gas.

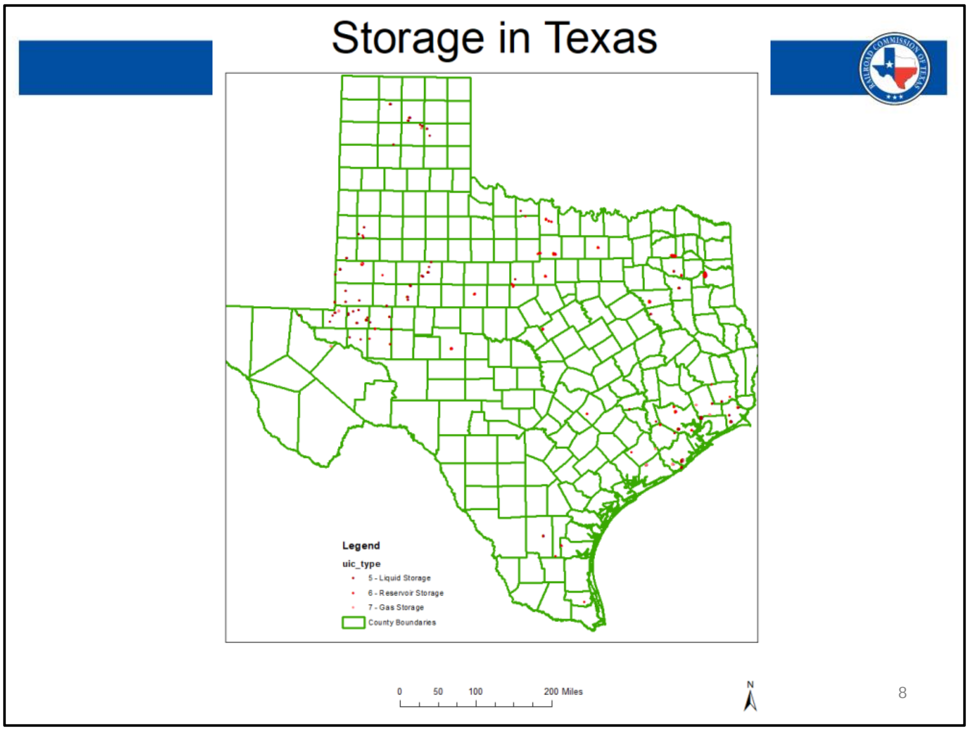
And, the Commission does not have federal delegation of authority for underground storage of gas from the federal agency that handles that, the Pipeline and Hazardous Materials Safety Administration or PHMSA ("Fem-Zah").

However, we still have state authority for gas storage, so we still permit storage of gas. But, you may have to talk to PHMSA as well. We are considering applying for federal delegation to simplify regulation of gas storage in Texas.



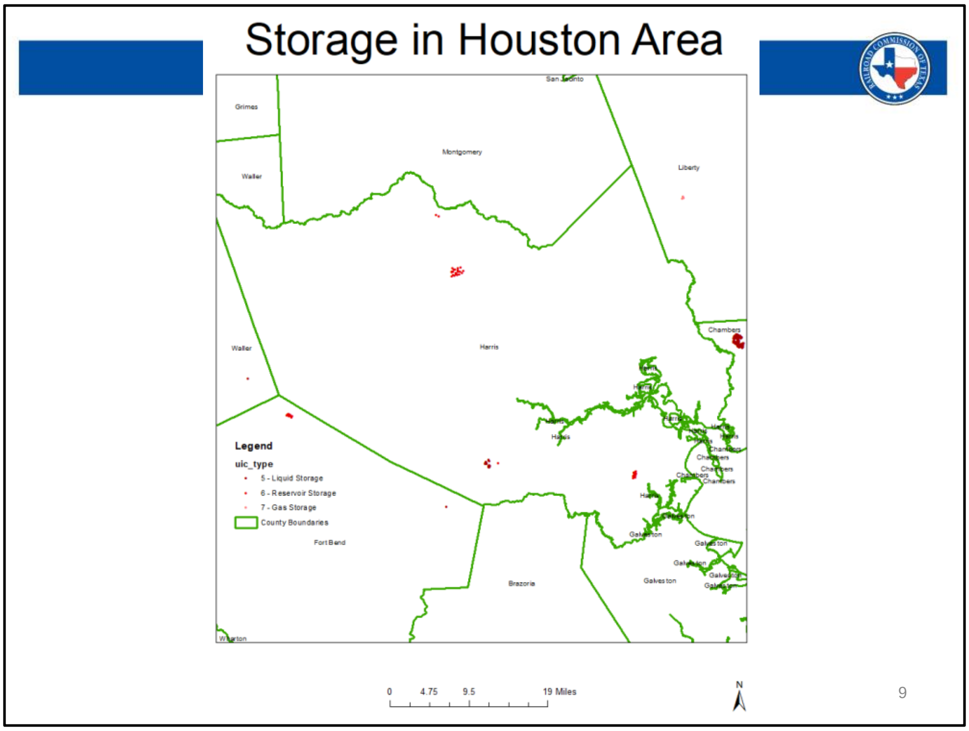
Here we have a map of all the injection wells in the state of Texas. The black and grey dots are injection/disposal wells, the red or light red are storage wells and the blue are brine mining wells.

I put this together so you can get a sense of the distribution of injection wells in the state, the oil and gas basins and the proportion of those wells that are for storage. You can tell there aren't very many storage wells, proportionally. On the next slide, we'll show you just the storage wells so we can actually see them.



So, again, we can see there aren’t a whole lot of storage facilities in the state compared to the total injection wells. The storage in the Permian and Panhandle is in bedded salt formations, like the Castillo, Clearfork and Salado formations. The gulf coast and east Texas storage is mostly in salt domes. Then, we can see in central Texas, where there are not substantial salt formations, the wells are a bright red which represents depleted gas reservoir storage.

It’s important for me to note two things about this map: one, that at this scale you’re not really seeing individual wells so much as a very small blobs typically representing many wells, and two, that these wells may not be active. They might just be storage permits—not drilled and completed– or they could’ve been plugged. We’ll get to specific numbers after the next slide.



Just to zoom in a little closer, here we can see the counties in the Houston area, and we can start to see individual storage wells. You may notice, too, that there can be many caverns and storage wells associated with one salt dome or storage facility. The cluster of bright red wells in the center, just north of the “Harris” County label, is not actually a salt dome, but the Bammel gas reservoir.

Then, I’ll point out the dark red blob to the right or east of the map under the “Chambers” County label, which are the storage wells in the Barbers Hill salt dome underneath the city of Mont Belvieu. This is one of the most active storage salt domes in Texas and has the most or highest density of storage wells in the state.

RRC Storage Statistics

- 98 Salt Storage Facilities
- Liquid Storage in Salt
  - 751 wells permitted
  - 331 active
- Gas Storage in Salt
  - 113 wells permitted
  - 58 active
- Gas Storage in Reservoir
  - 453 wells permitted
  - 120 active

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To save you from counting all those dots, like I promised, here are a few basic counts for oil and gas storage in Texas. We have nearly a hundred storage facilities. Of those, there are 751 liquid storage wells permitted in salt, 331 of which are active. We have 113 gas storage wells permitted in salt with about half of those active. And, lastly, we have 453 gas storage wells in a depleted reservoir and over a quarter of those are active.

Oil Storage Permits in Salt

- Standard for permit issuance
- Terms
- Scale and storage wells
- Notice of application and hearing
- Area of Review (AOR)
- Freshwater protection
- Salt structure and geology
- Cavern integrity
- Safety

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First, were going to discuss storage permitting in salt since that is the norm for Statewide Rule 95. This presentation assumes that you have a basic understanding of injection well permitting and builds on that knowledge. We will draw contrasts to the typical injection/disposal permit application process.

We will discuss the standard for permit issuance, some typical salt storage terms, what salt storage and storage wells look like, how notice and hearing, Area of Review and freshwater protection are different. And we will discuss salt structure and geology, cavern integrity and Rule 95's safety section.

Oil Storage Standard

- An underground crude oil storage facility may be created, operated, or maintained in a manner that will prevent:
  - waste of the stored crude oil,
  - uncontrolled escape of crude oil,
  - pollution of fresh water, and
  - danger to life or property.

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Underground storage of oil must do four things: it must not waste oil or otherwise allow it to escape, it must not pollute freshwater, and it must not endanger lives or property. This is the standard that we will look for when we decide whether or not an application for permit should be approved.

Storage Leaching vs. Brine Mining

- “solution mining”
  - Has a common language meaning; don’t need to declare a rule definition
- “leaching a cavern”
  - Similar meaning to “solution mining”, typically used for purpose of storage
- “brine mining injection well”
  - Explicitly defined by rule

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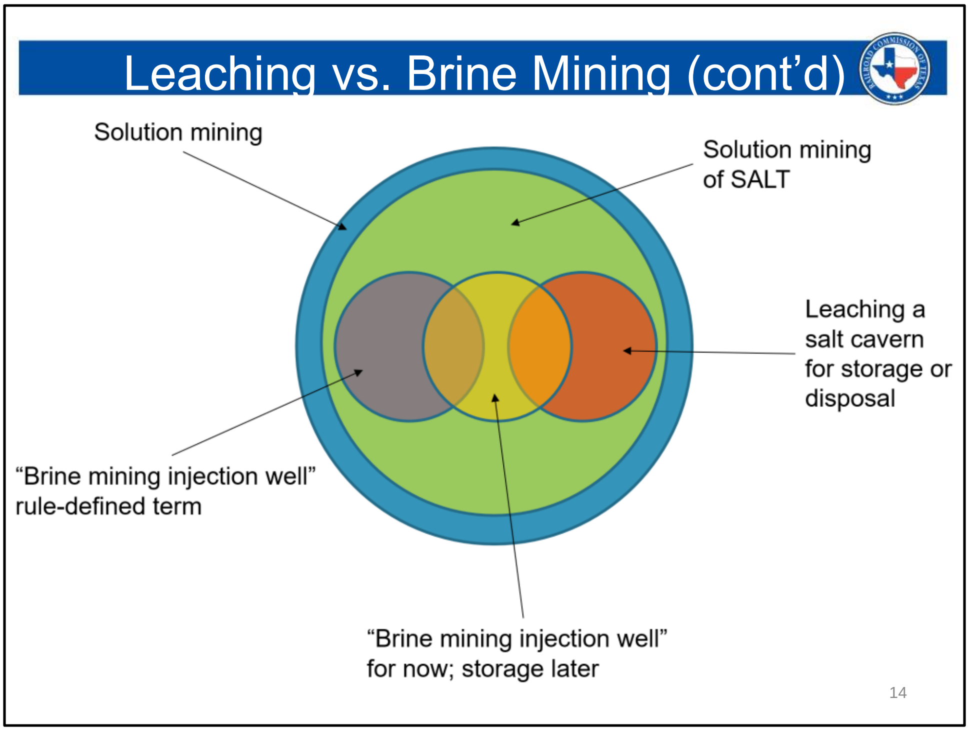
We have some common terms we use when referring to the process of removing salt by dissolution from a salt structure.

Some terms are generally understood and don’t need to be defined by a statute or rule. The terms “solution mining” and “leaching a cavern” are like this. We tend say “leaching” for storage and “mining” for brine mining to try to distinguish between the different purposes and rules, but they are both “solution mining”.

The term "brine mining injection well" does have a specific rule definition, however, and it's important to understand how that impacts our regulation.



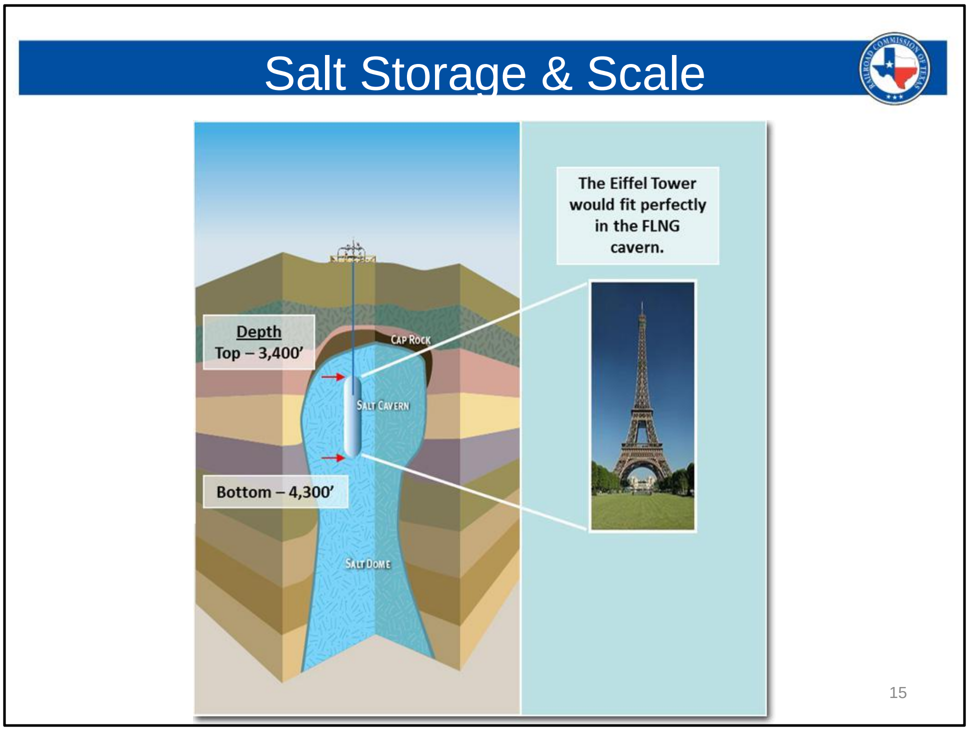
This Venn Diagram illustrates the relationship between different purposes of solution mining and how they’re regulated.

To grow a storage cavern, you have to “solution mine” it to make the void space. This is the physical operation and solution mining of salt is just one kind of solution mining.

We have a couple Commission rules for solution mining, so which rule do we file under? Is it brine mining under Statewide Rule 81 or is it leaching for storage under Rule 95?

We’re “solution mining” under both rules, doing basically the same physical operation. So, then it’s about the purpose for the solution mining. If the applicant states that the solution mining is “for the purpose” of making a void space for storage or disposal, then it is not “brine mining” by definition. Otherwise, we say that the operation is brine mining. The applicant is responsible, of course, for applying for the correct permit for their “solution mining” purpose.

If the business purpose of the “solution mining” changes, for example, you begin for the purposes of brine mining, but then want to use the cavern for storage or disposal, the applicable rule changes and you have to apply for a new permit under the applicable rule.

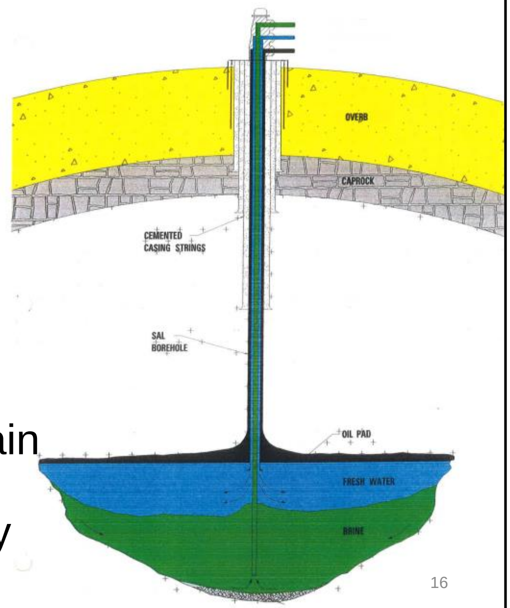


This illustration shows the salt dome in light blue, which is a salt structure that has pushed it’s way up through more dense geologic strata and stopped at some depth when it reached buoyancy. They often have a shape like a lava lamp makes, where they have a bulbous head at the top and a slightly narrower stock. There’s caprock immediately above that is often altered and very porous. Salt is essentially impermeable, but can be easily dissolved with unsaturated water. So, we can hollow out a void in salt with injected water. Then, we can use that void to store other fluids and we use storage wells to transmit fluids in and out of the cavern.

Finally, I think it is always important to get a sense of scale when we talk about storage, because storage caverns and salt domes are just unbelievably big. So, here we can see that this particular salt cavern is about a thousand feet tall, which is big enough to fit the Eiffel Tower. Of course, the salt dome is much bigger than that, so we may have many Eiffel-Tower-sized caverns inside one dome. And, a thousand feet tall wouldn’t be the tallest of our storage caverns. They’re really big!

Wellbore Description

- Storage wells are more complicated
  - Bigger
  - Fluids in and out
- Two-well configuration
- Fluids must be displaced to maintain operating pressure and cavern integrity



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Storage wells are typically more complicated than your standard injection/disposal well or oil or gas well.

There are two basic reasons for this: they're bigger and they are designed to get fluids in and out. The wells have to be bigger to address demand and operate safely.

Therefore, the diameter of a storage well may be 36 inches wide, compared to a typical injection/disposal or oil or gas well which are more often around 9 or 13 inches wide.

Storage wells typically have a casing string and a hanging string so that they can inject brine through the hanging string and produce oil from the casing string. This diagram to the right is even a little more complicated than that. It has a casing string that is open to the oil pad, then it has two hanging strings. Unfortunately, you can't really see the bottom of the casing string on this diagram since the oil pad is also colored black. But, it's about even the "OIL PAD" label on the diagram.

The strings for injection and production are reversed in this case. The injection is occurring above the production, because this well is leaching the cavern not storing hydrocarbons. You can see the second hanging string extends down into the brine, shown in green, to produce the brine, while freshwater, shown in blue, is injected above the second hanging string through the first hanging string to solution mine the salt.

Some caverns may not have a single well performing injection and production, but instead use two wells to perform both operations. It’s important to be able to inject and produce at the same time so that we can displace fluids in the storage cavern. This way we don’t over or under pressurize the cavern.

Notice & Hearing – Salt Storage

- Notice of Application:
  - Surface and adjacent tract owners
  - Oil, gas and salt leaseholders on tract and adjacent tracts
  - County clerk and, if applicable, city clerk
- Published Notice for 3 consecutive weeks
- Hearing required for new storage
  - May 5, 2020 Order has suspended requirement until May 5, 2021

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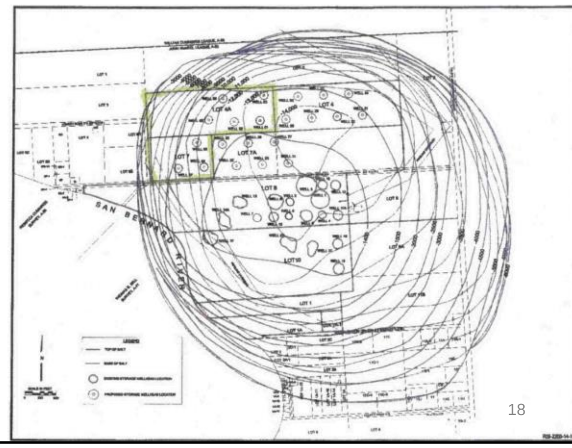
Notice and hearing requirements for storage are a bit more rigorous than for a typical injection/disposal well. You must notify surface and adjacent tract owners, like you would with a Commercial Disposal well, but also all oil, gas and salt leaseholders on the surface and adjacent tracts.

Then, instead of one publication, you have to run the published notice once a week for three consecutive weeks.

Finally, all new storage facilities are required to have a hearing by rule. However, the May 5, 2020 Order suspended that hearing requirement for one year.

AOR – Salt Storage

- Area of review is a quarter mile from the areal limits of storage
- Include all storage facilities within a quarter-mile



How is the Area of Review or AOR different from injection/disposal wells?

Well, it’s based on the extent of the storage instead of treating the well like a point location and, in addition to the typical well list, you have to identify all storage facilities within a quarter mile, too.

Buffering a quarter mile from the storage limits can be a complicated task, so often the AOR we get is like this image here. The facility is outlined in dusty highlighter yellow and they’ve just shown every storage facility and well in the vicinity and the boundaries of all the storage on the salt dome for good measure.

Freshwater Protection

- Statewide Rule 13 applies
- Storage wells must be constructed in a way to protect freshwater
  - All outer casings cemented to surface
- Geologic isolation of freshwater

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Just like injection/disposal wells and all oil and gas operations, generally, you must protect freshwater. Statewide Rule 13, which sets standards for well construction, applies to storage wells just like all other wells under our jurisdiction.

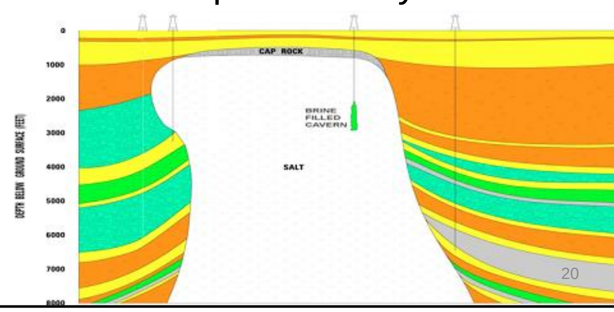
Additionally, Rule 95 requires all outer casing strings to be cemented to surface. This adds an additional layer of protection for freshwater from any fluids that could potentially come up or around the wellbore.

Finally, geologic isolation is not a common permit application deficiency since the storage is occurring in salt and salt is essentially impermeable. Plus, adequate storage should confine fluids in all directions, so there is substantial financial incentive to ensure no loss of product.

However, there are substantial geologic concerns for cavern storage in salt.

Salt Structure & Geology

- Thickness, continuity, structure required to be known as part of application
  - Ensure that void space will not reach the limits of the salt structure
  - Salt structure is not compromised by fractures or faulting



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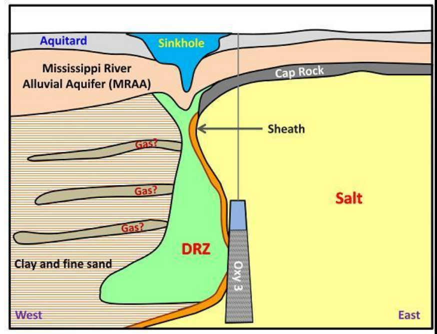
A cavern is, of course, at its most basic definition a hole. It can serve as storage if its boundaries aren't compromised, or unfortunately, it can serve as a conveyance if it loses integrity.

Therefore, you must submit information to demonstrate the thickness, continuity and structure of the salt to ensure that: the cavern can be safely created and operated without intersecting the edge of the salt and to demonstrate that there are no faults, fractures or other features that could compromise the cavern.

Cavern Integrity

- Types of cavern failure:
  - – Cavern closure
  - – Loss of integrity
  - – Coalescence
  - – Roof dissolution
  - – Casing shoe bond failure
  - – Surface collapse



- Testing
  - – Nitrogen-Brine Interface test
    - Including casing shoe bond test
  - – Sonar

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This leads us to the concept of cavern integrity or stability. Caverns can be compromised several ways. The cavern can close-up through precipitation of the brine back into solid salt. The cavern can become compromised so that it can no longer hold fluids and pressure. Two caverns that are too close together can coalesce to become one large cavern. The roof can become structurally unstable and cause collapse. The casing shoe bond can become compromised.

And, lastly, we can cause surface collapse. In the example on the right, we see a storage well that maybe might have seemed to be a safe distance from the edge of the salt dome at the top, but at depth the salt dome is narrower and the cavern intersected the salt dome's edge while it was leaching. This, obviously compromised the cavern, but it also allowed sediments to enter the void space causing geologic collapse and a sinkhole at the surface.

Therefore, rigorous review and testing of cavern wells is needed. The Mechanical Integrity Test that is performed every 5 years on storage wells is a Nitrogen-Brine Interface test. Although the test is very different from a standard well pressure test, the concept is very similar. Instead of pressuring up the tubing-casing annulus to ensure the well has integrity. You have to pressure up the entire storage cavern.

A casing shoe bond test is required as part of the MIT. And, sonar surveys are performed to ensure that shape of the cavern is understood over time.

Sinkhole Picture

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This is a picture of the sinkhole that resulted from that diagram. From this far away, it kind of looks like a mud pit, landfarm or maybe just barren land. But, actually, all the trees and anything else there were essentially swallowed up by the sinkhole. The sinkhole at this stage covered about an acre, so it's a over a 100 feet across. However, it grew to encompass 37 acres.

Safety

- Monitoring of injection and withdrawal operations
- Storage wellhead
- Product, brine, and fresh water surface piping
- Overfill detection and automatic shut-in methods
- Fire detection devices or methods and fire control systems
- Emergency response plan
- Notification of emergency or uncontrolled release
- Public education
- Employee safety training
- Warning systems and alarms
- Wind socks
- Barriers
- Wellhead, surface piping, and associated valves
- **Must be in place before storage operations begin**

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I'm not going to discuss each one of these bullet points. Each one is a subtitle and subsection under Statewide Rule 95(h), which is all about safety.

These facilities can be dangerous if not regulated and operated properly. They're storing flammable liquids at pressure and are huge engineering feats with serious consequences if something goes wrong, so the rule takes safety very seriously. I encourage you to read the rule to make sure that each one of these safety sub-sections is addressed.

It's also important to note that most of these safety features must be in place before storage operations can begin.

Amending a Storage Permit

- Common amendments
  - Adding caverns
  - Increasing cavern capacity
  - Injection pressure or rate change
- Compliance check
- If you already have a SWR 95 permit, you can store oil now
  - No amendment needed
  - Make sure you're up-to-date on regulations

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We don't have published amendment guidance to reduce application requirements like we do for injection/disposal permit applications. Like I said, we will be working on broad storage guidance in the next year. Typically, we get permit amendment applications that are essentially a full new application.

The two main reasons people want to amend their storage permits is to add a new cavern, increase cavern capacity, or change the injection pressure or rate. Additionally, you can expect that we will do a compliance check– just like we do for injection/disposal permits.

Unlike injection/disposal permits, you are not as restricted to what you can inject by the permit. You can inject any liquid hydrocarbon under the Commission's jurisdiction. So, if you have a storage well storing other liquid hydrocarbons you can empty your cavern and start storing oil as soon as your ready. That being said, you should, of course, make sure that you don't have any outstanding regulatory requirements, like reports, testing or safety equipment, before commencing or changing storage operations.

Oil Storage **Not** in Salt

- May 5, 2020 Order
  - Authorizes storage of oil in formations other than salt
  - Accepting permit applications for one year
  - May store oil for up to five years
  - No hearing required for storage permits
- Application Guidelines for Storage of Crude Oil in Geologic Formations Other Than Salt

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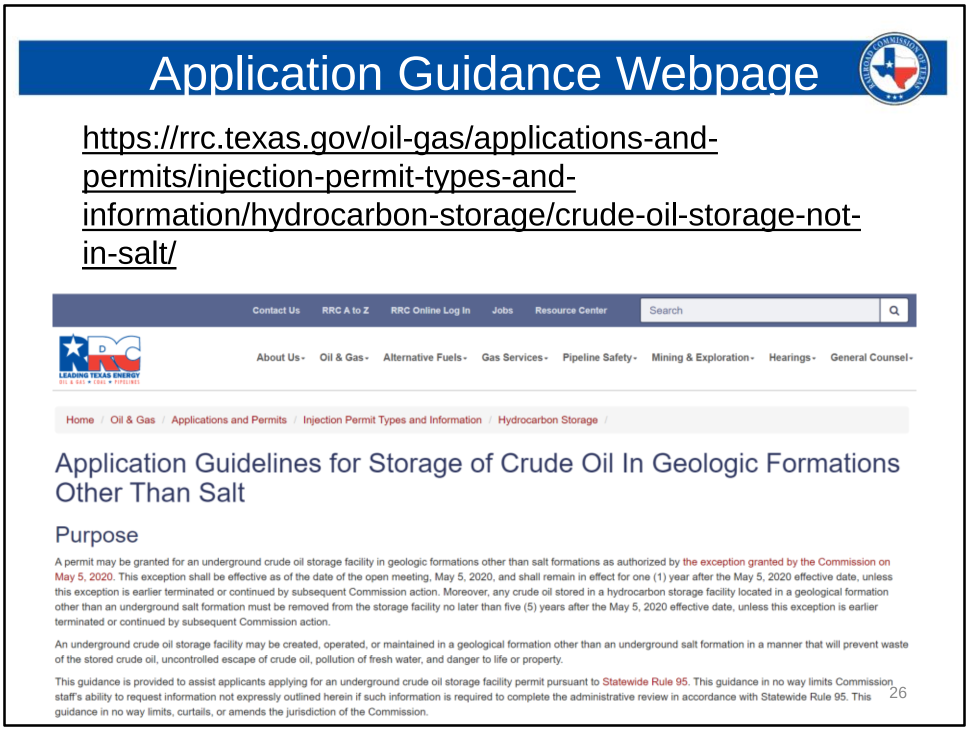
Now, we're going to begin discussing oil storage in geologic formations other than salt. First thing, the May 5, 2020, order allowed applications to be submitted for this for one year and that permitted facility could store oil for up to five years. The order also suspended the requirement for a hearing on new storage permits.

Storage of liquids, including crude oil, into formations other than salt is not common. We do not have rules in Texas that explicitly allow for it. That's why the May 5th order was issued. The good news is our existing rules, especially Rule 95, gives a good start on how to think about permitting this kind of storage. We created a webpage with application guidelines for oil storage not in salt to fill in the gaps. So the rest of the slides today will be clarifications to our standard salt storage permitting process for oil storage not in salt.



Here's a screen shot of the top of the webpage we created where you can find this guidance. At the top there is the URL in case this presentation gets distributed in a format where you are not able to click the link. On the Application Guidelines page, in the first sentence, there is also a link to the May 5th Order if you want to read that.

Guidance Outline

- **Form H-4 (front and back)**
- Application attachments
- SWR 95 (d) – Waste of oil, fresh water and safety
  - **Feasibility**
  - **Confinement**
- **AOR**
- Safety
- **Notice and hearing**

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This is the basic outline of the Application Guidelines webpage.

You can see the items that we're going to discuss over the next slides in bold. We're discussing these specifically because they may be substantially different from the typical injection permit or storage permit process.

The first thing we're going to do is address inconsistencies in the Form H-4, which assumes that the storage medium is salt.

Form H-4 Terms

- Submit a Form H-4 for each proposed Underground Storage Facility
- Ignore Item 12
- Items 13–16 should be used to identify
  - the storage reservoir(s) and/or geologic formation(s)
  - the depth of the top and bottom of the storage reservoir(s) and/or geologic formation(s)
- Items 17 & 18, “Cavity” means storage well
  - Attach a table if there’s not enough room to describe all the storage wells at the facility
- Item 19, “Cavity” means the depth of the top and bottom of the injection interval
  - “Capacity” is not applicable

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First, you need to submit a Form H-4 to store oil, regardless of what geologic formation it’s in– salt or not. However, the terms on the Form H-4 assume a salt cavern. We can successfully use the Form H-4 for storage in formations other than salt with a few tweaks in our understanding of what the terms mean for storage not in salt.

You don’t need to fill out Item 12 on the form.

For Items 13 through 16, you need to identify the storage reservoir or geologic formation and provide the top and bottom of the storage reservoir or geologic formation.

For Items 17 and 18, assume that “Cavity” instead means “Storage Well”. Please submit a well table as an attachment if you’re applying for more than one storage well.

For Item 19, assume that “Cavity” means the top and bottom of the injection interval. “Capacity” is not applicable.

Feasibility – General & Fluid Data

- General
  - Description of the creation, operation and maintenance of the facility
  - Description of the procedure to inject and withdraw stored crude oil, including maximum injection pressure
- Fluid data
  - Relative permeability curve for hydrocarbon phase and for water phase

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Feasibility: Can you put the oil in and get it back?

Some of these items are already clearly required by Statewide Rule 95 or the Form H-4. However, at the risk of duplication, we need to highlight or clarify a few items for storage of oil in geologic formations other than salt. Then, there are some items here that must be addressed because Rule 95 or the Form H-4 assumes that the storage will be in salt.

General: these items are highlighted because we anticipate that the responsive information could be substantially different than from typical storage permit application.

Fluid data: Storing and injecting fluid into a salt void versus storing these fluids in geologic pore space is very different. So, we need to know how the fluids will act in the pore space you're proposing for storage.

Feasibility - Engineering

- Engineering
  - Inflow performance relation (IPR) of the hydraulic conduit, from wellhead to wellbore exit, that will be used for injection and withdrawal
  - Determination of total capacity available for storage
  - A determination of the estimated ultimate recovery factor
  - If the storage interval is productive, the estimated volume of existing hydrocarbons and ultimate recovery factor of the existing hydrocarbons
  - Determination of the percentage of stored crude oil that would be permanently immobile if the storage reservoir were filled to 50% and 100% capacity

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Engineering: This is not my specialty since I'm a geologist. However, our Storage Lead and Engineer, Scott Rosenquist, has put this list together to ensure that injection into geologic pore space and retrieval from it is feasible and safe. Also, that we understand how much oil this reservoir is capable of storing and how much oil will ultimately be lost to the reservoir since physical forces keep some oil ultimately trapped on grains of sediment forever.

Confinement - Geology

- Geology
  - Structure map of the upper and basal confining layer of the storage reservoir
  - Description of the confining boundaries of the storage reservoir
  - An evaluation of anomalous geologic features (e.g., faulting, natural fracturing, folding, and unconformities) that could compromise confinement

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Confinement: The storage reservoir must be bounded on all sides!

Geology: This is really no different than the requirement for salt storage. But, because the storage reservoir is not a void space being created in an essentially impermeable geologic formation, the geologic analysis to demonstrate that the reservoir is bounded on all sides will be very different. For example, reservoir gas storage has been permitted in depleted reservoir in an igneous intrusion creating a geologic boundary between the reservoir and adjacent sedimentary formations similar in some ways to salt dome. And, it has been permitted into depleted reservoirs bounded by faults. The reservoir traps were sufficient to collect gas over geologic time and so the assumption is that they can also store injected gas. However, the conditions for storage of hydrocarbon, injecting under pressure, and natural phenomenon over geologic time may be very different. Therefore, confinement must be demonstrated.

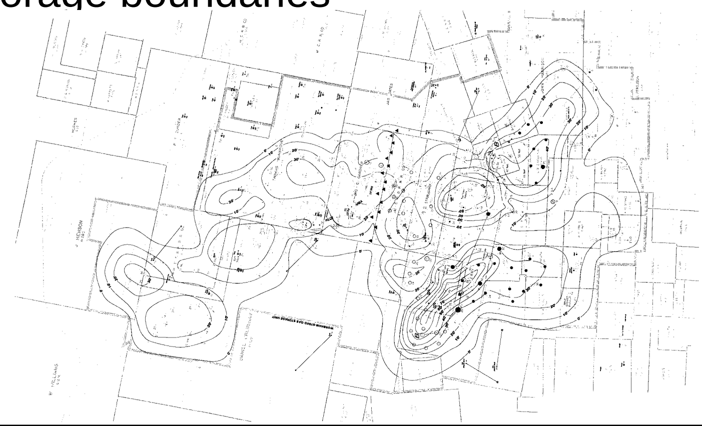
Operations: Again, the engineering of storage could compromise the storage reservoir itself. If injection of the fluid exceeds the fracture gradient, fractures will be created that could compromise the confining boundaries of the storage reservoir. Or, the fluid itself which may not be native to the formation could have physical interactions with the reservoir, like dissolution, that could compromise confinement. So, we need to know the physical parameters of the operation to ensure confinement will continue under the proposed storage operations.

Testing: If there are going to be multiple wells and some will be designated for injection and some for production. Then, it's likely that a standard pressure test would suffice. However, we will need to understand exactly how MITs will be performed if the wells are going to be more complicated.

Finally, we want to make it clear that review of a permit application for oil storage into non-salt formations is new and may require additional information and further review following initial application. We don't know everything.

AOR – Non-Salt Storage

- Identify all wells and storage facilities within a quarter mile of the proposed storage boundaries



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The Area of Review or AOR for non-salt formations is likely to be more complicated than for and injection/disposal well or even for salt storage, although the standard is really the same as it is for salt storage.

Since the boundaries of the storage may be determined by sedimentary boundaries or structural elements, like faulting, the area of the AOR is likely to be more complex. In this particular example, you can see that the boundary of the reservoir is defined by isopach, showing zero feet of thickness of reservoir at the boundary– essentially a pinch out.

So, this very odd and unique shape would then have to be buffered by a quarter mile and all wells within that shape would have to be identified and analyzed to ensure that they don't compromise the storage.

As a geologist, I could just stare at this map forever! But alas, we must move on!

Notice & Hearing – Non-Salt Storage

- Same as for salt storage unless the boundaries of the storage go beyond adjoining tracts of the tract of the proposed storage facility
- Publication Guidelines on the Guidelines webpage
- A hearing may not be required since the May 5, 2020 Order suspended that requirement
  - However, a hearing may still be required if the application is protested or administratively denied

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The notice and hearing requirements for non-salt oil storage are generally the same as those for salt storage.

However, we wanted to make it clear that, if for some reason, the extent of the storage reservoir goes beyond the surface tract that you notify all applicable persons. We've included this in our online guidance.

Also included in our online guidance, is a section called Publication Guidance. This walks you through how to prepare your publication to make sure it meets our standards for review.

Finally, while the de facto hearing requirement for storage was suspended by the May 5th Order, it is important to remember that a hearing still may be required if the application is protested or is administratively denied.

Thank You!

- Scott Rosenquist, Storage Lead / Engineer
- Ric Rosso, Permit Tech Team Manager
- Sean Avitt, Manager
- UIC_Permits@rrc.texas.gov

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Thanks for participating today! I'd like to thank Scott, our Storage Lead, and Ric Rosso, who is my Permit Tech Team Manager. If you have any permitting questions after today, you can send them to UIC_Permits@rrc.texas.gov. Now, I'm happy to take any questions!