Radionuclide Compliance in Texas: Challenges and Solutions

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EPA
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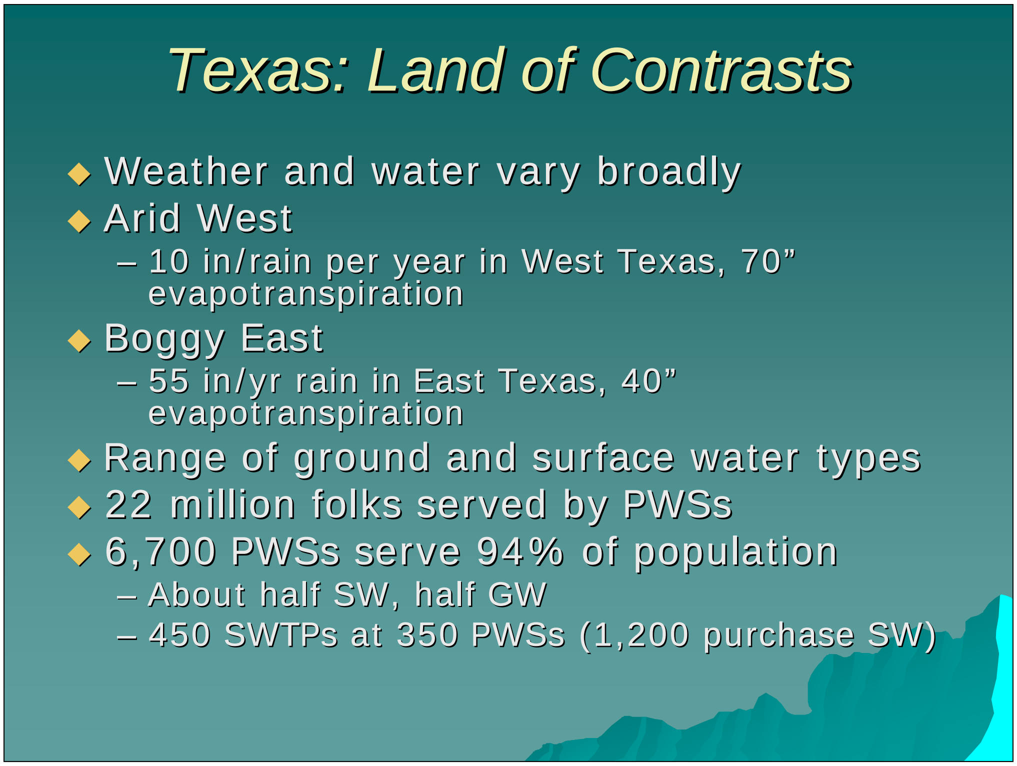
Outline

- Texas Geology
- Radionuclides in Texas
- How Texas deals with Violators
  - Feasibility study

Texas Perspective

Kristine Krieg



Texas is large in surface area and population. It is almost as if we have five states, here; from a water quality, weather, and cultural perspective. The best phrase that captures the sense of West Texas is “Whisky’s for drinkin’, Water’s for fighting.” There is little surface water, and the ground water is of relatively poor quality. That is a sharp contrast with the bayous, marshes, and tall pine forests of East Texas, with abundant surface water and relatively abundant ground water.

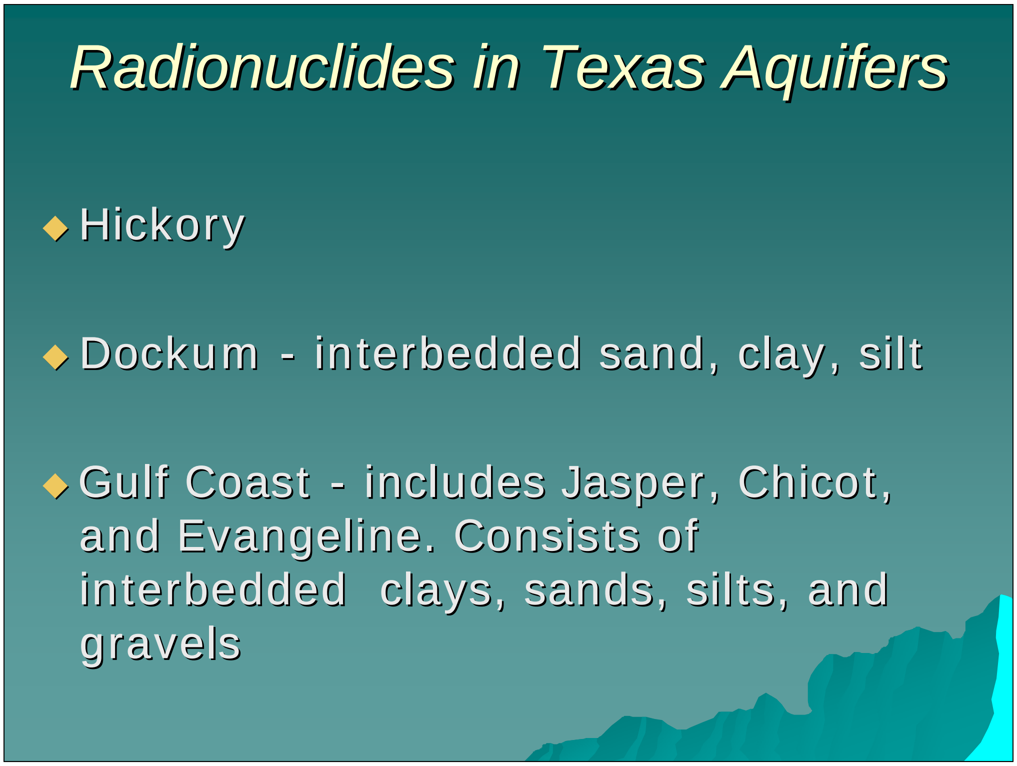
Generally, population is most highly concentrated around large cities. 38 systems serve over 100,000 people. An emphasis on regionalization along with water scarcity make the system to population ratio low as contrasted with some states.

Texas: Public Water Systems

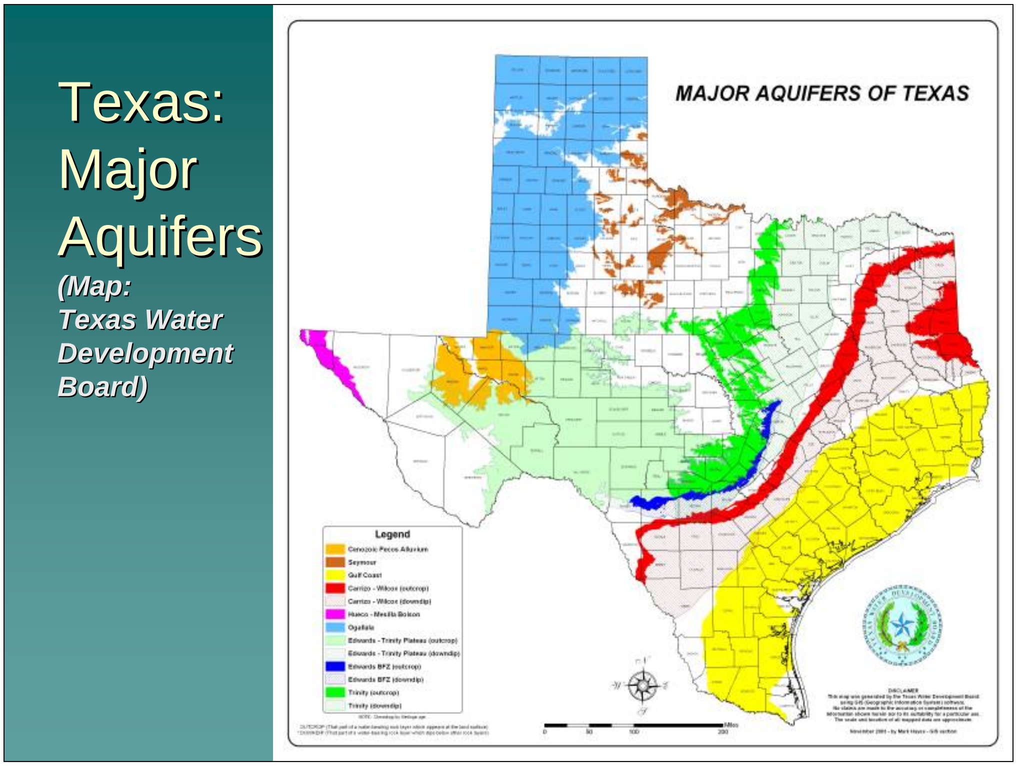
- 6702 active public water systems
- 4625 systems that have to comply with the radionuclide rule

Radionuclides Schedule

- Texas does not adopt by reference
  - We go through a writing and rulemaking process
  - Texas Administrative Code 290.108
- ***TCEQ Proposed Rules***
  - ***August 13, 2004***
- ***TCEQ Final Rules***
  - ***December 17, 2004***
- ***Federal Effective Date (Uranium MCL)***
  - ***December 8, 2003***
- **Uranium samples were collected in Texas starting in 2001**
  - **First uranium violator identified in 2004**



Here are the three aquifers that have high radionuclides.

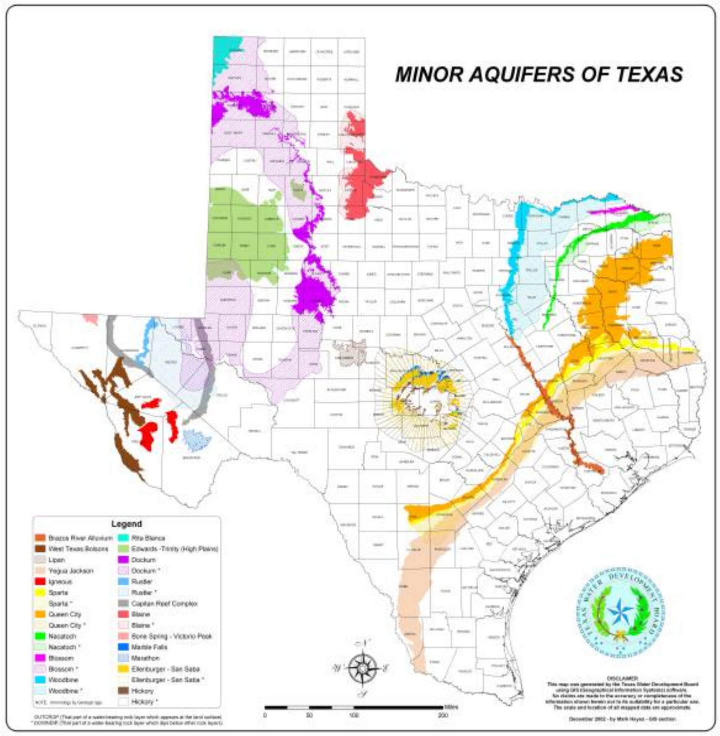


This map shows 9 major aquifers of Texas. The gulf coast is one of the aquifers that has high rads.

These include the Ogallala in the Panhandle down thru the Permian basin, the Gulf Coast – along the gulf coast. The Edwards in Central to West Texas is made up of several units, including the politically-significant, karstic portion near Austin, then, following the Oauchita range is the Carrizo-Wilcox

Texas: Minor Aquifers

Map: Texas Water Development Board)



Here is a map of the 21 minor aquifers. The circular formation near Central Texas is the Hickory Sands – part of the Llano uplift. The Dockum, which is in purple, also has rad violators.

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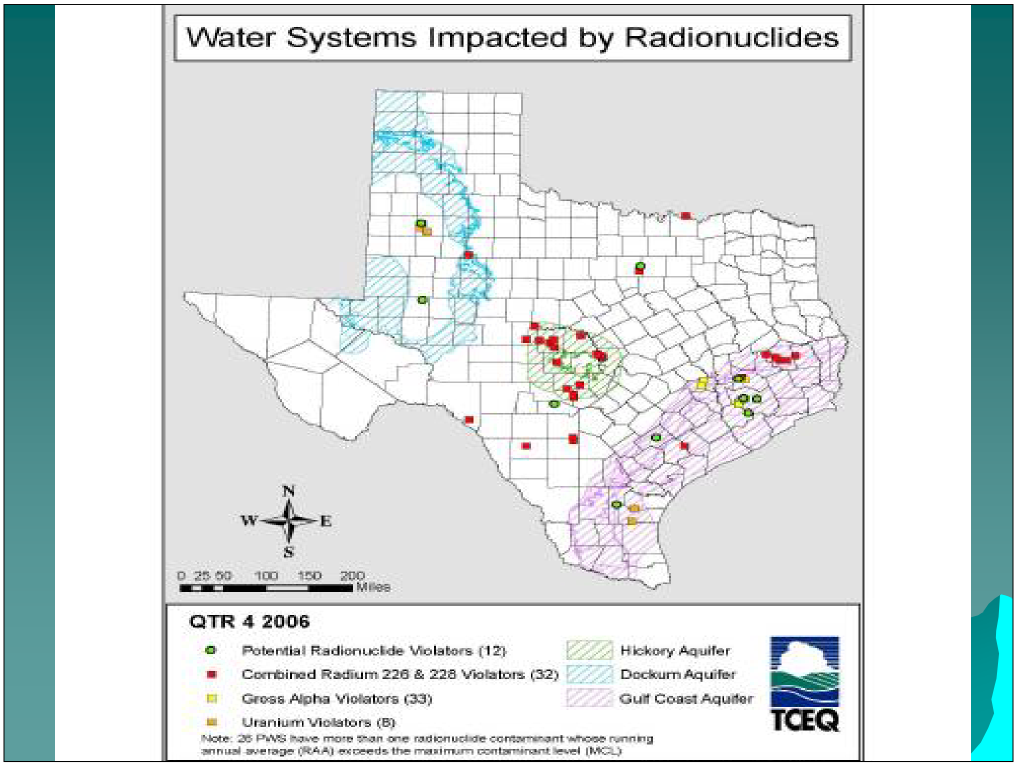
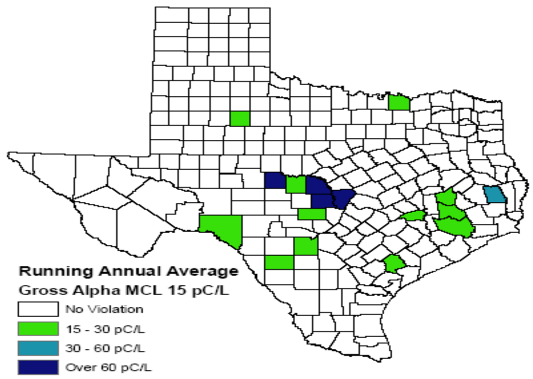
Violators

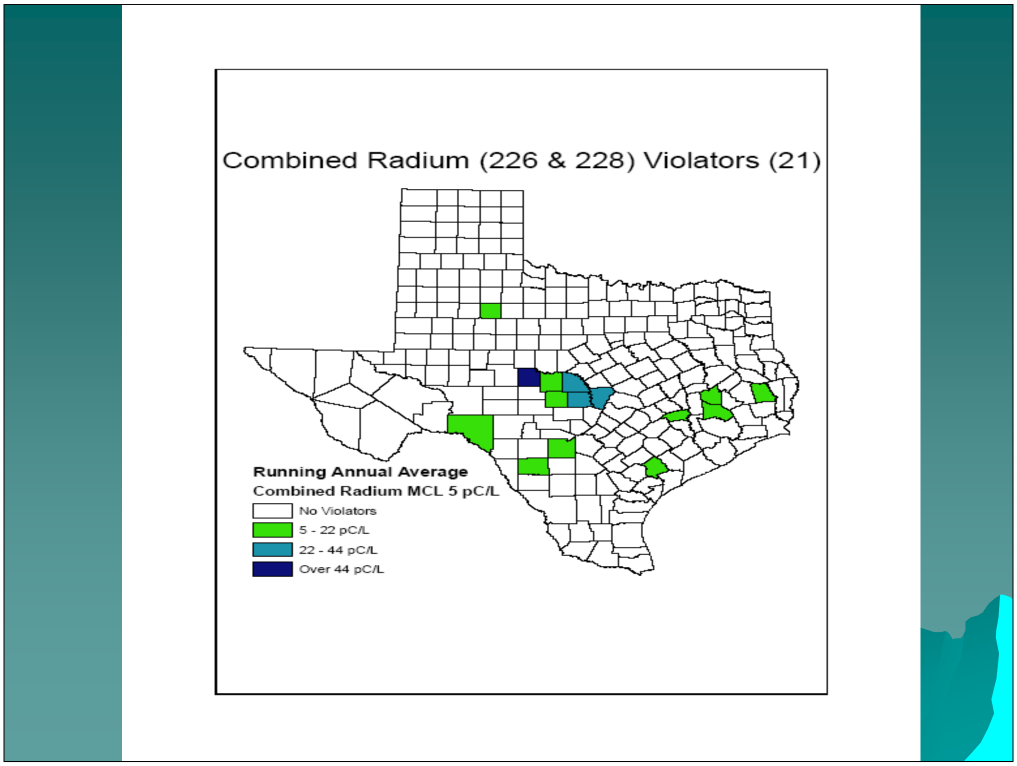
- Gross Alpha- 25
- Combined Radium (226 and 228)- 21
- Uranium- 7
- Note: 26 PWS have more than one radionuclide contaminant whose running annual average (RAA) exceeds the maximum contaminant level (MCL).

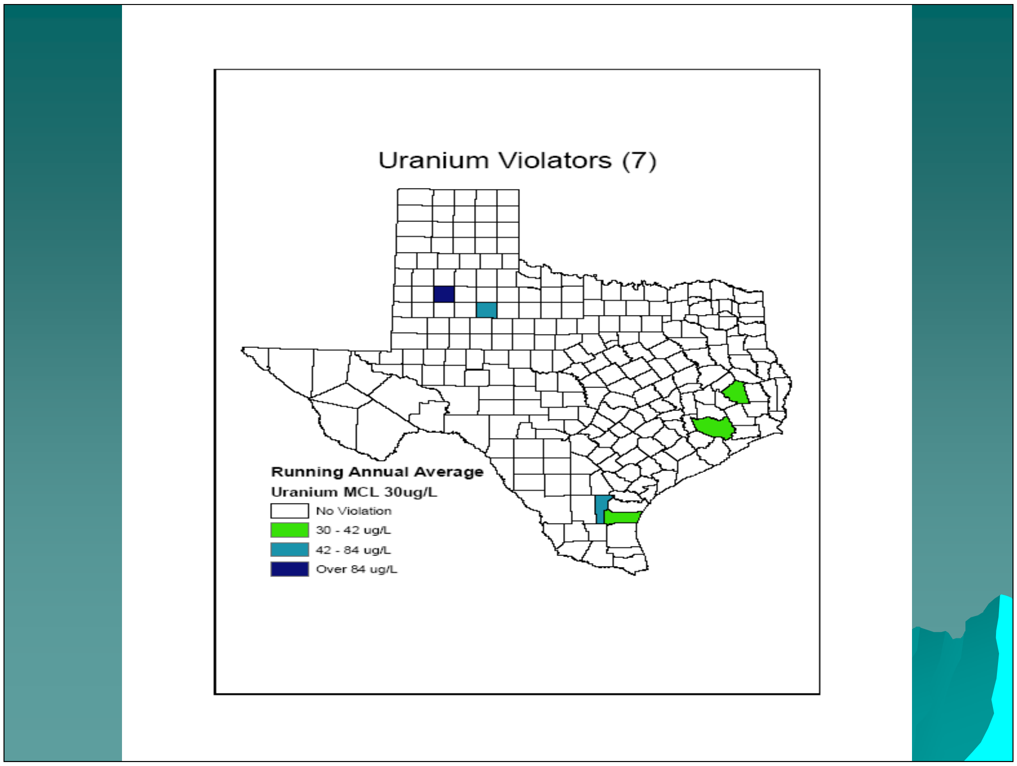


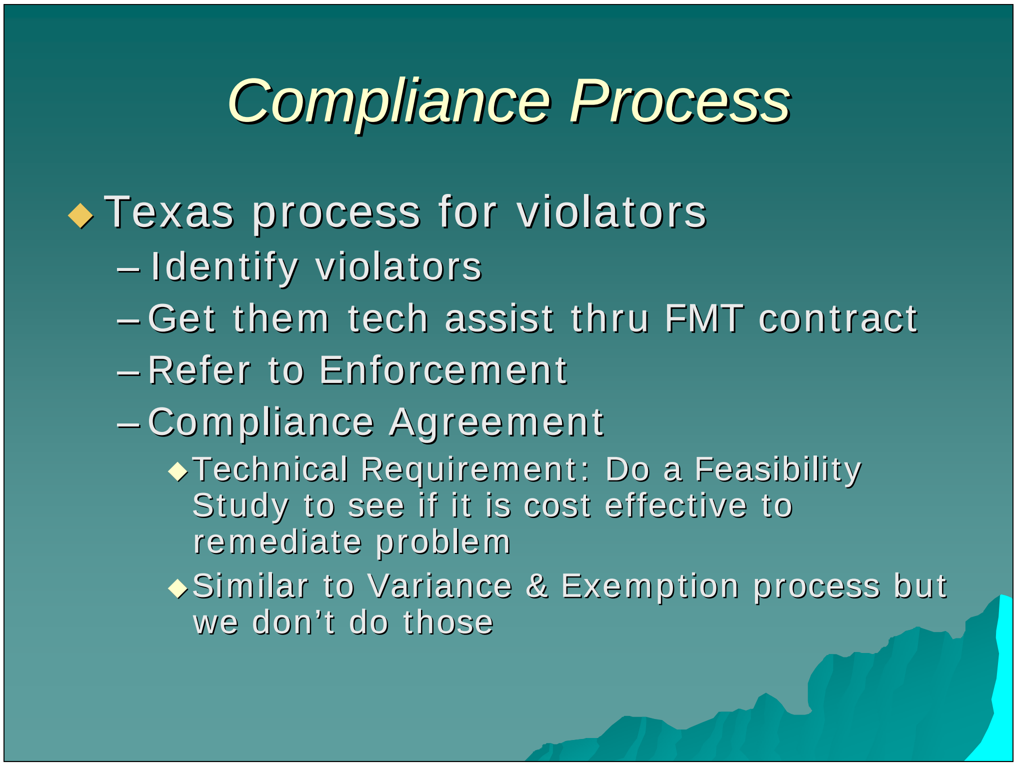
This map shows each chemical's violators. The green dots are the potential violators which there are about 10.

Gross Alpha Violators (25)




Combined Radium (226 & 228) Violators (21)
Running Annual Average
Combined Radium MCL 5 pC/L
No Violators
5 - 22 pC/L
22 - 44 pC/L
Over 44 pC/L


Uranium Violators (7)
Running Annual Average
Uranium MCL 30ug/L
No Violation
30 - 42 ug/L
42 - 84 ug/L
Over 84 ug/L



I identify the exceeders by looking at routine sample results. Once identified the system is put on quarterly monitoring and after 4 quarters and the running annual average is over the MCL the system is a violator. I send them a Notice of Enforcement letter, which states that the system has to provide public notice to their customers and research their options to correct the violation.

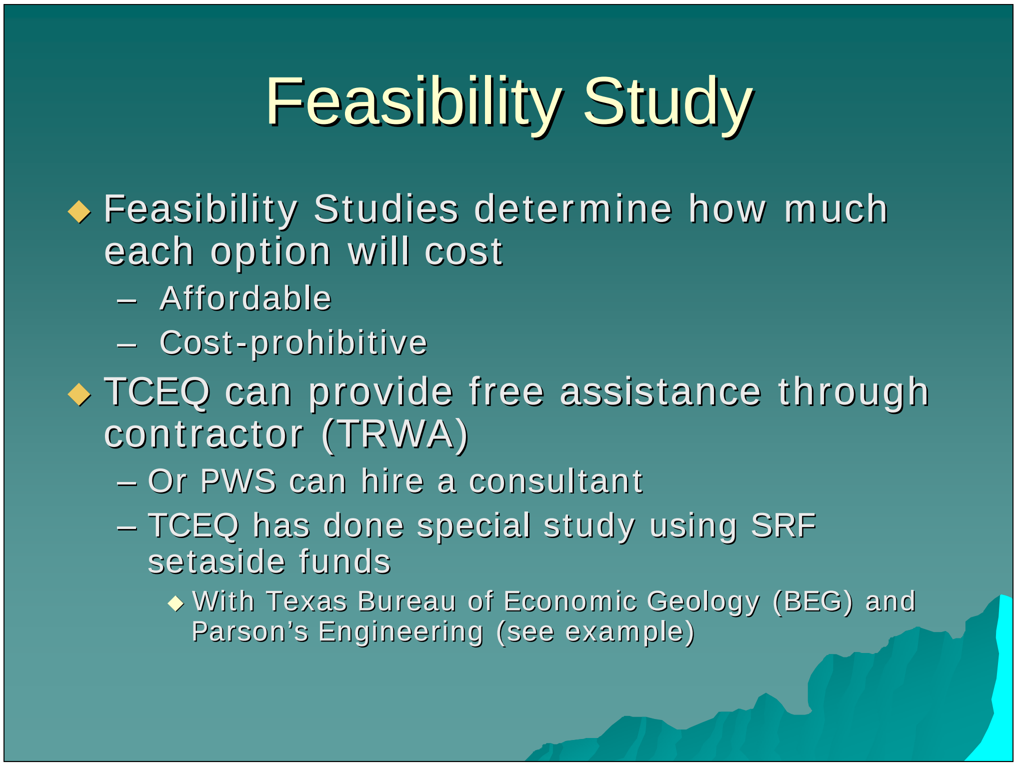
TCEQ provides directed assistance through the Financial, Managerial, and Technical contract. Texas Rural Water Association is the contract that provides this assistance through direction from TCEQ.

After the NOE is sent to the system then the enforcement process is started. I enter in the violations in a database called CCEDS. The packet is then sent to enforcement where they draft a compliance agreement. The CA requires public notice to be sent out to their customers, to do a feasibility study, which shows the different options to correct the violation, and progress reports.

TCEQ does not do variances and exemptions.

Options for Meeting the Radionuclide Rule Challenge in Texas

Mike Howell



Radionuclides are leached into groundwater when it comes into contact with uranium or thorium bearing soils.

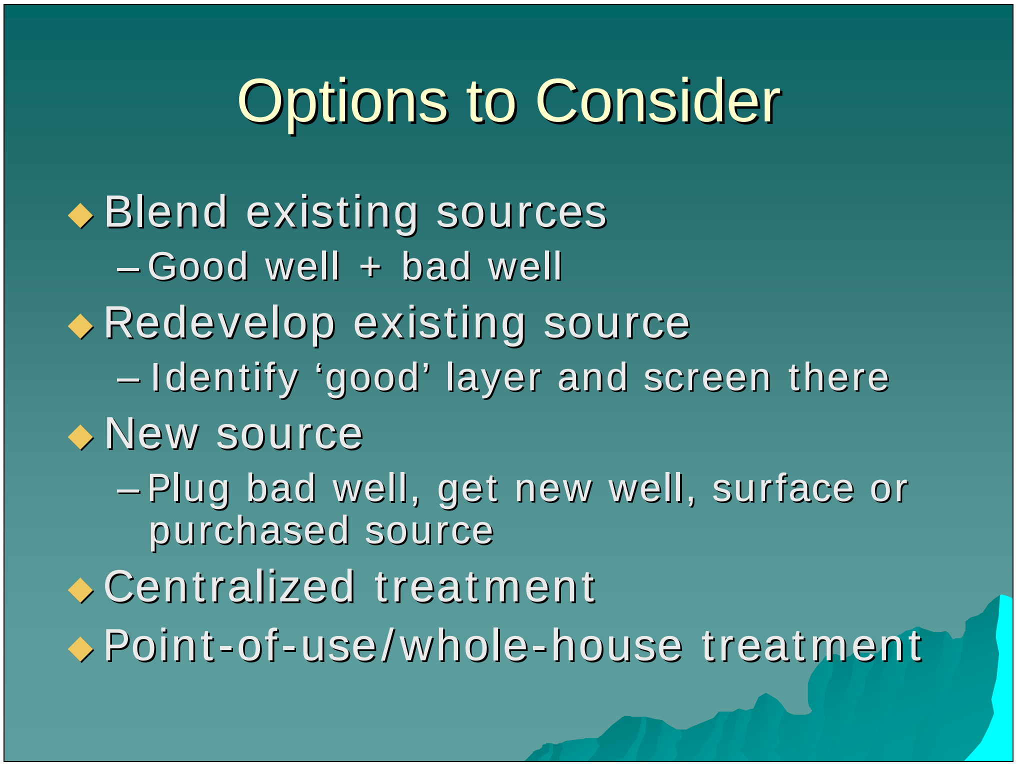
In 1976 EPA revised drinking water standards to include radionuclides.

FS is used to determine the feasibility and cost of supplying water that meets the drinking water quality standards.

Primary Violators: Report done by licensed engr

If PWS submitting FS to meet requirements of CA resulting from primary chem violation,

Study must be performed by a licensed engr.



<u>Options to consider in a feasibility study</u>

Connect to neighbor

blend existing sources

drill new well

blend with new source, or

treat water to meet std

<u>Study results</u>

Some PWS can develop new GW source

Others, the only option is treat the water and dispose of NORM waste.

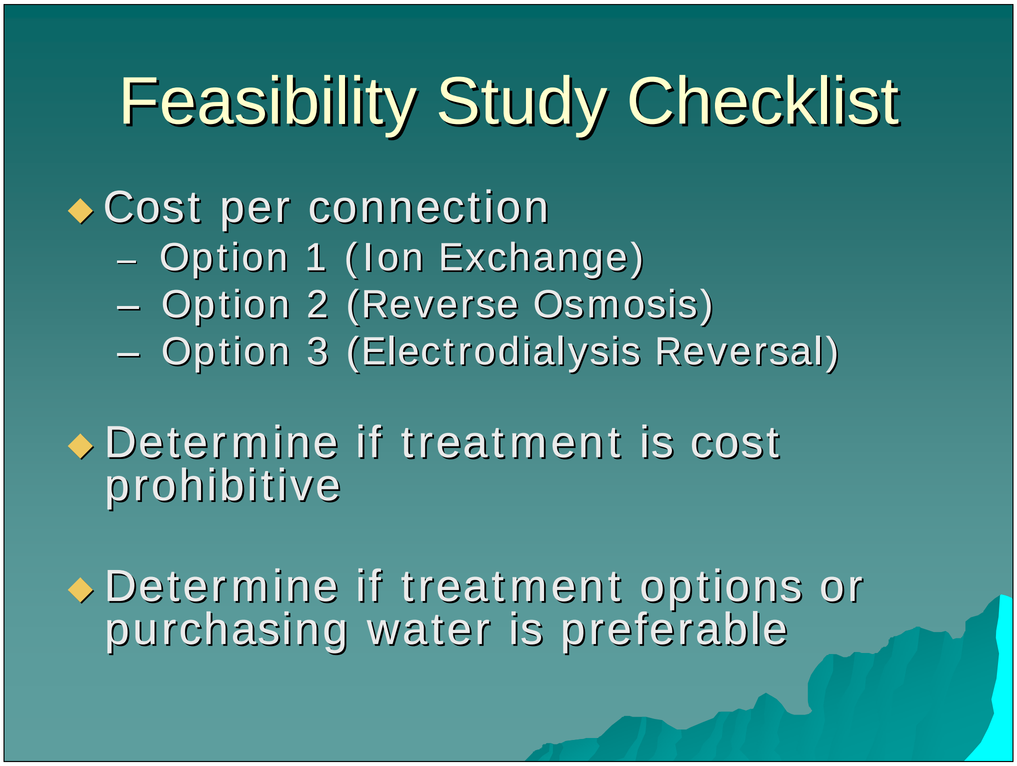
Feasibility Study Checklist

SYSTEM INFORMATION	
For system submitting Feasibility Study	
Name of system	
PWS ID of system	
Responsible official at system (and phone number)	
Contact person at system (and phone number)	
System's engineer (if applicable) (and phone number)	
Mailing address of system	
Number of connections	
Standard(s) violated	

POTENTIAL PURCHASED WATER SOURCES		
Nearest possible PWS to connect to (with water that meets all standards)		
Name of nearest system		
PWS ID of nearest system		
Contact person at nearest system (and phone number)		
Distance to nearest system (shortest pipe length)		
Any drinking water standards violations?		
Will this system agree to provide water? (Y/N)		
QUANTITY of water available from this system		
CAPITAL Cost to connect to nearest system		
COST of water: $ per 1000 gallons delivered		
COST per connection of purchasing all needed water from this source		
Other possible PWS to connect to (with water that meets all standards) within 5 miles		
Name of system		
PWS ID of system		
Contact person at system (and phone number)		
Distance to system (shortest pipe length)		
Any drinking water standards violations?		
CAPITAL Cost to connect to system amortized: $ per 100 gallons		
Capital cost		
COST of water: $ per 1000 gallons delivered		
QUANTITY of water available from this system		
COST per connection of purchasing all needed water from this source		
Add additional pages for other systems within five miles.		

Feasibility Study Checklist

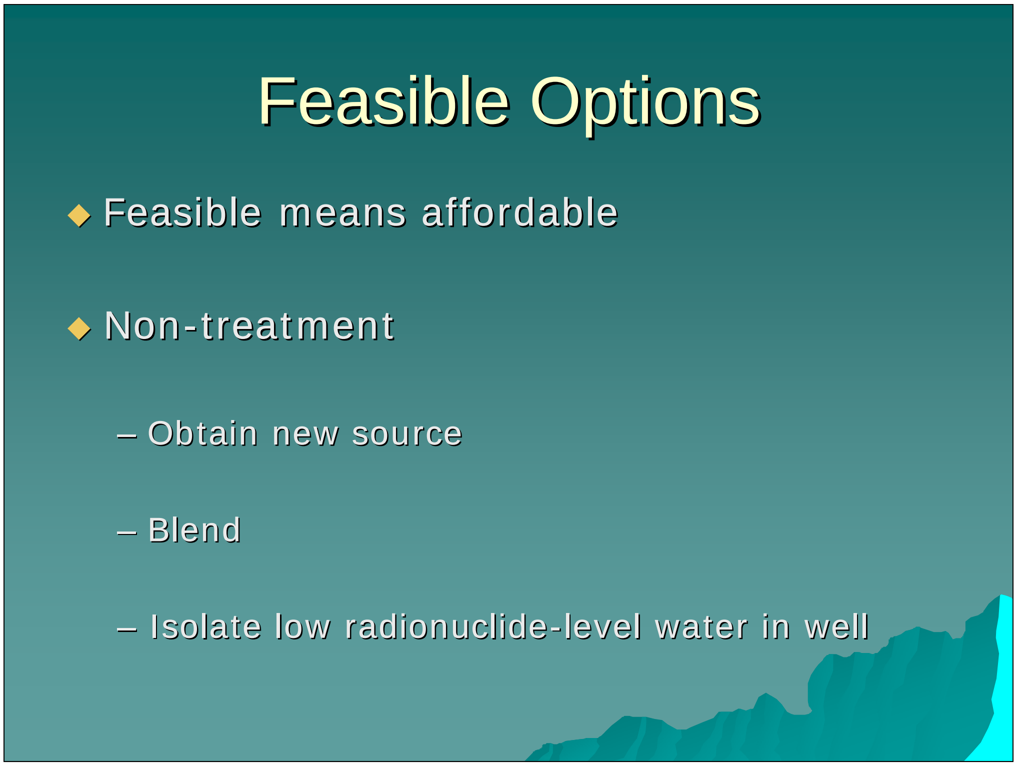
- Treatment Option A
  - Capital cost
  - Operational cost
  - Media replacement
  - Waste disposal cost
- Treatment Option B
  - Same as above



After examining options, PWS will:

Need to develop a plan, including obtaining funding,

of how they can ensure they are in compliance with all TCEQ rules and regulations.



Attached is a poster created by CH2M Hill showing an arsenic project near Norman, Oklahoma. The poster shows the following:

Drilling well

Geophysical logging

Water quality sampling

Installation of a packer assembly

The geophysical log determines the depth of each sand zone.

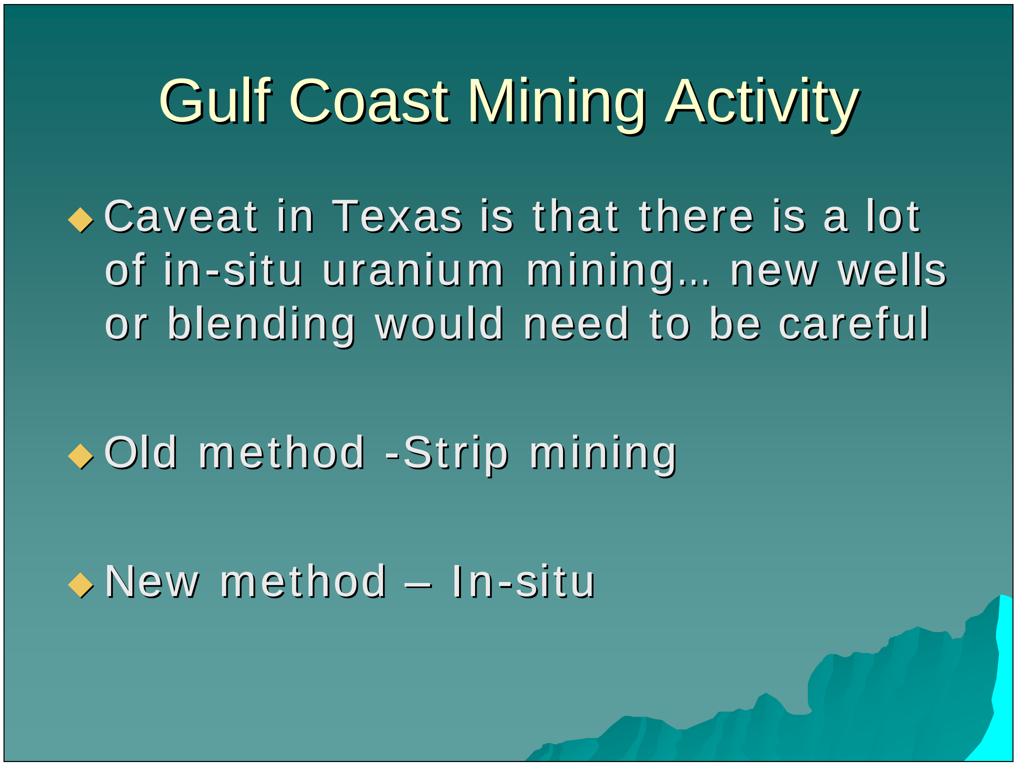
The water quality sampling determines which zones have elevated arsenic concentrations.

The packer assembly is placed at a certain depth so the well would not collect water from zones with elevated arsenic concentrations.

<u>Example</u>

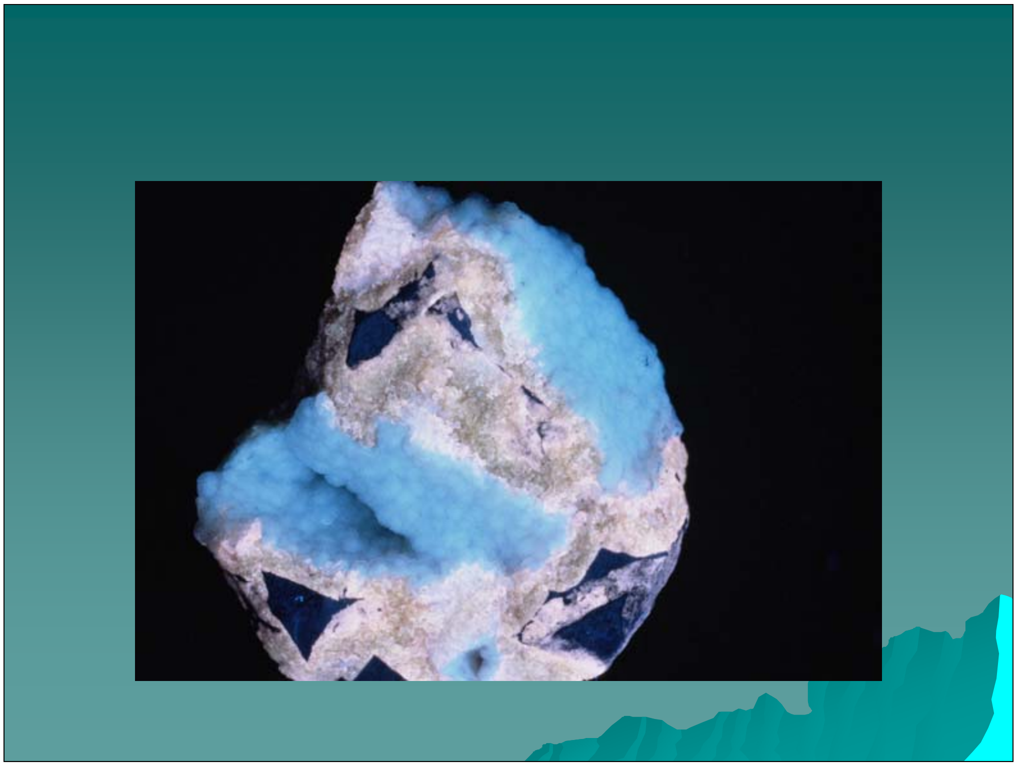
If Zones 1 and 2 have elevated arsenic concentrations.

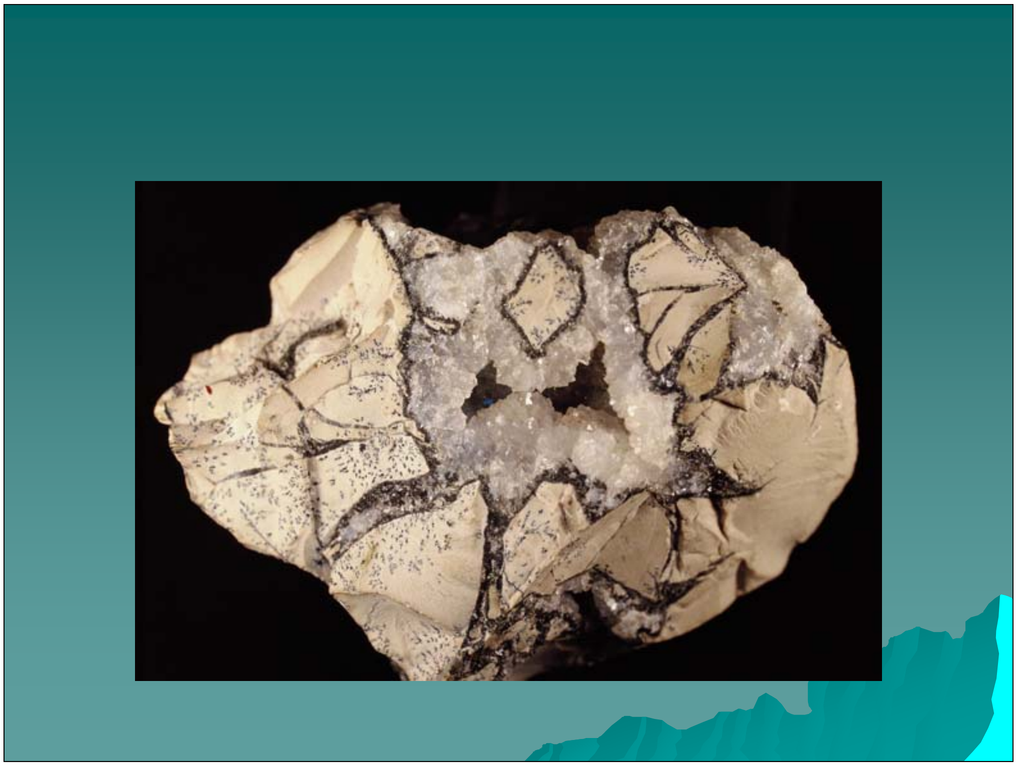
The packer is installed (inside the casing and outside the pipe) below zone 2 and above zone 3.



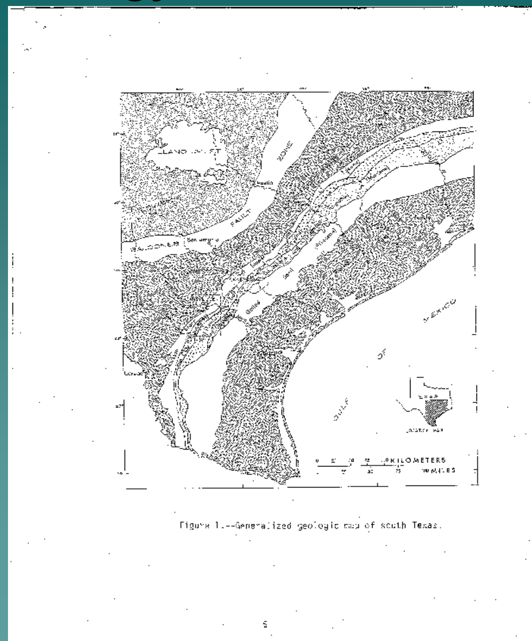
Mining operations have many test wells in area to make sure ‘soluble’ uranium does not go outside capture zone.

Cost of yellow cake is $85.00/lb





Geology of South Texas



Llano Uplift

Edwards Plateau

Balcones Fault Zone

Pre-Jackson Rocks (Eocine, Paleocene, and Upper Cretaceous)

Jackson Group – Karnes Co

Frio Clay (Oligocene) – Karnes Co

Catahoula Tuff (Miocene) – Karnes Co

Oakville Sandstone and Fleming Formation (Miocene) - Karnes Co

Goliad Sand (Pliocene) - Karnes Co

Rocks of Holocene and Pleistocene age

Recovery of Uranium Pit

Railroad Commission for State of Texas has jurisdiction for oil and gas industry wastes.

<u>Recovery an abandoned uranium pit</u>

Grade of 1 to 5

Cost is Millions of Dollars

Feasible Options

- Treatment
  - Centralized
  - Point of use

Lajitas, Texas

EDR unit

Lajitas, Texas

ED is electrochemical separation process in which ions migrate through ion-selective semi-permeable membranes as a result of their attraction to two electrically charged electrodes.

Driving force for ion transfer is direct electric current.

ED is different from RO in that it removes only dissolved inorganics but not particulates, organics, or silica.

EDR is improved form of ED where polarity of direct current is changed every 15 min.

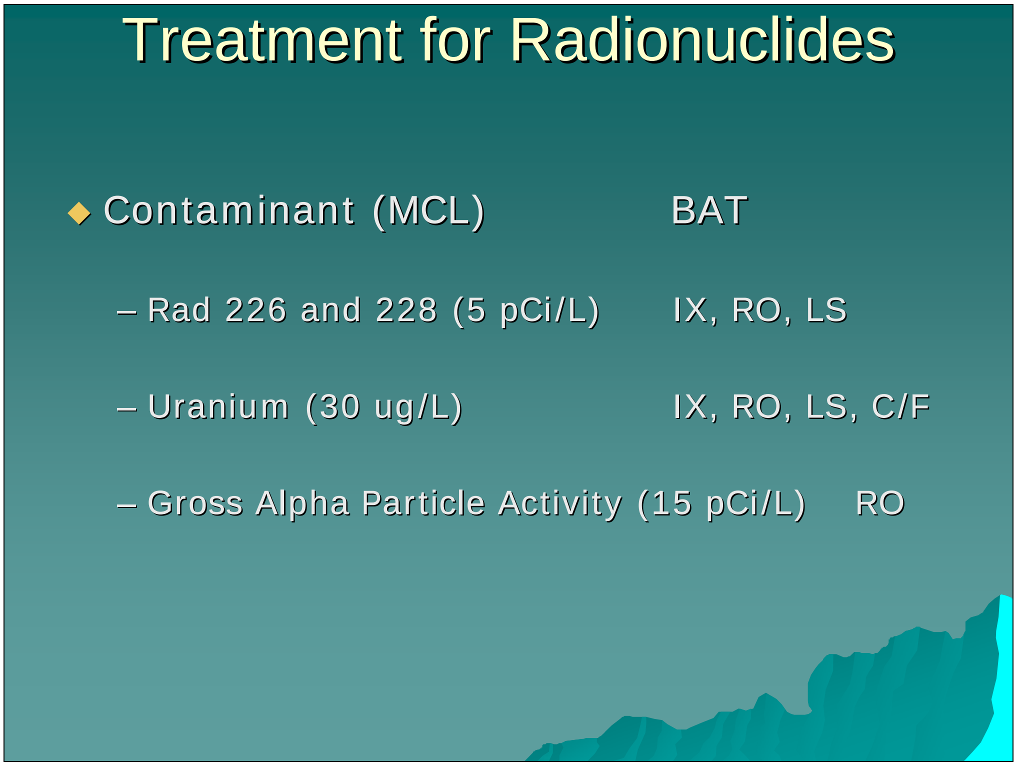
ADV

- Change of polarity reduces formation of scale, fouling films, and, thus achieves higher water recovery.

Disadv

– Expensive, does not remove particulates, organics, or silica.

- Not suitable for high levels of iron, manganese, hydrogen sulfide, and hardness.



NORM radionuclides can be removed from source water by various water treatment techniques:

<u>Uranium removal</u>

Including WRT Z-92

AA

POU/WHT (Adsorption treatment unit)

<u>Radium 226 and 228 Removal</u>

including WRT Z-88 radium specific adsorption resin

ED / EDR

Potassium Permanganate Greensand Filtration

WRT Z-88 process is similar to IX except no regen of resin which is disposed of upon exhaustion.

Z-88 does not remove calcium and magnesium.

Media lasts from 2 – 4 years before replacement.

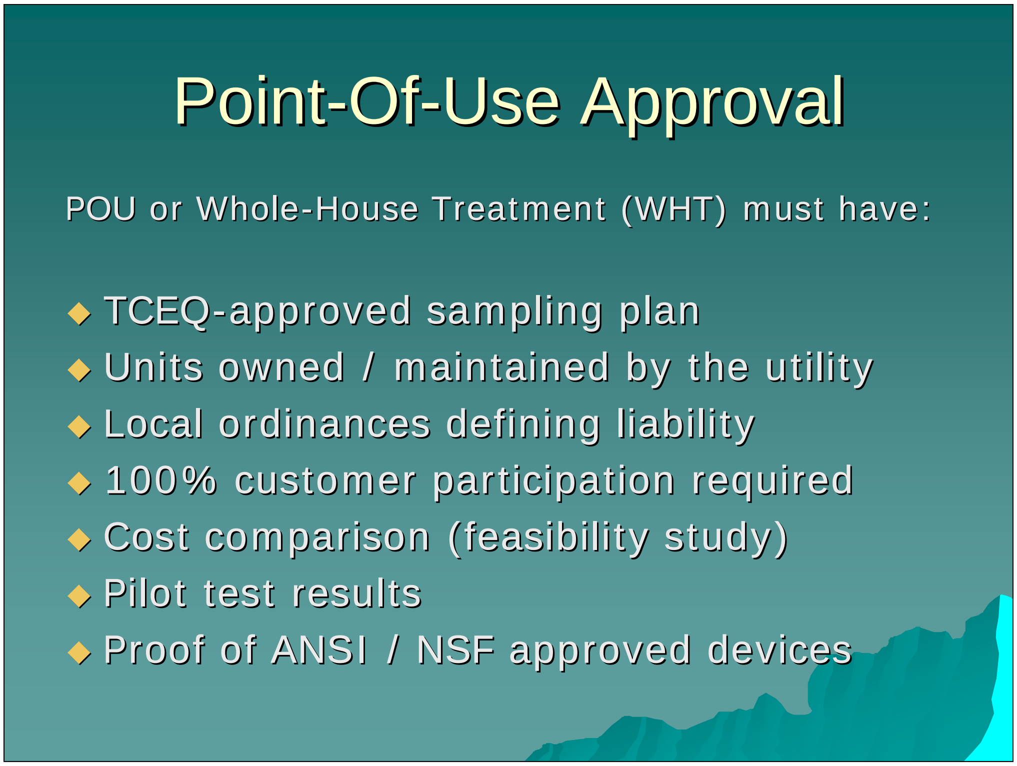
Equipment owned by WRT.

Ownership of spent media transferred to approved disposal site.

Contract - client pays WRT upon treated water unit cost ($.50 - $1.00/1,000 gal).

Uranium removal

WRT Z-92 adsorption media



Caution

Radionuclide concentrations can increase in the POU or WHT filters, so PWS should not slack on maintenance

Uranium removal

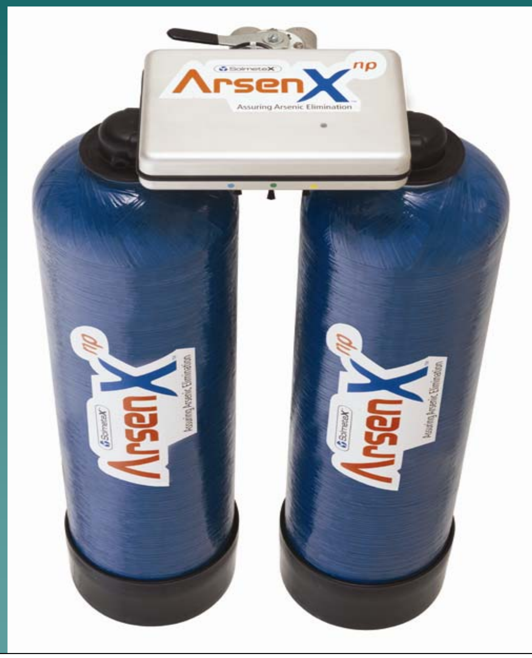
Heavy metal that can cause kidney damage before damage by radiation.

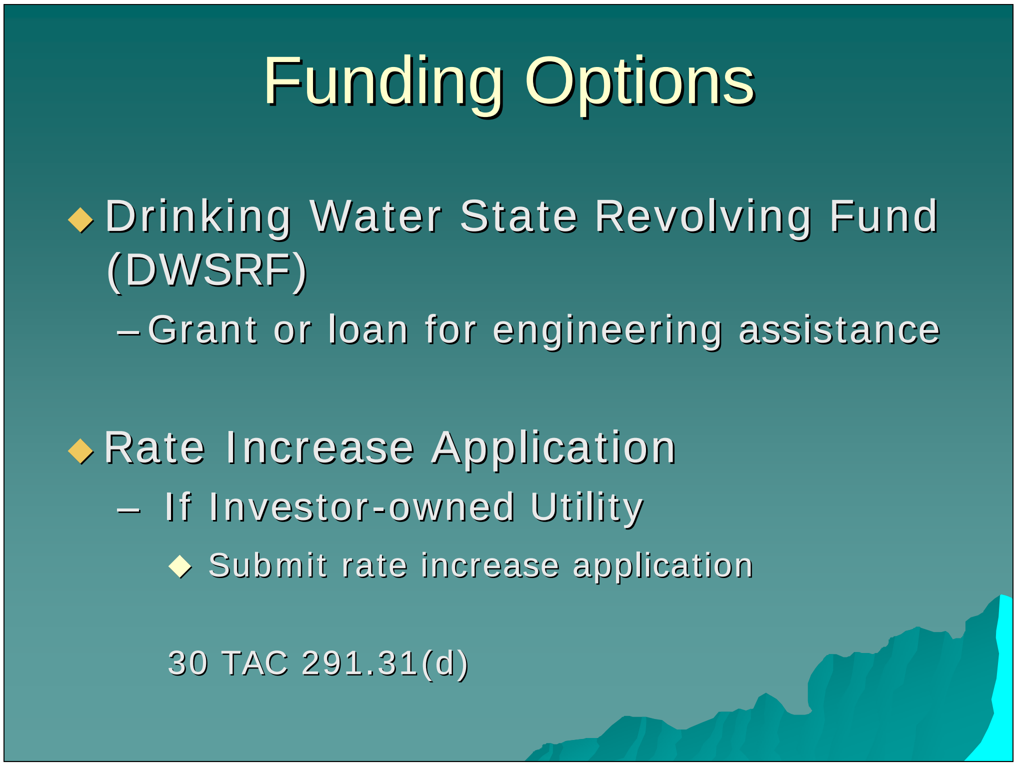
PWS can use small adsorption tmt units installed 'under the sink' (POU) or where water enters home (WHT).

Note:

POU tmt units need to be more complex than units typically found in commercial retail outlets in order to meet regulatory requirements.

Point-Of-Use





To fund an arsenic removal project:

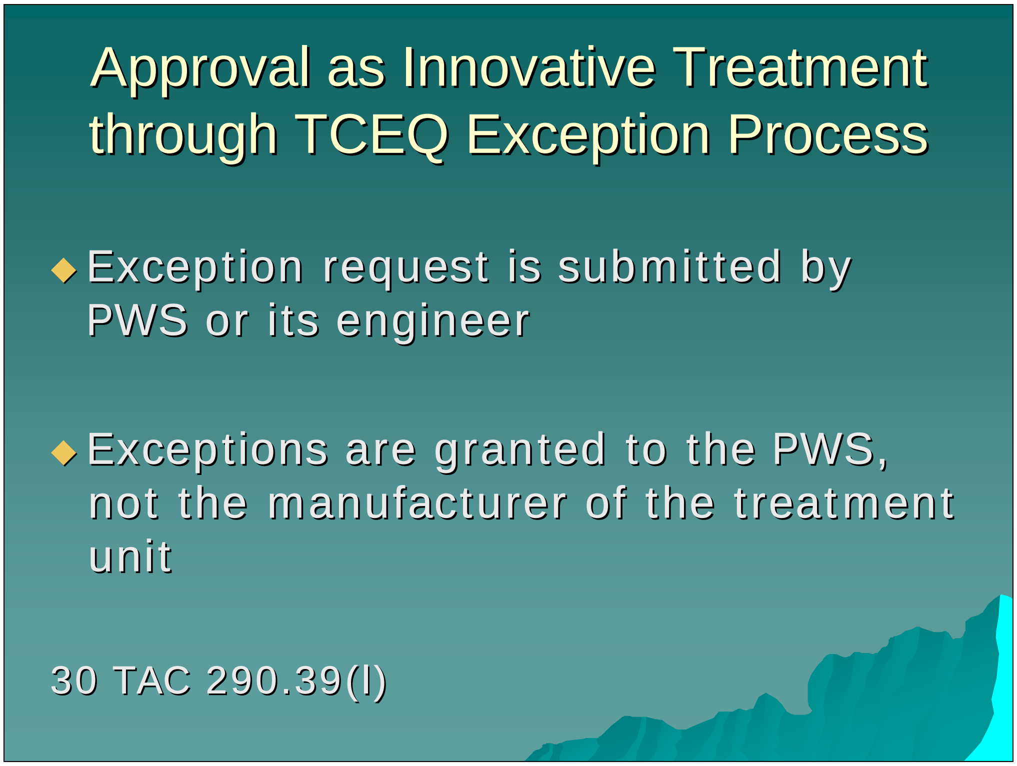
•Apply for grant or loan by completing DWSRF application

If IOU:

•Rate increase application (if applicable)

•Capital improvement surcharge

Rent unit



Exception request submitted to TCEQ and approved:

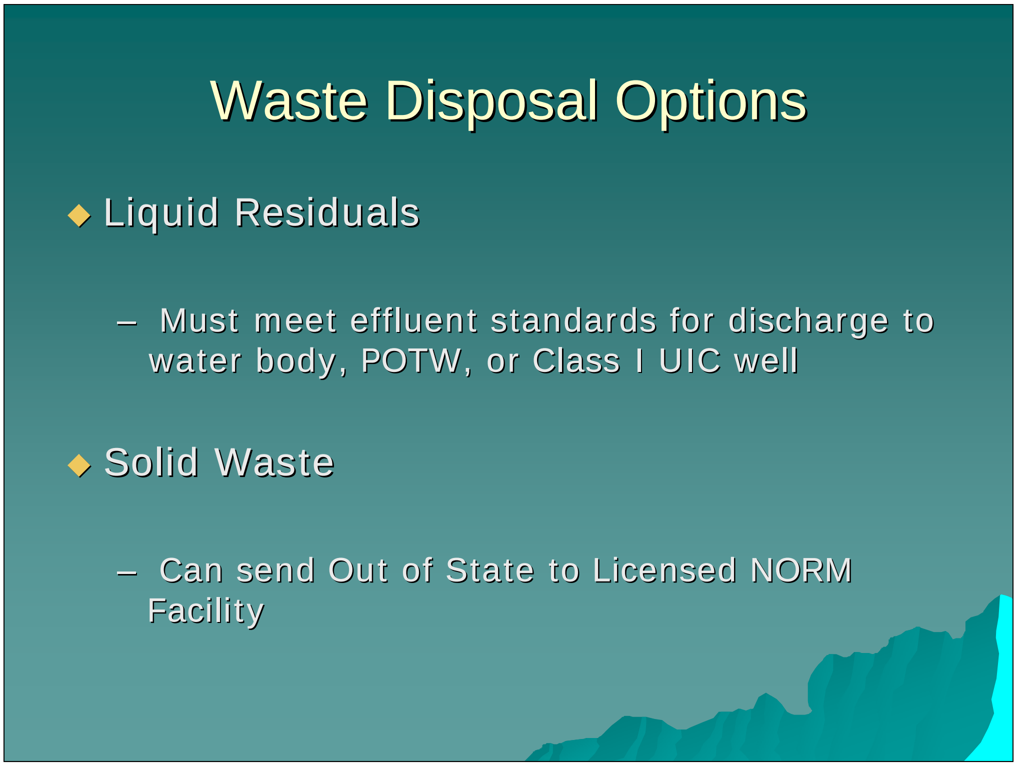
For arsenic removal:

Treatment options
(Adsorption / IX / CF / RO / Hybrid IX – I-B ads)

are considered <u>innovative treatment</u>

For approval from TCEQ, submit

- Exception request with pilot study
- Plans and specifications
- Discharge permit application to TCEQ or POTW
  - Solid
  - Liquid



<u>Disposal options include</u>

Discharge to environment (see D. Helstrom)

Discharge to sanitary sewer system

Deep well injection (See D. Clarke or Bryan Smith)

Disposal Issue

- Method of disposal must be available before PWS will install treatment
- 0 permits issued in Texas for discharge of waste from drinking water facilities
- Two pending permits including Class I well in Winnie, TX - Proposal by Newpark Corp to inject RAD waste into salt dome; Class V well in Lajitas, TX
- Confining layer separates RADs from aquifer

Disposal Issues of Ion Exchange and Activated Alumina

- Regeneration solution and removed solids contains high concentrations of contaminant ions
- Consider disposal options before choosing either of these compliance technologies

Summary

- Radionuclides are naturally-occurring in TX
- Uranium regulation recently revised
- New regs = increased violations
- Multiple compliance options – reviewed through feasibility study
- Radionuclide concentrations can increase in the POU/ WHT filters, so PWS should perform maintenance
- Treatment options limited by cost of treatment and disposal of waste

Agency Assistance

Drinking Water Quality Team

Public Drinking Water Section

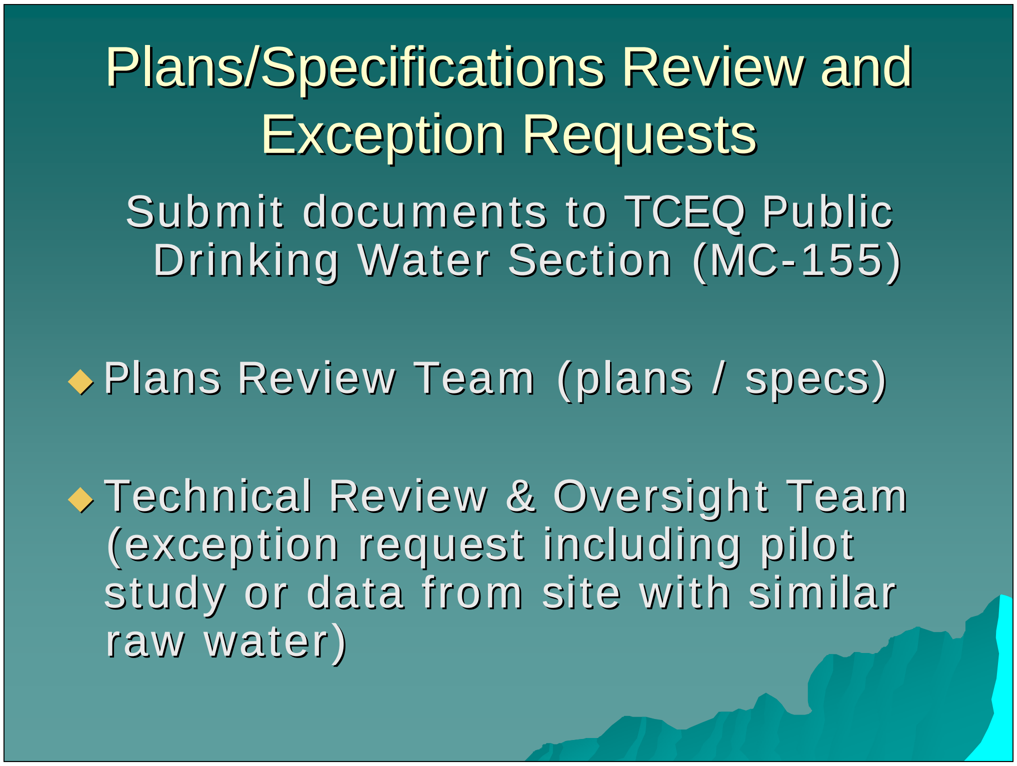
(512) 239-4691

http://www.tceq.state.tx.us

TCEQ Contacts

- Land Application of Sludge
  (512) 239-3410
- Industrial Wastewater
  (512) 239-4671
- Municipal Solid Waste
  (512) 239-2334
- Industrial / Hazardous Waste
  (512) 239-6412


BONUS SLIDES



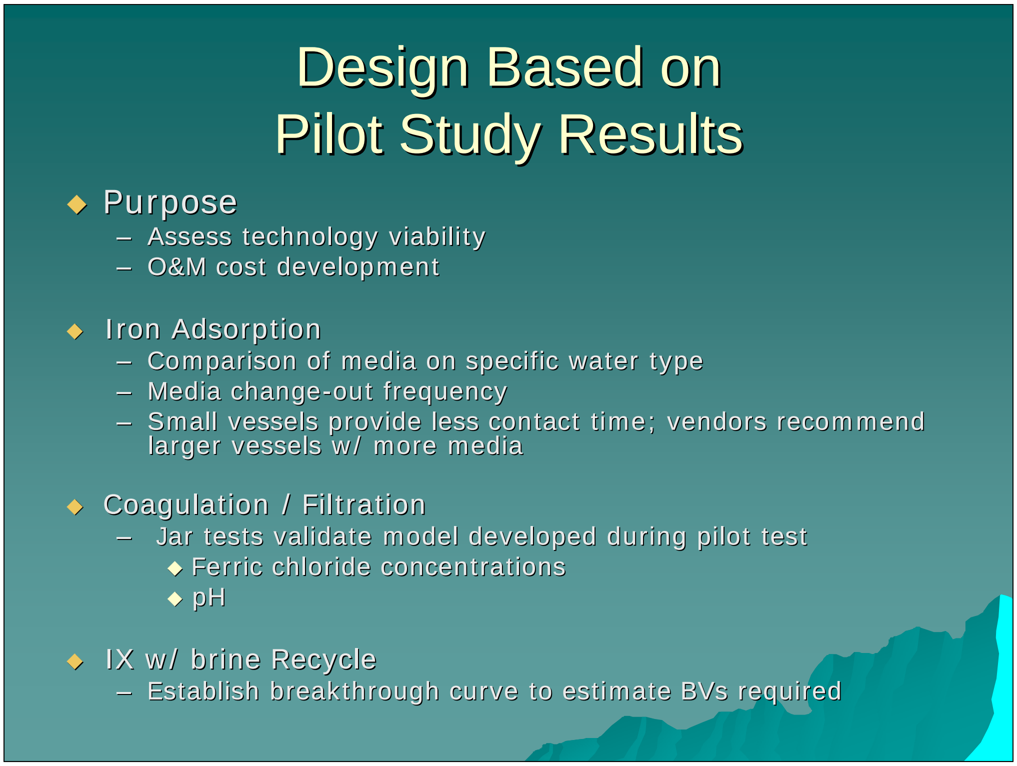
Engineer or PWS submits to PDW section:

•Exception request w/ 90 day pilot study report, or

•Data from site with similar raw water (TROT)

Once exception granted:

•Engineer submits signed and sealed plans and specs (Plans Review)



Results of pilot study:

- Assess technology viability
- O&M cost development
- Comparison of media on specific water type
- Media change-out frequency

Adsorption

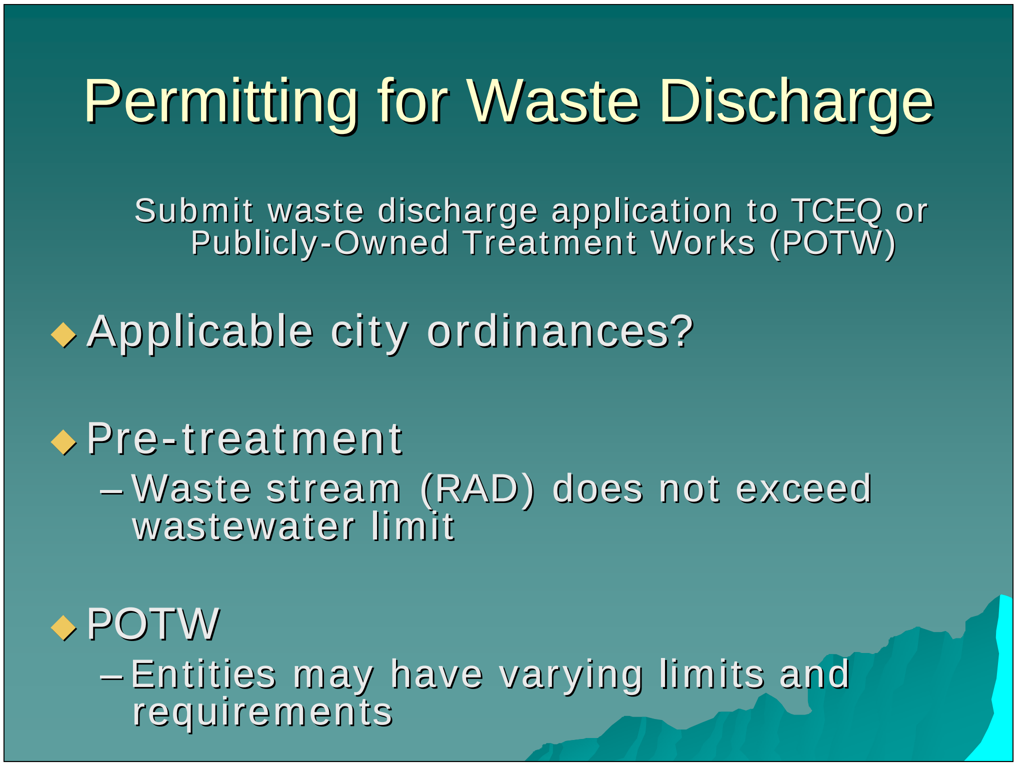
- Estimate media life

Coagulation / Filtration

- Jar tests validate model developed during pilot test
  - Ferric chloride concentrations
  - Optimal pH

IX w/ brine Recycle

- Establish breakthrough curve to estimate BVs required
- Small vessels provide less contact time
- Vendors recommend larger vessels w/ more media



Submit application for permit of waste discharge to:

TCEQ, or

Publicly-Owned Treatment Works (POTW)

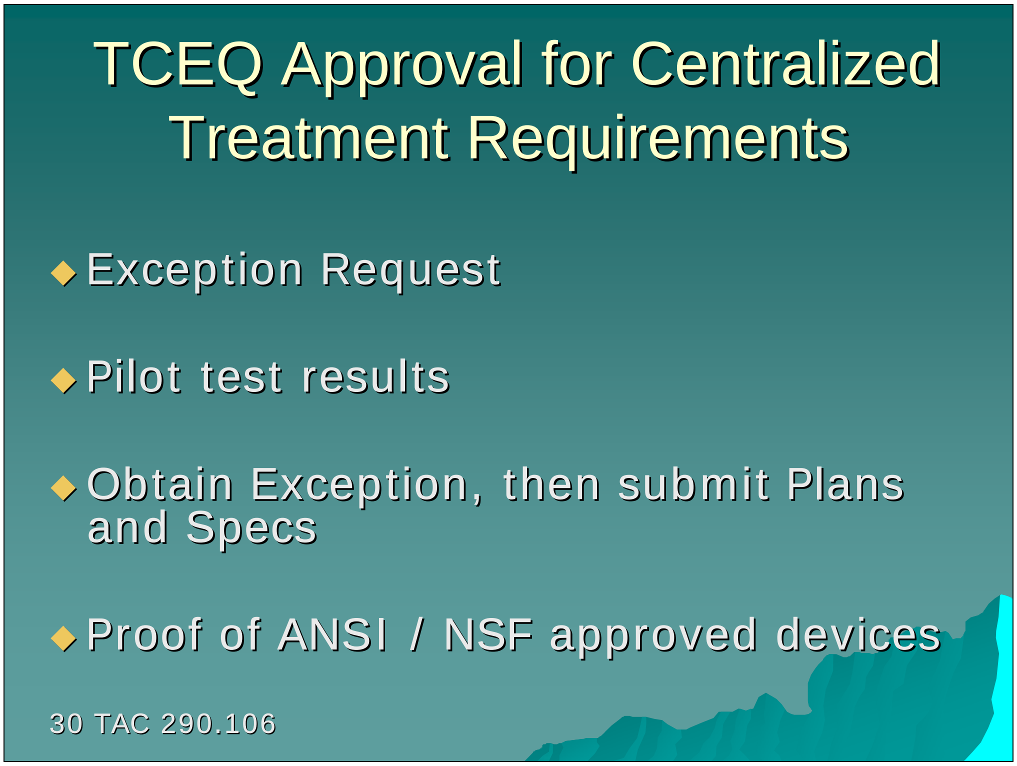
Are their city ordinances that prohibit activity?

<u>Is pre-treatment necessary to ensure arsenic in waste stream does not exceed wastewater limit?</u>

<u>Each POTW may have limits and requirements on arsenic concentration based on method of sludge disposal:</u>

Landfill (can receive higher As conc)

Land applied sludge (cannot receive high As conc)

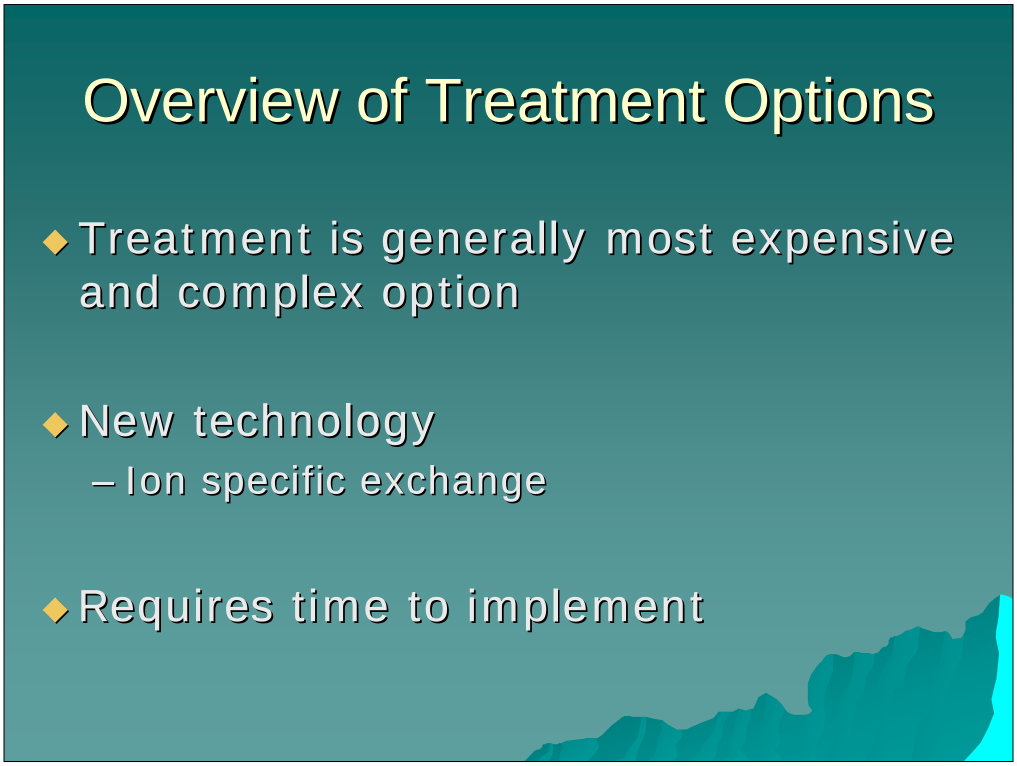


Items to be submitted to TCEQ for approval:

Exception and pilot study results

Plans and spec approval

Proof and ANSI / NSF approved devices



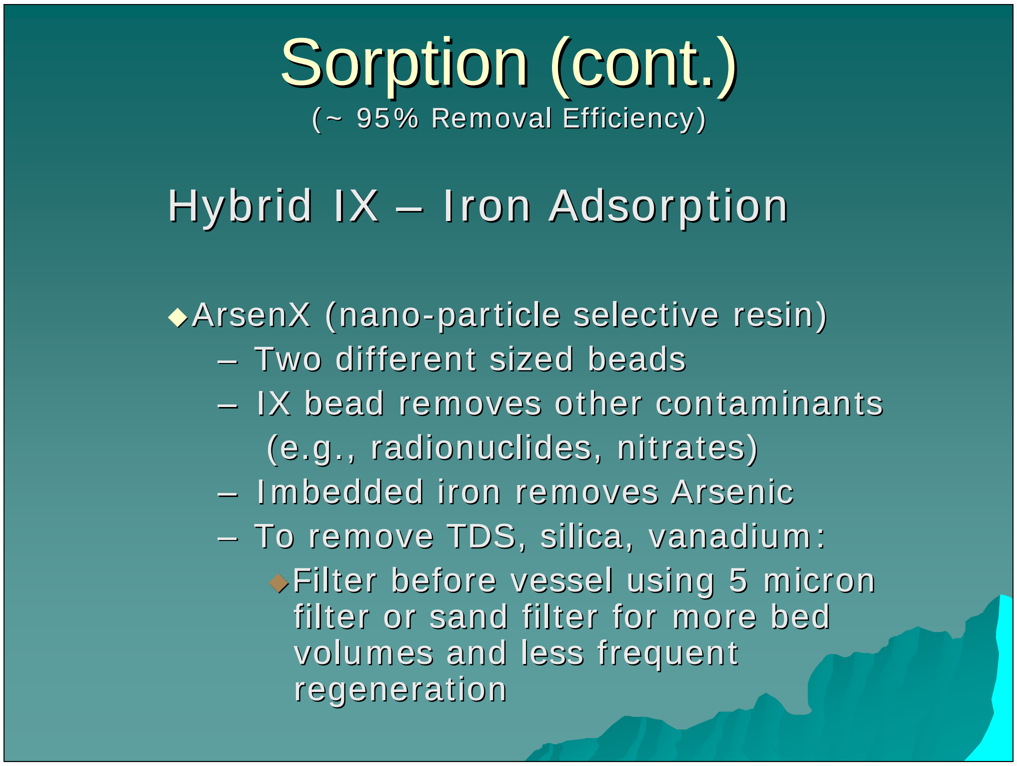
$ to comply w/ revised rule

Small systems face challenges due to:

Practicality of implementation / Logistics / Funding from reduced customer base

Blending (if system has two water sources)

New tmt options



New technology

Hybrid IX – Iron-based adsorption media

Two different sized beads

Imbedded iron removes Arsenic

IX bead removes other contaminants (rads / nitrates)