

**Class III *In Situ* Uranium
Injection Wells and Aquifer
Exemptions in Texas: Multiple
Levels of Permitting Protection
for USDW Protection**

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Historical

- Uranium discovered in South Texas in 1954
- Surface mining began in 1960 in Karnes County; currently no active surface mines
- First *in situ* mining permit issued in 1975 by the Texas Water Quality Board (predecessor agency to TCEQ)

UIC Authorization

- Texas has an EPA-approved Underground Injection Control (UIC) Program
- EPA granted Texas primacy for its UIC program in 1982
- Primacy is for Class I-V wells
- TCEQ regulates Class I, III, IV and V UIC Wells
- Railroad Commission of Texas regulates Class II and certain Class III UIC wells

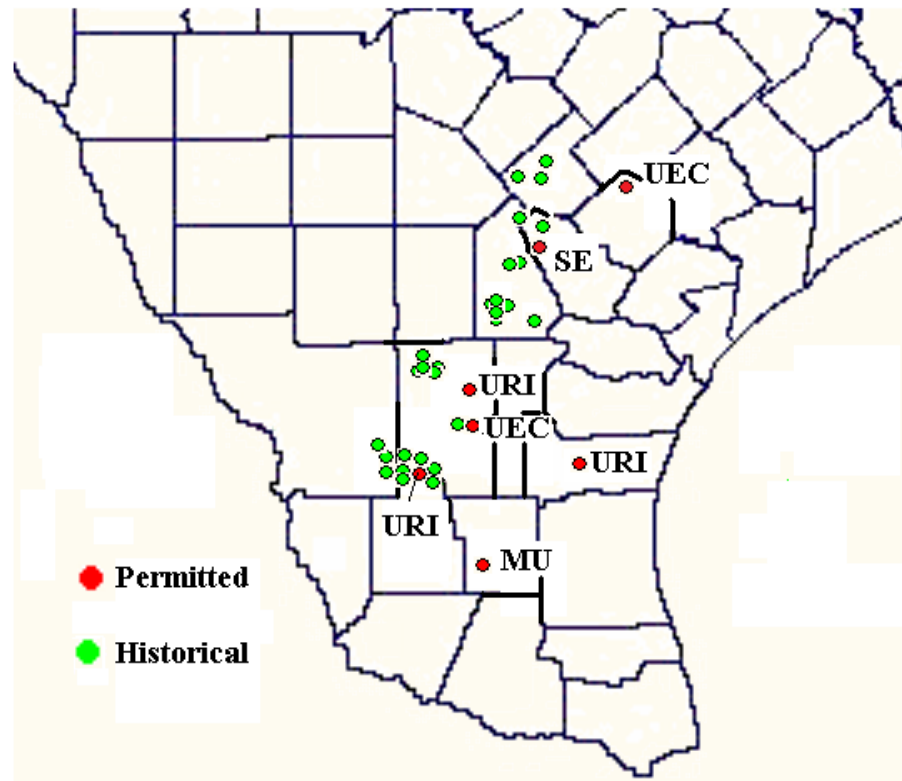
Class III Permits

- 39 permits issued for *in situ* uranium mining since 1975
- 94 Production Areas authorized within 39 area permits since 1975
- Seven active permits; 20 production areas at present time

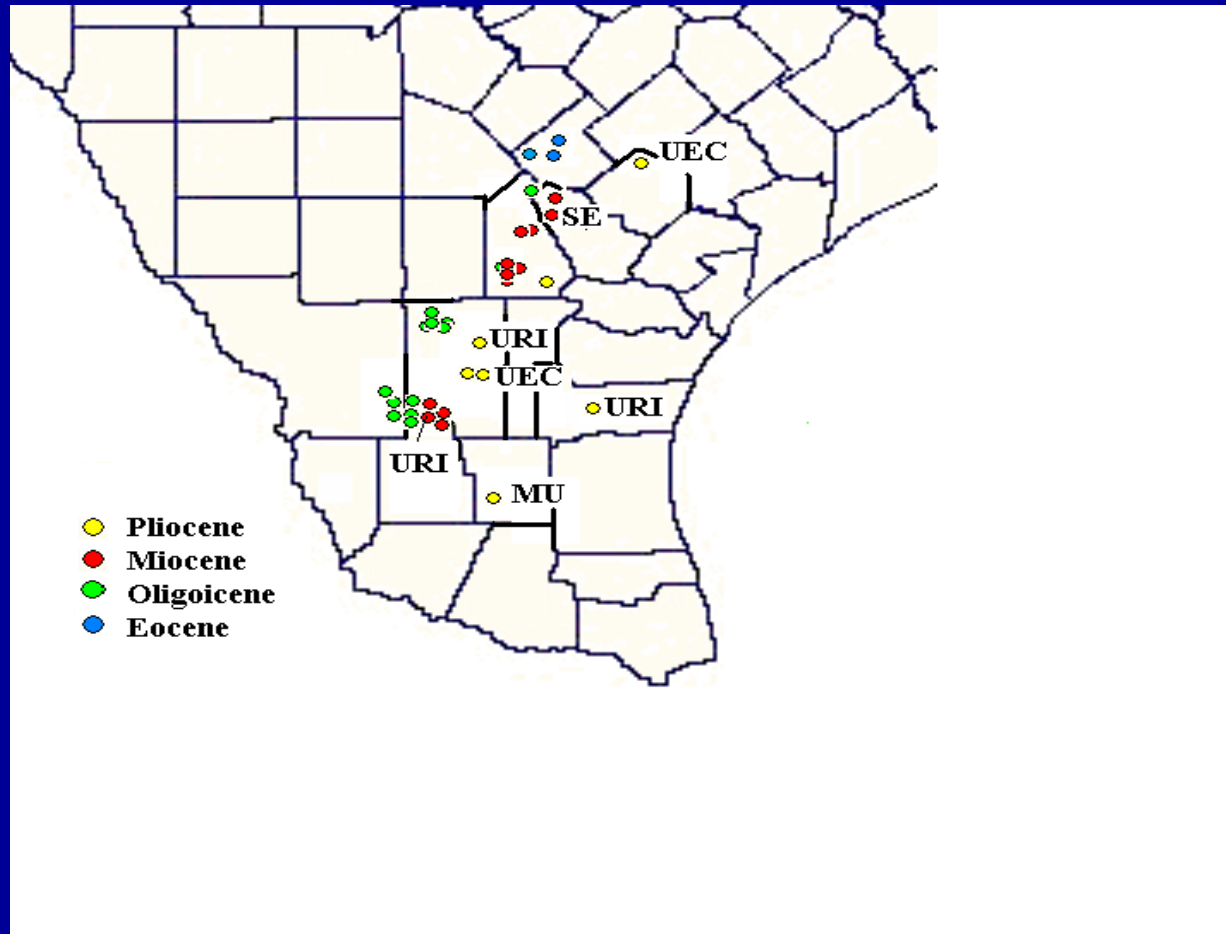
Active Permits

- URI Kingsville Dome, Kleberg Co. (1986)
- URI Rosita, Duval Co. (1987)
- URI Vasquez, Duval Co. (1997)
- Mesteña Alta Mesa, Brooks Co. (2000)
- UEC/STMV La Palangana, Duval Co. (2008)
- Signal Equities Brevard, Bee/Live Oak County (2010)
- UEC Goliad Project, Goliad Co. (2011)

In Situ Uranium Mining Sites



Geologic Age of Mineralized Unit



Class III Injection Wells

Class III – injection wells used for *in situ* recovery of minerals

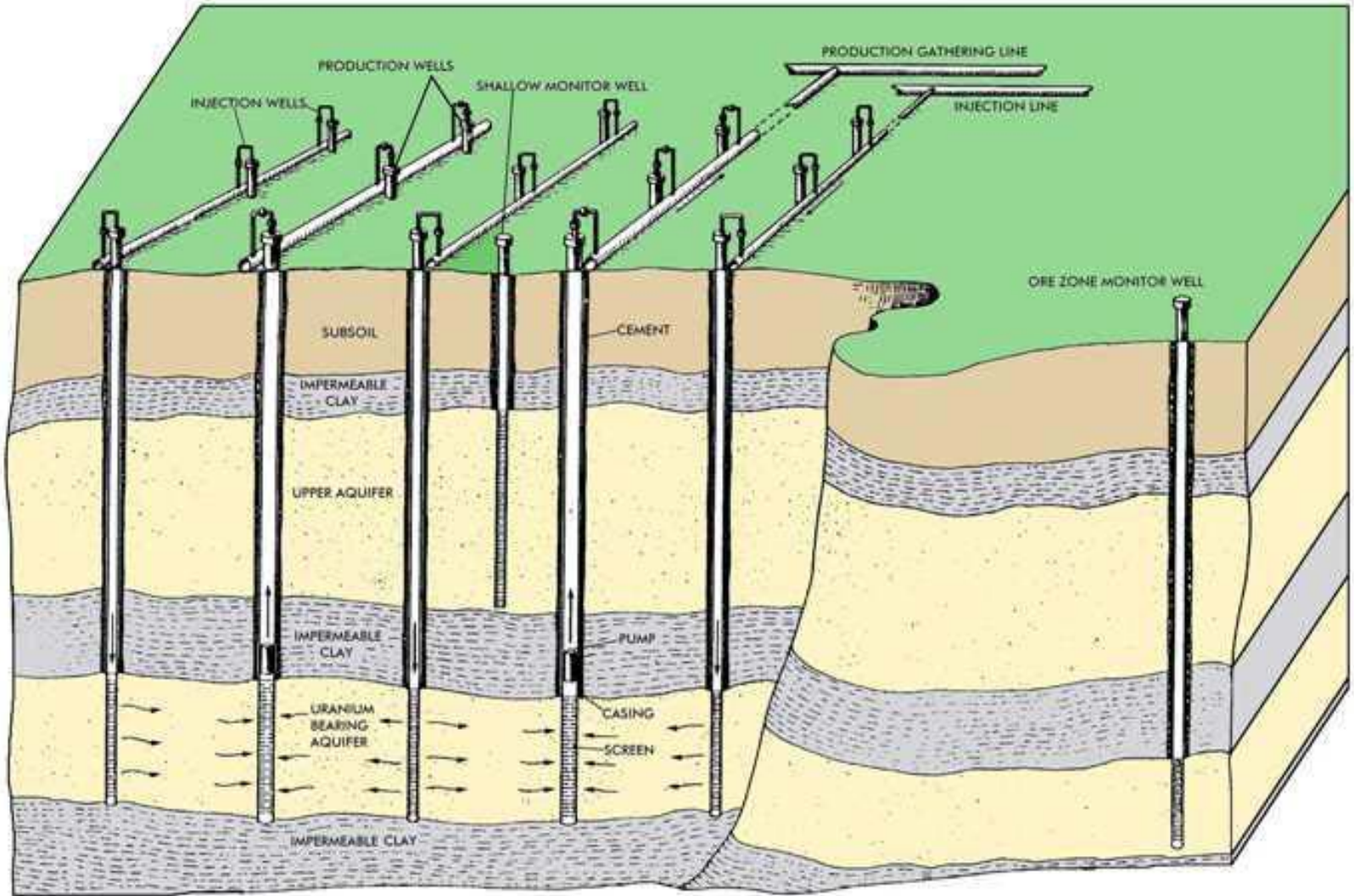
In Texas, Class III wells have been used to recover uranium, sodium sulfate, and sulfur

Currently in Texas, only uranium is being mined using Class III wells

In Situ Uranium Mining

- Uses a network of injection and production wells completed in a subsurface ore zone
- Injects oxygenated water (sometimes with added sodium carbonate and/or small amounts of acid) into the ore zone to dissolve uranium
- Pumps the uranium-bearing solution to the land surface for recovery and processing into the product “yellow cake” (U_3O_8)
- Recycles the mining process water back into the ore zone for recovery of more uranium

Block Diagram of *In Situ* Uranium Mining Operation



In Situ Uranium Jurisdiction

- Texas Railroad Commission (TRRC):
Issues permits for exploration wells
- Texas Commission on Environmental Quality
Class III UIC Permits, Production Area Authorizations, and associated Aquifer Exemptions

Additional TCEQ Programs that apply at an *In Situ* Site

- Class I UIC injection wells for disposal of wastewater generated during mining process (Radioactive Materials Division)
- Air Quality Permitting (Air Permitting Division)
- Radioactive Materials License for Processing facility (Radioactive Materials Division)

Statutory and Regulatory Basis

- For *In Situ* mining:
- Texas Water Code, Chapter 27
- Title 30 of the Texas Administrative Code, Chapter 331:

Standards for Class III wells:

§§ 331.81 – 331.86; 331.122

Standards for Production Area

Authorizations: §§ 331.101 – 331.109

Statutory and Regulatory Basis

For storage and processing facility:

- Texas Health and Safety, Chapter 401
- Title 30 of the Texas Administrative Code, Chapter 336

Underground Source of Drinking Water (USDW)

An aquifer or a portion of an aquifer that:
supplies drinking water for human consumption; or
in which the groundwater contains fewer than 10,000 milligrams per liter of total dissolved solids, and
is not an exempted aquifer

Basic Requirements of UIC Rules

- Pollution of USDWs by an injection well is prohibited.
- All injection wells must have permits or other authorization.
- Permits shall require any necessary conditions to prevent pollution of USDWs.
- Permits shall require financial assurance for well closure.
- Public participation and opportunity for contested case hearing is required in decisions on permits, production area authorizations, and aquifer exemptions.

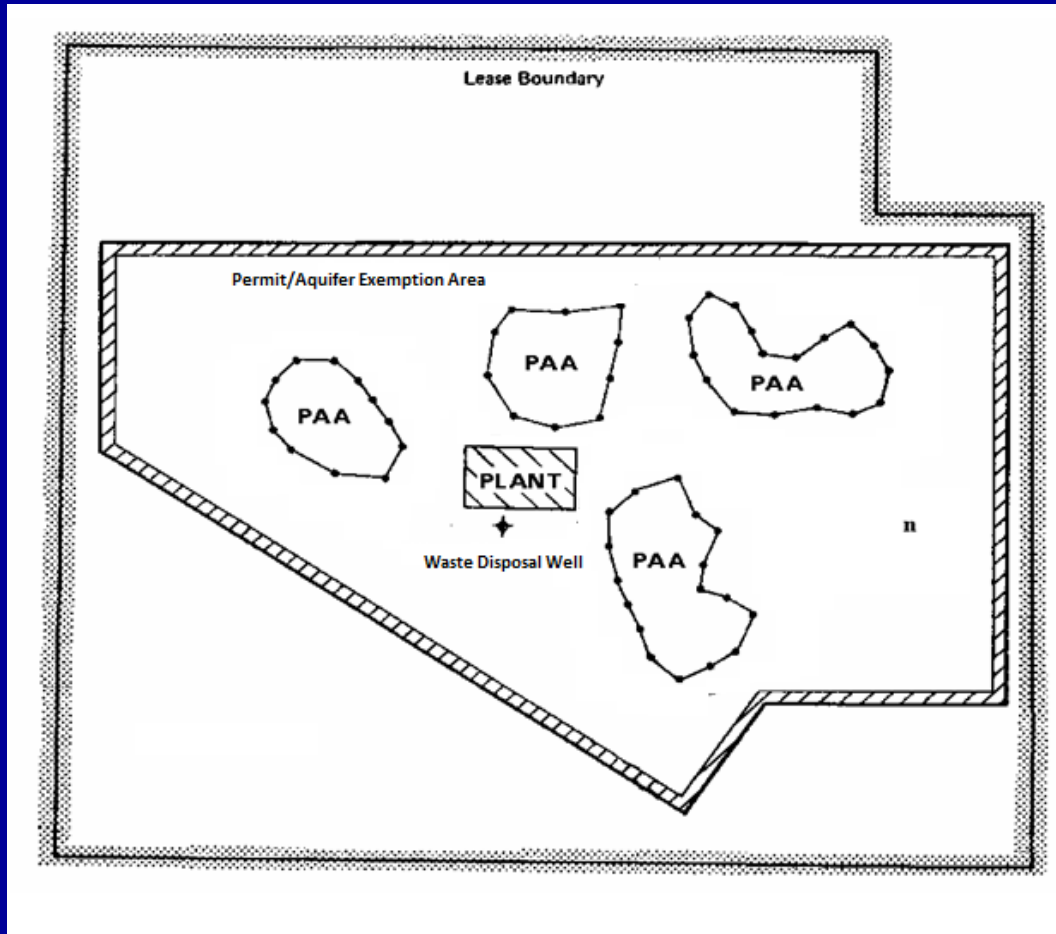
Mining Authorization Process

Two-step Process:

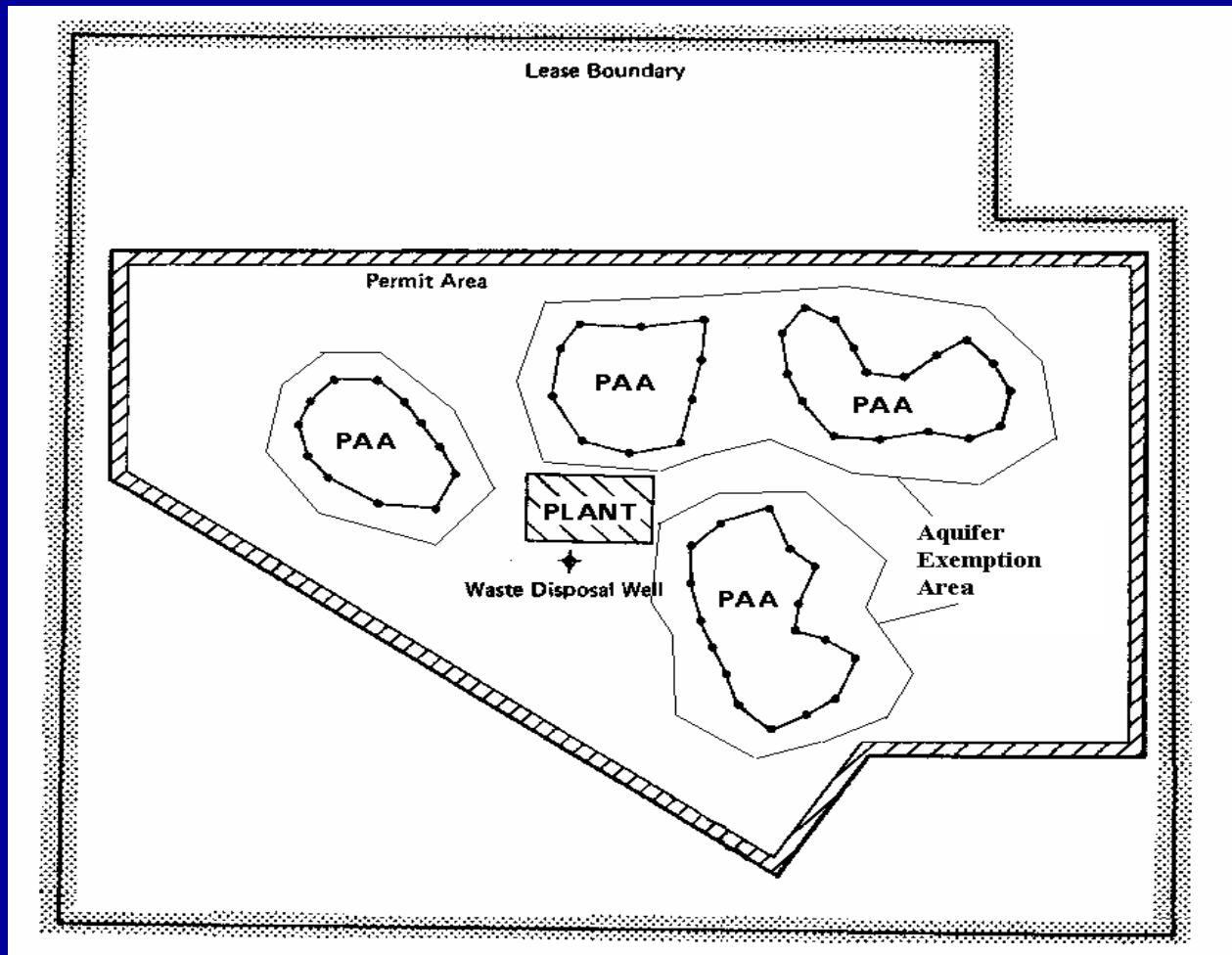
Class III Well Area Permit

Production Area Authorization for each
ore body

Mine Area Schematic



Mine Area Schematic



Area Permits

- One permit issued for a defined area comprising the mine
- Multiple Class III wells authorized within defined area
- Wells are of similar design and operation
- Single operator for all wells

Permit Information

- Regional and local geology and hydrogeology
- Proposed well design, completion, and testing
- Proposed hydrologic testing program
- Proposed Mine Plan
- Proposed restoration procedures
- Aquifer Exemption

Production Area Authorization

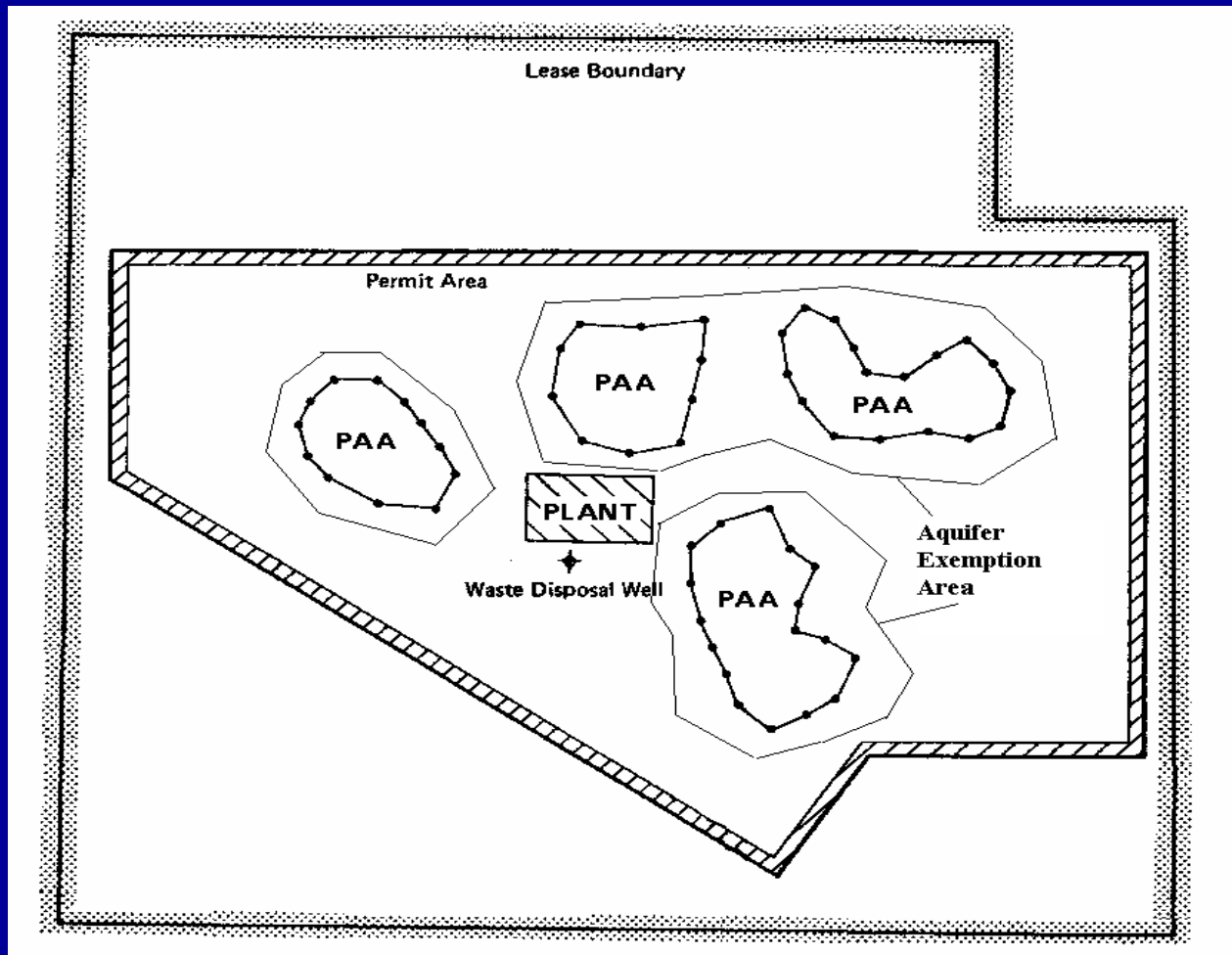
A document, issued under the terms of a class III injection well permit, approving the initiation of mining activities in a specified production area within a permit area.

Several PAAs may be issued under a single Class III well area permit.

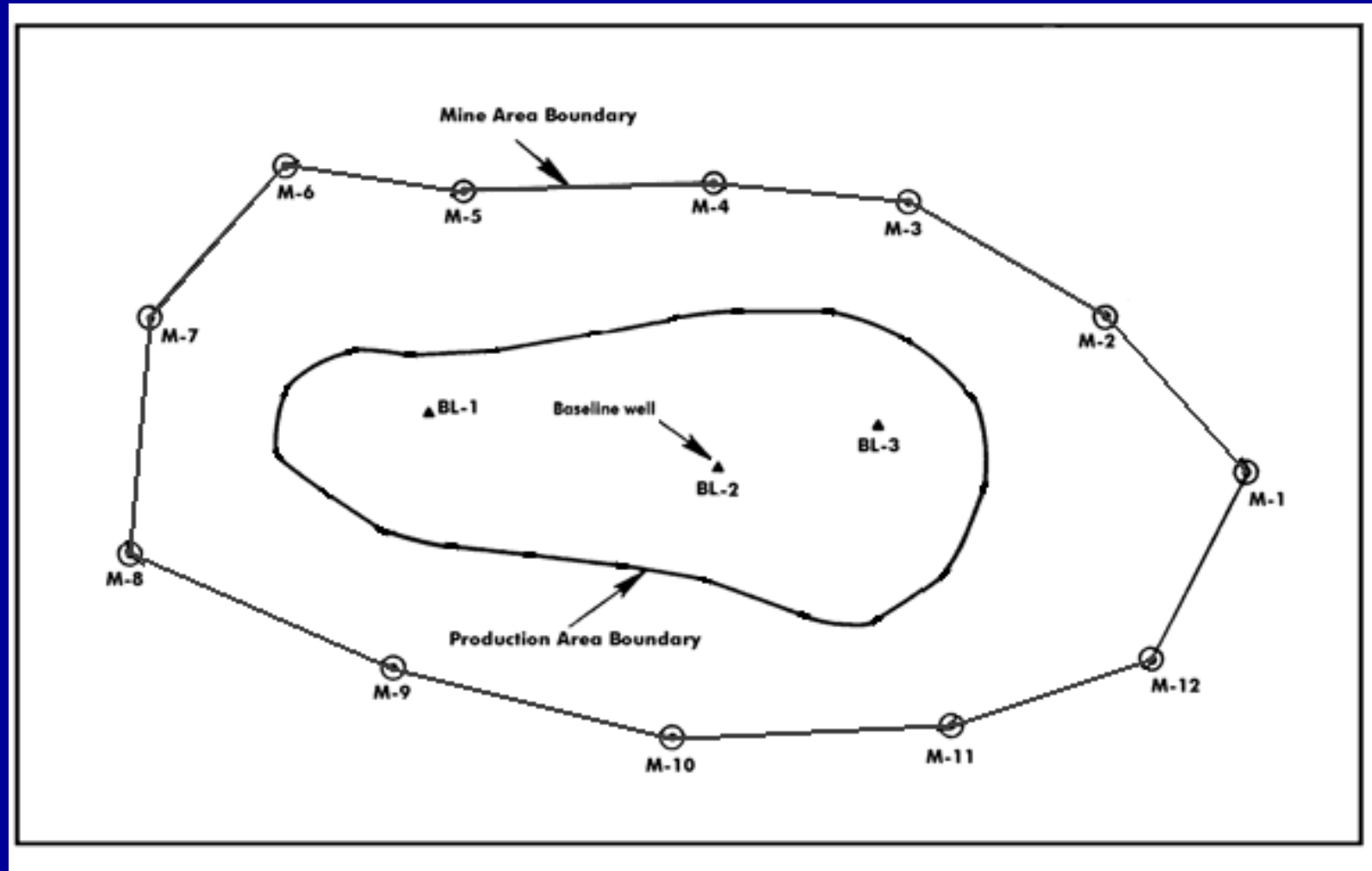
PAA Information

- Production area geology and hydrogeology
- Monitor wells
- Update Mine Plan
- Proposed Restoration Table
- Production Area map
- Proposed control parameters for groundwater monitoring
- Hydrologic Testing
- Financial Assurance

Mine Area Schematic



Schematic Plan View of Production Area Authorizations with Typical Well Arrays



Public Participation

- Notice of applications for permits and PAAs, and aquifer exemption requests published in local newspaper
- Notice mailed to landowners and mineral owners
- Notice mailed to adjacent landowners and mineral owners
- Notice mailed to government officials and interested parties

Public Participation

- Notice provides opportunity to comment on applications
- Comments are addressed in a Response to Comments that is sent to all commenters
- Notice provides opportunity to request a contested case hearing

Public Participation

- All hearings requests considered by TCEQ Commissioners
- If request is granted, case is referred to State Office of Administrative Hearings (SOAH)
- SOAH appoints an Administrative Law Judge (ALJ) to conduct hearing

Public Participation

- ALJ determines parties to hearing
- ALJ sets hearing schedule, including discovery period, and place and duration of hearing
- After conclusion of hearing ALJ issues a Proposal for Decision (PFD)
- PFD provides ALJ's recommendations to TCEQ Commissioners

Public Participation

- TCEQ Commissioners consider recommendations in ALJ's PFD
- TCEQ Commissioners make final decision on applications
- Any hearing party may request TCEQ Commissioners reconsider their decision
- Any Party may challenge TCEQ Commissioner's decision in court

South Texas Uranium

To date, all uranium deposits mined in South Texas using *in situ* methods occur in USDWs, although the water within the mineralized zones does not meet primary drinking water standards without treatment.

At each of these sites, prior to mining, the area and zone to be mined required an exemption of the production zone from classification as a USDW.

Exempted Aquifer

An aquifer or a portion of an aquifer that meets the criteria for a USDW, but which has been exempted from being a USDW in order to allow for injection of fluids.

40 CFR §146.4

30 TAC §331.13

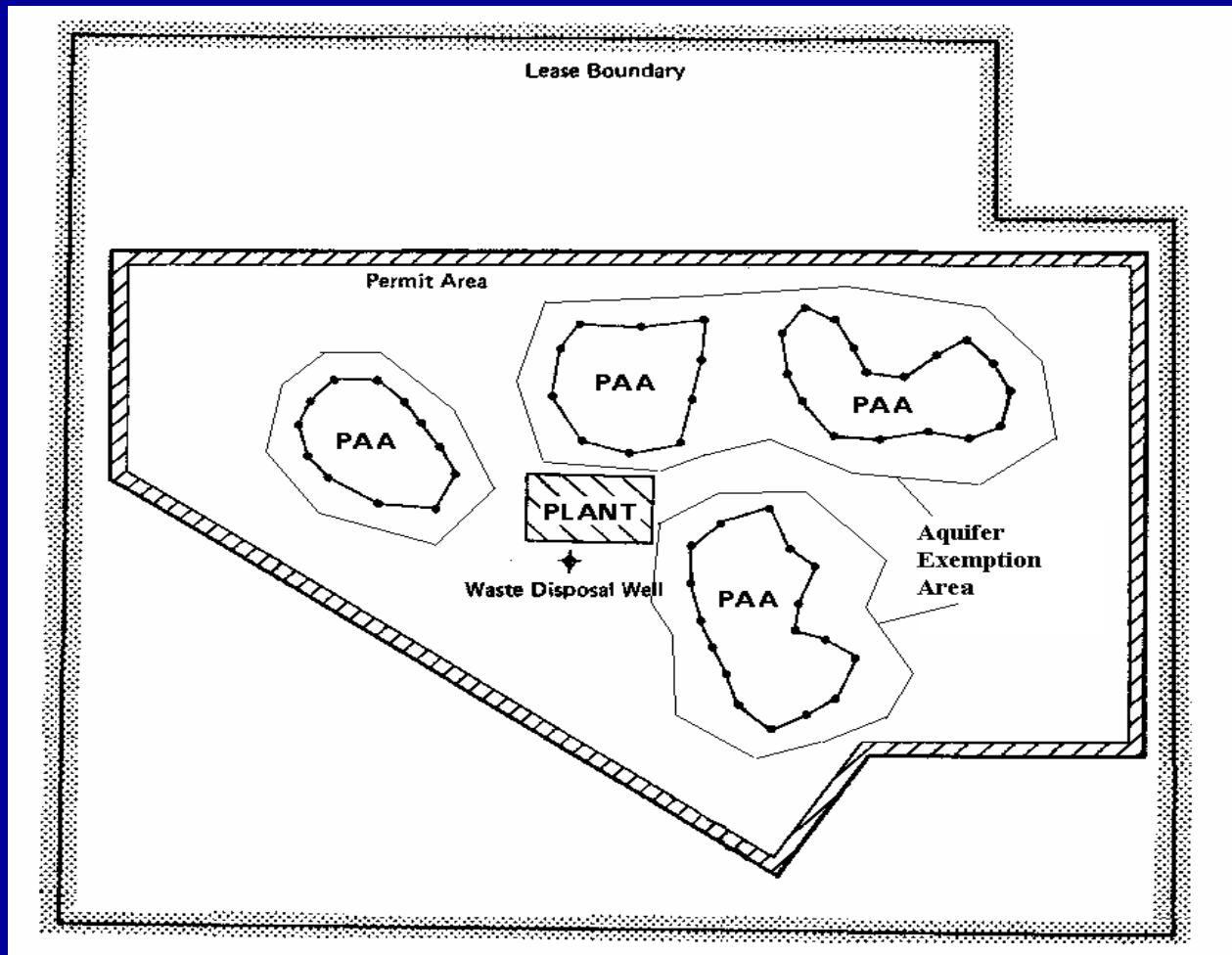
Aquifer Exemption Criteria

- Water is not currently used for drinking, and
- Until the quality of the ground water is restored and the exempt status is removed, water will not be used for drinking because of its mineral or geothermal character, its depth or location, or its pre-existing contamination renders it impractical for treatment to make it fit for drinking.

Issuance of Aquifer Exemptions

- Requires approval by TCEQ and EPA
- Removes the specified portion of the aquifer from definition and regulation as a USDW
- Is a necessary complement to a UIC permit and production area authorizations before *in situ* uranium mining may begin

Mine Area Schematic



USDW Protection

TCEQ permitting program is designed to protect USDWs from contamination

In situ uranium mining fluids results in an increase in the concentrations of certain constituents (such as uranium, radium, and arsenic) in groundwater

An aquifer exemption is needed for mining

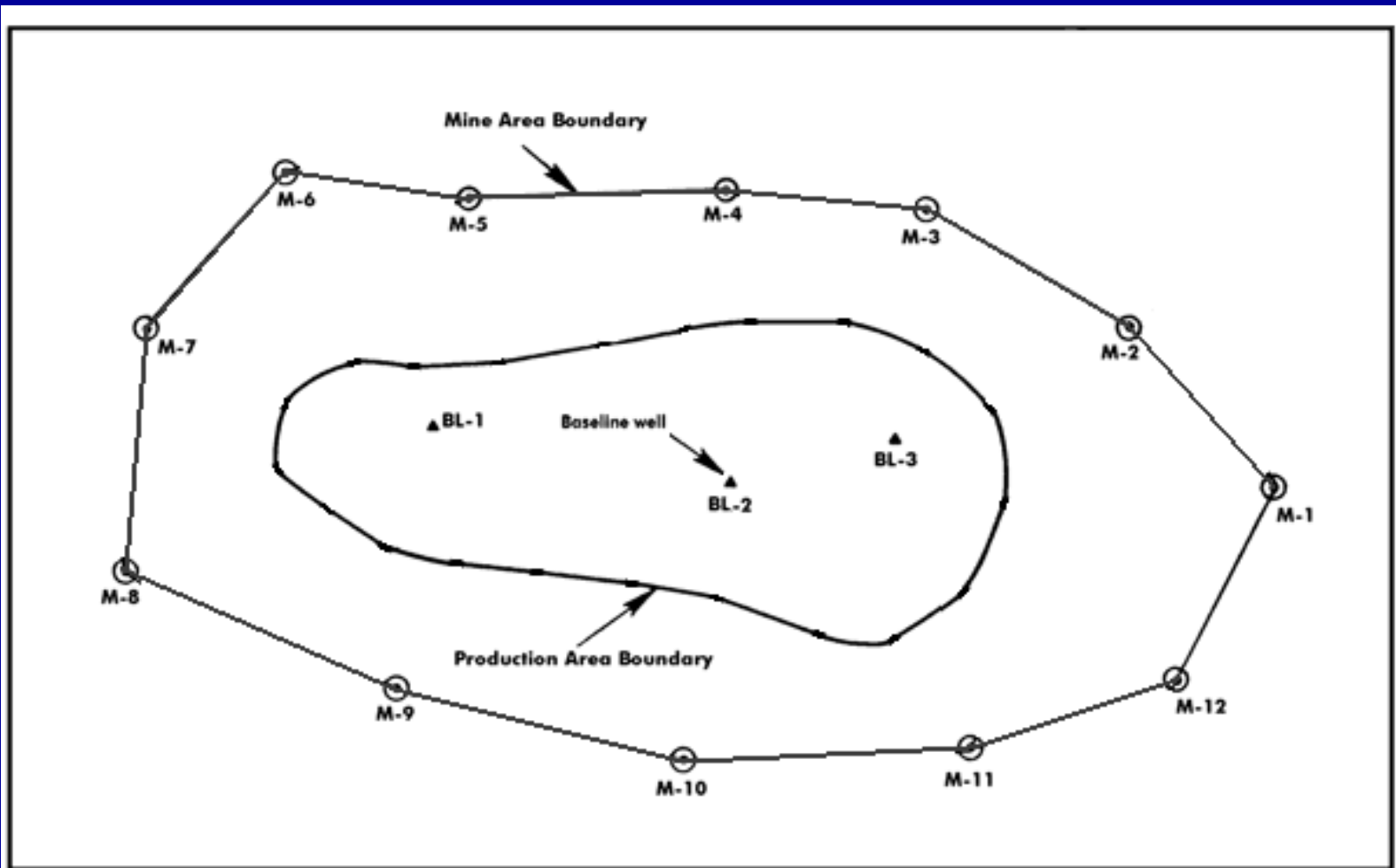
USDW Protection at *In Situ* Uranium Mining Sites

- Mining fluids must be confined to production zone of mine area; operator pumps more water than is injected to direct flow of mining fluids from injection well to production wells
- Production zone and non-production zone monitor wells are sampled during mining and aquifer restoration to detect any excursions of mining fluids

USDW Protection at *In Situ* Uranium Mining Sites

If groundwater monitoring indicates movement of injected mining fluids out of the production zone of the production area, operator is required to initiate procedures to reverse this movement; increased sampling frequency is required until excursion is remediated

Schematic Plan View of Production Area Authorizations with Typical Well Arrays



USDW Protection at *In Situ* Uranium Mining Sites

Once mining in a production area is complete, aquifer restoration is required

Groundwater in mined production area must be restored to pre-mining groundwater quality as established by baseline monitoring program

USDW Protection at *In Situ* Uranium Mining Sites

Groundwater quality in mined aquifer must be restored to established baseline values for 26 groundwater quality parameters

Once operator determines aquifer restoration has been achieved, aquifer must be monitored for one year to verify restoration is complete

Restoration Constituents

Ca	Cl	As	Uranium
Mg	NO ₃ -N	Cd	Radium-
Na	F	Fe	226
K	SiO ₂	Pb	
CO ₃	TDS	Mn	
HCO ₃	ECond	Hg	
SO ₄	Alkalinity	Mo	
pH	Ammonia	Se	

USDW Protection at *In Situ* Uranium Mining Sites

- Natural conditions in the aquifer are chemically reducing; injection of mining fluids creates an oxidizing environment in which uranium and other constituents are mobilized.
- Oxidized zone is confined to Production Area where mining fluids are injected.

USDW Protection at *In Situ* Uranium Mining Sites

- Outwards from oxidized zone, natural reducing conditions exist
- Migration of any residual concentrations of constituents remaining after aquifer restoration would encounter these reducing conditions
- Reducing condition will result in precipitation of dissolved constituents and return to reducing conditions

Summary and Conclusions

- TCEQ has administered a Class III UIC permitting program for *in situ* uranium mining since 1975
- TCEQ received EPA Primacy for its UIC permitting program in 1982
- TCEQ has adopted statutes and regulations for administration of its Class III UIC Program

Summary and Conclusions

- TCEQ's Class III UIC permitting program allows and encourages public participation through:
 - Public Notices
 - Public Meetings
 - Opportunity to provide public comment
 - Opportunity for a contested case hearing

Summary and Conclusions

- The requirements of TCEQ's Class III UIC permitting program are designed to provide protection of USDW through:
 - Confinement of mining fluids to production zone within production area
 - Aquifer exemptions
 - Groundwater monitoring for excursion detection
 - Remediation of excursions
 - Aquifer Restoration once mining is complete

Questions?

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