# State Office of Administrative Hearings

Cathleen Parsley
Chief Administrative Law Judge
November 8, 2010

Les Trobman, General Counsel
Texas Commission on Environmental Quality
PO Box 13087
Austin Texas 78711-3087

Re: **SOAH Docket No. 582-07-2673; TCEQ Docket No. 2007-0204-WDW; In Re: Application of Texcom Gulf Disposal, L.L.C. for Texas Commission Environmental Quality Commission Underground Injection Control Permit Nos. WDW410, WDW411, WDW412, and WDW413**

Dear Mr. Trobman:

The above-referenced matter will be considered by the Texas Commission on Environmental Quality on a date and time to be determined by the Chief Clerk's Office in Room 201S of Building E, 12118 N. Interstate 35, Austin, Texas.

Enclosed are copies of the Amended Proposal for Decision After Remand and Proposed Order that have been recommended to the Commission for approval. Any party may file exceptions or briefs by filing the original documents with the Chief Clerk of the Texas Commission on Environmental Quality no later than **November 29, 2010**. Any replies to exceptions or briefs must be filed in the same manner no later than **December 8, 2010**.

This matter has been designated **TCEQ Docket No. 2007-0204-WDW; SOAH Docket No. 582-07-2673**. All documents to be filed must clearly reference these assigned docket numbers. Copies of all exceptions, briefs and replies must be served promptly on the State Office of Administrative Hearings and all parties. Certification of service to the above parties and an **original and eleven copies** shall be furnished to the Chief Clerk of the Commission. Failure to provide copies may be grounds for withholding consideration of the pleadings.

Sincerely,

Thomas H. Walston
Administrative Law Judge

Catherine C. Egan
Administrative Law Judge

/nl
Enclosures
cc: Mailing List

300 West 15th Street Suite 502 Austin, Texas 78701 / P.O. Box 13025 Austin, Texas 78711-3025
512.475.4993 (Main) 512.475.3445 (Docketing) 512.475.4994 (Fax)
www.soah.state.tx.us

# STATE OFFICE OF ADMINISTRATIVE HEARINGS

**AUSTIN OFFICE**
**300 West 15th Street Suite 502**
**Austin, Texas 78701**
**Phone: (512) 475-4993**
**Fax: (512) 475-4994**

## SERVICE LIST

**AGENCY:** **Environmental Quality, Texas Commission on (TCEQ)**

**STYLE/CASE:** **TEXCOM GULF DISPOSAL LLC**

**SOAH DOCKET NUMBER:** **582-07-2673**

**REFERRING AGENCY CASE:** **2007-0204-WDW**

---

**STATE OFFICE OF ADMINISTRATIVE HEARINGS**

**ADMINISTRATIVE LAW JUDGE**
**ALJ THOMAS H. WALSTON**

---

**REPRESENTATIVE / ADDRESS** | **PARTIES**

SCOTT HUMPHREY
ATTORNEY
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
OFFICE OF PUBLIC INTEREST COUNSEL
P. O. BOX 13087, MC-103
AUSTIN, TX 78711-3087
(512) 239-0574 (PH)
(512) 239-6377 (FAX)
shumphre@tceq.state.tx.us

OFFICE OF PUBLIC INTEREST COUNSEL

---

DOCKET CLERK
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
OFFICE OF THE CHIEF CLERK
PO BOX 13087
AUSTIN, TX 78711
(512) 239-3300 (PH)
(512) 239-3311 (FAX)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

---

JOHN E WILLIAMS
STAFF ATTORNEY
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
LITIGATION DIVISION MC-173
PO BOX 13087
AUSTIN, TX 78711
(512) 239-0455 (PH)
(512) 239-0606 (FAX)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

---

PATRICK LEE
VINSON & ELKINS
THE TERRACE 7, 2801 VIA FORTUNA, STE. 100
AUSTIN, TX 78746-7568
(512) 542-8629 (PH)
(512) 236-3265 (FAX)

TEXCOM GULF DISPOSAL, LLC

---

MICHAEL A. GERSHON
LLOYD GOSSELINK BLEVINS ROCHELLE &
TOWNSEND, P.C.
816 CONGRESS AVENUE, SUITE 1900
AUSTIN, TX 78701
(512) 322-5800 (PH)
(512) 472-0532 (FAX)

LONE STAR GROUNDWATER CONSERVATION DISTRICT

---

JOHN A. RILEY
VINSON & ELKINS
2801 VIA FORTUNA, STE. 100
AUSTIN, TX 78746
(512) 542-8520 (PH)
(512) 236-3329 (FAX)

TEXCOM GULF DISPOSAL, LLC

---

J. DIANE GOSS
STAFF ATTORNEY
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
ENVIRONMENTAL LAW DIVISION
PO BOX 13087
AUSTIN, TX 78711
(512) 239-5731 (PH)
(512) 239-0606 (FAX)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

---

RICHARD WARD
16015 CREIGHTON
CONROE, TX 77302
(936) 520-5314 (PH)
(936) 756-8102 (FAX)

JAMES LANGSTON

RICHARD WARD

FLORA HARRELL

PATTY MOUTON

JAMES A. LANGSTON III

LOIS NELSON

BRIAN RODEL

AL & JERRY ZARUBA

EDGAR AND SHIRLEY HOAGLAND

---

DAVID WALKER
ASST. COUNTY ATTORNEY
207 W. PHILLIPS, FIRST FLOOR
CONROE, TX 77301
(936) 539-7957 (PH)
(936) 760-6920 (FAX)

CITY OF CONROE

MONTGOMERY COUNTY

---

KEVIN A. FORSBERG
15949 HWY. 105 W, SUITE 59
MONTGOMERY, TX 77316
(936) 588-6226 (PH)
(936) 588-6229 (FAX)
kevin@forsberglaw.net

NICKY E. DYER

EDWIN A. (ART) WILSON

---

MARY SIMMONS MENDOZA
ATTORNEY
HAYNES & BOONE, LLP
600 CONGRESS AVENUE, SUITE 1300
AUSTIN, TX 78701
(512) 867-8418 (PH)
(512) 867-8690 (FAX)

DENBURY ONSHORE, LLC

---

SARA M. FORLANO
MONTGOMER COUNTY ATTORNEYS OFFICE
207 WEST PHILLIPS, SUITE 100
CONROE, TX 77301
(936) 539-7828 (PH)
(936) 760-6920 (FAX)
sara.forlano@mctx.org

MONTGOMERY COUNTY

CITY OF CONROE

---

**Note: PLEASE NOTE: THIS CASE IS CONSOLIDATED WITH 582-07-2674.**

xc: Docket Clerk, State Office of Administrative Hearings

SOAH DOCKET NO. 582-07-2673
TCEQ DOCKET NO. 2007-0204-WDW

| | | |
|---|---|---|
| APPLICATION OF TEXCOM GULF DISPOSAL, L.L.C. FOR TEXAS COMMISSION ON ENVIRONMENTAL QUALITY UNDERGROUND INJECTION CONTROL PERMIT NOS. WDW410, WDW411, WDW412, AND WDW413 | §<br>§<br>§<br>§<br>§<br>§ | BEFORE THE STATE OFFICE<br><br>OF<br><br><br>ADMINISTRATIVE HEARINGS |

## TABLE OF CONTENTS


I. INTRODUCTION ..... 1

II. PARTIES, PROCEDURAL HISTORY, JURISDICTION, AND NOTICE ..... 4

A. Parties ..... 4
B. Procedural History ..... 5
C. Jurisdiction and Notice ..... 6

III. BACKGROUND ..... 11

IV. APPLICABLE LAW ..... 16

V. DISCUSSION ..... 17

A. Completeness of Application ..... 17

B. Suitability of Location for Proposed Injection Wells ..... 21

1. Geologic Suitability of Area and Injection Zone ..... 22
2. Presence and Significance of Faults Within the Area of Review ..... 25
3. Presence and Significance of Artificial Penetrations Within the Area of Review ..... 33
4. Other Issues Related to Location of Proposed Injection Wells ..... 43

C. Reservoir Modeling ..... 54

1. Introduction ..... 54
2. Permeability Used in Reservoir Modeling ..... 56

a. Discussion of evidence and argument from the original hearing. ..... 56
b. Permeability and the 2009 Fall-off Test Results ..... 61

3. Transmissivity of Fault Located 4,400 Feet South of Site ..... 66
4. Other Issues Related to Reservoir Modeling ..... 71
5. Modeling Using Remand Order Parameters ..... 72
6. ALJs' Analysis Concerning Reservoir Modeling ..... 76

D. Public Interest Issues ..... 78

1. Alternative Disposal Options ..... 80
2. Protection of Surface Water and Groundwater ..... 90
3. Traffic ..... 97
4. Other Public Interest Requirements ..... 108

a. Compliance History ..... 108
b. Purpose of the Injection Well Act ..... 109

5. Other Issues Concerning UIC Permit Applications ..... 112

VI. ASSESSMENT OF REPORTING AND TRANSCRIPTION COSTS ..... 116

VII. CONCLUSION AND RECOMMENDATION ..... 118

APPENDICES

**SOAH DOCKET NO. 582-07-2673**
**TCEQ DOCKET NO. 2007-0204-WDW**

| | | |
|---|---|---|
| **APPLICATION OF TEXCOM GULF DISPOSAL, L.L.C. FOR TEXAS COMMISSION ON ENVIRONMENTAL QUALITY UNDERGROUND INJECTION CONTROL PERMIT NOS. WDW410, WDW411, WDW412, AND WDW413** | §<br>§<br>§<br>§<br>§<br>§ | **BEFORE THE STATE OFFICE**<br><br>**OF**<br><br><br>**ADMINISTRATIVE HEARINGS** |

## AMENDED PROPOSAL FOR DECISION AFTER REMAND

## I. INTRODUCTION

TexCom Gulf Disposal, L.L.C. (TexCom) has applied for four Underground Injection Control (UIC) permits to authorize four Class I underground injection wells to dispose of nonhazardous industrial wastewater at a facility located near the City of Conroe in Montgomery County, Texas. The Executive Director (ED) of the Texas Commission on Environmental Quality (TCEQ) approved the Application and prepared draft permits which, if approved, would authorize TexCom to conduct wastewater injection in accordance with the terms, requirements, and conditions set forth in the permits. Montgomery County and the City of Conroe (Aligned Protestants), the Lone Star Groundwater Conservation District (Lone Star), several aligned individual protestants (Individual Protestants), and Denbury Onshore, LLC (Denbury)[1] oppose TexCom's Application. They assert that the Application is deficient, that TexCom did not meet its burden of proof on multiple issues, and that the proposed underground injection activities pose an unacceptable risk to the underground drinking water for the area. The TCEQ Office of Public Interest Counsel (OPIC) opposes the application and contends that TexCom failed to demonstrate that the proposed facility will meet public interest requirements.

TexCom requested a direct referral of this matter to the State Office of Administrative Hearings (SOAH) for a contested case hearing without limitation on the issues to be considered. The original hearing occurred during December 2007, and a Proposal for Decision was issued

[1] Denbury was admitted as a party during the course of the remand proceedings.

April 25, 2008 (the Original PFD).[2] That PFD found that when TexCom modeled the cone of influence (COI)[3] for its proposed injection activities it should have used a permeability factor of 80.9 millidarcies (mD) rather than 500 mD, and it should have assumed that the east-west running fault located 4,400 feet south of the facility (EW-4400-S fault) was laterally nontransmissive rather than transmissive. These changed assumptions would have the effect of increasing the COI and possibly the area of review (AOR).[4]

On December 12, 2008, the Commission issued an interim order to remand this case to SOAH with instructions to receive evidence and to issue an amended PFD on new reservoir modeling to be conducted using a permeability factor of 80.9 mD and an assumption that the EW-4400-S fault is nontransmissive in the horizontal direction. The interim order also allowed receipt of additional evidence and argument concerning public interest requirements and alternative disposal options.

---

[2] TexCom also requested a direct referral of its separate application for a solid waste permit for the proposed surface facility at the site. That application was designated as TCEQ Docket No. 2007-0362-IHW; SOAH Docket No. 582-07-2674. TexCom's Application for the UIC permits and its Application for an Industrial Solid Waste permit for the surface facility were consolidated for the hearing on the merits and for the remand hearing. A separate supplemental proposal for decision (PFD) concerning the surface-facility solid waste permit application will be issued simultaneously with this Amended PFD.

[3] 30 TEX. ADMIN. CODE (TAC) § 331.2(25) defines cone of influence as: "The potentiometric surface area around the injection well within which increased injection zone pressures caused by injection of wastes would be sufficient to drive fluids into an underground source of drinking water or freshwater." In this case, the COI is the area of pressure increase within the injection zone of 421 pounds per square inch (psi) or greater, which would be sufficient to displace a drilling-mud plug in an abandoned well and create a potential pathway to contaminate a USDW or freshwater aquifer.

[4] The AOR is the area surrounding an injection well for which an applicant must provide information. The AOR for a Class I injection well is the territory within 2.5 miles of the proposed well, or the area within the COI, whichever is greater. 30 TAC § 331.42 states:

> Area of Review
> (a) The area of review is the area surrounding an injection well or a group of wells, for which the permit application must detail the information required in Subchapter G of this title (relating to consideration Prior to Permit Issuance).
> (b) The area of review is:
> (1) for Class I wells, and area determined by a radius of 2 1/2 miles from the proposed or existing well bore, or the area within the cone of influence, whichever is greater. . . .

Based on the evidence presented at the original hearing and at the remand hearing, the Administrative Law Judges (ALJs) make the following findings and recommendations:

- Water Code § 27.018(c) is not jurisdictional and the procedural requirements of section 27.018(c) were met before the ALJs began to hear testimony.
- Whether TexCom's Application is administratively or technically complete is not a decisive issue. Instead, the substance of the information provided in the Application and other evidence must be evaluated to determine whether the proposed injection wells satisfy the requirements of the applicable statutes and rules.
- TexCom's proposed injection wells would be sited in a geologically suitable area.
- Presence of faults in the AOR or uncertainty concerning the transmissivity of the EW-4400-S fault do not compel denial of TexCom's permits.
- The massive Jackson Shale formation is a superior upper confining unit for TexCom's proposed injection zone in the Cockfield formation.
- TexCom's proposed facility is located in the Conroe Oil Field. Within the AOR, several hundred artificial penetrations from oil and gas wells pass through the Jackson Shale formation and into the injection zone in the Cockfield formation.
- TexCom adequately accounted for the artificial penetrations within the COI and AOR which penetrate the Jackson Shale and the Cockfield formations.
- TexCom did not establish by a preponderance of the evidence that the sand, silt, and shale layers between the Lower, the Middle, and the Upper Cockfield strata (which comprise the injection zone) are sufficient to prevent migration of injected wastewater from the Lower Cockfield injection interval into the injection zone within the Middle and Upper Cockfield strata.
- A permeability factor of 80.9 mD is appropriate for modeling TexCom's proposed injection reservoir.
- The EW-4400-S fault should be assumed to be nontransmissive for purposes of modeling TexCom's proposed injection reservoir.
- An appropriately modeled COI and AOR for TexCom's proposed activities would extend 2.7 miles (14,300 feet) to the north of well WDW315; 3.2 miles (17,130 feet) to the east and west; and 3.4 miles (18,140 feet) to the southeast and southwest, along the EW-4400-S fault.
- The underground injection method of disposal for Class I nonhazardous wastewater is practical, economic, and feasible.
- In Montgomery County, the Conroe Publicly Owned Treatment Works is a reasonable alternative to underground injections of Class I nonhazardous wastewater.
- Denbury's current and proposed hydrocarbon production operations in the Conroe Oil Field from the Upper Cockfield formation pose a risk that Class I

nonhazardous wastewater injected by TexCom would be pumped to the surface from the injection zone. If that occurs, ground and surface freshwater would not be protected from pollution as required by Water Code § 27.051(a)(3).

- Due to traffic concerns and roadway conditions, an entrance to TexCom's facility on Creighton Road is not acceptable. An entrance on FM 3083 would be more suitable, although it is uncertain whether the Texas Department of Transportation would allow an entrance to TexCom's facility on that road.
- TexCom's compliance history is average by default.
- TexCom did not establish by a preponderance of the evidence that installation and use of its proposed underground injection facility is in the public interest.
- The ALJs recommend that the Commission deny TexCom's permit applications.
- Transcript costs for the original hearing should be allocated pursuant to the agreement of the parties to that hearing.
- Transcript costs for the remand hearing should be allocated 45% to TexCom; 35% to Denbury; 10% to Aligned Protestants; and 10% to Lone Star.

## II. PARTIES, PROCEDURAL HISTORY, JURISDICTION, AND NOTICE

### A. Parties

| Party | Representative |
|---|---|
| TexCom Gulf Disposal, L.L.C. (TexCom) | John Riley and Patrick Lee, Attorneys, Austin, Texas |
| Montgomery County and City of Conroe (Aligned Protestants) | David K. Walker, Montgomery County Attorney; Julie B Stewart, Assistant Montgomery County Attorney, Conroe, Texas |
| Lone Star Groundwater Conservation District (Lone Star) | Michael A. Gershon, and Jason Hill, Attorneys, Austin, Texas |
| Aligned Individual Protestants[5] (Individual Protestants) | Kevin A. Forsberg, Attorney, Montgomery, Texas |
| Denbury Onshore, LLC (Denbury)[6] | Mary Simmons Mendoza, Attorney, Austin, Texas |

[5] The individual protestants are: Nickey E. Dyer, Flora Harrell, Edgar Hoagland, Shirley Hoagland, Patty Mouton, James Langston, James A. Langston, III, Lois Nelson, James Nolan, George Phillips, Brian Rodel, Richard Ward, Edwin (Art) Wilson, Al Zaruba, and Jerry Zaruba.

[6] As noted above, Denbury was not a party during the original hearing.

| | |
|---|---|
| ED | J. Diane Goss and John E. Williams, Staff Attorneys, Environmental Law Division, TCEQ |
| OPIC | Scott A. Humphrey, Attorney, Public Interest Counsel[7] |

## B. Procedural History

| | |
|---|---|
| August 2, 2005 | TexCom filed UIC Application with the TCEQ for WDW410, WDW411, WDW412, and WDW413. |
| August 31, 2005 | TexCom's UIC Application declared administratively complete. |
| March 9, 2006 | ED held public meeting in Conroe, Texas, to receive public comment. |
| April 27, 2006 | TCEQ Staff issued Technical Summary and Executive Director's Preliminary Decision approving the Application. |
| January 11, 2007 | ED issued written responses to public comment. |
| April 13, 2007 | TexCom requested direct referral of the proceeding to SOAH. |
| April 19, 2007 | Case referred to SOAH for a contested case hearing. |
| May 9, 2007 | TCEQ Chief Clerk issued notice of hearing for July 18, 2007. |
| July 18, 2007 | Preliminary hearing held by SOAH in Conroe, Texas. |
| July 24, 2007 | SOAH Order No. 1 established a procedural schedule leading to a hearing on the merits on December 12, 2007. |
| December 12-18, 2007 | Hearing on the Merits held in Conroe and Austin, Texas. |
| February 4, 2008 | Parties filed Closing Arguments. |
| February 25, 2008 | Parties filed Replies to Closing Arguments and the record closed for the original proceeding. |
| April 25, 2008 | Original PFD issued. |
| December 12, 2008 | The Commission issued an Interim Order to remand this case to SOAH to receive evidence and issue an amended PFD on new |

[7] Emily A. Collins represented OPIC during the original hearing.

| | |
|---|---|
| | reservoir modeling, public interest requirements, and alternative disposal options. |
| February 23, 2009 | A procedural schedule was established setting a hearing on the merits on July 20, 2009. |
| May 20, 2009 | The hearing was canceled and proceedings were abated to allow time for TexCom to reperforate existing well WDW-315 and to conduct a new fall-off test. |
| December 15, 2009 | A new procedural schedule was established and a hearing on the merits was set for April 20, 2010. |
| March 31, 2010 | Denbury filed a motion to intervene. TexCom objected to Denbury's request to intervene; the other intervenors and OPIC did not object; and the ED neither supported nor opposed the request. |
| April 12, 2010 | Denbury's motion to intervene was granted, and the hearing on the merits was rescheduled to June 15, 2010. |
| June 15-24, 2010 | Remand hearing on the merits. |
| August 20, 2010 | Parties filed written closing arguments. |
| September 7, 2010 | Parties filed replies to closing arguments and the record closed. |

## C. Jurisdiction and Notice

Jurisdiction and notice were not contested at the original hearing. However, on the first day of the remand hearing (June 15, 2010), Denbury filed a Plea to the Jurisdiction, arguing that SOAH lacked jurisdiction to hear testimony because proper notice of the hearing was not mailed to the owner of the mineral rights under TexCom's property. The ALJs proceeded with the hearing and allowed time for the other parties to file responses and allowed time for Denbury to file a reply to the responses. TexCom and the ED opposed Denbury's Plea to the Jurisdiction, while the other Protestants and OPIC supported it. On June 23, 2010, the ALJs orally denied Denbury's plea to the jurisdiction.[8] Because the Protestants have re-urged the jurisdictional issue in their closing statements, the ALJs will address the issue in this Amended PFD.

[8] Remand Tr. 1475-1476.

In its Plea to Jurisdiction, Denbury pointed out that, for Class I injection wells, 30 TAC § 39.651(c)(4)(C), (d)(4)(c), and (f)(3)(B)(iii) require the Commission's Chief Clerk to mail a "Notice of Receipt of Application and Intent to Obtain Permit;" a "Notice of Application and Preliminary Decision;" and a "Notice of Hearing" to, among others, "persons who own mineral rights underlying the existing or proposed injection well facility." TexCom stated in its application that it owned these mineral interests, but, according to Denbury, an entity known as Sabine Royalty Trust actually owned them. Thus, Denbury asserted that as a result of TexCom's incorrect information, the Commission's Chief Clerk did not mail the notices required by 30 TAC § 39.651 to Sabine Royalty Trust. Due to lack of a mailed notice of hearing to Sabine Royalty Trust, Denbury argued that TEXAS WATER CODE (Water Code) § 27.018(c) deprives SOAH of jurisdiction to hear testimony in this case. That section provides:

> Before the commission begins to hear testimony in a contested case . . . , evidence must be placed in the record to demonstrate that proper notice regarding the hearing was given to affected persons. If mailed notice to an affected person is required, the commission or other party to the hearing shall place evidence in the record that notice was mailed to the address of the affected person included in the appropriate county tax rolls at the time of mailing. For the purposes of this subsection, the affidavit of the commission employee responsible for the mailing of the notice, attesting to the fact that notice was mailed to the address included in the tax rolls at the time of mailing, shall be prima facie evidence of proper mailing. The commission may not proceed with receipt of testimony in a contested case until there is compliance with this subsection.

Denbury argued that SOAH's jurisdiction to hear this case is contingent upon compliance with the requirements of 30 TAC § 39.651(f)(3)(B)(iii), which requires mailed notice to the mineral interest owner, and Water Code § 27.018(c). Therefore, because mailed notice of hearing was not given to the owner of mineral rights under TexCom's property, Denbury argued that SOAH lacked jurisdiction to hear testimony in this case, and it requested that TexCom's application be returned to the TCEQ for further processing or, alternatively, that the hearing be abated until proper notice was completed. The other Protestants and OPIC supported Denbury's position.

In response, TexCom argued that Water Code § 27.018(c) is a procedural statute, not a jurisdictional statute, and that the proper jurisdictional statute is Water Code § 27.011. That statute grants the Commission jurisdiction to issue permits for underground injection wells.[9] TexCom stressed that Water Code §§ 5.551-.553 and 27.018, which are the statutes that require the various notices, are all procedural statutes rather than jurisdictional statutes. TexCom also relied on *City of DeSoto v. White*,[10] in which the Texas Supreme Court held that mandatory notice requirements contained in statutes are not necessarily jurisdictional. Rather, the Supreme Court stated that a statute must contain explicit language stating that it is jurisdictional.[11] Because the statutes requiring certain notices in this case do not expressly state that compliance is jurisdictional, TexCom argued that any error in providing notice to the mineral interest owner did not deprive SOAH or the Commission of jurisdiction.[12] In addition, TexCom argued that Denbury did not have standing to complain about lack of mailed notice to a third party.[13] Finally, TexCom stated that it did provide notice to the operator and lessee of the mineral interest under its property and under neighboring property, which TexCom argued sufficiently complied with the notice requirements.

The ED agreed with TexCom that SOAH has jurisdiction over this matter even if the mineral rights owner did not receive mailed notice. The ED noted that Water Code §§ 5.102, 5.556, 5.557, and 27.018(a), as well as TEX. HEALTH & SAFETY CODE § 361.081, provided jurisdiction for the Commission to hold a contested case hearing on TexCom's application and

---

[9] Water Code § 27.011 provides:

> Unless the activity is subject to the jurisdiction of the railroad commission or authorized by a rule of the commission, no person may continue utilizing an injection well or begin drilling an injection well or converting an existing well into an injection well to dispose of industrial and municipal waste, to extract minerals, or to inject a fluid without first obtaining a permit from the commission [TCEQ].

[10] 288 S.W.3d 389 (Tex. 2009).

[11] *Id.* at 395.

[12] It is not clear from the record whether TexCom acknowledges an error in mailing the notice of hearing to the mineral interest owner.

[13] *McDaniel v. Texas Natural Resources Conservation Comm'n,* 982 S.W.2d 650, 654 (Tex. App. – Austin 1998, pet. denied).

authorized the Commission to refer the hearing to SOAH. Like TexCom, the ED argued that under *City of Desoto v. White*, a statute is not jurisdictional unless it explicitly so indicates. In the ED's view, Water Code § 27.018(c) is procedural rather than jurisdictional, and neither the Commission nor SOAH is deprived of jurisdiction to hear this case, even if a mailed notice of hearing was not provided to the owner of the mineral rights under TexCom's property.

The ALJs conclude that the requirements of Water Code § 27.018(c) are procedural, not jurisdictional. Therefore, even assuming, without deciding, that the actual owner of mineral rights under TexCom's property did not receive mailed notice of hearing as required by 30 TAC § 39.651(f)(3)(B)(iii), that error did not deprive either SOAH or the Commission of jurisdiction to hear this case. The Texas Supreme Court made clear in *City of DeSoto v. White* that statutory requirements should not be found jurisdictional, "absent clear legislative intent to that effect."[14] The Court explained that failure of a jurisdictional requirement would deprive a court or agency of the power to act, or to have ever acted, as a matter of law. Consequently, a judgment by a court or a decision by an agency would be vulnerable to a delayed attack long after the proceedings had concluded, which could impair confidence in the finality of court judgments and agency decisions.[15]

Like the statute considered in *City of DeSoto*, nothing in Water Code § 27.018(c) explicitly states that it is jurisdictional. Instead, section 27.018(c) provides that the Commission cannot begin to hear testimony in a contested case until evidence is placed in the record demonstrating that proper notice was given to affected persons. The plain language of the section shows it is a procedural statute about when the Commission, or SOAH acting on behalf of the Commission, can begin to hear testimony. Section 27.018(c) does not grant or deprive the Commission or SOAH of subject matter jurisdiction.

Further, compliance with Water Code § 27.018(c) occurred, and the Commission and SOAH were authorized to begin to receive testimony, when evidence was placed into the record

---

[14] 288 S.W.3d 389, 393 (Tex. 2009).

[15] *Id.* at 393-394.

that proper notice regarding the hearing had been given. In this case, evidence of mailed notice and of published notice was presented at the preliminary hearing held on July 18, 2007. Jurisdictional Exhibit No. 2 is an affidavit concerning published notice of the amended notice of hearing, and Jurisdictional Exhibit No. 3 is a certificate by the Commission's Chief Clerk, certifying that the amended notice of hearing was mailed on June 5, 2007, to several hundred individuals and entities, including state legislators, local officials, and various state and federal agencies.[16] This evidence was received into the record at the preliminary hearing without objection, and no party questioned whether proper notice had been provided. Thus, because evidence was placed into the record to demonstrate that proper notice regarding the hearing was given to affected persons, the Commission and SOAH were authorized under section 27.018(c) to begin hearing testimony in this contested case. The SOAH ALJs began to hear testimony when the original evidentiary hearing convened on December 12, 2007.

As discussed, the ALJs conclude that Water Code § 27.018(c) is procedural rather than jurisdictional; that the requirements of the statute were met upon receipt of evidence that proper notice was provided; and that SOAH was authorized to begin hearing testimony in this case. Further, nothing in section 27.018(c) required SOAH to stop hearing testimony when Denbury cited a potential error in TexCom's compliance with the notice requirements. Indeed, stopping and restarting a hearing whenever a late assertion of a defect in notice is made would not be feasible. In this case, for example, mailed notice was sent to several hundred individuals and entities. It would not be unusual to discover that some persons or entities had changed names, died, moved, or changed addresses. Stopping a hearing each time an error in notice was alleged could create an opportunity for parties to engage in gamesmanship and disrupt the hearing process. Therefore, the ALJs conclude that once the requirement of Water Code § 27.013(c) to place evidence of proper notice in the record was met, and once SOAH began to receive testimony, section 27.013(c) did not require the ALJs to suspend the hearing or to stop receiving testimony when Denbury asserted that TexCom made an error in meeting the notice requirements.

---

[16] Jurisdictional Exhibit 3.

In summary, the ALJs conclude that Water Code § 27.018(c) is not jurisdictional and that the procedural requirements of section 27.018(c) were met before the ALJs began to hear testimony. Therefore, the ALJs recommend that the Commission uphold the denial of Denbury's plea to the jurisdiction.[17]

## III. BACKGROUND

TexCom is a Texas C Corporation formed to own, manage, and operate certain disposal businesses. It applied for four permits to construct and operate up to four Class I UIC wells on approximately 27 acres of land located at 16185 Creighton Road in Montgomery County. TexCom purchased the 27-acre tract in 2005, and one of the permits (WDW410) would be for an existing Class I well at the site that was permitted in 1994 and completed in 1999 by a previous owner of the property, Crossroads Environmental, Inc. (Crossroads). However, that well (previously permitted as WDW315) was never placed into service and the prior permit for the well expired in 2004. The remaining three permits would be for new wells to be drilled by TexCom.

Class I UIC wells include wells that inject industrial wastewater into a geological formation that is deeper than the deepest underground source of drinking water (USDW) within 1/4 mile of the wellbore.[18] Class I wells may be permitted to receive hazardous waste, but TexCom has applied for permits that only allow disposal of nonhazardous wastewater, as defined by the U.S. Environmental Protection Agency (EPA) and the TCEQ. The permits would exclude wastewater with characteristics of ignitability, corrosivity, reactivity, or toxicity, as well as wastes generated from specific operations the EPA has designated as hazardous. The maximum allowed injection rate would be 350 gallons per minute for the entire facility, as specified by the

---

[17] The fact that Water Code § 27.013(c) is not jurisdictional does not mean that TexCom or other applicants can disregard applicable notice requirements. For example, valid objections and evidence presented at a preliminary hearing which indicate defective notice could preclude SOAH from beginning to hear testimony. Likewise, an affected person who did not receive proper notice could be granted late intervention, depending on the circumstances. Further, 30 TAC § 305.66 provides for various possible consequences when an applicant provides false or misleading information.

[18] 30 TAC § 331.11(a)(1)(B).

UIC draft permits. This is a cumulative maximum flow, meaning that the combined injection rates for all operating wells at the site cannot exceed this total rate.[19]

If the permits are granted, TexCom's wells will dispose nonhazardous wastewater by injection into a geological formation known as the Lower Cockfield, which consists of shales and thin sands, at an injection interval between 6,045 and 6,390 feet below the surface. Immediately above the Lower Cockfield formation are the Middle Cockfield (5,629 to 6,045 feet) and the Upper Cockfield (5,134 to 5,629 feet) formations. Layers of sand, silt, and shale separate the Lower, Middle, and Upper Cockfield members, although the parties dispute whether these are sufficient to isolate each Cockfield layer from fluid migration between them. The "injection zone" encompasses the entire Cockfield Formation (Upper, Middle, and Lower), while the "injection interval" (where the wells would be perforated) is within the Lower Cockfield only.[20]

Below the Lower Cockfield is the Cockfield Shale Member, consisting of massive marine shale with few thin sands and tite siltstones.[21] The Cockfield Shale Member is the lower confining unit for the project. Immediately above the Upper Cockfield is the Jackson Shale Formation, a massive formation of marine shales or mudstones with a dough-like consistency approximately 1,000 feet thick. A core sample from the Jackson Shale Formation showed it to be an impermeable formation. The Jackson Shale Formation serves as the Upper Confining Unit for the injection zone.[22] A diagram and a table of the geological formations are attached as Appendix A1 and A2.

---

[19] TexCom Ex. 49, Casey direct at 23.

[20] TexCom Ex. 49, Casey direct at 34. "Injection zone" is defined at 30 TAC § 331.2(53) as: "A formation, a group of formations, or part of a formation that receives fluid through a well." "Injection interval" is defined at 30 TAC § 331.2(50) as: "That part of the injection zone in which the well is authorized to be screened, perforated, or in which the waste is otherwise authorized to be directly emplaced."

[21] TexCom Ex. 49, Casey direct at 32-33.

[22] TexCom Ex. 49, Casey direct at 34.

The proposed facility is located within the area of the large Conroe Oil Field, which has produced more than 700 million barrels of oil since the 1930s. Nearly all of the hydrocarbon production of the Conroe Oil Field was extracted from the Upper Cockfield at approximately 5,000 feet. No known hydrocarbon production has occurred in the Middle or Lower Cockfield. The Conroe Oil Field includes about 17,000 acres, and it has had approximately 750 producing wells within its boundaries over the years.[23] As noted above, the Jackson Shale formation is the upper confining unit, separating the injection zone from USDWs located above. However, because the primary production zone for the Conroe Oil Field was the Upper Cockfield formation, hundreds of oil-well bore holes penetrated the Jackson Shale to reach the Upper Cockfield within the AOR.

USDWs are located above the Jackson Shale. The base of the lowermost USDW is at approximately 4,088 feet, in the Catahoula Aquifer, which sits on top of the Jackson Shale Formation. However, the deepest drinking water well within the 2.5 mile radius of WDW315 is a municipal water well completed in the Jasper aquifer at 1,500 feet depth, approximately 11,900 feet distant from the existing TexCom well.[24]

TexCom calculated that the waste plume will spread 2,770 feet out from the borehole over the 30-year life span of the injection well. However, briney water that already exists in the injection interval will be displaced by the injected wastewater. In the original hearing, it was undisputed that the waste plume would not reach the EW-4400-S fault. In the remand hearing, however, Denbury offered testimony that the Cockfield formation's geology is not homogeneous or uniform, and it argued that sand channels with better permeability can create a pathway for wastes fluids to radiate farther than modeled by TexCom and possibly to the fault.[25] Under either scenario, however, it is clear that the existing briny water in the injection interval would realize a pressure increase at the fault from injection operations. The parties dispute whether the fault is laterally transmissive, thus allowing the pressurized water to pass through the fault; or

---

[23] TexCom Ex. 57, Langhus direct at 12.

[24] TexCom Ex. 49, Casey direct at 35.

[25] Denbury Remand Reply to Closing Arguments at 12-13.

whether it is nontransmissive, thus acting as a pressure barrier. Whether the fault is transmissive is significant in determining the extent of the COI and AOR and for identifying artificial penetrations within that area.

As previously noted, one of the four proposed UIC wells (WDW410) was permitted as WDW315 in 1994, and it was drilled and completed in 1999 by Crossroads, the previous owner of the property. However, Crossroads never constructed a surface facility and the permit expired before the well was put into wastewater disposal operation. If approved, that well would be re-permitted as WDW410, and the three additional proposed wells would be permitted as WDW411, WDW412, and WDW413.

Montgomery County is a suburban/rural county located immediately north of Houston. It has experienced rapid population growth and its current population exceeds 400,000. At present, and for the foreseeable future, Montgomery County will rely almost exclusively on groundwater from the Evangeline aquifer as its source for drinking water.[26] The Evangeline aquifer is located at 150-750 feet below the surface, above the wastewater injection interval for TexCom's facility, with several geological strata layered between them.

As mentioned earlier, the Commission remanded this case to SOAH to receive evidence and issue an amended PFD on new reservoir modeling to be conducted using a permeability factor of 80.9 mD and an assumption that the EW-4400-S fault is nontransmissive in the horizontal direction. By agreement of the parties, the remand proceeding was abated for a time to allow TexCom to reperforate existing well WDW-315 and to conduct a new pressure fall-off test. The parties believed this would help resolve the disputes concerning the permeability of the proposed injection interval and the transmissivity of the EW-4400-S fault. However, the new fall-off test was not conducted long enough to determine whether the EW-4400-S fault is laterally transmissive, and data provided by this fall-off test raised new issues concerning the permeability of the injection interval.

---

[26] TexCom Ex. 6, UIC Application, Vol. I, at 77.

In late December 2009, Denbury acquired interests in operations that included oil, gas, and mineral leases to the acreage where TexCom proposes to operate its facility, and on March 31, 2010, Denbury filed a motion to intervene. Denbury is currently producing oil from the Conroe Oil Field, and in the future it plans to recover oil and gas with carbon dioxide ($CO_2$) enhanced oil recovery from the Upper Cockfield formation. This is within TexCom's proposed injection zone, although it is not within the injection interval.[27] Denbury's method of oil recovery would involve injecting $CO_2$ to repressurize the entire Cockfield formation. This would include adding new injection wells and production wells. Denbury claimed that these activities would affect TexCom's injection pressures; the fate and transport of injected waste materials; the COI; and the integrity of wells within the area. Denbury also claimed that TexCom's injected wastewater would migrate to the Upper Cockfield strata and would be pumped to the surface through Denbury's production wells. Therefore, Denbury's motion to intervene was granted.

Due to TexCom's reperforating and conducting a new fall-off test on existing well WDW315, the issues considered on remand were expanded and included the following:

- Reservoir modeling using the parameters set in the remand order;
- The 2009 fall-off test results;
- Public interest requirements; and
- Alternative disposal options.

In addition, Denbury raised issues concerning notice and jurisdiction (previously addressed), and geologic considerations.

[27] As stated before, "Injection zone" is defined at 30 TAC § 331.2(53) as: "A formation, a group of formations, or part of a formation that receives fluid through a well." "Injection interval" is defined at 30 TAC § 331.2(50) as: "That part of the injection zone in which the well is authorized to be screened, perforated, or in which the waste is otherwise authorized to be directly emplaced."

## IV. APPLICABLE LAW

The Texas Injection Well Act is contained in Ch. 27 of the Water Code, with Subchapter D governing the issuance of permits. Among other things, § 27.051 provides:

> (a) The commission may grant an application in whole or in part and may issue the permit if it finds:
>
> (1) that the use or installation of the injection well is in the public interest;
>
> (2) that no existing rights, including, but not limited to, mineral rights, will be impaired;
>
> (3) that, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution;
>
> (4) that the applicant has made a satisfactory showing of financial responsibility if required by Section 27.073 of this code; . . .
>
> . . .
>
> (c) In the permit, the commission . . . shall impose terms and conditions reasonably necessary to protect fresh water from pollution, including the necessary casing.
>
> (d) The commission, in determining if the use or installation of an injection well is in the public interest under Subsection (a)(1), shall consider, but shall not be limited to the consideration of:
>
> (1) compliance history of the applicant and related entities . . .;
>
> (2) whether there is a practical, economic, and feasible alternative to an injection well reasonably available;
>
> . . .

In addition, 30 TAC § 331.121(a), (b), and (c)[28] include a lengthy list of criteria that the Commission must consider before issuing a Class I Injection Well Permit, including information about the geologic structure of the local area, USDWs and freshwater aquifers,[29] the confining

---

[28] Subsections (d), (e), (f), and (g) concern either salt caverns or hazardous waste injection well permits and do not apply to TexCom's application.

[29] Fresh water is defined at 331.2(40):
Fresh water – Water having bacteriological, physical, and chemical properties which make it suitable and feasible for beneficial use for any lawful purpose.
(A) For the purposes of this subchapter, it will be presumed that water is suitable and feasible for beneficial use for any lawful purpose only if:
(i) it is used as drinking water for human consumption; or
(ii) the groundwater contains fewer than 10,000 milligrams per liter (mg/L) total dissolved solids; and
(iii) it is not an exempted aquifer.
(B) This presumption may be rebutted upon a showing by the executive director or an affected person that water containing greater than or equal to 10,000 mg/L total dissolved solids can be put to beneficial use.

geologic zone, geologic faults, other wells and artificial penetrations into the injection zone, proposed operating data, the public interest, and other information. Additional general requirements are contained in 30 TAC §§ 281.5, 305.45, and 305.49.

On December 6, 2007, the Austin Court of Appeals issued an opinion in *Texas Citizens for a Safe Future and Clean Water v. Railroad Comm'n of Texas*,[30] which held that the public interest requirement for Class II injection wells (which contains the same language as the public interest requirement for Class I UIC wells) should include consideration of traffic safety concerns. Based on that decision, the ALJs allowed the parties to offer evidence about their traffic safety concerns related to TexCom's proposed facility.[31]

## V. DISCUSSION

The issues contested by the parties at the original hearing included: completeness of the Application, suitability of the location for the proposed wells, reservoir modeling, and public interest issues. The issues contested in the remand hearing included: reservoir modeling, geology, artificial penetrations in the COI/AOR, and the public interest. The public interest issues addressed in both hearings included: protection of surface water and groundwater, traffic, and other public interest requirements. These are discussed below.

### A. Completeness of Application[32]

In the original hearing, the Intervenors[33] contended that TexCom's Application was incomplete in various respects. TexCom disputed these contentions. The ALJs find that whether TexCom's Application is administratively or technically complete is not a decisive issue for this

[30] 254 S.W.3d 492 (Tex. App. Austin – 2007, *pet. granted*).

[31] A further appeal of *Texas Citizens* is currently pending before the Texas Supreme Court, but when this Amended PFD was issued, the Court had not yet issued a decision.

[32] This issue was not remanded and no evidence or argument was received at the remand hearing specifically related to this issue. The discussion of this issue has been partially modified from the Original PFD to provide context after the remand hearing.

[33] Intervenors in the original hearing included OPIC, Lone Star, the Aligned Protestants, and the Individual Protestants. Denbury was not a party in the original hearing.

case. Instead, the substance of the information provided in the Application and other evidence admitted at the hearing must be evaluated to determine whether the proposed injection wells satisfy the requirements of the applicable statutes and rules. Those substantive issues are discussed in later sections of this PFD.

Intervenor Lone Star pointed out that the AOR is the area surrounding an injection well for which an applicant must provide information, and 30 TAC § 331.42 defines the AOR for a Class I injection well as the territory within 2.5 miles of the proposed well, or the area within the cone of influence COI, *whichever is greater.* [34] In this case, the COI is the area of pressure increase within the injection zone of 421 pounds per square inch (psi) or greater, which would be sufficient to displace a drilling-mud plug in an abandoned well and thus create a potential pathway to contaminate a USDW or freshwater aquifer.[35] As will be discussed in more detail in the section on Reservoir Modeling, one of the calculations in the original hearing by Lone Star's expert (Mr. Phil Grant, P.G.) produced a COI of 14,300 feet, or 2.7 miles, which is greater than the 2.5-mile AOR for which TexCom provided data and information in the original hearing. Therefore, Lone Star maintained at the original hearing that TexCom's Application was not complete because it did not expand the AOR to 2.7 miles. However, Mr. Grant changed his position at the remand hearing based on additional modeling, and he now claims that the AOR extends 3.4 miles from WDW315. Lone Star argued that TexCom failed to account for all artificial penetrations within this expanded AOR.

---

[34] 30 TAC § 331.42 states:
Area of Review
(a) The area of review is the area surrounding an injection well or a group of wells, for which the permit application must detail the information required in Subchapter G of this title (relating to consideration Prior to Permit Issuance).
(b) The area of review is:
(1) for Class I wells, and area determined by a radius of 2 1/2 miles from the proposed or existing well bore, or the area within the cone of influence, whichever is greater. . . .

[35] Tr. at 280-82. (References to the transcript from the original hearing are designated as: "Tr."; references to the remand hearing transcript are designated as (Remand Tr.). 30 TAC § 331.2(25) defines cone of influence as: "The potentiometric surface area around the injection well within which increased injection zone pressures caused by injection of wastes would be sufficient to drive fluids into an underground source of drinking water or freshwater."

Finally, Lone Star complained at the original hearing that TexCom failed to identify all known or suspected faults in the AOR as required by 30 TAC § 331.121(a)(2)(A). Although TexCom described two faults within the AOR, Mr. Grant testified that a third fault also exists, which he identified as NS-700-E, but which TexCom did not include in its Application.[36]

In the original hearing, Aligned Protestants (Montgomery County and the City of Conroe) also maintained that TexCom failed to properly identify and evaluate in its Application all known or suspected faults. They also stated that TexCom's Application contained insufficient records of artificial penetrations within the COI, and that it did not include all water wells identified by public records within the AOR.[37]

Likewise, the Individual Protestants criticized TexCom's Application for failing to address all artificial penetrations within the AOR. They also argued that the Application contained an improper COI and lacked compatibility testing of proposed injection materials.[38]

Based on *Citizens Against Landfill Location v. Texas Commission on Environmental Quality*,[39] OPIC argued that whether TexCom's Application is administratively or technically complete is not a decisive issue. Rather, OPIC stated, the purpose of the hearing is to determine whether the substance of the information provided in TexCom's Application and other evidence fulfill the statutory purposes of the Injection Well Act.[40]

The ED pointed out that the Commission declared TexCom's Application administratively complete on August 31, 2005. And after reviewing the evidence presented at hearing, the ED's permit writer for these UIC draft permits, Ms. Kathryn Hoffman (now Kathryn

---

[36] Lone Star closing argument at 10-31 (References to closing arguments are from the original hearing unless specifically noted to be from the remand hearing).

[37] Aligned Protestants closing argument at 6-7.

[38] Individual Protestants closing statement at 6-8.

[39] 169 S.W.3d 258, 272 (Tex. App. – Austin 2005, pet. denied).

[40] OPIC closing argument at 3-4.

Flegal), adopted her Technical Summary and Preliminary Decision without change. Therefore, the ED concludes that the administrative completeness of the UIC Application is not at issue.[41]

TexCom argued that the purpose of the Commission's rules setting forth the information required in UIC Applications is to collect information needed by the TCEQ Staff to evaluate the technical merits of the project. In this case, the TCEQ project manager, Ms. Hoffman, testified that the Application included all information required by the Commission's rules and all the information she needed to understand the project and make her evaluation. TexCom also stated that the Protestants' sole UIC expert did not testify that the Application was fatally flawed, but only that he disagreed with certain inputs in the reservoir modeling.

In response to Lone Star's arguments, TexCom noted that the substantive issues concerning COI modeling were discussed in other parts of the Application and the parties' briefing and will be evaluated in other parts of this PFD. Concerning the eighteen wells that Lone Star claimed in the original hearing were not identified in the Application, TexCom pointed out that Lone Star's witness, Mr. Grant, actually testified only that eighteen wells did not have total depth information on file with the Railroad Commission.[42] In other words, Mr. Grant did not testify that these wells were not identified in the Application. Finally, TexCom acknowledged that Mr. Grant testified about an additional fault about 750 feet east of the wellhead, but it emphasized that identification of faults is a subjective judgment. While Mr. Grant thought a fault existed at that location, he did not include it in his reservoir modeling, and TexCom's witness, Dr. Bruce Langhus,[43] reviewed the same materials and concluded that a fault did not exist at that location.[44]

The ALJs agree with OPIC that the purpose of this proceeding is to determine whether the substance of TexCom's Application and other evidence fulfills the statutory purposes of the

---

[41] ED closing argument at 5-6.

[42] Lone Star Ex. 8, Grant direct at 59.

[43] Dr. Langhus holds a Ph.D. in geology.

[44] TexCom response brief at 2-6.

Injection Well Act, as the ED has already determined that the Application was administratively and technically complete prior to the hearing. *Citizens Against Landfill Location*[45] involved a solid waste facility, rather than an injection well, and the court relied on TEX. HEALTH & SAFETY CODE § 361.068, which does not apply to this application. Nevertheless, the court's conclusion is persuasive that an applicant need not establish at a contested case hearing that its Application is technically and administratively complete, because the applicant will have already done so prior to the hearing.[46]

Therefore, whether TexCom's Application is administratively or technically complete is not a decisive issue for this case. Instead, the substance of the information provided in the Application and other evidence must be evaluated to determine whether the proposed injection wells satisfy the requirements of the applicable statutes and rules. Protestants' complaints about the completeness of TexCom's Application all relate to disputes about the substantive issues discussed later in this Proposal for Decision (Presence and Significance of Faults; Presence and Significance of Artificial Penetrations; Reservoir Modeling).

## B. Suitability of Location for Proposed Injection Wells

TCEQ rules set out the siting requirements for Class I injection wells.[47] In order to comply with 30 TAC § 133.121(c)(2) and (3), TexCom must show, among other things, that the site and injection zone would be located in a geographically suitable area; that the injection zone has "sufficient permeability, porosity, thickness, and areal extent to prevent migration of fluids into USDW or fresh water aquifers," and that the confining zones are "laterally continuous and free of transecting transmissive faults or fractures over an area sufficient to prevent the movement of fluids into a USDW or freshwater aquifer; and . . . contain at least one formation of sufficient thickness with the lithologic and stress characteristics capable of preventing initiation

---

[45] 169 S.W.3d 258, 272 (Tex. App. – Austin 2005, pet. denied).

[46] *Id.*

[47] 30 TAC § 331.121(c)(1-4).

and/or propagation of fractures."[48] As the applicant, TexCom has the burden of proving by a preponderance of the evidence that the injection wells meet the pertinent regulatory requirements.

### 1. Geologic Suitability of Area and Injection Zone[49]

Section 331.121(c)(2) requires that the siting for Class I injection wells be in areas that are geologically suitable. Geological suitability is to be based upon:

> (A) an analysis of the structural and stratigraphic geology, the hydrogeology, and the seismicity of the region;
>
> (B) an analysis of the local geology and hydrogeology of the well site, including, at a minimum, detailed information regarding stratigraphy, structure, and rock properties, aquifer hydrodynamics, and mineral resources; and
>
> (C) a determination that the geology of the area can be described confidently and that limits of waste fate and transport can be accurately predicted through the use of analytical and numerical models.

Unlike typical UIC permit applications, TexCom has the benefit of geological data from the existing well (WDW315) permitted by the TCEQ in 1994. Dr. Langhus testified that the Eocene sands of the Cockfield formation make an excellent injection reservoir because of its petro-physical characteristics, mineralogic composition, and areal extent.[50] Based on his review of core-samples reports and wireline logs from the existing well, Dr. Langhus found that the injection interval in the Lower Cockfield has sufficient thickness, porosity, permeability, and aerial extent to safely contain wastewater injected into this formation throughout the life of

---

[48] It was undisputed that TexCom met the requirement set out in 30 TAC § 331.121(c)(1). That subsection provides: "All Class I injection wells shall be sited such that they inject into a formation that is beneath the lowermost formation containing, within 1/4th mile of the wellbore, a USDW of freshwater aquifer."

[49] This issue was not remanded and no evidence or argument was received at the remand hearing specifically directed to this issue. However, the discussion of this issue has been partially modified to place it in context after the remand hearing.

[50] TexCom Closing Arguments at 11; TexCom Ex. 57, Langhus direct at 21.

TexCom's facility.[51] John Santos, the TCEQ's geologist responsible for reviewing Section V (Geology) and Section VII (Reservoir Mechanics) of TexCom's Application, agreed with Dr. Langhus and testified that the injection interval was sufficient to accommodate the proposed injection of wastewater and prevent the type of fluid migration that could pollute USDWs.[52] Mr. Santos opined that the ground water flow within the injection interval and zone moves at very slow rates generally toward the coast.[53] It was undisputed that seismic risk is almost non-existent.

According to Dr. Langhus, the Jackson Shale formation and the bottom Cockfield Shale formation will serve as adequate upper and lower confining layers respectively.[54] Mr. Santos confirmed that the Jackson Shale formation, a marine mudstone that contains a few thin sands, has a net impermeable shale thickness of approximately 1,000 feet. It is laterally continuous and free of transmissive faults or fractures in the AOR.[55] The Jackson Shale formation is also of sufficient thickness and has lithologic and stress characteristics to prevent the initiation and propagation of fractures because of its mudstone and dough-like consistency.

Lone Star's expert, Mr. Grant, testified that based on the three factors listed in Section 331.121(c)(2), he believes the area is geologically suitable for underground injection of nonhazardous waste.[56] But he disputes TexCom contention that it has met the remaining siting requirements. Mr. Grant clarified that while the Lower Cockfield sand strata are geographically suitable to serve as an injection reservoir, TexCom's injection wells create "endangerment issues" because of the impact that pressure increases will have on the artificial penetrations

---

[51] TexCom Closing Arguments at 11; TexCom Ex. 57, Langhus direct at 23. In the original hearing, Dr. Langhus' testimony suggested that he had seen the actual core samples. This became a matter of dispute in the remand hearing, and Dr. Langhus clarified that he saw the core-sample analytical reports but not the actual core samples. Remand Tr. 1953-1954.

[52] ED Ex. 12, Santos direct at 7.

[53] *Id.*

[54] TexCom Closing Arguments at 12; Tex Com Ex. 57, Langhus direct at 21.

[55] ED Ex. 12, Santos direct at 7.

[56] Lone Star Ex. 8, Grant direct at 19.

within the COI, and because TexCom failed to meet the TCEQ rules designed to ensure the safety of USDWs and fresh water aquifers.[57] These issues are addressed further below.

The Aligned Protestants and Individual Protestants challenge the geological suitability of the location because TexCom did not use the most reliable permeability calculations in defining the AOR and COI; did not meet the requirements of 30 TAC § 331.121(c)(4)(A)-(C); and because TexCom's wells may impair existing rights.[58] These issues, while relevant to siting requirements, are not dispositive of whether the area is geologically suitable based on the criteria set out in 30 TAC § 331.121(c)(2).

The ALJs find that TexCom satisfied the criteria set out in § 331.121(c)(2), and that TexCom's Class I wells are sited in geologically suitable areas. Dr. Langhus, Mr. Santos, and Mr. Grant agreed that the proposed Class I injection wells would be located in a geologically suitable area. TexCom has analyzed the structural and stratigraphic geology, the hydrogeology, and the seismic activity of the region and at the well sites; has described the geology of the region and the area at and around the wells confidently; and the limits of waste fate and transport can be accurately predicted through the use of analytical and numerical models and information from the existing well.

As noted previously, the Cockfield formations are made up of a thick marine mud-like section overlain by interbedded sands and shales.[59] The Lower Cockfield formation has thick porous and permeable sand that can provide storage for large volumes of nonhazardous waste. The Jackson Shale formation will serve as the Upper Confining Zone and the Cockfield Shale will serve as the Lower Confining Zone. The region does not have a history of seismic activity. Based on the evidence, the ALJs find that TexCom's proposed wells are located in areas that are geologically suitable.

---

[57] Lone Star Ex. 8, Grant direct at 20.

[58] Aligned Protestants Closing Arguments at 7 and 8; Section 27.051(a)(2) of the Water Code.

[59] TexCom Closing Argument at 12.

According to Lone Star, the remaining issues in dispute concern: (1) the effect faulting has on the size of the injection reservoir that is available to accept injected wastewater and the permeability of the reservoir; (2) the pressure caused by the wastewater on artificial penetrations, including oil and gas wells; and (3) TexCom's compliance with § 331.121(c)(4).

The Aligned Protestants claimed that TexCom's reservoir modeling and evaluations had too many errors and omissions to be reliable. Reservoir modeling is discussed below, and is not addressed here. According to the Aligned Protestants, TexCom also failed to identify a buffer zone between the upper confining zone and the lowermost USDW, the Catahoula Aquifer, as required by 30 TAC § 331.121(c)(4)(A); identified the EW-4400-S-fault as laterally transmissive when it is not; improperly characterized the shale content of the Lower Cockfield, thus miscalculating its permeability; and, misrepresented that TexCom's wells would not impinge on the mineral rights of others.

### 2. Presence and Significance of Faults Within the Area of Review[60]

Section 331.121(a)(2)(A) requires TexCom to submit a map with its Application "showing the location of the injection well for which a permit is sought and the applicable area of review. . . . The map should also show faults, if known or suspected."[61] TCEQ rules further require TexCom to delineate all faults within the AOR and to demonstrate that "the fault is not sufficiently transmissive or vertically extensive to allow migration of hazardous constituents out of the injection zone."[62] As noted previously, the confining zones (the Jackson Shale formation and the Cockfield Shale) must be: (1) "laterally continuous and free of transecting, transmissive faults or fractures over an area sufficient to prevent the movement of fluids into a USDW or freshwater aquifer," and must (2) contain "at least one formation of sufficient thickness and with

[60] This issue was not included in the remand order. However, Denbury presented a small amount of evidence concerning an additional fault that will be discussed. In addition, other portions of the discussion in this section have been partially modified to place it in context after the remand hearing.

[61] 30 TAC § 331.121(a)(2)(A).

[62] 30 TAC § 331.121(a)(2)(P).

lithologic and stress characteristics capable of preventing initiation and/or propagation of fractures."[63]

Whether faults exist in the AOR, and whether the faults are transmissive or nontransmissive, are important factors to consider in determining how much wastewater an injection zone can accept and whether the pressure build-up can cause fluid in the injection zone to migrate up the artificial penetrations and into USDWs. At the original hearing, the parties disagreed and presented evidence as to the number of faults within the AOR, the size of the AOR, and the effect these faults have on the build-up of pressure within the injection reservoir. Mr. Grant explained that the presence of faulting may limit the size of the injection reservoir available to accept wastewater, which will directly impact the resulting pressure increases calculated by the pressure modeling.[64] TexCom identified two faults, Lone Star identified three faults, and the Aligned Protestants and Individual Protestants identified 31 faults.

This area of the Conroe Oil Field sits on top of a salt dome structure that caused a number of faults along the area uplifted by the salt. Mr. Greg Casey, a petroleum engineer, explained that TexCom identified any fault large enough to cause sufficient stratigraphic change in the formation and allow for communication between the Cockfield layers. The closest such fault is the EW-4400-S fault, a fault that has between a 100-foot and 150-foot displacement (throw). The second fault identified is located at the extreme southern edge of the AOR and has a throw of approximately 75 feet.[65] Lone Star identified another fault in the AOR, a north-south fault with a 25-foot to 50-foot throw.[66] The two smaller faults were not discussed in significant detail by the parties. Instead, the parties focused on the EW-4400-S fault, which TexCom argued is horizontally transmissive.

---

[63] 30 TAC § 331.121(c)(3)(B).

[64] Lone Star Ex. 8, Grant at 31.

[65] TexCom Ex. 57, Langhus direct at 18.

[66] Lone Star Ex. 8, Grant direct at 32.

Mr. Casey explained at the original hearing that faults with a displacement of 100 feet or more may permit different portions of member sands to communicate horizontally. For example, at such a fault the top of the Middle Cockfield sands would be across from the bottom of the Upper Cockfield sands. Mr. Casey agreed that it is theoretically possible that the AOR has other small faults. But he stated that none of the faults could extend above the Jackson Shale formation.[67]

Mr. Casey also noted that the Injection Interval for all four injection wells would be between 6,045 feet and 6,390 feet,[68] and that the Injection Zone would include the Upper, Middle, and Lower Cockfield formations.[69] While the Lower, Middle, and Upper Cockfield could communicate at the EW-4400-S fault, Mr. Casey testified that the fault movement caused smearing of the clay on the formation that would inhibit or eliminate fluid movement vertically.[70]

Dr. Langhus and Mr. Casey testified that there are only two reliable methods to identify a fault. One is to review the pressure responses at various distances from the wellbore during a fall-off test. The other is to observe through wireline logs that a section of the subsurface stratum is missing, called "cut-with-wells."[71] Dr. Langhus stated that all other methods of identifying faults rely on the geologist's subjective interpretations.

Dr. Langhus agreed with Mr. Casey that only two relevant faults exist in the AOR. The EW-4400-S fault is located 4,400 feet to the south of the TexCom site,[72] and the second fault

---

[67] TexCom Ex. 49, Casey direct at 39; TexCom Ex. 57, Langhus direct at 22.

[68] Tr. at 178.

[69] TexCom Ex. 6, Application at 85.

[70] TexCom Ex. 49, Casey direct at 33.

[71] Tr. at 360-363 and 1323-1327.

[72] TexCom Ex. 57, Langhus direct at 18.

located on the extreme southern edge of the AOR with a 75-foot throw.[73] Dr. Langhus contends that the EW-4400-S fault is laterally transmissive and that the pressure caused by the TexCom's wastewater injections will migrate to the other side of the fault, thus reducing the pressure.

Lone Star's expert, Mr. Grant, disagreed that the EW-4400-S-fault is laterally transmissive. He opined that just the opposite is true, this fault is nontransmissive and will not reduce the increased pressure within the injection reservoir. If the fault is nontransmissive, Mr. Grant explained, the pressure within the injection reservoir will significantly increase. As noted previously, Mr. Grant also located another fault that was not included on TexCom's mapping. According to Mr. Grant, TexCom should have identified this fault on its map because it was on Exxon's structural maps of the Conroe Oil Field. He maintained that the lateral and vertical transmissivity of this fault should have been addressed, and possibly factored into the pressure model, although he did not include it in his reservoir modeling.[74]

As for whether the EW-4400-S fault is laterally transmissive, Mr. Grant testified that because a fault cutting through shale in the Lower Cockfield smears the shales along the fault line, it creates a pressure seal at the fault.[75] Consequently, Lone Star maintained that the EW-4400-S fault is nontransmissive and does not release pressure within the injection reservoir as argued by TexCom. Therefore, TexCom should have shown the EW-4400-S fault as nontransmissive in calculating the COI.

Aligned Protestants' expert Dr. Collier claimed that the AOR has 31 additional faults, beyond those found by the other two experts. Dr. Collier based his opinions on his interpretation of differences in stratum depths in various applications submitted by Exxon to the Railroad Commission. TexCom argued that these additional faults are purely interpretative and are not based on objective testing by either the fall-off test or by the cut-with-wells test. After reviewing

---

[73] *Id.*

[74] Lone Star Ex. 8, Grant at 32-33.

[75] Lone Star's Closing Argument at 32; Tr. 1078-1079.

the same materials that Dr. Collier reviewed, Dr. Langhus stated that Dr. Collier had no credible evidence to support any of the additional 31 faults.

During cross-examination, Dr. Collier conceded that some fault lines on his fault map either were not properly transcribed or could not be found on the source material he identified. He agreed that some fault lines appeared continuous through different geological horizons on the map, but were not, thus making the fault appear more substantial.[76] Finally, Dr. Collier conceded that Exxon's mapping may have been motivated by what Exxon wanted from the Texas Railroad Commission at the time.

Dr. Collier also presented testimony about surface faults in the AOR that he included on his map and documented with photographs of cracks in pavement and asphalt resurfacing.[77] However, Dr. Collier agreed that not every fault visible at the surface extended 6,000 feet below the surface. Conversely, he agreed that not every fault within the AOR extends upward to the surface because they die out structurally.[78] Only one alleged surface fault, the "Big Barn East," was within the AOR,[79] and none of the surface cracks extended into the Lower Cockfield formation.[80]

Dr. Collier could not identify the faults on his map that were transmissive laterally or vertically.[81] According to Dr. Collier, at least nineteen faults he identified went down as far as the Upper Cockfield formation, but he did not know if they were transmissive.[82] Dr. Collier did not independently assess the underlying data he considered, and he included faults with an

---

[76] Tr. at 959-961.

[77] Aligned Protestants Ex. 1-C.

[78] Tr. at 986-988

[79] Tr. at 896; TexCom Closing Argument at 22.

[80] Tr. at 896; TexCom Closing Argument at 22.

[81] *Id.*

[82] Tr. at 1000-1001.

interpreted offset of zero to 50 feet. Dr. Langhus was emphatic that an offset of zero is not an offset. He also questioned whether an offset of 50 feet is a fault or just local undulation of topography or regional dips.

While all 31 additional faults identified by Dr. Collier existed well above the injection interval,[83] the Aligned Protestants and Individual Protestants asserted that the rules require a full disclosure of all known and suspected faults in the AOR. TexCom should have identified all surface and subsurface features that might be a fault. The rule, they contend, does not allow TexCom to pick and choose which fault or suspected faults exist in the AOR.[84] Because TexCom failed to identify all the faults or suspected faults in the AOR, both request that TexCom's Application be denied.

After the original hearing, the ED and OPIC recommended that if the permits are issued to TexCom, the TCEQ include in its order a requirement that TexCom conduct a new fall-off test on the existing well that extends past the EW-4400-S fault to determine if it is laterally transmissive. If the EW-4400-S fault is transmissive, the existing fluid in the injection zone will be displaced to the south of the fault. If it is not transmissive, the EW-4400-S fault will act as a dam or barrier to the movement of the fluid in the injection zone, causing the test fluid to compress existing fluid, which in turn will exert pressure back to the wellbore.[85] OPIC also asked that if the EW-4400-S fault is not transmissive, TexCom be required to research the additional artificial penetrations within the enlarged COI and take corrective action it to ensure that the artificial penetrations present no endangerment or contamination to USDWs and fresh and surface water.

TexCom performed a new fall-off test in 2009, after the original hearing, but the test was not run long enough to reach the EW-4400-S fault. Therefore, it is still uncertain whether the EW-4400-S-fault is transmissive. If the fault is transmissive, it would partially validate the

---

[83] Tr. at 1006.

[84] Aligned Protestants Closing Arguments at 14-14.

[85] ED Closing Argument at 10.

original COI calculations made by TexCom. Further, the Commission's remand order directed the parties to perform additional reservoir modeling, assuming the fault is nontransmissive. That modeling has now been performed. Therefore, modeling has been performed both ways - assuming the EW-4400-S fault is transmissive, and assuming it is not transmissive. Transmissivity of this fault and reservoir modeling are discussed in more detail later in this PFD.

During the remand hearing, Denbury witness Jon Herber testified that he reviewed 3D seismic data that indicated two additional faults within the AOR near WDW315.[86] He stated that one fault appeared to be about 2,000 feet north of WDW315; the other fault was located within the AOR at an unspecified distance south of the EW-4400-S fault; and both faults appeared to run generally parallel to the EW-4400-S fault, according to Mr. Herber.[87] Denbury complained that TexCom did not reflect the fault 2,000 feet north of the well in its application or in its modeling, so it is unknown what impact these might have on the COI or the migration of injected waste. It also criticized TexCom's rebuttal evidence on this question because TexCom's witness, Mr. Phil Lakin, only reviewed the seismic data for about eight hours shortly before he testified.[88]

TexCom responded that the Commission did not even remand a question about the presence of additional faults; therefore, it is beyond the scope of this remand proceeding. It also complained that Mr. Herber first testified about these faults during redirect examination at the remand hearing, and he offered no opinion on the throw of the faults, whether the faults are transmissive, or whether they persist into the Lower Cockfield.[89] TexCom noted that Denbury only suggested that the fault to the north of WDW315 was relevant; yet, Mr. Herber acknowledged on cross-examination that the alleged fault to the north of WDW315 was not

---

[86] Mr. Herber referred to well WDW410, which is the same well as the existing WDW315. This PFD will refer to the well as WDW315.

[87] Remand Tr. 1029-1031; 1110-1119; 1122-1133; TexCom Ex. 103.

[88] Denbury Closing Argument at 28-29.

[89] TexCom Remand Closing Argument at 15-16.

obvious in the 3D seismic data but, instead, required "a little more imagination to see."[90] At the remand hearing, TexCom presented rebuttal testimony from Mr. Phil Lakin, a geophysicist. Mr. Lakin reviewed the 3D seismic information provided to him by Mr. Herber. In Mr. Lakin's opinion, the area Mr. Herber identified as a fault north of WDW315 is actually a syncline, or an underground valley, not a fault. He explained that a syncline does not have a displacement or break in the horizon like a fault.[91] Finally, TexCom pointed out that no witness testified that this alleged fault to the north of WDW315, if it did exist, would have any impact on modeling.[92]

The ALJs were not persuaded by Denbury's contention that additional relevant faults exist within the AOR. Denbury witness Herber first mentioned additional faults during redirect testimony at the remand hearing. The testimony was not detailed and was not supported by other witnesses or by any data other than his interpretation of 3D seismic data. None of the other witnesses at the original hearing or at the remand hearing testified that a fault in the area described by Mr. Herber extended into the Lower Cockfield. And, as pointed out by TexCom, Mr. Herber provided no meaningful information about the alleged fault, such as the throw or whether it was transmissive. Likewise, no witness testified as to the impact, if any, such a fault would have on reservoir monitoring. TexCom also presented rebuttal testimony from Mr. Lakin that the 3D seismic data actually indicated a syncline, not a fault. Denbury criticized TexCom's rebuttal evidence because Mr. Lakin only reviewed the 3D seismic data for about eight hours the day before he testified. However, as noted, Mr. Herber never mentioned additional faults in his prefiled direct testimony. Instead, he first testified about this question at the remand hearing during redirect testimony, over the strenuous objection of TexCom. Taking all the evidence into account, the ALJs do not find that TexCom failed to include all relevant faults in its evaluation of the geology of the area.

In summary, the ALJs do not believe it is necessary that TexCom's Application be denied due to the presence of faults in the AOR or because of uncertainty concerning the transmissivity

---

[90] Remand Tr. 1131.

[91] Remand Tr. 1751-1753.

[92] TexCom Remand Closing Argument at 16-17.

of the EW-4400-S fault. Additional modeling has already been performed that more conservatively assumed the fault is nontransmissive. That modeling is discussed later in this Amended PFD.

### 3. Presence and Significance of Artificial Penetrations Within the Area of Review

The Commission's remand order required the parties to conduct reservoir modeling using more conservative assumptions than used by TexCom at the original hearing. As discussed later in this PFD, the new reservoir modeling produced a COI and AOR larger than the 2.5-mile AOR evaluated in the original hearing for artificial penetrations. Therefore, at the remand hearing, TexCom introduced evidence concerning additional artificial penetrations beyond the original 2.5-mile radius AOR. To avoid confusion, the discussion of artificial penetrations is divided into two parts: (1) evidence and arguments from the original hearing, and (2) evidence and arguments from the remand hearing.

The following discussion is taken from the Original PFD and concerns evidence and arguments from the original hearing about the prior 2.5-mile radius AOR:

The parties agreed that the general area around the TexCom facility is covered with active and abandoned oil and gas wells. Dr. Langhus represented that at least 750 producing wells have been drilled through the Jackson Shale formation since the Conroe Oil Field was discovered in 1931. As mentioned previously, at least 505 artificial penetrations are in the 2.5-mile AOR, all of which are oil and gas wells.[93] Many of these wells have been plugged or abandoned.[94] Most oil and gas wells were drilled into the Upper Cockfield (depth 5,134 to 5,629 feet), where virtually all of the hydrocarbon production has occurred, and none was drilled specifically to or completed within the Lower Cockfield. However, Dr. Langhus acknowledged that some wells were drilled through the Lower Cockfield formation to depths of 14,000 feet,

[93] Aligned Protestants Closing Argument at 19; Tr. at 382-384.

[94] TexCom Ex. 6, Application at 62; TexCom 49, Casey direct at 43..

into the Wilcox sands.[95] Mr. Casey testified that the wells drilled past the Cockfield formation and into the Wilcox sands were dry holes and were plugged up to the Upper Cockfield for production.[96] Dr. Langhus explained that despite the significant drilling in the AOR, TexCom's wells are in an appropriate setting because the wastewater will be injected below most closed and existing wells.[97]

Mr. Casey pointed out that approximately 110 underground injection wells exist in Texas, most of which have been operating for decades without incident.[98] By way of comparison, Mr. Casey noted that Texas has almost 50,000 Class II injection and disposal wells used to dispose oil-and-gas drilling fluids. These injection wells are not regulated by the TCEQ's strict standards, but are instead regulated by the Texas Railroad Commission under much less scrutiny.[99] TexCom will not accept any hazardous materials, including any radioactive or inflammable waste, or any waste with high bacteriologic concentration.[100] Based on TexCom's projected, annualized, maximum modeled injection rates for a 30-year life, Mr. Casey concluded that inter-formational fluid flow would not occur in these boreholes even under conservative conditions.

According to Mr. Casey, TexCom identified six wells within TexCom's previously calculated 750-foot COI, none of which penetrated the Lower or Middle Cockfield.[101] Dr. Langhus added that 26 water wells existed in the 2.5-mile AOR. The deepest well was 1,500

---

[95] TexCom Ex. 57, Langhus direct at 12.

[96] TexCom Ex. 49, Casey direct at 44.

[97] TexCom Ex. 57, Langhus direct at 12.

[98] TexCom Ex. 49, Casey direct at 16.

[99] TexCom Ex. 49, Casey direct at 16-17.

[100] TexCom Ex. 49, Casey direct at 18.

[101] TexCom Ex. 49a, Casey corrections at 1.

feet deep. The Texas Water Development Board listed no other drinking water wells below 1,500 feet.[102]

The Aligned Protestants pointed out that the TCEQ's rules require an applicant for a Class I injection well to include a map of all artificial penetrations in the AOR, particularly those penetrating the injection zone or the confining unit. Therefore, they contended the Applicant must supply pertinent information about each well, including type, construction, drilled date, location, depth, records of plugging and completion. They argued that the absence of such records creates serious questions about the Jackson Shale formation's suitability as a confining unit. In addition, if Mr. Grant's reservoir modeling correctly expanded the AOR, TexCom would need to research, evaluate, and take corrective action, if necessary, on more artificial penetrations.

At the original hearing, the Aligned Protestants objected to TexCom's failure to secure well records for eighteen wells in the AOR. According to Dr. Collier, the lack of well records, the deterioration of closed wells over time, and the potential for improper plugging of abandoned wells raised serious questions as to the suitability of the Jackson Shale formation to serve as the upper confining unit.[103] Because of the lack of records for some of these wells, he claimed it was inconclusive as to whether the artificial penetrations penetrated the Lower Cockfield. Moreover, if the COI were increased, additional wells would be in the AOR and would need to be researched.

The ED explained that the lightest plugging mud for oil and gas wells used in the Conroe Oil Field weighs nine pounds per gallon. Because wastewater is being injected into the well, if the upward pressure of the fluid is greater than the downward pressure of the plugging mud, the plugging mud and ultimately the fluids will migrate upwards through abandoned wells that penetrate the injection zone.[104] TexCom maintained that the no artificial penetrations extended

---

[102] TexCom Ex 57, Langhus direct at 20.

[103] Aligned Protestants Ex. 1, Collier direct at 37; Aligned Protestants Response at 23.

[104] ED Closing Arguments at 10; Tr. at 193.

to the Lower Cockfield within its previously calculated 750-foot COI. As a result, the ED found that there are no artificial penetrations that could be influenced by the injection zone pressure.[105]

In its response, TexCom explained that both the characteristics of the Cockfield formations and the Jackson Shale formation will prevent any migration of fluid from the Lower Cockfield to USDWs or fresh water. Mr. Casey explained that it is unlikely the waste fluid could even migrate to the Jackson Shale formation because it is being injected 1,000 feet below into the Lower Cockfield formation. He believed layers of shale separate the Lower Cockfield from the Middle Cockfield, and the Middle Cockfield from the Upper Cockfield. Consequently, he opined, multiple layers of shale separate the Lower Cockfield from the Jackson Shale formation and serve to prevent the vertical migration of fluids. According to Mr. Casey, the pressure build-up in the injection interval because of the injectate would be insufficient to cause a migration to the Jackson Shale formation.[106]

Mr. Casey and Dr. Langhus further stated that if fluid did migrate upward, the Jackson Shale formation would act as an intact trapping feature because the massive quantity of mudstone lacks sufficient strength to maintain open channels (as is supported by the wire log signatures). Any faults within the AOR and beyond are therefore sealed by the mudstone in the Upper Confining Zone (Jackson Shale). Given the significant number of oil gas wells and production in the Upper Cockfield, the Jackson Shale formation has proven to be an effective confining layer.[107] Finally, Mr. Casey opined that waste fluids from the Lower Cockfield could not migrate through almost a mile of shale, mudstone, and other geologic formations between the injection zone and the deepest drinking well or USDWs.[108]

---

[105] ED Closing Arguments at 11.

[106] TexCom Ex. 49, Casey direct at 34-35.

[107] Tr. at 1013.

[108] TexCom Ex. 49, Casey direct at 35.

After the first hearing, the ALJs agreed that TexCom did not identify every artificial penetration within the AOR, but instead restricted its listing to those that penetrated the Cockfield formations. However, as indicated by the evidence, the artificial penetrations not listed by TexCom would also be effectively confined by the Jackson Shale formation. Those few that were drilled past the Lower Cockfield were drilled in the 1930s and 1940s, and these uncased wells have been sealed naturally by the Jackson Shale formation. The ALJs agreed that if the Jackson Shale formation was not an effective confining zone, the large number of oil and gas wells drilled in this area would have already contaminated the USDWs and freshwater aquifers. Therefore, the ALJs found that TexCom provided sufficient evidence regarding the artificial penetrations within TexCom's original 2.5-mile AOR to show that it complied with the TCEQ's rules, 30 TAC 331.121 (a)(2)(A)-(C). The ALJs noted that if the fall-out test done by TexCom prior to the first well being put into operation increased the AOR, TexCom would need to provide additional information regarding artificial penetrations within the expanded AOR.

The following discussion concerns evidence and arguments from the remand hearing about artificial penetrations in an expanded AOR.

The Commission's remand order directed the parties to conduct additional modeling of the injection reservoir and to calculate the COI using a permeability factor of 80.9 mD and treating the EW-4400-S fault as nontransmissive. As discussed later in this PFD, the parties' experts modeled the COI with these assumed inputs as follows:

| | |
|---|---|
| Greg Casey (TexCom) | 2.94 miles |
| Kathryn Flegal (ED) | 2.80 miles |
| Phil Grant (Lone Star) (2007) | 2.70 miles |
| Phil Grant (Lone Star) (2010) | 3.40 miles |
| James Fairchild (Denbury) | 2.94 miles (all other parameters the same)[109] |
| James Fairchild (Denbury) | 5.00 miles (changes to other parameters)[110] |

[109] Mr. Fairchild did not give a specific distance for this model run, but he said it was essentially the same as TexCom's result. Denbury Ex. 4, Fairchild direct at 7-8.

[110] Mr. Fairchild made adjustments to the modeled reservoir boundary and the productivity index, and he developed a structure to represent the regional geology and used a finer grid system. Denbury Ex. 4, Fairchild direct at 9-14. The five-mile distance encompassed the entire grid modeled by Mr. Fairchild.

All of these modeled COI's are greater than the 2.5-mile AOR considered during the original hearing. Therefore, during the remand hearing, TexCom provided additional evidence concerning artificial penetrations located within the expanded AOR. Because the EW-4400-S fault was assumed to be nontransmissive in this modeling, all of the expanded modeled area for the AOR was located north of the fault.

For TexCom, Mr. Casey testified that none of the several hundred wells located within his calculated 2.94-mile AOR were of concern in terms of potential pathways to USDWs.[111] He based this conclusion on well records TexCom obtained form the Railroad Commission for all wells located within an area extending 4.5 miles north, east, and west, and 2.5 miles south of WDW315.[112] These records are reproduced in TexCom Exs. 87 (wells out to 2.94 miles) and 94 (wells between 2.94 miles and 4.5 miles), and they are summarized in spreadsheets contained in TexCom Exs. 88 and 94. All of these well locations are shown on a map at TexCom Ex. 86.

Lone Star witness Phil Grant and ED witness Kathryn Flegal (formerly Ms. Hoffman) also reviewed the well records, and they both agreed that, within a 2.94-mile AOR, there were no wells of concern that would cause endangerment of drinking water sources.[113] As shown above, this AOR extending 2.94 miles north of WDW315 encompasses the COIs calculated by Mr. Casey (2.94 miles); Ms. Flegal (2.80 miles); Mr. Grant in 2007 (2.70 miles); and Mr. Fairchild (keeping all other parameters the same, 2.94 miles). Denbury did not dispute the conclusions of Mr. Casey, Mr. Grant, and Ms. Flegal on this question, although Denbury did argue that TexCom was required to research artificial penetrations even farther out to five miles from the well bore.[114]

---

[111] TexCom Ex. 84, Casey supplemental direct at 8-15.

[112] Even though the EW-4400-S fault was assumed to be nontransmissive, the Commission's rules define the AOR as the size of the COI or 2.5 miles, whichever is *greater*. Therefore, even assuming the EW-4400-S fault is nontransmissive and that the COI does not extend south of the fault, records were nonetheless compiled for wells out 2.5 miles south from WDW315.

[113] Remand Tr. 531 (Grant); Remand Tr. 1816 (Flegal).

[114] Denbury Remand Closing Arguments at 30; Denbury Remand Reply to Closing Arguments at 20. Denbury also argued that cross-flow between artificial penetrations can occur. That question is discussed below under Other Issues Related to Geology.

As noted, in 2010 Mr. Grant calculated a COI of 3.40 miles, using the remand parameters. This increased COI was based on pressure increases running east and west along the EW-4400-S fault that he had not modeled in 2007. Thus, a 0.46-mile band between TexCom's calculated 2.94-mile COI and Mr. Grant's 2010 calculated 3.40-mile COI remained in question. Therefore, Mr. Casey also collected and examined the records for wells between 2.94 miles and 4.5 miles north, east, and west from the TexCom site. In his opinion none these wells, including those in the 0.46-mile band between 2.94 miles and 3.40 miles, created pathways for migration of fluids out of the Cockfield formation.[115] Mr. Grant also reviewed these records, and he identified six wells that concerned him: wells D-3, D-4, D-5, E-1, E-30, and E-37.[116]

Mr. Grant's concerns about these wells are shown on the following table:[117]

| Well | Type of Well | Mr. Grant's Concern |
|---|---|---|
| D-3 | Dry hole. | Depth and plugging status unknown. |
| D-4 | Dry hole. | Depth and plugging status unknown. |
| D-5 | Canceled / abandoned. | No records. |
| E-1 | Dry hole. | Plugging status unknown. |
| E-30 | Dry hole. | Depth and plugging status unknown. |
| E-37 | Injection disposal well. | Depth and plugging status unknown. |

In response to these concerns, TexCom pointed out that wells E-1, E-30, and E-37 are outside the 3.50-mile radius shown on the well map at TexCom Ex. 86.[118] Thus, these wells are beyond even the 3.40-mile COI calculated by Mr. Grant in 2010. Wells D-3, D-4, and D-5 are located northwest of TexCom's proposed wells, between the 2.94-mile radius and the 3.50-mile radius shown on the well map. TexCom notes, however, that Mr. Grant's 2010 modeling showed a COI extending 3.2 miles to the east and west of WDW315 and 3.4 miles to the

[115] Remand Tr. 370-371.

[116] Remand Tr. 532-534.

[117] Remand Tr. 534-538.

[118] These wells are on the far left side of the map (west of TexCom's proposed facility).

southeast and southwest along the EW-4400-S fault, but only 2.7 miles to the north of WDW315.[119] Lone Star Ex. 24 is a plot of Mr. Grant's 2010 COI compared to TexCom's 2.94-mile COI, and TexCom argues that this diagram shows that wells D-3, D-4, and D-5, which are located northwest of WDW315, are actually outside the COI modeled by Mr. Grant, as well as outside the 2.94-mile COI calculated by TexCom. Therefore, TexCom contends all of the wells that Mr. Grant cited as a concern for lack of records are, in any event, beyond the COIs calculated by Mr. Grant, Mr. Casey, and Ms. Flegal, and therefore do not pose a threat to USDWs in the area. Further, TexCom cited testimony from Mr. Grant that dry holes were likely uncased through the Jackson Shale and would have naturally sealed under the force of that formation.[120] And finally, TexCom argued that these wells are not a concern because they are far beyond the calculated 2,770-foot waste plume. TexCom noted that the waste plume model is purely a volume calculation and is not affected by different permeability factors, which are not an input into the waste plume calculation.[121]

The ALJs find that the wells of concern cited by Mr. Grant do not threaten USDWs or fresh water resources within the AOR. As noted by TexCom, wells E-1, E-30, and E-37 are outside the 3.50-mile radius shown on the well map, and thus are beyond even the 3.40-mile COI calculated by Mr. Grant in 2010. Although not as certain, it also appears likely that wells D-3, D-4, and D-5, which are located northwest of WDW315, are also outside the COI modeled by Mr. Grant in 2010. They are clearly outside the COI calculated by Mr. Grant in 2007, as well as the COIs calculated by Mr. Casey and Ms. Flegal. Further, wells D-3 and D-4 were dry holes that most likely were not cased through the Jackson Shale and would have sealed naturally within the Jackson Shale. Well D-5 was indicated as "canceled/abandoned," which suggests that it may have never been drilled,[122] and which would account for the lack of records.

---

[119] Lone Star Ex. 22, Grant direct at 5.

[120] Remand Tr. 541-544.

[121] TexCom Remand Closing Argument at 25-26; TexCom Ex. 84, Casey supplemental direct at 7.

[122] Remand Tr. at 536.

Mr. Bob Smith, an Individual Protestant, provided testimony that well RM-5 (2.87 miles northwest of WDW315) and well C-57 (located 1.98 miles north of WDW315) were not plugged at a level below the deepest usable drinking water.[123] The levels of the relevant geologic formations and aquifer systems in the area are as follows:

| | | |
|---|---|---|
| Gulf Coast Aquifer System | 0-150 feet<br>150-750 feet<br>750-1,010 feet<br>1,010-1525 feet | Chicot Aquifer<br>Evangeline Aquifer<br>Burkeville Aquifer<br>Jasper-Oaksville Aquifer |
| Catahoula Formation | 1,525-4,088 feet | Deepest base of USDW above the Jackson Shale and includes the Frio and Vicksburg aquifers |
| Jackson Shale Formation | 4,088-5,180 feet | Upper confining zone for the UIC. |
| Cockfield Formation | 5,134-6,390 feet | Injection zone. |
| Cockfield Shale Member | Below 6,390 feet | Lower confining zone for the UIC. |

Well RM-5 was drilled to a total depth of 9,267 feet, and it was plugged at two depths: 1,752-1,528 feet and 20 feet to surface. Well C-57 was drilled to a total depth of 6,656 feet, and it was plugged at 2,600-2,500 feet, 450-350 feet, and 20 feet to surface. Thus, as indicated on the chart above, both of these wells penetrated the entire Cockfield formation, including the Lower Cockfield injection interval, but their lowest cemented plugs are located above the Jackson Shale and within the Catahoula Formation aquifer system, just below the Gulf Coast Aquifer system.

In its response, TexCom seems to have misunderstood Mr. Smith to have claimed these wells were not plugged at all, as TexCom merely cited to the evidence showing that these wells were plugged at the same levels noted by Mr. Smith.[124] TexCom further pointed out that neither Mr. Grant, Ms. Flegal, nor Mr. Casey expressed any concern about these wells, which are located within the 2.94 AOR calculated by Mr. Casey.[125]

---

[123] Individual Protestants Ex. D, Smith direct at 5 and attached Individual Protestants Ex. 27.

[124] TexCom Remand Response to Closing Arguments at 37-39; TexCom Ex. 87 at 2599 (plugging of RM-5) and at 297 (plugging of C-57).

[125] TexCom Remand Response to Closing Arguments at 38-39.

The ALJs find that the two wells cited by Mr. Smith do not present a risk of contamination to the USDWs from TexCom's proposed injection activities. Mr. Smith correctly pointed out that that wells RM-5 and C-57 penetrated the Lower Cockfield, and the deepest cement plugs for these wells are located above the Jackson Shale and within the Catahoula Formation. However, the records for these two wells show that both were dry holes.[126] Testimony also established that dry holes likely were not cased through the Jackson Shale, which would account for the cement plugs being placed above the Jackson Shale. This is confirmed by the records for these wells: well RM-5 had casing of only 1,544 feet and tubing or drill pipe of only 1,752 feet; and well C-57 had casing only to 412 feet.[127] As mentioned previously, the evidence established that dry holes uncased through the Jackson Shale Formation collapse and seal naturally within that formation. Thus, the ALJs find that wells RM-5 and C-57 do not pose a threat of contamination to the USDWs from TexCom's proposed injection activities.

The Commission's rule at 30 TAC § 331.121(a)(2)(A)-(C) requires the Commission to consider: (1) a map showing, within the AOR, the identity and location of all producing wells, injection wells, abandoned wells, and dry holes; (2) a tabulation of all wells within the AOR which penetrate the injection zone or confining zone, including a description of the well type, construction, date drilled, location, depth, and a record of plugging and/or completion; and (3) the protocol followed to identify, locate, and ascertain the condition of abandoned wells within the AOR which penetrate the injection or the confining zone. As described earlier, TexCom provided the required map, voluminous records, and a spreadsheet tabulation of the records (TexCom Exs. 86, 87, 88, and 94). It also provided testimony concerning its efforts to search and locate wells. Although the parties dispute the correct extent of the COI and AOR, the information provided by TexCom extended 4.5 miles north, east, and west of WDW315 and 2.5 miles south of WDW315. Although Denbury witness Fairchild estimated a COI of more than five miles, this estimate made various changes to the modeling assumptions prescribed in the remand order, and his changes were not supported by any other experts who testified in this case. Therefore, considering all the evidence, the ALJs find that TexCom has adequately accounted for

---

[126] TexCom Ex. 87 at 2595 (RM-5) and at 289(C-57).

[127] TexCom Ex. 87 at 2601 (RM-5) and at 296 (C-57).

the artificial penetrations within the COI and AOR which penetrate the Jackson Shale upper confining unit and the Cockfield formation injection zone.

### 4. Other Issues Related to Location of Proposed Injection Wells

The following discussion is taken from the Original PFD and concerns evidence and arguments from the original hearing.

According to the Aligned Protestants, TexCom failed to comply with the siting requirements set out in 30 TAC § 331.121(c)(4)(A)-(C). An applicant must comply with the provisions of 30 TAC § 331.121(c)(4)(A)-(C) unless the applicant can show that it meets the exception set out in 30 TAC § 331.121(c)(4)(D).[128] According to TexCom, this exception applies to its Application because "the geology, nature of the waste, or other considerations" ensure that abandoned boreholes or other conduits would not cause endangerment of USDWs, and fresh or surface water. TexCom explained that the Jackson Shale formation's mudstone composition is impermeable and will prevent the migration of fluid into a USDW and fresh or surface water. Therefore, TexCom insists that it does not need to comply with § 331.121(c)(4)(A)-(C). The Protestants disagree that the Jackson Shale formation is completely

---

[128] 30 TAC § 331.121(c)(4) provides:

> The owner or operator shall demonstrate to the satisfaction of the executive director that:
>
> > (A) the confining zone is separated from the base of the lowermost USDW or freshwater aquifer by at least one sequence of permeable and less permeable strata that will provide an added layer of protection for the USDW or freshwater aquifer in the event of fluid movement in an unlocated borehole or transmissive fault; or
> > (B) within the area of review, the piezometric surface of the fluid in the injection zone is less than the piezometric surface of the lowermost USDW or freshwater aquifer, considering density effects, injection pressures, and any significant pumping in the overlying USDW or freshwater aquifer; or
> > (C) there is no USDW or freshwater aquifer present;
> > (D) the commission may approve a site which does not meet the requirements in subparagraphs (A), (B), or (C) of this paragraph if the owner or operator can demonstrate to the commission that because of the geology, nature of the waste, or other considerations, that abandoned boreholes or other conduits would not cause endangerment of USDWs, and fresh or surface water.

impermeable, and argue that TexCom must comply with the requirements set out 30 TAC § 331.121(c)(4)(A)-(C).

The Protestants charge that TexCom failed to provide a "buffer zone" between the Catahoula Aquifer and the Jackson Shale formation as required by 30 TAC § 331.121(c)(4)(A). TexCom contends that it does not need to include a buffer zone for the reasons stated above. TexCom reasons that the geology and permeability of the Lower Cockfield formation, demonstrated by its reservoir modeling, prevent the build-up of sufficient pressure over the project lifetime to cause injected wastewater to migrate upward through abandoned boreholes. But if pressure did build up, TexCom reiterated that the Jackson Shale formation would confine any migration of fluid from the injections zone.[129] Consequently, TexCom asserts that a buffer zone is not required.

However, even if a buffer zone is required, TexCom maintains it complied with this requirement. As stated in the Application, in the unlikely event that injected wastewater migrated approximately 1,000 feet up through the Cockfield formation and then through the impermeable Jackson Shale formation, TexCom posits that the sands at the base of the Catahoula Aquifer (2,800 feet to 4,000 feet) would serve as a buffer zone between the Jackson Shale formation and the USDW. TexCom describes the Catahoula as "largely a thick mudstone" with isolated thin sands.[130] The base of the Catahoula Aquifer has brackish water, with a salt content between 2,000 and 10,000 ppm. Until 2002, the bottom of the Catahoula was used for permitted disposal of Class II waste and oilfield brine. Consequently, Dr. Langhus questions whether the water in the base of the Catahoula Aquifer meets the definition of USDW because it contains brine and oil and gas from the oil fields.[131] No water wells are currently using the Catahoula

---

[129] TexCom Closing Argument at 14 and 16; TexCom Ex. 57, Langhus direct at 22 and 24; and TexCom Response at 7.

[130] TexCom Closing Arguments at 13.

[131] Tr. at 402-404, 446, and 455-458.

Aquifer in the AOR. The water is treatable to health and aesthetic standards, although Dr. Langhus says the cost to remove the oil and brine would be prohibitive.[132]

Protestants vehemently disagree with TexCom's position, stating that all of the Catahoula Aquifer is a USDW and cannot be used as the buffer zone.[133] The Protestants emphasize that the TCEQ's rules require the protection of all USDWS — it does not allow an applicant to selectively choose which USDWs are worthy of protection.

The Aligned Protestants also argue that TexCom failed to prove it satisfied the requirements of 30 TAC § 331.121(c)(4)(B). That rule requires TexCom to show that "within the area of review, the piezometric surface of the fluid in the injection zone is less than the piezometric surface of the lowermost USDW or freshwater aquifer, considering density effects, injection pressures, and any significant pumping in the overlying USDW or freshwater aquifer . . . ." The Aligned Protestants challenge Dr. Langhus' position that § 331.121(c)(4)(B) is irrelevant because the geology would prevent the upward migration of wastewater to the USDW.

The reservoir modeling issue is discussed in detail in Section V.C. While TexCom appears to have failed to meet the requirements regarding a buffer zone and the piezometric surface, the initial question for the ALJs to consider is whether TexCom is required to comply with these provisions. The ALJs find that TexCom is not required to do so because the geology of this area will prevent the upward migration of wastewater into the USDW or freshwater. The Jackson Shale formation, the upper confining zone, will prevent boreholes or other conduits to endanger USDWs and fresh or surface water. As TexCom explained, the thick, marine mudstone of the Jackson Shale formation will effectively seal any fault that may occur. Any uncased abandoned boreholes or other conduits would have collapsed under the weight of the Jackson Shale formation. Therefore, the ALJs find that TexCom has demonstrated that the geology of the area will prevent the upward migration of wastewater into a USDW and fresh and surface water.

---

[132] TexCom Ex. 6, Application at 83-85.

[133] TexCom Ex. 6, Application at 84-85; Tr. at 402-404; and Aligned Protestants Closing Arguments at 9.

The Aligned Protestants also raised an issue about whether TexCom complied with § 27.051(a)(2) of the Water Code. According to the Aligned Protestants, TexCom's injection wells would encroach on the mineral rights of then Conroe Oil Field operator, Wapiti. Consequently, Wapiti sued TexCom, claiming trespass into its oil producing zone.[134] TexCom countered that the lawsuit had been dismissed because TexCom wells do not interfere with any mineral rights.[135]

Based on the evidence presented, the ALJs find that TexCom has shown that no other rights have been infringed on by its proposed underground injection wells. These wells will be drilled significantly below any known oil and gas deposits (Upper Cockfield) and pose no proven threat to any other rights. Therefore, the ALJs find that TexCom's proposed injection wells would not interfere with any others rights in the area.

The following discussion concerns evidence and arguments from the remand hearing.

Denbury argued that wastewater TexCom injects into the Lower Cockfield could migrate to the Middle and Upper Cockfield through cross-flow between well boreholes. Denbury also maintained that the shale layers between the Cockfield strata do not confine each layer, so the different layers of the Cockfield communicate with each other.

Concerning cross-flow between well boreholes, Denbury stated that a well perforated or damaged within the Lower Cockfield, but not plugged within the Lower Cockfield, could act as a conduit for injectate and formation fluid to migrate to the Upper Cockfield and above, up to the depth of the well's plug. Denbury witness Mark Swadener explained this could occur in a well with its casing perforated or damaged in the Lower Cockfield and also perforated or damaged in the Upper Cockfield, with a plug above the Upper Cockfield.[136] Fluid could thus enter the well's bore in the Lower Cockfield through perforations or damage and exit the well's bore in the

---

[134] Aligned Protestants Response at 9.

[135] TexCom Response at 29.

[136] Remand Tr. 1473-1474.

Middle or Upper Cockfield through perforations or damage at those levels. Denbury stated that if this happens, TexCom's injected wastewater would migrate from the Lower Cockfield to the Upper Cockfield and then be pumped to the surface through Denbury's production wells.[137]

Denbury also asserted that the Lower Cockfield naturally passes fluids to the Middle and Upper Cockfield formations. According to Denbury, this communication between Cockfield layers occurs: (1) because of faults and fractures between the layers that would not seal vertically; (2) because the shale layer between the Lower Cockfield and Middle Cockfield is not continuous; and (3) because the layer between the Lower Cockfield and Middle Cockfield merely contains alternating thin layers of sands, silts, and shale insufficient to isolate the Lower Cockfield.

Denbury witness Herber testified that the Conroe Oil Field has a complex system of faults and fractures, and he believed that shale smearing at the EW-4400-S fault does not effectively seal the Lower Cockfield from the Middle Cockfield.[138] Further, Denbury witness Robert Sutherland testified that pressure readings from the 1999 and 2009 fall-off tests showed the Lower Cockfield pressure is approximately 200 psi below virgin pressure. This equates to a loss of pressure gradient from 0.440 psi/ft to 0.404 psi/ft.[139] In Mr. Sutherland's view, this pressure gradient drop below virgin pressure proves that the Lower Cockfield communicates with the Middle Cockfield at the EW-4400-S fault.[140] Mr. Swadener provided similar testimony. He added that without communication between the layers, the pressure gradient should not be depleted in the Lower Cockfield because no hydrocarbon production has occurred there; consequently, he said, communication must occur between the Lower Cockfield and an above hydrocarbon-production zone (the Upper Cockfield) to account for the pressure decline.[141] Thus,

---

[137] Denbury Remand Closing Arguments at 30.

[138] Denbury Ex. 13, Herber direct at 6-7.

[139] A pressure gradient is determined by measuring the pressure at a given depth in psi and then dividing that pressure by the depth.

[140] Denbury Ex. 1, Sutherland direct at 7-8.

[141] Denbury Ex. 18, Swadener direct at 7-8.

Denbury argued that TexCom's injected waste would not remain trapped in the Lower Cockfield but would rise from the injection interval and migrate throughout the entire Cockfield injection zone and beyond.[142]

Denbury emphasized a statement in TexCom's application that "the shale layers do not appear to be thick enough to isolate the individual sand members [Cockfield layers] either stratigraphically or across the [EW-4400-S] fault."[143] In addition, Denbury cited a 2005 email by TexCom witness Dr. Bruce Langhus, which stated: "I don't know whether we can say that there is a competent confining zone anywhere within the Cockfield. I think we'd have to permit the entire package from 5134' to 6390'."[144] Mr. Herber agreed, noting that a well log for WDW315 showed the layer between the Lower Cockfield and the Middle Cockfield as being alternating thin beds of sand, silt, and shale, rather than a uniform, confining shale layer.[145] He explained that the shales in the Cockfield formation vary in thickness and do not have field-wide continuity, so they would not act as a confining layer in the sense that the Jackson Shale is a confining layer. Mr. Herber examined several logs for wells north of the EW-4400-S fault. These logs showed that the shales above the Lower Cockfield vary considerably in thickness, and in at least one instance, were not present. He added that this fits the geologic depositional model for a deltaic-fluvial complex.[146] In rebuttal, TexCom witness Bruce Langhus testified that he looked at the well logs for six wells in the area that penetrated the Lower Cockfield, and all six indicated that the shale layer between the Lower Cockfield and the Middle Cockfield existed, ranging in thickness from 26 feet to 46 feet. In response to this testimony, Denbury suggested that Dr. Langhus "cherry picked" the wells to review. To support this contention, Denbury noted

---

[142] Denbury Remand Closing Arguments at 31-33.

[143] TexCom Ex. 6 at 85.

[144] Denbury Ex. 27.

[145] Remand Tr. at 1015-1016,

[146] Denbury Ex. 13, Herber direct at 13.

that two wells – Tiptin #1 and Grand Lake #1, Unit 2 – penetrated the Lower Cockfield and were referenced in TexCom Ex. 94, but Dr. Langhus did not include these in his log analysis.[147]

Aligned Protestants and Individual Protestants support Denbury's arguments but offered no additional evidence on the issue.[148] The ED offered no comments.[149]

TexCom argued that these issues related to geology lack merit and are beyond the scope of this remand proceeding. Concerning cross-flow between wellbore, TexCom stressed that Denbury did not identify any artificial penetration with perforations as deep as the lower Cockfield. Indeed, it is not likely that any such wells exist because all hydrocarbon production occurred in the Upper Cockfield. Therefore, any well drilled below the Lower Cockfield would likely be plugged to the Upper Cockfield to prevent the inward flow of brine from the lower zones.[150]

With regard to additional faulting within the area of WDW315, TexCom noted that Denbury witness Herber studied the 3D seismic data for the well, but he identified only the two alleged faults previously discussed. One of those was south of the EW-4400-S fault and the other actually a syncline and not a fault, according to TexCom. Further, TexCom stated, none of the witnesses identified any indication of faulting from the 1999 or the 2009 fall-off tests on WDW315, which tested out to 1,500 feet and 2,583 feet from the borehole respectively.[151]

TexCom downplayed the statement in its application that the shale layers between the Cockfield strata are not sufficient to isolate those strata. It stated that this was consistent with the testimony from both Mr. Casey and Dr. Langhus that the shale layer was not sufficiently thick to

---

[147] Denbury Remand Reply to Closing Arguments at 21.

[148] Aligned Protestants Remand Closing Arguments at 7; Individual Protestants Remand Closing Statement at 14-17.

[149] ED Remand Closing Argument at 8.

[150] TexCom Remand Response to Closing Arguments at 34.

[151] TexCom Remand Response to Closing Arguments at 39-41.

isolate the Lower Cockfield across the EW-4400-S fault, which has a throw of 100-150 feet. And in any event, TexCom stated, that one sentence taken from the voluminous application should not trump the testimony provided at both the original and remand hearing. TexCom emphasized that even Lone Star witness Grant testified that a 30-to-35-foot continuous shale layer separated the Lower and Middle Cockfield levels for at least three to four miles to the south and potentially four to five miles to the north, and that this shale layer prevented any communication between the Lower and Middle Cockfield strata within human time (as contrasted with millions of years of geologic time). Thus, Mr. Grant stated that whatever TexCom injected into the Lower Cockfield would remain in the Lower Cockfield.[152]

TexCom also referred to Dr. Langhus' testimony that he reviewed logs from six wells in the area that had been drilled into the Lower Cockfield and that all six showed the shale layer between the Lower Cockfield and the Middle Cockfield, ranging in thickness from 26 to 46 feet.[153] In response to Denbury's suggestion that Dr. Langhus selectively chose which well logs to analyze, TexCom pointed out that these were all of the logs for wells extending into the Lower Cockfield that Dr. Langhus had located.[154] In addition, TexCom emphasized that even Denbury witness Herber testified that the shale layer between the Lower Cockfield and the Middle Cockfield was continuous to the south, and he merely hypothesized that the shale layer grew thinner and eventually disappeared at some unknown distance to the north.[155]

With respect to the pressure gradient in the Lower Cockfield, TexCom noted testimony from Dr. Langhus that the pressure gradient was essentially the same in the 1999 and 2009 fall-off tests at 0.406 psi/ft.[156] TexCom suggested that this steady pressure gradient over a ten-year period when hydrocarbon production occurred in the Upper Cockfield supports a conclusion that

---

[152] Remand Tr. 528-530.

[153] Remand Tr. 1916-1922; TexCom Ex. 114 (summary of log data from the six wells).

[154] Remand Tr. 1916-1922; 1948-1949.

[155] Remand Tr. 1034-1035.

[156] Remand Tr. at 1903-1908.

the Lower Cockfield is not in communication with the Upper Cockfield. In addition, it pointed out that Wapiti Well #2315 showed a lower pressure gradient of 0.397 psi/ft in the Upper Cockfield, which TexCom argues corroborates the conclusion that the Cockfield layers are not communicating.[157] Further, Dr. Langhus testified that the virgin pressure referred to by Mr. Sutherland was merely an *average* virgin pressure taken from literature, and at least half of the reservoirs would have had a lower virgin pressure gradient.[158]

In summary, TexCom argued that wastewater injected into the Lower Cockfield by TexCom would remain in the Lower Cockfield, and, in any event, if the wastewater somehow managed to migrate up to the Upper Cockfield, it would still be blocked from entering any USDW by the massive Jackson Shale formation. Further, TexCom noted, if the injected wastewater could migrate into the Middle and Upper Cockfield, then the pressure buildup would be much less and the COI would be significantly less than predicted by all the modelers in this remand hearing.[159]

The ALJs find that the evidence did not support Denbury's theory that cross-flow between well bores would endanger USDWs. First, the great weight of the evidence established that no production wells were perforated within the Lower Cockfield because no hydrocarbon production ever occurred from that stratum. Some wells were drilled through the Lower Cockfield for completion at lower levels, and Denbury suggested that the casing on those wells could corrode within the Lower Cockfield and allow flow of TexCom's injected waste to the Upper Cockfield, assuming the well was also corroded or perforated at that level. But none of the parties identified any wells penetrating the Lower Cockfield that are located within the projected area of the waste plume. Further, the evidence showed that any well drilled through the Lower Cockfield that was perforated in the Upper Cockfield for production would have also been plugged at the Upper Cockfield to prevent inflow of brine from below. In short, there is no evidence to show that Denbury's theory of cross-flow between well bores would actually occur

---

[157] TexCom Remand Response to Closing Arguments at 45-46. Remand Tr. at 1902-1903.

[158] Remand Tr. at 1903.

[159] TexCom Remand Response to Closing Arguments at 47-48.

within the area of TexCom's waste plume to allow the injected waste to migrate from the Lower Cockfield to the Upper Cockfield.

As for waste migration through additional faulting, the ALJs already found earlier in this PFD that Denbury's evidence and arguments about more faulting within the AOR was not persuasive. Denbury also offered evidence and argument that the EW-4400-S fault is laterally and vertically transmissive and would allow migration of fluids from the Lower Cockfield to the Middle Cockfield and then the Upper Cockfield. The ALJs continue to find that the evidence is inconclusive on whether the EW-4400-S fault is transmissive. To be conservative and to protect USDWs, the fault has been assumed to be nontransmissive for purposes of reservoir modeling. Likewise, to be conservative for protection of USDWs, the fault should be assumed to be transmissive for purposes of evaluating waste migration out of the Lower Cockfield. Denbury has theorized that some sand channels could possibly allow the waste plume to reach the EW-4400-S fault. However, the weight of the evidence – based on testimony from Mr. Casey, Mr. Grant, and Ms. Flegal (formerly Ms. Hoffman) – was that TexCom properly modeled the extent of the waste plume at 2,770 feet from the well bore, based on 30 years of injection at the maximum permitted rate, 24-hours per day. This is well short of the EW-4400-S fault. Thus, a preponderance of the evidence established that the waste plume will not reach the EW-4400-S fault to allow further migration up through the Middle Cockfield and to the Upper Cockfield.

Denbury's arguments that the shale layers between the Cockfield strata are not sufficient to prevent fluid migration between the Lower, Middle, and Upper Cockfield segments give the ALJs greater concern. On the one hand, Lone Star witness Phil Grant was firm in his testimony that the shale layer between the Lower and Middle Cockfield was persistent within the AOR and would prevent fluid migration between those two layers within the AOR. Likewise, the six well logs reviewed by Dr. Langhus indicated a persistent shale layer ranging in thickness from 26 to 46 feet (although the locations of these wells are not clear to the ALJs). Denbury's argument that Dr. Langhus "cherry picked" the well logs to examine is not well taken. Denbury cited the Tiptin #1 and the Grand Lake #1, Unit 2 as two wells that penetrated the Lower Cockfield for which Mr. Grant did not examine well logs. However, the records in TexCom Ex. No. 94 show that the Tiptin #1 well (E030) was drilled in 1920 and no records exist for it except a notation on

an old cloth map from the 1950s, so obviously no well log exists for that well. Likewise, the Grand Lake #1, Unit 2 well (EO33) was drilled in 1953, and there is no evidence that a log is available for that well. And in any event, the well map at TexCom Ex. 86 showed that both of these wells are located more than 3.5 miles from WDW315, well beyond the 2,770-foot waste plume.

On the other hand, Denbury witness Herber testified that the layer between the Lower Cockfield and the Middle Cockfield is not a uniform confining shale layer, but rather consists of alternating thin beds of sand, silt, and shale. Further, before TexCom filed its application, Dr. Langhus sent his team an email questioning whether a competent confining zone existed anywhere within the Cockfield and suggesting that TexCom would need to permit the entire Cockfield formation. TexCom also stated in its application that the shale layers did not appear thick enough to isolate the Cockfield layers, either stratigraphically or across the EW-4400-S fault. TexCom attempted to downplay these statements, yet the TexCom application designated the entire Cockfield (Lower, Middle, and Upper) as the injection zone. As discussed previously, the injection zone is: "A formation, a group of formations, or part of a formation that receives fluid through a well."[160] Thus, TexCom's application presumes that the entire Cockfield may receive wastewater through its proposed injection wells. Therefore, the ALJs find that TexCom did not establish by a preponderance of the evidence that the sand, silt, and shale layers between the Upper, Middle, and Lower Cockfield strata are sufficient to prevent fluid migration between those strata. Consequently, it would be possible for waste injected by TexCom into the Lower Cockfield formation to migrate into the Middle and Upper Cockfield formations, which formations TexCom's Application has included within the injection zone.

[160] 30 TAC § 331.2(53). "Injection zone" is distinguished from the "injection interval," which 30 TAC § 331.2(50) defines as "That part of the injection zone in which the well is authorized to be screened, perforated, or in which the waste is otherwise authorized to be directly emplaced."

## C. Reservoir Modeling

### 1. Introduction

Reservoir modeling's ultimate purpose is to protect USDWs and other freshwater resources. It is used to determine how the pressures exerted by injected wastewater will dissipate throughout the reservoir over time, to calculate the COI, and to make a meaningful evaluation of the proposed project. The COI, as described previously, is the area around an injection well where the injection zone pressure could increase to a level sufficient to displace a mud plug in an abandoned oil well, thus providing a pathway for injected wastewater or displaced brine to migrate to a USDW or freshwater aquifer located above the injection zone. The COI is important because it defines the area where artificial penetrations must be identified and evaluated. Reservoir modeling also predicts the extent of the waste plume over the life of the well's injection activities.

Inputs into the reservoir model include injection rates and quantities, injection-interval layer thickness, permeability, porosity, structure, water saturation, temperature, rock compressibility, water compressibility, and the type of formation fluid found in the Lower Cockfield.[161] To perform the calculations for reservoir modeling, TexCom's consultants used a BOAST98 computer model; Lone Star's witness used a PRESS2 model; and ED witness Flegal used a PRESS model. The PRESS, PRESS2, and BOAST98 programs all produce similar pressure-increase calculations, while the BOAST98 also predicts flow and transport.[162]

The disputed issues related to the reservoir modeling, which produced different results and were most hotly contested, concerned the model input for the permeability of the injection interval and the transmissivity of the fault located 4,400 feet south of the well site (EW-4400-S). Because TexCom and Lone Star used different model inputs concerning these issues, the COI calculated by Lone Star's modeling covered a larger area than TexCom's calculated COI. At the first hearing, TexCom had modeled a COI with a 750-foot radius; Lone Star had modeled a COI

[161] TexCom Ex. 49, Casey direct at 37.

[162] Tr. at 1049-50.

with a 3,170-foot COI, assuming the EW-4400-S fault was transmissive, and a 14,300-foot COI, assuming the fault was not transmissive. A larger COI would encompass more abandoned oil and gas wells, and more information would be needed about the depth and plugging of these wells.

In most cases, an applicant performs its initial reservoir modeling based on maps, reports, and other secondary information concerning permeability and other geological characteristics of the area. However, to assure more accurate reservoir modeling, the TCEQ's rules at 30 TAC § 331.65 require a permitee to remodel and recalculate the AOR and COI after a new well is drilled, based on actual data and testing information obtained from logging and testing of the well and formation. This actual data about the well's subsurface characteristics provides for more accurate modeling than secondary information, and if this new modeling calculates a larger AOR or COI, the permitee must conduct further evaluation of additional artificial penetrations that may exist in the expanded area or must alter the operating parameters to reduce the size of the newly modeled AOR and COI.

The present case is unique, however, because a great amount of geologic information is known about the Conroe Oil Field and the completion and testing of existing well WDW315 provided actual information about the proposed injection interval and injection zone. Much of the dispute concerning reservoir modeling resulted from TexCom using a higher permeability factor than shown by the 1999 testing of WDW315. TexCom used the higher permeability factor because it planned to reperforate WDW315 at both the currently perforated sands and additional sands. The Intervenors expressed great concern that TexCom would not be required to retest and remodel the COI and AOR for WDW315, because they believed that § 331.65 may not apply to an existing well as contrasted with a new well. TexCom and the ED believed that § 331.65 required retesting and remodeling of WDW315's reservoir. However, at the original hearing, the ED proposed and TexCom agreed to adding a special condition to the permit for WDW410 to require retesting and remodeling after TexCom reperforated WDW315, and to require additional investigation or adjustment of TexCom's proposed operating parameters if the new testing and modeling produced results adverse to TexCom's prior assumptions and modeling.

In the Original PFD, the ALJs found that TexCom should have used more conservative assumptions regarding permeability and the transmissivity of the EW-4400-S fault in its modeling. However, the ALJs also found that those concerns could be adequately addressed by the proposed special condition for WDW410 that would require TexCom to retest and remodel the reservoir for that well. The Commission subsequently remanded this case to receive further evidence on reservoir modeling, assuming permeability of 80.9 mD and assuming that the EW-4400-S fault is laterally transmissive. In addition, after the remand, TexCom reworked and reperforated WDW315, and it performed a new fall-off test on the well. However, these actions created new issues concerning permeability which are discussed later in this Amended PFD.

### 2. Permeability Used in Reservoir Modeling

#### a. Discussion of evidence and argument from the original hearing.

Permeability refers to the capacity of pores or openings in the sands and rocks of the injection zone to transmit fluids.[163] The more permeable the injection zone, the more readily the wastewater will pass through the sand and rock and disperse, thus more rapidly reducing the hydraulic pressure around the injection well and resulting in a smaller COI.[164] Conversely, a less permeable injection zone will hinder the flow of the wastewater and the reduction of pressure, causing a larger COI. A "darcy" is the accepted unit of porous permeability; a millidarcy (mD) is 1/1,000th of a darcy.

In performing its original reservoir modeling, TexCom assumed the Lower Cockfield injection zone had a permeability of 500 mD and assumed that the fault located 4,400 feet south of the site (EW-4400-S) was laterally transmissive within the Cockfield formation. In contrast, Lone Star's witness assumed a permeability of 80.9 mD and performed two models, one assuming the EW-4400-S fault was laterally transmissive and the other assuming the fault was not transmissive. With these assumptions, TexCom calculated a COI of 750 feet (radius). Lone

---

[163] TexCom Ex. 6, Application at 126. "Porosity " is the ratio of void space in a given volume of rock to the total bulk volume of rock, expressed as a percentage. *Id.* at 127. The Middle Cockfield has an estimated porosity of 29%, and the Lower Cockfield has an estimated porosity of 24%. *Id.* at 124 of 314.

[164] Tr. at 191.

Star calculated a COI of 3,170 feet, assuming that fault EW-4400-S was transmissive, and a COI extending 14,300 feet (approximately 2.7 miles) north of the bore hole, assuming the fault was not transmissive and acted as a dam or flow barrier to the south. A larger COI would require further investigation into possible artificial penetrations in the enlarged area, or it could require a modification to operational parameters, such as a reduction in the maximum injection pressure and injection rate, to limit the area of the COI.

As mentioned previously, WDW315 was never put into wastewater disposal operation, but the previous owner did perform a fall-off test on the well, which was designed, in part, to determine permeability of the injection zone by measuring the reduction or "fall-off" of pressure after injecting water.

A fall-off test is performed by injecting a fluid (typically water) into an injection well for a specific period of time, followed by shutting in the well for an additional period of time. A pressure transducer placed in the well records the dissipation, or fall-off, of bottom-hole pressures during the testing period. This data is analyzed using reservoir analysis software to determine various reservoir characteristics, such as permeability and the presence of pressure barriers.[165]

The fall-off test conducted by the prior owner on WDW315 (now WDW410) calculated the permeability of the injection interval at 80.9 mD.[166] Lone Star used 80.9 mD as a conservative assumption in its reservoir modeling. In contrast, TexCom assumed permeability of 500 mD based on core samples taken when WDW315 was drilled in 1999, and based on its plans to enlarge the perforated injection interval for the well and to increase the number of perforations per foot of well casing. TexCom also argued that, in any event, if the permit is granted, another fall-off test would be conducted after it reperforated the well casing and before injection operations begin. TexCom argued that if a subsequent fall-off test indicated a permeability less

[165] Lone Star Ex. 8, Grant direct at 23.

[166] TexCom Ex. 6, UIC Application, Vol. I, at 126.

than 500 mD and a larger COI, operational adjustments would be made to the permit (reduce injection rates and volumes) to compensate for the lower permeability.

TexCom's witness, Mr. Casey, testified that core analysis performed when WDW315 was drilled in 1999 indicated a permeability range of 550 to 685 mD for the section that TexCom plans to perforate, and a literature review indicated estimates of reservoir permeability as high as 1,400 mD. He expected an average permeability between 600 and 800 mD after the well was reperforated, but he used a 500-mD permeability factor in his modeling, which he thought was conservative.[167]

TexCom contended that the previous fall-off test performed on WDW315 did not represent the sand intervals that TexCom would perforate; consequently, it rejected Lone Star's argument that a permeability value of 80.9 mD should be used in reservoir modeling. Mr. Casey testified that, for unknown reasons, the previous owner of the well perforated about 90 feet at the shaliest (least permeable) parts of the Lower Cockfield. In contrast, TexCom would reperforate the well across a total of 145 feet of sand intervals (including the 90 feet already perforated) in order to reposition the injection interval in a more permeable segment.[168] In response to Lone Star's statement that the additional sands to be used by TexCom would require a permeability factor of 1,400 mD in order to bring the injection interval average up to 500 mD, TexCom argued that Lone Star failed to account for TexCom perforating with four to six shots per foot, as opposed to the prior owner perforating with two shots per foot,[169] and Lone Star's averaging calculation failed to account for the high permeability sections absorbing wastewater more quickly than other segments.[170]

---

[167] TexCom Ex. 6, UIC Application, Vol. I, at 126; TexCom Ex. 49, Casey direct at 22; Tr. at 189, 199, 202.

[168] Tr. at 180, 201-202.

[169] TexCom Ex. 6, UIC Application, Vol. I, at 113.

[170] TexCom response at 15-16.

TexCom emphasized that its own interests would be served by reperforating well WDW315 because it would be difficult to inject wastewater into the sections perforated by the prior owner. In addition, the draft permits require TexCom to follow the plans and specifications of its Application, which specify that WDW315 will be reperforated as described.[171] Likewise, TexCom stated, the UIC permitting rules require TexCom to submit to the TCEQ a completion or workover report that must include fall-off testing, and, if appropriate, a recalculated AOR and COI based on the new tests.

If new testing showed TexCom's assumptions were not conservative enough, the TCEQ would require certain project parameters be changed to compensate for the unfavorable test results, such as reduction of the maximum allowable injection pressure.[172] Finally, TexCom stated that it had no objection to a permit condition proposed by Mr. Grant that would require TexCom to: (1) perform fall-off testing after reperforating WDW315; and (2) if the permeability is found to be lower than 500 mD, (a) re-calculate the COI, (b) evaluate any additional artificial penetrations located within the enlarged COI, and (c) make any needed changes to the operating parameters or undertake any corrective actions needed with respect to any endangered artificial penetrations. Under these conditions, TexCom believed any concerns about the permeability assumptions used in reservoir modeling would be adequately addressed.[173]

Lone Star explained that reservoir modeling is important for understanding the consequences of a proposed UIC injection operation, and a reliable formation pressure model requires the use of valid, appropriately conservative input parameters. It also stresseed that, based on data from the previous fall-off testing on WDW315, 100 feet of the 145 feet of net sands available for TexCom to inject into in the Lower Cockfield have an average permeability of only 80.9 mD. In Lone Star's view, this conservative permeability factor from an actual fall-off test should have been used by TexCom in the reservoir modeling in order to be protective of USDWs and fresh water aquifers. Therefore, Lone Star's expert, Mr. Grant, used a permeability

---

[171] TexCom Ex. 6, UIC Application, Vol. I, at 113.

[172] Tr. at 1111-13. *See* also, 30 TAC §§ 331.45, 331.62, and 331.65.

[173] TexCom closing brief at 32-34.

factor of 81 mD and a 145-foot injection zone in performing his reservoir modeling (along with other assumptions that the parties do not dispute). As noted previously, this produced a COI of 3,170 feet, assuming fault EW-4400-S is laterally transmissive, and a COI extending 14,300 feet (approximately 2.7 miles) north of the bore hole, assuming the fault is not transmissive, compared to TexCom's modeled 750-foot COI.[174]

Lone Star emphasized that approximately 100 feet of the 145 feet that TexCom would reperforate had an average permeability of only 80.9 mD. Thus, in order for the entire 145 feet of sands to have an average permeability of 500 mD, as suggested by TexCom, the remaining 45 feet of available sands must have an average permeability of 1,400 mD.[175] It also pointed out that the original owner of WDW315, Crossroads, estimated in its Application that the permeability of its entire proposed injection interval (430 feet) would average 1,400 mD, but the subsequent fall-off test showed that those estimates were much too high.[176] Thus, Mr. Grant testified in the original hearing that, although theoretically possible, it is extremely unlikely that the remaining 45 feet of net sands available for TexCom in the Lower Cockfield will have a high enough permeability to bring the average for the entire 145 feet of available net sands up to 500 mD, as assumed in TexCom's prior reservoir modeling.[177] Therefore, Lone Star argued that the permeability value used by TexCom is neither appropriate nor sufficiently conservative to adequately safeguard the USDWs and freshwater aquifers located above the injection zone.[178]

Aligned Protestants repeated the arguments of Lone Star. They also criticized TexCom's reliance on a core sample taken during the drilling of WDW315 from a single sand strata located above the current 100-foot perforated injection interval.[179] Therefore, the Aligned Protestants

---

[174] Lone Star Ex. 8, Grant direct at 51-54.

[175] Tr. at 1130-31, 1145-46.

[176] *See* TexCom Ex. 11, at 153, 165.

[177] Tr. at 1134.

[178] Lone Star closing argument at 37-41.

[179] Lone Star Ex. 8 at 12, 27-29.

rejected TexCom's contention that a 500-millidarcy permeability factor was a conservative assumption when the fall-off test performed on WDW315 indicated a permeability of only 80.9 mD.[180]

The OPIC asserted essentially the same arguments as Lone Star and the Aligned Protestants.

The ED agreed with Lone Star's witness, Mr. Grant, that a pressure fall-off test should be conducted following completion of WDW410 to accurately determine the permeability of the injection zone. The ED noted that prior to beginning injection operations, TexCom would be required to obtain written approval from the ED.[181] In addition, the ED proposed new permit provisions to clarify that TexCom would be required to perform a fall-off test and submit the results in a completion report for WDW410 within 90 days of completing the well.[182]

**b. Permeability and the 2009 Fall-off Test Results**

After the Commission remanded this case, it was abated at the parties' request to allow time for TexCom to reperforate existing well WDW315 and to conduct a new fall-off test as proposed in the Original PFD. The purpose of this was to obtain information on the actual permeability of the reperforated and expanded injection interval and to determine whether the EW-4500-S fault is transmissive. TexCom reperforated the well and performed the new fall-off test during September 8-15, 2009.[183] The reperforation increased the injection interval from 100 feet to 145 feet. TexCom perforated the additional 45 feet at a density of six shots per foot, and increased the perforation density of the exiting 100 feet from two shots per foot to four shots per foot.[184] After the workover of WDW 315 was completed, TexCom ran a new fall-off test.

---

[180] Lone Star closing argument at 23-25.

[181] 30 TAC 331.65(a)(4); *see also,* Draft Permits at page 2, Section V.

[182] ED Closing argument at 11-12.

[183] TexCom Ex. 91.

[184] TexCom Ex. 84, Casey direct at 4.

However, the new fall-off test did not run long enough to reach the EW-4400-S fault to determine whether the fault is laterally transmissive. Further, data from the new fall-off test caused even more disagreement about the permeability of the injection interval.

The parties offered a variety of estimates for permeability of the injection interval of existing well WDW315 based on data from the 2009 fall-off test. TexCom witness Mr. Casey calculated permeability of 190.6 mD while Lone Star witness Mr. Grant calculated 48.68 mD.[185] The difference in these calculations occurred because Mr. Casey used in his calculations 1.26 centipoise (cP)[186] viscosity for the fluid injected during the fall-off test,[187] while Mr. Grant used 0.43 cP viscosity for the native formation fluid.[188] In addition, the EPA reviewed TexCom's 2009 fall-off test, and it used 0.36 cP viscosity for the native formation fluid to calculate premeability at 42 mD.[189] The 1999 fall-off test conducted for then-owner Crossroads calculated permeability at 80.9 mD using a viscosity of 0.50 cP. The company owned by Denbury witness James Fairchild calculated that 80.9 mD permeability in 1999, and Mr. Fairchild testified that the 2009 fall-off test also indicated a permeability "in the same ballpark" as 80 mD. However, it is not clear whether his estimate was based on actual calculations or was merely an intuitive hunch.[190] Denbury witness Robert Sutherland stated that, based on the 2009 fall-off test, permeability fell within the range of 62 mD to 90.8 mD, depending on whether the viscosity of the actual reservoir fluid or the injection fluid is used in the calculation.[191]

---

[185] Lone Star Ex. 22. Grant direct at 14.

[186] A poise is a unit of measurement of viscosity; one centipoise is 1/100th of one poise.

[187] TexCom Ex. 91, Well Perforation and Testing Report, at 23.

[188] Lone Star Ex. 22, Grant direct at 14-16. Mr. Grant calculated "an equivalent fluid viscosity" of 0.43 cP based on records in TexCom's application that showed native formation fluids had total dissolved solid content of 105,000 milligrams per liter. *Id.* at 16. *See also*, Tr. 575-580; TexCom Ex. 98, Grant viscosity calculation information.

[189] Lone Star Ex. 26.

[190] Remand Tr. 1181-1183; 1286-1287.

[191] Denbury Ex. 1, Sutherland direct at 14.

The different permeability estimates are summarized in the following table:

| | Input Injection Interval | Input Pressure Data | Input Viscosity | Result Permeability |
|---|---|---|---|---|
| **TexCom** | 145 feet | 2009 Fall-off Test | 1.26 cP | 190.6 mD |
| **Crossroads** | 100 feet | 1999 Fall-off Test | 0.50 cP | 80.9 mD |
| **Lone Star** | 145 feet | 2009 Fall-off Test | 0.43 cP | 48.68 mD |
| **EPA** | 145 feet | 2009 Fall-off Test | 0.364 cP | 42.0 mD |
| **Fairchild** | 145 feet | 2009 Fall-off Test | unknown | 80 mD +/- |
| **Sutherland** | 145 feet | 2009 Fall-off Test | 0.41 cP | 62 mD |
| **Sutherland** | 145 feet | 2009 Fall-off Test | 0.60 cP | 90.8 mD |

No party asserted that the injection interval or the pressure data from the fall-off tests were improperly utilized in the permeability calculations, but the parties did disagree on the proper input for viscosity. In simple terms, viscosity is the thickness of a fluid and its resistance to flow. A fluid with a higher viscosity is more resistant to flow than a fluid with a lower viscosity. The viscosity of a fluid is a function of its specific gravity and its temperature. Generally, higher specific gravity and lower temperature produce a higher viscosity, while lower specific gravity and higher temperature produce lower viscosity.[192] The different viscosity inputs are the primary reason for the different permeability results calculated by the expert witnesses.

Lone Star witness Grant testified that TexCom erred in calculating the viscosity input by using the surface temperature of 97.6° F and the specific gravity of 1.18 for the brine injected during the 2009 fall-off test. A proper viscosity calculation for this fall-off test, Mr. Grant stated, would use the higher bottomhole temperature of 185° F and the lower specific gravity of the brine in the formation, both of which would reduce the viscosity value. He explained that a pressure injection/fall-off test generates a pressure wave – or transient – in the formation away from the wellbore. This pressure transient generates a pressure response back at the well that is recorded by a measuring gauge that is placed in the wellbore. In formations that have received injected waste for many years, it would be appropriate to use the specific gravity and viscosity of the injected liquid in calculating the fall-off test results, Mr. Grant stated. However, in a well

[192] Remand Tr. 498-499.

like TexCom's, where little or no injection has occurred, the fluid injected by TexCom during the fall-off test would travel only a few feet from the well bore and would have little effect on the pressure transients. Therefore, Mr. Grant stated that the viscosity of the native formation fluid should be used to calculate permeability because that is the fluid that will primarily affect the fall-off test pressure transients.

Sampling records from WDW315 showed the native brine had total dissolved solids of 105,000 milligrams per liter, which Mr. Grant said indicated a specific gravity of 1.07 rather than the 1.18 used by TexCom. Mr. Grant also testified that TexCom should have used the bottomhole temperature of 185° F rather than the surface temperature of 97.6° F when determining the viscosity of the fluid in the formation. Thus, using the bottomhole temperature of 185° F and a specific gravity of 1.07, Mr. Grant believed that the proper viscosity to use in calculating permeability for the Lower Cockfield in the area of WDW315 was 0.43 cP rather than the 1.26 cP used by TexCom.[193]

Mr. Robert Sutherland, a witness for Denbury, calculated viscosity at 0.6 cP by using the viscosity of the injection fluid adjusted to the 185° F reservoir temperature. As an alternative, he calculated viscosity at 0.41 cP, based on reservoir water (containing 80,000 ppm salt) at 185° F. Mr. Sutherland did not elaborate on the specific gravity of water containing 80,000 ppm salt.[194]

As noted in the chart above, the EPA calculated viscosity of 0.36 cP. However, on cross examination Mr. Grant agreed that this calculation was too low because the EPA used a specific gravity of 1.02, based on literature about the Conroe Oil Field in general, rather than a specific gravity of 1.07, as indicated by actual samples taken from WDW315.[195]

The specific inputs used in calculating a 0.5 cP viscosity in the fall-off test for Crossroads in 1999 are unknown, but Mr. Grant agreed that the difference between viscosities of 0.5 cP and

---

[193] Lone Star Ex. 22, Grant direct at 14-16; Remand Tr. 575-580.

[194] Denbury Ex. 1, Sutherland direct at 14.

[195] Remand Tr. 523.

0.43 cP would be a matter of professional judgment on which two qualified experts could differ.[196] Finally, Mr. Grant acknowledged that in the first hearing of this matter, he recommended a finding of permeability of 80.9 mD, which was based on the viscosity of 0.5 cP used to analyze the 1999 fall-off test.[197] The different viscosity determinations are shown below:

| | **Input Temperature** | **Input Specific Gravity** | **Result Viscosity** |
|---|---|---|---|
| **TexCom** | 97.6° F | 1.18 | 1.26 cP |
| **Lone Star** | 185° F | 1.07 | 0.43 cP |
| **Crossroads (1999)** | unknown | unknown | 0.50 cP |
| **EPA** | 185° F | 1.02 | 0.36 cP |
| **Sutherland** | 185° F | 1.18 | 0.60 cP |
| **Sutherland** | 185° F | 80,000 ppm salt | 0.41 cP |

The ALJs find that the 80.9 mD permeability factor determined in the 1999 Crossroads fall-off test and included in the Commission's remand order is an appropriate permeability factor to use for reservoir modeling of the Lower Cockfield at WDW315. First, the evidence established that the 190.6 mD permeability calculated by Mr. Casey for TexCom and the 42.0 mD calculated by EPA are not valid. As for the EPA's calculation, Mr. Grant explained that the EPA used a specific gravity of 1.02 that was too low for the viscosity calculation when compared to a specific gravity of 1.07 indicated by actual samples taken from WDW315. As discussed, the viscosity input is the primary variable affecting the different permeability calculations, and the EPA's 0.364 cP viscosity input was too low. Likewise, the evidence was clear that Mr. Casey calculated a much too high viscosity value of 1.26 cP by using the surface temperature and the specific gravity of the injectate rather than the bottom hole temperature and the lower specific gravity of the native brine. In turn, this high viscosity value incorrectly skewed Mr. Casey's permeability calculation up to 190.6 mD.

Mr. Sutherland's 90.8 mD permeability factor is somewhat suspect because, for that calculation, he used a 0.60 cP viscosity based on the specific gravity of the injectate rather than the specific gravity of the native brine. The ALJs are also uncertain about Mr. Grant's 48.68 mD

[196] Remand Tr. 512.

[197] Remand Tr. 510.

calculation, which used a viscosity input of 0.43 cP, and Mr. Sutherland's 62 mD calculation, which used a viscosity input of 0.41 cP. According to the testimony, a higher viscosity input should result in a higher permeability factor. Yet, their calculations produced the opposite result – Mr. Southerland's lower viscosity input 0.41 cP produced a higher permeability factor than Mr. Grant's 0.43 cP viscosity input. It also appears that Mr. Sutherland's viscosity calculation might be low as he calculated specific gravity based on 80,000 ppm salt compared to Mr. Grant basing his specific gravity input on 105,000 of dissolved solids. Presumably, if Mr. Sutherland had used the same viscosity factor as Mr. Grant (0.43 cP), he would have calculated a permeability factor of even greater than 62 mD.

Mr. Grant agreed that the difference between viscosities of the 0.5 cP viscosity used by Crossroads in 1999 and the 0.43 cP that Mr. Grant used in the remand hearing would be a matter of professional judgment on which two qualified experts could differ. And no party disagreed that a 0.50 cP viscosity input results in a permeability factor of 80.9 mD. Further, at the time of the 1999 testing, no contested case was pending so there was no motive to slant the results. Therefore, the ALJs find that a permeability factor of 80.9 mD is appropriate for use in reservoir modeling in this case.

### 3. Transmissivity of Fault Located 4,400 Feet South of Site

Discussion concerning evidence and argument received at the original hearing.

Although there was general disagreement about geologic faulting in the area of the proposed facility, the parties did agree that an east-west running fault exists in the Lower Cockfield formation approximately 4,400 feet south of the site (EW-4400-S). The Lower Cockfield injection interval already contains saltwater, brine, and other fluids, so if wastewater is injected into the proposed injection wells under pressure, it would displace the existing fluids in the injection interval in all directions. If the EW-4400-S fault is transmissive, the portion of the existing fluid in the injection zone that is displaced to the south will pass the fault.[198] But if that

[198] According to TexCom's modeling, the actual waste plume would not reach the fault, but the existing fluids in the injection zone would be displaced in the area of the fault.

fault is not transmissive, it will act like a dam or barrier to the movement of the existing fluids in that direction. Further, if not transmissive, the injected wastewater would compress the existing fluid, which would then exert pressure backwards towards the well and cause the waste plume and COI to extend a greater distance in other directions.

The parties agreed that a fall-off test can detect such pressure boundaries, but the 1999 fall-off test performed on WDW315 had a radius of investigation of only 1,500 feet and did not reach the fault located 4,400 feet to the south. TexCom assumed the fault is transmissive in performing its reservoir modeling that calculated a 750-foot COI. Because it assumed the fault was transmissive between the Lower and Middle Cockfield formations, TexCom model inputs increased the thickness of the injection interval to 401 feet to the south of the fault to account for the net layer thickness of the Middle Cockfield.[199] In contrast, Lone Star calculated a COI of 3,170 feet, assuming the fault is transmissive (but using a 145-foot injection interval throughout), and a COI extending 14,300 feet (approximately 2.7 miles) north of the bore hole, assuming the fault is not transmissive.[200]

TexCom stated that in calculating the extent of the wastewater plume (2,770 feet), it was more conservative to assume the fault was horizontally transmissive, as the wastewater plume would spread farther under that assumption.[201] Further, Dr. Langhus testified that before oil production began, the oil/water contact point was at the exact same depth, 4,990 feet below the surface, on both sides of the fault, indicating that the two sides were in communication and that the fault was horizontally transmissive.[202] TexCom added that the transmissivity of the fault could be verified by a fall-off test, and, at the original hearing, it did not object to a permit special condition specifying a radius of investigation extending 5,400 feet (1,000 feet beyond the

---

[199] TexCom Ex. 6, UIC Application, Vol. I, at 124; Lone Star Ex. 8, Grant direct at 48; Tr. 330, 343-44.

[200] As discussed previously, TexCom and Lone Star also used different assumptions concerning the permeability of the injection zone.

[201] Tr. at 322.

[202] Tr. at 1360-62.

fault) for the fall-off test that would be conducted after WDW315 is reperforated (if the permit is granted), in order to confirm whether the fault is transmissive.[203]

Lone Star contended that the evidence established that the fault is likely not transmissive at the Lower Cockfield, and an appropriate conservative approach to reservoir modeling would treat the fault as nontransmissive. It stressed that the shales throughout the Cockfield formation have a muddy, dough-like consistency that smear along fault planes, and that this shale smearing can create a pressure seal that inhibits flow from one side of the fault to the other side.[204] In addition, it noted, a pressure seal can occur by a sand-shale juxtaposition across the fault. This occurs when a non-permeable shale layer on one side of a fault aligns with a permeable sand layer on the other side of the fault. Lone Star's witness, Mr. Grant, testified that both shale smearing and sand-shale juxtaposition likely occurs at EW-4400-S in the Lower and Middle Cockfield formations, making it a nontransmissive fault.[205] Therefore, Lone Star argued that the fault is not transmissive and that TexCom's previous reservoir modeling was not based on conservative assumptions to safeguard USDWs and fresh water aquifers.[206]

Aligned Protestants relied on the testimony of Mr. Grant and also argued that the more conservative approach to reservoir modeling would be to assume the fault is nontransmissive. They also cited ED witness Santos' testimony that, in his experience, faults in general are not transmissive.[207]

OPIC noted the contradictory positions taken by TexCom's and Lone Star's experts concerning the transmissivity of fault EW-4400-S. But OPIC stated in the original hearing that

---

[203] TexCom brief at 37; TexCom response brief at 18. 30 TAC § 331.66 authorizes the Commission to add additional requirements and conditions: "Additional Requirements and Conditions . . . (4) The commission may prescribe additional requirements for Class I wells to protect USDWs, and fresh or surface water from pollution."

[204] Tr. at 418-19; 934, 1078-79.

[205] Lone Star Ex. 8, Grant direct at 48-49; Tr. at 1078-79.

[206] Lone Star closing argument at 41-43.

[207] Tr. at 1290; Aligned Protestants closing argument at 25-26.

its concerns would be adequately addressed if TexCom were required by a special permit condition to run a fall-off test after reperforation of WDW315 long enough to have a radius of investigation of 5,400 feet (1,000 feet beyond the fault).[208]

Discussion concerning evidence and argument received at the remand hearing.

As discussed previously, TexCom performed another fall-off test in 2009. However, that fall-off test also did not run long enough to determine whether the EW-4400-S fault is transmissive. That fall-off test had a radius of investigation of approximately 2,583 feet,[209] which was nearly 1,900 feet short of the EW-4400-S fault. Therefore, no new objective evidence was presented at the remand hearing concerning transmissivity of the fault.

However, Denbury did offer expert opinion testimony at the remand hearing. Denbury argued that if the fault is vertically transmissive, it could provide a pathway for injected waste to migrate from the Lower Cockfield to the Middle and Upper Cockfield, and eventually into Denbury's production wells. Mr. Sutherland testified that TexCom's injection activities could increase reservoir pressure up to 3,824 psi, compared to 2,640 psi virgin pressure, which could possibly dilate the fault, if it is nontransmissive, or enhance the migration along the fault, if it is transmissive.[210]

In addition, Denbury witness Jon Herber testified that he did not believe smearing at the EW-4400-S fault would effectively seal the Lower Cockfield from the Middle and Upper Cockfield. Like Dr. Langhus, he noted that the oil-water interface at virgin field conditions was at the same level throughout the Conroe Oil Field, which indicated that the various fault blocks in the Conroe Oil Field must have been in communication. Also, production records from the field showed oil wells with greater water production were generally located near known faults, which, according to Mr. Herber, indicated that the faults likely served as a conduit for the

---

[208] OPIC closing argument at 10-11.

[209] TexCom Ex. 91 at 25.

[210] Denbury Ex. 1, Sutherland direct at 9.

upward migration of water.[211] On cross-examination, Mr. Herber clarified that he believes the fault is transmissive in some areas, but nontransmissive in other areas due to smearing. Thus, the transmissivity of the fault is variable due to smearing. He also agreed that vertical transmissivity is generally lower than horizontal transmissivity, but he disagreed that the ratio is generally 1:10.[212] Mr. Herber also stated that transmissivity can occur along the fault plane, rather than across the plane or up the plane. If fluid in the Lower Cockfield crossed the fault plane in the horizontal direction, it would enter the Middle Cockfield, which has slipped down at the fault.[213]

For TexCom, Mr. Casey testified at the remand hearing that he continued to believe that the fault is horizontally transmissive and that fluid would move from the Lower Cockfield into to the portion the Middle Cockfield that dropped down at the fault. However, he agreed that some smearing probably occurred at the EW-4400-S fault, which could inhibit movement of fluid across the fault.[214] Mr. Casey also testified that, in general, vertical transmissivity is about ten times lower than horizontal transmissivity. Thus, TCEQ only allows use of the thickness of the injection interval for modeling purposes because the fluid likely would not travel above or below that level.[215] Also, he stated, vertical transmissivity along EW-4400-S fault would be very low, if at all, due to the sand and shale nature of the formation that would likely not leave voids. In contrast, faults in hard rock in other parts of the country can leave voids that provide pathways for vertical migration.[216] However, Mr. Casey acknowledged that in TexCom's original modeling, it assumed a 401-foot thick injection interval on the opposite side of the EW-4400-S fault (compared to a 145-foot thickness on the well-side of the fault), which suggests vertical transmissivity.[217]

---

[211] Denbury Ex. 13, Herber direct at 7-9.

[212] Remand Tr. 893-895.

[213] Remand Tr. at 897-899.

[214] Remand Tr. at 182-184; 231-232.

[215] Remand Tr 453-455.

[216] Remand Tr. 456.

[217] Remand Tr. 459-461.

Lone Star witness Grant testified at the remand hearing that he continued to believe the EW-4400-S fault is laterally sealing and is nontransmissive.[218] He also testified that between the WDW315 wellbore and the EW-4400-S fault, the shale layer between the Lower Cockfield and the Middle Cockfield is sealing, so no communication occurs between those layers in that area.[219] In short, Mr. Grant testified that communication does not occur between the Lower Cockfield and the Middle Cockfield in the AOR.[220] Mr. Grant also agreed that vertical transmissivity in sands of the Lower Cockfield is lower than horizontal transmissivity; probably at a ratio of 1:10, or maybe 1:5 in clean sands. He added that stratification of sands with shale layers would also reduce vertical transmissivity in the Lower Cockfield.[221]

The ALJs continue to find that the evidence is inconclusive on whether the EW-4400-S fault is laterally or vertically transmissive. Therefore, to be conservative and protective of USDWs, the ALJs continue to recommend that the fault be assumed as nontransmissive for purposes of reservoir modeling, but be assumed as transmissive for purposes of considering migration between the Cockfield strata.

### 4. Other Issues Related to Reservoir Modeling

Discussion from the Original PFD and the original hearing.

During the weekend break of the original hearing, Staff witness Hoffman (now Ms. Flegal) again modeled the COI using different inputs than she had previously used, resulting in a COI ranging from 5,000 to 10,000 feet, as compared to her previously estimated COI of 150 feet. However, she testified that she believed her original calculation of a 150-foot COI was based on more reasonable assumptions and was more accurate.[222] Aligned Protestants stated that

---

[218] Remand Tr. 475; 525.

[219] Remand Tr. 527-529.

[220] Remand Tr. 529-530.

[221] Remand Tr. 553-554.

[222] Tr. at 1206-12

this new modeling raised concerns about Ms. Hoffman's ability to confirm the accuracy of TexCom's modeling. They also criticized her reliance on TexCom to reperforate the well and conduct another fall-off test to verify the reservoir model inputs.[223]

TexCom discounted Ms. Hoffman's revised modeling performed during the course of the hearing. It stressed that Ms. Hoffman herself testified that the results of this model run should be discounted and that she believed her original calculated 150-foot COI was more accurate. In TexCom's view, there should be no disagreement with Ms. Hoffman's rejection of her weekend modeling because she was the person who performed the modeling and no other person even reviewed her model inputs or procedures. Further, TexCom noted that even if Ms. Hoffman's most extreme estimate of 10,000 feet were accepted, it would still not affect TexCom's AOR, which was 2.5 miles (13,200 feet).[224]

The ALJs placed no significance on Ms. Hoffman's weekend modeling. At most, it showed that the models will produce varying results when different assumptions and inputs are used. Even Ms. Hoffman testified that she thought that modeling was inaccurate, and she believed her original modeling was based on more reasonable assumptions and was more accurate.

### 5. Modeling Using Remand Order Parameters

The Commission's remand order directed the parties to model the injection reservoir and to calculate the COI from TexCom's proposed operations, using a permeability factor of 80.9 mD and treating the EW-4400-S fault as nontransmissive. With these inputs, the parties' experts calculated the COI as follows:

| | |
|---|---|
| Greg Casey (TexCom) | 2.94 miles |
| Kathryn Flegal (ED) | 2.80 miles |

[223] Aligned Protestants Response to Closing Arguments at 27-28.

[224] TexCom Closing Brief at 38-39.

| | |
|---|---|
| Phi Grant (Lone Star) (2007) | 2.70 miles |
| Phil Grant (Lone Star) (2010) | 3.40 miles |
| James Fairchild (Denbury) | 2.94 miles (all other parameters the same)[225] |
| James Fairchild (Denbury) | 5.00 miles (changes to other parameters)[226] |

Mr. Casey performed his modeling with a BOAST98 computer program, using the prescribed permeability and the fault transmissivity inputs. Because the EW-4400-S fault was assumed to be nontransmissive, the program determined a COI with an irregular shape that extended 15,500 feet (2.94 miles) from WDW-315 in the east-west direction, and 12,000 feet (2.27 miles) from the well in the northerly direction. TexCom then mapped the AOR as a semi-circle with a 2.94-mile radius north of the fault and a semi-circle with a 2.5-mile radius south of the fault.[227] The Intervenors criticized TexCom's remand modeling because it assumed an open boundary condition for the reservoir rather than a closed boundary as TexCom's previous modeling had assumed.[228] The original modeling assumed a 10-mile by 10-mile block with closed boundaries.[229] All other things being equal, changing from a closed boundary to an infinite-acting open boundary would decrease pressures and reduce the COI.[230] Materials in TexCom's application indicated that its original modeling used a closed boundary,[231] and Dr. Mark Layne, who performed TexCom's modeling, confirmed that the original model used a closed boundary and the 2009 model used an open boundary.[232] He simulated an open boundary

---

[225] Mr. Fairchild did not give a specific distance for this run, but he said it was essentially the same as TexCom's result. Denbury Ex. 4, Fairchild direct at 7-8.

[226] Mr. Fairchild made adjustments to the modeled reservoir boundary and the productivity index, and he developed a structure to represent the regional geology and used a finer grid system. Denbury Ex. 4, Fairchild direct at 9-14. The five-mile distance encompassed the entire grid modeled by Mr. Fairchild.

[227] TexCom Ex. 84 at 6-8.

[228] Tr. at 355-356,

[229] Tr. at 415.

[230] Tr. at 416.

[231] Tr. at 292-295.

[232] Tr. at 1721-1722.

by inputting 340% super-porosity beyond the modeled reservoir boundary.[233] Thus, TexCom made an additional change in its modeling assumptions, which reduced TexCom's modeled COI from what it would have been if modeled with a closed boundary.

For the ED, Ms. Flegal recalculated the COI with the prescribed assumptions, using a PRESS computer model.[234] Her PRESS analysis determined a COI extending 2.8 miles from WDW315 running southeast and southwest (along the fault) and extending 2.1 miles in a northerly direction. Thus, Ms. Flegal's PRESS analysis produced a 2.8-mile radius AOR. Even though this COI is larger than Ms. Flegal calculated before the original hearing, she continues to believe that no corrective action is required by TexCom because it provided additional well records that covered a 2.94-mile AOR, which encompassed her 2.8-mile COI. She also agreed with Mr. Casey that uncased artificial penetrations for which no well record exist would seal naturally and would not provide a pathway for waste injected by TexCom to migrate to USDWs or other fresh water sources.[235]

In 2007, for the original hearing, Mr. Grant calculated a 2.7-mile COI using a PRESS2 computer model and using the same assumptions as directed by the Commission's remand order. Mr. Grant explained, however, that his 2007 model only calculated the COI to the north of WDW315. After remand, he recalculated the COI using the same computer model and the same assumptions, but he also analyzed pressure increases in other directions. This analysis produced a COI extending 2.7 miles (14,300 feet) to the north of well WDW315; 3.2 miles (17,130 feet) to the east and west; and 3.4 miles (18,140 feet) to the southeast and southwest, along the EW-4400-S fault. Mr. Grant explained that the irregular shape of the COI results from the assumption that the EW-4400-S fault is nontransmissive and acts as a pressure barrier to the south. Based on the greater distances he calculated to the east and west of WDW315, Mr. Grant opined that TexCom has not accurately described the full extent of the COI and AOR.[236]

---

[233] Tr. at 299; Tr. at 1718-1720.

[234] Ms. Flegal explained that the PRESS and PRESS2 models are the same. Tr. 1814-1815.

[235] ED Ex. 19, Flegal Supplemental Direct at 4-8.

[236] Lone Star Ex. 22, Grant direct at 2-7.

Mr. Grant stated that his modeling for the COI assumed the facility would operate at the maximum allowed injection rate, 24 hours per day for 30 years. He agreed that, if TexCom's facility operated only 16 hours per day at the same maximum injection rate, the resulting COI would be smaller.[237]

For Denbury, Mr. Fairchild performed modeling using a VIP program. In his first modeling run, Mr. Fairchild used the same inputs as Mr. Casey used for his 2009 modeling: 80.9 mD permeability, 24% porosity, no horizontal transmissivity at the EW-4400-S fault, and an injection thickness of 145 feet. Mr. Fairchild stated that, using these parameters, his VIP model produced essentially the same results as Mr. Casey's modeling, which indicated there is no significant difference in the VIP and BOAST models.

However, Mr. Fairchild disagreed with some other inputs used in Mr. Casey's 2009 model – the open reservoir boundary; a less precise grid system; and a Productivity Index (PI) of 168. He stated that using superporosity to simulate an open boundary and to mimic the effect of an extended aquifer is not uncommon. But in Mr. Fairchild's opinion, a proper methodology would use an analytic aquifer to mathematically represent the aquifer beyond the grid boundary. By changing only the boundary condition to TexCom's inputs, Mr. Fairchild determined that after 30 years the reservoir pressure would increase 700 psi more than calculated by TexCom. However, it is not clear from Mr. Fairchild's testimony how much this would affect the radius of the COI.[238]

Mr. Fairchild also explained that he used a finer grid system (smaller cells) than used in TexCom's model, which more precisely predicted the pressure increases. He also thought that the PI of 168 used in the TexCom model was much too high. The PI affects the capability of the well to inject fluid. In Mr. Fairchild's opinion, the two fall-off tests indicated a PI in the range of 5. With these adjustments, Mr. Fairchild's modeling indicated a pressure increase over 30 years approximately 1,100 psi greater than identified by TexCom. Under these circumstances,

---

[237] Remand Tr. 584-586.

[238] Denbury Ex. 4, Fairchild direct at 9-10; Denbury Ex. 8.

Mr. Fairchild stated that the COI would extend to the full 5-mile limit of his model to the north.[239]

On cross-examination, Mr. Fairchild agreed that if the entire Cockfield is in communication, as Denbury argues, then the pressure increase would be lower.[240] His modeling assumed 12,000 barrels injected every day for 30 years, and it was not limited to the 1250 psi maximum allowed injection pressure.[241] He further acknowledged that if the EW-4400-S fault is laterally transmissive, the volume of the reservoir would increase and the pressure increases would be less.[242]

In argument, Lone Star now contends that the modeling ordered by the Commission is moot because the required assumptions are no longer the best evidence. Instead, Lone Star argues that data from the 2009 fall-off test, which involved the expanded and reperforated injection interval, is more reliable. It argues that reservoir modeling should use the lower permeability data from the 2009 fall-off test.[243]

### 6. ALJs' Analysis Concerning Reservoir Modeling

The ALJs find that appropriately conservative reservoir modeling in this case should use an injection interval of 145 feet and a permeability factor of 80.9 mD, and it should assume the EW-4400-S fault is nontransmissive. Using these inputs, the ALJs find that Mr. Grant's 2010 modeling should be adopted for establishing the COI for TexCom's proposed operations, extending 2.7 miles (14,300 feet) to the north of well WDW315; 3.2 miles (17,130 feet) to the east and west; and 3.4 miles (18,140 feet) to the southeast and southwest, along the EW-4400-S fault.

---

[239] Denbury Ex. 4, Fairchild direct at 6-15.

[240] Remand Tr. 1265-1266.

[241] Remand Tr. 1297-1298.

[242] Remand Tr. 1290.

[243] Lone Star Closing Argument at 8; Lone Star Reply to Closing Arguments at 3.

The ALJs decline to adopt Mr. Casey's 2.94-mile COI because this model used the remand order parameters and also changed the reservoir boundary condition from a closed boundary, as used in the prior modeling, to an open boundary. The evidence was undisputed that this change had the effect of reducing the modeled pressure increases and the COI.

Ms. Flegal used the same PRESS computer program as Mr. Grant and the same remand order parameters, yet her model indicated a smaller COI extending 2.1 miles to the north and 2.8 miles southeast and southwest along the EW-4400-S fault. To be conservative, she assumed a 2.8 mile radius COI north of the fault.[244] This difference was not explained in testimony, but it appears to be based on Ms. Flegal using a viscosity input of 0.72 cP, while Mr. Grant used a viscosity input of 0.84 cP.[245] To be conservative and protective of USDWs, the ALJs recommend using Mr. Grant's values.

The ALJs do not find that Mr. Fairchild's 5-mile COI is reasonable. First, it is not known how far Mr. Fairchild's modeled COI reaches. His model grid extended five miles and his results enveloped the entire grid and presumably extended even further. In addition, Mr. Fairchild made several changes to the modeling inputs with only cursory explanations, and none of the other experts recommended or supported these. Mr. Fairchild also acknowledged that his model assumed an injection pressure even greater than authorized by TexCom's proposed permits. It appeared to the ALJs that Mr. Fairchild made adjustments to his model inputs simply to extend the COI as far as possible.

Taking all of the evidence into account, the ALJs find that appropriately conservative reservoir modeling using a permeability factor of 80.9 mD and assuming the EW-4400-S fault is nontransmissive, establishes a COI and AOR for TexCom's facility that extends 2.7 miles (14,300 feet) to the north of well WDW315; 3.2 miles (17,130 feet) to the east and west; and 3.4 miles (18,140 feet) to the southeast and southwest, along the EW-4400-S fault. As discussed previously, TexCom has adequately accounted for the artificial penetrations within this COI.

---

[244] ED Ex. 19, Flegal direct at 6.

[245] *Compare*, ED Ex. 19, Flegal direct at 6, and Lone Star Ex. 23, model inputs and results.

## D. Public Interest Issues

TexCom and the ED asserted that granting the requested UIC permits is in the public interest. The Protestants vehemently disagreed and argued that granting the requested UIC permits is not in the public interest because (1) a reasonable alternative for Class I industrial wastewater already exists in Montgomery County, (2) the injection well will contaminate surface and ground water used for drinking water, (3) TexCom's operation will create serious traffic safety issues, and (4) TexCom is not competent to operate a Class I industrial wastewater disposal business.

In section 27.051(a)(1) of the Water Code, the Legislature directed TCEQ to determine, among other things, that the use and installation of an injection well "is in the public interest" before the issuance of a permit.[246] While the term "public interest" is not defined in either the Water Code or TCEQ's applicable regulations, section 27.051(d) of the Water Code identifies two factors that must be considered when evaluating this issue—the applicant's (and its related entities) compliance history and whether a practical, economic, and feasible alternative is reasonably available.[247]

The ED agreed that TCEQ may consider other factors when determining whether the use and installation of a nonhazardous UIC well is in the public interest, but maintained that the Commission should be guided by case law in interpreting the meaning of public interest.[248] The ED noted that the 1976 Supreme Court decision *NAACP v. Federal Power Commission*[249] held that "the use of the words 'public interest' in a regulatory statute is not a broad license to promote the general public welfare. Rather the words take meaning from the purposes of the regulatory legislation."[250]

---

[246] Water Code § 27.051(a)(1).

[247] Water Code § 27.051(d)(1) and (2); 30 TAC § 331.121(b).

[248] ED Closing Argument at 14.

[249] 425 U.S. 662 (1976).

[250] *Id.* at 669.

As a result of the statute and case law, the ED concluded that TCEQ may only consider three factors to determine whether TexCom's project is in the public interest: (1) TexCom's compliance history; (2) whether practical economic, and feasible alternatives to an injection well are reasonably available; and (3) whether the purposes set out in § 27.003 of the Water Code (the Injection Well Act) are satisfied.[251] Section § 27.003 provides that:

> It is the policy of this state and the purpose of this chapter to maintain the quality of fresh water in the state to the extent consistent with the public health and welfare and the operation of existing industries, taking into consideration the economic development of the state, **to prevent underground injection that may pollute fresh water,** and to require the use of all reasonable methods to implement this policy.[252]

Protestants argued in the original hearing, that the ED's interpretation of the term "public interest" is too limited. Relying on *Texas Citizens vs. Railroad Commission,*[253] they argued that public interest concerns include not only the three factors mentioned above, but other issues such as traffic safety. The Protestants claim that if TexCom's proposed disposal service is permitted it will create significant traffic safety problems. Additionally, the Protestants point out that the purpose of the Injection Well Act requires consideration of the potential pollution TexCom's UIC wells could have on fresh water in Montgomery County.

Despite this statutory language, the ED insisted that the words "public interest" do not permit a "broad unfettered interpretation" of what must be considered in this matter, and posits that to use a public interest determination as a substitute for zoning or county waste regulations is wrong.[254] The ED emphasized that the term "public" is neither restricted to Montgomery County residents nor is "public interest" restricted to nonhazardous waste produced in Montgomery County.

---

[251] ED Original Closing Argument at 17.

[252] ED Original Closing Argument at 15. Emphasis added.

[253] 254 SW3d 492, (Tex. App-Austin 2007), *pet. granted*

[254] ED's Original Closing Argument at 19.

Consistent with the ED's position, Ms. Hoffman (now Ms. Flegal) verified that TCEQ staff are not trained to evaluate public nuisance issues. Instead the staff reviews the application's public interest demonstration section to confirm that it complies with Water Code § 27.051(a) and (d). She testified that the Commission must decide issues regarding public nuisance.[255] The ED argued that TexCom's application should be approved if the underground injection wells promote economic development and do not pollute fresh water.

The ALJs agree that the statute requires TCEQ to determine whether permitting the disposal of Class I nonhazardous waste in an underground injection well is in the public interest. Contrary to the ED's position that TCEQ is limited to considering only three factors, section 27.051(d) specifically states that the Commission is not limited to these factors in evaluating public interest concerns.[256] That statutory mandate is broad enough to consider safety issues concerning the drinking water, traffic, and any other issue that may impinge on public safety. Therefore, the ALJs will address whether there is a practical, economic, and feasible alternative to the injection well, whether the injection well poses a safety hazard to the surface and underground water in Montgomery County, and whether granting the permit is in the public interest.

### 1. Alternative Disposal Options

The Protestants maintained that TexCom failed to prove the need for an underground injection disposal well. TexCom disagreed, but also contended that the statute does not require such a showing, only that alternative disposal options be considered. In determining if the use or

---

[255] Tr. at 1267.

[256] Water Code § 27.051(d) states:

> d) The commission, in determining if the use or installation of an injection well is in the public interest under Subsection (a)(1), shall consider, **but shall not be limited to** the consideration of:
>
> (1) compliance history of the applicant and related entities under the method for evaluating compliance history developed by the commission under Section 5.754 and in accordance with the provisions of Subsection (e);
>
> (2) whether there is a practical, economic, and feasible alternative to an injection well reasonably available; and
>
> (3) if the injection well will be used for the disposal of hazardous waste . . . .

Emphasis Added.

installation of an injection well is in the public interest, the Water Code requires the Commission to consider whether there is a practical, economic, and feasible alternative to an injection well reasonably available.[257]

TexCom has consistently maintained the underground injection disposal does not have the environmental drawbacks of landfills, publicly owned treatment works (POTW), and incinerator disposal.[258] TexCom argues that when liquid waste is disposed of in a contained formation, it is trapped in a safe, contained location, where it can no longer influence air quality, surface water quality, and the aquifers used for drinking water.[259] TexCom also reiterated its position during the remand hearing that the presence of an existing UIC well makes it illogical "to interpret § 27.051(d) to require consideration of alternative to injection."[260]

In the original hearing, Ms. Flegal verified that TexCom's public interest demonstration (Section XIV, Attachment C, of the Application) complied with the applicable rules and statutes.[261] The ED maintained that the record supports a finding that granting TexCom's application is in the public interest because there are no practical, economic, and feasible alternatives to disposal by injection reasonably available.[262] The ED relied predominantly on the Application and Dr. Ross' testimony in reaching this conclusion.

Dr. Ross testified that UIC wells provide "a safe, responsible, and state approved means to dispose of Class I nonhazardous wastewater generated specifically by generators within the county."[263] He opined that underground injection wells are technically superior to other methods of disposal, including landfills, incinerators, or direct discharge into surface waters.[264]

---

[257] Water Code § 27.051(d)(2).

[258] TexCom Remand Closing Argument at 34.

[259] *Id.*; TexCom Ex. 92, Bost direct at 14-15.

[260] TexCom Remand Closing Argument at 30.

[261] ED Ex. 1 at 6 and 23.

[262] ED Original Closing Argument at 17.

[263] Tr. at 102; ED Original Closing Argument at 17.

[264] ED Closing Argument at 17.

Mr. Casey agreed that no practical, economic, and feasible alternatives exist in the Montgomery County area for the disposal of the type of nonhazardous waste that TexCom will be accepting.[265]

To support this position, TexCom referred to the testimony of Lone Star's expert Ray Shull and Dr. Pearce, where both recognized that nonhazardous wastewater treated in a POTW reintroduces pollutants to the drinking water supply.[266] TexCom also pointed out that Lone Star witness Mr. Grant agreed that underground injection is the most environmentally responsible disposal option for Class I wastewater because it permanently isolated pollutants far below the surface.[267] Finally, the draw backs of incineration include the expense and air emissions.

OPIC noted in the original hearing that other than the presence of the existing well, TexCom offered no meaningful evidence on this issue. At the remand hearing TexCom and several Protestants presented additional evidence regarding alternative disposal options. TexCom has the burden of proof to show what other disposal methods are available and why a UIC is the best alternative. Although TexCom asserted it previously presented sufficient evidence on this issue, TexCom offered testimony at the remand hearing of Robert C. Bost,[268] an expert in waste disposal, to address the feasibility of alternative methods of disposal for Class I nonhazardous waste.

Mr. Bost explained that large quantities of liquid industrial waste can be disposed of by several methods, including: (1) treatment at a POTW with disposal into surface water bodies; (2) pretreatment of water followed by disposal into a coastal waste disposal facility; (3) solidification of the liquid waste and subsequent land filling; (4) incineration; and (5) underground injection. In Mr. Bost's opinion, injecting waste into an underground

---

[265] TexCom Ex. 49, Casey direct at 55-57.

[266] Tr. at 592-595 and 715-121.

[267] Tr. at 1043-1044.

[268] Mr. Bost is a senior partner at Environmental Resources Management, an environmental consulting firm in Houston, Texas. He is a Texas Professional Engineer, a Texas licensed Professional Geoscientist, and an internationally licensed Certified Ground Water Professional (CCGWP). TexCom Ex. 92, Bost direct at 4-5.

permanent containment area is "safer, more reliable, more economical, and has fewer environmental impacts than any of the other disposal options."[269] Capturing liquid waste deep beneath the surface in a contained formation, he contends, allows the waste to degrade naturally and does not pollute the air or surface water.

Conversely, he added, waste disposed by landfill can leach hazardous constituents into the subsurface or groundwater. Wastewater treatment plants risk having residual constituents discharged into the surface water. Incineration facilities generate significant amounts of ash that must be disposed of and emit air pollutants.[270] Mr. Bost noted that currently there are no UIC wells for Class I nonhazardous waste in Montgomery County, but he maintains there is a need for one.[271] Mr. Bost explained that almost all of the Class I wastewater generated in Montgomery County is being trucked an average of 82 miles for disposal out of county.[272] TexCom argues that trucking this wastewater an average of 82 miles, instead of the seven miles required if TexCom is permitted, is not a reasonably available, economic, or practical option for these generators.[273]

After studying TCEQ records regarding the generation and disposal of waste in Montgomery County and the surrounding counties, Mr. Bost reported that only Harris County generates more liquid waste than Montgomery County. The oil and gas industries in the area, as well as dry cleaners, light industrial manufacturing operations, municipalities, and other businesses contribute to the creation of approximately 1.6 million gallons per day of Class 1 nonhazardous liquid waste in Montgomery County.[274] In 2007, 99.9 percent of the liquid industrial waste generated in Montgomery County was disposed outside Montgomery County—75 percent in Jefferson County; 24 percent in Liberty County, and 1 percent in Harris

---

[269] TexCom Ex. 92, Bost direct at 14.

[270] TexCom Ex. 92, Bost direct at 14-15.

[271] Remand Tr. at 126-127.

[272] TexCom Remand Closing Argument at 31; TexCom Ex. 92, Bost direct at 17 and 20.

[273] *Id.*

[274] TexCom Ex. 92, Bost direct at 15-16.

County.[275] If TexCom were permitted, the maximum volume of liquid waste it could dispose of in a day is 500,000 gallons, about a third of the Class I nonhazardous waste generated within Montgomery County.

Mr. Bost testified that TexCom's operation will have a positive economic impact on Montgomery County, a public interest issue.[276] He opined that the most efficient way of disposing of waste is to do so in close proximity to where the waste is generated. Because the companies currently trucking their Class 1 nonhazardous wastewater out of the county would save money if they could dispose of the waste locally, he reasoned they would use TexCom's facility. Additionally, 25 additional jobs would be created, which he stated would generate more revenue for local businesses and increase sales tax collections. He also maintained that because local generators would not need to truck the waste out of Montgomery County, the county will experience a reduction in traffic incidents, fuel consumption, and air emissions.

The Protestants challenged Mr. Bost's claim that TexCom will improve the area's economy. Under cross-examination, Mr. Bost agreed that TexCom has no contracts with any industry producing Class 1 nonhazardous wastewater in Montgomery County, and no commitment that these companies will use TexCom's facility should it be permitted. But, he countered that even if these companies did not use TexCom, TexCom would be creating additional capacity for the growth of the county and the waste generated by that growth.[277]

Mr. Bost also agreed that nothing prevents TexCom from obtaining all of its customers from outside Montgomery County, thus increasing the amount of traffic rather than decreasing it. In turn, the influx of traffic could increase the number of accidents and spills and the amount of emissions into the air. Mr. Bost also agreed he neither considered that tanker trucks idling at the TexCom facility would generate emissions, nor did he consider the cost to the county for roadway improvements that may be necessary if TexCom receives this permit.[278]

---

[275] TexCom Ex. 92, Bost direct at 17; Remand Tr. at 69

[276] Remand Tr. at 77.

[277] Remand Tr. at 109.

[278] Remand Tr. at 96 and 110-112.

As for the suitability of the location of the wells, Mr. Bost agreed that the intent of the UIC disposal program is to trap the waste deep underground so that the waste can degrade naturally. He recognized that the process can take as long as 10,000 years. Therefore, he agreed that it is essential that the waste injected by TexCom into the Cockfield formation remain trapped within this formation.[279] But, he acknowledged that he did not consider in his economic analysis any interaction between Denbury's oil and gas operation and TexCom's operation, despite knowing that the Conroe Oil Field is an active oil and gas field.[280]

The Protestants argued that several alternative disposal methods are available for nonhazardous waste, *i.e.* POTW, commercial incineration, and landfill disposal after treatment and solidification of the wastewater. In the original hearing, Lone Star expert Shull testified that a POTW can accept Class I nonhazardous industrial wastewater that is pretreated by the industrial wastewater generator.[281] In addition, the Protestants pointed out that the businesses in Montgomery County that do generate nonhazardous waste have already found alternative disposal methods, indicating that there is no need for TexCom's proposed business.

Conroe's POTW is already permitted to dispose of Class I wastewater, and the Protestants assert that it is a preferable disposal method to a UIC that could potentially pollute the underground water source in the county. Melvin Solomon, Assistant Plant Superintendent/Pretreatment Coordinator for Conroe's POTW, explained that the City does not accept hauled waste. Instead, a potential customer has to connect its pretreated waste stream to a sewer line to transport the waste to its facility. At the time of the remand hearing, the City's POTW received Class I nonhazardous industrial waste daily from ten different industrial generators located in Conroe.[282]

Mr. Solomon verified that TCEQ permitted the Conroe POTW to receive pretreated Class I nonhazardous industrial wastewater. The facility is also regulated by the EPA and by City

---

[279] Remand Tr. at 72.

[280] Remand Tr. at 77-81.

[281] OPIC Closing Argument at 16; Tr. at 592-595

[282] Aligned Protestants Ex. 5, Solomon direct at 4.

ordinances. Before using the City's POTW facility, an industrial generator must complete a form identifying in detail the waste to be discharged to it.[283] If necessary, the industrial generator must pretreat the waste to bring it into acceptable levels for discharge into the POTW facility where it will undergo further treatment. Each industrial generator is inspected at least once a year to test the wastewater stream to ensure it meets the limits required to dispose it at the City's facility.[284]

Once the wastewater is received and treated at the City's POTW, the POTW discharges the effluent into the San Jacinto River, which flows into Lake Houston and is part of the water supply for the City of Houston. Mr. Solomon testified that Conroe's POTW does a daily discharge concentration test, followed by a weekly concentration average. Additional tests are taken every three months, which include chemical specific analysis. In Mr. Solomon's 19 years at the City's POTW, he has never had an improper discharge into the San Jacinto River.[285]

Mr. Solomon recognized the limits of the City's POTW, noting that it could not treat high salinity waste because the POTW's treatment process does not remove salinity. Additionally, he agreed that some portion of the waste would leak as it made its way to the POTW through the sewer lines, because "there is no such thing as non-leaking sewer pipe."[286] Despite these draw backs, Mr. Solomon opined that a wastewater treatment facility remains the best way to dispose of Class I nonhazardous industrial wastewater because it is an environmentally safe disposal method that returns the liquid, after testing and treatment, back into the water supply.

Mr. Solomon also opined that Conroe's POTW is a significant reason industries move to the Conroe area. Currently, the City's POTW is not operating at capacity—it treats 6.8 million gallons per day, but is permitted to treat up to 10 million gallons per day. Conroe is also studying whether the City's future needs justify an expansion of its current wastewater treatment

---

[283] Aligned Protestants Ex. 5, Solomon direct at 5-6.

[284] Aligned Protestants Ex. 5, Solomon direct at 8-9.

[285] Aligned Protestants Ex. 5, Solomon direct at 9-10.

[286] Remand Tr. at 1344-1345.

facility or the building of a new facility at a different location.[287] According to Mr. Solomon, the City can handle any new industrial clients needing to dispose of Class I wastewater. In Mr. Solomon's tenure as superintendent, Conroe's POTW has not rejected a request for wastewater treatment from an industrial generator.[288]

Dr. Pearce, a microbiologist and expert in POTW facilities, confirmed Mr. Solomon's testimony that Conroe's POTW is capable of handling any Class I nonhazardous wastewater that TexCom listed in its application. After reviewing the compounds in the wastewater TexCom may accept, Dr. Pearce determined that 98 percent of the compounds are biodegradable and the other two percent would be captured as sludge and disposed of properly.[289] He pointed out that TCEQ permitted Conroe's POTW to dispose of Class I wastewater, and the POTW has done so without incident.

Because a POTW is heavily regulated by TCEQ and the EPA and must routinely and regularly monitor, test, and evaluate the wastewater, Dr. Pearce maintains that it is safer disposal method than an injected wastewater system that is less closely monitored. In his opinion, a POTW is a more consistent and reliable wastewater disposal process than "just putting something in the ground and then wondering what happens to it or having good data to support what is happening to it."[290] Dr. Pearce concluded that a POTW protects the public interest more than a deep injection well because the contents of the effluent is known by the POTW and if there is a problem it is immediately evident.[291]

Dr. Pearce clarified that his company has evaluated the microbiological aspects of Conroe's POTW effluent for the past 16 years.[292] He disagrees with TexCom's claim that Conroe's POTW would discharge harmful effluent into the San Jacinto River. He emphasized

---

[287] Aligned Protestants Ex. 5, Solomon direct at 12.

[288] Aligned Protestants Ex. 5, Solomon direct at 20.

[289] Aligned Protestants Ex. 9, Pearce direct at 20-22.

[290] Aligned Protestants Ex. 9, Pearce direct at 23.

[291] Aligned Protestants Ex. 9, Pearce direct at 25.

[292] Aligned Protestants Ex. 9, Pearce direct at 5.

that the effluent released by a POTW is so insignificant that it not as injurious as pollutants or contaminants that naturally enter the water stream. Additionally, Dr. Pearce testified that disposing of Class I wastewater through a POTW is preferable to injecting it into the earth because it keeps the fluid in the water cycle.

Explaining that the water cycle allows water that evaporates off the San Jacinto to collect in clouds and to return to earth as rain, Dr. Pearce reasoned that this allows the treated wastewater to replenish ponds, lakes, rivers, and aquifers.[293] Water conservation, he stated, is important to maintain the integrity of the volume of water in the environment. Dr. Pearce opposes the deep injection well process because it interferes with the water cycle by trapping water deep in the subsurface of earth, thus creating "an imbalance in the water cycle."[294]

Dr. Pearce also repeated his concern with the potential contamination of the aquifer through deep injection well disposal. Dr. Pearce asserted that the risk of a breach of TexCom's system could contaminate the aquifer for all time. Using the POTW disposal process for Class I wastewater eliminates this concern.[295] He clarified that wastewater treatment plants such as Conroe's POTW "facilitate the biodegradability of a wastewater stream" and are more suitable "to the disposal of the wastewater stream than just trying to hide it, just trying to get it out of sight, out of mind."[296]

William Ray Wilder, PhD., President and owner of Axis Environmental Services, Inc., raised another concern: whether the wastewater stream injected into the Cockfield formation will be compatible with the subterranean formation. In his opinion, whether a Class I wastewater generator uses a POTW or deep injection well, some pretreatment may be necessary. For the deep injection well, this is to ensure that the wastewater does not destroy or deteriorate the formation.[297]

---

[293] Aligned Protestants Ex. 9, Pearce direct at 11-12.

[294] Aligned Protestants Ex. 9, Pearce direct at 13.

[295] Aligned Protestants Ex. 9, Pearce direct at 16.

[296] Aligned Protestants Ex. 9, Pearce direct at 17.

[297] Aligned Protestants Ex. 10, Wilder direct at 18.

Dr. Wilder also challenged the need for the proposed UIC. He noted that Huntsman Petroleum, the largest generators of Class I wastewater in Montgomery County, currently trucks its waste to another county. But, if Huntsman wanted, it could dispose of its waste on its own property because it has two TCEQ approved permits for underground injection disposal wells. Dr. Wilder submitted that if TexCom does not secure Huntsman Petroleum as a customer, then it will need to get customers from outside Montgomery County to truck in waste because there is not enough Class I wastewater in Montgomery County to support TexCom's business without both Huntsman and Chevron.[298]

As discussed in the original PFD, it is evident to the ALJs that various alternatives to a UIC exist, including the POTW. And as argued by OPIC, TexCom was required to present alternatives with "a measure of specificity" to comply with the Water Code's requirement that the Commission consider whether there is a practical, economic, and feasible alternative to a UIC that is reasonably available. TexCom's argument that the injection method is the only practical method of disposal because a well already exists does not excuse TexCom from discussing other alternatives. TexCom did address alternatives in its Application, Attachment C, and through its witnesses in both the original and remand hearings.

The evidence presented shows that the injection method of disposal for Class I nonhazardous wastewater is a practical, economic, and feasible disposal method for Class I wastewater. Conroe's POTW is currently another viable alternative and is already permitted to dispose of Class I wastewater. Disposal by POTW creates several risks that the deep well injection does not create. Disposal by POTW creates a risk that Class I waste will leak from the sewer pipes into the ground close to the surface and that a certain amount of contaminants will flow into the San Jacinto River and Lake Houston, sources of drinking water for Montgomery County and the City of Houston. Landfills also allow for the leaching of Class I waste into the subsurface and/or ground water. And, incineration is not only costly, but pollutes the air and creates ash.

---

[298] Aligned Protestants Ex. 10 at 35.

Conversely, the underground injection well disposal method also comes with risks. If the wastewater migrates, it could potentially contaminate Montgomery County's sole underground source of drinking water. Additionally, it may result in more tanker trucks coming into Montgomery County. No one method is free from complications. However, based on the evidence, the ALJs find that currently there is a reasonable alternative to the disposal of nonhazardous waste, the POTW that is already permitted to dispose of Class I nonhazardous waste.

### 2. Protection of Surface Water and Groundwater

TexCom argued that underground injection "is the most environmentally responsible disposal option because it **permanently** isolates . . . pollutants . . . a mile or more below the surface, where they will never come into contact with the human environment or drinking water supply."[299] The Protestants adamantly opposed granting TexCom's application for UIC permits because it puts Montgomery County's current sole source of drinking water at risk.[300] Both Lone Star and Aligned Protestants argued that any possibility that the proposed UIC wells could contaminate Montgomery County's groundwater[301] warrants the denial of TexCom's application. This area has experienced explosive growth in recent years, and the need to maintain and protect the only source of water in the area is paramount.

As noted above, section 27.051(a)(3) of the Water Code provides that the Commission may grant an application and issue a UIC permit if it finds, among other things, that, "with proper safeguards, both ground and surface fresh water can be adequately protected from pollution." During the original hearing, Denbury was not a party and had not made plans to engage in $CO_2$ enhanced oil recovery at the Conroe Oil Field. Protecting Denbury's oil and gas operation is not an issue before the ALJs. However, whether the Class I wastewater that

---

[299] TexCom Closing Arguments at 46. Emphasis added.

[300] Aligned Protestants emphasized that the Evangeline Aquifer is the sole source of drinking water for more than 400,000 Montgomery County citizens.

[301] Montgomery County's drinking water comes from subsurface water referred to as groundwater.

TexCom injects underground could migrate out of the Cockfield formation and contaminate ground or surface fresh water is an issue that is properly before the ALJs.

Denbury stressed that TexCom's waste disposal will not be permanent. Instead, Denbury argued that its oil and gas production in the Conroe Oil Field will cause this wastewater to resurface. Because the entire Cockfield formation is in communication, Denbury believes that the pressure profile created by its active oil and gas production will cause TexCom's wastewater to migrate to the Upper Cockfield, the production interval. Once the wastewater is in the production interval, its production wells will pull this wastewater back to the surface along with the oil and gas.[302] In essence, Denbury contends that the injected Class I wastewater will make a round trip from the surface through the Cockfield formations, and back to the surface.

Denbury disagrees with TexCom expert Dr. Langhus' testimony that the layers of the Cockfield formation are not in communication. According to Dr. Langhus, the reason that the WDW315 well pressure gradient at 6,000 feet (Lower Cockfield) remained the same despite the withdrawal of fluids from the production interval (Upper Cockfield) is because Cockfield formations are not connected.[303] Denbury's geologic engineer Mr. Sutherland disagreed. He explained that the Conroe Oil Field is a "water drive" field, meaning that when fluids are removed "water will come back in when we take oil and gas and water out."[304] Because water quickly replenishes what was removed to equalize the pressure, Mr. Sutherland opined that the constant pressure gradient proves that fluid moves between the Cockfield formations.

Denbury also highlighted Mr. Casey's original prefiled testimony where he stated that "the pressures in the middle and lower Cockfield are lower than normal due to communications between the zones at the various faults across the areas where the oil was produced."[305] This is consistent with Denbury witness Mr. Swadener's statement that "fluids from the areas of higher pressure, the Lower Cockfield, would tend to migrate up to areas of lower pressure, the Upper

---

[302] Denbury Remand Reply Closing Arguments at 2.

[303] Remand Tr. at 1910.

[304] Denbury Remand Reply Closing Arguments at 25.

[305] Denbury Remand Reply Closing Arguments at 26; TexCom Ex. 49 at 32.

Cockfield."[306] Denbury asserts that this process will grow worse when it begins $CO_2$ injection operations.

Despite Denbury's evidence, TexCom still maintained that it is not possible for injected wastewater at the proposed facility to reach any USDW. As noted in the original PFD, Mr. Casey opined that shale layers prevent vertical communication of fluids between the Lower Cockfield (where wastewater will be injected) and the Middle and Upper Cockfield. He testified in the original hearing that there is no pathway for wastewater to migrate up out of the Lower Cockfield unless it travels horizontally to fault EW-4400-S and then migrates vertically.[307] Based on Mr. Casey's modeling, which TexCom asserted was based on "unrealistically conservative worst-case assumptions," TexCom contended that over the lifetime of the facility, wastewater will only travel 2,770 feet radially from the borehole and will not even reach fault EW-4400-S, located 4,400 feet to the south. TexCom also contended that no artificial penetrations within the COI (at the time 750 feet) extend into the Lower Cockfield.[308]

Assuming that injected wastewater could reach fault EW-4400-S, and from there migrate into the Middle or Upper Cockfield, TexCom reiterated that the entire Cockfield sands are separated from all USDWs by the 1,000-foot thick marine shales of the Jackson Shale Formation, which form the upper confining zone.[309] Any artificial penetrations into the Upper or Middle Cockfield that lacked proper casing would have naturally collapsed and closed within the Jackson Shale formation.[310] TexCom concluded that because of the Jackson Shale formation it is impossible for any injected wastewater to escape the injection zone, located thousands of feet below the USDWs, even if it somehow managed to migrate out of the Lower Cockfield injection interval and into the Middle or Upper Cockfield layers.[311]

---

[306] Denbury Remand Reply Closing Arguments at 31; Denbury Ex. 18 at 9.

[307] TexCom Ex. 49, Casey direct at 35. TexCom Brief at 42.

[308] TexCom Brief at 42.

[309] *Id.* 30 TAC § 331.2(26) defines confining zone as: "A part of a formation, a formation, or group of formations between the injection zone and the lowermost underground source of drinking water or freshwater aquifer that acts as a barrier to the movement of fluids out of the injection zone."

[310] Tr. at 441.

[311] TexCom Ex. 49, Casey direct at 35.

In the original PFD, the ALJs found that, except for artificial penetrations, the Jackson Shale formation provides an impervious barrier preventing the contamination of Montgomery County's underground water. This has not changed. But in the intervening time between the original hearing and the remand hearing, Denbury became the oil field operator of the Conroe Oil Field and presented new evidence about the interaction between TexCom's operation and its operation that may increase the risk of contaminating the groundwater. The ALJs will discuss the issues created by Denbury's operation as it affects Montgomery County's groundwater and whether surface and groundwater is protected from the Class I wastewater TexCom intends to inject into the Lower Cockfield.

TexCom represented that it plans to inject its waste into the Lower Cockfield. While TexCom insists that the waste will remain in the Lower Cockfield, the application indicated the waste could migrate and accumulate in the Middle and Upper Cockfield as well. All three formations are included in TexCom's application as part of the injection *zone*.[312] Waste migrating to the Upper Cockfield is of particular concern given Denbury current production of oil and gas from wells in close proximity of TexCom's well and given its near future plans to engage in $CO_2$ enhanced oil recovery (EOR). Denbury's producing wells create areas of lower pressure, called pressure sinks, that pull formation fluid towards the wellbores and ultimately to the surface.

Currently, one of Denbury's wells is less than a mile from TexCom's proposed wells, and pressure sinks already exist along the EW-4400-S fault.[313] Denbury witness Mark Swadener testified that the interaction of pressure created by TexCom's operation and the pressure created by Denbury operations will cause TexCom's injected waste to migrate to the Upper Cockfield and be pulled to the surface. When Denbury begins its $CO_2$ EOR, a number of new wells will be drilled adding new pressure sinks that will lower the pressure of the Upper Cockfield at those points as well.[314]

---

[312] The injection zone includes the Lower, Middle, and Upper Cockfield; while the injections interval only includes the area where waste will actually be injected, the Lower Cockfield.

[313] Denbury Ex, 1 at 6; Denbury Ex. 18 at 19.

[314] Denbury Ex. 18 at 5 and 14.

This condition is further intensified if the EW-4400-S fault is vertically transmissive, as Denbury believes, because the fault will allow fluid, including injected wastewater, to rise from the higher-pressure formation, the Lower Cockfield injection interval, to the low-pressure sinks in the Upper Cockfield created by Denbury's operation. Denbury agreed that the EOR operation requires that the $CO_2$ be injected into the Upper Cockfield, which will create a higher pressure in that area. But, Denbury witness Mr. Sutherland testified that this pressure increase is insufficient to stop the migration of fluid from the Lower Cockfield to the Upper Cockfield.[315] The bottom line, Denbury argued, is that TexCom's injectate will migrate into Denbury's productive zone and will ultimately be pumped to the surface through Denbury's wells.

From the outset of this contested case, Lone Star challenged TexCom's assertion that it is impossible for wastewater to reach any USDW. Lone Star explained that TexCom's previous reservoir modeling assumed an artificially high permeability factor of 500-mD, to reduce the size of the COI. Lone Star witness Phil Grant calculated a much larger COI of nearly 2.7 miles using an 81-mD permeability factor derived from the 1999 Crossroads pressure fall-off test. Using Mr. Grant's calculated permeability factor of less than 50 mD, indicated in TexCom's 2009 PFOT, Mr. Grant calculated a COI of 3.4 miles.[316] This expanded COI includes a number of undocumented artificial penetrations that Lone Star stated provide pathways for the injected waste to contaminate Montgomery County's USDW and fresh surface water sources.[317]

Aligned Protestants reiterated that the parties have had, and continue to have, significant disputes concerning reservoir modeling and the geologic suitability of the location of the proposed facility. Although, the wastewater to be disposed will be classified as "nonhazardous," the categories of nonhazardous waste that TexCom proposes to inject are very non-specific in terms of the types of wastes that are to be disposed,[318] and include herbicides, pesticides, metals,

---

[315] Denbury Ex. 1 at 9-10.

[316] TexCom Remand Closing Argument at 8; and Lone Star Ex. 22, Grant direct at 4-5.

[317] Lone Star Reply Brief at 47-48. Lone Star also makes arguments concerning surface water protection that are discussed in the original PFD concerning the surface facility. *See* SOAH Docket No. 582-07-2674, TCEQ Docket No. 2007-0362-IHW (April 25, 2008).

[318] Aligned Protestants Ex. 2, Pearce direct at 15.

and caustic materials. They stress that these industrial contaminants are hazardous and potentially threatening to human health and the environment.[319] Aligned Protestants argued that TexCom has not established that the sole source of drinking water for Montgomery County will be protected from contamination by the proposed industrial wastewater injection wells.[320]

Individual Protestants continued to argue that TexCom cannot satisfy the requirements of 30 TAC § 331.121(c)(4)[321] that there be a sequence of permeable and less permeable strata between the confining zone (Jackson shale) and the lowermost USDW; that the piezometric surface of the fluid in the injection zone is less than the piezometric surface of the lowermost USDW or freshwater aquifer; or that there is no USDW or freshwater aquifer present. Under these circumstances, the rule requires TexCom to demonstrate that abandoned boreholes or other conduits would not endanger the USDWs, freshwater groundwater, or surface water. But for the reasons discussed in previous sections, the Individual Protestants argued that TexCom cannot satisfy the burden of demonstrating that abandoned wells within the COI would not endanger surface or groundwater in the area. Therefore, Individual Protestants asserted that TexCom has not satisfied the requirement of proving that the groundwater and surface water are protected.[322]

---

[319] *Id.* Pearce direct at 19-20.

[320] Aligned Protestants Closing Argument at 33-37.

[321] 30 TAC § 331.121 (c)(4) states that owner or operator shall demonstrate to the satisfaction of the executive director that:

> (A) the confining zone is separated from the base of the lowermost USDW or freshwater aquifer by at least one sequence of permeable and less permeable strata that will provide an added layer of protection for the USDW or freshwater aquifer in the event of fluid movement in an unlocated borehole or transmissive fault; or
> (B) within the area of review, the piezometric surface of the fluid in the injection zone is less than the piezometric surface of the lowermost USDW or freshwater aquifer, considering density effects, injection pressures, and any significant pumping in the overlying USDW or freshwater aquifer; or
> (C) there is no USDW or freshwater aquifer present;
> (D) the commission may approve a site which does not meet the requirements in subparagraphs (A), (B), or (C) of this paragraph if the owner or operator can demonstrate to the commission that because of the geology, nature of the waste, or other considerations, that abandoned boreholes or other conduits would not cause endangerment of USDWs, and fresh or surface water.

[322] Individual Protestants Closing Statement at 13-14.

The ED simply stated that the previous analysis concerning geologic suitability and reservoir modeling establish that the proposed injection well facility will be protective of surface water and groundwater.[323]

As discussed above, the ALJs originally found that the area of the proposed injection-well was geologically suitable. However, the ALJs also recommended that special conditions be added to the permit for WDW410 to require: reperforation of well WDW315; new fall-off testing to establish the permeability of the Lower Cockfield injection interval and to establish whether the EW-4400-S fault is transmissive; new reservoir modeling based on the new fall-off test results; and alterations to operating parameters or other corrective action, as needed, to account for any adverse results that may be determined.

Prior to the remand hearing, TexCom reperforated well WDW315 and conducted a new fall-off test. TexCom did not run the test long enough to reach the EW-4400-S fault. According to TexCom the new fall-off test returned a permeability of 190.6 mD.[324] However, the ALJs have concluded that TexCom's calculated permeability factor is not valid and is too high.

The ALJs find that Denbury's operation creates a real risk that the "permanent disposal" of the waste will not remain permanent. TexCom dismissed Denbury's argument that TexCom's injected waste will not remain trapped in the Lower Cockfield formation and will be pulled back to the surface by its oil and gas operations as affecting only Denbury's mineral rights, a matter not before the Commission. TexCom failed to consider it a public interest issue even if the wastewater it injects underground resurfaces into the human environment. The ALJs are concerned that waste disposed of in a manner intended to be permanent may become temporary.

TexCom's position that the ALJs previously found that the injectate will remain in the Lower Cockfield ignores the evidence presented at the remand hearing, showing that pressure sinks could cause the injectate to migrate to the Upper Cockfield, the oil and gas production

---

[323] ED Original Closing Argument at 13.

[324] TexCom Remand Closing Arguments at 17. TexCom Ex. 84, Casey direct at 20-21.

interval, and its own Application that includes the entire Cockfield in the injection zone. If, as TexCom argued, the injectate cannot migrate to the Upper Cockfield where it can be pulled to the surface by Denbury's operation, then TexCom does not need a permit that includes the Middle and Upper Cockfield as the injection zone. But, TexCom did request that the injection zone include both the Middle and Upper Cockfield.

The evidence presented at the remand hearing does not establish by a preponderance of the evidence that both ground and surface fresh water will be adequately protected from pollution from the proposed UIC wells if TexCom injection zone extends into the Middle and Upper Cockfield. The Water Code § 27.051(a)(3) requires proof that, "with proper safeguards, both ground and surface fresh water can be adequately protected from pollution." TexCom offered no evidence of additional conditions to arrest the potential for Denbury's operation to cause the injected wastewater to migrate and ultimately return to the surface where it could contaminate ground and surface fresh water. Consequently, the ALJs find that TexCom did not establish by a preponderance of the evidence that with proper safeguards, both ground and surface fresh water can be adequately protected from pollution from waste injected into TexCom's proposed UIC wells.

### 3. Traffic

Similar to this case, the question of public safety arose in *Texas Citizens vs. Railroad Commission,*[325] concerning a matter before the Railroad Commission. The Railroad Commission granted a permit to Pioneer Exploration, LTD, to operate a commercial injection well for the purpose of disposing oil and gas wastewater. The evidence showed that the well site could operate 24 hours per day, seven days a week, with 20 to 50 trucks hauling saltwater waste to the site daily. The same roads necessary to access the site were also used by children and pedestrians, and the roads were narrow and unpaved and had several blind curves. Texas Citizens argued that the large number of trucks hauling 2,000 to 5,000 barrels of saltwater waste per day on these roads would create a public safety issue.

---

[325] As previously noted, this opinion is presently pending before the Texas Supreme Court. At the time of this PFD, no decision had been rendered by the Supreme Court.

The Railroad Commission found that traffic-related concerns were not within its jurisdiction and could not be considered. Instead, the Railroad Commission relied only on evidence showing the possibility for increased capacity for oil and gas production in finding that the proposed injection well was in the public interest. The Third Court of Appeals disagreed. It held that road-safety and increased truck traffic must be considered in making a public interest finding because Section 28.051(b) of the Texas Water Code required the Railroad Commission to determine that the use or installation of the injection well was in the public interest.[326]

Contrary to TexCom's argument that this issue is outside TCEQ's jurisdiction because TxDOT has the sole discretion to regulate road-way safety, the Court in *Texas Citizens* noted that practically all matters of public safety are regulated by some governmental agency and held that the Railroad Commission was not limited in its scope of review simply because these issues fell within another agency's jurisdiction. According to the Court, under the Texas Water Code the Legislature gave the Railroad Commission the broad mandate to consider public interest in determining whether to grant the permit.

The Court went on to say that the Railroad Commission did not need authority to regulate road safety issues to decide whether the development of an injection well would create traffic-related safety problems that outweighed the benefits of increased oil and gas production. According to the Court, the Railroad Commission was not asked to regulate road safety, but merely to consider potential threats to public safety before issuing the permit. The Court further recognized that in fulfilling the mandates of this statute the Railroad Commission had the authority to resolve public-safety issues by regulating the activities allowed by the permit, such as limiting the number of trucks having access to the site each day, the hours of operation, or requiring the use of alternate access routes.

According to the ED, *Texas Citizens* is not controlling in this matter because the Court was interpreting the Railroad Commission's consideration of public interest, even though the

[326] Section 27.051(b)(1) provides that "(b) The railroad commission may grant an application for a permit under Subchapter C in whole or part and may issue the permit if it finds: (1) that the use or installation of the injection well is in the public interest; . . ."

standard is the same and is in the same statute.[327] However, the ED opined that if the Commission accepts *Texas Citizens* as binding in this matter, then the record still supports a finding that the use and installation of TexCom injection wells is in the public interest.[328] The Protestants disagreed with the ED and argued that the TCEQ is held to the same broad statutory language in § 27.051(a)(1) of the Water Code as the Railroad Commission. They stressed that the holding in *Texas Citizens* is binding in this matter.[329] The ALJs agree that the statute and *Texas Citizens* provide that traffic safety concerns are a public interest issue.

To evaluate TexCom's application for a permit to operate a nonhazardous underground wastewater injection facility, it is important to consider where the surface facility is located. As previously noted, TexCom's facility is located on approximately 27 acres of land at 16185 Creighton Road, near FM 3083, on the east side of Conroe.[330] In the 1990s this area had a mix of commercial, industrial, and residential property. Residential homes are located on Creighton Road adjacent to TexCom's facility, and residential neighborhoods are located in the area surrounding the site. With Conroe's explosive growth, the complexion of this area has continued to evolve into a primarily commercial and residential area, with new residential communities being developed within five miles of TexCom's facility.[331]

Currently, the proposed site entrance (the driveway) is 700 feet west of the intersection of Creighton Road and Albert Moorehead Road.[332] Creighton Road is a narrow, two-lane rural county road, with an unimproved shoulder. The road has a 30,000 pound maximum capacity and requires two significant turns to get into TexCom's facility from nearby FM 3083.

---

[327] ED Closing Argument at 18.

[328] ED Closing Argument at 18-19.

[329] Section 27.051(a)(1) of the Water Code provides that, "(a) The commission may grant an application in whole or part and may issue the permit if it finds: (1) that the use or installation of the injection well is in the public interest. . . ."

[330] Aligned Protestants Closing Argument at 30; TexCom Ex. 82.

[331] Aligned Protestants Closing Argument at 30.

[332] A map of this area is attached as Appendix B.

TexCom proposed an alternative site that the ALJs recommended in the original PFD. This entrance exists on the opposite end of TexCom's property from the original proposed entrance. TexCom has 72 feet of frontage property on FM 3083, which is a rural two-lane state highway with asphalt pavement, improved shoulders, and a 55-60 mph speed limit. Currently, TexCom does not have access to that highway. TexCom proposes to construct an entrance along FM 3083 for incoming trucks rather than the entrance on Creighton Road.[333]

The Texas Department of Transportation (TxDOT) has jurisdiction over FM 3083.[334] Changing TexCom's entrance to FM 3083 is contingent upon TxDOT granting TexCom a driveway permit. Before granting the permit, TxDOT must be satisfied that providing access to FM 3083 through a driveway to TexCom's frontage property is safe for other traffic.[335] The viability of using TexCom's frontage road as the entrance to the site received significantly more attention during the remand hearing than it did during the original hearing.

OPIC, Denbury, Aligned Protestants, and Individual Protestants argued that TexCom's operation will jeopardize the safety of people living near and traveling on Creighton Road and FM 3083. They contended that because tanker trucks cannot easily maneuver the turns on Creighton Road, and because Creighton Road was not designed to handle the weight and amount of truck traffic that TexCom's site could generate, it is not safe for this road to serve as the entrance and exit for TexCom's operation.

In the original hearing, TexCom's expert, Scott Graves, P.E., explained that TexCom hired him to evaluate the availability and adequacy of the existing roads around TexCom that tanker trucks would use to access the facility. He assumed that TexCom would: (1) preschedule truck deliveries, (2) evenly distribute the deliveries throughout the day, (3) limit tanker trucks to

---

[333] Tr. at 146; OPIC Closing Arguments at 12.

[334] TexCom Ex. 8 at 11 and 15.

[335] TexCom Brief at 42; Tr. at 1437.

a volume of 5,000 gallons, and (4) have the trucks use the facility entrance on Creighton Road.[336] According to Mr. Graves, these five routes provide access to the facility:

1. North and southbound traffic on IH-45 to Loop 336 to FM-3083 to Albert Moorehead to Creighton Road;
2. Northbound IH-45 to Crighton Road/Creighton Road;[337]
3. Northbound US 59 to FM-1314 to Loop 334 to FM-3083 to Albert Moorehead to Creighton Road;
4. Westbound on FM-3083 to Albert Moorehead to Creighton Road; or
5. Southbound on Jefferson Chemical Road to Albert Moorehead to Creighton Road.[338]

Mr. Graves opined that truckers will likely use "through-roads" without weight restrictions and with speed limits of 55 mph or greater.[339] Loop 336 and FM-3083 routes (Routes 1, 3, and 4) are new highways without weight restrictions and provide connections from IH-45 and US 59, so most truckers would use these routes.[340] From FM 3083, trucks would have to turn on Albert Moorehead to Creighton Road to enter the facility.[341] With the exception of the segment leading to the current driveway, he does not think that truckers would use the Creighton Road route because this route is not significantly shorter than using Loop 336 to FM 3083, and Creighton Road has a load-restricted bridge that most tanker trucks cannot cross. This route also has narrower roads, is in poorer condition than the other roads, has two sharp curves that are difficult to navigate on Creighton Road between FM 1314 and TexCom's facility, and has lower speed limits than the other routes.[342]

---

[336] TexCom Ex. 80, Graves direct at 8; TexCom Brief at 41; TexCom Ex. 33 at 178 (Surface Facility Application).

[337] TexCom Ex. 82 shows the spelling for Creighton Road changes at a jag in the road, but it is the same road. For the purposes of this PFD, the road will be spelled Creighton Road.

[338] OPIC Closing Argument at 12, TexCom Ex. 80, Graves at 11.

[339] TexCom Ex. 80, Graves direct at 11.

[340] OPIC Closing Argument at 13; TexCom Ex. 80, Graves direct at 13.

[341] TexCom Ex. 80, Graves direct at 80.

[342] TexCom Brief at 40; TexCom Ex. 80, Graves direct at 13.

Even if the truckers do use the Creighton route (by residential homes), Mr. Graves opined that the increase in traffic the first year would be minimal and would remain small even if TexCom operated at full capacity.[343] After investigating the site and surrounding areas, Mr. Graves said he did not see any roadway features or conditions that could pose a safety problem. He did not think accessing TexCom's facility through the Creighton Road entrance would create a safety issue.[344]

Dr. Ross told Mr. Graves that for the first year of business TexCom has a target waste disposal volume of 2,000,000 gallons per month. Based on this target, Mr. Graves calculated that 23 vehicles (including the employees' vehicles) would be entering and exiting the facility each day (based on six days per week), generating 46 vehicles per day on the roadways (23x2).[345]

Mr. Graves also estimated the increase in traffic if TexCom accepted the maximum amount of waste volume each day. Assuming that truckers delivered 504,000 gallons of wastewater over a period of 12 hours, Mr. Graves estimated that approximately 101 trucks would be coming and going to TexCom's facility per day. However, Mr. Grave spread these delivers over the 12-hour day, finding that only nine trucks per hour would be delivering waste. Adding the employees' vehicles to this, Mr. Graves predicted that 108 vehicles would be entering and exiting the facility each day, generating 216 vehicles per day on the surrounding roads.[346]

Relying on Tudor's traffic count map of the area showing the Average Annual Daily Traffic and Average Daily Traffic, Mr. Graves estimated the impact TexCom's business would have on the current traffic near the facility.[347] According to Mr. Graves, during the first year of operation the average daily traffic for the road segments near the facility that truckers may use is:

---

[343] TexCom Brief at 41; TexCom Ex. 80, Graves direct at 17-19.

[344] TexCom Brief at 41; Tr. 1435-1436.

[345] TexCom Ex. 80, Grave direct at 8.

[346] *Id.*

[347] TexCom Ex. 80, Graves direct at 16; TexCom Ex. 83 (TxDOT traffic count maps).

| | |
|---|---|
| Loop 336 | 12,400 vehicles per day |
| FM-3983 | 9,400 vehicles per day |
| Creighton Road | 1,200 vehicles per day |
| Jefferson Chemical Road | 3,070 vehicles per day |

Assuming that all tanker trucks used the same route, Mr. Grave calculated the facility's traffic contribution to the total amount of traffic on the surrounding roads for the first year: Loop 336 would experience a 0.4 percent increase in traffic; FM 3083 would experience a 0.5 percent increase; Creighton Road would experience a 3.8 percent increase, all minimal increases according to Mr. Graves. If TexCom operated at maximum capacity, Loop 336 would experience a 1.7 percent increase in traffic; FM 3083 would experience a 2.3 percent increase; and Creighton Road would experience a 17.9 percent increase, again small changes according to Mr. Graves.[348]

Mr. Graves agreed that if TexCom relocated the entrance to FM 3083, truckers would not need to use either Albert Moorehead Road or Creighton Road to enter the facility, thus discouraging the use of the Creighton road route.[349] However, if this does not happen, Mr. Graves still believed that the impact on traffic generated by TexCom would be minimal. Mr. Graves concluded that there are suitable roads to access TexCom's facility from major transportation corridors, and that the increased traffic would not create a situation that is adverse to the public interest.[350] Mr. Graves further represented that if necessary for safety reasons, TxDOT could require a turn lane or a deceleration lane be installed on FM 3083 at the proposed driveway.[351]

At the conclusion of the original hearing, OPIC requested that TexCom be required to change the entrance to FM 3083, as Dr. Ross proposed, to lessen the public safety impact on

---

[348] TexCom Ex. 80, Graves direct at 17.

[349] OPIC Closing Argument at 13; TexCom Ex. 80, Graves direct at 15.

[350] TexCom Ex. 80, Graves at 19-20.

[351] Tr. at 1404 and 1437.

traffic in accordance with § 27.051(a)(1) of the Water Code.[352] TexCom agreed to this condition.

Although, the ED does not believe that traffic is a public interest issue in this matter, if the Commission finds it is, the ED asserted that the evidence shows that traffic will not be significantly influenced by TexCom's business. The ED accepted Mr. Graves' expert testimony that the traffic impact caused by TexCom would be minimal and that the truckers would probably use Loop 336 and FM 3083 to access the facility. The short part of Creighton Road that truckers would have to use if TexCom did not relocate the driveway to FM 3083 does not pose a safety issue in the ED's opinion, but is instead a comfort issue for the truckers because Creighton Road is in poor condition. Following the remand hearing, the ED offered no further closing arguments on this issue.

The Aligned Protestants disputed the accuracy of Mr. Grave's assumptions. Mr. Brassow, a TexCom expert, testified that TexCom does not have a plan for scheduling truck deliveries. Trucks will arrive randomly. On occasions, truckers may need to park their trucks on either Creighton Road or on the FM 3083 shoulder until TexCom can accept the waste.[353] Aligned Protestants also questioned the accuracy of Mr. Grave's expert opinion.[354] Mr. Graves said he viewed the site on a weekend and not during business hours, so he did not see the traffic on Creighton Road.[355] As a result, Aligned Protestants and Individual Protestants maintained that Mr. Grave could not adequately address this issue and that permitting this site will create safety hazards for the public on Creighton Road, particularly for those living close to TexCom's facility.

The Aligned Protestants also doubt TexCom's ability to secure permission from TxDOT to move the driveway to FM 3083, because TexCom has made no effort to obtain the driveway

---

[352] OPIC Reply at 6.

[353] Tr. at 499-501, 531-532.

[354] Aligned Protestants Closing Argument at 33; Original Tr. at 151 and 505.

[355] Aligned Protestants Closing Argument at 33; Original Tr. at 1415.

permit.[356] Additional evidence was presented at the remand hearing on traffic issues, including the viability of obtaining an access permit from TxDOT.

Karen Baker, one of nine area engineers working for the Texas Department of Transportation (TxDOT) in the Houston District, testified in her individual capacity as an expert for the Aligned Protestants. She has worked for TxDOT for over 26 years, the past 11 years in Conroe, Texas, and testified she is familiar with the roads surrounding TexCom's property and TxDOT's access management manual that sets out the distance required between access points along a roadway (TxDOT's manual).[357] TxDOT has the sole access management authority over the state roadways in Montgomery County, including FM 3083.[358] As TxDOT's area engineer, Ms. Baker is responsible for the design, construction, and maintenance of state roadways in Montgomery County, including FM 3083.

Access management is necessary to ensure the smooth flow of traffic while providing the safest access to these roadways. According to Ms. Baker, various engineering studies confirm that limiting the number of access points on a roadway reduces the likelihood of traffic accidents. Speed is one factor in setting the distance requirements.[359] The speed limit on FM 3083 is 55 miles per hour (mph). As a result, the access manual indicates that 425 feet must exist between two access points.

TexCom only owns 72 feet of frontage road along FM 3083. A dozen driveways exist on FM 3083 between TexCom's frontage property and the intersection of FM 3083 and Albert Moorehead Road,[360] a distance of approximately 1400 feet. Driveways that were already providing access to FM 3083 that do not comply with the access distance requirements set out in the TxDOT manual were "grandfathered" in under the previous policy.[361]

---

[356] Tr. 1401-1403.

[357] Aligned Protestants Ex. 2.

[358] In fact, the office where Ms. Baker currently works resolves all access issues in Conroe, Texas.

[359] Aligned Protestants Ex. 1.

[360] Albert Moorehead becomes Jefferson Chemical Road on the other side of the intersection at FM 3083.

[361] Aligned Protestants Ex. 1, Baker direct at 16.

TexCom's frontage property is sandwiched between two driveways with only 280 feet between them. Ms. Baker opined that for safety reasons there is not enough distance between TexCom's property and the adjacent driveways for TxDOT to allow access to FM 3083. She emphasized that the situation is further exacerbated by the type of vehicular traffic that would be coming to TexCom, because a high volume of industrial truck traffic was not contemplated on FM 3083. This situation could increase the required distance figures between access points to maintain roadway safety.

TexCom argued that the TxDOT manual is a guideline and not a binding regulation, and, as such, TxDOT may approve an application allowing less space between access points than that set out in the TxDOT manual.[362] While Ms. Baker agreed that TexCom could apply for a variance from TxDOT to allow it access to FM 3083, she opined that it was doubtful TxDOT would do so.

The ALJs recognize that TxDOT's manual does not have the force and effect of a statute or rule, but it does set out TxDOT's policies regarding access management of the state highway system. According to the manual, proper access management contributes to preserving roadway efficiency, reduces traffic delays and congestion, and enhances traffic safety.[363] TxDOT represented that decades of research conducted in the United States has shown that proper access management improves roadway safety.[364] When access density increases, crash rates increase.

In the remand proceeding, TexCom offered little evidence to address this concern. Instead, it insists that TxDOT, not TCEQ, will determine whether to allow TexCom access to FM 3083 as the ALJs previously recommended. However, while TxDOT has authority to grant or deny access to FM 3083, TCEQ must determine whether granting TexCom's application will jeopardize public safety.

---

[362] The manual describes the application process, which includes filing with TxDOT a *Permit to Construct Access Driveway Facilities on Highway Right of Way,* and the requirements that must be met. The right to request a variance is described in Section 5 of Chapter 2 in the TxDOT manual. If the application for a permit or for a variance is denied, the party may appeal the decision in accordance with 43 TAC § 11.55.

[363] Aligned Protestants Ex. 2, TxDOT Manual at 1-2 and 1-4.

[364] *Id.* at 1-4.

The evidence continues to support a finding that Creighton Road is not a suitable road to handle TexCom's projected daily truck traffic. Although, Samson Ukaegbu,[365] a traffic engineer with Traffic Data & Associates in Houston, Texas, IP's traffic expert, recommended TexCom consider making improvements to the Creighton Road unilaterally, and to use this road rather than FM 3083 as its entrance, the ALJs disagree.

The ALJs are not persuaded that TexCom is authorized to make changes to Creighton Road without Montgomery County's prior approval. The evidence showed that Creighton Road is not capable of handling the increased traffic and weight of trucks going to and from TexCom's facility. The portion of Creighton Road that all trucks would enter to get into the facility is narrow and in poor condition and is not designed to accommodate such heavy trucks. It also runs along side residential homes. While the percentage increase in traffic may not seem significant to Mr. Graves, tanker trucks passing homes 24-hours a day seven days a week would pose a risk to children of the area, and would increase the noise and congestion on this narrow road. This condition would get even worse if trucks park along Creighton road while waiting to enter TexCom's facility.

Although, the ALJs originally agreed that moving the location of TexCom's entrance to FM 3083 would allay concerns about the Creighton Road entrance, evidence presented at the remand hearings raised new safety concerns. FM 3083 is in good condition and was designed for heavier traffic, but gaining access to this highway may prove problematic. Residential property also exists on the stretch of FM 3083 between TexCom's property and the intersection of Moorehead Road/Jefferson Chemical Road. The possibility that trucks would idle outside or inside TexCom's facility, creates a safety risk for other motorist and for these residents. However, if TexCom secures access to FM 3083, most public interest concerns can be addressed through special conditions.

Therefore, the ALJs recommend that if TCEQ issues UIC permits to TexCom, that it include in the order the following special conditions: (1) that TexCom be required to relocate the

[365] Mr. Ukaegbu agreed with Ms. Baker that it is unlikely TxDOT would approve TexCom's application for access to FM 3083 due to safety concerns.

entrance to FM 3083 prior to its accepting deliveries of nonhazardous waste; (2) that TexCom be required to schedule deliveries during specific hours and specific days; (3) that no trucks delivering waste be permitted to idle for longer than 30 minutes on or near its facility; and (4) that no more than nine trucks per hour be scheduled to deliver waste.

### 4. Other Public Interest Requirements

#### a. Compliance History

Ms. Flegal testified that TexCom's compliance history classification is average by default and TexCom's compliance history score is 3.01. This is the classification and score given if TCEQ has no compliance history about a site.[366] This classification is sufficient for a permit issuance.[367]

The Protestants take issue with this position, noting that average by default means TexCom's history is insufficient to support any classification. Lone Star pointed out that the ED ignored what little history TexCom does have with TCEQ. TexCom received a notice of violation because TexCom failed to respond to four non-report notices (September 12, 2005; April 27 and July 10, 2006; and February 1, 2007) and failed to post signs and paint the wellhead of the existing well. Given that TexCom is a new company, this history is particularly important because it demonstrates "TexCom's lack of experience or know-how with Class I wells," according to Lone Star.[368]

The Protestants also pointed out that TexCom is in the process of trying to secure a new 60-percent partner on this project for an infusion of capital, begging the question of TexCom's solvency. At the time of the original hearing, TexCom indicated that Foxborough Energy Corp. (Foxborough) is that partner. Nothing is known about Foxborough other than it may be

---

[366] TexCom Ex. 62, Hoffman Deposition at 15.

[367] TexCom Ex. 62 at 19. ED's Closing Argument at 17.

[368] Lone Star Reply at 50; Tr. 37-43; Lone Star Ex. 16.

TexCom's 60-percent partner. The Protestants insisted that the compliance history of the new entity must also be considered and evaluated before any permits can be issued.

The ALJs are aware that TexCom is new to the business of nonhazardous waste disposal by a Class I injection well and that it purchased the site because it had an injection well already in place. This advantage saved TexCom the cost of drilling its first well, and it removed a great deal of uncertainty about the underground geology. The well was drilled to the same level TexCom intends to use for disposing of waste, and the prior owners conducted fall-off testing. The question is whether TexCom has a satisfactory compliance history. Because the company has no history other than its initial problems with reporting, signage, and painting, the ED correctly assessed it as average by default. To do otherwise would penalize all new companies irrespective of the qualifications of the new business to operate a disposal system. It is a neutral classification indicating that the business has no history with TCEQ.

**b. Purpose of the Injection Well Act**

As previously noted, the purpose of the Injection Well Act is to maintain the quality of the State of Texas fresh water consistent with the public health and welfare while taking into account the economic development of the State.[369] The Injection Well Act states that it is the policy of the state to prevent underground injection that **may** pollute fresh water.[370] Fresh water is defined in the Act as "water having bacteriological, physical and chemical properties which make it suitable and feasible for beneficial used for any law purpose.[371] Pollution is "the alteration of the physical, chemical, or biological quality of water, or its contamination, such that it makes the water harmful, detrimental, or injurious to humans, animals, or vegetation."[372]

The Protestants interpret § 27.003 of the Water Code and *Texas Citizens* to preclude the granting of TexCom's application. The Protestants insist that the most critical factor in

[369] Water Code § 27.003.

[370] Water Code § 27.003.

[371] Water Code § 27.002 (8).

[372] Water Code § 27.002 (4).

considering TexCom's Application for the UIC permits "is whether any benefits to be obtained from this project would be outweighed by the threat to the sole source of water for a very large population."[373] To support their strenuous objections to the project, the Protestants emphasized that Montgomery County is the third fastest growing county in Texas.[374]

Since WDW315 was permitted in 1994, Montgomery County has experienced substantial growth. In the year 2000, the population was approximately 293,000 and by the time of the original hearing it was approximately 423,000. This significant growth is continuing, with the entire population dependent on the Evangeline Aquifer for drinking water.[375] The possible pollution of any USDW, the Protestants urged, is a critical public interest factor that neither the ED nor TexCom has adequately addressed.

With this growth, the complexion of the area near TexCom's site is changing into a residential and commercial area. Residential developers have begun investing in property for future community development. Montgomery County Judge Alan Sadler expressed serious reservations about the "chilling effect" TexCom's facility would have on both residential and commercial development of the area.[376] This is not only due to the possible contamination of the water supply, but also due to increased truck traffic in the area, the eyesore of this site, increased noise from the trucks, the odor from trucks and the storage tanks, and the risk associated with spills from both trucks and the surface facility.

While the ED does not believe *Texas Citizens* applies to this case, if it does, the ED maintained the record still supports a finding that the installation and use of the wells are in the public interest and that TexCom has satisfied all the public safety requirements. The Protestants disagreed and accused the ED of giving insufficient attention to this issue. They charged that Ms. Flegal (Hoffman) is not trained to evaluate a claim for public nuisance,[377] and that she only

---

[373] Aligned Protestants Closing Argument at 40.

[374] Aligned Protestants Ex. 5, Solomon direct at 6.

[375] Aligned Protestants Ex. 5, Solomon direct at 6 and 9; Remand Tr. at 1049.

[376] Aligned Protestants Ex. 6 at 16-17.

[377] Tr. at 1267.

conducted a limited technical review of this issue. In their view, the ED failed to conduct any qualitative analysis on whether the proposed injection project would be in the public interest.[378]

The Protestants also challenged TexCom's assertion that this project will provide a service to the businesses in Montgomery County that generate and must dispose of nonhazardous waste.[379] Judge Sadler testified that no one has expressed support or need for TexCom's facility.[380] While Dr. Ross testified that TexCom was targeting large companies in Montgomery County such as Huntsman Chemical, TexCom presented no evidence of negotiations or contracts with any business in Montgomery County even during the remand hearing. Instead, Protestants argue that TexCom's operation will cost the county money.

Protestants assert that expenses in Montgomery County would increase because of TexCom's facility. Roads would need to be repaired more frequently due to increased truck traffic. Drainage ditches would need to be monitored around the facility to ensure that nonhazardous waste is not seeping off TexCom's property. Emergency services must be prepared to respond to spills that may include unidentified waste.[381] According to Judge Sadler, Montgomery County would also have to absorb the additional expense of having the County's Environmental Health Department oversee TexCom's compliance with environmental regulations and address the public inquiries about the facility.[382]

The ALJs are mindful that many people in Montgomery County do not want a waste disposal system as their neighbor. But Water Code § 27.003 does not list ensuring that an injection well is locally popular as a purpose of the Injection Well Act. The Protestants concern about the contamination of the Montgomery County water supply is a serious issue. Previously the evidence supported a finding that the waste injected into the Lower Cockfield would not

---

[378] Aligned Protestants Closing Argument at 39.

[379] Aligned Protestants Closing Argument at 43. *See* TexCom Ex. 1 at 5-6 and Tr. at 102.

[380] Aligned Protestants Ex. 5, Solomon direct at 16; Tr. at 834-835.

[381] Aligned Protestants Closing Argument at 45; Aligned Protestants Ex. 3 at 20, Aligned Protestants Ex. 4 at 13-15.

[382] Aligned Protestants Ex. 5, Solomon direct at 15.

migrate through the shales of the Cockfield formation and through the Jackson Shale formation. However, during the remand hearing, that finding was contested. The issue before the ALJs remains whether TexCom has met the requirements of the Water Code and TCEQ's regulations. As discussed above, the ALJs find that the preponderance of the evidence does not establish that the installation and use of the well is in the public interest, because TexCom failed to prove by a preponderance of the evidence that the waste it injects into the Lower Cockfield will not resurface and contaminate Montgomery County's water source given the current and future oil and gas production plans for the Conroe Oil Field.

### 5. Other Issues Concerning UIC Permit Applications

In the original hearing, Aligned Protestants accused TexCom of being inexperienced because it has never operated a Class I injection well and has no experienced personnel in this field. They also cited evidence that a privately held investment firm called Foxborough intended to become a new majority partner in TexCom, but little information was provided about this entity.[383] Therefore, Aligned Protestants argued that TexCom's lack of experienced personnel and an uncertain financial status raise questions about whether TexCom can carry out a flawless operation, as it claims.[384]

Like the Aligned Protestants, the Individual Protestants expressed concern about the lack of information regarding Foxborough, including no information about its environmental history. They believed that the identity and environmental history of this new owner in TexCom are important issues for the Commission to consider. The Individual Protestants argued that a permit should not be issued when so little information is available about the new majority owner.[385]

TexCom responded, emphasizing that the applicant in this case is TexCom Gulf Disposal, LLC, regardless of the ownership interests of other individuals or groups. It pointed out that

---

[383] Tr. at 138-143.

[384] Aligned Protestants Closing Arguments at 44-45.

[385] Individual Protestants Closing Argument at 17-18.

none of the applicable statutes or rules require TexCom to make any kind of demonstration regarding its individual investors, particularly an investor or group that acquires an interest in the company long after the ED has completed its review of the Application.[386]

The ALJs find that TexCom's potential new partner (Foxborough) and TexCom's lack of prior experience in operating a Class I UIC facility do not compel denial of its Applications. As noted by TexCom, it is the applicant, not Foxborough, and the rules do not require detailed information about its potential investors. Although TexCom does not have prior experience operating a UIC well, its Application, which is incorporated into its permit, requires it to have competent, qualified employees, and its operation and facility will be subject to numerous reporting requirements, as well as inspection and monitoring by the TCEQ.

Additional issues were raised during the remand hearing that warrant further scrutiny. The Protestants accused TexCom's performance during the entire application process as being unsatisfactory. They argued that TexCom lacks the competency to properly manage a Class I wastewater disposal operation, particularly one that poses such a threat to the sole source of drinking water for the county.

In support of this position, Lone Star pointed out that TexCom represented that the average permeability of the Lower Cockfield was 700-800 mD, despite the results of the fall-off test done in 1999 showing a permeability of 80.9 mD. Depending on the viscosity values used, TexCom's 2009 pressure fall-off test resulted in a permeability ranging from less than 50 mD to 190 mD, demonstrating how seriously wrong TexCom and its experts turned out to be. Lone Star maintained that such a gross error calls into question the credibility of all critical geological information submitted by TexCom.

As for how TexCom will function as an operator of a UIC well, Lone Star and Denbury refer to the manner in which TexCom dealt with the permit conditions required by TCEQ in the

[386] TexCom Response Brief at 29.

Class V permit for reworking and testing WDW315 in 2009.[387] The Class V permit required TexCom to use an injectate fluid with a specific gravity of no more than 1.05 as measured at 68 degrees Fahrenheit.[388] The permit clearly provided that the failure to comply with any authorization conditions was a material breach of the authorization that could result in sanctions.

Despite the importance of this test, TexCom failed to comply with the required specific gravity value for the injectate and instead used a fluid with a specific gravity of 1.18.[389] Mr. Casey's explanation for using the wrong injectate was that he "missed it."[390] Additionally, during the same test, TexCom used the surface temperature instead of the bottomhole temperature of the native fluids in its viscosity and permeability calculations. These errors, the Protestants argue, exemplify a pattern of technical incompetence, or worse, disregard for operating in accordance with TCEQ rules and conditions.[391] Intervenors argued that TexCom's past performance is prophetic of TexCom's future performance if its application is approved; therefore, it should be denied.

Denbury also drew attention to what it contends is another TexCom error—the packer setting. The proper packer setting is necessary to prevent waste from exiting the well above the injection interval.[392] Mr. Casey testified that the packer should be set just above the injection interval, at 6,045 feet—the Lower Cockfield. But during the 2009 fall-off test, the packer was at 5,108 feet above the entire injection zone, and 937 feet above the injection interval. This is significant because placing the packer above the injection interval creates a risk that waste will leak out of the well before the injection interval. Denbury stressed that if this happened, it could take up to a year before the leak is discovered.[393]

---

[387] Lone Star Remand Closing Argument at 14.

[388] Remand Tr. at 202.

[389] *Id.* ; TexCom Ex. 91.

[390] Remand Tr. at 205.

[391] Lone Star Remand Closing Argument at 15.

[392] TexCom Ex. 49, Casey direct at 23-24.

[393] Denbury Remand Closing Argument at 47-48; Remand Tr. at 473.

Finally, Aligned Protestants accuse Mr. Bost of inflating the amount of Class I wastewater generated in Montgomery County and disposed of by means other than a POTW. Mr. Bost said that he relied on TECQ records for the numbers he used in his calculations. According to Mr. Bost's calculations 4.7 billion pounds of Class I nonhazardous wastewater was generated in Montgomery County in 2007 excluding amounts disposed of at POTWs.[394] Two generators, Mr. Bost explained, generated 99.9 percent of this wastewater—Huntsmen and Chevron Phillips. If Mr. Bost's calculations were correct, Aligned Protestants reasoned, then TCEQ records should show that Huntsmen and Chevron generated 4,695,300,000 pounds of wastewater. However, TCEQ records indicate that Huntsmen generated only 233,176,387 pounds in 2007, and nothing in TCEQ records show that Chevron produced 4.5 billion pounds of wastewater. Aligned Protestants accuse Mr. Bost of inflating the wastewater generated in Montgomery County by 20 times, and argue that Montgomery County has no significant market for TexCom's disposal services.[395]

The ALJs are aware the each party has an interest in presenting evidence in the light most favorable to it. Mr. Casey's errors during the 2009 fall-off test was not egregious and appeared unintentional. The ALJs do not find that TexCom's minor infractions of the Class V permit are representative of how TexCom will operate its facility if permitted.

In conclusion, the ALJs find that (1) the Conroe POTW is a reasonably available, practical, economic, and feasible alternative for the disposal of Class I nonhazardous water in this area; (2) the preponderance of the evidence does not establish that the ground and surface fresh water can be adequately protected from the injected waste from the proposed injection wells, and (3) that traffic safety issues exist, but can be addressed by requiring TexCom to relocated the entrance to FM 3083 and by imposing certain conditions regarding the scheduling of deliveries, and time and dates of operation, and the amount of time truck may idle while waiting to dispose of its waste at TexCom's facility.

---

[394] TexCom Ex. 92, Bost direct at 16.

[395] Aligned Protestants Remand Closing Arguments at 13; Remand Tr. at 1349 and 1385-1387.

## VI. ASSESSMENT OF REPORTING AND TRANSCRIPTION COSTS

**Costs for Original Hearing:** By Order No. 1, the ALJs required a transcript to be prepared for the original hearing because the hearing was scheduled to last longer than one day. 30 TAC § 80.23 (b)(4). TexCom paid the transcription costs totaling $8,616.50. The parties reached an agreement on the allocation of the costs for the original hearing. Under the agreement, TexCom is responsible for the $25.00 charge for "E-Transcript" and the $553.00 charge for "Exhibit Copies – Oversize or Color." The responsibility for the remaining $8,038.50 is allocated as follows:

| | |
|---|---|
| TexCom | $4,019.25 |
| Aligned Protestants | $2,009.62 |
| Lone Star | $2,009.63 |

The ALJs found the parties' agreed allocation of transcript costs is fair and reasonable, and they recommend that the Commission approve this allocation and require Aligned Protestants and Lone Star to reimburse TexCom for the amounts shown above.

**Costs for Remand Hearing:** The parties did not agree to the allocation of transcript costs for the remand hearing. TexCom provided a summary of costs from Kennedy Reporting Service, showing a $14,715.00 fee for the transcript of the remand hearing (Volumes 1-8). Denbury complained about charges for administrative fees for electronic copies and exhibit costs. However, these do not appear on the invoice provided to the ALJs with the written arguments, and it is not clear what Denbury is referencing. The invoice does contain a charge for daily copy for parts of Volumes 5 and 6, and the ALJs agree that those charges should not be included in chargeable costs to the other parties.

As for the $14,715.00 expense, the Commission's rule at 30 TAC § 80.23(d) lists the factors to be considered in assessing reporting and transcription costs. The factors relevant to this case include the following:

(A) The party who requested the transcript. The ALJ ordered the transcript.

(B) The financial ability of the party to pay costs. Although no specific evidence was presented on the financial ability of the parties, the evidence did show that TexCom has investors and is an active business entity, and Denbury is a large energy company that has invested many millions of dollars in the Conroe Oil Field. The Aligned Protestants are local governmental entities (Montgomery County and the City of Conroe), both of which have significant financial resources. Likewise, the Lone Star Groundwater Conservation District is also a local governmental entity. In contrast, the Individual Protestants were comprised primarily of retired persons or other individuals with modest financial resources.

(C) The extent to which the party participated in the hearing. Although some limited straying occurred, the questioning of witnesses by the parties was generally to the point and directed toward relevant issues. TexCom presented two witnesses in its direct case and three witnesses for its rebuttal case. For their direct cases, Denbury called four witnesses; Lone Star called two witnesses; the Aligned Protestants called four witnesses; the Individual Protestants called four witnesses; and the ED called one witness. Thus, TexCom called a total of five witnesses and the Protestants collectively called fourteen witnesses. The ALJ finds that the extent of participation by all parties in cross examination was generally appropriate. The pages of transcript used by the parties during cross examination were approximately as follows: TexCom – 850 pages; Denbury – 340 pages; Individual Protestants – 130 pages; Lone Star – 120 pages; and Aligned Protestants – 100 pages. Although TexCom accounted for the largest amount of cross examination, the Protestants presented far more witnesses that resulted in TexCom's cross examination.

(D) The relative benefits to the various parties of having a transcript. All parties benefited from having a transcript, but as the party bearing the burden of proof,

TexCom had the greatest potential benefit from an ability to cite and reassemble the information within the record to support its application.

(E) The budgetary constraints of a state or federal administrative agency participating in the proceeding. The broad responsibilities and limited budgets of the agency parties in this case make it unreasonable to assess costs against them. The rules also preclude the Commission from assessing costs against parties that cannot appeal a Commission decision (the ED and OPIC).[396]

(F) This factor is inapplicable.

(G) Any other factor which is relevant to a just and reasonable assessment of costs. None.

After considering these factors, and particularly the financial ability of TexCom and Denbury; the limited resources of the Individual Protestants; and the number of witnesses called by the parties, the ALJs find it appropriate to assess the transcript costs as follows:

| | |
|---|---|
| TexCom | 45% |
| Denbury | 35% |
| Aligned Protestants | 10% |
| Lone Star | 10% |

## VII. CONCLUSION AND RECOMMENDATION

The ALJs recommend that the Commission deny TexCom's UIC well applications. If the Commission decides to grant the applications, the ALJs recommend that the entrance to TexCom's proposed facility be moved from Creighton Road to FM 3083 and that restrictions be imposed regarding the scheduling of deliveries, the time and days of operation, and the amount of time trucks may idle their engines while waiting to dispose of waste at TexCom's facility.

[396] 30 TAC § 80.23(d)(2).

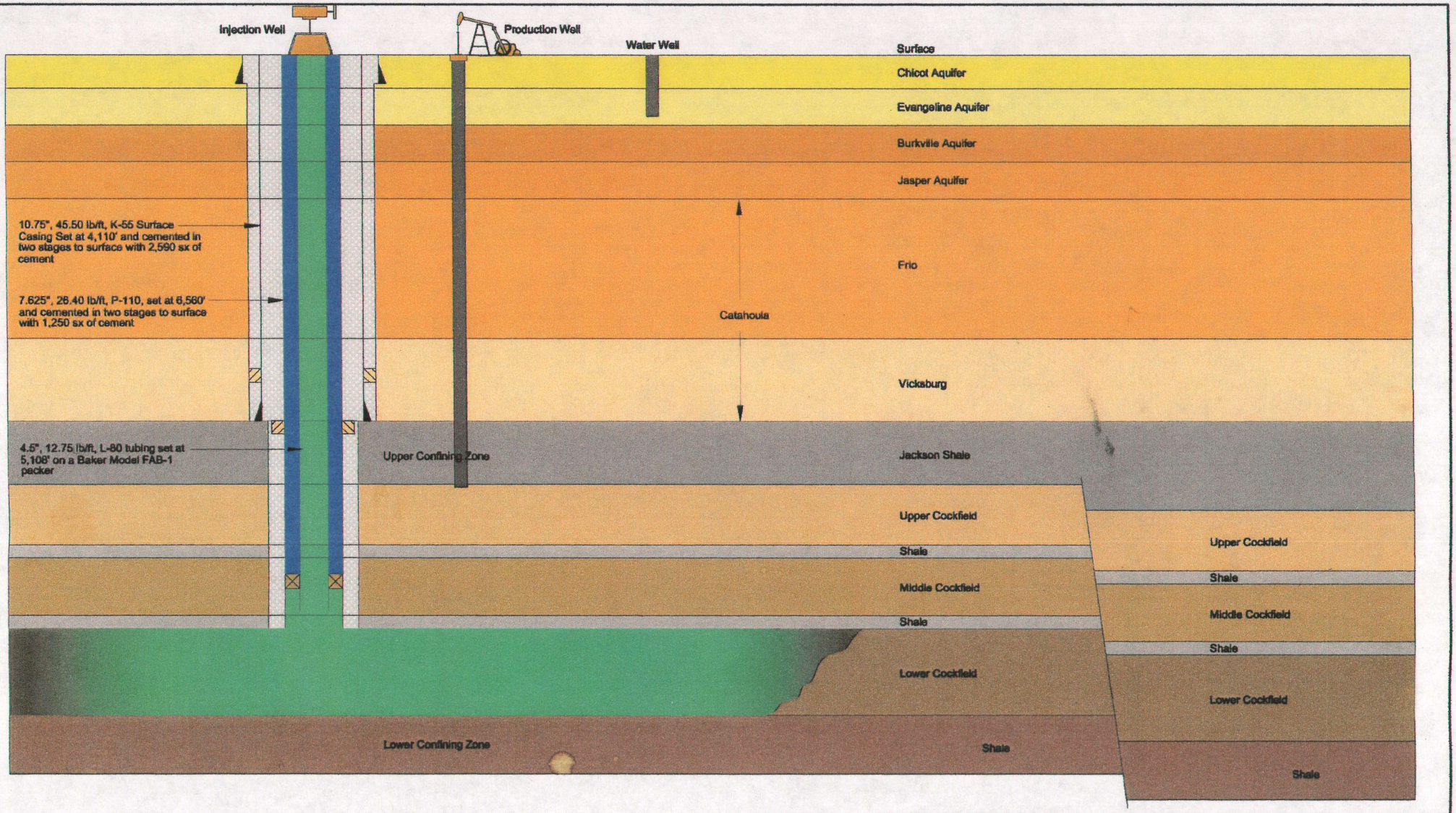
**SIGNED November 8, 2010.**

**CATHERINE C. EGAN**
**ADMINISTRATIVE LAW JUDGE**
**STATE OFFICE OF ADMINISTRATIVE HEARINGS**

**THOMAS H. WALSTON**
**ADMINISTRATIVE LAW JUDGE**
**STATE OFFICE OF ADMINISTRATIVE HEARINGS**

**TABLE A-1**

| | | |
|---|---|---|
| The Gulf Coast Aquifer System | 0-150 feet<br>150-750 feet<br>750-1,010 feet<br>1,010-1525 feet | Chicot Aquifer<br>Evangeline Aquifer<br>Burkeville Aquifer<br>Jasper-Oaksville Aquifer |
| The Catahoula Formation | 1,525 to 4,088 feet | Deepest base of USDW above Jackson and includes Frio and Vicksburg |
| The Jackson Formation | 4,088 and 5,180 feet (Total: 1,092 feet) | **Upper Confining Zone for UIC** that consists of a semi-solid, marine mudstone, that is impermeable. It is laterally continuous, and TexCom contends is free of transecting, transmissive faults or fractures. 30 TAC §331.121(c)(3)(B)(i). |
| The Cockfield | 5,134 to 5,629 feet | Upper Cockfield–the formation for most of Conroe's oil production. |
| | 5,629 to 6,045 feet | Middle Cockfield |
| | 6,045 to 6,390 feet | Lower Cockfield is the proposed injection interval. Thick porous and permeable sand allegedly provides storage capacity of large volumes of wastewater |
| Cockfield Shale Member | Below 6,390 feet | **Lower Confining Zone for UIC** |

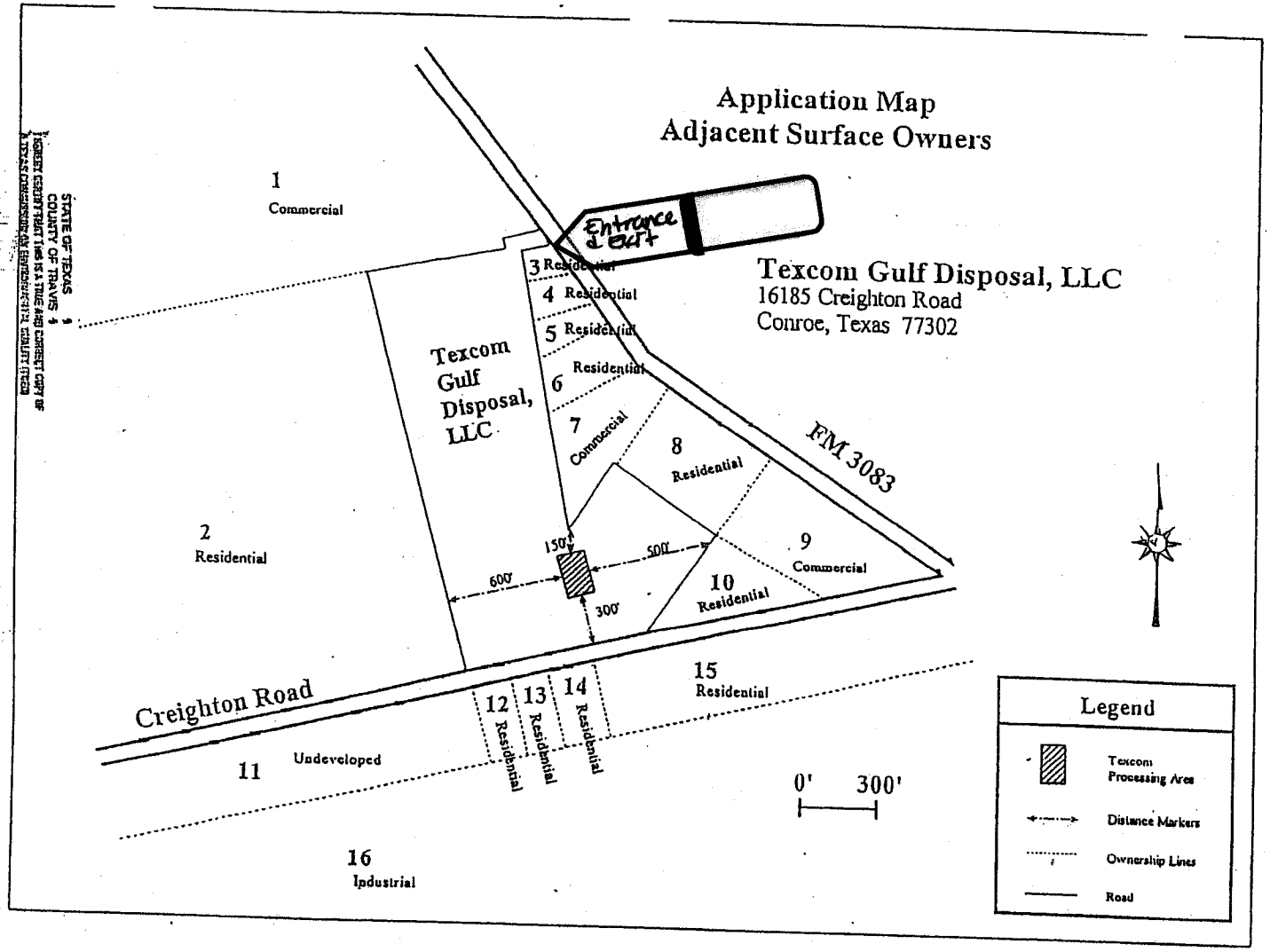



| | |
|---|---|
| | Injection Well Cross-Section |
| | TexCom Gulf Disposal, LLC<br>Montgomery County, Texas |
| | Not to Scale |

APPENDIX A2

Industrial Solid Waste Permit No. 87758
Permittee: Texcom Gulf Disposal, LLC

Sheet 2 of 3
ATTACHMENT B




STATE OF TEXAS
COUNTY OF TRAVIS
I HEREBY CERTIFY THAT THIS IS A TRUE AND CORRECT COPY OF
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY RECORD

SEP 28 1 2011

DOCUMENT, WHICH IS FILED IN THE RECORDS OF THE COMMISSION, WAS ORDERED BY HAND AND THE SEAL OF OFFICE

RICK THOMAS
RETRIEVER CUSTODIAN OF RECORDS
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

APPENDIX B

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

**AN ORDER** Denying the Application for Permit Nos. WDW410, WDW411, WDW412 and WDW413 to TexCom Gulf Disposal, LLC; TCEQ Docket No. 2007-0204-WDW; SOAH Docket No. 582-07-2673

On _____, the Texas Commission on Environmental Quality (Commission or TCEQ) considered the application of TexCom Gulf Disposal LLC (TexCom or Applicant) for Permit Nos. WDW410, WDW411, WDW412 and WDW 413, authorizing TexCom to construct and operate four Class I Underground Injection Control (UIC) wells in Montgomery County, Texas. Catherine C. Egan and Thomas H. Walston, Administrative Law Judges (ALJs) with the State Office of Administrative Hearings (SOAH), presented an Amended Proposal for Decision (PFD) recommending that the Commission deny TexCom's Application for Permit Nos. WDW410, WDW411, WDW412 and WDW 413. After considering the ALJs' Amended PFD, the Commission adopts the following Findings of Fact and Conclusions of Law:

## I. FINDINGS OF FACT

***General Findings and Procedural Issues***

1. The Applicant is TexCom Gulf Disposal, LLC (TexCom), 3600 South Gessner Road, Suite 200, Houston, Texas 77063.

2. TexCom was formed as a Texas C Corporation to own, manage, and operate certain disposal businesses.

3. In February 2005, TexCom acquired an approximate 27-acre site for the purpose of developing a commercial non-hazardous industrial wastewater disposal facility (the Facility).

4. The site of the proposed Facility is located near the corner of Creighton Road and FM 3083 on the southeast side of the City of Conroe in Montgomery County (the Site).

5. The Site was previously owned by Crossroads Environmental, Inc. (Crossroads), which, in the early 1990s, applied to the Texas Natural Resource Conservation Commission (TNRCC) for authorization, to construct and operate a commercial Class I UIC well at the Site to dispose of non-hazardous industrial wastewater.

6. On February 7, 1994, the TNRCC issued UIC Permit No. WDW315 to Crossroads, authorizing the construction and operation of a Class I UIC well.

7. The existing Well WDW315 was drilled and constructed in 1999.

8. WDW315 is located within the Conroe Oil Field.

9. Surface facilities were never constructed, and no wastewater was ever injected into the existing Well WDW315.

10. UIC Permit No. WDW315 expired on February 7, 2004, and the well was scheduled to be plugged prior to TexCom's acquisition of the Site in February 2005.

11. Since acquiring the Site, TexCom has installed continuous monitoring and recording devices for pressure, temperature, injection flow rates, and injection volumes at the existing Well WDW315; and has, in accordance with an agreement with TCEQ, been re-calibrating the monitoring devices and recorders each calendar quarter, and conducting annual mechanical integrity tests of the well.

12. TexCom is requesting authorization to put into operation the existing Well WDW315 and to construct and operate up to three additional Class I UIC wells at the Site to dispose of nonhazardous wastewater generated by industrial operations.

13. The existing well WDW315 would be re-permitted as Well WDW410, and the three additional proposed wells would be permitted as Wells WDW411, WDW412, and WDW413, each under its own separate UIC permit.

14. Under a separate Application, TexCom has also applied for a nonhazardous industrial solid waste permit (Permit No. 87758) to authorize the surface facility at the Site.

15. TexCom has applied for authorization to accept and dispose of Class I industrial wastewater, which is defined as nonhazardous by EPA and the TCEQ. This excludes any waste with the characteristics of ignitability, corrosivity, reactivity, or toxicity, as well as a list of specific types of wastewaters generated from various industrial operations that EPA has determined to be hazardous.

16. All wastewater received by TexCom would have to meet the definition of nonhazardous when it is received.

17. In its Application, TexCom provided a list of 18 waste stream categories it proposes to accept, such as "aqueous waste with low solvents," "aqueous waste with reactive sulfides," and "acid aqueous waste."

18. The effluent streams proposed for injection are mostly water and may or may not contain low concentrations of certain organic and inorganic substances.

19. Final composition of the various waste streams cannot be determined until the Facility is built and clients for disposal are put under contract.

20. TexCom submitted its UIC Application to TCEQ in August 2005.

21. TexCom made a copy of the application available for inspection and copying in a public place in Conroe, Texas.

22. By letter dated August 31, 2005, TCEQ declared the Application to be administratively complete.

23. TexCom submitted complete applications for WDW410, WDW411, WDW412, and WDW413.

24. Evidence was placed into the record that on September 6, 2005, the TCEQ mailed the Notice of Receipt of Application and Intent to Obtain Underground Injection Control Permits to adjacent landowners, public officials, and other persons entitled to receive notice under TCEQ rules or who requested notice.

25. On September 20, 2005, TexCom published the Notice of Receipt of Application and Intent to Obtain Underground Injection Control Permits in *The Courier*, a newspaper regularly published in Montgomery County with the largest circulation of newspapers published in that county.

26. TCEQ Staff's technical review of the UIC Application was performed in accordance with standard TCEQ procedures and policies.

27. TCEQ Staff issued Notices of Deficiency to TexCom during technical review, and, in response, TexCom provided updated UIC Application materials on December 7, 2005, January 29, 2006, February 22, 2006, March 17, 2006, April 5, 2006, and April 19, 2006.

28. The updated Application materials submitted by TexCom satisfactorily addressed all issues raised in the Notices of Deficiency issued by TCEQ Staff.

29. TexCom submitted a complete Technical Report that was included as a part of the applications for WDW410, WDW411, WDW412, and WDW413.

30. A public meeting concerning the Application was held on March 9, 2006, in Conroe. Notice of the public meeting had been published on February 16, February 23, and March 2, 2006, in *The Courier*.

31. TCEQ Staff summarized its technical review in the "Technical Summary and Executive Director's Preliminary Decision" dated April 27, 2006.

32. By letter dated July 3, 2006, the TCEQ's Executive Director indicated that technical review of the Application was complete, and that he had made a preliminary decision to issue the Draft Permits.

33. Evidence was placed into the record that on July 3, 2006, the TCEQ mailed the Notice of Application and Preliminary Decision to adjacent landowners, public officials, and other persons entitled to receive notice under TCEQ rules or who requested notice.

34. On July 9, 2006, TexCom published the Notice of Application and Preliminary Decision in *The Courier*.

35. Environmental Protection Agency (EPA) Region 6 was provided with a copy of the Draft Permits.

36. On January 11, 2007, the TCEQ's Executive Director issued written responses to public comments and indicated that none warranted any changes to the Draft Permits.

37. TexCom also submitted its UIC Application to the Railroad Commission of Texas (RRC). By letter dated September 16, 2005, the RRC indicated that it had conducted a review of the UIC Application, specifically studied aspects relating to injection operation, geology, and artificial penetrations within 1/4 mile of the Facility, and concluded that operation of the Facility would not injure or endanger any known oil or gas reservoir.

38. By letter dated April 13, 2007, TexCom requested that its UIC and Surface Facility Applications be directly referred to SOAH for a contested case hearing under TEX. WATER CODE § 5.557 and 30 TEX. ADMIN. CODE § 55.210.

39. SOAH scheduled the preliminary hearing for July 18, 2007, in the Montgomery County Commissioner's Courtroom.

40. Evidence was placed into the record that on June 5, 2007, the TCEQ mailed notice of the hearing to interested persons, public officials, and other persons entitled to receive notice under TCEQ rules or who requested notice.

41. TexCom arranged for notice of the hearing to be mailed on June 14, 2007, to 1,077 separate addresses, comprising all residential or business addresses and all owners of real property within one-half mile of the Site.

42. Notice of the hearing was published in *The Courier* and *The Houston Chronicle* on June 14, 2007.

43. TexCom's UIC and Surface Facility Applications were consolidated by SOAH for purposes of convenience and were considered during the same SOAH hearing, including the remand hearing.

44. At the preliminary hearing, the following were named as Parties to the proceeding: TexCom; the Executive Director of TCEQ; the Office of Public Interest Counsel (OPIC); Montgomery County; the City of Conroe; the Lone Star Groundwater Conservation District; Nicky E. Dyer; Flora Harrell; Edgar and Shirley Hoagland; Patty Mouton; James Langston; James A. Langston, III; Lois Nelson; James Nolan; George Phillips; Brian Rodel; Richard Ward; Edwin A. (Art) Wilson; and Al and Jerry Zaruba.

45. All of the individuals were aligned together as the "Aligned Individual Protestants;" Montgomery County and the City of Conroe were aligned as the "Aligned Protestants."

46. Prior to the hearing on the merits, James Nolan and George Phillips withdrew from the proceedings.

47. The hearing on the merits was held from December 12-18, 2007. The first three days of the hearing were conducted at the Montgomery County Commissioner's Court in Conroe, and the last two days were conducted at the SOAH in Austin.

48. All Parties except for OPIC pre-filed direct-case testimony and exhibits. All Parties participated in the hearing on the merits through their designated representatives.

49. The ED filed a response to public comment on the application, and each party was allowed to respond and to present evidence at the hearing on each issue raised in public comment or in the ED's response.

50. All Parties filed closing briefs on February 4, 2008, and responses to closing briefs on February 25, 2008, at which time the record closed.

51. On April 25, 2008, the ALJs issued a proposal for decision (PFD) recommending that TexCom's application be granted with certain special conditions.

52. On November 19, 2008, the Commission considered the PFD issued on April 25, 2008, and elected to remand the matter to SOAH.

53. On December 12, 2008, the Commission entered an Interim Order remanding the matter to SOAH with the following instructions:

> To abate the hearing in order for an analysis to be conducted using the 80.9 millidarcy permeability, and an assumption that the fault in question is non-transmissive in the horizontal direction. SOAH shall hold a hearing with that new modeling, and the Commission directs the ALJs to draft an amended PFD to bring back before the Commission. The hearing will also allow for evidence and argument to be taken on the public interest requirements, and alternative disposal options.

54. On February 25, 2009, a procedural schedule was issued setting the remand hearing on the merits on July 20, 2009.

55. At the request of TexCom, Lone Star, Aligned Protestants, and Individual Protestants, the hearing on the merits scheduled for July 20, 2009, was cancelled on May 20, 2009, and the proceeding was abated to allow TexCom time to reperforate existing well WDW315 and to conduct a new pressure full-off test (Order No. 16).

56. TexCom reperforated WDW315 and conducted a new pressure fall-off test on that well during September 2009.

57. On December 15, 2009, a new procedural schedule was issued resetting the hearing on the merits for April 20, 2010.

58. In December 2009, Denbury Onshore, LLC (Denbury) acquired the mineral leases in the Conroe Oil Field from the previous field operator, Wapiti.

59. On March 20, 2010, Denbury filed a motion to intervene. TexCom objected to the motion, the ED took no position, and the remaining parties did not oppose it.

60. On April 12, 2010, Denbury's motion to intervene was granted, Denbury was designated as a party, and the hearing on the merits was rescheduled to June 15, 2010.

61. Prior to the remand hearing on the merits, the Parties prefiled direct testimony and exhibits.

62. The remand hearing on the merits was held from June 15-24, 2010, at SOAH in Austin, Texas. All parties participated in the remand hearing through their designated representatives.

63. The parties filed remand closing arguments on August 20, 2010, and remand replies to closing arguments on September 7, 2010, at which time the record closed.

***Injection Well Construction and Operation***

64. TexCom's wells are proposed to dispose of nonhazardous industrial wastewater by injecting it through 145 feet of perforated wellbore into a geological formation known as the Lower Cockfield, at depths between 6,045 and 6,390 feet (the Injection Interval).

65. TexCom's proposed Injection Zone, the geological formation that receives fluid through the well, is between 5,134 and 6,390 feet below ground, and it includes the formations known as the Lower Cockfield (6,045 to 6,390 feet), the Middle Cockfield (5,629 to 6,045 feet), and the Upper Cockfield (5,134 to 5,629 feet).

66. The existing well WDW315 (to be permitted as WDW410) was constructed according to the following specifications: After drilling the surface hole to approximately 4,110 feet, 10.75-inch surface casing was set and cemented to the surface with 2,590 sacks of cement. The protection casing hole was drilled to 6,578 feet, and then 6,560 feet of 7 5/8-inch casing was run into the well. The casing was cemented to the surface in two stages with 1,260 sacks of cement.

67. WDW315 was completed with 4.5-inch tubing set on a packer at 5,108 feet. The packer is set above the entire Injection Zone and within the Jackson Shale upper confining unit.

68. All the down-hole components of the existing Well WDW315 were constructed out of carbon steel. All the components of the well, including the cement, were constructed out of materials compatible with the proposed injection fluid.

69. Annual tests have demonstrated that the existing Well WDW315 possesses mechanical integrity and has not developed any leaks.

70. The same basic design and construction techniques and materials used to construct Well WDW315 would be used to construct Wells WDW411, WDW412, and WDW413.

71. The proposed total drilling depth for each well is approximately 6,600 feet kelly bushing (KB). WDW315 has a total depth of 6,578 feet KB.

72. The surface casing for each of TexCom's wells would be set to 4,110 feet, which is below the lowest formation containing an underground source of drinking water (USDW).

73. The casing and cement used would be designed for the 30-year life expectancy of the wells, including the post-closure care period.

74. An electric motor driven-pump or pumps would be located at the surface to create pressure to force the wastewater down to the bottom of the wells. Surface injection pressure for the injection wells is anticipated to range between 0 pounds per square inch (psi) and 1,250 psi.

75. The maximum flow of wastewater to the injection well system at full facility production would be 350 gallons per minute for the entire Facility. This is a cumulative maximum flow, meaning that the total of the injection rates for all operating wells at the site cannot exceed this total rate.

76. Well WDW315 was initially perforated 100 feet in various sand intervals from 6,184 to 6,372 feet. In 2009, TexCom reperforated WDW315 for a total of 145 feet from 6,045 to 6,390 feet in order to reposition the Injection Interval in the optimal range for injection. This workover was performed by TexCom in September 2009 under a Class V authorization issued by TCEQ. Wells WDW411, WDW412 and WDW413 would also be required to be perforated within the Lower Cockfield formation, from 6,045 to 6,390 feet.

77. The injection wellheads area would be required to have secondary containment areas to collect and contain spills, leaks, or stormwater.

78. The injection wellheads would be required to have a built-in monitoring system, consisting of devices that would continuously record, at a minimum, injection tubing pressures, injection flow rates, injection fluid temperatures, injection volumes, tubing-long-string

casing annulus pressure, and tubing-long-string casing annulus volume. All gauges, pressure sensing devices, and recording devices would be required to be tested and calibrated quarterly.

79. The injection wellheads would be required to be equipped with automatic alarm and shutoff systems designed to sound in the event that pressures, flow rates, or other parameters designated by the Executive Director exceed a range or gradient specified in the permits.

80. The integrity of the long string casing, injection tubing, and annular seal would be required to be tested by means of an approved pressure test with a liquid or gas annually and whenever there has been a well workover.

81. The integrity of the cement within the Injection Zone would be required to be tested by means of an approved radioactive tracer survey annually.

82. Corrosion monitoring of well materials would be required to be conducted quarterly.

83. If a loss of mechanical integrity is discovered, TexCom must immediately cease injection, take reasonable steps necessary to determine if there has been a release into any unauthorized zone, notify the TCEQ Executive Director of the loss within 24 hours, notify the Executive Director when injection can be expected to resume, and restore and demonstrate mechanical integrity to the satisfaction of the Executive Director prior to resuming injection of wastewater covered by the permit.

***Location***

84. The geology of the area was described confidently and the limits of waste fate and transport can be accurately predicted through the data obtained from the existing well and the use of analytical and numerical models.

85. The proposed injection wells are located within the Conroe Oil Field.

86. The Conroe Oil Field was discovered in 1931 and operated by a single operator for much of its lifespan. Denbury became the unit operator for the Conroe Oil Field on March 31, 2010.

87. The geological formations that are most relevant are (starting with the deepest and proceeding toward the surface) the Cockfield formation (5,134 to 6,390 feet), the Jackson Shale formation (4,088 to 5,180 feet), the Catahoula Aquifer (which includes the Vicksburg and Frio Aquifers) (1,525 to 4,088 feet), and the Gulf Coast Aquifer System (0 to 1,525 feet).

88. The Cockfield Formation is made up of a thick marine mudstone section overlain by interbedded sands and shales.

89. The Cockfield consists of four separate parts: (1) the Cockfield Shale Member (starting at 6,390 feet and extending deeper), (2) the Lower Cockfield Member (6,045 to 6,390 feet), (3) the Middle Cockfield Member (5,629 to 6,045 feet) and (4) the Upper Cockfield Member (5,134 to 5,629 feet).

90. Within the Cockfield formation, most historical oil production within the Conroe Oil Field has been from the Upper Cockfield. None has been from the Lower Cockfield.

91. The Lower Cockfield, which would serve as the Injection Interval, consists of approximately 345 feet of shales and shaley sands. The sharp upper contact of the Lower Cockfield is the lower boundary of a 35-foot thick layer of alternating beds of shale, silt, and sand at the base of the Middle Cockfield.

92. The Lower Cockfield has sufficient thickness, areal extent, and lateral continuity to contain the proposed amount of injected fluid.

93. The Lower, Middle, and Upper Cockfield Members are separated from one another by layers of alternating beds of shale, silt, and sand. It was not established by a preponderance of the evidence that these layers would prevent injected wastewater or other fluids from passing vertically between the Lower, Middle, and Upper Cockfield.

94. The evidence was uncertain as to whether the Lower, Middle, and Upper Cockfield Members are in communication with each other within the Area of Review (AOR) at the east-west running fault located 4,400 feet south of the site, the EW-4400-S fault.

95. The proposed Injection Zone is the entire Cockfield Formation, which is approximately 1,222 feet thick.

96. The Cockfield Shale (starting at 6,390 feet and proceeding downward at least 182 feet) would serve as the Lower Confining Zone, and the marine mudstone of the Jackson Shale formation (4,088 to 5,134 feet) would serve as the Upper Confining Zone.

97. By the 1930s, surface and production casings were being made of steel as opposed to wood, and state regulators had begun requiring actual surveying of well locations.

98. During the 1930s, nearly all oil and gas wells within the Conroe Oil Field were completed in the Upper Cockfield, except for a few that were drilled to the Wilcox sands (12,000 feet depth) that were dry holes and plugged.

99. Even if the field operator had drilled a well to a lower depth looking for oil, the operator would likely have plugged that well back to the Upper Cockfield with cement or mechanical plugs in order to prevent the inward flow of brine from the lower zones and for oil production.

100. More than 500 artificial penetrations pierce through the Jackson Shale Formation and into the Cockfield formation within the AOR for TexCom's proposed operation.

101. By the early 1930s, the standard practice for abandoning oil wells was to plug them with cement.

102. If there were abandoned wells that had been drilled through the Jackson Shale formation that lacked adequate casing and were not plugged with cement, they would not have withstood

the pressures exerted by the surrounding mudstone of the Jackson Shale formation and would have collapsed and naturally sealed within a matter of years.

103. The COI is the area within which the reservoir pressure build-up over the lifetime of the facility is sufficient to, theoretically, displace a drilling mud plug in an abandoned well exposed to that pressure build-up.

104. The Jackson Shale formation exists between 4,088 and 5,180 feet, for a total of 1,092 feet, in the area of TexCom's proposed site.

105. In the area surrounding the Site, the overlying confining layers of the Jackson Shale formation and the underlying Cockfield Shale Member are free of transecting, vertically transmissive faults and fractures, and these formations are sufficiently thick, impermeable, and laterally continuous to confine the injected wastewater.

106. The Jackson Shale formation is composed of a semi-solid, dough-like substance. It is impermeable, free from transmissive faults or fractures, and would prevent any upward migration of liquids out of the Cockfield formation in the AOR.

107. The Jackson Shale formation would likely have collapsed into and sealed any uncased, abandoned boreholes drilled into the Upper Cockfield during the 1930's or earlier.

108. The Jackson Shale formation has a net impermeable shale thickness of approximately 1,000 feet.

109. Denbury's current hydrocarbon production wells completed in the Upper Cockfield within the Conroe Oil Field and along EW-4400-S currently produce about 11,300 barrels of fluid per day. Much of the fluid is formation water and brine.

110. For the entire Conroe Oil Field, Denbury currently produces about 2,500 barrels of oil per day and about 200,000 barrels of formation fluid and brine per day.

111. Denbury currently has one production well located about 3,000 feet from WDW315.

112. The production of fluids from Denbury's production wells creates areas of low pressure, or pressure sinks, at or near the wells. In underground formations, fluids migrate from areas of higher pressure towards pressure sinks.

113. The evidence was uncertain as to whether the layers of shale, silt, and sand that separate the different member of the Cockfield formations would prevent the upward migration of fluids from the Lower Cockfield Injection Interval to the Middle and Upper Cockfield members of the Injection Zone.

114. If TexCom's wastewater plume migrates from the Lower Cockfield Injection Interval to the Upper Cockfield portion of the Injection Zone, it could eventually be pumped to the surface through Denbury's production wells.

115. The production of more than 700 million barrels of oil in the area indicates that the Jackson Formation is still acting as an intact trapping feature and has not been breached.

116. There are two relevant faults within the AOR. The first is the EW-4400-S fault, which has a 100 to 150-foot down-to-the-basin off-set. The second is a parallel fault with up to approximately 75 feet of down-to-the-basin offset, mapped on the extreme southern edge of the AOR.

117. The evidence was uncertain as to whether two faults within the AOR are laterally or vertically transmissive.

118. Neither of the two faults within the AOR is capable of propagating upward through the Jackson Formation because of, among other things, its dough-like consistency.

119. Any faults in the area, including those identified within the AOR, would be sealed by the mudstone of the Jackson Formation, which lacks the strength to maintain open channels.

120. If other small faults with limited offset exist in the area, they would not influence the engineering or the safety margins of the project.

121. Within the AOR, the piezometric surface of the fluid in the Injection Zone is greater than the piezometric surface in the deepest USDW.

122. The TexCom site is located in an area with a seismic risk zone of 0.

123. The Gulf Coast Aquifer System is the major groundwater aquifer system in the area. The aquifers that make up the System in the vicinity of the Site are the Chicot Aquifer (0 to 150 feet), the Evangeline Aquifer (150 to 750 feet), the Burkeville Aquifer (750 to 1,010 feet), and the Jasper-Oakville Aquifer (1,010 to 1,525 feet).

124. The deepest drinking water wells in the area are completed at depths of between 1,000 and 1,500 feet deep, but the vast majority are only 140-200 feet deep.

125. The Catahoula Aquifer, which includes the Vicksburg and Frio Aquifers, lies below the deepest water wells and the Gulf Coast Aquifer System, at a depth of between 1,525 and 4,088 feet in the vicinity of the TexCom site.

126. The Catahoula Aquifer is largely a thick mudstone rather than an aquifer, but it does contain isolated, thin sands.

127. The base of the USDW in the area varies, but is no deeper than the base of the Catahoula Aquifer at approximately 4,088 feet beneath the surface and above the Jackson Shale formation.

128. Water with less than 10,000 parts per million (ppm) total dissolved solids (TDS) is considered suitable for drinking water. Below the Catahoula, the pore water is approximately 35,000 ppm TDS and is frequently mixed with varying amounts of hydrocarbons.

129. The Catahoula Aquifer has water that contains fewer than 10,000 ppm TDS.

130. The water in the Catahoula Aquifer is likely treatable to health and aesthetic standard to serve as drinking water.

131. The Catahoula is separated from the Injection Interval (Lower Cockfield) by the 1,092-foot thick Jackson Shale formation and about 900 feet of sands and shales in the Upper and Middle Cockfield members.

132. Due to the presence of an extensive, impermeable Upper Confining Zone (Jackson Shale formation), there is no communication between the USDW and any Members of the Cockfield Formation.

133. As recently as 2002, the Lower part of the Catahoula Aquifer was being used for permitted disposal of produced oilfield brine and other Class II wastes.

134. The Catahoula Aquifer is the lowermost USDW in the AOR.

135. No sequence of strata separate the top of the Jackson Shale formation from the bottom of the Catahoula Aquifer.

136. The Catahoula Aquifer is a USDW source and therefore cannot serve as an added layer of protection for USDWs or freshwater aquifers.

137. If any injected wastewater were capable of migrating upward out of the Lower Cockfield, through the Middle and Upper Cockfield members and the Jackson Shale formation, the Catahoula Aquifer between approximately 2,800 feet and 4,000 feet would not serve as a buffer zone between the top of the Jackson Confining Unit and the underground drinking water supply.

138. Except for artificial penetrations, the Jackson Shale formation would prevent the vertical migration of fluid that might endanger the USDWs and fresh or surface water.

***Reservoir Modeling***

139. To predict the changes in reservoir pressure after 30 years of injection, TexCom used a computer model called BOAST98.

140. BOAST98 was developed specifically for the type of analysis performed by TexCom and is an accepted computer model.

141. BOAST98 uses algorithms to predict pressure dissipation.

142. Inputs into the reservoir model included interval layer thickness, permeability, porosity, structure, water saturation, temperature, rock compressibility, water compressibility, and the type of formation fluid found in the Lower Cockfield.

143. Values for the various input parameters for the reservoir model were generated from geologic data, drilling logs, wireline logging, standard correlations, structural maps, and analysis of injection/fall-off testing.

144. The values for certain input parameters would be verified by actual testing before the wells can be put into wastewater disposal service.

145. In 1999, Crossroads had a pressure fall-off test performed on WDW315.

146. In 2009 TexCom had another pressure fall-off test performed on Well WDW315 after it was reperforated.

147. TexCom did not run the 2009 fall-off test long enough to determine whether the EW-4400-S fault is transmissive.

148. Based on the 1999 fall-off test and the 2009 fall-off test, an appropriate permeability factor for reservoir modeling is 80.9 millidarcies (mD).

149. For purposes of reservoir modeling, and in order to be protective of USDWs and underground freshwater resources, the EW-4400-S fault should be assumed to be laterally nontransmissive.

150. The COI and AOR for TexCom's proposed operation, based on appropriate reservoir modeling and assumptions, extends 2.7 miles (14,300 feet) to the north of well WDW315; 3.2 miles (17,130 feet) to the east and west; and 3.4 miles (18,140 feet) to the southeast and southwest, along the EW-4400-S fault.

151. TexCom adequately investigated and accounted for artificial penetrations within the AOR.

152. The Draft Permits require TexCom to annually monitor the actual pressure buildup in the Injection Zone.

153. The reservoir modeling results were used to calculate an estimated lateral extent of the injected effluent into the Lower Cockfield through volumetric analysis. This analysis determined that the injected waste fluids would travel 2,770 feet from the wellbore within the Lower Cockfield over the lifetime of the facility.

154. The "fracture pressure" is the surface pressure that, if applied, would fracture the objective formation.

155. The maximum allowable surface pressure (MASIP) is the maximum surface pressure at which fluids can safely be injected into the well.

156. The draft permit limits the injection pressure to 1,250 psi.

157. TexCom determined through its remand hearing modeling that if it injected at the maximum permitted rates continuously for 30 years, the reservoir pressure at the wellbore would increase over 30 years to a maximum of 3,897 psi, which is lower than the "bottom hole

fracture pressure," or the bottom hole pressure that could theoretically cause fracture of the formation, of 4,848 psi.

***Permeability Used in Reservoir Modeling***

158. The fall-off test conducted on Well WDW315 in 1999 indicated a permeability of 80.9 mD.

159. The fall-off test conducted on WDW315 in 2009 supported a permeability factor of 80.9 mD.

160. At the time that the 1999 fall-off test was conducted, WDW315 had been perforated by the previous owner of the property across 90 to 100 total feet of sand intervals spanning from 6,184 to 6,372 feet.

161. In order to improve permeability, TexCom re-perforated WDW315 across clean, non-shaley sand intervals within the Lower Cockfield in September of 2009, consistent with the project specifications set forth in its pending Class I application, and in compliance with the Class V authorization issued by TCEQ.

162. The 1999 and 2009 fall-off tests performed WDW315 were valid tests, and their results provide the most reliable information available on the permeability of the Injection Interval.

163. The project specifications in the UIC Application called for TexCom to re-perforate WDW315 across a total of 145 feet of non-contiguous sand intervals (including the 90 to 100 feet perforated by the prior owner) spanning from 6,045 to 6,390 feet in order to re-position the Injection Zone in the optimal range for injection. TexCom re-perforated WDW315 in accordance with these project specifications in September of 2009 under a Class V authorization issued by TCEQ.

164. For this Facility, the COI is the area of pressure increase within the Injection Zone of 421 psi or greater, which would be sufficient to displace a drilling-mud plug in an abandoned well and thus create a potential pathway to contaminate a USDW or freshwater aquifer.

165. The AOR is the territory within 2.5 miles of a proposed injection well, or the area within the COI, whichever is greater.

166. For TexCom's proposed facility, the AOR extends 2.7 miles (14,300 feet) to the north of well WDW315; 3.2 miles (17,130 feet) to the east and west; and 3.4 miles (18,140 feet) to the southeast and southwest, along the EW-4400-S fault.

***Transmissivity of Fault Located 4,400 Feet South of Facility***

167. In its original reservoir modeling, TexCom assumed that the fault 4,400 feet south of the site (fault EW-4400-SW) was horizontally transmissive.

168. At the time of virgin reservoir conditions (i.e., before oil production had begun in the area), the oil/water contact was at the exact same depth, 4,990 feet below the surface, on either side of the fault. This is consistent with the two sides of the fault in communication and the fault being horizontally transmissive.

169. Shale smearing and sand-shale juxtaposition could render the EW-4400-S fault non-transmissive horizontally.

170. It is uncertain whether fault EW-4400-S is transmissive horizontally.

171. To be conservative and protective of USDWs, TexCom should have assumed that the EW-4400-S fault was not horizontally transmissive for purposes of determining the extent of the COI in its original modeling.

172. Even an abandoned well that was not properly plugged would have been left with a column of drilling mud (a mud plug). In determining the COI, TCEQ requires applicants to assume that each abandoned well has only a mud plug consisting of 9 lb. per gallon mud with a 20 lb. gel strength.

173. For purposes of calculating the COI for this Facility, the pressure increase needed to dislodge an assumed mud plug in an abandoned artificial penetration was conservatively determined to be 421 psi.

174. The AOR for the facility would have to be expanded beyond TexCom's prior investigation to the extent the COI extends beyond 2.5 miles from the proposed injection wells.

175. In calculating the COI, TexCom assumed that it would continuous injecting wastewater at its maximum injection rate (350 gallons per minute), 24-hours a day, 365 days a year, for 30 years.

176. TexCom's model assumed that reservoir pressures would increase continuously for 30 years without interruption.

177. The injected wastewater (waste plume) was conservatively determined to travel a maximum of 2,770 feet from the wellbore within the Lower Cockfield over the lifetime of the Facility.

178. The injected wastewater should not reach the fault 4,400 feet south of the site, and would remain contained in the Lower Cockfield.

179. The proposed injection wells would not impair any existing mineral rights given the geological structure of the site.

***Well Closure and Post-Closure***

180. TexCom's well closure plan includes notifying TCEQ of the intent to plug the well at least 60 days prior to closure, conducting testing of the Injection Zone and the mechanical integrity of the well, flushing the well with drilling fluid, removing the injection tubing, inserting balanced cement plugs at various depths, pressure testing each plug, placing a

permanent marker at the wellhead, and then filing a plugging report with the Executive Director within 30 days after completion of plugging.

181. The estimated cost of plugging each proposed well is $76,400.

182. TexCom has provided financial assurance for the existing Well WDW315 in the form of a payment bond in the amount of $150,000. TexCom would be required to secure financial assurance for the proposed additional wells at least 60 days prior to drilling.

183. TexCom's post-closure plan calls for TexCom to submit a survey plat to the local zoning authority indicating the location of the wells relative to permanently surveyed benchmarks; submit a copy of the plat to the TCEQ UIC Unit in Austin; notify the Railroad Commission of Texas and provide information necessary to impose appropriate conditions on subsequent drilling activities that may penetrate the wells' confining or Injection Zone; retain records for a period of five years; and place a monument or permanent marker to identify the plugged well prior to abandonment.

***Draft Permits***

184. Although specifically tailored by TCEQ Staff for TexCom's facility, Draft Permit Nos. WDW410, WDW411, WDW412, and WDW413 are based on standard TCEQ templates.

185. The Draft Permits contain all of the same requirements, or substantively similar equivalents, found in permits issued by TCEQ to other UIC facilities.

186. The terms and conditions in the Draft Permits are similar to and at least as stringent as those found in other UIC permits issued by TCEQ.

***Public Interest***

***Alternative Disposal Options***

187. The City of Conroe has a publicly owned treatment works (POTW) this is permitted by TCEQ to dispose of pretreated Class I nonhazardous industrial wastewater.

188. Conroe POTW is regulated by TCEQ, the Environmental Protection Agency, and Conroe through ordinance.

189. Conroe's POTW is capable of disposing of any Class I nonhazardous wastewater that is listed in TexCom's application as waste TexCom may dispose in its underground injection wells.

190. Conroe's POTW does not discharge harmful effluent into the San Jacinto River.

191. Huntsman Petroleum (Huntsman), the largest generator of Class I wastewater in Montgomery County, has two TCEQ approved permits for underground injection disposal wells that it has not used.

192. Huntsman is located on Jefferson Chemical Road approximately a mile away from TexCom's facility

193. Huntsman currently trucks the Class I nonhazardous waste it generates approximately 82 miles to another county for disposal.

194. Conroe's POTW does not accept hauled waste, so industrial customers must connect their wastewater stream to a sewer line to transport it to the POTW.

195. While some portion of the waste water sent to a POTW through a sewer line may leak, there is no evidence that the leakage will be significant enough to pollute or contaminate Montgomery County's drinking water.

196. Conroe's POTW is a reasonable alternative for the disposal of Class I nonhazardous waste that is practical, economical, and feasible to a UIC in the Montgomery County area.

***Protection of Surface Water and Groundwater***

197. TexCom's Injection Zone includes not only the Lower Cockfield, but the Middle and Upper Cockfield formation.

198. If the wastewater injected by TexCom migrates to the Upper Cockfield, the oil and gas production in the Conroe Oil Field, particularly the proposed carbon dioxide enhanced oil recovery, could pull the wastewater back to the surface.

199. TexCom failed to prove by a preponderance of the evidence that the waste it injects into the Lower Cockfield would not migrate into the Upper Cockfield where it could be drawn to the surface through oil and gas production.

200. TexCom did not establish by a preponderance of the evidence that with proper safeguards, both ground and surface fresh water can be adequately protected from TexCom's injected wastewater.

***Traffic***

201. TexCom's application has the entrance of the facility on Creighton Road, approximately 700 feet west of the intersection of Creighton Road and Albert Morehead Road.

202. Residential and industrial properties are located on this stretch of Creighton Road.

203. Creighton Road is a narrow, two-lane rural county road, with an unimproved shoulder.

204. Creighton Road is weight restricted, having a 30,000 pound maximum capacity, and has two 90-degree turns, one at Creighton and Albert Moorehead Road and the other into TexCom's entrance.

205. The truck traffic going to and from TexCom's facility would cause that part of Creighton road to deteriorate rapidly.

206. Incoming truck deliveries of nonhazardous wastewater may not be prescheduled or evenly distributed throughout the workday.

207. Incoming trucks may take any of five different routes to get to TexCom's facility, but all would need to travel down 700 feet of Creighton Road to access TexCom's proposed entrance.

208. The five different routes to TexCom's facility include:

a. North and southbound traffic on IH-45 to Loop 336 to FM-3083 to Albert Morehead to Creighton Road;

b. Northbound IH-45 to Creighton Road;

c. Northbound US 59 to FM-1314 to Loop 334 to FM-3083 to Albert Moorehead to Creighton Road;

d. Westbound on FM-3083 to Albert Morehead to Creighton Road; or

e. Southbound on Jefferson Chemical Road to Albert Moorehead to Creighton Road.

209. The condition of the 700-foot segment of Creighton Road that all trucks must use to enter TexCom's facility is not adequate for this type of heavy traffic and would pose a safety hazard to the public.

210. Because the Creighton Road route has a load-restricted bridge, is narrow, and has two 90 degree curves, trucks coming from or going to TexCom's facility must substantially reduce the speed they are traveling to be safe.

211. The Creighton Road route does have geometric features, two 90 degree curves, and roadway conditions, narrow road and weight restrictions, that pose a safety problem with regard to trucks traveling to the facility.

212. The overall increase in traffic because of TexCom's facility along the 700 feet of Creighton Road used by all truckers to get to TexCom's facility would be substantial.

213. TexCom intends to construct a new site entrance along FM 3083 on 72 feet of its frontage property instead of using the Creighton entrance.

214. TexCom has to obtain a permit from the Texas Department of Transportation (TxDOT) prior to constructing the entrance along FM 3083.

215. TxDOT would evaluate TexCom's proposed driveway for safety following the access guidelines set out in TxDOT's access management manual (the access manual).

216. The access manual sets out the safest distance requirements between access points along a roadway.

217. Access management is necessary to ensure the smooth flow of traffic while providing the safest access to these roadways.

218. The speed limit on FM 3083 is 55 miles per hour.

219. For roadways with a speed limit of 55, the access manual indicates that 425 feet must exist between two access points.

220. A dozen driveways (access point) already exist on FM 3083 between TexCom's frontage property and the intersection of FM 3083 and Albert Moorehead Road, a distance of approximately 1,400 feet, because they were "grandfathered" in under a previous policy.

221. TexCom frontage property lies between two driveways that only have 280 feet between them.

222. Relocating the entrance to FM 3083 would obviate traffic concerns along Creighton Road, but may create traffic safety problems on FM 3083.

223. Residential property exists between TexCom's frontage property and the intersection of FM 3083 and Albert Moorehead Road.

224. Trucks that idle outside TexCom's facility waiting to be admitted to deliver its waste would create a safety risk for other motorist and the surrounding residents.

225. Tanker trucks traveling to TexCom's facility would be required to carry shipping papers identifying the truck's contents.

226. TexCom represented that it would keep specific information about its client's waste stream at the Facility.

***Other Public Interest Requirements***

227. Montgomery County is the third fastest growing county in Texas; currently its population is 423,000.

228. The area around the TexCom site is changing from residential and industrial to residential and commercial with the influx of new residents.

229. TexCom has no prior experience with Class I well disposal.

230. TexCom's project was planned around the existing injection well (WDW315). That well was permitted in 1994, but the permit has expired.

231. TexCom's parent company's core business is in the biodiesel market and Class II injection-well disposal.

232. TexCom received a notice of violation from TCEQ at this facility for failing to respond to non-report notices, failing to post signs, and failing to paint the wellhead of the existing well.

233. TexCom's compliance history is classified as average by default and its compliance score is 3.1.

234. TexCom's compliance history indicates that TexCom has no history with TCEQ.

235. Montgomery County is dependent on groundwater from the Evangeline Aquifer as its sole source of drinking water.

236. TexCom presented evidence regarding its analysis of whether any other alternative methods of disposal were feasible.

237. Montgomery County has several hundred businesses that generate non-hazardous waste, but Huntsman and Chevron Petroleum generate the majority of non-hazardous waste.

238. Two other disposal sites exist within 100 miles that can accept nonhazardous wastewater, both outside Montgomery County.

239. Some amount of local economic stimulation would result from the construction and operation of TexCom's facility.

240. At the time of the original hearing, TexCom was seeking a partner that would have 60 percent ownership in it for an infusion of capital.

241. At the time of the original hearing, TexCom indicated that Foxborough Energy Corp. (Foxborough) was that partner, but it was unclear whether the agreement was final.

242. No evidence was presented concerning Foxborough's compliance history.

243. Although TexCom admitted it was looking for a partner in this project, TexCom showed it had the required resources to operate a Class I UIC facility.

***Reporting and Transcription Costs for the Original Hearing***

244. By Order No. 1, the ALJs required a transcript to be prepared in this case because the hearing was scheduled to last longer than one day. *See* 30 TAC § 80.23 (b)(4).

245. TexCom paid the transcription costs totaling $8,616.50. This includes all regular, un-expedited transcription and delivery costs for the original and two copies of the transcript, travel expenses to Conroe, overtime fees, and other usual costs associated with recording and transcribing hearings.

246. The parties reached an agreement on the allocation of these costs. Under the agreement, TexCom is responsible for the $25.00 charge for "E-Transcript" and the $553.00 charge for "Exhibit Copies – Oversize or Color." The responsibility for the remaining $8,038.50 is allocated as follows: TexCom $4,019.25; Aligned Protestants $2,009.62; and Lone Star $2,009.63.

247. TexCom, the Aligned Protestants, and Lone Star were each represented by counsel and have demonstrated the financial ability to pay the reporting and transcription costs.

248. The availability of the transcript helped Applicant and all three Protestant Parties equally in preparing closing arguments and responses.

249. The agreed allocation of transcript costs is fair and reasonable, and Aligned Protestants and Lone Star should reimburse TexCom for the amounts shown above.

***Reporting and Transcription Costs for the Remand Hearing***

250. The parties did not agree to the allocation of transcript costs for the remand hearing.

251. TexCom provided a summary of costs showing a $14,715.00 fee for the transcript of the remand hearing (Volumes 1-8)

252. The ALJs ordered the transcript.

253. TexCom has investors and is an active business entity.

254. Denbury is a large energy company that has invested many millions of dollars in the Conroe Oil Field.

255. The Aligned Protestants are local governmental entities (Montgomery County and the City of Conroe), both of which have significant financial resources.

256. The Lone Star Groundwater Conservation District is a local governmental entity.

257. The Individual Protestants were comprised primarily of retired persons or other individuals with modest financial resources.

258. Some limited straying occurred, but the questioning of witnesses by the parties was generally to the point and directed toward relevant issues.

259. TexCom presented two witnesses in its direct case and three witnesses for its rebuttal case.

260. For their direct cases, Denbury called four witnesses; Lone Star called two witnesses; the Aligned Protestants called four witnesses; the Individual Protestants called four witnesses; and the ED called one witness.

261. TexCom called a total of five witnesses and the Protestants collectively called fourteen witnesses.

262. The extent of participation by all parties in cross examination was generally appropriate. The pages of transcript used by the parties during cross examination were approximately as follows: TexCom – 850 pages; Denbury – 340 pages; Individual Protestants – 130 pages; Lone Star – 120 pages; and Aligned Protestants – 100 pages. Although TexCom accounted for the largest amount of cross examination, the Protestants presented far more witnesses that resulted in TexCom's cross examination.

263. All parties benefited from having a transcript, but as the party bearing the burden of proof, TexCom had the greatest potential benefit from an ability to cite and reassemble the information within the record to support its application.

264. The broad responsibilities and limited budgets of the agency parties in this case make it unreasonable to assess costs against them. The rules also preclude the Commission from assessing costs against parties that cannot appeal a Commission decision (the ED and OPIC).

265. It is appropriate to assess the remand transcript costs as follows:

| | |
|---|---|
| TexCom | 45% |
| Denbury | 35% |
| Aligned Protestants | 10% |
| Lone Star | 10% |

*Other Remaining Issues*

266. With respect to all other uncontested issues, the Application and the remainder of the evidentiary record contain sufficient factual information regarding the UIC wells' design and operation to satisfy applicable statutory and regulatory requirements.

## II. CONCLUSIONS OF LAW

1. The Commission has jurisdiction over the disposal by injection of non-hazardous industrial waste and the authority to issue this permit under TEX. WATER CODE § 27.011.

2. Notice was provided in accordance with TEX. WATER CODE. § 27.018(b), 30 TEX. ADMIN. CODE Chapter 39, and TEX. GOV'T CODE §§ 2001.051 and 2001.052; and affected persons were provided an opportunity to request a hearing on TexCom's application in the manner required by law. Proper notice of the hearing and prehearing conference was given to affected persons pursuant to TEX. GOV'T CODE §§ 2001.051 AND 2001.052.

3. SOAH has jurisdiction to conduct a hearing and to issue a Proposal for Decision on contested cases referred by TCEQ. TEX. GOV. CODE § 2003.47.

4. As required by TEX. WATER CODE. § 27.012-.014, TexCom submitted a complete permit application that included all information required by 30 TEX. ADMIN. CODE §§ 281.5, 305.45, 305.49 and 331.121.

5. The Application was processed and the proceedings described in this Order were conducted in accordance with applicable law and rules of the TCEQ, specifically 30 TEX. ADMIN. CODE § 80.1 *et seq.*, and the State Office of Administrative Hearings, specifically 1 TEX. ADMIN. CODE § 155.1 *et seq.*, and TEX. WATER CODE. § 27.018.

6. The evidence in the record is sufficient to meet the requirements of applicable law for issuance of such permit, including the TEX. WATER CODE, Chapter 27 (the Injection Well Act) and 30 TEX. ADMIN. CODE Chapter 331.

7. The Draft Permit Nos. WDW410, WDW411, WDW412 and WDW413, as prepared by the TCEQ staff, include all matters required by law.

8. The four Class I UIC wells, if constructed and operated in accordance with the Injection Well Act, 30 TEX. ADMIN. CODE Chapter 331, and the Draft Permits, could adversely affect public health or the environment.

9. If the Facility is operated in compliance with applicable law, issuance of the Draft Permits could adversely affect the environment and the public health and welfare.

10. The contents of the permits to be issued to the Facility meet the requirements of the TEX. WATER CODE. §§ 27.011 and 27.051.

11. In accordance with 30 TEX. ADMIN. CODE § 305.44(a)(1), TexCom's UIC Application was signed by a responsible corporate officer.

12. In accordance with 30 TEX. ADMIN. CODE § 331.21, all geoscientific information in TexCom's Application was prepared by, or under the supervision of a licensed professional engineer, and was signed, sealed, and dated by the licensed professional engineer.

13. In accordance with TEX. WATER CODE § 27.015, the Railroad Commission of Texas issued a letter concluding that drilling or using the disposal well and injecting industrial waste into the subsurface stratum would not endanger or injure any known oil or gas reservoir.

14. The Draft Permits require TexCom to follow the plans and specifications contained in the UIC Application.

15. TexCom's wells, if constructed and operated in accordance with the specifications listed in the UIC Application and the requirements of the Draft Permits, would possess mechanical integrity as required by 30 TEX. ADMIN. CODE § 331.4 and would exhibit the mechanical integrity standards listed at 30 TEX. ADMIN. CODE § 331.43(a).

16. TexCom's wells, if constructed and operated in accordance with the specifications listed in the UIC Application and the requirements of the Draft Permits, would conform to the construction standards listed at 30 TEX. ADMIN. CODE § 331.62.

17. The casing depth for the proposed wells of 4,110 feet was set in consideration of the factors listed at TEX. WATER CODE § 27.056.

18. In accordance with TEX. WATER CODE § 27.016, TCEQ Staff physically inspected the TexCom site to determine the local conditions and the probable effect of the well, and determined the requirements for the setting of casing.

19. The well operations proposed in TexCom's UIC Application are consistent with the requirements of 30 TEX. ADMIN. CODE § 331.63.

20. In accordance with 30 TEX. ADMIN. CODE § 331.121(c)(1), TexCom's proposed wells would be sited such that they inject into a formation that is beneath the lowermost formation containing, within 1/4 mile of the wellbore, a USDW or freshwater aquifer.

21. In accordance with 30 TEX. ADMIN. CODE § 331.121(c)(2), TexCom's proposed wells would be sited in an area that is geologically suitable.

22. In accordance with 30 TEX. ADMIN. CODE § 331.121(c)(3)(A), TexCom's proposed wells would be sited such that the Injection Zone has sufficient permeability, porosity, thickness, and areal extent to hold the injected wastewater.

23. In accordance with 30 TEX. ADMIN. CODE § 331.121(c)(3)(B)(i), the confining zone is laterally continuous and free of transecting, transmissive faults or fractures over an area

sufficient to prevent the movement of fluids through faults or fractures into a USDW or freshwater aquifer.

24. In accordance with 30 TEX. ADMIN. CODE § 331.121(c)(3)(B)(ii), TexCom's wells would be sited such that the confining zone contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of prevent initiation and/or propagation of fractures.

25. The confining zone is not separated from the base of the lowermost USDW or freshwater aquifer by at least one sequence of permeable and less permeable strata that would provide an added layer of protection for the USDW or freshwater aquifer as specified by 30 TEX. ADMIN. CODE § 331.121(c)(4)(A),.

26. Within the AOR, the piezometric surface of the fluid in the Injection Zone is not less than the piezometric surface of the lowermost USDW or freshwater aquifer, considering density effects, injection pressures, and any significant pumping in the overlying USDW or freshwater aquifer, as specified by 30 TEX. ADMIN. CODE § 331.121(c)(4)(B).

27. In recognition of 30 TEX. ADMIN. CODE § 331.121(c)(4)(C), there is a USDW or freshwater aquifer present.

28. In accordance with 30 TEX. ADMIN. CODE § 331.121(c)(4)(D), because of the geology of the site, uncased abandoned boreholes would not endanger the USDWs, and the fresh or surface water.

29. Denbury's hydrocarbon production wells completed in the Upper Cockfield portion of the Injection Zone could pump to the surface the wastewater injected by TexCom into the Lower Cockfield Injection Interval that migrates to the Upper Cockfield.

30. TexCom's Closure Plan is consistent with the requirements of 30 TEX. ADMIN. CODE § 331.46.

31. In accordance with 30 TEX. ADMIN. CODE § 37.7021(c), financial assurance for the three proposed wells (WDW411, WDW412, and WDW413) need not be secured until 60 days prior to drilling.

32. In accordance with 30 TEX. ADMIN. CODE § 37.7021(c), the Draft Permits require TexCom to secure financial assurance in the amount needed to cover the cost of plugging each well.

33. In accordance with 30 TEX. ADMIN. CODE § 37.7021(c), financial assurance for the existing Well WDW315 (to become WDW410) must be secured at least 30 days prior to permit issuance.

34. In accordance with 30 TEX. ADMIN. CODE § 37.7021(c), evidence of financial assurance for the existing Well WDW315 has been provided by TexCom.

35. TexCom's Post-Closure plan meets the requirements of 30 TEX. ADMIN. CODE § 331.68(b).

36. In accordance with TEX. WATER CODE § 27.051(a)(4), TexCom has made a satisfactory showing of financial responsibility to the extent required by applicable rules.

37. The monitoring and testing requirements set forth in the Draft Permits satisfy the requirements of 30 TEX. ADMIN. CODE §§ 305.154(a)(6) and 331.64.

38. Based on the nature of the proposed activity and the local geology, ambient monitoring as contemplated by 30 TEX. ADMIN. CODE § 331.64(G) is not required.

39. The Draft Permits incorporate all terms and conditions required by 30 TEX. ADMIN. CODE Chapter 305, including Subchapter H.

40. The Draft Permits contain appropriate conditions to assure compliance with all applicable requirements of Chapter 27 of the Texas Water Code and Chapter 331 of TCEQ's regulations.

41. Under TEX. HEALTH & SAFETY CODE § 361.0231, it is the state public policy that adequate capacity should exist for the proper management of industrial and hazardous waste generated in this state.

42. In accordance with TEX. WATER CODE § 27.051(a)(1), use of existing Well WDW-315 and installation of the three additional wells proposed by TexCom is not in the public interest.

43. No corrective actions are needed with respect to any known artificial penetrations in the area in order to prevent or correct pollution of USDWs as contemplated by 30 TEX. ADMIN. CODE §§ 305.152 and 331.44.

44. TexCom's wells, if constructed and operated in accordance with the specifications listed in the UIC Application and the requirements of the draft permits, may not prevent the movement of fluid that would result in the pollution of a USDW, as required by 30 TEX. ADMIN. CODE § 331.5(a).

45. TexCom's wells, if constructed and operated in accordance with the specifications listed in TexCom's UIC Application and the requirements of the Draft Permits, may cause pollution of fresh water as defined by TEX. WATER CODE § 27.002(4).

46. In accordance with Tex. Water Code § 27.051(a)(3), both ground and surface fresh water may not be adequately protected from pollution if TexCom's proposed wells are operated in with the specifications listed in the UIC Application and the requirements of the Draft Permits.

47. In accordance with TEX. WATER CODE § 27.015, no impairment of oil or gas mineral rights would result from drilling or using the disposal wells and injecting industrial waste into the subsurface stratum.

48. In accordance with TEX. WATER CODE § 27.051(a)(2), existing rights, including, but not limited to mineral rights, will not be impaired by operation of the proposed wells in

accordance with the specifications listed in TexCom's UIC Application and the requirements of the draft permits.

49. In accordance with TEX. WATER CODE § 5.557, TexCom's UIC Application does not satisfy all applicable statutory and regulatory requirements.

52. If the permit is granted, special conditions should be added to Permit Nos. WDW410, WDW411, WDW312, and WDW413 to require: that the truck entrance of the Facility be relocated from Creighton Road to FM3083; that the deliveries be scheduled; and that the hours and days of operation be limited so as not to create any safety issues and to reduce the noise; and no odors may be generated by TexCom's operation.

53. The court reporting and transcript costs for the original hearing should be apportioned between Applicant, Lone Star, and the Aligned Protestants in accordance with their agreement.

54. The court reporting and transcript costs for the remand hearing should be allocated as follows:

| | |
|---|---|
| TexCom | 45% |
| Denbury | 35% |
| Aligned Protestants | 10% |
| Lone Star | 10% |

**NOW, THEREFORE, BE IT ORDERED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY, IN ACCORDANCE WITH THESE FINDINGS OF FACT AND CONCLUSIONS OF LAW, THAT:**

1. Permit Nos. WDW410, WDW411, WDW412 and WDW413 for four Class I Underground Injection Control wells in Montgomery County, Texas, are hereby denied.

2. All other motions, requests for specific Findings of Fact or Conclusions of Law, and other requests for general and specific relief, if not expressly granted herein, are hereby denied for want of merit.

3. The effective date of this Order is the date the Order is final, as provided by 30 TEX. ADMIN. CODE § 80.273 and § 2001.144 of the Texas Administrative Procedure Act, TEX. GOV'T CODE ANN.

4. The Chief Clerk of the Commission shall forward a copy of this Order to all parties.

5. If any provision, sentence, clause, or phrase of this Order is for any reason held to be invalid, the invalidity of any portion shall not affect the validity of the remaining portions of this Order.

**ISSUED:**

**TEXAS COMMISSION ON ENVIRONMENTAL QUALITY**

_____

**Bryan W. Shaw, Ph.D., Chairman**
**For the Commission**