WDW423 & WDW424
119588

Debbie Zachary

From: PUBCOMMENT-OCC
Sent: Tuesday, September 27, 2022 2:14 PM
To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Public comment on Permit Number WDW423
Attachments: Request for Reconsideration - Goliad County Groundwater Conservation District3.pdf

RFR
PM

From: gcgcd@goliadcogcd.org <gcgcd@goliadcogcd.org>
Sent: Tuesday, September 27, 2022 10:22 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Annalysa Camacho

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COMMENTS: Please open the attached file Request for Reconsideration for Permit Nos: WDW423 and WDW424.

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September 27, 2022

Texas Commission on Environmental Quality
Office of the Chief Clerk MC-105
P.O. Box 13087
Austin, Texas 78711-3087

Re: REQUEST FOR RECONSIDERATION
Permit Numbers: WDW423 and WDW424
Applicant: Uranium Energy Corporation

This Request for Reconsideration is brought pursuant to 30 TAC § 55.201 authorizing a request by any person for reconsideration and review of decisions made by the Executive Director of the Texas Commission on Environmental Quality ("TCEQ").

Goliad County Groundwater Conservation District ("GCGCD") is a governmental body created by the Legislature of Texas to protect and preserve the groundwater of Goliad County.

GCGCD requests that the TCEQ reconsider its decision not to hold a Public Meeting per letter dated August 30, 2022. GCGCD also requests that the TCEQ reconsider its decision that the above-referenced permit application meets the requirements of applicable law by letter dated September 12, 2022.

In its letter dated August 30, 2022, the TCEQ lists three factors considered in denying GCGCD's request for a Public Meeting. The first factor is "... if the Executive Director of the TCEQ determines that there is a substantial or significant degree of public interest in an application ...". The other factors do not appear applicable. First and foremost, this letter is not signed by nor does it appear carbon copied to the Executive Director. There isn't any indication that the Executive Director is aware of this decision. More importantly if this was in fact the factor the led the TCEQ to deny GCGCD's request for a public meeting it is flawed and should be reconsidered. By statute GCGCD has seven directors that are elected from the whole county with half being elected every two years. The seven directors of GCGCD voted unanimously to request a public meeting. If the elected directors of GCGCD are not a good representation of the public interest in groundwater in Goliad County there are larger issues that should and probably will be directed to the legislature.

In its request to consider that these permits meet applicable law, GCGCD's sole concern is that the quality and quantity of the groundwater in Goliad County be preserved. Nothing in these Permits or Response to Comment requires groundwater monitoring nor monitoring of faults to determine if these injection wells may be causing the faults in the area to slip and expose groundwater to contaminates. Although GCGCD went through the expense of hiring well known experts that cited much technical data in their comments, the TCEQ provide few cites to technical data in their response. GCGCD requests full scientific responses from the TCEQ in order from them to fully evaluate responses.

Below are specific Replies to the TCEQ's Response to Comments.

Reply to Response No. 1: Goliad County's comment was two pronged. The first prong of our comments dealt with available emergency services. The application listed (and likely still lists) Yorktown Memorial Hospital as the nearest emergency facility. As we indicated Yorktown Memorial Hospital has not been in operation for at least 3 decades. Therefore, it could not provide any emergency services. At a minimum it is expected that the application includes an emergency facility that is currently operational. This easily leads to confusion regarding the second prong of our comments. The second prong of our comments regarded the right to procedural due process that has not happened in this case. The essence of procedural due process is notice and the right to be heard. The notice must be reasonably calculated to apprise a party of the pendency of proceedings affecting them or their property and must afford an opportunity to present their objections before a competent tribunal. The competent tribunal portion of the proceeding statement is not being questioned. The first portion of the proceeding statement that notice must be reasonably calculated to apprise a party of the pendency of proceedings affecting them or their property is being questioned. An address in Yorktown Texas in Dewitt County with an emergency facility in Yorktown Texas that has not been in operation for more than 3 decades does not in any way notify a landowner in the Ander, Weser, etc. area of Goliad County of the pendency of proceedings affecting them or their property. Importantly, the area of the proposed project Ander, Weser, etc. is not mentioned in the NORI.

Reply to Response No. 2: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A. In addition, this response states, "The application provided a delineation of the faults in the AOR [Area of Review] and demonstrated to the satisfaction of the Executive Director that the faults are not sufficiently transmissive or vertically extensive to allow migration of injected fluids out of the proposed injection zone." No specific citation of the application that satisfied the Executive Director that the faults are not sufficiently transmissive or vertically extensive. Further there isn't any cite to technical data. For instance, there is data that injection wells have caused small earthquakes. *See* Appendix B. Small earthquakes and faults slipping due to injection of waste near faults bring into question TCEQ assertions that the faults are sealed and not sufficiently transmissive. What is the delineation between not sufficiently transmissive and transmissive?

Additionally, the potential combined effects on faults in the Area of Review ("AOR") of mining and fluid injection should be considered. In Appendix C the author concluded that small earthquakes in the Eagle Ford shale play are due to removal of large amounts of oil and water. Our understanding is that in situ uranium mining uses large amounts of water pumped into boreholes and removed to recover uranium. The impacts of this alone concern us. Injection of wastes near faults should not be allowed. Injection of wastes near faults where mining is also occurring is irresponsible.

In their response the TCEQ stated, "The District's comment did not specify which water wells in the area had a hydrogen sulfide odor. Since hydrogen sulfide may originate under varying conditions in localized, isolated stratigraphic zones or through "biofouling" in water wells, and since the location of these water wells relative to these specific faults and injection wells is unknown, the Executive Director cannot conclude that the presence of hydrogen sulfide odor in these water wells does by itself indicate the presence of a vertically transmissive fault." Our comment is related to wells in the AOR. It is concerning that the TCEQ simply offered other potential sources for the presence of hydrogen sulfide odor. They do not seem to be interested in investigation and eliminating sources of the hydrogen sulfide odor and ensuring it is not due to vertical transmissivity. There are approximately 60 domestic and livestock wells in the AOR. These wells are listed in the uranium mining application renewal that is in the possession of TCEQ. It would require a new visitation to determine the current condition and access to many of these wells is not available. During the 2006-2010 period of testing by GCGCD, elevated levels of hydrogen sulfide odor was detected at the Walker now Dueser well, the Abrameit wells, the Braquette wells, and the Bethke well. In fact, the Bethkes installed an elevated tank with a gravity feed water supply to allow the hydrogen sulfide fumes to vent. Lesser concentration of odor was detected at other wells.

Reply to Response No. 3: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A.

Reply to Response No. 4: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A. In addition, the stated purpose of the TCEQ's Underground Injection Control Program is to ensure that the injection of fluids is protective of fresh groundwater. The provisions stated deal with the construction of the injection wells. GCGCD has no issue with the design and proper construction of these wells. The issue remains potential vertical movement of contaminated injection fluids from the injection zones to potable groundwater above.

Reply to Response No. 5: See Groundwater Solutions memo dated September 25, 2022, attached as Appendix A.

Reply to Response No. 6: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A. Groundwater Solutions memo is date June 29, 2020. The TCEQ response indicated that the applicant updated it data on May 14, 2021. The obvious conclusion is the applicant updated its data due to Groundwater Solutions comments. The TCEQ nor the applicant has provided GCGCD with any updated data. This implicates fair play and due process.

Reply to Response No. 7: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A.

Reply to Response No. 8: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A. For some time the Texas Water Development Board ("TWDB') has considered the Catahoula part of the Gulf Coast Aquifer System and models it as such. The "Catahoula Formation, Oakville Sand, Lagarto, and into the base of the Goliad Formation" are usable groundwater that GCGCD manages. Numerous TWDB reports show a connection between the Yegua-Jackson and Catahoula. It is impossible to understand how at faults the communication between the Yegua-Jackson could somehow be less that it is in general outside fault zones.

Reply to Response No. 9: *See* Groundwater Solutions memo dated September 25, 2022, attached as Appendix A.

Reply to Response No. 10: The TCEQ's response states, "The Executive Director determined that there is not a substantial or significant degree of public interest in the application to warrant the holding of a public meeting on the application. Only one entity has submitted comments and requested a public meeting." This is baffling. Most Groundwater Conservation Districts ("GCD") only have 5 directors. It is reasonable to assume that in creating GCGCD that the State Legislature wanted to ensure that GCGCD represented the public interest in groundwater by requiring seven directors. All seven directors voted unanimously to request a public meeting.

By way of comparison the Goliad County Commissioner's Court consists of four county commissioners and a county judge. Each commissioner represents only a portion of Goliad County. The County Judge is elected at large. Five members in total. Few would question whether the Goliad County Commissioners Court represents the public interests of Goliad County. GCGCD consist of seven directors each elected at a countywide election. One is left to wonder how three appointed TCEQ commissioners represent the public interests of Goliad County and the state regarding air quality, water quality and myriad or other issues, if the seven directors of GCGCD elected in Goliad County do not represent the public's interest in groundwater of Goliad County.

Among other things the State Legislature tasks all Groundwater Conservation Districts ("GCDs") with the prevention of waste of groundwater. Part of the definition of the waste of groundwater in Texas Water Code Chapter 36.001(8) is:

> *(D) pollution or harmful alteration of groundwater in a groundwater reservoir by saltwater or by other deleterious matter admitted from another stratum or from the surface of the ground;*

GCGCD has and continues to prevent waste of groundwater to the best of their ability. The Texas Legislature further provides in Texas Water Chapter 36.015 that GCD are the Legislature preferred method of managing groundwater which includes waste defined above.

(b) In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions, consistent with the objectives of Section 59, Article XVI, Texas Constitution, groundwater conservation districts may be created as provided by this chapter. ***Groundwater conservation districts created as provided by this chapter are the state's preferred method of groundwater management*** *in order to protect property rights, balance the conservation and development of groundwater to meet the needs of this state, and use the* ***best available science*** *in the conservation and development of groundwater through rules developed, adopted, and promulgated by a district in accordance with the provisions of this chapter.*

Best available science is defined as:

(a) In this section, "best available science" means conclusions that are logically and reasonably derived using statistical or quantitative data, techniques, analyses, and studies that are publicly available to reviewing scientists and can be employed to address a specific scientific question.

GCGCD's position is that the TCEQ's response to comments does not rise to the level of best available science as defined above. It does not provide any assurance that injected fluids will not migrate from the injection zone into groundwater that the TCEQ and GCGCD are responsible for preventing waste of. Instead, we were provided with a lot of "it appears", "most likely", "unlikely", etc. Definite maybes.

GCGCD thanks the TCEQ for their diligence and response. GCGCD looks forward to timely response to our Request for Reconsideration.

Sincerely,

<signed>

Wilfred Korth President	Art Dohmann Vice-president	Carl Hummel Secretary
Wesley Ball Director	Barbara Smith Director	Roy Rosin Director

Terrell Graham
Director

Appendix A

GROUND WATER
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MEMORANDUM

To: Terrell Graham, Director- Goliad County GCD
From: John Oneacre
Date: September 25, 2022
Subject: Response to TCEQ Comments
Underground Injection Control Permit Nos. WDW423 & WDW424

Mr. Graham, I have reviewed the Texas Commission on Environmental Quality (TCEQ) comments regarding the above referenced UIC permits and have the following response to the TCEQ's comments.

Response No. 2, page 4. TCEQ makes the statement that the application "...demonstrated to the satisfaction of the Executive Director that the faults are not sufficiently transmissive or vertically extensive to allow migration of injected fluids out of the proposed injection zone; and a second statement claims "...the application demonstrates that it is likely that the fault plane will become filled and sealed with plastic shale. Due to the very plastic nature of the Gulf Coast Region shales and clays, faults tend to seal themselves, allowing no vertical fluid movement up the fault plane."

If the applicant has conducted technical field demonstrations that confirm these TCEQ statements, please provide whatever field tests were conducted. If no tests were conducted, the statements by the TCEQ are merely that – statements.

As provided previously, both the United States Geological Survey and the applicant's own consultant, Mr. Carothers, stated that vertical movement along the faults is the most likely explanation for the occurrence of petroleum and uranium deposits.

Faults can act as both barriers to fluid flow as well as conduits for flow; these conditions can occur along the same fault (Freeze and Cherry, 1979).

It should also be pointed out that the confining zone, primarily the Catahoula Formation can contain appreciable amounts of sandstone; in fact, publications of the Texas Bureau of Economic Geology have described the Catahoula as a sandstone and even as an aquifer.

Does the TCEQ dispute the USGS and the applicant's consultant? Inferred evidence strongly suggests that fluids have migrated along faults in the past; this places concern with TCEQs statement that the faults "...would likely ensure adequate sealing to prevent any significant vertical migration of formation and/or injected fluids along the fault plane." Using conditional wording such as 'likely' and 'significant' does not present a compelling and convincing position.

Response No. 3, page 6. TCEQ states that the Carothers (2007) report is not part of this application. And that is exactly the point. Carothers presented a stratigraphic column that extended to the Jackson Group, below the Vicksburg and opined that methane and/or reducing fluids migrated from depth along the faults and were the sources for precipitating uranium along the faults. USGS (2013) illustrated that shales and coals below the Catahoula/Frio are the source rocks for oil and gas above the Catahoula/Frio; the conduits for migration are growth faults. This would lead to the conclusion that the faults are not impermeable and that significant amounts of gas and fluids have migrated along faults.

Response No. 7, page 9. See comment to Response No.3.

Response No. 8, page 10. The District has not seen the revised version of Figure V-18, dated May, 15, 2021. As a courtesy, this revised version should be provided to the District for review.

Response No. 9, page 10. Carothers is very pertinent because the occurrence of uranium deposits above the Catahoula is associated with migration of methane and/or reducing fluids from below the Catahoula via faults.

Appendix B

Two-year survey comparing earthquake activity and injection-well locations in the Barnett Shale, Texas

Cliff Frohlich[1]

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Edited by Peter M. Shearer, University of California, San Diego, La Jolla, CA, and approved July 6, 2012 (received for review May 7, 2012)

Between November 2009 and September 2011, temporary seismographs deployed under the EarthScope USArray program were situated on a 70-km grid covering the Barnett Shale in Texas, recording data that allowed sensing and locating regional earthquakes with magnitudes 1.5 and larger. I analyzed these data and located 67 earthquakes, more than eight times as many as reported by the National Earthquake Information Center. All 24 of the most reliably located epicenters occurred in eight groups within 3.2 km of one or more injection wells. These included wells near Dallas–Fort Worth and Cleburne, Texas, where earthquakes near injection wells were reported by the media in 2008 and 2009, as well as wells in six other locations, including several where no earthquakes have been reported previously. This suggests injection-triggered earthquakes are more common than is generally recognized. All the wells nearest to the earthquake groups reported maximum monthly injection rates exceeding 150,000 barrels of water per month (24,000 m^3/mo) since October 2006. However, while 9 of 27 such wells in Johnson County were near earthquakes, elsewhere no earthquakes occurred near wells with similar injection rates. A plausible hypothesis to explain these observations is that injection only triggers earthquakes if injected fluids reach and relieve friction on a suitably oriented, nearby fault that is experiencing regional tectonic stress. Testing this hypothesis would require identifying geographic regions where there is interpreted subsurface structure information available to determine whether there are faults near seismically active and seismically quiescent injection wells.

induced earthquakes | triggered earthquakes | unconventional gas development | seismic hazards | domestic energy policy

It has been recognized since the 1960s that fluid injection into the subsurface can trigger earthquakes (1, 2). Injection-triggered earthquakes have accompanied injection projects undertaken for various purposes, including the production of geothermal energy (3), secondary recovery in oil and gas fields (4), the disposal of fluid wastes, and (very rarely) hydrofracturing (5, 6).

Recently several widely publicized earthquake sequences have occurred near injection wells disposing of fluid wastes in Texas (7–9), Arkansas (10), West Virginia, Ohio, and elsewhere. These fluid wastes are a byproduct of hydrofracturing; hydrofracturing has been an essential technology contributing to the development of unconventional gas resources ongoing in several locations in the United States including the Barnett and Eagle Ford Shales in Texas, the Haynesville Shale of Texas and Louisiana, the Bakken Shale in North Dakota, and the Marcellus Shale in Pennsylvania, New York, and West Virginia. Although this development has enormously increased domestic energy reserves, it may have contributed to an observed increase since 2009 in the number of small-magnitude earthquakes in the central and eastern United States (11). It has also raised policy concerns about possible seismic hazards associated with the practice of disposing of hydrofracture flowback fluids in injection wells (12).

Most investigations of induced or triggered earthquakes take place only after an earthquake occurs that is severe enough to be felt by nearby residents and receive media attention. Such events usually have magnitudes of approximately 3 or greater and occur in populated areas. Limiting research only to these events doesn't help us understand why some injection wells trigger seismic activity and others do not. I am unaware of any previous investigation comparing the properties of injection wells that do and do not induce earthquakes.

In the present study I evaluate seismic activity occurring between November 15, 2009 and September 15, 2011 within the Barnett Shale of Texas (Fig. 1). During this interval the National Science Foundation (NSF)-funded USArray program emplaced several hundred continuously recording, three-component broadband seismometers on a 70-km grid covering a 400-km-wide swath extending from the Canadian border to the Gulf of Mexico. In Texas, about 25 stations from this network were in or near the Barnett Shale recording data, allowing me to locate small regional earthquakes.

An important objective of this study is to assess the relationship between the presence/absence of earthquakes and the characteristics of nearby injection wells. In Texas, the vast majority of injection wells are Class II wells used to stimulate oil or gas production or to dispose of wastes associated with petroleum production such as hydrofracture fluids; the Texas Railroad Commission (RRC), which no longer regulates railroads, is responsible for regulating activity related to petroleum production. The RRC issues permits for drilling wells, and by law petroleum producers also provide the RRC with certain information concerning fluid injection, both when it is used to stimulate production and also when it used to dispose of fluid wastes.

Results

Seismic Data: Quarry Blasts and Earthquakes. Using a method to identify seismic phase arrivals by comparing short-term to long-term amplitude ratios, over the two-year study period I found 1,330 seismic events with arrivals at four or more USArray stations. Of these, 319 were events occurring outside the study area, often because their arrival times were within a few seconds of predicted arrivals for National Earthquake Information Center (NEIC)-reported distant earthquakes, or because the shear wave–compressional wave (S–P) intervals or other features of their seismograms indicated they weren't local.

I identified an additional 507 events as quarry blasts. The appearance of seismograms for quarry blasts and earthquakes is different, as quarry blasts typically have much larger, more prominent surface waves, and relatively weaker P and S arrivals except at the closest stations (distances of 30 km or less). Most quarries blast repeatedly, and thus the characteristic appearance of their seismic signals becomes familiar to an analyst (Fig. S1). In some cases seismograms at the nearest USArray station exhibited an unusual, high-frequency, radially polarized arrival that

Author contributions: C.F. designed research, performed research, analyzed data, and wrote the paper.

The author declares no conflict of interest.

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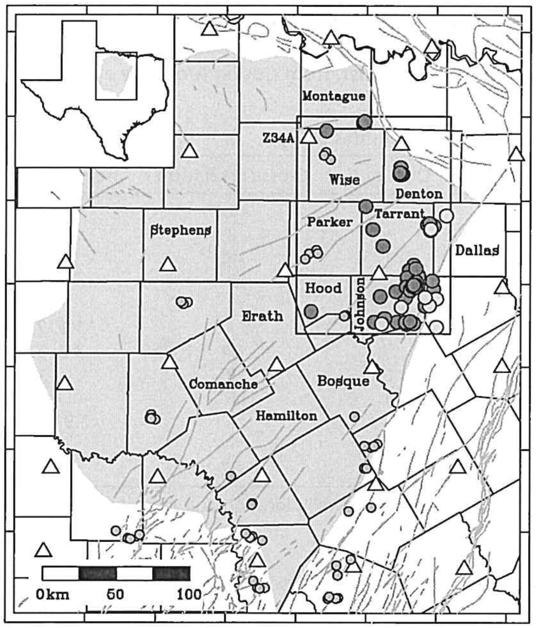

Fig. 1. Map of Barnett Shale study area; the *inset* and rectangle at upper left show the area in Texas included in this map. Triangles are locations of USArray temporary seismic stations, red circles are earthquakes located in this study (Table S1), green circles are quarry blasts located in this study, and white circles are epicenters reported by the NEIC during study interval (Nov 15, 2009 to Sept 15, 2011). The gray shaded area is approximate extent of the Barnett Shale; green lines are mapped faults (18); black lines are boundaries of Texas counties; labels indicate names of counties mentioned in the text. Dallas and Fort Worth are situated in Dallas and Tarrant Counties, respectively; the town of Cleburne is in Johnson County. The rectangle in the *Upper Right* of figure indicates region mapped in Fig. 2.

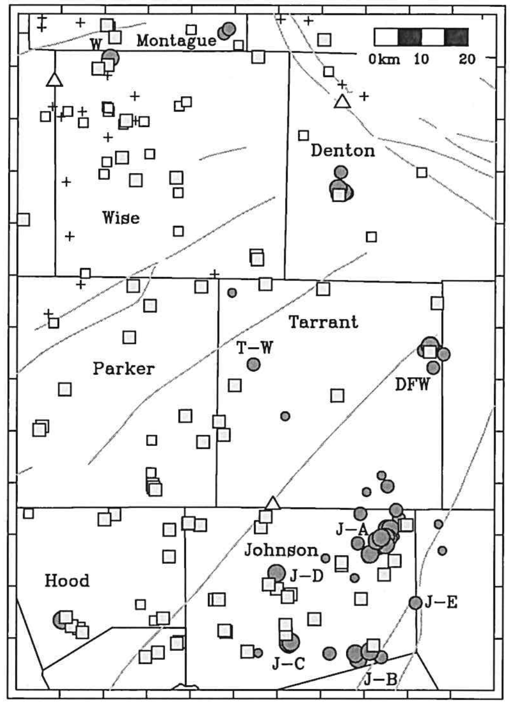

Fig. 2. Map showing earthquake epicenters determined in this study (red circles), injection wells (squares and + symbols) in use since October 2006, seismograph stations (white triangles), and mapped faults (green lines, from ref. 16). Circle sizes indicate quality of epicentral location, with large, medium and small sizes indicating qualities A, B, and C. Labels designate events or clusters in Table 1. For injection wells, yellow squares are wells with maximum monthly injection rates exceeding 150,000 BWPM (24,000 m^3/mo); white squares, exceeding 15,000 BWPM (2,400 m^3/mo); + symbols, exceeding 1,500 BWPM (240 m^3/mo).

traveled at 300 m/s, undoubtedly an airwave. Moreover, inspecting occurrence times for any characteristic group reveals that the events never occur at night or on weekends. I located representative events for 52 blasts from about a dozen groups (Fig. 1). In most cases, inspecting the locations on Google Maps revealed a quarry nearby; all quarry blast epicenters that had azimuthal gaps of 120° or smaller (all the "A"-quality locations, and some "B"-quality locations) were situated within 1.5 km from a visible quarry.

Among the remaining approximately 500 events, I was able to identify pickable P and S arrivals and determine epicenters for 67 earthquakes occurring within the study area (Figs. 1 and 2, Table 1 and Table S1). Of these, 46 were in Johnson County; most within three clusters (J-A, J-B, and J-Cleburne). In addition, there was a tightly clustered group of eight earthquakes in Denton County, and a cluster of six near the Dallas–Fort Worth airport between Tarrant and Dallas Counties. Finally, there were three isolated earthquakes in western Tarrant County, two events in Montague County, and single earthquakes in Wise and Hood Counties.

Only eight of these 67 located earthquakes were reported by the US Geological Survey's National Earthquake Information Center (NEIC); only 22 are in the catalog compiled by the USArray's Array Network Facility (ANF), the organization that manages USArray seismograph stations (*SI Text*). The differences between NEIC epicenters and those determined in this study ranged between 4 and 32 km, with five of the eight differences being between 9 and 16 km.

A reasonable estimate of location accuracy for the A-quality epicenters in this study is 1.5 km. This is consistent with the identification of quarries near A-quality blasts as mentioned above. And my locations for the five A-quality epicenters in the J-Cleburne group were all within 1.0 km of 2009 Cleburne epicenters located using a five-station temporary local network (8, 9).

Using signals recorded at the stations closest to several of the earthquake groups described above, I performed an autocorrelation analysis to search for additional unlocatable events too small to provide pickable P and S arrivals at three or more USArray stations. This search identified an additional 82 earthquakes (Table 1), with 40 of these associated with the Denton group.

The analysis of USArray data allowed me to locate more than eight times as many earthquakes are reported by the NEIC. For the earthquakes in Fig. 1, the eight events reported by the NEIC had magnitudes between 2.1 and 3.0 with a median of 2.5; the 59 additional earthquakes located using USArray data had magnitudes between 1.4 and 2.5 with a median of 2.0; and the 82 earthquakes identified by cross-correlation analysis had magnitudes between 1.4 and 1.8 with a median of 1.6.

Injection-Well Locations and Characteristics. Within the Barnett Shale neighborhood mapped in Fig. 1 there are 2,458 injection wells reporting maximum monthly injection rates of 1,500 barrels of water per month (BWPM; 1,500 BWPM is 240 m^3/mo) or greater since October 2006 (Table 2). Of these, 125 are within the seismically active area mapped in Fig. 2.

Most of the earthquakes identified in this study are situated close to injection wells. Eight of the epicenter groups possess A-quality epicenters (Table 1). All eight of these better-located groups have epicenters situated within 3.2 km of one or more of these injection wells, and six of these groups include epicenters within 2.0 km.

Injection had been ongoing at the wells near all eight of these epicentral groups prior to the known occurrence of earthquakes. Injection at all but one of these wells was at depths between 2 km and 4 km (Fig. 3 and Figs. S2 and S3). All had maximum monthly injection rates exceeding 150,000 BWPM (24,000 m^3/mo), and

Table 1. Earthquake groups as located in this study and as reported by the NEIC and the ANF. Reports the number of earthquakes in each group and quality category. Quality is assigned considering number and geographic distribution of seismic data used for location, with A indicating best locations. Distances listed are for all injection wells within 5 km, if such exist, from closest A-quality epicenter in each group, if such exists

County and Fig. 2 label of group	Quakes rept. by NEIC	Quakes rept. by ANF	Quakes identified in this study				Distance: nearest wells (km)
			Quality A	Quality B	Quality C	Cross-correlation	
Wise W	-	1	1	-	-	1	1.6, 3.4, 4.5
Montague	-	1	-	2	-	2	3.9
Denton	-	4	3	4	1	40	0.9
Tarrant T-W	-	2	-	1	2	3	5.5
Tarrant DFW	2	3	2	4	-	3	1.3
Hood	-	1	1	-	-	-	1.1, 2.4, 4.0
Johnson J-A	3	6	8	15	9	24	3.2, 3.6, 5.0
Johnson J-B	-	-	3	4	0	3	1.6
Johnson J-C (Cleburne)	2	3	5	-	1	6	1.8, 3.8
Johnson J-D	-	-	1	-	-	-	2.9*, 2.9, 3.3
Johnson J-E	1	1	-	1	-	-	9.2
totals	8	22	24	31	13	82	

*All listed injection wells are Class II wells except for one Class I well 2.9 km from the J-D epicenter; this well's location and injection history is virtually identical to a the Class II well near J-D (Fig. S2).

generally these injection rates had been maintained for a year or more prior to the onset of earthquake activity (Figs. 3 and 4). The Dallas–Fort Worth (DFW) group is an exception: Earthquake activity began in October 2008 after only six weeks of injection at a nearby well (7); DFW earthquakes have continued into 2011 even although injection ceased in August 2009.

However, wells having sustained injection rates of 150,000 BWPM (24,000 m^3/mo) are common; there were 161 such wells in the region mapped in Fig. 1, and almost 90% of these had no locatable earthquakes nearby (Table 2). For example, there are 14 such wells in Parker County with no nearby earthquakes, and 24 in Stephens County (Fig. 5). In Wise County there are nine such wells and only one locatable earthquake.

Discussion

Discovery of Previously Unknown Triggered Earthquakes. The most significant result of this investigation is that all of the better-located epicenters were situated within a few kilometers of one or more injection wells. This is important because it suggests that small triggered earthquakes, magnitude about 2 and smaller, occur more often than reported previously. Most of these wells associated with earthquakes were not suspected of triggering earthquakes prior to this study: The NEIC had reported no earthquakes near Denton, Hood, J-B, and Wise groups. And for the J-A and J-D groups, the NEIC locations had too-large uncertainties to identify individual wells; this study's more accurate locations are essential for identifying the responsible wells. Only the DFW and J-Cleburne groups had been confidently associated with particular wells prior to this study (7, 8); in both areas this association had been confirmed only because temporary local seismograph networks had been installed.

It is possible that some of these earthquakes have a natural origin, but it is implausible that all are natural. The strongest candidate for a natural event is J-E in Fig. 2, a single earthquake that occurred on 0530 h UT on December 5, 2009, and was situated approximately 9 km from the nearest injection well. Although the NEIC reported this earthquake and assigned it magnitude 2.9, this study assigned the location a B-quality because the earthquake occurred early in the study period and at that time USArray stations to the east had not yet been installed. Nevertheless it seems unlikely the location is inaccurate by more than a few kilometers.

Characteristics of Earthquake-Triggering Wells. A second significant result of this study is that maximum injection rates exceeded 150,000 BWPM (24,000 m^3/mo) at the wells nearest all of the eight earthquake groups described above. Although this suggests that earthquakes are more likely to be triggered if injection reaches a critical rate, this critical rate may well depend on local subsurface conditions and thus vary in different geographic regions. In the Barnett Shale fluids are injected into the highly permeable Ellenburger formation; critical rates might be differ-

Table 2. Characteristics of injection wells/leases in selected regions. Table values are number of permitted wells/leases; values in the "near earthquake (EQ)" column are number of wells where this study identified A-quality earthquake epicenters within 5 km; remaining columns are number of wells where maximum monthly injection rate between October 2006 and September 2011 exceeded specified value. Units for injection rates are barrels of water per month (BWPM); 1500 BWPM is 240 m^3/mo

Geographic region	near EQ	>150,000 BWPM	>15,000 BWPM	>1500 BWPM
Parker County	0	14	20	24
Stephens County	0	24	77	165
Tarrant County	1	8	8	8
Wise County	3	9	27	36
Johnson County	9	27	27	27
Seismic region (Fig. 2)	17	74	106	125
Barnett Shale (Figs. 1 and 5)	17	161	715	2,458
Texas		1,161	5,017	9,052

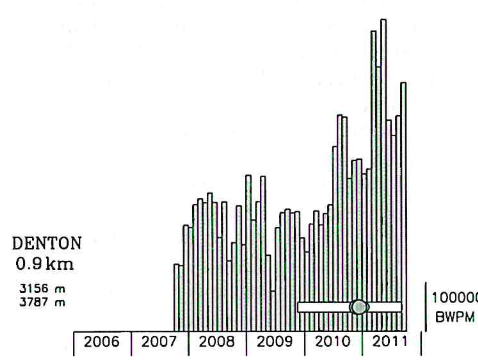

Fig. 3. Monthly injection rates at the injection well near the Denton earthquake group identified in this study. Scale bar at right of histogram is 100,000 BWPM (16,000 m^3/mo). The rectangle shows the time period of study; dark circles indicate earthquakes located in this study. Labels at *Left* indicate distance to epicenter and depth interval of injection. Injection rates for all other wells within 5 km of A- and B-quality epicenters are plotted in Figs. S2 and S3.

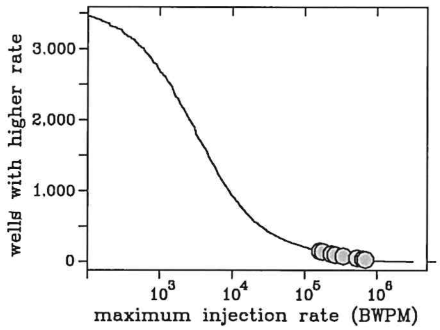

Fig. 4. Cumulative distribution of highest monthly injection rates for wells in the region mapped in Fig. 5. The horizontal axis is the highest monthly injection rate between October 2006 and September 2011; the vertical axis is the number of wells exceeding plotted value. Dark circles correspond to maximum values for wells closest to the eight earthquake groups with A-quality epicenters identified in Fig. 2 and Table 1. Note that all eight have maximum injection rates exceeding 150,000 BWPM (24,000 m^3/mo), a value exceeded by 160 wells in the mapped region (Figs. 1 and 5).

ent under conditions where the permeability and other subsurface properties are different.

Moreover, it is unclear why earthquakes occur near some high-rate injection wells and not near other wells having apparently similar characteristics. Within the Barnett Shale there are more than 100 similar wells with injection rates exceeding 150,000 BWPM (24,000 m^3/mo) that experienced no nearby identifiable earthquakes during the study period (Figs. 4 and 5).

A plausible explanation is that injection-triggering only occurs if fluids reach suitably oriented, nearby faults (7). Surveys of crustal stress and observations from deep boreholes at several locations worldwide indicate that: (*i*) stress in continental interiors is fairly uniform within regional provinces having dimensions of hundreds of kilometers (13); (*ii*) the brittle crust is in a state of failure equilibrium (14); with (*iii*) the stress levels being controlled by networks of pervasive naturally-occurring faults; (*iv*) where failure, enhanced by fluid flow, occurs according to Coulomb frictional failure theory along optimally oriented, critically stressed faults (15). Thus fluid injection may trigger earthquakes if pressures, rates, and permeability are sufficient to allow fluid to reach a favorably oriented fault and reduce the normal stress, decreasing fault strength.

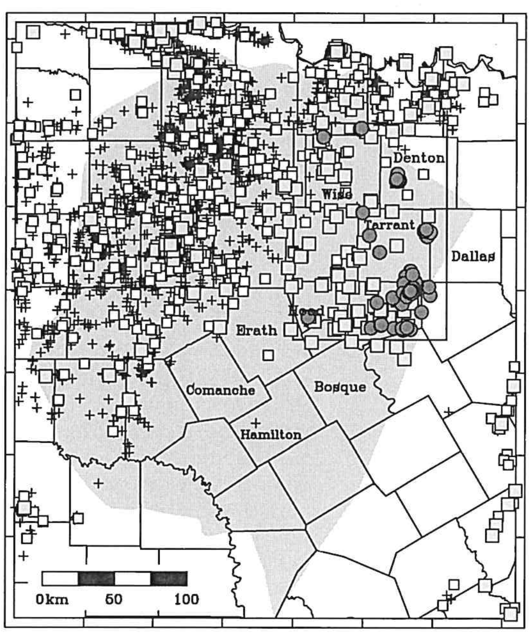

Fig. 5. Map of Barnett Shale area as in Fig. 1, showing earthquakes located in this study (red circles) and injection wells in use since 2006 (squares and + symbols). Yellow squares are wells reporting maximum monthly injection rates exceeding 150,000 BWPM (24,000 m^3/mo); white squares, exceeding 15,000 BWPM (2,400 m^3/mo); + symbols, exceeding 1,500 BWPM (240 m^3/mo).

There is evidence supporting this hypothesis for the DFW earthquakes (7). Here the relocated epicenters were situated along a northeast–southwest (NE–SW) trend, and both proprietary seismic data and regional tectonic maps (16) indicated a NE–SW trending subsurface fault within 1 km of the epicentral region (Fig. 2). Studies of regional stress (17, 18) find that the present-day regional stress system favors normal-faulting motion along NE–SW trending faults.

Some of the nonproprietary fault map data (16) is consistent with this hypothesis. It shows NE–SW trending faults in the area where earthquakes occur (Fig. 2). And where no earthquakes occur there is: (*i*) an absence of mapped faults in Stephens County where there are high-rate wells; (*ii*) an absence of high-rate wells in Comanche and Hamilton County, where there are NE-SW-trending faults; and (*iii*) an absence of both in Bosque County. However, there are no mapped faults near several of the earthquake groups in Fig. 2 (the Denton, Hood, J-A, J-C, and J-Cleburne groups).

Unfortunately, the quality of the available nonproprietary fault information is variable, and was collected well before the present development in the Barnett Shale. Thus near both seismically active and inactive wells, faults may exist that are absent in Figs. 1 and 2. What is desirable would be collaborative investigations with industry allowing a more thorough evaluation of the presence/absence of faulting near active and inactive injection wells.

Within the study area, the fraction of wells associated with earthquakes depends on the geographical region chosen. For wells having maximum injection rates exceeding 150,000 BWPM (24,000 m^3/mo) in Johnson County, this fraction is 0.33 (9 of 27 high-rate wells; Table 2); within the seismically active area of Fig. 2, it is 0.23 (17 of 74); within the Barnett Shale neighborhood of Figs. 1 and 5, the fraction is 0.11 (17 of 161).

Utility and Limitations of USArray Data. This study is an apt example of a positive but unanticipated benefit of the USArray Temporary Array, part of the NSF-funded EarthScope program. EarthScope was conceived and funded prior to most of the recent development of unconventional gas resources, and before the public realization that this development might trigger seismic activity. The present study's success at identifying previously unreported seismicity in the Barnett Shale suggests that an analysis of USArray data could provide similar information about triggered earthquakes elsewhere, as in the Bakken, Eagle Ford, and Haynesville Shales.

However, for analyzing triggered seismicity the USArray data does have limitations, and it doesn't replace the need for additional, focused monitoring efforts. The deployment of USArray stations is ephemeral, lasting only two years in any one location. While this interval provides a snapshot of seismic activity, its duration and timing isn't optimal for investigating the before, during, and after phases of an injection program. Moreover, the 70-km station spacing makes it difficult to accurately assess the depths of triggered earthquakes. In the present study I fixed earthquakes depths at 5 km to stabilize the determination of epicenters; this depth is arbitrary although plausible, considering the differing appearance of earthquakes and quarry blasts.

Materials and Methods

Deep injection wells are categorized as Class I, which are used to dispose of hazardous, industrial, or municipal wastes, or Class II, which inject fluids associated with oil and gas production. In Texas Class I injection wells are regulated by the Texas Commission on Environmental Quality, who provides information about wells upon request. Information about Class II injection well locations, depth, permitting history, and monthly injection rates is archived by the Texas Railroad Commission (RRC). The RRC issues permits for individual wells and for leases having numerous wells; these include injection wells used for waste disposal as well as for waterflooding and secondary recovery. The RRC's database is publically available online and includes monthly injection information for individual wells and leases, which is mostly complete for the past two decades. This study also utilized RRC data as compiled by the company IHS Inc.

All USArray-station seismograms analyzed for this investigation are archived at the IRIS Data Management Center and freely available. To identify seismic events, I identified candidate phase arrivals by comparing short-term and long-term averages at all seismic stations, inspecting arrivals for events identified at four or more network stations, then eliminating teleseisms and nonregional seismic events. For the remaining regional events, I picked P and S arrival times and/or identified events as quarry blasts. I then located events using a standard iterated least-square method using a flat-layered velocity model (7). Depths for quarry blasts were fixed at 300 m; earthquake depths were fixed at 5 km, the depth determined for DFW hypocenters using temporary local network data (7). All earthquake and quarry blast locations mapped in Figs. 1, 2, and 5 were determined using arrival picks from at least three nearby stations, including one or more stations with both P and S picks. I graded all locations as "A," "B," or "C," with the A grade given to epicenters determined using numerous impulsive P and S arrivals and with an azimuthal gap of 120° or less. To estimate magnitudes for regional earthquakes, I fit the magnitudes M_{NEIC} for events reported by the NEIC to the equation:

$$M_{\mathrm{NEIC}} = a\log_{10}(A_{\mathrm{Max}}) + b/D,$$

where A_{Max} is maximum signal amplitude and D is event-to-station distance. I then used the coefficients a and b to calculate M for events not reported by the NEIC.

Greater detail concerning this investigation is provided in the *SI Text* file linked to the online version of this paper. This file provides a list of earthquake epicenters determined in this investigation, figures corresponding to Fig. 3 showing monthly injection volumes for all injection wells within 5 km of epicenters, and a discussion comparing epicenters determined in this study to those reported by the ANF.

ACKNOWLEDGMENTS. This project benefitted from collaboration with scientists in the State of Texas Advanced Oil and Gas Resource Recovery (STARR) program at the University of Texas Bureau of Economic Geology. I especially thank Eric Potter for encouragement and valuable discussions and David Smith for helping me access Texas Railroad Commission data. This research was partially supported by the US Geological Survey (USGS), Department of the Interior, under USGS award number G12AP20001. The views and conclusions contained in this document are those of the author and should not be interpreted as representing the official policies, either expressed or implied, of the US government.

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Appendix C

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Two-year survey of earthquakes and injection/production wells in the Eagle Ford Shale, Texas, prior to the M_W4.8 20 October 2011 earthquake

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ABSTRACT

Between November 2009 and September 2011 the EarthScope USArray program deployed ~25 temporary seismograph stations on a 70-km grid in south-central Texas between 27°N–31°N and 96°W–101°W. This area includes the Eagle Ford Shale. For decades this geographic region has produced gas and oil from other strata using conventional methods, but recent developments in hydrofracturing technology has allowed extensive development of natural gas resources from within the Eagle Ford. Our study surveys small-magnitude seismic events and evaluates their correlation with fluid extraction and injection in the Eagle Ford, identifying and locating 62 probable earthquakes, including 58 not reported by the U.S. Geological Survey. The 62 probable earthquakes occur singly or in clusters at 14 foci; of these foci, two were situated near wells injecting recently increased volumes of water; eight were situated near wells extracting recently increased volumes of oil and/or water; and four were not situated near wells reporting significant injection/extraction increases. Thus in this region, while the majority of small earthquakes may be triggered/induced by human activity, they are more often associated with fluid extraction than with injection. We also investigated the M_W4.8 20 October 2011 Fashing earthquake—the largest historically reported earthquake in south-central Texas—that occurred two weeks after the removal of the temporary USArray stations. A field study indicated that the highest-intensity (MMI VI) region was about 10 km south of 2010–2011 foreshock activity, and that there were no high-volume injection wells within 20 km of the MMI V–VI region or the foreshocks. However, the 20 October 2011 earthquake did coincide with a significant increase in oil/water extraction volumes at wells within the MMI V–VI region, and this was also true for previous earthquakes felt at Fashing in 1973 and 1983. In contrast, our study found significant increases in injection prior to an m_{bLG}3.6 20 July 1991 earthquake near Falls City, Texas. Thus the Eagle Ford geographic region, with seismic activity associated both with extraction and injection, appears to be more complex than the Barnett Shale of northeast Texas, where a similar survey found possible correlations only with fluid injection.

1. Introduction

While earthquake seismologists have long recognized that fluid injection into the subsurface sometimes triggers earthquakes (Healy et al., 1968; Hsieh and Bredehoeft, 1981; Nicholson and Wesson, 1990; Suckale, 2009), this phenomenon has gained attention recently (e.g., National Research Council, 2012; Ellsworth, 2013) because earthquakes near injection disposal wells have occurred in several locations where no previous seismicity had been reported historically. These include Dallas–Fort Worth, TX (Frohlich et al., 2011; Janska and Eisner, 2012; Reiter et al., 2012), Cleburne, TX (Howe, 2012), Timpson, TX, and Youngstown, OH. In these cases the injected fluids were generated by shale-gas development projects where wells are hydrofractured to enhance subsurface permeability. The production of gas is accompanied by the flowback of hydrofracture fluids that require disposal, typically accomplished by injecting them elsewhere in designated Class II disposal wells.

This study investigates the relationship between seismicity, fluid injection, and fluid extraction in the Eagle Ford region of south-central Texas (Fig. 1). Gas and oil have been produced extensively from this region since before 1950, mostly from the Edwards formation, a Lower Cretaceous limestone that underlies the Upper Cretaceous Eagle Ford Shale. A series of southwest–northeast fault

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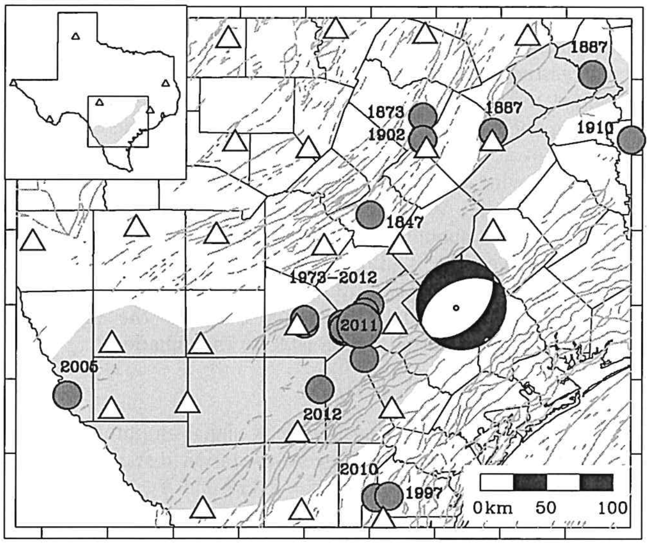

Fig. 1. Map showing extent of Eagle Ford Shale (shaded gray), USArray temporary seismograph stations operating during Nov 2009 to Sept 2011 period (triangles), historical seismicity (red circles; from Frohlich and Davis, 2002; and the NEIC), and mapped faults (green; from Ewing, 1990). Large red circle labeled "2011" is NEIC location for the 20 October 2011 M_W4.8 earthquake, and beachball at right is focal mechanism determined by the St. Louis group (Herrmann et al., 2011). Other labels indicate year of historical earthquakes. Inset with boundary of Texas shows mapped area and broadband seismograph stations (gray triangles) operating in 2005 prior to passage of the USArray. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

systems (see Fig. 1), including the Fashing Fault Zone, cuts through much of the Eagle Ford region (Harbor, 2011). Most of these fault systems formed in the proximity of up-dip Triassic/Jurassic salt and result from basinward salt movement (Montgomery, 1990). In some regional fields these faults provide the trap that makes petroleum production viable.

Earthquakes with epicenters within or on the boundaries of producing fields have occurred since a tremor was reported by residents of Fashing, TX, on 25 December 1973 (e.g., Pennington et al., 1986; Olson and Frohlich, 1992; Davis et al., 1995; Frohlich and Davis, 2002). The largest of these earthquakes, with M_W4.8, occurred on 20 October 2011 near the Fashing Gas Field. Since 2008 the Eagle Ford has been an intense focus of shale-gas development involving extensive hydrofracturing; this raises two questions: (1) Are small earthquakes within the Eagle Ford region associated either with fluid extraction or injection? And (2) Does the evidence indicate the M_W4.8 20 October 2011 earthquake is of natural origin, triggered by fluid extraction, or triggered by the injection to dispose of flowback brines associated with production and hydrofracturing?

Only a handful of seismograph stations operated in south-central Texas prior to 2009 (Fig. 1); however, the passage of the EarthScope USArray transportable array between 2009 and 2011 provided an unprecedented opportunity to identify and accurately locate earthquakes. The present study will survey seismic activity during this period and evaluate its relationship to both injection and extraction wells. We will compare results from the Eagle Ford region to results from a companion study of the Barnett Shale (Frohlich, 2012). We also present a summary of felt reports for the 20 October 2011 Fashing earthquake.

The present survey searches for possible correlations between seismicity and extraction/injection rates in the Eagle Ford region. Interpreting the significance of these correlations will require a more thorough analysis of local geology as well as physical modeling of subsurface hydrological/stress. This is the focus of an ongoing companion study for which we hope to enlist industry cooperation concerning the details of subsurface structure.

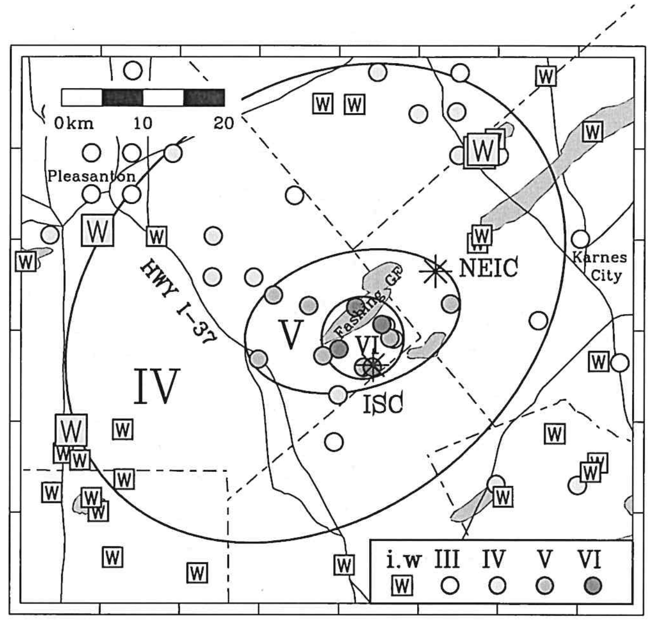

Fig. 2. Map of locations of felt reports (circles) defining the boundaries of regions experiencing modified Mercalli intensity (MMI) IV, V, and VI during the 20 October 2011 earthquake (see also Table S2 and Fig. S2). Yellow squares labeled "W" are injection wells: larger symbols—wells with maximum monthly rates >100,000 BWPM (16,000 m^3/mo); smaller symbols—wells with maximum monthly rates >10,000 BWPM (1600 m^3/mo). Stars '∗' indicate 20 October 2011 epicenter as reported by the NEIC and ISC. Shaded gray regions are producing oil and gas fields from Galloway et al. (1983) and Kosters et al. (1989). Note that there are no injection wells within ∼20 km of center of MMI VI area. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

2. Data and methods

2.1. Felt reports for the 20 October 2011 Fashing earthquake

We gathered felt report information (Fig. S2 and Fig. 2) in two ways. Following the 20 October 2011 earthquake one of the authors (M.B.) spent three days in the epicentral region interviewing residents, concentrating his efforts in the higher-intensity areas. We augmented these data with "Did you feel it?" (DYFI) information provided by the National Earthquake Information Center (NEIC). The DYFI program (Atkinson and Wald, 2007; Wald et al., 2011) is an Internet-based program where individuals can provide unsolicited responses to questions about their experiences and location during an earthquake. The responses are assigned a modified Mercalli intensity (MMI) value; the NEIC routinely presents summary online maps of the MMI distributions. For this study the DYFI data were especially useful for establishing boundaries for the MMI III and MMI IV regions, whereas the in-person interviews constrained the MMI V and MMI VI boundaries that had smaller areal extents but were situated in regions where population was sparse.

2.2. Seismic data and earthquake location

Our procedure for identifying seismic events involved three steps. The first step was to acquire vertical-component seismograms for the ∼25 USArray stations operating in the study area between November 2009 and September 2011. Then, to identify time intervals when locatable seismic events might have occurred,

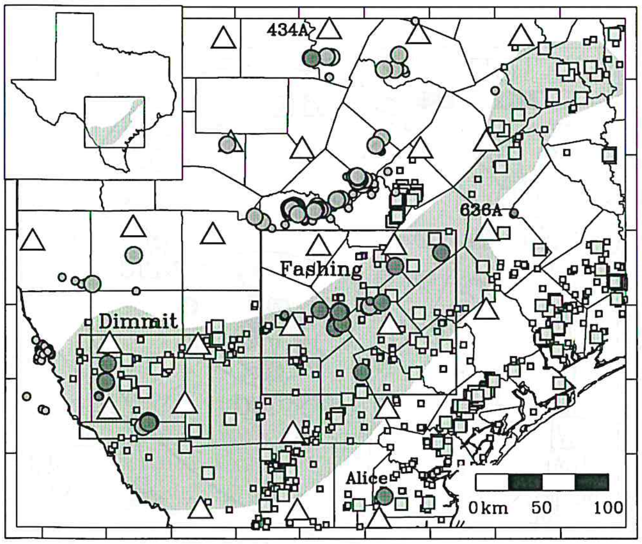

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Fig. 3. Map of seismic events (circles) located in this study, injection disposal wells (yellow squares) active October 2006 to November 2009, and USArray temporary stations (triangles). For seismic events, green circles have origin times between 1300 and 2400 hours, corresponding to local daylight work hours 7 AM to 6 PM; red circles occur at other times; larger circles are 'A' quality locations (see text); smaller circles are 'B' quality locations. In several areas events occur only during daylight work hours and are presumably quarry blasts. For injection wells: small symbols—maximum monthly volume >10,000 BWPM (1600 m^3/mo); large symbols—maximum monthly volume >100,000 BWPM (16,000 m^3/mo). Rectangles labeled 'Dimmit' and 'Fashing' show areas mapped in Figs. 4 and 8; labels near some USArray stations indicate stations mentioned in the text. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

we applied a filter that compared the ratio of the signal short-term average (STA; 4-s interval) and long-term-average (LTA; 1-h interval) of the vertical-component signal. We thus identified 2252 intervals where the STA/LTA ratio exceeded 5.0 during a 30-s interval at four stations.

The second step was to inspect arrivals for these signals, eliminating obvious teleseisms and non-regional seismic events. For this we calculated predicted phase arrival times for phases from selected earthquakes reported by the National Earthquake Information Center (NEIC), the Array Network Facility (ANF) and the Oklahoma seismic network. The third step was to acquire 3-component seismograms for the remaining intervals. For these intervals we picked P- and S-arrival times using Seismic Analysis Code (SAC) software. After some experience had been gained and after making some preliminary locations, we picked only representative events from groups of apparent quarry blasts, i.e., groups of numerous similar seismograms, all occurring during daytimes hours, with identical S–P times, large surface waves, and epicenters in or near quarries as identified on GoogleMap.

We located the remaining events using standard iterated least-squares methods and two different flat-layered velocity models modified from regional models described by Mitchell and Landisman (1971), Keller and Shurbet (1975) and Frohlich et al. (2012) (see Table S1). The crustal velocity varies significantly within the study area, and thus we obtained the most accurate locations when we used phase arrivals only from the 4–6 nearest USArray stations surrounding each epicenter. When events occurred in clusters, we reread the P- and S-arrivals within each cluster to ensure that we were picking the same arrival feature for the various events. The distances separating stations (~70 km) was too large to permit accurate determination of focal depths; thus we fixed focal depths at 5 km for all events. With these procedures we obtained locations for 245 seismic events (Fig. 3).

All earthquake and quarry blast locations in Fig. 3 were determined using arrival picks from at least three nearby stations, including one or more stations with both P and S picks. We graded all locations as 'A' or 'B', with the A-grade given to epicenters determined having an azimuthal gap of 200° or less and residuals of 1.0 s or smaller. We estimate that 'A' quality epicenters are accurate to within about 2 km, and 'B' quality epicenters to within about 4 km. Both are significantly more accurate than NEIC locations for small-magnitude (~M3) Texas earthquakes.

To estimate earthquake magnitudes, we fit the magnitudes M_{NEIC} for events reported by the NEIC to the equation:

$$M_{NEIC} = a \log_{10}(A_{Max}) + b/D,$$

where A_{Max} is maximum peak-to-peak signal amplitude as measured in this study and D is event-to-station distance. We then used the coefficients obtained ($a = 0.854$ and $b = -34.5$ km) to calculate M for events not reported by the NEIC, obtaining magnitudes ranging from ~1.5 to 3.0.

2.3. Injection of water; extraction of petroleum and water

Within the Eagle Ford there are thousands of wells drilled for producing oil and natural gas, for injecting water to enhance petroleum production, and for disposing of flowback brines associated routinely with production operations and hydrofracturing. The Texas Railroad Commission (RRC) regulates petroleum wells of all types; they also archive information about permitting history, well locations, depth, and monthly production/injection rates for oil, gas, and water. The RRC database is publicly available online and for individual wells includes monthly injection/production information that is mostly complete for approximately the past three decades. For this study we used RRC data as supplied in more user-friendly form by the company IHS Inc.

3. Results

3.1. Felt reports for the 20 October 2011 Fashing earthquake

The felt area of the Fashing earthquake extended over approximately 11,000 km^2 (MMI III area), from about 40 km south of Fashing to 90 km north (Table S2 and Fig. S1). The north boundary of the felt area included heavily populated San Antonio; the southern boundary is sparsely populated.

The most intense shaking (MMI VI) occurred within a 64 km^2 area that extended across the Fashing Gas field (Fig. 2). Here residents reported pictures falling off walls, items falling out of cupboards, and some cracking in masonry and sheet rock. The center of the MMI VI area (Table S2) was at 28.79N 98.17W, 12 km southwest of the epicenter determined by the NEIC (28.865N 98.079W), but only about 3 km from the prime epicenter reported by the International Seismological Center (28.7616N 98.1572W).

3.2. Seismic events: quarry blasts and earthquakes

The majority of events located in this study are probably quarry blasts. Of the 245 seismic events located in this study, 201 (82 per cent) occurred between hours 1300 and 2400; this corresponds to local times 7 AM to 6 PM, i.e., daylight working hours. These daylight events often occurred in clusters; e.g., in Fig. 3 note the cluster north of the 'Fashing' label, the cluster on the U.S.–Mexico border west of the 'Dimmit' label, and the clusters south and east of station 434A. Inspection of GoogleMap revealed crushed rock quarries near all of these clusters.

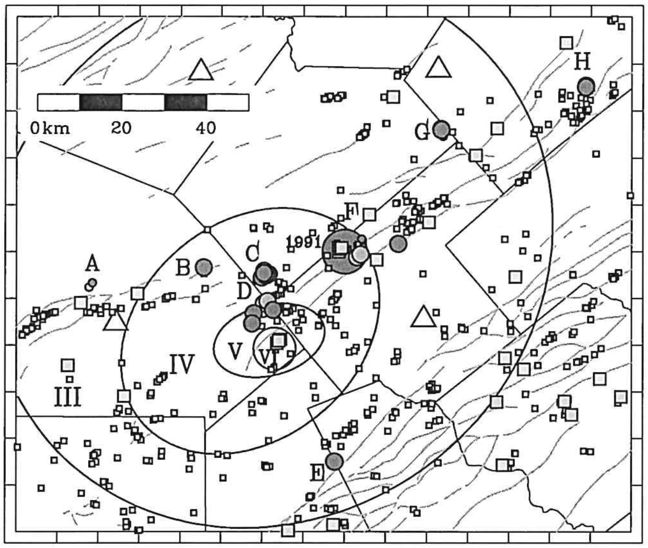

Fig. 4. For Fashing region, map of seismic events (circles, symbols as in Fig. 3), Class II injection wells (yellow squares, symbols as in Fig. 3), wells producing/extracting water (blue squares), USArray stations (triangles), and mapped faults (green; from Ewing, 1990). Labels 'A', 'B', etc. indicate event groups listed in Table S3 and discussed in the text except for the m_{bLG}3.6 20 July 1991 Falls City earthquake (large red symbol labeled 1991; see text for discussion). Ellipses labeled with Roman numerals III–VI are boundaries of MMI felt areas for the 20 October 2011 M_W4.8 earthquake (see Figs. 2, 3 and Fig. S1). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Elsewhere seismic events occurred during both daylight and nighttime hours. We have identified 62 as probable earthquakes (see Table S3). All but five of these occurred in two areas—near Fashing, TX, in Atascosa and Karnes Counties; and in Dimmit County.

3.3. *Fashing area: probable earthquakes and injection/production wells*

We located 35 probable earthquakes in the Fashing area (Figs. 3 and 4, and Table S3). Since 1982 the International Seismological Centre (ISC) has reported 15 earthquakes within the area mapped in Fig. 4; if we combine these with the probable earthquakes identified in this study, their magnitude-frequency distribution is consistent with a *b*-value of ~1.0 (Fig. 5).

The Fashing events we identified occurred within eight clusters (labeled A–H in Fig. 4), broadly distributed over a ~100-km-long SW–NE trending zone. None of the clusters were situated within the highest-intensity (MMI VI) region of the 20 October 2011 M_W4.8 earthquake; the closest cluster D was about 10 km northward.

All but three of the Fashing events occurred during the second year of this project, after 20 December 2010—ten months prior to the 20 October 2011 earthquake, and 22 occurred in April or May of 2011, approximately six months prior. These 22 were broadly distributed geographically, including events in clusters A, C, D, G and H. The last event we located occurred on 22 September 2011 (Event #6750, in cluster F). There were no USArray stations in the Fashing area to record the 20 October 2011 earthquake or its aftershocks, as the array moved eastward during the first week of October.

Two of the event clusters, cluster A and cluster F, were situated within 5 km of recently active injection wells (Table 1). Cluster A consists of two earthquakes with magnitude ~M1.8 occurring in May and August of 2011. Since 2000 production of oil and gas has been negligible within 5 km of cluster A (see Fig. S2), but there are several nearby active injection wells. The closest high-volume

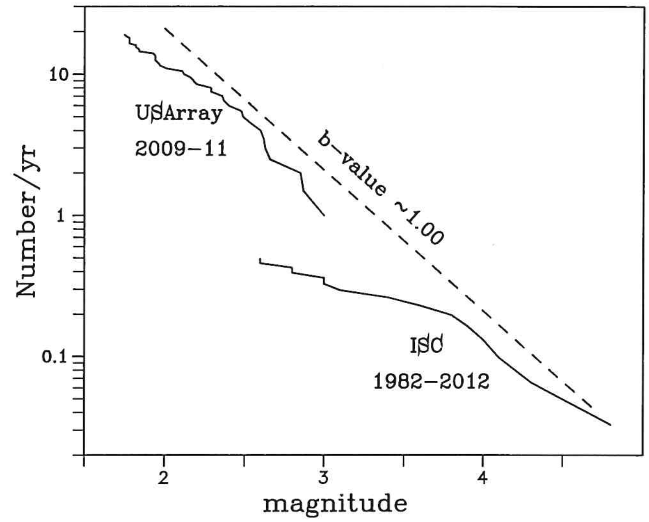

Fig. 5. Magnitude-frequency plots for earthquakes located in Fashing area (Fig. 4). Events labeled 'USArray 2009–11' are as identified in this study (see Table S3); events labeled 'ISC 1982–2012' are as reported by the International Seismological Centre (ISC). Note that a *b*-value (slope of magnitude-frequency line) of ~1.0 is consistent with both event groups.

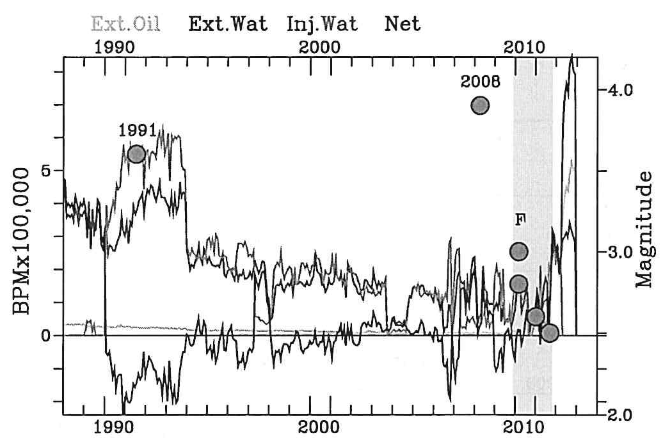

Fig. 6. For wells within 10 km of cluster F (29°N 98°W; see Fig. 4), monthly volumes (left axis) for the extraction of oil (green) and water (blue), injection of water (red), and the net (black: oil + water extracted − water injected). Red circles and right axis indicate occurrence and magnitude of earthquakes; gray shaded area indicates time interval when USArray station data was available. Note that m_{bLG}3.4 23 July 1991 Falls City earthquake followed significant increases in injection beginning in 1990, and the m_b4.1 7 April 2008 earthquake followed increases in production and injection in late 2006–2007. However, there is no obvious injection/production relationship with cluster F earthquakes. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

injection well [API 14201007611 at ~5 km distance] commenced injecting at rates of 10,000–70,000 BWPM (1600–11,200 m^3/mo) in 2004. Then in March 2011, two months prior to the occurrence of Event #6063 on 21 May 2011, injection rates increased to 262,344 BWPM (42,000 m^3/mo), and rates exceeded 190,000 BWPM (30,400 m^3/mo) until November 2011.

The epicenters in cluster F coincide with the maximum-intensity area of the 20 July 1991 m_{bLG}3.6 Falls City earthquake as determined by Olson and Frohlich (1992). The 1991 earthquake occurred following a large increase in monthly injection rates that began in 1990 (Fig. 6) and exceeded 500,000 BWPM (80,000 m^3/mo) for all but two months between October 1990 and December 1993. There is no obvious relationship to injection rates for cluster F epicenters that began occurring in March of

Table 1
Relationship of seismic events/event clusters to injection/extraction. Events/clusters are listed in Table S3 and labeled in Figs. 3, 4, and 8. Injection/extraction increase columns describe monthly sums for all wells within included radius.

Fashing clusters	Number of events	1st event	Injection increase	Wells included radius (km)	Oil/water extraction increase	No increase
A	2	May 2011	Feb 2011: ~200,000 BWPM increase	5		
B	1	Jan 2011		5	Oct–Nov 2010: produced water doubles to 28,000 BWPM	
C	12	Apr 2011		5	Mar 2011: oil + water doubles to ~70,000 BPM	
D	6	Aug 2010		5	Apr 2011: oil + water increases to ~100,000 BPM and more	note increase is *after* D begins
E	1	Feb 2011				none
F	4	Mar 2010	Jun 2011: ~200,000 BWPM inj. begins	5	Jan–Mar 2010: water increases to 90–100,000 BPM	
G	4	Apr 2011		10	Mar 2011: oil + water increases to ~80,000 BPM	
H	5	May 2011		5	Sep 2010–May 2011: oil + water increases to ~100,000 BPM	
Dimmit clusters	**Number of events**	**1st event**	**Injection increase**	**Wells included radius (km)**	**Oil/water extraction increase**	**No increase**
J	1	Nov 2010	steady injection of ~100,000 BWMP nearby for ~15 yr	5		not an increase
K	7	Jan 2010		5	Nov 2009: sudden water increase to 170,000 BWMP	
L	5	Apr 2010		5	Jan–Apr 2010: sudden increase of water to 10–20,000 BWPM	
M	9	Jun 2011		10	Oct 2010–May 2011: oil + water increases, reaching 290,000 BWPM	
Other events	**Number of events**	**1st event**	**Injection increase**	**Wells included radius (km)**	**Oil/water extraction increase**	**No increase**
434A	2	Sep 2010				none
636A	2	Nov 2010				none
Alice	1	Apr 2010				(complex)

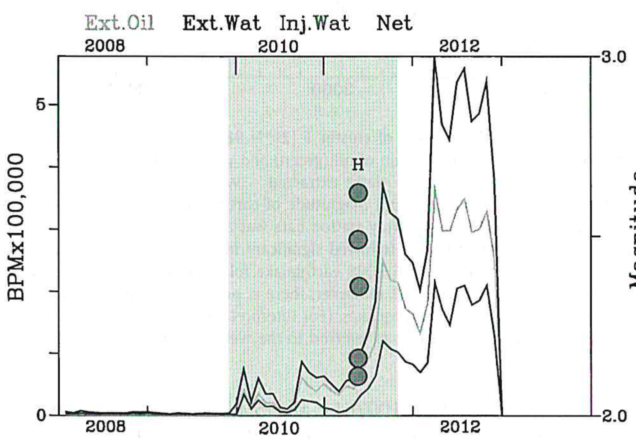

Fig. 7. For wells within 5 km of cluster H (29.353°N 97.413°W; see Fig. 4), monthly volumes (left axis) for the extraction of oil (green) and water (blue), injection of water (red), and the net (black; oil + water extracted − water injected). Red circles and right axis indicate timing and magnitudes of cluster H events; gray shaded area indicates time interval when USArray station data was available. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

2010 (Fig. S3). However, the extraction of water for wells within 5 km of F events did increase to nearly 100,000 BWPM between January and March of 2010 when the events began.

There are no recently active injection wells nearby clusters B, C, D, E, G and H; however, all but E coincide with increases in production of oil and/or water (Table 1). The B epicenter (Event #5220 in Table S3) occurred two months following a two-month spike in water production at wells within 5 km (Fig. S4). And the G and H activity only began after marked increases in production of oil and water at wells within 10 km (Fig. 7 and Fig. S5).

The C and D clusters are closest geographically to the highest-intensity region of the 20 October 2011 M_W4.8 earthquake. Oil and water production increased sharply near clusters D early in 2011 (Fig. S6) and near cluster C before April 2011 when the activity occurred. Rates of oil + water production remained high throughout most of 2011 and 2012. Although the 20 October 2011 earthquakes occurred following a peak in water production (Fig. S6), the D-cluster events began well before the increase commenced.

If we consider size and time dependence of the clusters A–F, none would be characterized as mainshock–aftershock sequences, with a large earthquake followed by numerous smaller-magnitude events (see Table S3). Instead, when there were several events in a cluster the times were generally swarm-like, with all events having similar magnitudes and occurring within a one- or two-month period (e.g., see clusters C, G, and H).

3.4. Dimmit area: probable earthquakes and injection/production wells

Our investigation identified 22 probable earthquakes (Fig. 8 and Table S3) in Dimmit County, an environment where no earthquakes had previously been reported. Except for one isolated event (la-

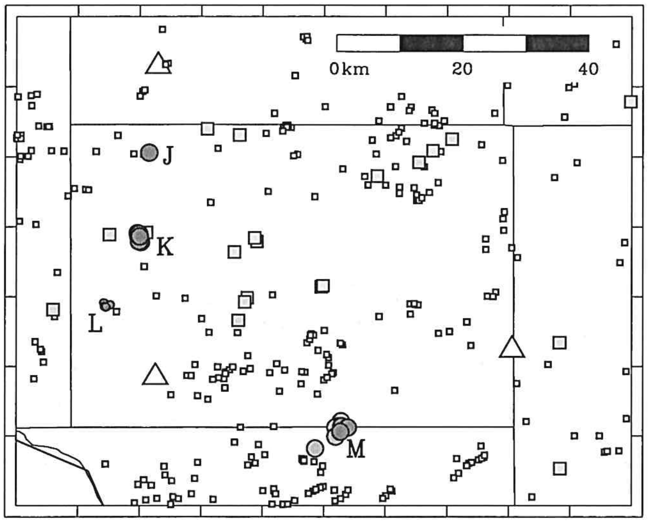

Fig. 8. For Dimmit County and neighboring region (see Fig. 3), map of seismic events (circles; symbols as in Fig. 3), USArray stations (triangles) and wells injecting water (yellow squares) and producing water (blue squares). For wells: small symbols—maximum monthly volume >10,000 BWPM (1600 m^3/mo); large symbols—maximum monthly volume >100,000 BWPM (16,000 m^3/mo). Labels 'J', 'K', etc. indicate event groups listed in Table S3 and discussed in the text. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

beled J in Fig. 8; #4728 in Table S3) all occurred in three clusters (K, L and M). The northern cluster K consisted of seven events, and began in January 2010. There were five events in cluster L, all occurring during April 2010, and nine events in cluster M, all in June and July, 2011.

Off these events none except event J occurred near active high-volume injection wells (Table 1). Wells within 5 km of J's location had been injecting at volumes of ~100,000 BWPM since 1996.

In contrast, clusters K, L, and M all are within 5–10 km of wells producing water or oil that reported significant increases in 2009 or 2010. For example, water wells within 5 km of cluster K produced 169,000 BWPM (27,000 m^3/mo) in November 2009; the K events began in January 2010 (Fig. S7). Wells within 10 km of M all began producing early in 2010; and for the two months prior to June 2011 when M activity began, their combined extraction of oil and water exceeded 270,000 BPM (Fig. S8). As in the Fashing area, the size and time dependence of Dimmit clusters was more swarm-like than aftershock-like, e.g., all the events in cluster M had magnitudes between 1.9 and 2.7, and all occurred within a three-week period.

3.5. Other probable earthquakes

The remaining probable earthquakes include the m_{bLG}3.9 25 April 2010 earthquake felt widely near Alice, TX (see Fig. 3 and Event #1986 in Table S3) that was the subject of an investigation by Frohlich et al. (2012). Two other isolated events that are probable earthquakes occurred on 18 September 2010 (Events #3906 and #3909 south of station 434A in Fig. 3). Although there are stone quarries that do sometimes generate quarry blasts near this location (a nearby city is named Marble Falls) the seismograms for these two events were distinct, with higher-frequency body waves and smaller surface waves than regional quarry blasts (see Fig. S9). Finally, two probable earthquake events occurred east of station 636A on 2 November 2010 and 9 December 2010 (Events #4484 and #4828 in Table S3). None of these remaining events are near active production or injection wells.

4. Discussion

4.1. Possibly-induced earthquakes and USArray

Like Frohlich's (2012) survey of earthquakes and injection wells in the Barnett Shale of northeast Texas, the present investigation of the Eagle Ford analyzed seismograms collected by the USArray stations to identify small-magnitude seismic events and evaluate their relationship to the extraction/injection of fluids in wells operated by the petroleum industry. Both studies surveyed seismicity in an area undergoing intensive petroleum operations, and evaluated possible relationships between seismicity and human activities. By surveying small-magnitude events, most too small to be reported by the NEIC or felt by local residents, these studies contrast with many investigations of induced/triggered seismicity that are initiated only after an earthquake occurs that is large enough to be felt by local residents and provoke media attention.

Both this study and Frohlich's (2012) survey were possible only because the USArray stations improved event-detection thresholds and increased accuracy of epicenter determination. The USArray program was conceived and funded before there was widespread public concern concerning possible human-caused earthquakes in Texas and elsewhere. Thus these investigations provide apt examples of the potential unanticipated benefits that can follow from large-data gathering programs like USArray, especially when the data are made freely available to all.

From an analysis of USArray data, the present investigation was to able to identify 62 small-magnitude events classified as probable earthquakes occurring in/near the Eagle Ford during the November 2009 to September 2011 survey period. Of these events, only four were reported by the NEIC. There were also five earthquakes outside the boundaries of the Eagle Ford (see events near stations 434A and 636A in Fig. 3) including the previously-studied m_{bLG}3.9 earthquake occurring in April 2010 near Alice, TX (see Frohlich et al., 2011).

For earthquakes occurring prior to the deployment, and following the removal of the USArray stations, there is often 10 km or more uncertainty in their epicentral location unless felt reports are available to better constrain the epicenter. For example, maximum-intensity foci were established for the m_{bLG}3.6 23 July 1991 and m_{bLG}4.3 9 April 1993 earthquakes near Falls City and Fashing (Olson and Frohlich, 1992; Davis et al., 1995). In contrast, no felt-report survey was undertaken for the m_b4.1 7 April 2008 earthquake and although it was felt in Falls City its exact location is uncertain.

4.2. Relationship of seismicity to injection/extraction

The principal result of this study was that the majority (~90 per cent) of the identified probable earthquakes occurred as single events or clusters at foci near active production or injection wells. Of these foci near active wells, 85 percent occurred near wells where injection or extraction had undergone a significant increase within a year or less prior to the beginning of seismic activity.

However, increases in fluid extraction, rather than injection, occurred prior to the majority of these events and foci (47 of 62 events; 8 of 14 foci). For example, in Dimmit County since 2008 production of water for hydrofracturing and agriculture has increased significantly (Nicot and Scanlon, 2012); 21 of the 22 events (3 of 4 foci) we identified in the Dimmit area (Fig. 8 and Table 1, clusters J–M) appear to be within 5–10 km of such wells. In the Fashing area (Fig. 4 and Table 1, clusters A–F) 28 of the 35 events (5 of 8 foci) identified are near wells showing increases in oil/water production.

Fluid injection increases at nearby wells did occur prior to seismic events at two foci—foci A in the Fashing region and J in Dimmit County. In addition, our investigation found that the m_{bLG}3.6 20 July 1991 Falls City earthquake followed an 18-month interval where injection at nearby wells had increased substantially.

These associations between seismic activity and increases in injection/production volumes imply that many of the Eagle Ford earthquakes were triggered/induced. Of course, injection/production activity is nearly ubiquitous throughout much of the Eagle Ford, and in many areas this activity increased markedly in 2010. Thus it is possible that earthquakes of natural origin may occur coincidentally near active wells. However, the observation that most earthquakes identified in this study occurred during the second year of the survey, when regional injection/production rates were generally higher, favors an induced/triggered origin.

The results of this survey indicate the relationship between seismicity and injection/extraction is more complex in the Eagle Ford than in the Barnett. In the Barnett, Frohlich's (2012) two-year survey found that seismic activity was clustered near injection wells, and these were wells having monthly injection rates exceeding 150,000 BWPM (24,000 m^3/mo). In the Eagle Ford, our survey finds that seismicity is associated with increases of both injection and extraction, and we were unable to identify a critical monthly rate. In both the Barnett and Eagle Ford there are numerous high-volume production and injection wells with no nearby seismicity.

There are geological and historical differences between the Barnett and the Eagle Ford that may explain the differences in their induced seismicity. In the Eagle Ford region petroleum has been produced by conventional means from various other strata, notably the Edwards formation, for more than 60 yr. The plays are fault bounded and some have been associated with extraction-related earthquakes since the 1970's (Pennington et al., 1986; Davis et al., 1995). In contrast, the induced earthquakes in the Barnett have mostly occurred areas where widespread development took place only within the past ten years (Frohlich, 2012). Thus the differences in Eagle Ford/Barnett induced seismicity may arise partly because human intervention affects a broader variety of geological formations in the Eagle Ford, and partly because features of induced seismicity can change over time scales of decades when injection/extraction is ongoing. This is certainly true for the seismicity associated with injection in Paradox Valley, CO, which has been ongoing for more than 20 yr (Ake et al., 2005).

In both the Eagle Ford and Barnett, as well as many other petroleum-producing regions in the U.S., the sparseness of permanent seismic station coverage is inadequate if we hope to understand why some operations induce earthquakes and others do not. The two-year coverage provided by USArray allows us to identify earthquakes with magnitudes of 2 and smaller and obtain epicenters with uncertainties of ∼2 km—often good enough to associate them with particular wells. However, two years is not a sufficiently long interval to obtain unequivocal statistical evidence that particular wells are or are not inducing earthquakes, nor was the station spacing of the USArray network adequate to obtain focal depth information. To better understand the scientific basis of induced earthquakes, for crafting effective policies regulating injection/extraction wells, and for developing effective strategies so that well operators can manage and mitigate the associated hazards, it is desirable to deploy more permanent regional seismic stations, including some densely instrumented networks in targeted areas where induced earthquakes are known to occur.

4.3. Was the M_W4.8 20 October Fashing earthquake induced/triggered?

We find no evidence that fluid injection is responsible for the 20 October 2011 earthquake. Injection is absent or negligible at wells within the MMI-V felt area, and at wells near foreshock clusters D and E. The nearest active high-volume injection wells are about 20 km distant near the site of the 1991 Falls City earthquake—it seems implausible that injection at this distance would induce/trigger the 2011 event.

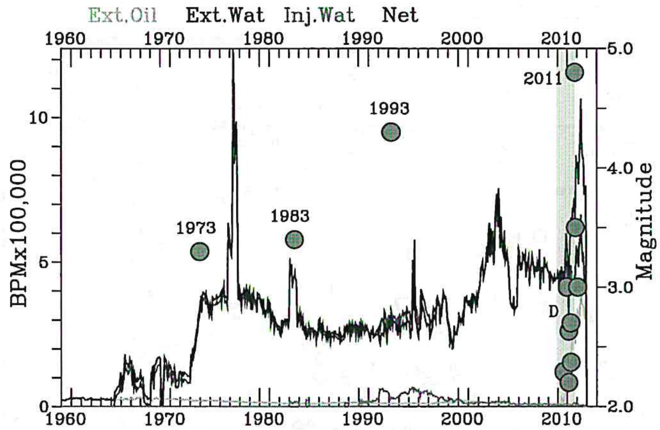

Fig. 9. Fashing earthquakes (red circles, right axis) and monthly volumes (left axis) for the extraction of oil (green) and water (blue), injection of water (red), and net (black: extraction oil + water − injection water) for wells within MMI V region of the 20 October 2011 earthquake (see Fig. 4). Note that earthquakes in 1973, 1983 and 2011 coincide with significant increases in extraction volumes. Gray shaded area indicates time interval when USArray station data was available. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

A comparison of Fashing seismic activity with the 50-yr record of production of petroleum and water in the MMI-V region of the 20 October 2011 earthquake (Fig. 9) suggests there is a relationship between seismic activity and the extraction of fluids (oil + water). The first known Fashing earthquake occurred on 25 December 1973 and followed a marked increase in the production of water at nearby wells that began late in 1971 and first reached 300,000 BWPM (48,000 m^3/mo) in November 1973. The m_{bLG}3.4 earthquake of 23 July 1983 occurred during a nine-month period beginning in January 1983 when water production exceeded 400,000 BWPM (64,000 m^3/mo). There is no apparent water-production anomaly associated with the m_{bLG}4.3 Fashing earthquake of 9 April 1993.

Finally, the M_W4.8 20 October 2011 earthquake followed increases in the production of oil and water that began in 2010. In fact, it was in October 2011 that the sum of oil + water extraction first exceeded its highest level of the previous three decades (750,000 BPM, or 120,000 m^3/mo, in December 2003).

Thus it is plausible that extraction of oil and water induced/triggered the M_W4.8 20 October 2011 earthquake. This is consistent with the previous studies Fashing-area earthquakes by Pennington et al. (1986) and Davis et al. (1995), who concluded that depressuring of subsurface fluids associated with the extraction of oil and water caused Fashing 1973–1993 earthquakes activity. It is notable that the centers of the maximum-intensity felt areas are virtually identical for the Fashing events of 23 July 1983 (m_{bLG}3.4), 9 April 1993 (m_{bLG}4.3), and 20 October 2011 (see Davis et al., 1995; Frohlich and Davis, 2002).

Acknowledgements

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Appendix A. Supplementary material

Supplementary tables and figures associated with this article can be found online at http://dx.doi.org/10.1016/j.epsl.2013.07.025.

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Melissa Schmidt

From:	PUBCOMMENT-OCC
Sent:	Wednesday, July 28, 2021 4:09 PM
To:	PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject:	FW: Public comment on Permit Number WDW424
Attachments:	TCEQ - WDW423 & WDW4242.pdf

H

From: gcgcd@goliadcogcd.org <gcgcd@goliadcogcd.org>
Sent: Wednesday, July 28, 2021 2:18 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

E-MAIL: gcgcd@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached letter requesting a contest case hearing.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Fred Duffy - Project Manager
Underground Injection Control Section
MC 233
P.O. Box 13087
Austin, TX. 78711-3087

Re: Application for Renewal of Class I Injection Well Permits WDW423 and WDW424
RN105304802 / CN60603228461

Goliad County Groundwater Conservation District (GCGCD) has received the above notice and is requesting a contested case hearing for the permits.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a contest case hearing based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter
GCGCD General Manager

Melissa Schmidt

From: PUBCOMMENT-OCC
Sent: Thursday, July 29, 2021 9:47 AM
To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Application for Renewal of Class I Injection Well Permit WDW423 & WDW424
Attachments: TCEQ WDW423 - WDW424.pdf; GCGCD request for public meeting July 27, 2020.pdf

H

From: Jan Bates <jan.bates@tceq.texas.gov>
Sent: Wednesday, July 28, 2021 5:14 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Cc: Fred Duffy <fred.duffy@tceq.texas.gov>; Carol Dye <carol.dye@tceq.texas.gov>; Bryan Smith <bryan.smith@tceq.texas.gov>; Alisha Stallard <Alisha.Stallard@tceq.texas.gov>; Brad Broussard <brad.broussard@tceq.texas.gov>; Ashley Forbes <ashley.forbes@tceq.texas.gov>
Subject: FW: Application for Renewal of Class I Injection Well Permit WDW423 & WDW424

OCC,

The attached request for contested case hearing on WDW423 and WDW424 was received by the UIC Permits Section via email on Monday July 26, 2021. Please see the email correspondence below. If you have any questions, please contact the project manager, Fred Duffy.

Jan Bates, Acting Section Manager

Jan Bates, P.E.
Underground Injection Control Permits Section
Radioactive Waste Materials Division
Texas Commission on Environmental Quality
(512) 239-6627
jan.bates@tceq.texas.gov

From: Heather Sumpter <hsumpter@goliadcogcd.org>
Sent: Monday, July 26, 2021 3:44 PM
To: Fred Duffy <fred.duffy@tceq.texas.gov>
Subject: Application for Renewal of Class I Injection Well Permit WDW423 & WDW424

Please see the above attached letter regarding request for a contested case hearing for Class I Injection Well Permits WDW423 & WDW424.

Thank you,

Heather Sumpter
General Manager
Goliad County Groundwater Conservation District
361-645-1716

ATTENTION BOARD MEMBERS: A "Reply to All" on this e-mail could lead to violations of the Texas Open Meetings Act. Please reply only to the sender.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Fred Duffy - Project Manager
Underground Injection Control Section
MC 233
P.O. Box 13087
Austin, TX. 78711-3087

Re: Application for Renewal of Class I Injection Well Permits WDW423 and WDW424
RN105304802 / CN60.0208461

Goliad County Groundwater Conservation District (GCGCD) has received the above notice and is requesting a contested case hearing for the permits.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a contest case hearing based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter
GCGCD General Manager

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 27, 2020

Texas Senator Lois Kolkhorst
P. O. Box 12068
Capitol Station
Austin, Texas 78711-2068

Re: Notice Received from TCEQ of Injection Well Permit Renewal from UEC
Permit WDW423 and WDW424

On April 27, 2020 Goliad County Groundwater Conservation District (GCGCD) was notified by TCEQ of an application that was received from Uranium Energy Corp. (UEC) for permit renewals to authorize injection of non-hazardous wastewater generated from processing of ion exchange resin from in-situ uranium mining at a facility located at 14869 North Hwy 183 in Goliad County. You can find the notice enclosed within.

GCGCD hired an expert hydrogeologist to review the documentation submitted by UEC to TCEQ for the permit renewal process. The hydrogeologist reviewed the documentation from UEC and other geological and hydrogeological reports and has submitted his review and comments to GCGCD which points out concerns of the injection wells. One of those concerns is the proposed area lies within a fault zone. This concern, along with others, needs to be discussed at a public meeting with TCEQ and State and local Government Representatives.

GCGCD is formally requesting a public meeting be held as soon as possible to address the concerns of the proposed injection wells, and to inform affected landowners and concerned citizens.

Sincerely,

Heather Sumpter
GCGCD General Manager

Cc.

Representative Geanie W. Morrison
District 30
Room 1N.9
P. O. Box 2910
Austin, TX 78768-2910

Texas Commission on Environmental Quality
Office of the Chief Clerk – MC 105
P.O. Box 13087
Austin, TX. 78711-3087

R.G Stanford LTD.
698 Stanford Lane
Victoria, TX. 77905

Evelyn Baldwin
13900 Hollow Green Dr.
Houston, TX. 77082

Gail Gilliland
1501 Goliad DR.
Arlington, TX. 76012

Glen Abrameit
6211 Wigton Dr.
Houston, TX. 77096

MAR G B Ranch, LLC
c/o Sydney Braquet
1324 Cortlandt Street #1
Houston, TX. 77008

Pam Long
358 E. FM 1961
Goliad, TX. 77963

Jo Nell Martin Life Estate
641 Crestview Dr.
Victoria, TX. 77905

Bonnie Schley
4945 Golly Road
Cuero, TX. 77954

Evan Kyle Lovett and Megan Lovett
208 Canterbury Lane
Victoria, TX. 77904

William David Cook
143 North U.S. Hwy 183
Yorktown, TX. 78164

Ted and Pam Long
358 E. FM 1961
Goliad, TX. 77963

Judge Mike Bennett
127 N. Courthouse Square
Goliad, TX. 77963

Texas Department of State
Health Services
7430 Louis Pasteur Dr.
San Antonio, TX. 78229

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

NOTICE OF RECEIPT OF APPLICATION AND INTENT TO OBTAIN NONHAZARDOUS WASTE UNDERGROUND INJECTION CONTROL PERMIT RENEWAL

PERMIT NOS. WDW423 and WDW424

APPLICATION. Uranium Energy Corp., 500 North Shoreline Boulevard, Suite 800N, Corpus Christi, Texas, an in-situ uranium mining business, has applied to the Texas Commission on Environmental Quality (TCEQ) for permit renewals to authorize injection of non-hazardous wastewater generated from the processing of ion exchange resin from in-situ uranium mining. The facility is located at 14869 North United States Highway 183, Yorktown, Texas 78164 in Goliad County, Texas. TCEQ received the application on January 23, 2020. The permit application is available for viewing and copying by appointment at the Goliad County Courthouse, 127 North Courthouse Square, Goliad, Texas 77963. The following link to an electronic map of the site or facility's general location is provided as a public courtesy and is not part of the application or notice: Goliad Project Map. For exact location, refer to application.

ADDITIONAL NOTICE. TCEQ's Executive Director has determined the application is administratively complete and will conduct a technical review of the application. After technical review of the application is complete, the Executive Director may prepare draft permits and will issue a preliminary decision on the application. **Notice of the Application and Preliminary Decision will be published and mailed to those who are on the county-wide mailing list and to those who are on the mailing list for this application. That notice will contain the deadline for submitting public comments.**

PUBLIC COMMENT/PUBLIC MEETING. **You may submit public comments or request a public meeting on this application.** The purpose of a public meeting is to provide the opportunity to submit comments or to ask questions about the application. TCEQ will hold a public meeting if the Executive Director determines that there is a significant degree of public interest in the application or if requested by a local legislator. A public meeting is not a contested case hearing.

OPPORTUNITY FOR A CONTESTED CASE HEARING. After the deadline for submitting public comments, the Executive Director will consider all timely comments and prepare a response to all relevant and material, or significant public comments. **Unless the application is directly referred for a contested case hearing, the response to comments, and the Executive Director's decision on the application, will be mailed to everyone who submitted public comments and to those persons who are on the mailing list for this application. If comments are received, the mailing will also provide instructions for requesting reconsideration of the Executive Director's decision and for requesting a contested case hearing.** A contested case hearing is a legal proceeding similar to a civil trial in state district court.

TO REQUEST A CONTESTED CASE HEARING, YOU MUST INCLUDE THE FOLLOWING ITEMS IN YOUR REQUEST: your name, address, phone number; applicant's name and permit number; the location and distance of your property/activities relative to the facility; a specific description of how you would be adversely affected by the facility in a way not common to the general public; a list of all disputed issues of fact that you submit during the comment period and, the statement "[I/we] request a contested case hearing." If the request for contested case hearing is filed on behalf of a group or association, the request must designate the group's representative for receiving future correspondence; identify by name and physical address an individual member of the group who would be adversely affected by the facility or activity; provide the information discussed above regarding the affected member's location and distance from the facility or activity; explain how and why the member would be affected; and explain how the interests the group seeks to protect are relevant to the group's purpose.

Following the close of all applicable comment and request periods, the Executive Director will forward the application and any requests for reconsideration or for a contested case hearing to the TCEQ Commissioners for their consideration at a scheduled Commission meeting. The Commission may only grant a request for a contested case hearing on issues the requestor submitted in their timely comments that were not subsequently withdrawn.

If a hearing is granted, the subject of a hearing will be limited to disputed issues of fact or mixed questions of fact and law that are relevant and material to the Commission's decision on the application submitted during the comment period.

MAILING LIST. If you submit public comments, a request for a contested case hearing or a reconsideration of the Executive Director's decision, you will be added to the mailing list for this application to receive future public notices mailed by the Office of the Chief Clerk. In addition, you may request to be placed on: (1) the permanent mailing list for a specific applicant name and permit number; and/or (2) the mailing list for a specific county. To be placed on the permanent and/or the county mailing list, clearly specify which list(s) and send your request to TCEQ Office of the Chief Clerk at the address below.

INFORMATION AVAILABLE ONLINE. For details about the status of the application, visit the Commissioners' Integrated Database at www.tceq.texas.gov/goto/cid. Once you have access to the CID using the above link, enter the permit number for this application, which is provided at the top of this notice.

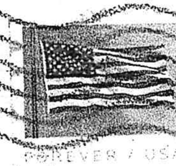
AGENCY CONTACTS AND INFORMATION. All public comments and requests must be submitted either electronically at www.tceq.texas.gov/agency/decisions/cc/comments.html, or in writing to the Texas Commission on Environmental Quality, Office of the Chief Clerk, MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Please be aware that any contact information you provide, including your name, phone number, email address and physical address will become part of the agency's public record. For more information about this permit application or the permitting process, please call the TCEQ's Public Education Program, Toll Free, at 1-800-687-4040 or visit their website at www.tceq.texas.gov/goto/pep. Si desea información en Español, puede llamar al 1-800-687-4040.

Further information may also be obtained from Uranium Energy Corp. at the address stated above or by calling Craig Wall at (361) 888-8235.

Issued: April 27, 2020

Goliad County Groundwater
Conservation District
P.O. Box 562
Goliad, TX. 77963

CORPUS CHRISTI
TX 784 1 L
03 AUG 2020 PM



Texas Commission on Environmental
Quality
Office of the Chief Clerk – MC 105
P.O. Box 13087
Austin, TX. 78711-3087

CHIEF CLERKS OFFICE
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TEXAS
COMMISSION
ON ENVIRONMENTAL
QUALITY

RECEIVED
AUG 06 2020
TCEQ MAIL CENTER
WT

78711$3087

Melissa Schmidt

From:	PUBCOMMENT-OCC
Sent:	Friday, July 30, 2021 8:06 AM
To:	PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject:	CORRECTION: Public comment on Permit Number WDW423
Attachments:	TCEQ - WDW423 & WDW4241.pdf

H

From: PUBCOMMENT-OCC
Sent: Wednesday, July 28, 2021 4:09 PM
To: PUBCOMMENT-OCC2 <pubcomment-occ2@tceq.texas.gov>; PUBCOMMENT-OPIC <pubcomment-opic@tceq.texas.gov>; PUBCOMMENT-ELD <pubcomment-eld@tceq.texas.gov>; PUBCOMMENT-WPD <pubcomment-wpd@tceq.texas.gov>
Subject: FW: Public comment on Permit Number WDW423

From: gcgcd@goliadcogcd.org <gcgcd@goliadcogcd.org>
Sent: Wednesday, July 28, 2021 2:15 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Goliad County G Conservation District

E-MAIL: gcgcd@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see attached letter requesting a contested case.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Fred Duffy - Project Manager
Underground Injection Control Section
MC 233
P.O. Box 13087
Austin, TX. 78711-3087

Re: Application for Renewal of Class I Injection Well Permits WDW423 and WDW424
RN105304802 / CN60603228461

Goliad County Groundwater Conservation District (GCGCD) has received the above notice and is requesting a contested case hearing for the permits.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a contest case hearing based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter
GCGCD General Manager

WDW 119588

FAX

TO:	Office of the Chief Clerk, MC 105 TCEQ	FROM:	Goliad County Groundwater Conservation District
FAX:	512-239-3311	FAX:	361-645-1772
PHONE:		PHONE:	361-645-1716
SUBJECT:	Permits WDW423 & WDW424	DATE:	7-19-22

COMMENTS: Please find the memorandum as supporting document as requested by TCEQ regarding permit WDW423 & WDW424 for request for public meeting.

File also submitted electronically.

REVIEWED
JUL 19 2022
By GCW PM

Thank you,
Heather Sumpter
GCGCD General Manager

GROUNDWATER SOLUTIONS, LTD

12902 Bristolberry Drive
Cypress, TX 77429
Office: (281) 807-1101
Fax: (281) 807-1105
Cell: (832) 724-7457
Email: john@groundwater.cc

REVIEWED
JUL 21 2022
By

MEMORANDUM

To: Heather Sumpter
Terrell Graham
From: John Oneacre
Date: June 29, 2020
Subject: Technical Comments on Uranium Energy Corporation's (UEC) Permit Application

Heather and Terrell, I have researched the UEC documents as wells as geological and hydrogeological reports by the Texas Bureau of Economic Geology and the United States Geological Survey. I have summarized some key geological/hydrogeological considerations for your review.

1. **Geological Setting**
    a. The proposed UEC site is located in the South Texas Gulf Coast geological area. Figure V-3 of Terra Dynamics report presents the stratigraphic sequence from the most recent Quaternary deposits to the older Wilcox Group.
    b. Figure V-3 also shows the proposed injection zone in the Vicksburg Saline Aquifer.
    c. The confining zones include the Jackson Group (below) and the Catahoula Group (above) as shown on Figure V-3.
2. **Terra Dynamics Discussion of Geology**
    a. Terra Dynamics (Terra) provides summaries of the various geological units listed on Figure V-3 in Section V of its report.
    b. Terra mentions "lignite" in the Eocene Queen City Formation and Jackson Group; both lie below the proposed injection zone.

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c. However, Terra does not discuss the significance of "lignite"; nor does Terra discuss source rocks for the oil and gas deposits. Terra provides a brief discussion of hydrocarbon production in Section V.B.6 Fault Transmissivity.
d. Terra noted that the UEC Area of Review (AOR) lies within the Wilcox Fault Zone (page V-19).
e. Terra gives two different numbers for faulting in the AOR.
    i. On page V-15, Terra discusses that two (2) minor faults are present to the northwest and southeast of the UEC injection well locations.
        1. According to Terra, the northwest fault has less than a 100-foot offset (less than the confining zone thickness).
        2. The southeast fault has, according to Terra, up to 150 feet of offset. Terra states that the southeast fault dies out within the lower Confining Zone.
    ii. On page V-17, Terra states, based upon the structure contour map, a total of four (4) faults can be mapped in the AOR.
        1. Terra states that two (2) northernmost faults ***appear*** to discontinue at the ***top*** of the Injection Interval. Up to nearly 200 feet of offset is noted for these faults.
        2. Terra does not provide additional discussion of the two (2) southernmost faults in this section.
    iii. Regarding fault transmissivity, Terra states that for faults in the Gulf Coast sediments, the faults are mainly sealing faults (i.e., inhibit flow along the faults) and cite Matthai and Roberts (1996) as a reference for reduced permeability along faults.

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f. Terra states that that hydrocarbon producing wells are oriented and aligned along the strike of the faulting (page V-22).
    i. Terra states "this shows that the faults are the primary trapping mechanism for hydrocarbons in the UEC AOR and are sealing with respect to hydrocarbons".
    ii. However, in the very next sentence Terra states "it does not appear that significant stacking of reservoirs is present along the faults or in the AOR in general, which may suggest upward migration and charging of shallower reservoirs from deeper source rocks through the fault".
    iii. Hopefully, you see the glaring contradiction regarding movement along the faults.
    iv. Terra concludes: "...it is very unlikely that vertical migration of injected fluids from the Injection Interval through transmissive faults is a concern in the area of the facility".
    v. So, Terra says on the one hand, fluids will not migrate along faults; but, on the other hand, hydrocarbons migrated from deeper to shallower reservoirs along the faults. The faults therefore are not transmissive to fluids except hydrocarbons is the conclusion of this section of Terra's report.

3. **Ground Water Solutions Discussion of Terra' report**
    a. There are several key issues to discuss regarding the geology, hydrogeology, and structural geology of the AOR.
    b. First, on the list of key issues is the geology. Although Terra does not put emphasis on the source rocks for hydrocarbons, it is important to understand:
        i. Source rocks
        ii. Types of source rocks, such as shales or coal
        iii. Movement of hydrocarbon from deeper source rocks to shallower reservoir formations

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c. The United States Geological Survey (USGS) produced a report in 2013 titled "Geologic Assessment of Undiscovered Oil and Gas Resources-Oligocene Frio and Anahuac Formations, United States Gulf of Mexico Coastal Plain and State Waters" (Swanson, Karlsen, and Valentine, 2013).

    i. In this report, the USGS provided a figure that presents the stratigraphy represented in the report along with those formations that are source rocks for oil and gas in the reservoir rocks (see Figure 1). For the large geographical area that includes Goliad County, the USGS identified the source rocks as Lower Tertiary; these source rocks include the Wilcox, Clairborne Group, Jackson, and Vicksburg. The types of source rocks from the Lower Tertiary include both shale and coal within those groups/formations.

    ii. The types of hydrocarbon found in the reservoir rocks include both oil and gas. Reservoir rocks include Miocene and Pliocene formations including the Oakville (Jasper), and Goliad Sand (Evangeline). These reservoir rocks, although down dip from Goliad County, have large vertical distances between the source rocks and reservoir rocks. The obvious question is how did the oil/gas migrate from the deeper Tertiary to the shallower Miocene and Pliocene?

        1. The USGS (2013) stated: "A number of studies indicated that migration of oil and gas in the Cenozoic (this includes all groups/formations from the Lower Eocene Wilcox to the Pliocene Goliad Sand) Gulf of Mexico basin primarily is vertical occurring along abundant growth faults associated with sediment deposition or along faults associated with salt domes

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(Dow, 1984; Sassen, 1990; Nehring, 1991; Schenk and Viger, 1996).

iii. The USGS and other researchers interpretation of growth faults is that the faults are not necessarily impermeable to fluid/gas movement but rather are the conduits that permit the deeper sourced hydrocarbons to migrate upward vertically to the reservoir rocks.

iv. The USGS and other researchers explanation for migration of hydrocarbons along growth faults is contrary to Terra's discussion of potential migration of fluids along the growth faults. In Section V.B.6 Fault Transmissivity, Terra makes the following statement: "The large thickness of shale strata above the Injection Interval, which provides extensive shale to shale contact along the fault plane, combined with possible shale smearing along the fault plane, should ensure adequate sealing to prevent any significant vertical migration of formation and/or injected fluids along the fault plane" (page V-23). Note the words "should ensure" and "prevent any significant vertical migration".

v. If, as the USGS and other researchers have written in various technical journals/publications, formations such as the Wilcox are the source rocks for oil and gas in formations that lie above the proposed Catahoula confining layer; how did the hydrocarbons get through the Catahoula? The answer logically is through the growth faults.

vi. Terra describes the extent of the four (4) faults identified in Section V. Geology and Hydrogeology (pages V-19 & V-20). Terra interprets the upper extent of the four faults to end before reaching the top of the Confining Zone. However, on Terra's Figure V-18, Terra shows fault offsets not only

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through the proposed Confining Zone, but also into zones above the base of the USDW. Parallel to this fault to the northwest there appears to be significant offset of geological formations that Terra did not identify as a fault or inferred fault. The apparent offset is greater than the fault identified by Terra. I have provided an enlarged image of the apparent fault. This may be a monocline or an area of increased dip or a fault. Because this area has a number of faults, the possibility of a fault cannot be ruled out. If this feature is a fault, then offsets extend through the Oakville (Jasper Aquifer), into/through the Burkeville, and perhaps into the Goliad Sand (Evangeline Aquifer). Terra's cross-section has a lack of shallow geophysics in the area to ascertain the upper limit of the offsets. The discussion on Carothers below will address this.

vii. The offsets I have noted could be of importance for several reasons:

1. USGS and researchers believe hydrocarbons migrate vertically via growth faults;
2. Stratigraphic traps are common updip of the major growth faults (Nehring, 1991);
3. In the South Texas uranium district, uranium deposits show close spatial relationships to fault-line oil fields (Schmitt, 1988);
4. Weeks (1960) suggested that hydrogen sulfide from fault-controlled oil fields may have precipitated uranium in nearby sedimentary rocks and formed the uranium deposits in south Texas.
5. Carothers (2007) prepared estimated uranium reserves under the property for Uranium Energy

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Corporation (UEC). In Section 7.2 of Carothers' report titled "Local and Property Geology", Carothers' makes the following statement regarding uranium mineralization in the Goliad Sand:

a. "The site area structures include two faults that intersect and offset the mineralized units. These faults are normal, with one downthrown toward the coast and one downthrown toward the northwest. The fault throws range from about 40 to 80 feet" (page 7-2).
b. Carothers noted that the mineralized (uranium) units, are described by UEC as Sands A through D (younger to older).
c. Carothers obviously believed that faults (growth) extended into the mineralized uranium deposits because he used the term "offset".

6. Carothers described the uranium deposits as roll front deposits that are "C" shaped or truncated "C" shaped. The source is likely the older volcanic deposits that were leached/eroded along their outcrops. Leaching by oxygen rich water/ground water will cause uranium to become soluble and move along the path of ground water flow.
7. Carothers states: "There are at least two northeast-southwest trending faults at the Goliad property that are likely related to the formation of the Goliad Project mineralization. The northwesterly fault is a typical Gulf Coast normal fault, downthrown toward the coast, while the southeastern fault is downthrown to the northwest, forming a graben structure. Both faults are

normal faults. Throw on the northwest fault is about 75 feet and the southeast fault has about 50 feet of throw. The presence of these faults is likely related to the increased mineralization at the site. The faulting has probably served as a conduit for reducing waters-gases to migrate from deeper horizons as well as altering the groundwater flow system in the uranium-bearing sands" (page 8-1).

a. Note the significance of Carothers' statement; he interprets the change in the oxidation-reduction potential (ORP) that resulted in precipitation of the uranium along the faults is due to "reducing waters-gases...from deeper horizons".
b. This statement by Carothers is contrary to Terra; Terra stated that the faults appear to die out before reaching the top of the confining zone.
c. Another contrary statement by Carothers is he believed that the faulting served as a "conduit" for water-gas from deeper formations. Terra stated that the faults are "sealing" faults that do not permit flow of fluids. Terra's modeling assumed no-flow in the fault zones.
d. Carothers shows the locations of the two faults on Figure 8-3 of his report; on one of his cross-sections, Carothers shows the northern fault and essentially extends the fault to ground surface.

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8. Carothers again provides the geochemical discussion on the process of moving uranium from its source to the enriched deposits: "Groundwater flowing from northwest to southeast in the Goliad sands likely contained low concentrations of dissolved uranium resulting from oxidizing conditions and the relatively short distance from the recharge area. The geochemical conditions in the sands near the UEC property changed from oxidizing to reducing due to an influx of reductants. Hydrogen sulfide and/or methane dissolved in groundwater are likely sources of creating a reduction-oxidation boundary in the area with consequent precipitation and concentration of uranium mineralization. The Goliad uranium-bearing sand intervals are dominantly unoxidized sediments due to the strong geochemical reduction" (page 9-5). Combining Carothers' previous statement of faulting acting as a conduit with this statement of hydrogen sulfide and/or methane gives a complete picture of the geology, structural geology, hydrogeology, and geochemistry of the site.
9. Carothers interpretation is in agreement with Eargle et al (1975); the authors stated that the reducing agents for uranium in the south Texas deposits were probably local carbonaceous material and hydrogen sulfide or methane that originated in nearby buried petroleum accumulations.
10. Carothers further states that most of the gamma anomalies occur along the northernmost fault; that the uranium deposits are tabular and are up to 5,000 feet

in length along the strike of the fault, and that the mineralized zones are of limited widths of only 50 feet to 500 feet. This again shows that ground water flowing over/through the northernmost fault encountered reduced water that contained strong reducing agents such as hydrogen sulfide and/or methane emanating from deeper zones resulting in precipitation of uranium.

11. Carothers' Figures 11-1 through 11-4 show the shape of the uranium deposits in the four sands; Figures 11-1, 3, and 4 show that the uranium deposits lie close to the northernmost fault.

12. Carothers produced another report in 2008 by the same title but with additional data for the purpose of being in compliance with NI 43-101; this is noted in Section 23 "Certificate of Qualified Person". In this report, the mineralized uranium zones are presented in Figures 17-1 through 17-4 on UEC title block. The two faults noted by Carothers are shown on Figures 17-1 and 17-4.

13. I need to point out that Terra Dynamics Incorporated's report is dated 2020; Mr. Carothers' reports are dated 2007 and 2008. Terra does not reference either of Carothers' reports. The obvious question is why doesn't Terra cite Carothers? Especially since Carothers signed off on the NI 43-101 certification.

GROUND WATER SOLUTIONS, LTD

REFERENCES

Carothers, Thomas, 2007. Technical Report for Uranium Energy Corp's Goliad Project In-Situ Recovery Uranium Property, Goliad, Texas, 64 pp.

Chowdhury, Ali H., Turco, Mike J., 2006. Geology of the Gulf Coast Aquifer, Texas, Chapter 2. In: Mace, R.E., et al., Eds., Aquifers of the Gulf Coast of Texas: Texas Water Development Board Report 365, prepared in conjunction with the United States Geological Survey, 28 pp.

Dale, O.C., Moulder, D.A., and Arnow, Ted., 1957. Ground-Water Resources of Goliad County, Texas, United States Geological Survey Bulletin 5711, prepared in cooperation with the San Antonio River Authority. 25 pp.

Dow, W.G., 1984. Oil source beds and oil prospect definition in the Upper Tertiary of the Gulf Coast: Gulf Coast Association of Geological Societies Transactions, v. 34, p. 329-339.

Eargle, D.H., Dickinson, K.A., and Davis, B.O., 1975. South Texas uranium deposits: American Association of Petroleum Geologists Bulletin, v. 59, no. 5, p. 766-779.

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GROUND WATER SOLUTIONS, LTD

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hsumpter goliadcogcd.org

From:	donotreply@tceq.texas.gov
Sent:	Tuesday, July 19, 2022 8:46 AM
To:	hsumpter goliadcogcd.org
Subject:	TCEQ Confirmation: Your public comment on Permit Number WDW423 was received.
Attachments:	GWS Memo on UEC Permit Application.pdf

REGULATED ENTITY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562 118 S. Market St.
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see attached memorandum prepared by John Oneacre for GCGCD, as requested by email.

Based on TCEQ rule Section 1.10(h), the TCEQ General Counsel has waived the filing requirements of Section 1.10(c) to allow the filing of comments, requests, or withdrawals using this online system. The General Counsel also has waived the requirements of Section 1.10(e) so that the time of filing your electronic comments or requests is the time this online system receives your comments or requests. Comments or requests are considered timely if received by 5:00 p.m. CST on the due date.

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Sent:	Tuesday, July 19, 2022 8:52 AM
To:	hsumpter goliadcogcd.org
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REGULATED ENTITY NAME GOLIAD PROJECT

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NAME: Heather Q

EMAIL: hsumpter@goliadcogcd.org

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ADDRESS: PO BOX 562 118 S. Market St.
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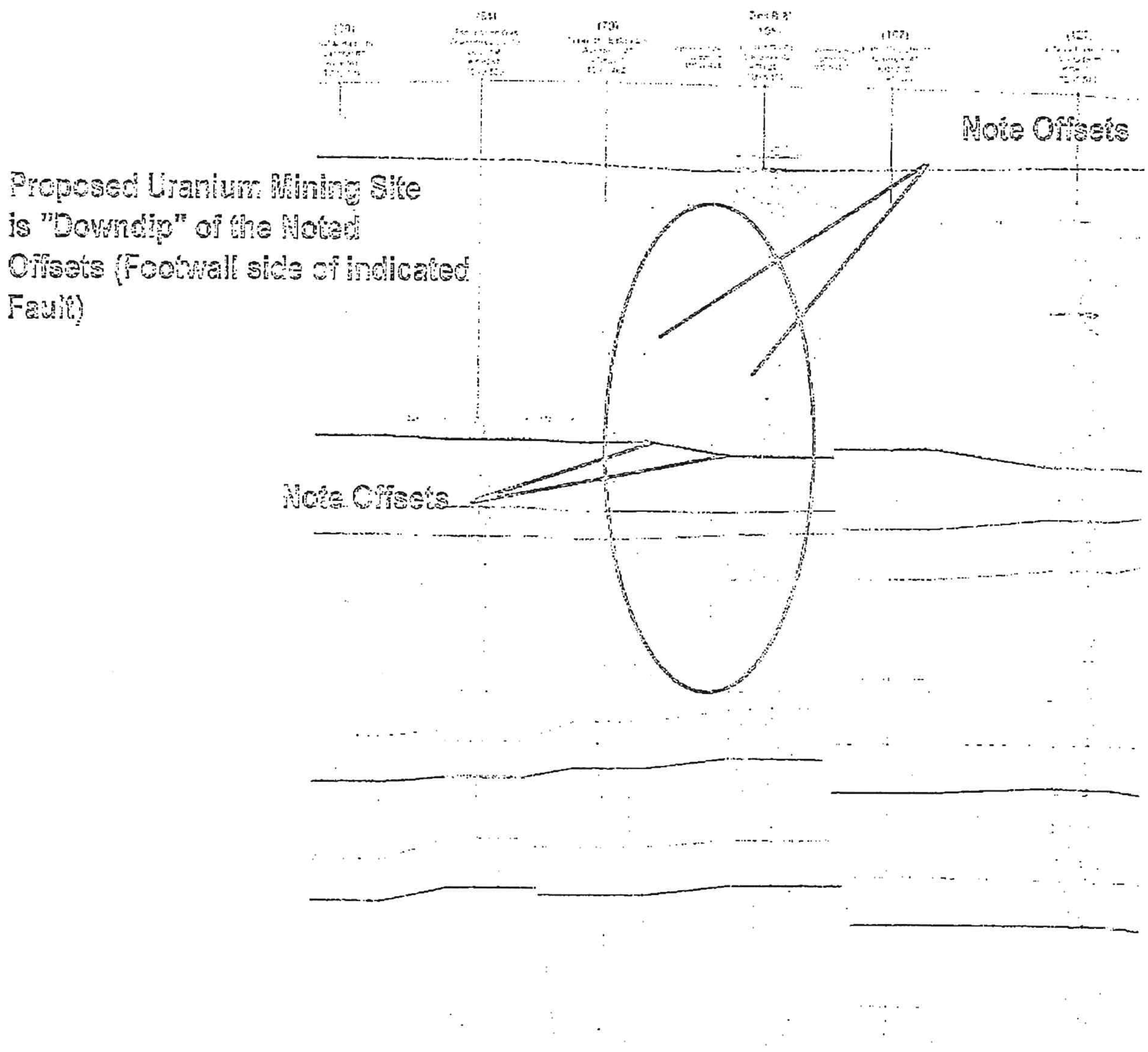
Note Offsets
Proposed Uranium Mining Site is "Downdip" of the Noted Offsets (Footwall side of indicated Fault)
Note Offsets

PERIOD	EPOCH	AGE	GROUP OR FORMATION	GAS	OIL	SOURCE ROCK Shale	SOURCE ROCK Coal
QUAT.	HOLO.	— — —	— — — —				
QUAT.	PLEI.	Calabrian	Undifferentiated	△	●		
TERTIARY / NEOGENE	PLIOCENE	Piacenzian Zanclean	Undifferentiated	△	●		
TERTIARY / NEOGENE	MIOCENE	Messinian Tortonian Serravallian Langhian Burdigalian Aquitanian	Fleming Fm.	△	●		
TERTIARY / PALEOGENE	OLIGOCENE	Chattian	Anahuac Fm. Catahoula Fm. Frio Fm.	△	●		
TERTIARY / PALEOGENE	OLIGOCENE	Rupelian	Vicksburg[1]	△	●	■	☆
TERTIARY / PALEOGENE	EOCENE	Priabonian	Jackson[1]	△	●	■	☆
TERTIARY / PALEOGENE	EOCENE	Bartonian Lutetian	Claiborne Gp. (Sparta Sand, Cane River Fm, Carrizo Sand)	△	●	■	☆
TERTIARY / PALEOGENE	EOCENE	Ypresian	Wilcox[1]	△	●	■	☆
TERTIARY / PALEOGENE	PAL.	Thanetian Selandian Danian	Midway Gp.	△	●	■	
CRETACEOUS	UPPER	Maastrichtian	Navarro[1] (Olmos Fm-Escondido Fm.)	△	●		☆
CRETACEOUS	UPPER	Campanian	Taylor Gp. (Anacacho Ls/ San Miguel Fm./ Ozan Fm/Annona Chalk)	△	●	■	
CRETACEOUS	UPPER	Santonian Coniacian	Austin Gp./Tokio Fm./ Eutaw Fm.	△	●		
CRETACEOUS	UPPER	Turonian Cenomanian	Eagle Ford[2] Woodbine[3]/Tuscaloosa[1]	△	●	■	
CRETACEOUS	LOWER	Albian	Washita Gp. (Buda Limestone)	△			
CRETACEOUS	LOWER	Albian	Fredericksburg Gp. (Edwards Ls. /Paluxy[3])	△	●		
CRETACEOUS	LOWER	Albian	Glen Rose[4] (Rodessa Fm.)	△	●	■	
CRETACEOUS	LOWER	Aptian	Pearsall Fm. - James Ls.	△	●	■	
CRETACEOUS	LOWER	Aptian Barremian Hauterivian Valanginian Berriasian	Sligo Fm. Hosston Fm. (Travis Peak Fm.)	△	●	■	☆
JURASSIC	UPPER	Tithonian	Cotton Valley[1] / Bossier Fm.	△	●	■	
JURASSIC	UPPER	Kimmeridgian	Haynesville Fm./ Gilmer Ls.	△	●	■	
JURASSIC	UPPER	Oxfordian	Smackover Fm. Norphlet Fm.	△	●	■	
JURASSIC	MID.	Callovian Bathonian	Louann Salt Werner Fm.				
JURASSIC	L.	Hettangian					
TRIA.	UP.	Rhaetian Norian Carnian	Eagle Mills Fm.			■	

EXPLANATION

- △ Gas reservoir rock
- ● Oil reservoir rock
- ■ Shale source rock
- ☆ Coal source rock
- Fm. = Formation
- Gp. = Group
- Ls. = Limestone

[1] Indicates classification of Group or Formation, depending on locality use.

[2] Indicates classification of Group, Formation, Clay or Shale, depending on locality use.

[3] Indicates classification of Formation or Sand, depending on locality use.

[4] Indicates classification of Formation or Limestone, depending on locality use.

Figure 1. Generalized stratigraphic section of the northern Gulf of Mexico coastal plain, with the Frio Formation (equivalent to the Catahoula Formation in updip areas) and Anahuac Formation highlighted in blue (Warwick and others, 2007a; modified from Salvador and Quezada Muñeton, 1991; Nehring, 1991; Palmer and Geissman, 1999; Humble Geochemical Services and others, 2002). Potential source rocks are indicated in the last column. Abbreviations and symbols: Mid., Middle; Pal., Paleocene; Plei., Pleistocene; Holo., Holocene; Quat., Quaternary; wavy line, missing section; jagged line, interfingering; dashed line, uncertain.

Paul Worrall

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WDW 119588

Debbie Zachary

From:	PUBCOMMENT-OCC
Sent:	Wednesday, July 20, 2022 1:44 PM
To:	PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject:	FW: Public comment on Permit Number WDW424
Attachments:	Figure 1 of2013-1257 13.pdf

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Tuesday, July 19, 2022 8:58 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

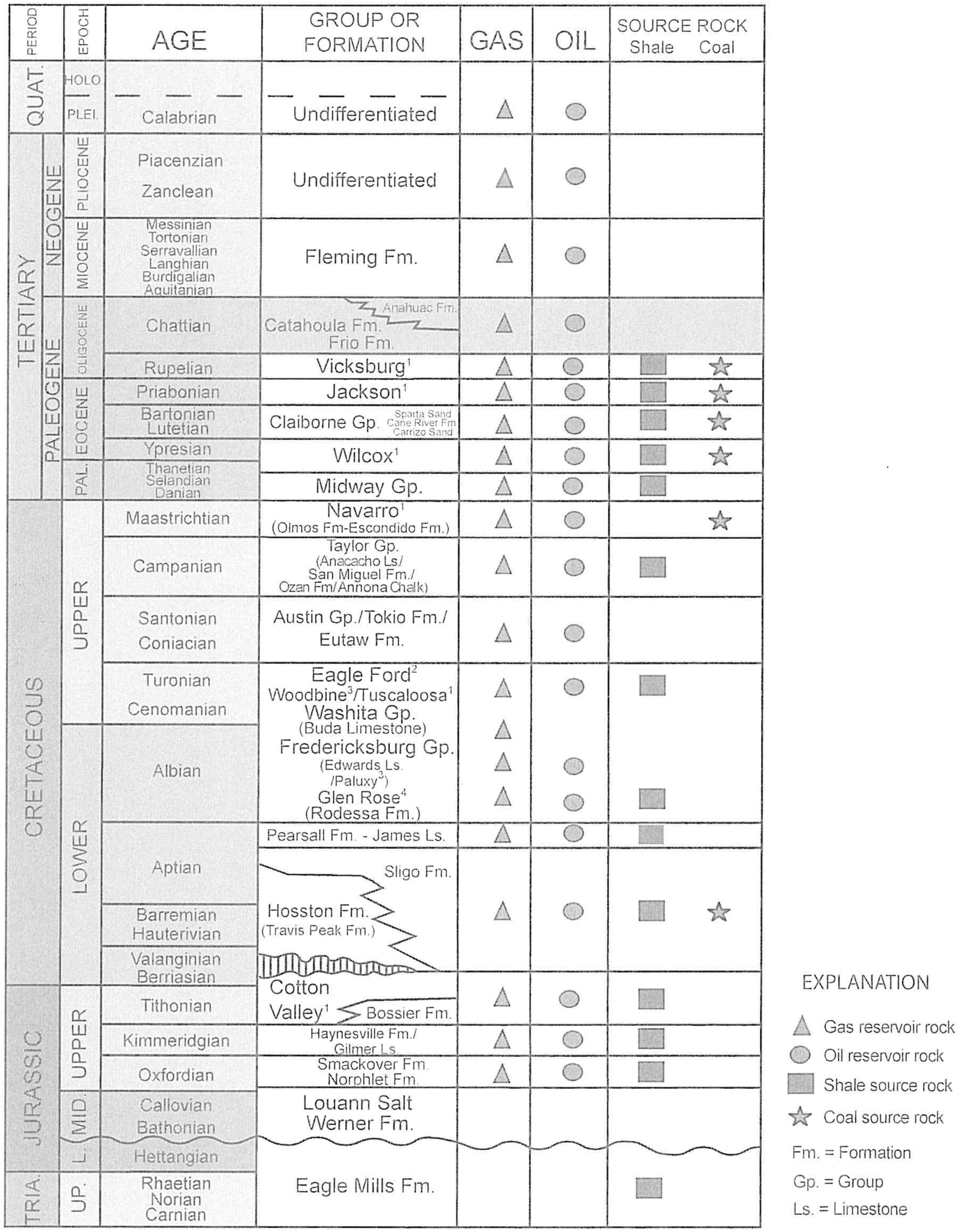
COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562 118 S. Market St.
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached document as apart of memorandum submitted to TCEQ prepared by John Oneacre for GCGCD.



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WDW
119588

Debbie Zachary

From: PUBCOMMENT-OCC
Sent: Wednesday, July 20, 2022 1:45 PM
To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Public comment on Permit Number WDW424
Attachments: Figure V-18 Zoom.pdf

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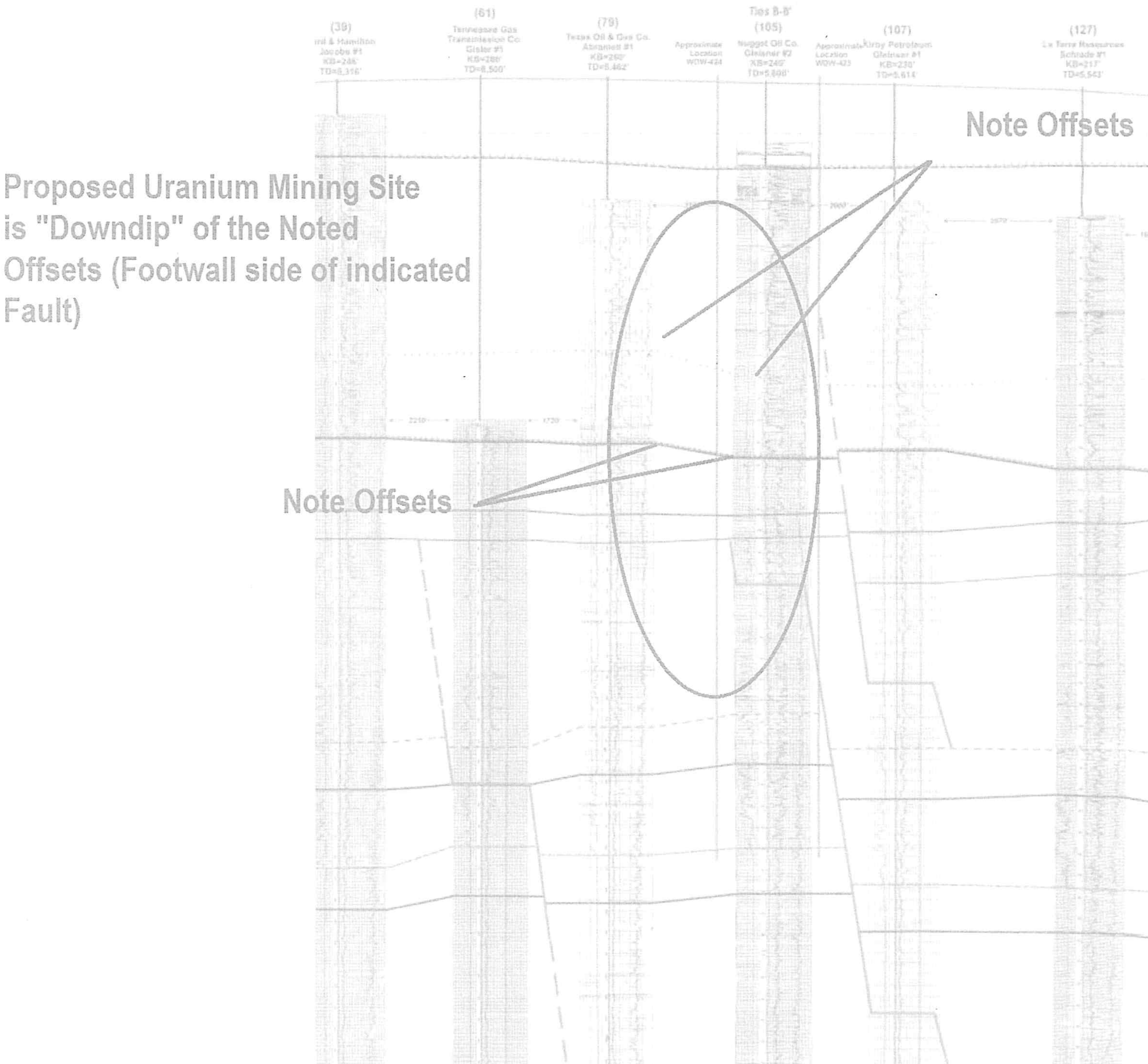

Ties B-B'
(39)
Jacobs #1
KB=246'
TD=8,316'
(61)
Tennessee Gas Transmission Co.
Gisler #1
KB=286'
TD=8,500'
(79)
Texas Oil & Gas Co.
Abramett #1
KB=260'
TD=8,462'
Approximate Location
WDW-424
(105)
Nugget Oil Co.
Gleisner #2
KB=249'
TD=5,898'
Approximate Location
WDW-423
(107)
Kirby Petroleum
Gleisner #1
KB=230'
TD=5,614'
(127)
La Terra Resources
Schrade #1
KB=217'
TD=5,543'
Note Offsets
Proposed Uranium Mining Site is "Downdip" of the Noted Offsets (Footwall side of indicated Fault)
Note Offsets

WDW
119588

Debbie Zachary

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NAME: Heather Q

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GOLIAD TX 77963-0562

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FAX:

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GROUND WATER SOLUTIONS, LTD

12902 Bristolberry Drive
Cypress, TX 77429
Office: (281) 807-1101
Fax: (281) 807-1105
Cell: (832) 724-7457
Email: john@groundwater.cc

MEMORANDUM

To: Heather Sumpter
Terrell Graham
From: John Oneacre
Date: June 29, 2020
Subject: Technical Comments on Uranium Energy Corporation's (UEC) Permit Application

Heather and Terrell, I have researched the UEC documents as wells as geological and hydrogeological reports by the Texas Bureau of Economic Geology and the United States Geological Survey. I have summarized some key geological/hydrogeological considerations for your review.

1. **Geological Setting**
   a. The proposed UEC site is located in the South Texas Gulf Coast geological area. Figure V-3 of Terra Dynamics report presents the stratigraphic sequence from the most recent Quaternary deposits to the older Wilcox Group.
   b. Figure V-3 also shows the proposed injection zone in the Vicksburg Saline Aquifer.
   c. The confining zones include the Jackson Group (below) and the Catahoula Group (above) as shown on Figure V-3.
2. **Terra Dynamics Discussion of Geology**
   a. Terra Dynamics (Terra) provides summaries of the various geological units listed on Figure V-3 in Section V of its report.
   b. Terra mentions "lignite" in the Eocene Queen City Formation and Jackson Group; both lie below the proposed injection zone.

c. However, Terra does not discuss the significance of "lignite"; nor does Terra discuss source rocks for the oil and gas deposits. Terra provides a brief discussion of hydrocarbon production in Section V.B.6 Fault Transmissivity.

d. Terra noted that the UEC Area of Review (AOR) lies within the Wilcox Fault Zone (page V-19).

e. Terra gives two different numbers for faulting in the AOR.

   i. On page V-15, Terra discusses that two (2) minor faults are present to the northwest and southeast of the UEC injection well locations.

      1. According to Terra, the northwest fault has less than a 100-foot offset (less than the confining zone thickness).

      2. The southeast fault has, according to Terra, up to 150 feet of offset. Terra states that the southeast fault dies out within the lower Confining Zone.

   ii. On page V-17, Terra states, based upon the structure contour map, a total of four (4) faults can be mapped in the AOR.

      1. Terra states that two (2) northernmost faults ***appear*** to discontinue at the ***top*** of the Injection Interval. Up to nearly 200 feet of offset is noted for these faults.

      2. Terra does not provide additional discussion of the two (2) southernmost faults in this section.

   iii. Regarding fault transmissivity, Terra states that for faults in the Gulf Coast sediments, the faults are mainly sealing faults (i.e., inhibit flow along the faults) and cite Matthai and Roberts (1996) as a reference for reduced permeability along faults.

f. Terra states that that hydrocarbon producing wells are oriented and aligned along the strike of the faulting (page V-22).

   i. Terra states "this shows that the faults are the primary trapping mechanism for hydrocarbons in the UEC AOR and are sealing with respect to hydrocarbons".

   ii. However, in the very next sentence Terra states "it does not appear that significant stacking of reservoirs is present along the faults or in the AOR in general, which may suggest upward migration and charging of shallower reservoirs from deeper source rocks through the fault".

   iii. Hopefully, you see the glaring contradiction regarding movement along the faults.

   iv. Terra concludes: "…it is very unlikely that vertical migration of injected fluids from the Injection Interval through transmissive faults is a concern in the area of the facility".

   v. So, Terra says on the one hand, fluids will not migrate along faults; but, on the other hand, hydrocarbons migrated from deeper to shallower reservoirs along the faults. The faults therefore are not transmissive to fluids except hydrocarbons is the conclusion of this section of Terra's report.

3. **Ground Water Solutions Discussion of Terra' report**

   a. There are several key issues to discuss regarding the geology, hydrogeology, and structural geology of the AOR.

   b. First, on the list of key issues is the geology. Although Terra does not put emphasis on the source rocks for hydrocarbons, it is important to understand:

      i. Source rocks

      ii. Types of source rocks, such as shales or coal

      iii. Movement of hydrocarbon from deeper source rocks to shallower reservoir formations

c. The United States Geological Survey (USGS) produced a report in 2013 titled "Geologic Assessment of Undiscovered Oil and Gas Resources-Oligocene Frio and Anahuac Formations, United States Gulf of Mexico Coastal Plain and State Waters" (Swanson, Karlsen, and Valentine, 2013).

   i. In this report, the USGS provided a figure that presents the stratigraphy represented in the report along with those formations that are source rocks for oil and gas in the reservoir rocks (see Figure 1). For the large geographical area that includes Goliad County, the USGS identified the source rocks as Lower Tertiary; these source rocks include the Wilcox, Clairborne Group, Jackson, and Vicksburg. The types of source rocks from the Lower Tertiary include both shale and coal within those groups/formations.

   ii. The types of hydrocarbon found in the reservoir rocks include both oil and gas. Reservoir rocks include Miocene and Pliocene formations including the Oakville (Jasper), and Goliad Sand (Evangeline). These reservoir rocks, although down dip from Goliad County, have large vertical distances between the source rocks and reservoir rocks. The obvious question is how did the oil/gas migrate from the deeper Tertiary to the shallower Miocene and Pliocene?

      1. The USGS (2013) stated: "A number of studies indicated that migration of oil and gas in the Cenozoic (this includes all groups/formations from the Lower Eocene Wilcox to the Pliocene Goliad Sand) Gulf of Mexico basin primarily is vertical occurring along abundant growth faults associated with sediment deposition or along faults associated with salt domes

(Dow, 1984; Sassen, 1990; Nehring, 1991; Schenk and Viger, 1996).

iii. The USGS and other researchers interpretation of growth faults is that the faults are not necessarily impermeable to fluid/gas movement but rather are the conduits that permit the deeper sourced hydrocarbons to migrate upward vertically to the reservoir rocks.

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World Nuclear Association, 2020. Geology of Uranium Deposits, 8 pp.

Wood, Leonard A., Gabrysch, R.K., Marvin, Richard, 1971. Reconnaissance Investigation of the Ground –Water Resources of the Gulf Coast Region, Texas. United States Geological Survey Bulletin 6305, prepared in cooperation with the Texas Water Commission, 118 pp.

W DW
119588

Debbie Zachary

From: PUBCOMMENT-OCC
Sent: Wednesday, July 20, 2022 1:40 PM
To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Public comment on Permit Number WDW423
Attachments: Figure 1 of2013-1257 13.pdf

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Tuesday, July 19, 2022 8:53 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

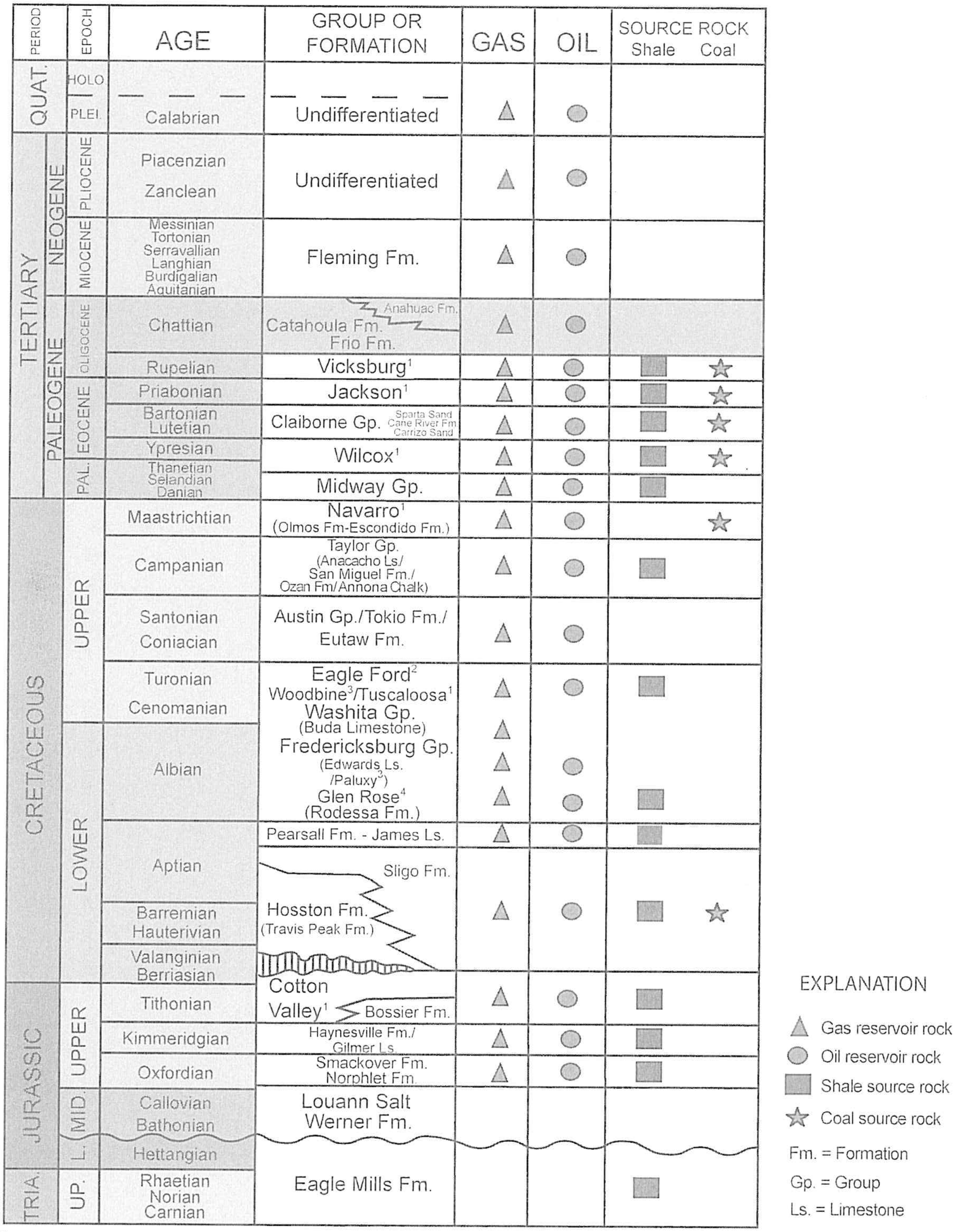
COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562 118 S. Market St.
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached document as apart of memorandum submitted to TCEQ prepared by John Oneacre for GCGCD.



[1] Indicates classification of Group or Formation, depending on locality use.

[2] Indicates classification of Group, Formation, Clay or Shale, depending on locality use.

[3] Indicates classification of Formation or Sand, depending on locality use.

[4] Indicates classification of Formation or Limestone, depending on locality use.

Figure 1. Generalized stratigraphic section of the northern Gulf of Mexico coastal plain, with the Frio Formation (equivalent to the Catahoula Formation in updip areas) and Anahuac Formation highlighted in blue (Warwick and others, 2007a; modified from Salvador and Quezada Muñeton, 1991; Nehring, 1991; Palmer and Geissman, 1999; Humble Geochemical Services and others, 2002). Potential source rocks are indicated in the last column. Abbreviations and symbols: Mid., Middle; Pal., Paleocene; Plei., Pleistocene; Holo., Holocene; Quat., Quaternary; wavy line, missing section; jagged line, interfingering; dashed line, uncertain.

WDW 423 & 424
119588

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From:	PUBCOMMENT-OCC
Sent:	Wednesday, July 20, 2022 1:40 PM
To:	PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject:	FW: Public comment on Permit Number WDW423
Attachments:	Figure V-18 Zoom.pdf

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Tuesday, July 19, 2022 8:52 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

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RN NUMBER: RN105304802

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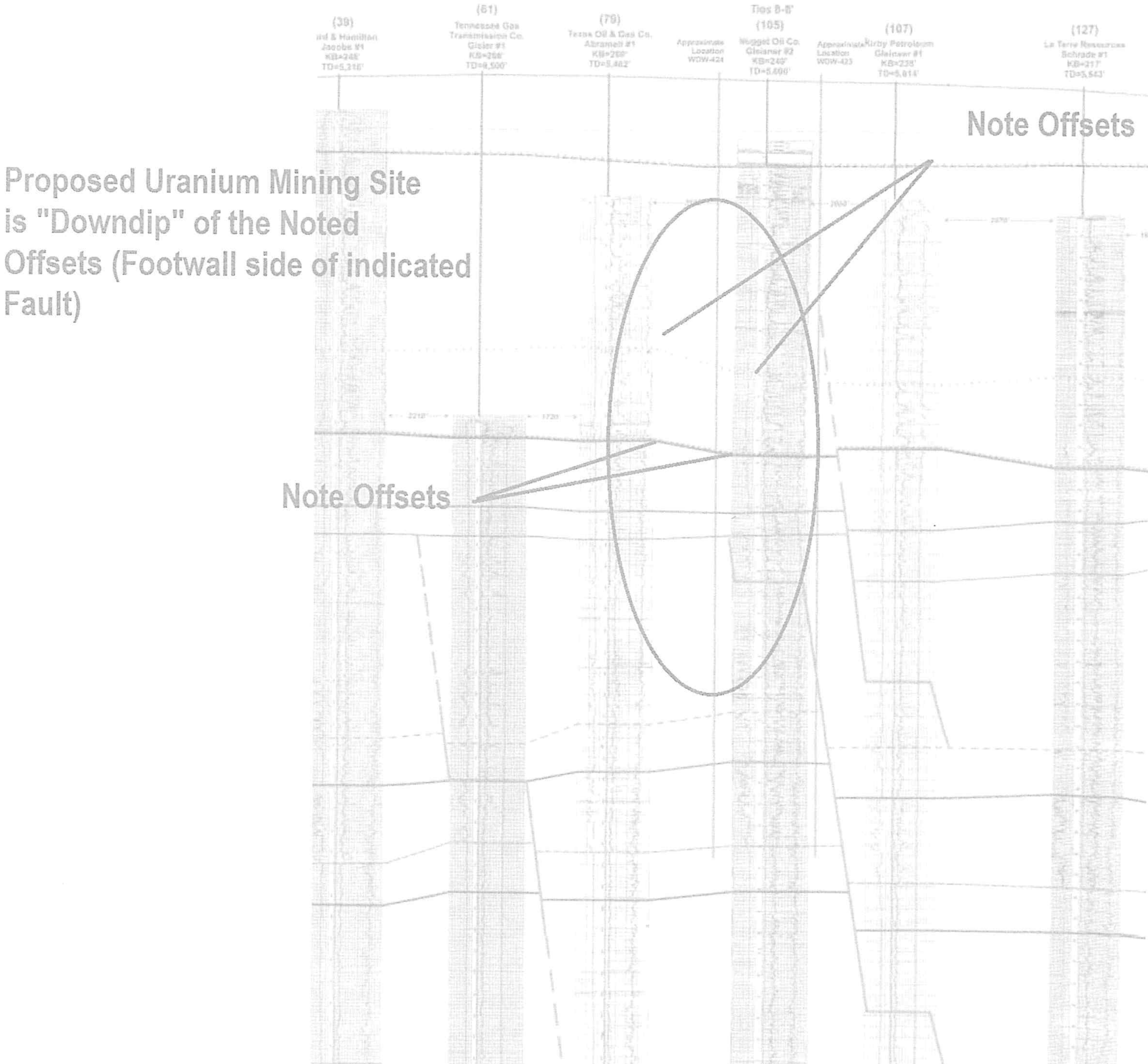

Proposed Uranium Mining Site is "Downdip" of the Noted Offsets (Footwall side of indicated Fault)
Note Offsets
Note Offsets
(39)
(61)
Tennessee Gas Transmission Co.
(79)
Texas Oil & Gas Co.
Approximate Location
(105)
Nugget Oil Co.
Approximate Location
(107)
Kirby Petroleum
(127)
La Terre Resources

WDW
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To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Public comment on Permit Number WDW423
Attachments: GWS Memo on UEC Permit Application.pdf

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Tuesday, July 19, 2022 8:46 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
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GROUND WATER
SOLUTIONS, LTD

12902 Bristolberry Drive
Cypress, TX 77429
Office: (281) 807-1101
Fax: (281) 807-1105
Cell: (832) 724-7457
Email: john@groundwater.cc

MEMORANDUM

To: Heather Sumpter
Terrell Graham
From: John Oneacre
Date: June 29, 2020
Subject: Technical Comments on Uranium Energy Corporation's (UEC) Permit Application

Heather and Terrell, I have researched the UEC documents as wells as geological and hydrogeological reports by the Texas Bureau of Economic Geology and the United States Geological Survey. I have summarized some key geological/hydrogeological considerations for your review.

1. **Geological Setting**
   a. The proposed UEC site is located in the South Texas Gulf Coast geological area. Figure V-3 of Terra Dynamics report presents the stratigraphic sequence from the most recent Quaternary deposits to the older Wilcox Group.
   b. Figure V-3 also shows the proposed injection zone in the Vicksburg Saline Aquifer.
   c. The confining zones include the Jackson Group (below) and the Catahoula Group (above) as shown on Figure V-3.
2. **Terra Dynamics Discussion of Geology**
   a. Terra Dynamics (Terra) provides summaries of the various geological units listed on Figure V-3 in Section V of its report.
   b. Terra mentions "lignite" in the Eocene Queen City Formation and Jackson Group; both lie below the proposed injection zone.

c. However, Terra does not discuss the significance of "lignite"; nor does Terra discuss source rocks for the oil and gas deposits. Terra provides a brief discussion of hydrocarbon production in Section V.B.6 Fault Transmissivity.

d. Terra noted that the UEC Area of Review (AOR) lies within the Wilcox Fault Zone (page V-19).

e. Terra gives two different numbers for faulting in the AOR.

   i. On page V-15, Terra discusses that two (2) minor faults are present to the northwest and southeast of the UEC injection well locations.

      1. According to Terra, the northwest fault has less than a 100-foot offset (less than the confining zone thickness).

      2. The southeast fault has, according to Terra, up to 150 feet of offset. Terra states that the southeast fault dies out within the lower Confining Zone.

   ii. On page V-17, Terra states, based upon the structure contour map, a total of four (4) faults can be mapped in the AOR.

      1. Terra states that two (2) northernmost faults ***appear*** to discontinue at the ***top*** of the Injection Interval. Up to nearly 200 feet of offset is noted for these faults.

      2. Terra does not provide additional discussion of the two (2) southernmost faults in this section.

   iii. Regarding fault transmissivity, Terra states that for faults in the Gulf Coast sediments, the faults are mainly sealing faults (i.e., inhibit flow along the faults) and cite Matthai and Roberts (1996) as a reference for reduced permeability along faults.

f. Terra states that that hydrocarbon producing wells are oriented and aligned along the strike of the faulting (page V-22).
   i. Terra states "this shows that the faults are the primary trapping mechanism for hydrocarbons in the UEC AOR and are sealing with respect to hydrocarbons".
   ii. However, in the very next sentence Terra states "it does not appear that significant stacking of reservoirs is present along the faults or in the AOR in general, which may suggest upward migration and charging of shallower reservoirs from deeper source rocks through the fault".
   iii. Hopefully, you see the glaring contradiction regarding movement along the faults.
   iv. Terra concludes: "...it is very unlikely that vertical migration of injected fluids from the Injection Interval through transmissive faults is a concern in the area of the facility".
   v. So, Terra says on the one hand, fluids will not migrate along faults; but, on the other hand, hydrocarbons migrated from deeper to shallower reservoirs along the faults. The faults therefore are not transmissive to fluids except hydrocarbons is the conclusion of this section of Terra's report.

3. **Ground Water Solutions Discussion of Terra' report**
   a. There are several key issues to discuss regarding the geology, hydrogeology, and structural geology of the AOR.
   b. First, on the list of key issues is the geology. Although Terra does not put emphasis on the source rocks for hydrocarbons, it is important to understand:
      i. Source rocks
      ii. Types of source rocks, such as shales or coal
      iii. Movement of hydrocarbon from deeper source rocks to shallower reservoir formations

c. The United States Geological Survey (USGS) produced a report in 2013 titled "Geologic Assessment of Undiscovered Oil and Gas Resources-Oligocene Frio and Anahuac Formations, United States Gulf of Mexico Coastal Plain and State Waters" (Swanson, Karlsen, and Valentine, 2013).

   i. In this report, the USGS provided a figure that presents the stratigraphy represented in the report along with those formations that are source rocks for oil and gas in the reservoir rocks (see Figure 1). For the large geographical area that includes Goliad County, the USGS identified the source rocks as Lower Tertiary; these source rocks include the Wilcox, Clairborne Group, Jackson, and Vicksburg. The types of source rocks from the Lower Tertiary include both shale and coal within those groups/formations.

   ii. The types of hydrocarbon found in the reservoir rocks include both oil and gas. Reservoir rocks include Miocene and Pliocene formations including the Oakville (Jasper), and Goliad Sand (Evangeline). These reservoir rocks, although down dip from Goliad County, have large vertical distances between the source rocks and reservoir rocks. The obvious question is how did the oil/gas migrate from the deeper Tertiary to the shallower Miocene and Pliocene?

      1. The USGS (2013) stated: "A number of studies indicated that migration of oil and gas in the Cenozoic (this includes all groups/formations from the Lower Eocene Wilcox to the Pliocene Goliad Sand) Gulf of Mexico basin primarily is vertical occurring along abundant growth faults associated with sediment deposition or along faults associated with salt domes

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Eargle, D.H., Dickinson, K.A., and Davis, B.O., 1975. South Texas uranium deposits: American Association of Petroleum Geologists Bulletin, v. 59, no. 5, p. 766-779.

Nehring, R., 1991. Oil and gas resources, in Salvador, A., ed., The Gulf of Mexico Basin: Boulder, Colo., Geological Society of America, The Geology of North America, v.J, p. 445-494.

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Lori Rowe

From:	PUBCOMMENT-OCC
Sent:	Thursday, May 26, 2022 11:09 AM
To:	PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject:	FW: Public comment on Permit Number WDW423
Attachments:	TCEQ Letter WDW423 7 WDW424 20222.pdf

WDW
119588

PM

From: gcgcd@goliadcogcd.org <gcgcd@goliadcogcd.org>
Sent: Tuesday, May 24, 2022 2:07 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: gcgcd@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached comments and request.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

May 24, 2022

Texas Commission on Environmental Quality (TCEQ)
Office of the Chief Clerk
MC-105
P.O. Box 13087
Austin, TX. 78711-3087

On January 15, 2020, UEC submitted an application to TCEQ for permit renewal for the construction of underground injection wells WDW423 and WDW424 for disposal of nonhazardous waste. The original permit was issued on May 25, 2010.

The mailing address, the listing of the Yorktown (Dewitt County) mayor, and the listing of Yorktown Memorial Hospital, could suggest that the location is in Dewitt County. The site however is in Goliad County and the many livestock and domestic wells that could be potentially contaminated are in Goliad County. Additionally, the Yorktown Memorial Hospital has been closed for 37 years and is an abandoned structure.

In the 28 months since the filing of this permit renewal, TCEQ has done an admirable job of reviewing the application. TCEQ has issued three individual listings of deficiencies. It does call in to question the quality level of the applicant.

A major issue associated with the location of these injection wells has not been vetted. The proposed location is near to two major faults. Do those faults provide a vertical conduit which can allow an injected fluid under pressure to contaminant the drinking water aquifer above?

There are several natural factors that strongly indicate that vertical transmission occurs. The presence of hydrogen sulfide odor at the water wells is noted. The deposition of uranium ore is in the top four aquifer water sands is another scientific indicator.

The attached memorandum dated June 29, 2020, prepared by Dr. John Oneacre for Goliad County Groundwater Conservation District (GCGCD) is a thorough evaluation of the geological features of the faults. This memorandum explores known features of the faults and previous technical evaluations. It is interesting to note that the technical information provided by Carothers in 2007 associated with the original uranium mining permits disagrees with the Terra information provided with the current permitting renewals. USGS and other researchers' evaluation of migration along growth faults also needs to be considered.

In summary, no technical data has been provided to verify the geology of these two close proximity faults. Further there is no provision provided to monitor the action of these faults if injection operation occurs. There is no assurance or protection provided to protect the drinking water produced from many domestic and livestock wells in the vicinity of those faults.

GCGCD requested a public meeting on July 26, 2021, and on April 22, 2022, to be held to discuss the deficiencies and concerns associated with these injection renewal permit applications. No response was given to GCGCD on the July 2021, request and GCGCD and has been awaiting a response to the April 22, 2022, request. Again, GCGCD is requesting a public meeting. The letters to TCEQ requesting the meetings are attached.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Cc.

Texas Senator Lois Kolkurst
P.O. Box 12068, Capitol Station
Austin, TX. 78711
District Address: 5606 North Navarro #300M
Victoria, TX. 77904

Representative Geanie W. Morrison
District 30
Room 1N.9
Austin, TX. 78768-2910
District Address: 1908 N. Laurent, Ste. 500
Victoria, TX. 77901

Lori Rowe

From:	PUBCOMMENT-OCC
Sent:	Thursday, May 26, 2022 11:12 AM
To:	PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject:	FW: Public comment on Permit Number WDW424

From: gcgcd@goliadcogcd.org <gcgcd@goliadcogcd.org>
Sent: Tuesday, May 24, 2022 1:14 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Conservation Sumpter

EMAIL: gcgcd@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached comments and request.

Michael O'Malley

From:	PUBCOMMENT-OCC
Sent:	Wednesday, May 4, 2022 9:21 AM
To:	PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject:	FW: Public comment on Permit Number WDW424
Attachments:	TCEQ Letter - WDW423 - WDW424 April 29, 2022.pdf

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Tuesday, May 3, 2022 11:00 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: 118 S MARKET ST
GOLIAD TX 77963-4345

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached request.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

April 29, 2022

Texas Commission on Environmental Quality
Office of the Chief Clerk
Mc-105
P.O. Box 13087
Austin, TX. 78711-3087

Re: Notice of Application and Preliminary Decision for Nonhazardous Waste Underground Injection Control Permit - WDW423 and WDW424

Goliad County Groundwater Conservation District (GCGCD) has received the above notice dated April 13, 2022, and is requesting a public meeting to be held. As a follow up, GCGCD previously requested a public meeting on July 26, 2021, on the same application for renewal and was not given a response.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Michael O'Malley

From:	PUBCOMMENT-OCC
Sent:	Wednesday, May 4, 2022 9:20 AM
To:	PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject:	FW: Public comment on Permit Number WDW423
Attachments:	TCEQ Letter - WDW423 - WDW424 April 29, 2022.pdf

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Tuesday, May 3, 2022 10:59 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: 118 S MARKET ST
GOLIAD TX 77963-4345

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached request.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

April 29, 2022

Texas Commission on Environmental Quality
Office of the Chief Clerk
Mc-105
P.O. Box 13087
Austin, TX. 78711-3087

Re: Notice of Application and Preliminary Decision for Nonhazardous Waste Underground Injection Control Permit - WDW423 and WDW424

Goliad County Groundwater Conservation District (GCGCD) has received the above notice dated April 13, 2022, and is requesting a public meeting to be held. As a follow up, GCGCD previously requested a public meeting on July 26, 2021, on the same application for renewal and was not given a response.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter
GCGCD General Manager

Michael O'Malley

From:	PUBCOMMENT-OCC
Sent:	Monday, May 2, 2022 3:25 PM
To:	PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject:	FW: Public comment on Permit Number WDW424
Attachments:	Letter to TCEQ WDW4232 WDW4241.pdf

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Monday, May 2, 2022 1:56 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see attached request.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

April 29, 2022

Texas Commission on Environmental Quality
Office of the Chief Clerk
Mc-105
P.O. Box 13087
Austin, TX. 78711-3087

Re: Notice of Application and Preliminary Decision for Nonhazardous Waste Underground Injection Control Permit - WDW423 and WDW424

Goliad County Groundwater Conservation District (GCGCD) has received the above notice dated April 13, 2022, and is requesting a public meeting to be held. As a follow up, GCGCD previously requested a public meeting on July 26, 2022, on the same application for renewal and was not given a response.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter
Heather Sumpter
GCGCD General Manager

Michael O'Malley

From: PUBCOMMENT-OCC
Sent: Monday, May 2, 2022 3:25 PM
To: PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject: FW: Public comment on Permit Number WDW423
Attachments: Letter to TCEQ WDW4232 WDW4241.pdf

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Monday, May 2, 2022 1:55 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see attached request.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

April 29, 2022

Texas Commission on Environmental Quality
Office of the Chief Clerk
Mc-105
P.O. Box 13087
Austin, TX. 78711-3087

Re: Notice of Application and Preliminary Decision for Nonhazardous Waste Underground Injection Control Permit - WDW423 and WDW424

Goliad County Groundwater Conservation District (GCGCD) has received the above notice dated April 13, 2022, and is requesting a public meeting to be held. As a follow up, GCGCD previously requested a public meeting on July 26, 2022, on the same application for renewal and was not given a response.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter
GCGCD General Manager

Michael O'Malley

From:	PUBCOMMENT-OCC
Sent:	Monday, May 2, 2022 3:11 PM
To:	PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject:	FW: Public comment on Permit Number WDW424
Attachments:	Letter to TCEQ April 2022.pdf

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Friday, April 29, 2022 10:16 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see the attached request.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Office of the Chief Clerk
Mc-105
P.O. Box 13087
Austin, TX. 78711-3087

Re: Notice of Application and Preliminary Decision for Nonhazardous Waste Underground Injection Control Permit - WDW423 and WDW424

Goliad County Groundwater Conservation District (GCGCD) has received the above notice dated April 13, 2022, and is requesting a public meeting to be held. As a follow up, GCGCD previously requested a public meeting on July 26, 2022, on the same application for renewal and was not given a response.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Michael O'Malley

From:	PUBCOMMENT-OCC
Sent:	Monday, May 2, 2022 3:10 PM
To:	PUBCOMMENT-RAD; PUBCOMMENT-ELD; PUBCOMMENT-OCC2; PUBCOMMENT-OPIC
Subject:	FW: Public comment on Permit Number WDW423
Attachments:	Letter to TCEQ April 2022.pdf

WDW
119588

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Friday, April 29, 2022 10:14 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: MS Heather Sumpter

EMAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see attached request for public meeting.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Office of the Chief Clerk
Mc-105
P.O. Box 13087
Austin, TX. 78711-3087

Re: Notice of Application and Preliminary Decision for Nonhazardous Waste Underground Injection Control Permit - WDW423 and WDW424

Goliad County Groundwater Conservation District (GCGCD) has received the above notice dated April 13, 2022, and is requesting a public meeting to be held. As a follow up, GCGCD previously requested a public meeting on July 26, 2022, on the same application for renewal and was not given a response.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Lori Rowe

From:	PUBCOMMENT-OCC
Sent:	Wednesday, August 25, 2021 1:54 PM
To:	PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject:	FW: Public comment on Permit Number WDW424
Attachments:	TCEQ WDW424 & WDW422 Request for Public Meeting.pdf

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Wednesday, August 25, 2021 9:44 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW424

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW424

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

E-MAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Request for public meeting attached.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Fred Duffy - Project Manager
Underground Injection Control Section
MC 233
P.O. Box 13087
Austin, TX. 78711-3087

Re: Application for Renewal of Class I Injection Well Permits WDW423 and WDW424
RN105304802 / CN60603228461

Goliad County Groundwater Conservation District (GCGCD) has received the above notice and is requesting a public meeting to be held.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Lori Rowe

From: PUBCOMMENT-OCC
Sent: Wednesday, August 25, 2021 1:54 PM
To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Public comment on Permit Number WDW423
Attachments: TCEQ WDW424 & WDW422 Request for Public Meeting.pdf

WDW
119588

PM

From: hsumpter@goliadcogcd.org <hsumpter@goliadcogcd.org>
Sent: Wednesday, August 25, 2021 9:43 AM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Heather Sumpter

E-MAIL: hsumpter@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Request for public meeting attached.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Fred Duffy - Project Manager
Underground Injection Control Section
MC 233
P.O. Box 13087
Austin, TX. 78711-3087

Re: Application for Renewal of Class I Injection Well Permits WDW423 and WDW424
RN105304802 / CN60603228461

Goliad County Groundwater Conservation District (GCGCD) has received the above notice and is requesting a public meeting to be held.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a public meeting based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Melissa Schmidt

From: PUBCOMMENT-OCC
Sent: Wednesday, July 28, 2021 4:09 PM
To: PUBCOMMENT-OCC2; PUBCOMMENT-OPIC; PUBCOMMENT-ELD; PUBCOMMENT-WPD
Subject: FW: Public comment on Permit Number WDW423
Attachments: TCEQ - WDW423 & WDW4241.pdf

WDW
119588

From: gcgcd@goliadcogcd.org <gcgcd@goliadcogcd.org>
Sent: Wednesday, July 28, 2021 2:15 PM
To: PUBCOMMENT-OCC <PUBCOMMENT-OCC@tceq.texas.gov>
Subject: Public comment on Permit Number WDW423

REGULATED ENTY NAME GOLIAD PROJECT

RN NUMBER: RN105304802

PERMIT NUMBER: WDW423

DOCKET NUMBER:

COUNTY: GOLIAD

PRINCIPAL NAME: URANIUM ENERGY CORP

CN NUMBER: CN603228461

FROM

NAME: Goliad County G Conservation District

E-MAIL: gcgcd@goliadcogcd.org

COMPANY: Goliad County Groundwater Conservation District

ADDRESS: PO BOX 562
GOLIAD TX 77963-0562

PHONE: 3616451716

FAX:

COMMENTS: Please see attached letter requesting a contested case.

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 26, 2021

Texas Commission on Environmental Quality
Fred Duffy - Project Manager
Underground Injection Control Section
MC 233
P.O. Box 13087
Austin, TX. 78711-3087

Re: Application for Renewal of Class I Injection Well Permits WDW423 and WDW424
RN105304802 / CN60603228461

Goliad County Groundwater Conservation District (GCGCD) has received the above notice and is requesting a contested case hearing for the permits.

GCGCD is charged with the protection, preservation, and conservation of the groundwater within its jurisdiction. GCGCD believes that there is reason to hold a contest case hearing based on research, information and documentation obtained to the possible negative effects to landowners and the aquifer.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

GOLIAD COUNTY GROUNDWATER CONSERVATION DISTRICT
118 S. Market St., P.O. Box 562, Goliad, Texas 77963-0562
Telephone: (361) 645-1716 Facsimile: (361) 645-1772
website: www.goliadcogcd.org | email: gcgcd@goliadgcd.org

July 27, 2020

Texas Senator Lois Kolkhorst
P. O. Box 12068
Capitol Station
Austin, Texas 78711-2068

Re: Notice Received from TCEQ of Injection Well Permit Renewal from UEC
Permit WDW423 and WDW424

On April 27, 2020 Goliad County Groundwater Conservation District (GCGCD) was notified by TCEQ of an application that was received from Uranium Energy Corp. (UEC) for permit renewals to authorize injection of non-hazardous wastewater generated from processing of ion exchange resin from in-situ uranium mining at a facility located at 14869 North Hwy 183 in Goliad County. You can find the notice enclosed within.

GCGCD hired an expert hydrogeologist to review the documentation submitted by UEC to TCEQ for the permit renewal process. The hydrogeologist reviewed the documentation from UEC and other geological and hydrogeological reports and has submitted his review and comments to GCGCD which points out concerns of the injection wells. One of those concerns is the proposed area lies within a fault zone. This concern, along with others, needs to be discussed at a public meeting with TCEQ and State and local Government Representatives.

GCGCD is formally requesting a public meeting be held as soon as possible to address the concerns of the proposed injection wells, and to inform affected landowners and concerned citizens.

Sincerely,

Heather Sumpter

Heather Sumpter
GCGCD General Manager

Cc.

Representative Geanie W. Morrison
District 30
Room 1N.9
P. O. Box 2910
Austin, TX 78768-2910

Texas Commission on Environmental Quality
Office of the Chief Clerk – MC 105
P.O. Box 13087
Austin, TX. 78711-3087

R.G Stanford LTD.
698 Stanford Lane
Victoria, TX. 77905

Evelyn Baldwin
13900 Hollow Green Dr.
Houston, TX. 77082

Gail Gilliland
1501 Goliad DR.
Arlington, TX. 76012

Glen Abrameit
6211 Wigton Dr.
Houston, TX. 77096

MAR G B Ranch, LLC
c/o Sydney Braquet
1324 Cortlandt Street #1
Houston, TX. 77008

Pam Long
358 E. FM 1961
Goliad, TX. 77963

Jo Nell Martin Life Estate
641 Crestview Dr.
Victoria, TX. 77905

Bonnie Schley
4945 Golly Road
Cuero, TX. 77954

Evan Kyle Lovett and Megan Lovett
208 Canterbury Lane
Victoria, TX. 77904

William David Cook
143 North U.S. Hwy 183
Yorktown, TX. 78164

Ted and Pam Long
358 E. FM 1961
Goliad, TX. 77963

Judge Mike Bennett
127 N. Courthouse Square
Goliad, TX. 77963

Texas Department of State
Health Services
7430 Louis Pasteur Dr.
San Antonio, TX. 78229

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

NOTICE OF RECEIPT OF APPLICATION AND INTENT TO OBTAIN NONHAZARDOUS WASTE UNDERGROUND INJECTION CONTROL PERMIT RENEWAL

PERMIT NOS. WDW423 and WDW424

APPLICATION. Uranium Energy Corp., 500 North Shoreline Boulevard, Suite 800N, Corpus Christi, Texas, an in-situ uranium mining business, has applied to the Texas Commission on Environmental Quality (TCEQ) for permit renewals to authorize injection of non-hazardous wastewater generated from the processing of ion exchange resin from in-situ uranium mining. The facility is located at 14869 North United States Highway 183, Yorktown, Texas 78164 in Goliad County, Texas. TCEQ received the application on January 23, 2020. The permit application is available for viewing and copying by appointment at the Goliad County Courthouse, 127 North Courthouse Square, Goliad, Texas 77963. The following link to an electronic map of the site or facility's general location is provided as a public courtesy and is not part of the application or notice: Goliad Project Map. For exact location, refer to application.

ADDITIONAL NOTICE. TCEQ's Executive Director has determined the application is administratively complete and will conduct a technical review of the application. After technical review of the application is complete, the Executive Director may prepare draft permits and will issue a preliminary decision on the application. **Notice of the Application and Preliminary Decision will be published and mailed to those who are on the county-wide mailing list and to those who are on the mailing list for this application. That notice will contain the deadline for submitting public comments.**

PUBLIC COMMENT/PUBLIC MEETING. **You may submit public comments or request a public meeting on this application.** The purpose of a public meeting is to provide the opportunity to submit comments or to ask questions about the application. TCEQ will hold a public meeting if the Executive Director determines that there is a significant degree of public interest in the application or if requested by a local legislator. A public meeting is not a contested case hearing.

OPPORTUNITY FOR A CONTESTED CASE HEARING. After the deadline for submitting public comments, the Executive Director will consider all timely comments and prepare a response to all relevant and material, or significant public comments. **Unless the application is directly referred for a contested case hearing, the response to comments, and the Executive Director's decision on the application, will be mailed to everyone who submitted public comments and to those persons who are on the mailing list for this application. If comments are received, the mailing will also provide instructions for requesting reconsideration of the Executive Director's decision and for requesting a contested case hearing.** A contested case hearing is a legal proceeding similar to a civil trial in state district court.

TO REQUEST A CONTESTED CASE HEARING, YOU MUST INCLUDE THE FOLLOWING ITEMS IN YOUR REQUEST: your name, address, phone number; applicant's name and permit number; the location and distance of your property/activities relative to the facility; a specific description of how you would be adversely affected by the facility in a way not common to the general public; a list of all disputed issues of fact that you submit during the comment period and, the statement "[I/we] request a contested case hearing." If the request for contested case hearing is filed on behalf of a group or association, the request must designate the group's representative for receiving future correspondence; identify by name and physical address an individual member of the group who would be adversely affected by the facility or activity; provide the information discussed above regarding the affected member's location and distance from the facility or activity; explain how and why the member would be affected; and explain how the interests the group seeks to protect are relevant to the group's purpose.

Following the close of all applicable comment and request periods, the Executive Director will forward the application and any requests for reconsideration or for a contested case hearing to the TCEQ Commissioners for their consideration at a scheduled Commission meeting. The Commission may only grant a request for a contested case hearing on issues the requestor submitted in their timely comments that were not subsequently withdrawn.

If a hearing is granted, the subject of a hearing will be limited to disputed issues of fact or mixed questions of fact and law that are relevant and material to the Commission's decision on the application submitted during the comment period.

MAILING LIST. If you submit public comments, a request for a contested case hearing or a reconsideration of the Executive Director's decision, you will be added to the mailing list for this application to receive future public notices mailed by the Office of the Chief Clerk. In addition, you may request to be placed on: (1) the permanent mailing list for a specific applicant name and permit number; and/or (2) the mailing list for a specific county. To be placed on the permanent and/or the county mailing list, clearly specify which list(s) and send your request to TCEQ Office of the Chief Clerk at the address below.

INFORMATION AVAILABLE ONLINE. For details about the status of the application, visit the Commissioners' Integrated Database at www.tceq.texas.gov/goto/cid. Once you have access to the CID using the above link, enter the permit number for this application, which is provided at the top of this notice.

AGENCY CONTACTS AND INFORMATION. **All public comments and requests must be submitted either electronically at** www.tceq.texas.gov/agency/decisions/cc/comments.html, **or in writing to the Texas Commission on Environmental Quality, Office of the Chief Clerk, MC-105, P.O. Box 13087, Austin, Texas 78711-3087.** Please be aware that any contact information you provide, including your name, phone number, email address and physical address will become part of the agency's public record. For more information about this permit application or the permitting process, please call the TCEQ's Public Education Program, Toll Free, at 1-800-687-4040 or visit their website at www.tceq.texas.gov/goto/pep. Si desea información en Español, puede llamar al 1-800-687-4040.

Further information may also be obtained from Uranium Energy Corp. at the address stated above or by calling Craig Wall at (361) 888-8235.

Issued: April 27, 2020

Goliad County Groundwater
Conservation District
P.O. Box 562
Goliad, TX. 77963

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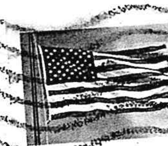
03 AUG 2020 PM



Texas Commission on Environmental Quality
Office of the Chief Clerk – MC 105
P.O. Box 13087
Austin, TX. 78711-3087

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