KELLY HART & HALLMAN LLP
301 CONGRESS AVENUE, SUITE 2000
AUSTIN, TEXAS 78701

Telephone: (512) 495-6400
Telecopy: (512) 495-6605
Writer's Direct Dial: (512) 495-6405
Email Address: monica.jacobs@khh.com

201 Main Street, Suite 2500
Fort Worth, Texas 76102
1000 Louisiana, Suite 4700
Houston, Texas 77002

November 1, 2010

Via Hand Delivery
Ms. LaDonna Castañuela, Chief Clerk
Texas Commission on Environmental Quality
12100 Park 35 Circle, Bldg. F
Austin, Texas 78753

Re: SOAH DOCKET NO. 582-09-3064/TCEQ DOCKET NO. 2008-1888-UIC
- consolidated with -
SOAH DOCKET NO. 582-09-6184/TCEQ DOCKET NO. 2009-1319-UIC
Reply to Exceptions re: Application of Uranium Energy Corp for Permit No. UR03075 and for Aquifer Exemption and for Production Area Authorization UR03075PAA1 in Goliad County, Texas

Dear Ms. Castañuela:

Enclosed for filing is the original and eight (8) copy of the following document:

- **APPLICANT URANIUM ENERGY CORP'S REPLY TO PROTESTANTS' EXCEPTIONS TO PROPOSAL FOR DECISION**

Please return a file-marked copy with our waiting courier. If you have any questions, please contact Monica Jacobs at the number listed above.

Sincerely yours,

Stacey Supak-Diaz
Legal Secretary to Monica Jacobs
Phone: (512) 495-6403

Enclosures
cc: Jim Blackburn
Rob Baiamonte
Shana Horton
Garrett Arthur
Pat Calhoun

TCEQ DOCKET NO. 2008-1888-UIC and SOAH DOCKET NO. 582-09-3064

APPLICATION OF	§	**BEFORE THE STATE OFFICE**
URANIUM ENERGY CORP	§	
FOR PERMIT NO. UR03075,	§	**OF ADMINISTRATIVE**
AND FOR AQUIFER EXEMPTION	§	
AND FOR PAA-1	§	**HEARINGS**
IN GOLIAD COUNTY, TEXAS	§	

APPLICANT URANIUM ENERGY CORP'S REPLY TO PROTESTANTS' EXCEPTIONS TO PROPOSAL FOR DECISION

COMES NOW Uranium Energy Corp ("UEC") and files this its Reply to the Exceptions to Proposal for Decision filed by Protestant Goliad County Groundwater Conservation District (the "District") and Protestant Goliad County (the "County"), and for same respectfully shows the Texas Commission on Environmental Quality (the "commission") the following:

INTRODUCTION

The Protestants raise a significant number of arguments in their Exceptions. Not surprisingly, the overwhelming majority of these arguments have already been briefed extensively and considered by Judge Wilfong (the "Administrative Law Judge" or "ALJ") as part of the contested case hearing process. Pleadings in this case have necessarily been lengthy. In recognition of and deference to the commission's role, however, the body of this Reply consists only of essential points and background rather than an exhaustive reiteration of the applicable evidence.

To accommodate the possibility that the commission may desire more information regarding some of the referred Issues, additional information regarding some of the Protestants' arguments is included as attachments.

As noted in UEC's Exceptions to the Proposal for Decision, there are only two points

upon which UEC respectfully disagrees with the ALJ's recommendations: the necessity for (1) more information regarding the Northwest Fault at this stage of the permitting process and (2) a recalculation of restoration surety before issuance of PAA-1. Significantly, UEC's disagrees only regarding the timing of these two recommendations, not their substance. In other words, UEC agrees and anticipates that it will be conducting additional pump tests involving the Northwest Fault as well as periodically updating financial surety; as explained in its Exceptions, UEC respectfully disagrees with the ALJ's findings that the appropriate time for these actions to occur is before issuance of the Mine Permit and PAA-1.

I.

UEC DID NOT FAIL TO SUBMIT DATA OR VIOLATE APPLICABLE RULES

In Sections I and II of its Exceptions, the County argues that because of UEC's conduct during the hearing process, UEC does not deserve the opportunity to provide additional evidence through remand or receive permits from the commission. These arguments are each incorrect for the following reasons.

A. UEC Did Not Violate 30 TAC § 80.17(a) Regarding Burden of Proof.

1. UEC's Burden of Proof

UEC more than met its burden of proof regarding the Issues and PAA-1 requirements under 30 TAC § 80.17(a). Under Section 27.051 of the Texas Injection Well Act, the commission "may grant an application in whole or in part and may issue the permit if it finds: 1) that the use or installation of the injection well is in the public interest; 2) that no existing rights, including, but not limited to, mineral rights, will be impaired; 3) that, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution; and 4) that the applicant has made a satisfactory showing of financial responsibility. ..."[1]

[1] TEX. WATER CODE ANN. § 27.051 (Vernon Supp. 2010).

In this case, the commission referred twenty-one disputed issues of fact (the "Issues"), which were raised in public comments, to SOAH for a contested case hearing.[2] Each of these Issues relate to one or more of the four ultimate findings required under Section 27.051(a). The twenty-one Issues, broken down by the ultimate statutory inquiry to which each most closely relates, are as follows:

a. Section 27.051(a)(1): Whether the use or installation of the injection well is in the public interest.

Issue A: Whether the use and installation of the injection wells are in the public interest under Texas Water Code §27.051(a). Public interest in regard to this issue includes whether UEC's mining operation or restoration activities will adversely impact the public interest by unreasonably reducing the amount of groundwater available for permitting by the Goliad County Groundwater Conservation District.

Issue B: Does the Applicant's compliance history require denial of the application under Texas Water Code § 27.051(e) and 30 TAC Chapter 60?

Issue K: Are local roadways sufficient to handle traffic to and from the proposed facility?

Issue M: Will the Applicant's proposed activities negatively impact livestock and wildlife, including endangered species?

Issue O: Will the Applicant's proposed activities adversely affect public health and welfare?

Issue U: Whether there is a "practical, economic and feasible alternative to an injection well reasonably available" within the meaning of that term as set forth in TWC § 27.051(d)(2).

b. Section 27.051(a)(2): Whether existing rights, including, but not limited to, mineral rights, will be impaired.

Issue N: Will the Applicant's proposed activities negatively impact the use of property?

[2] The commission rules provide that when the commission grants a request for a contested case hearing, it "shall issue an order specifying the number and scope of the issues referred to SOAH for a hearing." 30 TAC § 50.115(b).

c. Section 27.051(a)(3): Whether, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution.

Issue C: Does the application adequately and accurately describe baseline conditions of the groundwater in the proposed permitted area under applicable requirements of 30 TAC Chapter 331?

Issue D: Does the application meet all applicable criteria of 30 TAC § 331.122, related to required consideration by the Commission prior to issuing a Class III Injection Well Area Permit?

Issue E: Has the Applicant demonstrated that the proposed exempted aquifer meets the applicable criteria of 30 TAC § 331.13?

Issue F: Is the application sufficiently protective of groundwater quality?

Issue G: Does the application adequately characterize and describe the geology and hydrology in the proposed permit area, including fault lines, under the applicable rules?

Issue H: Do the geologic and hydraulic properties of the proposed permit area indicate that the Applicant will be able to comply with rule requirements?

Issue J: Is the application sufficiently protective of surface water quality?

Issue L: Whether UEC's proposal for restoration of groundwater to baseline levels as contained in the permit application is reasonable and adequate.

Issue P: Whether the proposed mining is in the recharge zone of the Gulf Coast Aquifer (Evangeline component).

Issue Q: Whether the Gulf Coast Aquifer is a confined aquifer in the areas of Goliad County where UEC will conduct UIC activities.

Issue R: Whether mining fluids will migrate vertically or horizontally and contaminate an USDW (underground source of drinking water).

Issue S: Whether there are any USDWs within the injection zones proposed by UEC.

Issue T: Whether any USDWs within Goliad County will be adversely impacted by UEC's proposed in situ uranium operations.

d. Section 27.051(a)(3): Whether the applicant has made a satisfactory showing of financial responsibility.

Issue I: Does the Applicant meet the applicable requirements for financial assurance under Texas Water Code §§ 27.051, 27.073, and 30 TAC Chapters 37

and 331?

To obtain a favorable finding on any of the twenty-one Issues referred to SOAH by the commission, UEC, as the applicant, has the burden of proof by a preponderance of the evidence.[3] UEC's ultimate burden, however, is to establish each of the four ultimate facts required by Section 27.051(a) by a preponderance of the evidence.

2. The ALJ's Findings

In the Proposal for Decision ("PFD"), the ALJ recommended findings favorable to UEC as to three of the ultimate issues under Section 27.051(a). First, with regard to whether the use or installation of the injection wells are in the public interest, the ALJ found as follows:

> Considering all the evidence, the ALJ concludes that the ED properly determined that UEC's Mine Application is in the public interest consistent with the policy of the state as defined by the Legislature.[4]

Second, with regard to whether UEC has made a satisfactory showing of financial responsibility, the ALJ found as follows:

> UEC satisfies the requirements for financial assurance under TEX. WATER CODE §§ 27.051 and 27.073, and 30 TAC chs. 37 and 331.[5]

Third, with regard to whether existing rights, including, but not limited to, mineral rights, will be impaired, the ALJ found as follows:

> The clear preponderance of the evidence proves that UEC's proposed uranium mining activities will not negatively impact the use of property.[6]

In addition, the ALJ recommended favorable findings on many of the referred Issues that relate to the remaining ultimate statutory issue – *i.e.*, whether or not, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution. Those

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[3] 30 TAC § 80.17(a).

[4] PFD, p. 24; *see also id.*, p. 22 ("The ALJ finds that UEC's proposed installation and use of Class III injection wells for *in situ* mining of uranium are in the public interest, in accordance with the criteria in TEX. WATER CODE § 27.051(a).").

[5] *Id.*, p. 57.

[6] *Id.*, p. 94; *see also id.*, p. 90 ("UEC's proposed *in situ* uranium mining activities will have no substantial negative impact on the use of property.").

favorable findings include:

> (Issue C) For purposes of the Mine Application the ALJ finds that the application adequately describes the baseline groundwater conditions.[7]
>
> (Issue D) The Mine Application satisfies the requirements of 30 TAC § 331.122.[8]
>
> (Issue E) The ALJ finds that the preponderance of the evidence supports the conclusion the UEC has demonstrated that the proposed exempted aquifer meets the applicable criteria of 30 TAC § 331.13.[9]
>
> (Issue J) UEC's Mine Application is sufficiently protective of surface water quality.[10]
>
> (Issue K) UEC's proposal for restoration of groundwater to baseline levels is reasonable and adequate, provided that the proposal for restoration is applied to achieve baseline water quality corresponding to the average of all three rounds of baseline sampling for all constituents.[11]
>
> (Issue P) UEC's proposed *in situ* uranium mining is not within the recharge [zone] of the Gulf Coast Aquifer (Evangeline component).[12]
>
> (Issue Q) The ALJ finds that the preponderance of the evidence confirms that Sands B, C, and D, are confined and Sand A is unconfined. Although no statute or rule prohibits *in situ* mining in an unconfined aquifer, the ALJ notes the ED's stated intention, if and when UEC submits a PAA application to mine Sand A, to fully evaluate the unconfined nature of Sand A and establish monitoring and operational requirements appropriate for that condition.[13]

As to the remaining referred Issues related to the protection of fresh water (Issues F, G, H, R and T), the ALJ also made many findings favorable to UEC, including:

> UEC's expert witnesses presented a wealth of information about the geology and hydrology of the area, including the areas within and surrounding the proposed

[7] *Id.*, p. 36; *see also id.*, p. 33 ("To the extent that the Class III application includes information regarding water quality for the purpose of providing a general idea of the quality of the water within the area that UEC proposes to mine, the Class III application adequately and accurately describes the pre-mining groundwater quality.").
[8] *Id.*, p. 36; *see also id.*, p. 39.
[9] *Id.*, p. 44; *see also id.*, p. 40 ("UEC has demonstrated that the proposed exempted aquifer meets the criteria of 30 TAC § 331.13.").
[10] *Id.*, p. 68.
[11] *Id.*, p. 76.
[12] *Id.*, p. 96.
[13] *Id.*, p. 108; *see also id.*, p. 104 ("Sand B, where UEC proposes to commence mining, and Sands C and D are confined.").

mine site.[14]

The preponderance of the evidence was that two faults exist within the proposed mine permit area: the Northwest Fault and the Southwest Fault.[15]

[With regard to] the location of the Northwest Fault . . . Dr. Bennett and his colleagues in the lineup of UEC experts were able to rely on public information about the stratigraphic offset of correlative beds as shown by the cross-sections of the local geology. Goliad County's questions raised questions about the accuracy and reliability of that information. But, neither the questions nor the evidence provided by Protestants were sufficient to overcome UEC's evidence on that point.[16]

UEC's proposed methods of confinement have long been supported by the ED and accepted by the Commission.[17]

The use of a bleed is well-established as a method of forcing mining solutions to seek a nearby and maintained down-gradient point of exit. . . . . [I]n the end, the Protestants' evidence was more in the nature of questions, challenges to sufficiency, rather than persuasive evidence that these methods were not sufficient. Thus, the ALJ concludes the preponderance of the evidence supports UEC's position, as supported by the ED's testimony.[18]

The use of monitor well rings is another of the well-established processes that have been used in other *in situ* mines in Texas. Although the parties similarly disagreed on some of the technical details associated with the monitoring of the data, UEC's evidence on this point was not effectively challenged by the Protestants.[19]

[With regard to] whether the boreholes compromised the natural protections of the existing geologic and hydrologic formations...., [t]he preponderance of the evidence is that the mine will be monitored carefully by UEC and will be subject to scrutiny by the ED during the initial phases of its development.[20]

The ALJ determined, however, that additional evidence should be developed to resolve the following: 1) whether the Northwest Fault is sealed or transmissive; and 2) if it is transmissive, whether, with proper safeguards, fresh water can be protected from pollution.[21]

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[14] *Id.*, p. 52.
[15] *Id.*, p. 53.
[16] *Id.*, pp. 53-54.
[17] *Id.*, p. 117.
[18] *Id.*, p. 117.
[19] *Id.*, p. 117.
[20] *Id.*, pp. 117-18.
[21] *Id.*, pp. 1-2; *see also id.* at p. 138.

The ALJ recommends that the commission remand this matter to SOAH for the limited purpose of allowing additional evidence on these issues. The County argues that this recommendation means that UEC has failed to meet its burden of proof and that the commission should, therefore, deny the Applications. As explained below, however, UEC has met its burden of proof. Moreover, even if the commission were to determine that additional evidence is needed, the Applications should not be denied, but rather should be remanded as recommended by the ALJ.

3. UEC Met Its Burden of Proof

As mentioned, the applicable standard of proof is the preponderance of the evidence standard.[22] The preponderance of the evidence means the greater weight and degree of credible evidence.[23] The standard does not require that a party establish a fact with absolute certainty or exclude every other possibility.[24] Rather, a party satisfies this burden of proof if, considering the circumstances and evidence as a whole, the ultimate fact sought to be established is reasonably probable.[25] "Satisfying a burden of proof necessarily involves weighing evidence. For a preponderance of the evidence, any evidence that tips the scales is sufficient."[26]

a. The Preponderance of the Evidence Establishes that the Northwest Fault Does Serve as a Barrier to Groundwater Flow

To characterize the geology and hydrogeology of the proposed mine permit area, the Mine Application (which was admitted into evidence) includes, among other things: regional hydrogeologic cross-sections;[27] permit-area cross sections;[28] potentiometric surface maps—both

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[22] 30 TAC § 80.17(a).
[23] *Upjohn Co. v. Freeman*, 847 S.W.2d 589, 591 (Tex. App.–Dallas 1992, no writ); *Davenport v. Cabell's Inc.*, 239 S.W.2d 833, 835 (Tex. Civ. App.–Texarkana 1951).
[24] *Benoit v. Wilson*, 239 S.W.2d 792, 797 (Tex. 1951); *McMillen Feeds, Inc. of Texas v. Harlow*, 405 S.W.2d 123, 130 (Tex. Civ. App.–Austin 1966, writ ref'd n.r.e.); *State Farm Mut. Auto. Ins. Co. v. Davis*, 576 S.W.2d 920, 921 (Tex. Civ. App.–Amarillo 1979, writ ref'd n.r.e.).
[25] *Benoit*, 239 S.W.2d at 797; *McMillen Feeds*, 405 S.W.2d at 130; *R&R Contractors v. Torres*, 88 S.W.3d 685, 695 (Tex. App.–Corpus Christi 2002, no pet.).
[26] *Montanez v. State*, 195 S.W.3d 101, 110 (Tex. Crim. App. 2006).
[27] Exhibit UEC-Holmes 13, at Chapter 6 (Figures 6.3, 6.5 and 6.6).
[28] *Id.* at Appendix C (Figures 6.7-6.13).

within each sand and for the region—that show the direction of groundwater flow;[29] structure and isopach maps for each of the four sands;[30] and gamma logs from each sand.[31] The Mine Application also includes narrative descriptions of the hydrology (Chapter 6) and geology (Chapter 7) of the proposed mine permit area, which are based upon the data described above.

Section 331.122 of the commission rules requires that mine applications include "a map showing the injection well(s) and area for which the permit is sought and the applicable area of review."[32] The rule further provides as follows: "The map should also show faults, if known or suspected. Only information of public record is required to be on this map."[33] In compliance with these requirements, the Mine Application includes project maps showing two faults in the proposed mine permit area.[34] In addition, the Mine Application includes a short narrative description of the structural geology of the faults:

> As indicated on previously referenced cross-sections and project maps, two strike oriented (southwest to northeast) normal faults are present in the permit area. It appears that both faults are high angle since no fault cuts were readily discernible within the log data reviewed. However, the faults are mapped based on stratigraphic offset of correlative beds as indicated on the cross-sections. The fault in the northwest portion of the project area is downthrown on the south side of the fault and demonstrates variable offset but generally indicates approximately 100 feet of displacement at the top of the Sand A structural surface (Figure 6.14).
>
> The fault in the southeast portion of the project area is downthrown on the north side of the fault and the two faults generally form a graben structure between them (Figure 6.12). The south fault also shows variable offset but generally about 60 feet of displacement at the top of the Sand A structural surface (Figure 6.14) is indicated.

Section 331.122 of the commission rules also requires that mine applications include a description of the hydrologic testing program proposed by the applicant.[35] In accordance with

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[29] *Id.* at Chapter 6 (Figures 6.22 and 6.23).
[30] *Id.* at Appendix C (Figures 6.14-6.21).
[31] *Id.* at Appendix B.
[32] 30 T.A.C. § 331.122(2)(A).
[33] *Id.*
[34] Exhibit UEC-Holmes 13, at Figure 1.3 and Figures 6.14-6.21.
[35] 30 T.A.C. § 331.122(2)(G).

that requirement, the Mine Application includes a description of the hydrologic testing program that UEC proposes to conduct in each proposed production area as part of the production area authorization application process.[36] The Mine Application description states that "aquifer pumping tests will be performed to determine the degree of hydrologic connection between aquifers, determine and locate any possible no flow or recharge boundaries (e.g. faults), and verify the hydraulic connection between the production zone monitor wells...."[37] The Mine Application does not (and is not required to) include the results of any such proposed hydrologic testing, and thus it does not address the issue of the transmissivity of either of the two identified faults. The information in the Mine Application and the information provided during the technical review process met the TCEQ's regulatory requirements regarding the delineation of these faults.[38]

In the contested case hearing, UEC submitted the testimony of nine experts in various subject areas in support of the Mine Application and the PAA-1 Application. One of these experts is Dr. Philip C. Bennett, a hydrogeologist and geochemist, who expressed opinions on a variety of matters related to the hydrogeology and geochemistry of the mine permit area. As part of his assessment of available data, Dr. Bennett expressed the opinion that the Northwest Fault is sealed with respect to both vertical and horizontal fluid movement. In his direct prefiled testimony, Dr. Bennett testified as follows:

> **Q: Will fluids migrate vertically along faults in the Mine Permit Area?**
> **A:** No. There is no evidence suggesting there is present-day movement of fluids along the faults mapped in the Mine Permit Area, and there is substantial data refuting this suggestion. While these faults may have transported fluids in the geologic past, all evidence today suggests these faults are sealed, and in fact may have lower permeability than the surrounding formations. UEC conducted the NW Fault Pump Tests very close to the Northwest Fault. Pump tests are a well established method for interrogating the subsurface environment for regions

[36] Exhibit UEC-Holmes 13, at Chapter 11.
[37] *Id.* at page 11-1.
[38] *See e.g.,* ED's Exceptions, pp. 6-7.

> of low or high permeability, and they are effective for detecting a leaking or sealing fault. During the NW Fault Pump Tests, when a well on one side of the fault was pumped, there was no response at all in the observation well located in the same sand but on the opposite side of the fault, and there was also no response in observation wells on the same side of the fault but in different sands. These tests thus show that the Northwest Fault is sealed with respect to both vertical and horizontal fluid movement.[39]

In his rebuttal prefiled testimony, Dr. Bennett elaborated on this opinion (which was challenged by the Protestants) and explained an additional basis for his opinion regarding the Northwest Fault's sealing nature:

> The water levels in wells above and below the NW Fault show a substantial decrease in static water level elevations along a NW to SE line across the NW Fault. ***All sand zones show a dramatic drop in water level across the fault***, with an extremely high gradient (change in water table elevation divided by distance). For the A-sand transect, the gradient approaches 0.2 across the fault, while the gradients on either side of the fault are all very small, as expected for a sandstone aquifer. ***This dramatic change*** in gradient is encountered in a *homogeneous* porous media aquifer, and ***would only occur across a low-permeability boundary such as a fault. Since there are no underground "water falls" in granular porous media, this very steep gradient located over the fault indicates a marked decrease in hydraulic conductivity*** (K). This is consistent with the stratigraphic interpretation of borehole logs on each side of the fault that show the permeable zones juxtaposed on confining zones across the fault (Cross-Section E-E'). My opinion ... is consistent with the actual data as well as peer-reviewed literature findings.[40]

During Dr. Bennett's cross-examination at the live hearing, the Protestants showed him one page of data in graph form taken from the 24-hour Northwest Fault pump test data. After noting numerous times that the graph indicated a malfunctioning transducer,[41] Dr. Bennett, who has seen the results of 100s of pump tests,[42] testified that the graph had no effect whatsoever on his opinion that all evidence suggests that the Northwest Fault is sealed.[43]

The Protestants also questioned Mr. David Murry, a geologist who provided expert

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[39] Bennett Direct Prefiled Testimony, p. 37, ll. 7-19.
[40] Issue G Rebuttal Testimony, Bennett, p. 9, l. 22—p. 10, l. 11 (emphasis added).
[41] Bennett Cross-Examination, Transcript, p. 910, ll. 5-6; p. 911, ll. 6-8; p. 912, ll. 21-22; p. 913, ll. 6-7; p. 914, ll. 1-2; p. 944, ll. 24-25; p. 946, ll. 5-6.
[42] *Id.* at p. 945, ll. 5-7.
[43] *Id.* at p. 989, ll. 13-20.

testimony on behalf of the Executive Director, about this same graph from the Northwest Fault pump test, despite the fact that Mr. Murry had offered no opinion regarding the transmissivity of the Northwest Fault in his prefiled testimony. Mr. Murry testified as follows regarding the graph:

> I guess, the only thing I would say is we -- I looked at this data right here over a few seconds. It *seems* that, yes, that's what it *appears* to be that there is a response in "C." The only thing I can tell you is that graphs -- that's one of the most messy graphs I've ever seen. But *based on what I was shown here*, yes, it *appears* that there is communication in "C" across the fault.[44]

The Protestants did not ask Mr. Murry about the water levels or peer-reviewed literature relied upon by Dr. Bennett in forming his opinion regarding the sealing nature of the Northwest Fault.

The ALJ found both Dr. Bennett and Mr. Murry to be credible witnesses. Thus, to determine what the preponderance of the evidence shows regarding the transmissivity of the Northwest Fault, the commission must examine the weight and degree of both witnesses' testimony. Given the straightforward nature of Dr. Bennett's testimony as compared to the qualified nature of Mr. Murry's testimony, given the fact that Dr. Bennett's opinion is based upon water level data that is completely independent of any pump test data, and given the fact that Dr. Bennett's opinion is based upon peer-reviewed literature findings, the greater weight and degree of credible evidence points to the Northwest Fault being sealing – *i.e.*, serving as a barrier to the flow of groundwater.

b. The Preponderance of the Evidence Establishes that, Regardless of Whether the Northwest Fault Is Transmissive or Sealing, Fresh Water Will Be Protected from Pollution

Perhaps more importantly, the preponderance of the evidence establishes that, regardless of whether the Northwest Fault is transmissive or sealing, fresh water will be protected from pollution. As mentioned, under Section 27.051(a), to grant an injection well permit, the

[44] Murry Cross-Examination, p. 1342, ll. 7-14 (emphasis added).

commission must find "that, with proper safeguards, both ground and surface fresh water can be adequately protected from pollution."[45] One of the express purposes of Chapter 331 of the commission rules, and the focus of the vast majority of its provisions, is establishing those "proper safeguards."[46] One such safeguard is the prohibition against the conducting of any mining operations in any production area unless and until the commission has issued a production area authorization for that area.[47] Another such safeguard is the requirement that an application for a production area authorization must include the results of hydrologic testing, which, in this case, for any production area that involves the Northwest Fault, must be designed to investigate the horizontal and vertical transmissivity of the Northwest Fault.[48]

The preponderance of the evidence—in fact, the undisputed evidence—establishes that UEC cannot conduct any mining operations in any production area involving the Northwest Fault unless and until UEC designs and installs a monitor well system around the production area, conducts pump tests designed to investigate the vertical and horizontal transmissivity of the Northwest Fault and to show that the monitor well system is in hydraulic communication with the area to be mined, submits the results of the pump test as a part of a PAA application, and obtains a PAA from the commission.[49]

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[45] TEX. WATER CODE ANN. § 27.051(a)(3) (Vernon Supp. 2010).

[46] 30 TAC § 331.1(a) ("The purpose of this chapter is to implement the provisions of the Injection Well Act, Texas Water Code, Chapter 27, as it applies to the commission. The implementation shall be consistent with the policy of this state to: maintain the quality of fresh water in the state to the extent consistent with the public health and welfare and the operation of existing industries, taking into consideration the economic development of the state; prevent underground injection that may pollute fresh water; and require the use of all reasonable methods to implement this policy.").

[47] ED Exhibit 10, Response 25, p. 20 (explaining that a production area authorization "is needed to mine an ore body within a permit area"); Holmes Direct Testimony, p. 15, ll. 4-8.

[48] ED Exhibit 10, Response 25, p. 20 (citing 30 TAC § 305.49(B)(6)); Exhibit UEC-Holmes 40, p. 8 (providing instructions for a PAA application technical report); Executive Director Exhibit 4.

[49] ED Exhibit 10, Response 25, p. 20 (citing 30 TAC § 305.49(B)(6)); Exhibit UEC-Holmes 40, p. 8 (providing instructions for a PAA application technical report); Executive Director Exhibit 4.

4. Even if the Commission Determines that Additional Evidence is Needed, the Applications Should Not Be Denied, but Rather Should be Remanded

As explained above, UEC has met its burden of proof. As a result, the Applications should be granted without the delay and expense of a remand. However, even if the commission determines that additional evidence is needed, the Applications should not be denied, but rather should be remanded as recommended by the ALJ.

Section 2003.047(m) of the Administrative Procedure Act provides that, following the issuance of a proposal for decision, the commission may "refer the matter back to the administrative law judge to reconsider any findings and conclusions set forth in the proposal for decision or take additional evidence or to make additional findings of fact or conclusions of law."[50] The statute sets no limitations on the commission's authority to order such a remand. The commission's own rules likewise provide that "[t]he commission, on the motion of any party or on its own motion, may order the judge to reopen the record for further proceedings on specific issues in dispute."[51]

Thus, the commission has express statutory authority and discretion under its own rules to remand this matter to SOAH for the taking of additional evidence related to the transmissivity of the Northwest Fault, should it deem such additional evidence to be necessary at this stage in the permitting process. Given the fact that pump tests are not and have not been required by TCEQ for mine applications, in this case, both the law and equity support such a remand in lieu of denial of the Applications.

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[50] TEX. GOV'T CODE ANN. § 2003.047(m).

[51] 30 TAC § 80.265 ("The commission, on the motion of any party or on its own motion, may order the judge to reopen the record for further proceedings on specific issues in dispute. The commission's order shall include instructions as to the subject matter of further proceedings and the judge's duties in preparing supplemental materials or revised orders based upon those proceedings for the commission's adoption.").

B. Counsel for UEC Did Not Violate Texas Code of Professional Responsibility Rule 3.04(b)

The County's counsel is correct that it would indeed be reprehensible if counsel for UEC violated Rule 3.04(b) in offering Mr. Craig Holmes as an expert witness; fortunately, such a violation did not occur. It should also be noted that Mr. Holmes did not liquidate his stock options, as asserted by the County.[52] Instead, Mr. Holmes surrendered them, giving up a portion of his compensation for past work on UEC's behalf in an effort to remove any possible question regarding his credibility; contrary to the County's statement, he received no remuneration for the divested stock options.[53]

Further details from the evidentiary record regarding Mr. Holmes' thirty years of expertise in uranium mining permitting and his extensive work on UEC's applications—including the (literally) voluminous applications for a Radioactive Material License and Class I Disposal Wells—is contained in Attachment 1. Regardless, on virtually every substantive point, the accuracy of Mr. Holmes' testimony and his professional credibility in his field of expertise has been backed-up or confirmed by either another expert witness, documentation, or in the case of aquifer exemptions, EPA's own written interpretation.[54]

Finally, as the commission knows, "[i]n a contested case hearing, the ALJ is the sole judge of witness credibility and is free to accept or reject the testimony of any witness . . . ."[55] In this situation, Judge Wilfong had the opportunity to observe Mr. Holmes' extensive cross-examination at hearing, which lasted more than a full day, as well as to consider the consistency of his opinions with those of other credible experts. UEC respectfully suggests that Judge Wilfong's decision to utilize Mr. Holmes' testimony in making his findings should be afforded

[52] County's Exceptions, p. 7.
[53] Holmes Cross-Examination, Transcript, p. 243, ll. 2-11; p. 290, ll. 11-20.
[54] *See infra* at Part II.E.
[55] *Granek v. Texas State Bd. of Medical Examiners*, 172 S.W.3d 761, 778 (Tex. App.-Austin 2005, no pet.; *Southern Union Gas Co. v. Railroad Comm'n*, 692 S.W.2d 137, 141-42 (Tex. App.-Austin 1985, writ ref'd n.r.e.).

deference.

C. UEC Did Not Violate 30 TAC § 305.125(19)

Finally, the County claims that UEC violated Section 305.125(19) by failing to "formally submit"[56] water quality data and pump test data to TCEQ "that was contrary to representations in the application."[57] The County's claim that UEC violated 30 TAC § 305.125(19) is incorrect for two reasons.

1. UEC Did In Fact Provide the Water Quality Data and Pump Test Information to TCEQ

First, it is noteworthy that Mr. Murry could not have considered the second and third rounds of water quality data as part of his review of UEC's Mine Application because these sampling events occurred after the Mine Application had been sent to SOAH.[58] In fact, however, UEC did provide the water quality data in question to TCEQ as part of discovery.[59] Similarly, Mr. Murry testified quite clearly regarding the Northwest Fault pump tests that although "those pump tests were not submitted as part of either the Class 3 application, ***which wouldn't be required***, or as part of the PAA Application,"[60] he had seen the 24-hour pump test data before the hearing as it "was submitted as part of discovery."[61] The key excerpts from Mr. Murry's testimony are included in Attachment 1.

Furthermore, the County's complaints regarding UEC's failure to "formally" submit the information to TCEQ is disingenuous; any attempt by UEC to do so would have given rise to complaints by the Protestants that they were facing moving targets and/or that UEC was unfairly bolstering its Applications after-the-fact.

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[56] County's Exceptions, p. 6.
[57] County's Exceptions, p. 3.
[58] *See* Exhibit Goliad County-Sass 12; UEC's Closing Argument, Part I.A.7, p. 4.
[59] County's Exceptions, p. 7.
[60] Murry Cross-Examination, Transcript, p. 1333, l.25—p. 1334, l. 17 (emphasis added).
[61] Murry Cross-Examination, Transcript, p. 1336, l.18—p. 1337, l.2.

2. Neither the Water Quality Data Nor the 24-Hour Pump Test Are "Contrary" to UEC's Applications

As experts in the geochemistry of uranium and radium, Dr. Bennett and Dr. Daniel Erskine, testified that none of the three rounds of water quality data are more or less valid than the others.[62] The second and third sets are not contrary to the first; they are simply reflective of natural conditions in the aquifer at different points in time. And since there are no claims made in the Mine Application regarding the sealed or unsealed nature of either the Northwest or Southeast faults,[63] the 24-hour pump test cannot be contrary to the Application, regardless of how one interprets the results.

The County's arguments under Part III of its Exceptions regarding baseline water quality and the Northwest Fault are addressed below in the discussions regarding Issues C and G respectively.

II.

REPLY TO EXCEPTIONS REGARDING THE MINE APPLICATION (ISSUES A-U)

A. Issue A: Whether the use and installation of the injection wells are in the public interest under Texas Water Code §27.051(a). Public interest in regard to this issue includes whether UEC's mining operation or restoration activities will adversely impact the public interest by unreasonably reducing the amount of groundwater available for permitting by the Goliad County Groundwater Conservation District.

1. The District's Exceptions

The District predicts the following scenario:

> [The District] recognizes that it may not have any authority to restrict groundwater use within the proposed permit area, but it certainly has such authority outside the permit area. That is [the District's] concern. If water tables drop outside the permit area [the District] will be forced to reduce groundwater permitting surrounding the proposed permit area. This is not in the public interest. [The District] will manage the groundwater, to the best of its ability, on a sustainable basis to the detriment of the surrounding landowners if the

[62] Erskine Cross-Examination, Transcript, p. 136, ll. 9-23; p. 138, ll. 1-19; p. 140, ll. 17-23; p. 141, ll. 6-16; Bennett Cross-Examination, Transcript, p.843, l. 5 – p. 844, l. 6; p. 845, ll. 4-8.
[63] *See* Exhibit UEC-Holmes 13.

circumstances require it to do so.[64]

Said another way, without regard to the amount of groundwater actually available for permitting, the District suggests that it can and will restrict the pumping rights of landowners adjacent to the proposed Mine Permit Area. The District also states that the ALJ incorrectly applied the rule of capture. The District is mistaken on both counts.

a. The ALJ Correctly Applied Existing and Applicable Groundwater Law

Regarding this Issue, the ALJ stated:

> [T]he ALJ finds that it is contrary to legislative intent and principles of statutory interpretation to interpret a more general statutory requirement, like the public interest, to override more specific law—such as the rule of capture and the exemption from groundwater conservation district regulation of groundwater use for *in situ* mining.[65]

Instead of viewing either the rule of capture or the groundwater districts' legislatively mandated modification of the rule in isolation, the ALJ correctly applied them both in light of the Chapter 36 exemption for in situ uranium mining: where districts have regulatory authority, their powers modify the rule of capture; in instances where the districts have no regulatory authority, however—such as with in situ uranium mining, oil and gas production, and sulphur production[66]--the rule of capture still applies.

b. The District's Assertions Regarding Groundwater Availability Contravene Its Own Management Plan

Under Chapter 36 of the Texas Water Code, all groundwater conservation districts are required to develop a groundwater management plan setting forth, among other things, estimates of the projected water supply and demand for water within the district according to the most recent state water plan.[67] The Management Plan developed and adopted by the District projects

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[64] District's Exceptions, p. 2.
[65] PFD, p. 25.
[66] *See* TEX. WATER CODE ANN. § 36.117(l) (Vernon 2008).
[67] TEX. WATER CODE. ANN. § 36.1071(e) (Vernon 2008).

that 800 acre-feet per year will be used for uranium mining and exploration,[68] which is almost ***four times*** the amount that UEC projects it would use on an annual basis.[69] Even with this inflated projection, the District's own Management Plan further predicts that both the City of Goliad and the rural area of the county "will have adequate water supplies" to meet the projected demands.[70]

c. The District Cannot Legally Penalize Property Owners Outside the Mine Permit Area to Compensate for Perceived Shortages

As the court of appeals held in *South Plains Lamesa Railroad, Ltd. v. High Plains Underground Water Conservation Dist. No. 1*, under the Texas Constitution, a groundwater conservation district "has only such powers and authority as 'may be conferred by law.' "[71] Moreover, the power of a groundwater conservation district "is limited by the terms of applicable statutes authorizing its creation and a district can exercise no authority that the Legislature has not clearly granted."[72] For several reasons, the District lacks the authority to indirectly regulate the amount of groundwater used by UEC's production and injection wells as it plans to do – *i.e.*, by restricting the pumping rights of landowners adjacent to the mine permit area.

First, as already mentioned, injection and production wells for in situ uranium mining are expressly exempt from Chapter 36 and, thus, from the jurisdiction of groundwater conservation districts pursuant to Section 36.117(l).[73] Moreover, Texas courts have repeatedly held that one may not accomplish indirectly what a statute prohibits him from doing directly.[74] Second, the

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[68] *See* Exhibit GCGCD-Dohmann "A", at p. 13.
[69] Issue A Rebuttal Testimony, p. 13, l. 22 – p. 14, l. 6.
[70] *See* Exhibit GCGCD-Dohmann "A", at p. 18.
[71] 52 S.W.3d 770, 776 (Tex. App. – Amarillo 2001, no pet.) (citing Tex. Const. Art. XVI, § 59(b)).
[72] *Id.* (citing *Tri-City Fresh Water Supply Dist. No. 2 v. Mann*, 142 S.W.2d 945, 948 (Tex. 1940)).
[73] TEX. WATER CODE ANN. § 36.117(l) (Vernon 2008).
[74] *Daughters of Charity Health Servs. v. Linnstaedter*, 226 S.W.3d 409, 410 (Tex. 2007) (holding that because hospitals are prohibited by statute from suing patients for the difference between the hospital's rates and the discounted workers' compensation rates, they cannot accomplish indirectly -- by filing a lien against patients' tort recovery -- what they could not do directly by filing suit); *West Orange-Cove Consol. I.S.D. v. Alanis*, 107 S.W.3d 558, 600 (Tex. 2003) ("This Court has repeatedly held that the State

District has not promulgated a rule allowing it to indirectly regulate groundwater used by exempt wells as it proposes. As a result, the District has no authority to implement such a regulation. As the court of appeals held in *South Plains Lamesa*:

> Because section 36.002 requires that regulation of groundwater ownership rights must be by rule promulgated by the District, not discretionary decisions, the District did not have the authority to implement such regulation without a rule adopted after public notice and public hearing are required by Section 36.101(b).[75]

Third, under Chapter 36, the District lacks authority to promulgate such a rule. Although Chapter 36 authorizes a groundwater conservation district to regulate groundwater production by limiting the amount of water produced, it also places express limitations on that authority. As the Texas Supreme Court recently explained in *Guitar Holding Co., L.P. v. Hudspeth County Underground Water Conservation Dist. No. 1*,[76] limitations on pumping rights "may be imposed on new permit applications, ***but only when done uniformly***" so that all new uses are "***treated equally***."[77] As a result, the District lacks authority to single out an adjacent landowner (or several adjacent landowners) to offset exempt or excessive groundwater usage by a third party.

2. The County's Exceptions

The County begins by asserting that the ALJ did not equally weigh the negative aspects of mining with the positive aspects. On its face, this assertion is absurd. The ALJ spent six pages of the PFD summarizing the Protestants' arguments regarding the public interest—not surprisingly, these arguments exclusively concerned alleged negative aspects of uranium mining.

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may not accomplish indirectly what it is prohibited from doing directly."); *City of Univ. Park v. Van Doren*, 65 S.W.3d 240, 248 (Tex. App. – Dallas 2001, pet. denied) ("But the City may not accomplish indirectly what it cannot do directly."); *Christie v. Harris County Fresh Water Supply Dist. No. 23*, 317 S.W.2d 219, 226 (Tex. Civ. App. – Waco 1958, writ ref'd n.r.e.) (""As in other cases where it is sought to do indirectly what cannot be done directly, it is the policy of the law to look beyond the face of the transaction and to hold unlawful any agreement having the effect of avoiding the statutory prohibition.'").

[75] 52 S.W.3d at 781.

[76] 263 S.W.3d 910 (Tex. 2008).

[77] *Id.* at 917-18 (emphasis added) (citing TEX. WATER CODE ANN. § 36.113(e) (Vernon 2008)); *see also* TEX. WATER CODE ANN. § 36.101(a) (requiring groundwater conservation districts "to develop rules that are fair and impartial").

In addition, the ALJ specifically stated that he considered all of the evidence in reaching an opinion regarding Issue A.[78]

The County then asserts that the viability of nuclear power is unclear. Not only is there no evidence in the record that would support this assertion, but the County itself supplied evidence to the contrary. The County introduced a United States Geological Study ("USGS") report authored by Susan Hall (the "Hall Study") as one of the studies relied on by its hydrogeologist. Among other things, the Hall Study describes the history of uranium mining in Texas and highlights the importance of the uranium mining industry in meeting national energy demands and moving the United States toward energy independence.[79] The Hall Study states that the United States has been steadily producing uranium using uranium in-situ recovery mining since the mid-1970s,[80] and that "Texas has been the location of the greatest number of uranium in-situ recovery (ISR) mines in the United States."[81] The study reports that despite the fact that thirty-eight percent of U.S. uranium reserves are amenable to in situ mining, the United States still imports eighty-two percent of its uranium.[82] The study concludes, therefore, that "the safe and effective use of ISR technology in mining uranium deposits is a potentially critical element in the movement towards energy independence in the United States."[83]

Next, the County contends that in the legislatively-mandated balancing of interests, the preservation of clean water is at least as—and perhaps more—valuable than the recovery of uranium.[84] First, evidence shows (and County exceptions acknowledge) that the water in and around uranium ore bodies is not "clean."[85] Second, the Texas Legislature has already weighed

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[78] PFD, p. 24.
[79] Exhibit Goliad County-Darling 12, at pp. 1 & 4.
[80] *Id.* at p. 4.
[81] *Id.* at p. 1.
[82] *Id.* at p. 4.
[83] *Id.*
[84] County's Exceptions, p. 28.
[85] Galloway Direct Testimony, p. 26, ll. 6-15; Executive Director Exhibit 10, p. 83, Response 140;

in regarding the balancing of water supply versus energy recovery. The Legislature has not only recognized that the development of the state's energy-producing natural resources is in the public interest,[86] but by expressly exempting production or injection wells drilled for oil, gas and uranium from the jurisdiction of groundwater conservation districts, the Legislature has clearly indicated how potential conflicts between these two competing public interests should be resolved in situations where there are proper safeguards in place.

In a similar vein, the County explicitly asserts that TCEQ staff also failed to consider the negative aspects of mining in its review of the Mine Application. What the County seems determined to ignore is that, as the ALJ notes, "[t]he rules clearly require a balancing approach,"[87] and Mr. Murry testified that he reviewed the Mine Application to ensure that UEC would meet all applicable regulatory requirements.[88] Since the balancing of potential negative effects of mining with recovery of uranium is inherent in the rules, TCEQ staff had to have considered potential negative aspects in the course of its technical review of the Mine Application.

The County also states that there are other sites in Texas that are better suited to uranium mining. This assertion is interesting because the record is devoid of any evidence regarding any other potential sites—good or bad. Regardless, as both the language of the statute and TCEQ contested case precedent make clear, Section 27.051(d) requires TCEQ to consider whether there is an alternative ***to the installation and use of an injection well,*** not whether there are ***alternative locations*** for the injection well. For example, in *Application of Pilgrim's Pride*

Bennett Direct Testimony, p. 32, l. 21 – p. 33, l. 6.

[86] See TEX. WATER CODE ANN. § 36.117 (Vernon 2008); *see also* Tex. Const. art. XVI, § 59 (declaring that "[t]he conservation and development of all of the natural resources of this State" ... [are] public rights and duties"); *Berkeley*, 282 S.W.3d at 244 (recognizing increased capacity for oil and gas production as a public interest factor that favors the granting of a permit for a salt water disposal injection well).

[87] PFD, p. 24.

[88] Murry Cross-Examination, Transcript, p. 37, l. 25—p. 38, l. 7.

Corp. for Permit Nos. WDW-352, WDW-353, WDW-354, WDW-355, WDW-356, and WDW-357,[89] the applicant sought six permits to inject nonhazardous wastewater that would be generated by a planned poultry processing and rendering facility. The protestants argued that the proposed injection wells "could be located somewhere else, away from their property."[90] In a proposal for decision that was adopted by TCEQ, the ALJ responded as follows:

> Of course, there are many other locations where the wells could be built. However, the ALJ concludes that neither the Commission nor [the applicant] is required to endlessly consider other potential locations. Water Code § 27.051 (d) directs the Commission to consider whether there is an alternative to "an injection well," not an alternative to the proposed injection well location.[91]

Finally, the County concludes that the ALJ did not analyze whether the first round of groundwater samples was in fact representative of the groundwater within the "proposed mining boundary."[92] The County overlooks the fact that the ALJ could not have reached some of his other findings without finding that the first round of samples was just as representative as the other sample sets. For example, the ALJ recommended that the three rounds of sample data be averaged to arrive at restoration table values. If the ALJ believed that the first round of data was somehow invalid or not representative, he would have either excluded the first round of data or recommended that it be given lesser weight than the other two data sets rather than recommending that the three sets be simply averaged. One finding is inherent in the other.

B. Issue B: Does the Applicant's compliance history require denial of the application under Tex. water Code § 27.051(e) and 30 TAC Chapter 60?

The District filed no exceptions regarding Issue B. The County, however, complains 1)

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[89] SOAH Docket No. 582-99-1864, TCEQ Docket No. 1999-0421-UIC (June 4, 2003) (proposal for decision) (hereinafter, the "Pilgrim's Pride Proposal for Decision"); TCEQ Order Issuing Permit Nos. WDW-352, WDW-353, WDW-354, WDW-355, WDW-356, and WDW-357 to Pilgrim's Pride Corp., TCEQ Docket No. 1999-0421-UIC, SOAH Docket No. 582-99-1864 (Aug. 28, 2000) (hereinafter, the "Pilgrim's Pride Order Approving Applications."). In its Closing Argument, UEC asked the ALJ to take official notice of the Pilgrim's Pride Proposal for Decision and Order Approving Applications. UEC's Closing Argument, p. 151.

[90] Pilgrim's Pride Proposal for Decision, p. 39.

[91] *Id.*

[92] County's Exceptions, p. 28.

that "no evidence was presented by UEC that corrective action was taken towards unplugged boreholes;"[93] and 2) that UEC's "extensive list of regulatory violations" impacted groundwater quality.[94] Both of these assertions are incorrect.

1. The Evidentiary Record Contains Extensive Evidence Regarding Corrective Action

The County described the violation regarding borehole plugging cited by the Railroad Commission of Texas ("RCT") in its Closing Argument:

> Finally, UEC was cited for "fail [ure] to properly install a cement surface plug" on five boreholes. The Inspector was only able to locate fourteen boreholes, but "of the fourteen boreholes located, five were found to be open to the surface with the cement plug estimated to be greater than 20 feet below the surface." In other words, 36% of the inspected boreholes were found without a *surface* plug as required by Permit 123 and 16 T.A.C. § 11.138.[95]

Obviously, a cement plug that has fallen back into a borehole or that comes too close to the surface as was also described in RCT's Notice of Violation[96] and failure to plug a borehole entirely are two completely different conditions. And far from presenting "no evidence" of corrective action, UEC submitted 185 pages of official records from the RCT as a part of its prefiled rebuttal testimony.[97] The RCT records conclusively establish that, upon issuance of the NOV, UEC promptly undertook corrective action to remedy the issues identified therein.[98]

Specifically, on June 12, 2007, at UEC's request, the RCT made a site visit to assess UEC's corrective actions.[99] The RCT confirmed that remedial action taken by UEC was satisfactory and set up a full inspection visit for June 18, 2007.[100] On that date, the RCT conducted a full on-site inspection and verified that all remedial action required under the NOV

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[93] County's Exceptions, p. 29.
[94] County's Exceptions, p. 30.
[95] County Closing Argument, Part II.B, p. 17 (emphasis added).
[96] UEC's Closing Argument, Part II.L.3.a, p. 91.
[97] Exhibit UEC-Holmes 33.
[98] Exhibit UEC-Holmes 33, at pp. 31-45.
[99] *Id.* at pp. 31-33 (RCT Report for Inspection conducted June 12, 2007).
[100] *Id.*

had been completed.[101] Accordingly, the RCT terminated the NOV with the following explanation:

> UEC had completed the remedial action required. ***Specifically, UEC has installed a [cement] surface plug at all sites***, installed PVC pipe to mark each borehole location, and removed all drilling mud, cuttings, cement, and other debris burying it with no less than one foot of topsoil.[102]

Additional detailed information regarding the results of monthly RCT inspection reports subsequent to the remedial action is included in Attachment B.

2. UEC's Exploration Activities Did Not Negatively Impact Groundwater Quality

The RCT,[103] TCEQ[104] and Dr. Bennett opined at some length, on numerous occasions, that UEC's exploration drilling did not negatively impact groundwater quality. For example, with respect to the County's theory that leaving the boreholes and/or RBL wells open for more than 48 hours allowed air into the boreholes or wells, which in turn allowed enough oxygen to contact the formation to oxidize the uranium and artificially raise uranium values, Dr. Bennett explained that oxygen diffusion from the atmosphere consists of at least five steps, with the key step in this situation being the interfacial transfer across the air/water interface:[105]

> A dry sponge will rapidly soak up water, while a completely wet sponge will not soak up any at all. Mud-rotary borehole drilling involves the rapid recirculation of drilling fluid from the advancing borehole, through an open pit, and back into the borehole. The starting condition of the borehole fluid at the end of the drilling activity therefore is saturated with oxygen and in equilibrium with the atmosphere. It is thermodynamically impossible for additional oxygen to diffuse from the atmosphere into a saturated fluid . . . .[106]

Summaries of additional rebuttal testimony from Dr. Bennett refuting every permutation of the County's theory regarding the alleged manipulation of groundwater quality is included in

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[101] *Id.* at pp. 35-45 (RCT Report for Inspection completed June 18, 2007).
[102] *Id.* at p. 40 (emphasis added).
[103] *See* Attachment B.
[104] *See, e.g.,* Executive Director Exhibit 10, pp. 65-66, Response 104; Executive Director Exhibit 17, p. 32, Response 38; pp. 55-57, Responses 76-78.
[105] Issue C Rebuttal Testimony, Bennett, p. 23, ll. 1-18.
[106] *Id.* at p. 23, ll. 8-14.

Attachment C.

C. Issue C: Does the application adequately and accurately describe baseline conditions of the groundwater in the proposed permitted area under applicable requirements of 30 TAC Chapter 331?

1. The District's Exceptions

The District argues that UEC failed to meet its burden of proof because "no water samples were taken in the hundreds of acres"[107] in the eastern and southern portions of the Mine Permit Area. The claim that "no water samples" were taken in these areas is false. Water samples were taken from existing wells in these areas.[108]

The rules are not explicit or restrictive regarding the locations of wells for establishing baseline quality for mine applications; however, the definition of "baseline quality" does shed some light on the commission's expectations. Baseline quality is defined as "[t]he parameters and their concentrations that describe the local groundwater quality of an aquifer prior to the beginning of injection operations."[109]

Local groundwater quality in this instance refers to the portion of the aquifer likely to be impacted after injection operations—in other words, applicants should establish a general understanding of starting conditions before the beginning of operations. The Mine Application summarizes exactly how this "local groundwater quality" has been established:

> Water quality was established by sampling a large number of water wells. Sampling was conducted for all of the wells within the proposed permit area boundary and nearly all of the known wells within 1 km of the permit boundary. In addition, UEC completed 20 baseline wells within the permit boundary . . . . Not including the 20 baseline wells completed by UEC, a total of 47 wells were sampled for 28 water quality constituents. ***As a result of this sampling effort, local water quality is now firmly established.***[110]

And as the Executive Director noted in his Response to Comments regarding the Mine

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[107] District's Exceptions, p. 3.
[108] *See, e.g.*, Exhibit UEC-Holmes 13, Figure 4.1.
[109] 30 TAC § 331.2(12).
[110] Exhibit UEC-Holmes 13, p. 5-1 (emphasis added).

Application:

> Groundwater samples from the twenty baseline wells were analyzed for 26 constituents and parameters, as were groundwater samples from 47 private wells in the vicinity of the proposed site. ***Data from the baseline wells appears remarkably similar to data from the private wells for all constituents and parameters with the exception of uranium and radium-226***, which are significantly higher in the baseline wells.[111]

In other words, UEC established that groundwater quality in the rest of the Mine Permit Area is similar to the quality in the Regional Baseline ("RBL") wells except for the levels of uranium and radium-226.

2. The County's Exceptions

The County also contends that local groundwater quality was not properly established, but focuses the majority of its argument on alleged manipulation of the baseline water quality by UEC.[112] The County begins by arguing that simply averaging the three sets of data will not fix the fact that the first two rounds of data were "tainted by UEC's exploration and well development activities."[113] According to the County, these activities—which included jetting the RBL wells[114] – introduced oxygen into the subsurface, which oxidized the uranium and released radium from the uranium ore.[115] The County asserts that while it presented "extensive" and "compelling" evidence on this topic,[116] UEC "never explained in its pre-filed direct or rebuttal testimony" the reason that the third round of data differed in some respects from the first round of data.[117]

The County has a remarkable tendency to treat significant portions of the hearing process as if they never happened. Although the desire to do so is somewhat understandable, the result is

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[111] Executive Director Exhibit 10, p. 59, Response 90 (emphasis added).
[112] County's Exceptions, Section III, pp. 14-25; Section IV, p. 30-32.
[113] County's Exceptions, p. 16.
[114] County's Exceptions, pp. 22-23.
[115] County's Exceptions, pp. 23-24.
[116] County's Exceptions, p. 19.
[117] County's Exceptions, p. 17.

not helpful. In contrast to the County's interesting interpretation of the case record, the evidence actually shows the following:

- The County did present extensive evidence regarding its many theories regarding how UEC manipulated the baseline water quality by: drilling exploratory boreholes; leaving the boreholes and/or RBL wells open for more than 48 hours so that air entered them; leaving the boreholes and/or RBL wells open for more than 48 hours so that rain entered them; failing to put the RBL wells in the correct locations; failing to make the well screens long enough; completing the PTW wells incorrectly; sampling the wells incorrectly; and/or conducting the pump tests required by the commission rules for the PAA-1 Application. But, neither the scientists at RCT, TCEQ nor UEC's geochemistry experts found this evidence to be "compelling" or convincing. And unlike the Protestants' experts, UEC's experts have extensive experience specifically regarding the geochemistry of uranium and radium. Additional information regarding the qualifications and expertise of UEC's experts regarding the geochemistry of uranium and radium is included in Attachment C.

- The extensive evidence presented by the County was in fact extensively and effectively rebutted by the aforementioned highly qualified experts on numerous occasions; just because the County does not like the explanation offered regarding the differences between the three sample sets, does not mean that that the explanation is not scientifically-valid or that the explanation was not provided. Summaries of this testimony are included in Attachment C.

- In its effort to make its case, the County ***changed*** the quoted testimony of Dr. Bennett, which it cites on page 22 of its Exceptions. Since UEC pointed out the exact same error during closing arguments, the alteration of the testimony must be intentional. This fact is, to use the County's word, disconcerting. Details regarding this misrepresentation of the record are included in Attachment C.

- Despite that County's assertion, there is in fact no evidence in the record regarding the RBL wells being jetted; all of the testimony regarding jetting relates to the BMW wells, which were not used to establish water quality for the Mine Application.

- In making its argument regarding jetting to the commission (and previously to the ALJ), the County ignored key testimony by Mr. Holmes, Mr. Murry, and Dr. Bennett. As the County admits in its Exceptions, Mr. Underdown, who actually performed the jetting on the BMW wells, testified very clearly regarding the methodology he used, which did not involve introducing air at the well screen level. Dr. Bennett explained in detail how the method described by Mr. Underdown works and that it does not involve the introduction of air at the well screen level.[118] In its argument to this commission, the County ignores Dr. Bennett's testimony and cites Mr. Murry's testimony as support for the County's proposition that air must reach the screen during jetting.[119] In fact, however, Mr. Murry merely testified that the jetting process ***can*** introduce oxygen into the screen area ***if*** the

[118] Bennett Cross-Examination, Transcript, p. 920, l. 7 – p. 924, l. 19.
[119] County's Exceptions, p. 23.

air line is lowered into the casing.[120]

D. Issue D: Does the application meet all applicable criteria of 30 TAC § 331.122, related to required consideration by the Commission prior to issuing a Class III Injection Well Area Permit?

The District filed no exceptions regarding Issue D. The County, on the other hand, argued that 1) exploratory plugged boreholes are "wells" in the context of Section 331.122 and should have been identified as such by UEC; and 2) UEC should have identified the proposed production areas in greater detail (*e.g.*, showing the locations of associated injection wells), rather than simply showing the areas where it has identified ore and intends to mine. First, as is explained in greater detail in Attachment D, boreholes plugged to the surface with cement and soil do not meet the Chapter 331 definition of a well.[121]

Second, the Mine Application contains maps showing the proposed permit area,[122] maps showing the area of review,[123] a map showing the location of the baseline (registered) wells,[124] an example diagram of a production area,[125] and information regarding the anticipated number of injection wells within each of the anticipated production areas[126] that are also shown on various maps.[127] As Mr. Murry summarized, UEC provided a map showing the pattern of wells[128] and maps showing the areas of mineralization where "one would expect they are going to drill injection wells . . . ."[129] This is exactly the level of detail required for a mine application under Section 331.122.

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[120] Murry Cross-Examination, Transcript, p. 1307, l. 5—p. 1308, l. 22.
[121] 30 TAC § 331.2(110) (defining a well as "[a] bored, drilled, or driven shaft whose depth is greater than the largest surface dimension, a dug hole whose depth is greater than the largest surface dimension . . . .").
[122] *See e.g.*, Exhibit UEC-Holmes 13, Figure 1.4.
[123] *Id.*
[124] Exhibit UEC-Holmes 13, Figure 5.1.
[125] *Id.* at Figure 9.4.
[126] *Id.* at p. 13-1.
[127] *Id.* at Figures 1.3 and 1.4.
[128] Murry Cross-Examination, Transcript, p. 1188, l. 24—p. 1189, l. 11.
[129] *Id.* at p. 1213, l. 24—p. 1214, l. 5.

E. Issue E: Has the Applicant demonstrated that the proposed exempted aquifer meets the applicable criteria of 30 TAC § 331.13?

Section 331.13 provides that an aquifer or portion of an aquifer may be exempt if it meets two criteria: (1) that it not currently serve as a source of drinking water for human consumption; and (2) that it will not in the future serve as a source of drinking water for human consumption for one or more specified reasons.[130] During the cross-examination of Mr. Murry at the hearing, the District's lawyer asked Mr. Murry a series of hypothetical questions regarding how he would view a proposed aquifer exemption boundary if there were a water well located just one foot outside the boundary.[131] The Protestants appears to rely upon the hypothetical well as evidence that UEC's request for an aquifer exemption should be denied, while ironically asserting that TCEQ's interpretation and application of the aquifer exemption regulations "defies logic and science."[132] To be clear, the evidence conclusively establishes that there are no water wells located within the proposed exempt area at all and that the closest such wells are ***75 to 80 feet*** away.[133]

The District's position is essentially the same as the County's position, which is that a proposed exemption area currently serves as a source of drinking water for human consumption within the meaning of Section 331.13 if the area is "hydraulically connected" to any drinking water well.[134] To support this position, the County relies upon Dr. Clark's testimony regarding his interpretation of excerpts from EPA comments that were published in the Federal Register thirty years ago.[135] As shown below, not only is Dr. Clark's interpretation incorrect, but the EPA quotations highlighted in the County's Exceptions are incomplete, out of context, and therefore

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[130] 30 TAC § 331.13(c)(1), (2).
[131] Murry Cross-Examination, Transcript, p. 113, l. 24—p. 115, l. 12.
[132] District's Exceptions, p. 3; *see also*, County's Exceptions, p. 35.
[133] Exhibit UEC-Holmes 13; Holmes Cross-Examination, p. 499, ll.5-11.
[134] County's Exceptions, pp. 33-35.
[135] Clark Testimony, p. 29, ll. 1-12; Exhibit Goliad County-Clark 30 (containing single-page excerpts from 44 Fed. Reg. 23738 (April 20, 1979); 45 Fed. Reg. 42472 (June 24, 1980); and 46 Fed. Reg. 48243-01 (October 1, 1981)).

grossly misleading.

In addition, the County complains that the boundaries of the proposed Aquifer Exemption Area were drawn too broadly, and that "to the extent that the existing water quality data is proposed to be utilized in support of an aquifer exemption, it can only support an exemption for the mineralized portions of the various sands and not for the entire area shown in the application."[136] Finally, the County argues that because Mr. Holmes is not a registered geoscientist or professional engineer, that UEC violated Section 305.49(a)(9). As discussed below, the County is, once again, mistaken on these points.

1. The County's Quotations from the Federal Register Are Incomplete and Therefore Misleading

According to Dr. Clark, his understanding of the "underlying idea" of the aquifer exemption regulations is largely based on certain comments made by EPA on April 20, 1979 and June 24, 1980, in conjunction with the proposal and promulgation of the 1980 UIC Regulations that were subsequently withdrawn by EPA.[137] On October 1, 1981, EPA proposed revised UIC program regulations.[138] The EPA explained that the revised regulations were the result of reevaluations of the proposed regulations and that they included substantial changes to "major program concepts" of the UIC regulatory scheme.[139] Moreover, the snippet of EPA commentary that the County chose to highlight is from rulemaking comments made by EPA on April 20, 1979, when proposing the outdated regulations that were later rejected. The County states:

> Specifically, the EPA stated, 'the intent of the exemption of mineral, oil or geothermal producing portions of aquifers from designation as underground

[136] County's Exceptions, p. 36.
[137] Clark Testimony, p. 29, ll. 1-12; Exhibit Goliad County-Clark 30 (containing single-page excerpts from 44 Fed. Reg. 23738 (April 20, 1979); 45 Fed. Reg. 42472 (June 24, 1980); and 46 Fed. Reg. 48243-01 (October 1, 1981). Concurrently with the filing of its Response to Closing Arguments, UEC filed a Request for Official Notice in which it asked the ALJ to take official notice of the complete versions of these federal register publications.
[138] 46 Fed. Reg. 48243-01.
[139] *Id.* at 48244; *see also id.* at 48244-48247 (providing an overview of the change to "major program concepts").

> sources of drinking water is to allow current production in such aquifers to continue undisrupted by these regulations. *The exemption is not intended as a green light to exempt any aquifer or its portion which merely has the potential to be used in the future for production purposes.*'[140]

In addition, the County omitted the rest of the quotation, which reads:

> Such aquifers should be designated [as USDWs by the State]. ***However, potential producers/injectors may at any time petition the State to exempt a portion of an aquifer on this ground***, subject to the public notice and EPA approval requirements. ...[141]

Thus, the EPA clearly explained that while it did not want States to exclude aquifers from their initial designations of USDWs on the ground that the aquifers merely had the potential to be used for future production purposes, it had no problem with prospective producers/injectors seeking an aquifer exemption on that very ground.

In its October 1, 1981 comments proposing the new UIC program regulations, the EPA made that point abundantly clear in the context of explaining its proposed changes to the criteria for obtaining an aquifer exemption.[142] The County, however, mischaracterizes the context of the October 1, 1981 comments and again provides only a short misleading snippet. The County states as follows:

> Two years later, the Agency did consider exempting aquifers for areas not yet producing minerals, but made very clear, '[it] still wants to prevent the possibility of wholesale exemption of aquifers over large areas of the country simply because they are mineral bearing.'[143]

The actual EPA comment, in its fuller context, reads as follows:

> ***The Agency is . . . proposing to modify the first exemption criteria which could have been construed as prohibiting mineral exploitation of previously unproduced areas.*** The Agency still wants to prevent the possibility of wholesale

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[140] County's Exceptions, p. 34. Despite the fact that the County incorrectly cites to the Texas Register, a review of Exhibit 30 to Dr. Clark's testimony shows that the referenced document is 44 Fed. Reg. 23738 (April 20, 1979).

[141] 44 Fed. Reg. at 23743 (emphasis added).

[142] 46 Fed. Reg. 48243-01 (October 1, 1981), at 48245.

[143] County's Exceptions, p. 34. Again, despite the fact that the County incorrectly cites to the Texas Register, a review of Exhibit 30 to Dr. Clark's testimony shows that the referenced document is 46 Fed. Reg. 48243-01 (October 1, 1981), at 48245.

> exemption of aquifers over large areas of the country simply because they are mineral bearing. ***However, EPA is proposing a modification to allow for exemption of aquifers if they are expected to yield commercially-producible minerals or hydrocarbons.***
>
> A subsection is being added to § 122.35 [now § 40 C.F.R. § 144.7] which details specific information which the Director should require from permit applicants in order to make a judgment that an aquifer contains commercially-producible minerals or hydrocarbons.[144]

In its exceptions, the County repeatedly claims the moral high ground noting, "[y]ou cannot just offer the information that supports your case. You have to submit it all, both good and bad . . . ."[145] Apparently, the "you" in that sentence only applies to others.

2. The Protestants' Interpretation of "Currently Serves" and "Source of Drinking Water" Is Incorrect

a. "Currently Serves"

In rulemaking comments, EPA has specifically addressed the proper interpretation of the "currently serves" criteria. In 1985, EPA approved an aquifer exemption for a 6.7 acre area to allow a uranium mining company to conduct a research and development project in the Chadron aquifer near Crawford, Nebraska. Five years later, the EPA approved an expansion of the exempted area to cover 3,000 acres, as requested by the State. In both cases, EPA explained that the test for "currently serves" is whether or not anyone is "currently using water for human consumption from the [aquifer] ***in the specific lateral boundary***" of the proposed exemption area.[146]

b. "Source of Drinking Water"

The Protestants repeatedly complain about the Braquet wells being excluded from the proposed Aquifer Exemption Area. For example, the District states:

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[144] 46 Fed. Reg. 48243-01 (October 1, 1981), at 48245 (emphasis added).
[145] County's Exceptions, p. 6.
[146] 50 Fed. Reg. 5253-01 (February 7, 1985), at 5253; 55 Fed. Reg. 21191-01 (May 23, 1990), at 21192 (emphasis added). UEC filed a Request for Official Notice regarding these two EPA publications concurrently with UEC's Response to Closing Arguments.

> The aquifer exemption [boundary] was drawn to exclude the Braquet wells, downgradient of the eastern portion of the aquifer exemption area, even though the B Sand ore body extends past the monitoring well ring for [the] B Sand in the PAA-1 permit. Applicant is giving up mining that ore in order to exclude a source of drinking water for human consumption. It is quite clear the only purpose for drawing the aquifer boundary was not based on hydrology or geology, just to circumvent the intent of the rule.[147]

This argument was squarely addressed by the Eighth Circuit in *Western Nebraska Resources Council v. E.P.A.*,[148] which was decided in 1991. In that case, as the court explained, the protestant's "principal complaint" was that the boundaries of the aquifer exemption area were "'gerrymandered'" – in other words, they were "carefully drawn so that no present wells using the Chadron aquifer [were] included, which permitted the finding that the exempted portion 'does not currently serve as a source of drinking water,' 40 C.F.R. § 146.4(a)."[149] Both the EPA and the court, however, found the applicant's exclusion of existing wells from the proposed exempted area to be not only appropriate, but commendable:

> With respect to the exclusion of existing Chadron aquifer wells, we agree with EPA that this kind of 'gerrymandering' is laudable as well as consistent with the regulations. As EPA stated in its order, those using water from aquifers outside the 3,000 [exempted] acres 'will not lose protection under the SDWA because migration of fluids vertically or horizontally from the exempt site will be in violation of the permit and the SDWA.'[150]

3. Water Quality Within the Proposed Exemption Area Supports the Exemption, but is Not Determinative

In the federal UIC regulations, the EPA "details specific information" that it will "require from permit applicants in order to make a judgment that an aquifer contains commercially-producible minerals or hydrocarbons."[151] The rule, 40 C.F.R. § 144.7, does not require an applicant to submit information delineating the boundaries of the mineralized zones or ore bodies. Rather, it requires "general information on the mineralogy and geochemistry of the

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[147] District's Exceptions, p. 3.
[148] 943 F.2d 867 (8th Cir. 1991).
[149] *Id.* at 871.
[150] *Id.*
[151] 46 Fed. Reg. 48243-01 (October 1, 1981), at 48245.

mining zone:

> For Class III wells, the Director shall require an applicant for a permit which necessitates an aquifer exemption under §146.04(b)(1) to furnish the data necessary to demonstrate that the aquifer is expected to be mineral or hydrocarbon producing. Information contained in the mining plan for the proposed project, such as a map and general description of the mining zone, ***general information on the mineralogy and geochemistry of the mining zone,*** analysis of the amenability of the mining zone to the proposed mining method, and a time-table of planned development of the mining zone shall be considered by the Director in addition to the information required by §144.31(g).[152]

UEC has submitted such information and has established that the proposed exemption area is mineral-bearing with production capability. Moreover, as Mr. Holmes testified[153] and as the EPA rule-making comments regarding the Chadron aquifer exemption show,[154] the EPA does not simply "rubber-stamp" requests for aquifer exemptions. If, for some reason, EPA believes that the areas referred to by the County are not appropriate for exemption, it will revise the boundaries.

4. UEC Did Not Violate Section 305.49(a)

This section requires "a complete delineation by a licensed professional geoscientist or a licensed professional engineer of any aquifer or portion of an aquifer for which exempt status is sought."[155] As Mr. Holmes testified, "[f]irst, UEC geologists identified the uranium ore bodies. Once the area of the initial production zones was fairly well delineated, an aquifer exemption boundary was then defined."[156] And as described in the Mine Application, "[t]he extent of the aquifer exemption is shown on all of the cross-sections (see Figures 6.8a through 6.13) . . . . [T]he lateral extent of the aquifer exemption area would encompass all of the production areas shown on Figure 1.3 Project Map."[157]

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[152] 40 C.F.R. 144.7(c)(1) (emphasis added).
[153] Holmes Cross-Examination, Transcript, p. 495, l. 21 – p. 495, l. 16.
[154] 50 Fed. Reg. 5253-01 (February 7, 1985).
[155] 30 TAC § 305.49(a)(9).
[156] Holmes Direct Testimony, p. 58, ll. 19-20.
[157] Exhibit UEC-Holmes 13, p. 14-1.

Each of these cross-sections was individually sealed by a professional geoscientist, and as Mr. Holmes pointed out, geologists also identified the lateral extent of the proposed aquifer exemption since the "boundary tightly conforms to the footprint of the four initial proposed production areas."[158] Moreover, Mr. Holmes made it clear that Mr. Anthony, who is a licensed professional engineer and who signed and sealed the Mine Application technical report, worked with Mr. Holmes and had the final say in the location of the proposed aquifer exemption boundary.[159]

F. Issue F: Is the application sufficiently protective of groundwater quality?

1. The District's Exceptions

a. Evidence Regarding Boreholes Establishes That They Are Not Pathways

The District argues that abandoned boreholes should be evaluated as potential pathways, and states that there is "NO data indicating the boreholes act as a barrier or partial barrier to migration of mining fluids."[160] There is in fact ample evidence in the record regarding the fact that abandoned boreholes will not serve as conduits between confining layers. In fact, when questioned by counsel for the District at hearing, Dr. Bennett elaborated upon his opinion that the boreholes would not provide pathways for vertical migration by stating that the boreholes would also not provide an opportunity for lateral migration across the width of the borehole.[161] Portions of Dr. Bennett's testimony and additional discussion of the evidence regarding the potential for vertical and lateral migration are included in Attachment R.

b. Abandoned Boreholes Will Not Provide Pathways for Migration from Sand B to Sand A

The District claims that the nine monitoring wells in Sand A above PA-1 are insufficient

[158] Holmes Direct Testimony, p. 58, l. 19—p. 59, l. 1; Holmes Re-Direct, Transcript, p. 467.
[159] Holmes Re-Direct, Transcript, p. 468; Holmes Re-Cross, Transcript, p. 505, ll. 13-20.
[160] District's Exceptions, p. 4.
[161] Bennett Cross-Examination, Transcript p. 948, ll. 9-15.

in number and location due to the presence of "abandoned boreholes" in the area that could be conduits for mining fluids during mining.[162] As Dr. Bennett testified:

> . . . even if some of these old boreholes were not plugged with cement across the sand units as currently required by the Texas Railroad Commission, there would be drilling mud in the boreholes across the sand units. . . . The boreholes would likely also contain clay because . . . the walls of uncased boreholes are prone to sloughing and caving in, even in fractured rock formations. . . . Regardless, even in the absence of clay from a collapsed borehole wall, drilling mud in a borehole, in and of itself, constitutes a significant barrier to groundwater flow, particularly after it has been allowed to gel for a time. While being circulated, drilling mud acts as a high density fluid with suspended colloidal clay particles, and the high density creates a region of high head preventing formation fluid from entering the borehole. But once it is allowed to set it forms a gel with substantially higher resistance to entry of the formation fluids (Collins and Kortum 1989). Further, uncased boreholes will typically collapse, and the thick sequence of clays will move across the borehole, further sealing and preventing migration. Even a few centimeters of clay will substantially retard fluid movement, and for the A/B confining unit, it is 1000 to 1500 centimeters of clay. Even if old, poorly plugged boreholes were to exist in the production area of PA-1, they would not constitute pathways for vertical migration, and the data provided to me does not show such boreholes exist.[163]

c. An Aquifer Testing Plan Has Already Been Developed and Additional Testing of the Northwest Fault Will Be a Requirement of Future PAA Applications

The District also argues that there should be additional testing regarding the transmissivity of the Northwest Fault and that UEC should be required to develop an aquifer testing plan that describes how the pump test will be performed. UEC's aquifer testing plan is included in the Mine Application,[164] and as discussed above, UEC will be required to test the Northwest Fault if and when UEC files applications for PAs 2, 3 and 4.

2. The County's Exceptions

The County simply reiterates its burden of proof argument (addressed above in Part I) and cites its arguments under Issues L, R and T as reasons why the Mine Application is not sufficiently protective of groundwater; these arguments are addressed in Part II.L, Part II.R and

[162] District's Exceptions, pp. 4-5.
[163] Issue R Rebuttal Testimony, Bennett, p. 5, l. 16 – p. 6, l. 8.
[164] Exhibit UEC-Holmes 13, at Chapter 11.

Part II.T, respectively.

G. Issue G: Does the application adequately characterize and describe the geology and hydrology in the proposed permit area, including fault lines, under the applicable rules?

1. The District's Exceptions

With regard to Issue G, the District again argues that it is "essential" that "abandoned boreholes be evaluated in order to accurately describe the hydrology of the mine permit area."[165] This argument is addressed above in Part II.F and below under Issue R in Part II.R.

2. The County's Exceptions

a. The Northwest Fault Was Properly Characterized

UEC's Exceptions and the discussion above regarding the alleged failure to submit data to TCEQ address the arguments raised by the County (under Part III of its Exceptions) regarding the relative transmissivity of the Northwest Fault and the timing of pump testing. The County also suggests that UEC withheld data from its own expert. Although the ALJ is correct that post-hearing evidence that UEC did provide this data to Dr. Bennett cannot be considered,[166] from a logical standpoint, it stretches the bounds of credulity to suppose that UEC would provide this data to ***all*** the other parties in discovery, but not provide it to its own expert. This would, quite simply, be stupid. UEC's counsel is not stupid.

The County also asserts that the ALJ "underestimated" the importance of the location, width, and stratigraphy of the Northwest Fault.[167] In addition, the County takes UEC to task for not having determined exactly how it will mine the production areas around the Northwest Fault, claiming that the "[i]nability to mine any portion of the proposed areas could have a significant

[165] District's Exceptions, p. 5.
[166] PFD, p. 54, Footnote 159.
[167] County's Exceptions, p. 10.

impact on the economic feasibility of the entire mining project."[168] The County cites Mr. Underdown's cross-examination as support for the County's contention that UEC has not "even made an *initial* determination" as to how it will mine near the fault.[169] In fact, Mr. Underdown testified that UEC has not yet "made an *internal* determination" as to how it will conduct its mining operations near the fault, but that it will make those determinations as part of any subsequent PAA applications.[170]

In essence, the County is criticizing UEC for not developing all four potential production areas before receiving a mine permit. Not only would this be a huge additional investment of capital, but it runs counter to the Texas in situ uranium mining staged permitting structure of issuing PAAs under and as an extension of a mine permit, rather than just one UIC permit that authorizes all injection activity. Furthermore, the County is arguably not in the best position to assess the economic feasibility of a uranium mining project. Regardless, that is not an issue in this proceeding.

b. The Direction and Speed of Groundwater Was Properly Characterized

Finally, the County suggests that UEC has inadequately characterized the direction and speed of groundwater flow at the site.[171] As shown below, this suggestion is without merit.

1. The Direction of Groundwater Flow

The County's argument appears to be in part a reference to the cross-examination of Mr. Kelley regarding a micro-gradient on the western side of PA-1—between BMW 7 and BMW 8—that appears to be towards the west. The County argues that this extremely local shift in gradient exposes existing upgradient water wells to migrating mining fluids and associated contaminants. It is only possible to reach this conclusion by taking an enormous, flailing leap

[168] County's Exceptions, p. 11.
[169] *Id.* (emphasis added) (citing Underdown Cross-Examination, Transcript, p. 199, l. 6 – p. 202, l. 17).
[170] Underdown Cross-Examination, Transcript, p. 202, ll. 7-17.
[171] County's Exceptions, pp. 12-13.

away from the science of hydrogeology and the law of gravity.

Groundwater flows from higher hydraulic head to lower hydraulic head.[172] As Dr. Bennett explained, "[y]ou can think of this in terms of a river, where the water will if possible take the steepest and shortest path downhill."[173] In the vicinity of the Mine Permit Area, the overall direction (or regional gradient) of this underground "river" is coastward towards the southeast.[174] As in other aquifers, "flow is locally modified by surface topography, structures such as faults, and local aquifer sand body geometry."[175] However, as the County's witness, Dr. Clark, testified, "groundwater moves inexorably ... toward the coast through all of this geology."[176]

As Dr. Clark also explained, potentiometric or water level maps "may be assembled at several scales."[177] While a potentiometric map assembled on a regional scale focuses on the water's inexorable movement toward the coast, one assembled on a local scale focuses on the water's path through the local geology. As Mr. Kelley testified at the hearing, one view is not somehow incompatible with the other.[178]

Scale is important. The existence of a local gradient towards the east in PA-1 does not change the fact that the regional gradient is southeast towards the coast. Likewise, the existence of a micro-gradient to the west between BMW-7 and BMW-8 (which are right next to each other), does not change the fact that the local gradient within PA-1 is to the east. There is no evidence to suggest that this micro-gradient (1) continues to the west beyond BMW-8, or (2) somehow overcomes the local or regional gradients, which are both in the opposite direction. By analogy, just because there is a slight depression in the riverbed of an east-bound river does not

[172] Bennett Direct Testimony, p. 10, ll. 13-20.
[173] Bennett Direct Testimony, p. 10, ll. 15-16.
[174] Galloway Direct Testimony, p. 28, ll. 10-15; Clark Prefiled Testimony, p. 18, ll. 24-27.
[175] Galloway Direct Testimony, p. 28, ll.10-12.
[176] Clark Prefiled Testimony, p. 18, ll. 24-27.
[177] Clark Prefiled Testimony, p. 19, 11. 2-4.
[178] Kelley Re-Direct, Transcript, p. 756, l. 10—p. 757, l. 9.

mean that the course of the entire river is split into two different directions traveling east and west.

2. The Speed of Groundwater Flow

Again, as Dr. Galloway testified, "it is extremely important to consider scale" when discussing geology and groundwater flow.[179] With respect to the different rates of groundwater flow referenced by the County, the 6.7 feet reference is, as with much of the other information in Chapter 6, based on available hydrogeologic literature for the area.[180] In contrast, the 19 feet per year rate is specific to a very local portion of Sand B, as gleaned from the PA-1 pump tests. In short, as Dr. Galloway remarked during the hearing, "I guess the inconsistency is in the eye of the beholder on that."[181] Finally, it is difficult to understand how the County could view Mr. Blandford's testimony regarding flow rate as being "unchallenged" when UEC's witness, Mr. Kelley, testified regarding the 19 feet per year rate *after* Mr. Blandford provided his testimony on flow rate.

c. UEC Does Not Object to the ED's Suggested Permit Provision Regarding Future Pump Tests and the Northwest Fault

UEC has no objection to the inclusion of the Northwest Fault pump test permit provision suggested by the ED,[182] as it is UEC's understanding that the testing prescribed by this proposed provision is already required.

H. Issue H: Do the geologic and hydraulic properties of the proposed permit area indicate that the Applicant will be able to comply with rule requirements?

The District did not file exceptions regarding Issue H, and the County once again contends that the ALJ's recommendation regarding the Northwest Fault means that UEC failed to meet its burden of proof; this argument is addressed above in Part I. The County also suggests

[179] Issue G Rebuttal Testimony, Galloway, p. 12, ll. 17-19.
[180] *See* Exhibit UEC-Holmes 13, p. 6-21 (listing reference articles).
[181] Galloway Cross-Examination, Transcript, p. 49, ll. 13-14.
[182] ED's Exceptions, p. 10.

that UEC should have the details regarding the monitoring well rings for future production areas worked out before a mine permit is issued. Once again, this argument runs directly counter to the existing permitting process requiring operators to have PAAs as well as a mine permit.

I. Issue I: Does the Applicant meet the applicable requirements for financial assurance under Texas Water Code §§ 27.051, 27.073, and 30 TAC Chapters 37 and 331?

The District does not address Issue I in its Exceptions. The County "agrees with the ALJ that the financial assurance should be recalculated to reflect the cost of restoration to appropriate baseline."[183] While UEC agrees that a recalculation of financial assurance will and should occur on a regular basis according to the applicable regulations, UEC respectfully disagrees with the ALJ regarding the necessity for that recalculation to occur before the issuance of PAA-1 for the reasons explained in UEC's Exceptions.

J. Issue J: Is the application sufficiently protective of surface water quality?

The District did not file any exceptions regarding Issue J. In contrast, the County not only excepts to the PFD, but makes conclusory-sounding statements that are, in fact, not found anywhere in the record. Specifically, the County opines on geologic cross-sections, stating "[t]his means that groundwater passing through Sand A, and down gradient from ore body in the A sand, re-enters the surface water system to the north in a short time and to the east in a somewhat longer time."[184]

In fact, the Protestants' evidence regarding potential surface water impacts was limited **solely** to prefiled testimony statements by the County's witness, Dr. Clark. First, Dr. Clark stated that "[i]t appears that sand A is connected with Fifteen Mile Creek." Second, he stated that "sand A is not completely confined in all areas, indicating ***possible*** connection with the

[183] County's Exceptions, p. 38.
[184] County's Exceptions, p. 39.

surface water."[185] There was no testimony or evidence presented at any time regarding groundwater from Sand A reaching "the surface water system to the north" at all, let alone "in a short time." Although the meaning of the latter statement is unclear (*i.e.*, what areas? what surface water?), the inference is that groundwater from Sand A within the Mine Permit Area will ultimately reach Fifteen Mile Creek and that the "interaction"[186] will be detrimental. Again, no evidence supports this inference.

Logically, interaction between groundwater from the Mine Permit Area and surface water in Fifteen Mile Creek is a concern only if constituents from Sand A within the Mine Permit Area (a) migrate to Fifteen Mile Creek and (b) migrate in quantities that are potentially harmful. While there is no evidence in the record to support Dr. Clark's inferred concern, there is considerable evidence that constituents such as uranium and radium-226 will not be migrating from the Mine Permit Area into Fifteen Mile Creek.

First, under the Mine Permit, any production areas within Sand A will be restored after mining.[187] Second, the geochemical nature of both the surrounding aquifer and the constituents themselves will severely limit any migration. Uranium is immobilized when it encounters sufficiently reducing conditions,[188] and as the County's witness, Dr. Sass, explained, "the whole area is a reducing area."[189] The movement of radium-226 will likewise be retarded by precipitation and adsorption onto clays and iron oxides.[190]

Ultimately, however, if the County develops specific concerns regarding the migration of constituents from a production area in Sand A to Fifteen Mile Creek, the appropriate time to

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[185] Clark Testimony, p. 33, ll. 2-5 (emphasis added).
[186] *Id.* at l. 6.
[187] Executive Director Exhibit 6, Sections G.3 and G.4.
[188] Galloway Direct Testimony, p. 15, ll. 4-11.
[189] Exhibit UEC-Bennett 12, p. 96, l. 19—p. 98, l. 8; *see also* Galloway Direct Testimony, p. 24, l. 8 (noting that "most of the subsurface environment is reducing.").
[190] Issue C Rebuttal Testimony, Erskine, p. 17, ll. 10-20.

address those concerns, as the ALJ concluded,[191] is during the production area authorization application process for Sand A, not this proceeding.

K. Issue K: Are local roadways sufficient to handle traffic to and from the proposed facility?

Neither the District nor the County except to the ALJ's findings regarding Issue K in the PFD.

L. Issue L: Whether UEC's proposal for restoration of groundwater to baseline levels as contained in the permit application is reasonable and adequate.

The District did not file exceptions related to Issue L. The County, however, continues to make pessimistic predictions regarding restoration while ignoring the evidence in the record. Some relevant points from the record include:

- One of Dr. Darling's observations was that "[i]n all cases, the Amended and Last Sampled [actual] Concentrations of uranium exceed the PDWS [Primary Drinking Water Standard]."[192] What Dr. Darling neglected to add is that out of 73 PAAs considered, only six had baseline restoration values below the PDWS to begin with.[193]

- The Hall Study, which focused on the actual restoration values instead of the amended values (which were typically higher), found that: (1) 32% of the actual restored uranium values were less than baseline;[194] (2) 96% of the actual restored radium values were below baseline;[195] (3) 82% of the actual restored arsenic values were less than baseline;[196] and (4) 91% of the actual restored lead values were below baseline.[197]

- Contrary to the County's claim, the evidence shows that an amendment was not sought for Production Area Authorization UR01941PAA3 at COGEMA's O'Hearn Mine. And, as TCEQ responded during a recent rulemaking:

  > . . . the commission notes that at these sites, the concentration of many of the groundwater constituents were reduced to the initially-established aquifer restoration values, but that for other constituents, concentrations were reduced by restoration efforts, but not to the initially-established restoration values. . . .The commission also notes that *the pre-mining groundwater quality at all mining sites did not meet federal primary*

[191] PFD, p. 73.
[192] *Id.* at p. 4.
[193] *Id.* at Attachment D.
[194] Exhibit Goliad County-Darling 12, p. 15.
[195] *Id.* at p. 17.
[196] *Id.* at p. 18.
[197] *Id.* at p. 19.

> *drinking water standards for one or more regulated constituents, and that at all sites, the radioactivity associated with radium-226 in the groundwater exceeded the primary drinking water standard of 5.0 picocuries per liter.*[198]

- The record establishes that another uranium mining company very recently used just six pore volumes—the same as UEC's current restoration estimate—in restoring one of its production areas, and the groundwater quality data showed good results.[199]

Additionally, in order to make the statement that restoration techniques proposed by UEC are "the exact same" as those used in the past, the County had to somehow discount testimony regarding:

- The use of reverse osmosis on a commercial scale *during mining* to provide a jump start on restoration.
- The initiation of restoration as soon as mining ends in a production area.
- Continued use of the ion exchange (IX) columns to remove residual uranium *during restoration* instead of only during mining.
- And the fact that, even though no restoration model is required, UEC does have a state-of-the-art hydrogeological model, created by Mr. Kelley and his team, which UEC can use to increase its restoration success in its first production area.[200]

Mr. Murry's testimony that the technology that will be used is essentially the technology that has been used in the past does nothing to further the County's argument; the technology that is used in light bulbs is essentially the same as when they were first invented, but people typically do not take that fact as a pronouncement of failure to progress in the field of light bulb development. In this case, Mr. Underdown provided an example of the advancements that have been made with respect to restoration: the membranes that are used in the reverse osmosis process are now "specifically designed to function with a longer life span and higher performance in the particular water quality which they will be used."[201]

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[198] Exhibit UEC-Holmes 35, pp. 1651-52 (emphasis added).
[199] Holmes Cross-Examination, Transcript, p. 522, l. 14 – p. 523, l. 25.
[200] Exhibit UEC-Holmes 13, p. 8-1; Underdown Direct Testimony, p. 22, l. 21 – p. 23, l. 6; Holmes Direct Testimony, p. 53, l. 21 – p. 54, l. 21 and p. 70, ll. 5-17; Kelley Direct Testimony, p. 27, ll. 4-11.
[201] Underdown Direct Testimony, p. 23, ll. 4-6.

M. Issue M: Will the Applicant's proposed activities negatively impact livestock and wildlife, including endangered species?

The District did not file any exceptions related to Issue M. The County, on the other hand, suggests that Dr. Reagor's analysis of this Issue is "narrow" and inadequate.[202] (The County does not mention Mr. Kuhl's testimony wherein he testified that he anticipates impacts on wildlife would be minimal and short-term,[203] limited to temporary re-location within mining areas.[204] Looking specifically at endangered species, Mr. Kuhl also testified that no impacts to endangered species of plants or animals are anticipated as result of the Project.[205])

Dr. Reagor, who from 1969 to 2008, was Head of the Department of Toxicology at the Texas Veterinary Medical Diagnostic Laboratory at Texas A&M University, testified that he actually relied on a variety of sources of information in his analysis:

> To become familiar with the proposed uranium mining project, I reviewed UEC's Mine Application and its pending RML Application with a special emphasis on portions related to the topology of the area, the facility layout, drainage features, fluid control devises, safety design features, inspection protocols, process plans, operational monitoring plans, safety protocols, emergency response plans, and corrective action procedures. I also had discussions with Craig W. Holmes and William Robert Underdown, Jr., and I have reviewed the testimony of both Mr. Holmes and Mr. Underdown. I have also reviewed the testimony of Dr. Philip Bennett and the testimony of Van Kelley. In addition, I conducted my own independent research on in situ uranium mining to obtain an understanding about the mining process. Finally, I visited the Mine Permit Area on August 24, 2009 and on January 2, 2010, to investigate local conditions and help verify the other information I had obtained about the site.[206]

Perhaps even more importantly, however, Dr. Reagor has impeccable credentials and experience,[207] neither of which were challenged by the Protestants. And Dr. Reagor certainly has the experience to independently and critically assess technical information provided to him, including (1) the relative merits and credibility of that information; and (2) the scope of that

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[202] County's Exceptions, p. 42.
[203] Exhibit UEC-Holmes 13, p. 8-1.
[204] *Id.* at p. 11, ll. 10-15.
[205] Kuhl Direct Testimony, p. 15, ll. 3-12.
[206] Reagor Direct Testimony, p. 4, ll. 13-23.
[207] Exhibit UEC-Reagor 1 (detailing Dr. Reagor's experience and qualifications).

information, *i.e.*, whether he is considering all necessary factors such as how spills are dealt with and how the migration of mining fluids is prevented.

Two final significant and relevant facts not mentioned by the County include:

- There is no testimony in the record that previous mines have failed to restore groundwater to pre-mining uses. Indeed, one of the required regulatory findings in the restoration table amendment process is that "the formation water present in the exempted portion of the aquifer would be suitable for any use to which it was reasonably suited prior to mining . . . ."[208]

- Dr. Reagor also testified about his personal experience with livestock and the benefits of in situ uranium mining versus surface mining:

> I did diagnostic work on various cattle that had become ill during the operation of an adjacent open pit uranium mining facility in Karnes County. I observed that ***once the mining operator switched from the open pit mining process to the in situ process and cleaned up the surface contamination associated with the open pit mining, the health problems with the adjacent cattle ceased.***[209]

N. Issue N: Will the Applicant's proposed activities negatively impact the use of property?

The District did not file exceptions related to Issue N. The County essentially argues—while mischaracterizing Mr. Kuhl's testimony—that even in the absence of actual groundwater contamination the proposed uranium mining operation will nevertheless negatively impact the price of cattle and property values in the area because of the associated "stigma."[210] This is not the issue that was referred to SOAH by the Commission, and respectfully, it is not an issue that is within TCEQ's jurisdiction to decide.[211]

Significantly, none of the Protestants put forth ***any*** evidence that the prospect of in situ mining in Goliad County has negatively affected property values or that property values in other

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[208] 30 TAC § 331.107(g)(2)(C).
[209] Reagor Testimony, p. 3, l. 21—p. 4, l. 2 (emphasis added).
[210] County's Exceptions, p. 43.
[211] *See* Executive Director's Closing Argument, p. 18; *FPL Farming, Ltd. v. Tex. Natural Res. Conservation Comm'n*, 2003 WL 247183, *4-6 (Tex. App. – Austin, Feb. 6, 2003, pet. denied) (upholding Commission's interpretation of Section 27.051(a)(2) of the Water Code, which requires a finding that no existing rights will be impaired, as focusing on impacts to a person's "intended use" of property).

Texas counties have been affected by past uranium mining. The reason for this omission is that no negative effect has actually occurred; instead, this is another "what if" devaluation specter, not an actual injury tied to land use.

O. Issue O: Will the Applicant's proposed activities adversely affect public health and welfare?

The District did not file exceptions related to Issue O. The County contends that the ALJ's recommendation regarding Northwest Fault means that UEC failed to meet its burden of proof. This contention is fully addressed above in Part I.

UEC presented evidence on many issues that may affect public health and welfare. Under Issues J, L and R, the evidence establishes that fresh water is adequately and sufficiently protected from pollution. Under Issue M, the evidence establishes that air is adequately and sufficiently protected from pollution, that soil and vegetation is adequately and sufficiently protected from contamination, and that UEC's proposed activities will not negatively impact livestock and wildlife, including endangered species. Under Issue K, the evidence establishes that local roadways are sufficient to handle traffic to and from the proposed facility. Finally, under Issue A, UEC's mining operation or restoration activities will not adversely impact the public interest by unreasonably reducing the amount of groundwater available for permitting by the District.

In meeting its burden with respect to the other Issues referred by the commission, UEC has met its burden under Issue O.

P. Issue P: Whether the proposed mining is in the recharge zone of the Gulf Coast Aquifer (Evangeline component).

The District did not file exceptions related to Issue P. The County cites testimony by its witness, Dr. Clark, that the Mine Permit Area is in the recharge zone; this testimony was refuted by UEC's experts. The County also cites Dr. Galloway as having testified that "the site is on the

outcrop of the Goliad Formation."[212] However, Dr. Galloway clearly explained that while Sand A does outcrop in the Mine Permit Area, the outcrop area is located on the up-thrown side of the Northwest Fault – in other words, outside of the graben where Sand A will be mined.[213] Regardless, the key point regarding this Issue is that "the evidence is undisputed that there is no statute or rule prohibiting *in situ* mining within an aquifer recharge zone."[214]

Q. Issue Q: Whether the Gulf Coast Aquifer is a confined aquifer in the areas of Goliad County where UEC will conduct UIC activities.

Neither the District nor the County except to the ALJ's findings regarding Issue Q in the PFD.

R. Issue R: Whether mining fluids will migrate vertically or horizontally and contaminate an USDW (underground source of drinking water).

1. The District's Exceptions

a. Evidence Regarding Boreholes

The District again argues that abandoned boreholes "have not been figured into any analysis."[215] As explained under Issue F above, there is in fact ample evidence in the record regarding the fact that abandoned boreholes will not serve as pathways for the migration of mining fluids.

The District further asserts: "This court expressed concerns about the lack of an engineering study of borehole transmissivity."[216] In fact, however, the record establishes that such studies have been conducted and that Dr. Bennett relied upon them in forming his opinion that abandoned boreholes will not serve as pathways for the migration of mining fluid. Specifically, Dr. Bennett testified as follows:

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[212] County's Exceptions, p. 44 (citing Galloway Direct Testimony, p. 29, l. 10).
[213] Galloway Direct Testimony, p. 29, ll. 7-21.
[214] PFD, p. 104.
[215] District's Exceptions, p. 5.
[216] District's Exceptions, p. 5.

Q: Do you have any support for your opinion that drilling mud in a borehole constitutes a significant barrier to groundwater flow?

A: Yes. The sealing effect of drilling mud in boreholes has been the subject of studies and articles such as Collins, R.E. and D. Kortum, *Drilling Mud as a Hyrdraulic Sear in Abandoned Well Bores*, Underground Injection Practices Council, 1989 Winter Meeting, San Antonio, Texas; and K.E. Davis, *Factors Effecting the Area of Review for Hazardous Waste Disposal Wells*, Proceedings of the International Symposium on Subsurface Inspection of Liquid Wastes, New Orleans.[217]

b. Evidence Regarding Bleed

The District also contends that a one percent bleed "may not be sufficient to control an excursion."[218] The District further asserts: "[T]he court again expressed concern about Texas' historical acceptance of a 1% bleed to control mining fluid migrations in lieu of an engineering study. UEC has access to a state-of-the art hydrogeological model in place that can run that scenario."[219] First, Van Kelley testified that he has, in fact, performed sensitivity runs with the state-of-the-art model that he developed for UEC, and he determined that it is feasible to maintain hydraulic containment of injected mining fluids using a one percent bleed.[220] Moreover, the District's own witness, Mr. Blandford, also very clearly testified on a number of occasions that his own modeling work likewise showed that a 1% bleed is indeed feasible.[221] The clear preponderance of the evidence establishes that a one percent bleed will likely be sufficient.[222] Moreover, the record further establishes that UEC is not limited to a one percent bleed.[223] In fact, UEC will have extra capacity in its fluid handling system that it could use to

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[217] Issue R Rebuttal Testimony, Bennett, p. 6, ll. 9-16.
[218] District's Exceptions, p. 5.
[219] District's Exceptions, p. 5.
[220] Kelley Cross-Examination, Transcript, p. 742, ll. 7-20; Issue R Rebuttal Testimony, Kelley, p. 30, ll. 1-3.
[221] *See, e.g.*, Blandford Testimony, p. 30, ll. 8-22; *see also* Issue A Rebuttal Testimony, Holmes, p. 4, l. 5 – p. 5, l. 10.
[222] Issue R Rebuttal Testimony, Kelley, p. 30, ll. 1-3; Issue R Rebuttal Testimony, Bennett, p. 22, l. 5—p. 24, l. 13; Murry Cross-Examination, Transcript, p. 1399, l. 1—p. 1400, l. 6; Executive Director Exhibit 17, p. 66, Response 93; Issue A Rebuttal Testimony, Holmes, p. 4, l. 5 – p. 5, l. 10.
[223] Issue R Rebuttal Testimony, Holmes, p. 27, ll. 4-12.

increase its bleed should that become necessary.[224]

2. The County's Exceptions

a. Northwest Fault

The County contends that the ALJ's recommendation regarding Northwest Fault means that UEC failed to meet its burden of proof regarding Issue R.[225] As explained in Part I above, that argument is without merit.

b. Restoration

The County asserts that "UEC will be unsuccessful in restoring groundwater quality to baseline conditions and will obtain an amendment to restoration levels."[226] As explained under Issue L above, that argument is also without merit. The County further asserts that "once an amendment is issued, there is no longer a requirement to monitor groundwater quality or its migration pattern."[227] In making this argument, the County simply ignores the testimony of Mr. Murry, who explained that a mining company that has obtained an amendment to its restoration table "cannot just cease monitoring . . . . By the rule, they have to ask us [for permission] to cease monitoring."[228]

S. Issue S: Whether there are any USDWs within the injection zones proposed by UEC.

The District did not file exceptions related to Issue S, and while the County recommends a finding, this proposed finding is related to Issue F, not Issue S, and is therefore covered substantively in Part II.F above.

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[224] The maximum total amount of disposal well capacity that may be required is 133 gpm (*i.e.*, 50 gpm for mining operations, 75 gpm for restoration operations, and 8 gpm for plant run-off in case of a 25-year rain event), and UEC's Class I disposal wells are being permitted for a disposal rate of 200 gallons per minute. Thus, UEC will have 67 gpm of extra capacity that it could use to increase its bleed should that become necessary. Underdown Direct Prefiled Testimony, p. 12, l. 13 – p. 13, l. 22; UEC-Underdown Exhibits 4-5; Holmes Direct Testimony, p. 45, ll. 9-10.

[225] County's Exceptions, p. 45.

[226] *Id.*

[227] *Id.*

[228] Murry Cross-Examination, Transcript, p. 1265, ll. 2-6.

T. Issue T: Whether any USDWs within Goliad County will be adversely impacted by UEC's proposed in situ uranium operations.

The District did not file exceptions related to Issue T. The County reiterates its argument regarding UEC's burden of proof on the basis that the issue of the transmissivity of the Northwest Fault—which could lead to adverse impacts to USDWs—has not been resolved. This argument is addressed above in Part I above. The County then reiterates its argument that the "vast majority" of water within the proposed aquifer exemption area is suitable for human consumption, and if the exemption is granted, "will be authorized to be contaminated" and that the "damage [will be] permanent."[229]

As discussed above in Part II.E, water quality is not the only determining factor for whether an area is appropriate for an aquifer exemption. Furthermore, the data from the proposed production areas does ***not*** indicate that the "majority" of the water within the proposed exemption area is suitable for human consumption. In fact, it is because the data does not indicate suitability for human consumption that the Protestants have gone to so much trouble to create so many theories as to why the groundwater data is wrong. Simply put, elevated levels of uranium and radium are expected to be found in groundwater in and around areas of uranium mineralization.[230]

The relative merits of the County's opinions regarding UEC's likely success at groundwater restoration are discussed above in Part II.L. Finally, the statement that an exemption authorizes contamination of groundwater is patently false and reflects a fundamental misunderstanding of the law. Mr. Holmes addressed these issues in his rebuttal testimony, in which he explained that an aquifer exemption "is not a license to pollute the entire area."[231] Mr.

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[229] County's Exceptions, pp. 46-47.
[230] Galloway Direct Testimony, p. 25, l. 1—p. 26, l. 15; Bennett Direct Testimony, p. 32, l. 21—p. 33, l. 15.
[231] Issue A Rebuttal, Holmes, p. 16, l. 6 – p. 17, l. 2.

Holmes explained that while the purpose of an aquifer exemption is to allow valuable natural resources to be developed, "in situ recovery operations are designed to minimize to the fullest extent practicable the loss of mining solutions to areas outside the production zone within the production area."[232]

U. Issue U: Whether there is a "practical, economic and feasible alternative to an injection well reasonably available" within the meaning of that term as set forth in TWC § 27.051(d)(2).

The District did not file any exceptions related to Issue U, and the County simply reiterates its Issue A argument regarding alternative site analysis; this argument is addressed above under Part II.A.

III.

REPLY TO EXCEPTIONS REGARDING THE PAA-1 APPLICATION

A. Mine Plan

The District and the County did not file any exceptions related to the PAA-1 mine plan.

B. Restoration Table and Baseline Water Quality Table

The District did not file any exceptions related to the PAA-1 proposed restoration table or baseline water quality table. The County adopts its mine application arguments related to baseline water quality, which are addressed in Part II.C above.

The ALJ recommended that "the baseline water quality table and the restoration table should be amended to reflect the average of all three rounds of baseline groundwater quality sampling for all constituents."[233] In an attempt to follow the ALJ's recommendation, UEC submitted three attachments to its Exceptions: (1) a revised baseline water quality table; (2) a revised control parameter upper limits table; and (3) a revised restoration table. Later, after realizing that not all of its restoration table numbers matched the revised numbers submitted by

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[232] *Id.*
[233] PFD, p. 128.

the ED, UEC reviewed all of the laboratory sheets for the water quality data and discovered errors in the spreadsheet it used to calculate the average values. Corrected baseline and restoration tables are attached as Attachment T.

It should also be noted that in revising the baseline water quality table, UEC revised only the production area values used in the restoration table rather than the monitor well (mine area) values; UEC would be happy to make revisions to the mine area numbers as well, if that is the ALJ's recommendation. Finally, although revising the control parameter upper limits for the production zone seems a logical and fair result of the ALJ's recommendation, UEC has no objection to leaving them as they now appear in the current draft PAA-1, if that is the commission's preference.

C. Control Parameter Upper Limits

The District did not file any exceptions related to the PAA-1 control parameter upper limits. As the County concedes, the TCEQ "application form for a PAA states that an applicant may determine upper limits by either adding 25% or 5 mg/L to the highest detected concentration."[234] Nevertheless, the County asserts that, in this case, adding 25% is not an "acceptable method" and that adding 5 mg/L is "[a] more reasonable approach."[235] In fact, not only is adding 25% plainly an acceptable method under the TCEQ's own instruction form, the record establishes that it is the only workable method in this case.

For example, the highest detected, naturally-occurring chloride level in the overlying Sand A was 584 mg/L, resulting in a proposed upper control limit of 730 mg/L, which is 584 mg/L plus 25%. The County argues that the upper control limit should instead be only 589 mg/L, which is an increase of .008%. In other words, under the County's proposal, a fluctuation

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[234] County's Exceptions, p. 48; *see* Exhibit UEC-Holmes 20, PAA Application Form, p. 9 (instructing applicants to calculate control parameter upper limit by adding "either 25% or 5 mg/l above the highest value for each control parameter")

[235] County's Exceptions, p. 49.

of ***less than one one-hundredth of one percent*** of the highest known chloride level in Sand A would be characterized as an "excursion" requiring additional monitoring, corrective action and TCEQ involvement. However, the record establishes that, even under natural conditions, chloride levels are ***expected*** to show significant variability over time.[236] As a result, the County's proposal to declare every fluctuation of less than one one-hundredth of one percent to be an excursion would lead to constant false excursions.

Moreover, not only would the County's proposal lead to constant false excursions, it would also not provide any environmental advantage or benefit. The record establishes that: 1) the mining fluid will contain an unnaturally high level of chloride because chloride will be added to the mining fluid as a part of the mining process[237]; and 2) chloride is a conservative control parameter that it moves with groundwater without undergoing retardation like most other constituents.[238] Thus, any *actual* excursion of mining fluids would not cause a substantial increase in chloride levels in the affected monitor wells, not a tiny fluctuation.

D. Monitor Wells

The District did not file any exceptions related to the PAA-1 monitor well ring. The County argues that because its expert, Mr. Blandford, suggests that contaminants will not reach the monitor wells placed 400 feet from the area to be mined, the wells should be moved closer.[239]

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[236] Erskine Cross-Examination, Transcript, p. 136, ll. 9-23; p. 141, ll. 6-16; Bennett Cross-Examination, Transcript, p. 833, l. 23—p. 834, l. 7; Exhibit UEC-Holmes 33, at pp. 48-50. For example, in 2007, the District asserted that a 15% increase in the chloride level in a certain well was a result of UEC's exploration activities. Exhibit UEC-Holmes 33, at pp. 46-47. The RCT, however, explained that such increase was "well within the expected range for seasonal variation of chloride levels." *Id.*, p. 50. Groundwater data from the three sample sets taken in UEC's applications shows natural variation in chloride levels of 20% just within the PA-1 production area and 26% within the PA-1 mine area. Exhibit UEC-Holmes 20, at p.5-7 (showing a low chloride value of 150 mg/L); Exhibit Goliad County – Sass 13 (showing a high chloride value of 180 mg/L within the PA-1 production area and chloride values ranging between 147 mg/L and 185 mg/L within the mine area).

[237] Underdown Direct Testimony, p. 7, l. 23 – p. 8, l. 7.

[238] Exhibit UEC-Holmes 29, p. 159, ll. 4-7 (Blandford Deposition); Galloway Direct Testimony, p. 14, ll. 4-9; PAA-1 Rebuttal Testimony, Bennett, p. 9, ll. 16-17.

[239] County's Exceptions, p. 50.

First, the number, placement and construction of the monitor wells conforms to the requirements of Sections 331.82, 103 and 104; all applicable requirements were met.[240] Second, as Dr. Bennett pointed out, Mr. Blandford's modeling did nothing to support his ultimate conclusion that contaminated water will be left in place at the end of mining,[241] because he did not model containment measures or restoration.[242] Third, there is evidence in the record that the monitoring system actually *will* work.[243] Fourth, Mr. Blandford overlooked the point that monitor wells will be used not only for measuring water quality, but also for measuring water levels to ensure containment of fluids within the production area.[244] And finally, Mr. Blandford missed the point expressed by the ALJs in a recent landfill case.

In *BFI Waste Systems of North America for Permit No. 1410-C*,[245] a contested case hearing regarding a landfill permit, the protestants likewise argued that the "standard placement" of the monitoring wells, which was 500 feet from the landfill, was insufficient because the monitoring wells would be too far from the landfill units to detect contamination in a reasonable time.[246] They asserted that the site's slow groundwater flow rate required special design consideration.[247] The ALJs, however, concluded that the placement of the monitor wells complied with the applicable regulatory requirements and that the slow groundwater flow rate was a ***beneficial*** aspect of the site:

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[240] Exhibit UEC-Holmes 20, pp.1-3, 1-4,1-9 and Figure 1-4; Underdown Direct Testimony, p. 9, ll. 22—p. 11, l. 16; Kelley Direct Testimony, p. 26, ll. 1-9.
[241] Blandford Testimony, p. 40, ll. 7-13.
[242] Issue R Rebuttal Testimony, p. 23, l. 14—p. 24, l. 21.
[243] Underdown Cross-Examination, Transcript, p. 206, l. 23—p. 207, l. 10; Kelley Re-Direct, Transcript, p. 761, ll. 1-16.
[244] *Supra* at Part II.R.3.b.
[245] *In re: Application of BFI Waste Systems of North America for Permit No. 1410-C*, SOAH Docket No. 582-99-0784, TNRCC Docket No. 1999-0455-MSW (June 12, 2000) (Proposal for Decision) (hereinafter, "BFI Proposal for Decision"); TNRCC Order Issuing Permit No. 1410-C to BFI Waste Systems of North America; TNRCC Docket No. 99-0455-MSW; SOAH Docket No. 582-99-0784 (Sept. 1, 2000) (hereinafter, the "BFI Order Issuing Permit."). These documents are included in UEC's Request for Official Notice. UEC's Closing Argument, pp. 151-52.
[246] BFI Proposal for Decision at pp. 33-35.
[247] *Id.*

> The ALJs find that the monitoring system proposed by Applicant is planned in accordance with the applicable MSW rules. However, the site-specific conditions, particularly the slow vertical flow rate, render any monitoring system somewhat ineffective for this facility. When asked if the monitoring wells would detect contaminants in the event of a release by the Landfill, [the Executive Director's expert witness] testified, "I would never say never, but I would say that the likelihood is very remote." ***[This] testimony does not presume a failure by the monitoring wells, but rather a slow or nonexistent rate of groundwater flow that would prevent any released contaminants from rapidly reaching the wells.*** As noted previously herein, ***this is a beneficial aspect of this particular site.*** ... [W]hile these site-specific conditions make designing an effective monitoring system difficult, they do not indicate a problem with the application.[248]

In other words, Mr. Blandford's analyses, if correct, demonstrate a very good thing: namely, even if UEC did nothing to contain mining fluids during mining, not even the ***most conservative*** constituent will make it out of the production area and beyond the monitoring well ring.

E. Cost Estimates for Aquifer Restoration and Well Plugging and Abandonment

The County "agrees with the ALJ that the financial assurance should be recalculated to reflect the cost of restoration to appropriate baseline."[249] While UEC agrees that a recalculation of financial assurance will and should occur on a regular basis according to the applicable regulations, UEC respectfully disagrees with the ALJ regarding the necessity for that recalculation to occur before the issuance of PAA-1 for the reasons explained in UEC's Exceptions.

F. Whether the PAA-1 Application complies with all applicable statutory and regulatory Requirements.

The District files no exceptions on this topic, and the County relies upon its exceptions regarding Issue H; these exceptions are addressed above in Parts I and II.H.

[248] *Id.* at 36.
[249] County's Exceptions, p. 38.

IV.

TRANSCRIPT COSTS

The County talks quite a bit about fairness and honesty.[250] In this case, the honest truth is that the County is correct: the money the Protestants spent does indeed "pale[] in comparison"[251] to the amount of money and resources spent by UEC in defending itself against the County's federal lawsuit (which was dismissed)[252] and meeting its burden of proof on all the Issues in the contested case hearing, many of which are actually covered in other applications pending with TCEQ. Consequently, the ALJ's recommendation that the Protestants together share a mere 25% of the transcript costs—a transcript which they used liberally in their closing argument briefs—is abundantly fair.

WHEREFORE, Uranium Energy Corp respectfully requests that the commission issue the Class III Injection Well Area Permit UR03075 and an Order granting the request for designation of an exempt aquifer, including the Findings of Fact and Conclusions of Law attached hereto. Uranium Energy Corp further requests that the commission issue Production Area Authorization UR03075PAA1 with a revised baseline water quality table and a revised restoration table as set forth in Attachment T hereto, and a revised proposed control parameter table as set forth on Attachment 5 to Uranium Energy Corp's Exceptions to Proposal for Decision. Uranium Energy Corp also requests that the commission enter the Findings of Fact and Conclusions of Law attached to Uranium Energy Corp's Exceptions to Proposal for Decision as Exhibit A.

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[250] *See e.g.*, County's Exceptions, p. 4.
[251] County's Exceptions, p. 52.
[252] Kreneck Testimony, p. 2, l.19—p. 3, l.5.

Respectfully submitted,

KELLY HART & HALLMAN LLP
301 Congress Avenue, Suite 2000
Austin, TX 78701
(512) 495-6400
(512) 495-6401 (FAX)

By: _____

MONICA M. JACOBS
State Bar No. 24007433
DIANA NICHOLS
State Bar No. 00784682

ATTORNEYS FOR APPLICANT
URANIUM ENERGY CORP

CERTIFICATE OF SERVICE

I hereby certify that on this the 1st day of November 2010, a true and correct copy of the foregoing Applicant Uranium Energy Corp's Reply to Protestant Goliad County Groundwater Conservation District's Exceptions to Proposal for Decision has been served via electronic mail and hand delivery/overnight mail on the following:

Ms. Shana Horton
Mr. Don Redmond
Office of Legal Services, Environmental Law Division
Texas Commission on Environmental Quality
P.O. Box 13087, MC-173
Austin, Texas 78711-3087
Representing the Executive Director, TCEQ (***Via Electronic Mail & Hand Delivery)***

Mr. Garrett Arthur
Office of Public Interest Counsel
Texas Commission on Environmental Quality
P.O. Box 13087, MC-103
Austin, Texas 78711-3087
Representing Office of Public Interest Counsel, TCEQ (***Via Electronic Mail & Hand Delivery)***

Mr. Jim Blackburn
Blackburn Carter, P.C.
4709 Austin
Houston, Texas 77004
Representing Goliad County (***Via Electronic Mail & Overnight Mail)***

Mr. Rob Baiamonte
Baiamonte Law Firm
P.O. Box 1091
Goliad, TX 77963
Representing Goliad County Groundwater Conservation District (***Via Electronic Mail & Overnight Mail)***

Pat Calhoun
Goliad County Farm Bureau
Attn: P.T. Calhoun
P.O. Box 1369
Goliad, TX 77963
(***Via Electronic Mail & Overnight Mail)***

Diana L. Nichols

ATTACHMENT 1

TESTIMONY REGARDING QUALIFICATIONS AND EXPERTISE OF CRAIG HOLMES

DIRECT TESTIMONY OF CRAIG W. HOLMES

I.

QUALIFICATIONS AND AREAS OF EXPERTISE

Q: Please state your name, place of employment, and business address for the record.

A: My name is Craig W. Holmes. I am currently self-employed as a consultant in the uranium mining industry, and my business address is 8107 Pommel Drive, Austin, Texas 78759.

Q: What is your role in this proceeding?

A: I am providing expert testimony on behalf of Uranium Energy Corp ("UEC") generally in the area of regulatory compliance of UEC's application for a Class III Underground Injection Control permit, Permit No. UR03075, and UEC's application for an aquifer exemption, which is a part of UEC's application for Permit No. UR03075 (which I will refer to collectively as the "Mine Application"). I am also providing testimony in support of UEC's application for its first Production Area Authorization No. UR03075PAA1 ("PAA-1 Application") which has been consolidated with the Mine Application.

Q: What is the scope of your expert testimony?

A: I begin my testimony by providing an overview of the in situ uranium mining regulatory process and the various authorizations that are required for in situ mining. The rest of my testimony primarily addresses issues related to whether UEC's Mine Application and PAA-1 Application meet the administrative and technical requirements of Chapter 27 of the Texas Water Code and the Chapter 331 rules and other applicable rules of the Texas Commission on Environmental Quality ("TCEQ"). I also address the specific issues referred by the TCEQ Commissioners to the State Office of Administrative Hearings ("SOAH") for the contested case hearing in this docket.

Q: Can you identify the document attached to your testimony as Exhibit UEC-Holmes 1?

A: Yes. **Exhibit UEC-Holmes 1** is my *Curriculum Vitae*, which I prepared.

Q: Please summarize your educational background in general terms.

A: I received a Bachelor's Degree in 1973 (with honors) in the major area of study of Physical and Economic Geography from the University of Pittsburgh. In 1975, I received a Master's Degree from the University of Pittsburgh in the areas of study of meteorology/ climatology and physical/economic geography.

Q: Please summarize your work experience in general terms.

A: I have been working as an environmental consultant for over 30 years, primarily in the field of uranium mining. During this time, I have worked for Radian Corporation, Camp Dresser & McKee, Inc., Eggleston Holmes & Associates, and I am now operating a solo environmental consulting practice. Most of my experience has been focused on applying the federal and state regulatory requirements for permitting, licensing, restoring and reclaiming uranium mining operations. In addition, I have had a major role in conducting the required environmental baseline and impact studies for numerous uranium mining operations, and I have also worked extensively on groundwater restoration requirements for closing uranium mines.

Q: What were your responsibilities at Radian Corporation?

A: I worked in the atmospheric sciences division. My duties included setting up meteorological instruments at various field locations where mines or other projects were being proposed, analyzing meteorological data for input into air quality models, and preparing technical reports to address regulatory requirements.

Q: What did you do at Camp Dresser & McKee, Inc.?

A: I served as a project manager and as a technical staff member. My duties involved overseeing uranium mining projects; setting up field sampling programs (groundwater, surface water, air, soils, gamma and radon); and preparing Class III permit applications, radioactive material license applications and background material for aquifer exemption requests. I also prepared technical reports that supported the various permit/license applications. During this time, I worked on three in situ uranium projects that had PAAs. The projects included Texaco's Tex-1 Mine, Everest's Hobson Project and Tenneco's West Cole Project. I also managed the permitting of a surface uranium mine known as the Rhode Ranch Uranium Project.

Q: What kind of work did you specialize in at Eggleston Holmes & Associates?

A: During the time I was a principal with the environmental consulting firm of Eggleston Holmes & Associates, our firm primarily specialized in conducting environmental baseline and impact assessments for uranium mining operations. Our other areas of specialization involving uranium mining included groundwater restoration, financial surety, surface reclamation, radiological closeout surveys and feasibility studies. I also spent a considerable amount of time monitoring and responding to federal and state rules and regulatory changes affecting uranium mining.

Q: What kind of work do you do now that you operate as a solo environmental consultant?

A: In 2007, my partner in Eggleston Holmes & Associates, Alan C. Eggleston, passed away and I decided to continue operating an environmental consulting practice under my own name. The kind of work I do now is generally the same kind of work I performed when I was a partner in Eggleston Holmes & Associates, but the emphasis is more in the areas of regulatory advising and overall management of permit applications.

Q: Do you have professional experience that you believe makes you especially qualified to testify as an expert in this case?

A: Yes. As shown in my *Curriculum Vitae*, there are numerous projects that I have worked on that have given me extensive experience regarding the issues of this case. Most of my 30 years experience has been focused on working with uranium mining regulations and regulators -- developing mining applications and supporting materials to fulfill the requirements of uranium mining regulations both during the initial application process and during operations and closeout.

Q: How many uranium mining applications and permits have you worked on?

A: I would estimate that I have worked on approximately 80% of all of the permits, licenses, amendments and authorizations that have been issued involving the uranium industry in Texas. In particular, I have worked on approximately 16 Class III mine permit applications and approximately 40 PAA applications. I also worked on approximately eight restoration/reclamation projects.

Q: Based on your education and work experience, do you consider yourself to be an expert on issues related to Texas uranium mining operations, including aquifer exemptions and production area authorizations, and the associated regulations and permitting process?

A: Yes, I do.

Q: Do you adopt Exhibit UEC-Holmes 1 (*Curriculum Vitae* of Craig W. Holmes) as your testimony regarding your qualifications as an expert on uranium mining operations, including aquifer exemptions and production area authorizations, and associated regulations and permitting processes?

A: Yes.

Q: Do you have specific familiarity and expertise with respect to UEC's proposed in situ uranium mining project in Goliad County involved in the present docket ("the Goliad Project")?

A: Yes. I managed the preparation of all of the applications related to the Goliad Project including the applications for a Class III underground injection control permit, the aquifer exemption, PAA-1, the Radioactive Material License, Permit by Rule, and the Class I injection wells. As pertains to this hearing, I interfaced with TCEQ staff in their administrative and technical review of the Mine Application and PAA-1 Application and helped draft various responses to questions raised by TCEQ staff during their technical review of these applications. I also designed the program for sampling groundwater and surface water and participated in all of the usual steps required for obtaining TCEQ approval of a uranium mining project. In general terms, I have acted as the "general contractor" for these applications and as the primary UEC representative in dealing with TCEQ staff on technical and regulatory issues associated with UEC's applications. In addition, I have visited the site for the proposed Goliad Project a number of times in the course of working to develop these applications.

Q: Can you estimate how many times you have visited the site?

A: Between late 2006 and the present time, I have visited the site at least 20 times.

RESUMÉ OF
MR. CRAIG HOLMES

Craig W. Holmes
Regulatory Consultant
8107 Pommel Drive
Austin, Texas 78759
Office Telephone: 512.250.8151
Cell: 512.731.9082
Email: pommelhouse@sbcglobal.net

Education

University of Pittsburgh. 1973. Bachelor of Arts (Honors) multidisciplinary -- physical and economic geography.

University of Pittsburgh. School of Graduate Studies. 1975. Completed all courses and passed required comprehensive examinations for a Master of Sciences. Areas of study: climatology and meteorology.

Professional History

Craig W. Holmes, Regulatory Consultant (January 2007 to the present time)

Professional services include the following:

- Overall management and preparation of permit, exemption and license applications for in-situ uranium recovery operations.
- Design and management of baseline sampling programs (air, soil, sediment, vegetation, groundwater and surface water) necessary to support Underground Injection Control (UIC) permit applications, Production Area Authorization (PAA) applications and Radioactive Material License (RML) applications.
- Decommissioning of uranium process facilities.
- Preparing documentation for radioactive material license terminations.
- Providing assistance with groundwater restoration in depleted uranium ore zones.
- Interfacing with regulatory agencies on permits and license applications.
- Rulemaking in program areas that govern uranium recovery activities.
- Assessments involving acquisitions of uranium prospects.
- Legislative bill analysis and bill writing.
- Expert witness services.

A summary of Mr. Holmes' professional activities during the past two and a half years is summarized below.

<u>Uranium Energy Corp (UEC)</u>

Mr. Holmes is UEC's Chief Regulatory Consultant, and in this role his primary responsibility includes the preparation and management of all the authorizations that are required for uranium recovery operations.

The authorizations include the following:

- Radioactive Material License
- Class III Injection Well Permit
- Production Area Authorizations
- Class I Waste Disposal Well Permits
- EPA and TCEQ Aquifer Exemption
- U.S. Army Corps of Engineers Jurisdictional Determination
- Texas Historical Commission (Concurrence that the proposed project will not have a significant impact on cultural or archaeological resources.)
- Railroad Commission of Texas (Letter acknowledging that the proposed disposal wells will not endanger oil/gas resources.)
- Texas Department of Parks and Wildlife (Concurrence that the proposed project will not have a significant ecological impact.)
- Permit by Rule (Air quality permit.)

In addition to overseeing permitting and licensing, Mr. Holmes' duties extend to the areas of baseline sampling design, proposed operational monitoring, coordinating with certain consultants who provide services for permit applications, working with legal counsel, participating in public meetings, interfacing with regulatory agencies and advising the company on various regulatory matters.

COGEMA Mining, Inc. /Areva

Mr. Holmes is serving as a consulting general manager for site decommissioning and radioactive material license termination for two former uranium mining sites in Texas (Holiday-El Mesquite and O'Hern). Closure activities include radiological surveys, soil sampling, report writing, interfacing with TCEQ, and documenting the various stages of closure.

Uranerz Energy Corporation

Uranerz is a Wyoming-based uranium mining company. Mr. Holmes provides general regulatory services. Services include reviewing and writing certain chapters of the company's radioactive material license application; designing baseline sampling programs for soils, sediments, surface water, ambient radon-222 and gamma; and providing advice on Nuclear Regulatory Commission (NRC) regulations and proposed rules.

Rio Grande Resources Corporation (RGR)

RGR is a uranium mining company. Mr. Holmes has been retained to prepare a radioactive material license application for RGR's proposed uranium processing facility near Hobson, Texas. The application was filed with TCEQ in 2008. Mr. Holmes also prepared and filed a permit by rule application with TCEQ for RGR's proposed processing plant. The permit was issued in 2009.

Rulemaking

TCEQ recently completed a major update to the rules in areas governing uranium recovery operations and by-product material disposal. Mr. Holmes participated in this process on behalf of Uranium Energy Corp, Uranerz Corporation and COGEMA/Areva. The Railroad Commission of Texas (RCT) has also recently engaged in rulemaking in areas that regulate uranium exploration. Mr. Holmes participated in this process on behalf of COGEMA/Areva, UEC and Uranerz Energy Corp.

Legislation

During the 2007 legislative session, Mr. Holmes participated in the passage of two bills (HB-3837 and HB-3838). HB-3837 is a bill that clarifies RCT's exclusive jurisdiction over uranium exploration and HB-3838 is a bill that addresses the registration of uranium exploration wells that become part of a Class III injection well permit.

Eggleston Holmes and Associates (1982 to 2006)

Mr. Holmes was a general partner with Eggleston Holmes and Associates (EHA). EHA specialized in comprehensive environmental impact studies associated with in situ uranium mining. EHA had over 20 years of experience in permitting and assessing potential environmental impacts of in situ uranium mining operations. In this regard, EHA conducted numerous baseline and impact studies in Texas, Wyoming and New Mexico. EHA's specific areas of expertise with uranium mining environmental studies included the following:

- Baseline groundwater water quality characterization
- Groundwater impacts
- Groundwater restoration
- Land application/irrigation impacts from treated water
- Radiological impacts (MILDOS Dosimetry Modeling)
- Baseline radiological surveys
- Economic impacts of uranium operations
- Ecological baseline development and impact analysis
- Land use impacts
- Regulatory permitting, licensing and exemption filings
- Reclamation and radiological closeout surveys
- Soils and vegetation mapping
- Sediment, vegetation, soils and water sampling
- Meteorological and climatological characterizations
- Financial surety estimates for restoration and reclamation
- Feasibility studies for uranium properties and projects
- Water well inventories
- Rulemaking
- Legislative bill tracking and analysis
- Socioeconomic impact assessments of uranium operations
- General management of technical content of uranium permit and license applications
- Uranium market trends - future supply and demand

During the past 23years, Mr. Holmes worked extensively in all of the areas listed above.

Camp Dresser and McKee (CDM) 1978 to 1982

CDM was an international engineering and consulting firm. Mr. Holmes was employed to provide management and technical services for projects involving surface uranium mining, in situ uranium mining and surface lignite mining.

As a manager, Mr. Holmes was responsible for preparing project cost estimates, ensuring that projects were completed within budget and on time, and for laying out the technical and regulatory subjects that had to be included in the environmental studies. Management duties also included overall responsibility for the accuracy and completeness of the studies that were being performed.

In a technical role, Mr. Holmes worked extensively in the areas of state and federal environmental regulations concerning uranium and lignite mining, baseline water quality characterization, groundwater restoration, financial surety estimates, air quality sampling and measurement, meteorological characterization and measurement for air quality modeling, background air quality measurements, soil sampling and baseline soil characterization (soil types, uses, and soil chemical and radiological properties) land use impacts from mining and other mineral production activities, and economic impact analysis of mining projects.

Radian Corporation 1976 to 1978

Radian was an engineering and environmental consulting firm. Mr. Holmes was employed as a staff scientist in the atmospheric sciences division. In this capacity his responsibilities included setting up and maintaining meteorological instruments in field locations where environmental projects were being conducted, analyzing meteorological data and preparing it for input into air quality models, setting up water flow and water volume measuring instruments in field locations, collecting water data for use in environmental reports that addressed water quality and water volume issues, preparing technical reports, conducting economic impact studies of lignite mines and preparing various types of thematic maps for use in impact studies and permit applications.

<u>Studies, Reports, Permit/License Applications and Investigations</u>

- Air Quality Studies for several Texas utility companies
- Air Quality Permit Exemptions for Several In Situ Uranium Mines in Texas
- Aquifer Exemption Application and Approval for an In Situ Uranium Mine in Texas. *Mesteña Uranium, L.L.C.*
- Cost Estimates for Closure (Restoration and Reclamation) for the Proposed Alta Mesa in Situ Uranium Mine in Texas. *TOTAL Minerals Corporation*
- Cost Estimates for Closure (Restoration and Reclamation) for the Proposed Alta Mesa In Situ Uranium Mine in Texas. *MestenUranium, L.L.C.*
- Cost Estimates for Closure. (Restoration and Reclamation) for the Holiday - El Mesquite and O'Hern In Situ Uranium Mines in Texas. *TOTAL Minerals Corporation*
- Due Diligence Studies for the Acquisition of Several In Situ Uranium Mining Properties in Wyoming and Texas. *TOTAL Minerals Corporation*
-

- Economic Impact Analysis of Constructing Coal Gasification Plants in Economically Depressed Areas in Missouri and West Virginia. *U.S. Energy Research and Development Administration (ERDA)*
- Environmental Baseline and Impact Assessment for a Lignite Mine in Rockdale, Texas. *Shell Oil Company*
- Environmental Baseline Studies for an In Situ Uranium Mine in Hobson, Texas. *Everest Exploration, Inc.*
- Environmental Baseline and Impact Study for a Surface Uranium Mine in South Texas. Rhode Ranch Project. *Anaconda Copper Company*
- Environmental Baseline Studies for a Proposed In Situ Uranium Mine near Bessey's Creek, Texas. *Cambridge Royalty Oil Company*
- Environmental Baseline Studies for the Mt. Lucas In Situ Uranium Mine in Texas. *Everest Exploration, Inc.*
- Environmental Baseline Studies and Impact Assessments for URI's Rosita, KVD and Vasquez Uranium Mines in South Texas. *Uranium Resources, Inc.*
- Environmental Protection Agency (EPA) Aquifer Exemption Applications and Evaluations for In Situ Uranium Mining. *URI, TOTAL Minerals Corporation and Mesteña Uranium, L.L.C.*
- Environmental Studies and Impact Assessments for the West Cole In Situ Uranium Mine in South Texas. *TOTAL Minerals Corporation*
- Environmental Studies and Impact Assessments for the Holiday - El Mesquite In Situ Uranium Mine in Texas. *TOTAL Minerals Corporation*
- Environmental Baseline Studies and Impact Assessments for the Proposed Alta Mesa In Situ Uranium Mine in South Texas. *TOTAL Minerals Corporation*
- Environmental Studies for the Nell In Situ Uranium Mine Facility in South Texas. *Mobil*
- Environmental Studies for Radioactive Material License Area Expansions for U.S. Steel's In Situ Uranium Facility in South Texas
- Environmental Studies and Permit Preparation for the TEX 1 In Situ Uranium Mine in South Texas. *Texaco/Sunoco*
- Environmental Baseline Studies for the Highlands In Situ Uranium Mine in Wyoming. *Everest Exploration, Inc.*
- Expert Witness in Several Contested Cases Involving Uranium Projects – Texas and New Mexico
- Exploration and Assessment of Properties for Potential Uranium Development in South Texas. *Confidential Client*
- Feasibility Study for a Proposed Uranium Project in South Texas. *Confidential Client*
- Field Studies, Testing and Application Preparation for Several Production Area Authorizations (PAAs). *Mesteña Uranium, L.L.C.*
- Groundwater Restoration Evaluation for the Holiday - El Mesquite In Situ Uranium Mine in South Texas. *TOTAL Minerals Corporation*
- Groundwater Restoration Evaluation for the O'Hern In Situ Uranium Mine in South Texas. *TOTAL Minerals Corporation*
- Groundwater Restoration Management and Restoration Table Amendment for the Lamprecht In Situ Uranium Mine in South Texas. *Intercontinental Energy Corporation (IEC)*

- Groundwater Restoration Management and Restoration Table Amendment for the Zamzow In Situ Uranium Mine in South Texas. *Intercontinental Energy Corporation (IEC)*
- Identifying and Delimiting a Contaminant Plume of Radium-226 and Uranium in Surface and Subsurface Soils and Stream Sediments as a Result of Surface Discharges from URI's Benevides and Longoria Uranium Operations. *Uranium Resources, Inc. (URI)*
- Irrigation Study for an In Situ Uranium Mine in South Texas. *Everest Exploration's Hobson Facility*
- Irrigation Study and Permit Application for an In Situ Uranium Mine in South Texas. *Intercontinental Energy Corporation (IEC)*
- Irrigation Study and Permit Application for the Mt. Lucas In Situ Uranium Mine in South Texas. *Everest Exploration*
- Irrigation Studies for the Smith Ranch In Situ Uranium Mine in Wyoming. *Rio Algom*
- Irrigation Study and Permit Application for the Highlands In Situ Uranium Mine in Wyoming. *Everest Exploration, Inc.*
- Irrigation Plan and Management for the Pawnee In Situ Uranium Mine in South Texas. *Intercontinental Energy Corporation (IEC)*
- Land Use Investigation and Assessment for Possible Wilderness Classification. Wyoming. *KOCH Exploration*
- Mine Closure Plan for the Proposed Alta Mesa In Situ Uranium Mine in Texas. *TOTAL Minerals Corporation*
- Mine Closure Plan for the Proposed Alta Mesa In Situ Uranium Mine in Texas. *Mesteña Uranium, L.L.C.*
- Mine Closure Plan Cost Estimates for the Holiday - El Mesquite In Situ Uranium Mine in Texas. *TOTAL Minerals Corporation*
- Monitoring and Evaluating Groundwater Restoration Efforts at URI's KVD and Rosita Uranium Mine Facilities in South Texas (Duval and Kleberg Counties). *Kleberg County Government*
  Permit (Class III Injection Well) Application Preparation for the proposed Alta Mesa In Situ Uranium Mine in South Texas. *Mesteña Uranium, L. L. C.*
- Permit and License Application Preparation for the Rhode Ranch Surface Uranium Mine. *Anaconda Copper Company*
- Preliminary Field Studies for the Proposed Expansion (ESEP) of the Holiday - El Mesquite Uranium Project. *Malipai Resources, Inc.*
- Radioactive Material License Amendment Applications. *Various Uranium Clients*
- Radioactive Material License Application Preparation for the Alta Mesa In Situ Uranium Mine in South Texas. *Mesteña Uranium, L.L.C.*
- Radioactive Material License Renewal for the Holiday - El Mesquite In Situ Uranium Mine in South Texas. *COGEMA Mining, Inc.*
- Radiation Safety Manual Preparation for Mesteña Uranium, L.L.C.
- Radiological Impact Assessment for the Smith Ranch In Situ Uranium Mine in Wyoming. *Rio Algom*
- Radiological Impact Assessment for the proposed Alta Mesa In Situ Uranium Mine in Texas. *Mesteña Uranium, L.L.C.*
- Radiological Impact Assessment for the Highlands In Situ Uranium Mine in Wyoming. *Everest Minerals*

- Radiological Impact Assessment for the proposed Unit I Project in New Mexico. *URI, Inc.*
- Radiological Impact Assessment for the proposed Crownpoint Project in New Mexico. *URI, Inc.*
- Radiological Impact Assessment for the proposed Church Rock Project in New Mexico. *URI, Inc.*
- Radioactive Material License Application and Field Studies for the Proposed Expansion (Grid V) of the Holiday – El Mesquite Uranium Project. *Malipai Resources, Inc.*
- Radiological Impact Assessment for the Holiday - El Mesquite In Situ Uranium Processing Facility in South Texas. *COGEMA Mining, Inc.*
- Radioactive Material License Application for a Custom Device. *Kaneka High-Tech Materials, Inc.*
- Radioactive Material License Amendment to Substitute Krypton for Promethium in a Sealed Source. *Yokogawa Corporation.*
- Secondary Groundwater Compliance Evaluations. *Several South Texas Uranium Operations*
- Site Assessment and Remediation of Alleged Hazardous Waste Disposal without a Permit. *Aero Marine*
- Socioeconomic Impact Assessment for the Proposed Church Rock Project in New Mexico. *URI, Inc.*
- Waiver of Land Ownership Transfer to the State of Texas or Federal Government for the Anaconda Copper Company's Rhode Ranch Uranium Mine in South Texas

Legislation

- Initiated and Managed the Transfer of the Uranium Regulatory Program from the Texas Department of Health Bureau of Radiation Control (TDH-BRC) to the Texas Natural Resources Conservation Commission (TNRCC), predecessor of TCEQ. *Uranium Industry*
- Managed the Transfer of the Uranium Program from TNRCC back to the TDH-BRC. *Uranium Industry*
- Assessment of the Proposed Transfer the Uranium Program in Texas from the Department of State Health Services (DSHS) to TCEQ.

MR. MURRY'S TESTIMONY

MR. MURRY'S TESTIMONY REGARDING RECEIVING PUMP TEST INFORMATION VIA THE DISCOVERY PROCESS

Mr. Murry repeatedly testified that UEC ***did*** submit the data in question to TCEQ:

Q. And do you recall seeing a 24-hour pump test on the northwest fault?
A. Are you referring to seeing it during Dr. Bennett's testimony?
Q. No. I mean, there was -- there was a graphic that I attempted to introduce into evidence but I'm talking about prior to coming into this hearing.
A. UEC submitted some pump test data or I should say fault pump test data. They did not submit it as part of the application. Again, it was just some information that they sent to us. I don't recall if it was a 4-hour or a 24-hour. I took a quick look at that, but, again, for purposes of PA-1, which is some distance from the fault, I didn't see those tests to be -- to really apply. And again, being a regulator, I just say those pump tests were not submitted as part of either the Class 3 application, which wouldn't be required, or as part of the PAA application.[1]

* * *

Q. I'm showing you what has been marked as Goliad County Cross Exhibit No. 22, and I'm asking you to take a minute to page through it and see if you have ever seen that documentation before.
A. As I recall, this --
Q. Yes, sir. Go ahead.
A. Sir, as I recall, this was – this information was submitted as part of discovery.
Q. So you have seen it before?
A. I've seen it in -- yes.[2]

[1] Murry Cross-Examination, Transcript, p. 1333, l. 25 – p. 1334, l. 17.
[2] Murry Cross-Examination, Transcript, p.1336, l. 18 – p. 1337, l. 2.

ATTACHMENT B

SUMMARIES OF RAILROAD COMMISSION DOCUMENTATION

1. The County Files a Complaint with RCT Alleging that UEC's Exploration Activities Have Caused Uranium and Radium Contamination of the Groundwater, Including the Braquet Well

1. In January 2006, UEC applied for a uranium exploration permit from the Railroad Commission of Texas ("RCT").[1] The RCT approved the application and issued Uranium Exploration Permit No. 123 (the "Exploration Permit") to UEC.[2] The Exploration Permit authorized UEC to conduct uranium exploration activities within a 10,700-acre area in Goliad County (the "Exploration Permit Area").[3] In May 2006, UEC began exploratory drilling in the Exploration Permit Area.[4]

2. Just a few months later, in December 2006, the District had water quality testing conducted on various wells in the vicinity of the Exploration Permit Area.[5] The tested wells included six wells located on private property upgradient from UEC's exploration activities (collectively, the "Homeowner Wells"), which wells are owned by various individuals who are protestants in this contested case.[6] The tested wells also included three wells located downgradient from the exploration activities, including one of the Braquet wells.[7]

3. On February 5, 2007, the County's attorney, Mr. Blackburn, wrote a letter to the RCT on behalf of the County, in which he alleged that UEC was not in compliance with the conditions of its Exploration Permit and that UEC's exploration activities were adversely impacting groundwater quality in the area.[8] He represented to the RCT that the radium-226

[1] Exhibit UEC-Holmes 33, at p. 22 (containing official RCT records).
[2] *Id.*
[3] *Id.* at p. 23.
[4] *Id.* at p. 22.
[5] *Id.* at pp. 47-51.
[6] *Id.* at p. 47; *see also id.* at p. 53 (showing the location of the Homeowner Wells). The homeowners/protestants whose wells were tested were Craig Duderstadt, Tom Anklam, Aldon Bade, Reta Brown, and Ted Long. *Id.*
[7] *Id.* at pp. 47, 50.
[8] *Id.* at pp. 1, 19, 22, 50.

levels in three tested wells, including the Braquet well, exceeded the applicable MCL.[9] Based upon the test results, Mr. Blackburn alleged that UEC's exploration activities had caused radioactive contamination of the groundwater.[10]

a. RCT Investigates and Issues an NOV, But Determines that UEC's Exploration Activities Have Not Caused Uranium or Radium Contamination of the Groundwater

1. Pursuant to the Texas Uranium Surface Mining and Reclamation Act, the regulation of uranium exploration is within the exclusive jurisdiction of the RCT.[11] An exploration permit issued by the RCT governs "all activities associated with" uranium exploration.[12] Moreover, the RCT is "solely responsible for the control and disposition of waste and the abatement and prevention of pollution of surface and subsurface water resulting from . . . activities associated with uranium exploration ..."[13]

2. Thus, in response to the allegations in Mr. Blackburn's February 5, 2007 complaint, the RCT undertook an investigation. Beginning March 7, 2007, the RCT conducted a three-day on-site inspection of the Exploration Permit Area during which it examined 117 borehole sites[14] and conducted a gamma radiation survey of the area.[15]

3. By letter dated April 20, 2007, the RCT informed the County that Tim Walter, a hydrologist employed by the RCT, had investigated the County's complaint and had determined

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[9] *Id.*
[10] *Id.*
[11] TEX. NAT. RES. CODE ANN. §§ 131.001 *et seq.* (Vernon 2001 & Supp. 2009).
[12] *Id.* § 131.353(a)-(b)(1) (Supp. 2009).
[13] TEX. WATER CODE ANN. § 26.131(a)(1)-(2) (Vernon 2008); *see also* TEX. NAT. RES. CODE ANN. § 131.301 (Vernon 2001 & Supp. 2009) (providing that the RCT "has the exclusive authority to adopt rules and may issue orders and permits relating to the discharge or runoff of waste or any other substance or material from any permitted uranium exploration activity").
[14] Exhibit UEC-Holmes 33, at pp. 5-17 (Correspondence from RCT to UEC dated March 27, 2007 and attached Inspection Report dated March 7-9, 2007).
[15] *Id.* at pp. 20-30.

that *"no ground-water contamination ha[d] occurred as a result of [UEC's] drilling activities."*[16] The RCT concluded as follows:

> It is ***not plausible*** that the mobility of any uranium materials ha[d] been substantively affected by the drilling activities conducted by UEC. I conclude that ***the likely source of ground-water radioactivity generically identified in the analysis included in your complaint stems from natural sources in contact with the sampled wells themselves.***
>
> In summary, I have determined from the available evidence that no condition exists to warrant further enforcement action by the Commission with regard to ground-water issues. ***The Commission's investigation of your complaint has not revealed any practice or activity within the approved permit area that has adversely affected the wells identified in your complaint or the related aquifer,*** or is out of compliance with the Texas Uranium Mining Regulations (16 TEXAS ADMIN. CODE §11.1 et seq.); therefore, I consider investigation of the ground-water issues of your complaint to be closed.[17]

Because the RCT conclusively determined that UEC had not caused or contributed to any subsurface contamination, it did not cite UEC for any violation related to subsurface pollution.[18]

b. The District Files a Complaint with the RCT Alleging that UEC's Exploration Activities Have Somehow Caused Iron, Sulfate, Chloride, Calcium, Magnesium, Sodium, and Nitrate Contamination of the Homeowner Wells

1. On April 26, 2007, the District had further testing conducted on the Homeowner Wells.[19] The testing analysis did not show any contaminants or constituents in excess of MCLs in any of the Homeowner Wells, except for a high nitrate level[20] in one of the wells on Craig Duderstadts' property.[21]

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[16] *Id.* at p. 19 (Correspondence from RCT to James Blackburn dated April 20, 2007) (emphasis added).
[17] *Id.* (emphasis added).
[18] Issue B Rebuttal Testimony, Holmes, p. 4, 11.20-11.21; Exhibit UEC-Holmes 33.
[19] Attachment A, RCT Records, at pp. 46-50 (Correspondence from RCT to Art Dohmann dated September 5, 2007 and attached Memorandum from Tim Walter, P.G., Hydrologist).
[20] MCL for nitrate is 10 mg/L. 40 C.F.R. § 141.54. The testing analysis showed that the Duderstadt well had a nitrate level of 12.5 mg/L. Exhibit UEC-Holmes 33, at p. 46.
[21] Plaintiffs contend that the Bade Well's level of iron, which is a Non-Health-Related Constituent, also exceeded MCL. The testing analysis, however, was inconclusive as to the iron level in that well. Exhibit UEC-Holmes 22, at pp. 49-50. Id. at pp. 47-50.

2. Nonetheless, on July 9, 2007, Art Dohmann, President of the District, filed a complaint with the RCT in which he asserted that UEC's exploration activities had contaminated the Homeowner Wells.[22] Specifically, he alleged that, between December 2006 and April 2007, the Homeowner Wells had "experienced degradation of quality concurrently with the exploration drilling."[23] Mr. Dohmann did not allege any uranium or radium contamination; rather, he pointed out that some of the Homeowner Wells had experienced increases in the level of some non-health-related constituents (*i.e.*, iron, sulfate, and chloride, all of which remained far below the applicable MCLs)[24] and other non-regulated constituents (*i.e.*, calcium, magnesium and sodium).[25] Mr. Dohmann also alleged that there had been an increase in the nitrate level in the shallow Duderstadt Well. In fact, however, the December 2006 water analysis had not indicated the nitrate level in this well.[26] At any rate, as the RTC pointed out, there are several common causes of nitrate contamination in groundwater, including agricultural practices related to fertilizer use, leaking septic systems, and animal waste.[27]

c. RCT Investigates and Concludes That UEC's Exploration Activities Have Not Caused Iron, Sulfate, Chloride, Calcium, Magnesium, Sodium, and/or Nitrate Contamination of the Homeowner Wells

1. In response to Mr. Dohmann's complaint, the RCT conducted a thorough investigation and assessment. By letter dated September 5, 2007, the RCT submitted a detailed report of its findings and conclusions to Mr. Dohmann.[28] The RCT concluded that none of the increases in constituent values relied upon by Mr. Dohmann were significant. For example, with

[22] *Id.* at p. 47.
[23] *Id.*
[24] *See* 40 C.F.R. § 143.3 (setting MCL for chloride at 250mg/l, MCL for iron at .3 mg/l and MCL for sulfate at 250 mg/l).
[25] Exhibit UEC-Holmes 33, at pp. 47-48.
[26] *Id.* at p. 50.
[27] *Id.*
[28] *Id.* at pp. 46-57 (Correspondence from RCT to Art Dohmann dated September 5, 2007, and attached Memorandum from Tim Walter, P.G., Hydrologist).

regard to the increases in calcium, sodium, sulfate, and chloride in some of the wells, the RCT explained that the levels of these constituents vary over time as the result of several factors, including seasonal changes and variations in rainfall amounts, and that the increases noted by Mr. Dohmann were well within the expected ranges of natural variation for these constituents.[29]

2. On the basis of its investigation and findings, the RCT concluded that the increases in some constituents in Homeowner Wells between December 2006 and April 2007 were "not indicative of, nor likely to be the result of the uranium exploration activities conducted in the area."[30] The RCT further stated as follows:

> To date, the Commission's investigation of your complaint has not revealed any practice or activity at UEC's Uranium Exploration Permit No. 123 that is out of compliance with the Texas Uranium Mining Regulations or the Uranium Surface Mining and Reclamation Act. We consider this investigation to be closed.[31]

d. The District Files Yet Another Complaint with the RCT Alleging that UEC's Exploration Activities Caused Iron Biofouling of the Homeowner Wells

1. In January of 2008, Mr. Dohmann again wrote the RCT, stating that new water testing performed in October 2007 shows that some of the Homeowner Wells tested positive for iron bacteria.[32] Mr. Dohmann requested that the RCT conduct "an on-site study including long term monitoring" of what he called the "dirty well issue."[33]

e. The RCT Determines That UEC's Exploration Activities Could Not Have Caused Iron Biofouling of the Homeowner Wells

1. On February 29, 2008, the RCT responded to Mr. Dohmann's second complaint against UEC.[34] In declining his request for an on-site study, the RCT emphasized to Mr.

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[29] *Id.* at pp. 49-50. The RCT also noted that, despite the increases in the concentration of some constituents in some wells, the concentration of total dissolved solids in each of the Homeowner Wells actually decreased from December 2006 to April 2007. *Id.*
[30] *Id.* at pp. 46, 51.
[31] *Id.* at p. 46.
[32] *Id.* at p. 97 (Correspondence from RCT to Art Dohmann dated February 29, 2008).
[33] *Id.*
[34] *Id.* at p. 97 (Correspondence from RCT to Art Dohmann dated February 29, 2008).

Dohmann that UEC's exploration activities simply could not have impacted the Homeowner Wells:

> Your request is undoubtedly premised on the assumption that iron biofouling of the water wells is caused by the uranium exploration activities regulated by the Commission. ***Geoscientists in the Surface Mining and Reclamation Division do not believe there is any physical mechanism that would support the assumption that uranium exploration drilling could cause impacts to the hydrologic system creating specific changes in environmental conditions at the wells that would trigger iron biofouling.***[35]

The RCT also attached a few articles which explained that iron biofouling is a common problem with private wells, that it is caused by the presence of certain bacteria, and that it is marked by the presence of brown, foul-smelling slime that can clog pipes and filters.[36]

f. The County Files a Federal Lawsuit Against UEC for Allegedly Contaminating the Homeowner Wells and the Evangeline Aquifer in General

1 On March 18, 2008, the County filed a lawsuit in federal district court in which it alleged that UEC's exploratory activities had caused or contributed to the contamination of the Homeowner Wells and the Evangeline Aquifer in general.[37] The lawsuit was dismissed.[38]

g. Public Comments to Mine Application

The County and the District submitted public comments regarding the Mine Application[39] and the PAA-1 Application.[40] The District again contended that UEC's exploration activities had resulted in a "sudden deterioration of water quality."[41] In addition the District contended that "the introduction of oxygen during the drilling and development of [a] well will initiate the process of slowly dissolving the ore, which may result in the elevated

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[35] *Id.*
[36] *Id.* at pp. 99-105.
[37] Kreneck Testimony, p. 2, l.19 – p. 3, l.3.
[38] *Id.* at p. 3, l.5.
[39] Executive Director Exhibit 10 (containing the RTC Regarding Mine Application).
[40] Executive Director Exhibit 17 (containing the RTC Regarding PAA-1 Application).
[41] Executive Director Exhibit 10, Comment No. 104, at p. 65.

concentrations of constituents such as uranium ..."[42] The District also commented "that proper well development is needed to remove sediment and contamination prior to collecting samples."[43] The Executive Director responded to all concerns raised in the public comments.

II.
APPLICATION FOR PROPOSED CLASS III INJECTION WELL PERMIT NO. UR03075 AND AQUIFER EXEMPTION

A. Whether the use and installation of the injection wells are in the public interest under Texas Water Code §27.051(a). Public interest in regard to this issue includes whether UEC's mining operation or restoration activities will adversely impact the public interest by unreasonably reducing the amount of groundwater available for permitting by the Goliad County Groundwater Conservation District.

The Protestants simultaneously advocate an overly broad view of some public interest factors and an erroneously narrow view of others

On the one hand, for purposes of arguing that the granting of the Mine Permit is not in the public interest and describing the evidence in the record that they feel supports that argument, the Protestants ascribe to a broad view of the public interest inquiry. Therefore, the Protestants view the public interest inquiry as encompassing a wide variety of issues including compliance history, groundwater availability, public safety concerns, groundwater protection and restoration, financial assurance, adequate characterization of the geology and hydrology of the proposed Mine Permit Area, and even the technical sufficiency of the Mine Application.[44]

On the other hand, however, for purposes of arguing the UEC failed to meet its burden of proof on Issue A, describing the evidence that UEC presented, and describing the scope of the issues and evidence considered by the Executive Director, the Protestants present an unduly narrow view of the public interest inquiry.

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[42] Executive Director Exhibit 17, Comment No. 18, p. 15.
[43] *Id.*
[44] County's Closing Argument at pp. 6-7, 10-15; District's Closing Argument at pp. 10-11; *see also* Executive Director Exhibit 10, at p. 24 (RTC Regarding Mine Application).

c. *Misrepresentation of the Evidence in the Record*

Based upon the testimony of Dr. Darling, the Protestants characterize UEC as a habitual violator with no regard for rules.[98] Moreover, the County repeatedly asserts that "UEC did not challenge the accuracy of the evidence presented [regarding its compliance history], and UEC ***did not present any evidence rebutting*** its poor history."[99] In truth, however, as a part of its prefiled rebuttal testimony, UEC submitted 185 pages of official records from the RCT to establish UEC's actual compliance history with that agency as well as testimony by Mr. Holmes regarding his personal knowledge of the NOV.[100] Those records include reports from the numerous inspections conducted by RCT and reports regarding every investigation conducted by the RCT in response to the various complaints filed by the County and the District. Obviously, it is UEC's position that the most accurate characterization of its compliance record with the RCT is found not in the testimony of the Protestants' witnesses, but rather in the extensive official records of the agency itself.

It is undisputed that, following the March 2007 inspection described in Part I above, the RCT issued the ***only*** NOV that UEC has ever received.[101] Oddly, the District appears to criticize Mr. Holmes for failing to mislead the ALJ regarding these violations in his testimony.[102] However, part of being a truthful witness and a good corporate citizen is to acknowledge mistakes when they happen, correct and remediate the mistake, and institute changes to ensure that it does not happen again. And, evidence establishes that that is precisely what UEC did.

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[97] Issue B Rebuttal Testimony, Holmes, p. 6, 11.9-17; Exhibit UEC-Holmes 32, pp. 21-22.
[98] County's Closing Argument, Part II.B, p. 16; District's Closing Argument, Part II.B, p. 11.
[99] County's Closing Argument, p. 16; *see also id.* § p. 22.
[100] Exhibit UEC-Holmes 33; Issue B, Rebuttal Testimony, Holmes, p. 1, 1.14-p.7, 1.15.
[101] Issue B Rebuttal Testimony, Holmes, p. 4, 11.20-21.
[102] District's Closing Argument, p. 11.

While the County contends that the NOV was "only the beginning of UEC's failures,"[103] the RCT records paint a very different picture. First, the RCT records conclusively establish that, upon issuance of the NOV, UEC promptly undertook corrective action to remedy the issues identified therein.[104] On June 12, 2007, at UEC's request, the RCT made a site visit to assess UEC's corrective actions.[105] The RCT confirmed that remedial action taken by UEC was satisfactory and set up a full inspection visit for June 18, 2007.[106] On that date, the RCT conducted a full on-site inspection and verified that all remedial action required under the NOV had been completed.[107] Accordingly, the RCT terminated the NOV with the following explanation:

> UEC had completed the remedial action required. Specifically, UEC has installed a [cement] surface plug at all sites, installed PVC pipe to mark each borehole location, and removed all drilling mud, cuttings, cement, and other debris burying it with no less than one foot of topsoil.[108]

UEC's exploratory activities at the Exploration Permit Area continued through September 2008.[109] During the fifteen months between the termination of the NOV and the conclusion of UEC's exploration activities, the RCT conducted many additional on-site inspections to assess UEC's compliance with applicable plugging and reclamation requirements.[110] The RCT records establish that, in each case, UEC was found to be in full compliance with all plugging and surface reclamation requirements of the Exploration Permit

[103] County's Closing Argument, Part II.B, p. 18.
[104] Exhibit UEC-Holmes 33, at pp. 31-45.
[105] *Id.* at pp. 31-33 (RCT Report for Inspection conducted June 12, 2007).
[106] *Id.*
[107] *Id.* at pp. 35-45 (RCT Report for Inspection completed June 18, 2007).
[108] *Id.* at p. 40.
[109] Exhibit UEC-Holmes 33, at pp. 161-77.
[110] *Id.* at pp. 41-45, 58-96, 106-185 (RCT Inspection Reports).

and applicable regulations.[111] The following are excerpts from some of the RCT inspection reports over the course of this fifteen month period:

> August 23, 2007 Inspection Report: "Each hole was examined for compliance with the surface reclamation and plugging requirements of the Exploration Notice. I found that each had a concrete surface plug as required. I found that each location was clearly marked. I observed that UEC had removed all drilling mud, cuttings, cement and other debris from the surface and coated the site with a layer of what appeared to be topsoil. ..."[112]
>
> September 19/October 3, 2007 Inspection Report: "Proper location markings and reclamation efforts have greatly improved since the RCT's initial inspection."[113]
>
> November 12 & 14, 2007 Inspection Report: "The surface reclamation effort throughout the area inspected looked very good. .... All plugs were verified with a metal probe as seen in photos 7 and 8. ..."[114]
>
> December 19, 2007 Inspection Report: "Mud pits have been properly backfilled and all trash cleaned up. ..."[115]
>
> January 17, 2008 Inspection Report: ". . . . [A]ll mud pits have been backfilled and the mounded material smoothed over. ... The area has been well cleaned up and the only debris left on site from drilling activities are wooden pallets awaiting pick up. ..."[116]
>
> February 19, 2008 Inspection Report: Several drill sites in the vicinity of the old farmhouses and barns exhibited excellent surface restoration. ..."[117]
>
> March 19, 2008 Inspection Report: By email dated March 17, 2008, Ms. Margaret Rutherford requested an investigation of 2 exploration boreholes located adjacent to her property, reportedly approximately 300 feet from each of her 2 water wells that supply her drinking water. ... I collected a GPS coordinate at the Rutherford property line on Bluntzer Road, and determined borehole P1-07-1-20 to be approximately 374 feet from the property line and borehole P1-07-1-JN18 located at a distance of 246 feet. According to UEC records, drilling and logging of borehole P1-07-1-20 was completed on February 20, 2008 after which the borehole was plugged from a total depth of 500 feet with a slurry of 44 sacks of cement, 50 pounds gel and 9.2 bbls of water. Photo 7 documents a 10-foot metal probe sitting on top of the cement plug. Drilling and logging of borehole P1-07-

[111] *Id.*
[112] *Id.* at p. 43.
[113] *Id.* at p. 60.
[114] *Id.* at p. 69.
[115] *Id.* at p. 78.
[116] *Id.* at p. 83.
[117] *Id.* at p. 90.

JN18 was completed on February 26, 2008 and the hole plugged from a total depth of 480 feet with 42 sacks of cement, 50 pounds of gel and 8.83 bbls of water the same day. Borehole P1-07-JN18 is seen in Photo 8 also with the 10-foot metal probe sitting on top of the cement plug. Final topping off and surveying of the borehole plug to complete site restoration was not yet complete at either site although the mud pits were backfilled. I found the surface restoration at both sites to be in good order with all cuttings and drilling mud properly disposed of. The plugging and site restoration procedures followed for these boreholes is consistent with the requirements of the regulations and Permit No. 123A. ..."[118]

April 15-16, 2008 Inspection Report: A total of 62 exploration boreholes located in three separate areas of UEC's Permit No. 123A were inspected. Borehole and surface plugging and site restoration operations were completed for all boreholes inspected. In addition, UEC's current activity and practices were also observed at several active drill sites and boreholes in various stages of restoration. ...

After borehole plugging and settling, UEC tops the plug with cement to three-feet below the surface, places a section of PVC pipe to facilitate the RCT's with verification of the plug and backfills the surface with soil. ..."[119]

May 21, 2008 Inspection Report: A total of 28 exploration boreholes were individually inspected for verification of plugging and site restoration. ... All exploration boreholes were found to be in compliance with the regulations and permit requirements. ..."[120]

July 16, 2008 Inspection Report: A total of 53 exploration boreholes and 2 core holes were individually inspected for verification of plugging and compliance to the regulations and permit requirements for site restoration. Photos 1-12 document the site restoration efforts on the Braquet lease and can be considered typical of the 55 locations inspected. Re-vegetation is seen to be well advanced on the older drill sites and original contours were well restored at all location inspected. ..."[121]

August 14, 2008 Inspection Report: A total of 108 exploration boreholes, core holes and cased monitor wells were individually inspected for compliance to the regulations and permit requirements on UEC's Permit No. 123B. ... All boreholes and cased monitor wells inspected were found to be in compliance with the permit requirements. ..."[122]

September 17-18, 2008 Inspection Report: A total of 234 exploration boreholes and cased monitor wells were individually inspected for compliance to the

[118] *Id.* at p. 108.
[119] *Id.* at p. 116.
[120] *Id.* at p. 127.
[121] *Id.* at p. 137.
[122] *Id.* at p. 149.

regulations and permit requirements on UEC's Permit No. 123A. ... Most of these areas were subject to previous inspections and this inspection focused on the boreholes and wells completed after those inspections. With the exception of perhaps a dozen recent or in progress boreholes or wells, all locations on UEC Permit No. 123 A have been inspected and found to be in compliance. ..."[123]

October 16, 2008 Inspection Report: This inspection of UEC's Permit No. 123 focused on the exploration boreholes and cased wells, which have not been previously included on the monthly reports. A total of 4 plugged boreholes, 5 cased monitor wells and a rig water supply well were individually inspected for compliance to the regulations and permit requirements. These 10 drilling locations comprised the last un-inspected boreholes or wells on Permit No. 123B.
...

According to UEC's information and records of previous inspections by SMRD, all exploration boreholes, core holes, cased wells and rig supply wells on Permit No. 123B have been inspected for compliance to the permit requirements. There is no exploration drilling activity ongoing and none is currently planned according to UEC."[124]

d. *Mischaracterizations and Misrepresentations of Evidence Regarding UEC's Compliance History Since the NOV*

In characterizing UEC's compliance history with the RCT following the NOV, the Protestants ignore the RCT's official records summarized above. Some of the evidence that the Protestants instead rely upon is described below.

i. The Gamma Radiation Survey

In its Closing Argument, the County asserts as follows: "The NOV [was] only the beginning of UEC's failures. The Texas Railroad Commission conducted a Gamma Radiation Survey in response to a complaint from a Goliad citizen regarding improper placement of radioactive material during uranium exploration."[125] The County quotes from Dr. Darling's prefiled testimony in which he concluded that the results of the gamma survey "appear" to show

[123] *Id.* at p. 161.
[124] *Id.* at p. 180.
[125] County's Closing Argument, p. 18 (emphasis added).

that UEC was "in direct violation" of its exploration permit.[126] The County also quotes a passage from Paul Pierce's e-mail in which he describes an alleged meeting with an RCT representative, who allegedly stated "that 'the sites failed after initial UEC reclamation for one of several causes including high radioactivity at the surface of certain sites. *This radioactivity was said to greatly exceed background.*"[127]

Again, however, the County's characterizations of the gamma survey are refuted by the RCT's official records, which establish as follows: The gamma survey was conducted shortly after the March 2007 inspection that the resulted in the NOV, and as a part of the RCT's response to a compliant filed by the County. While the survey revealed that radiation levels at a "***small proportion***" of the borehole sites were slightly higher than background level, "[t]he extent of elevated gamma radiation levels within the surveyed areas was "***minimal***" and was "***not sufficient to pose a radiation exposure hazard.***"[128] Thus, the RCT did not cite UEC for any violations as a result of the gamma survey.[129] In other words, despite the County's implication to the contrary, UEC was not "busted" for elevated radiation levels.[130] Furthermore, the RCT records show that, on October 3, 2007, the RCT conducted another gamma survey and found that all of the gamma radiation measurements taken were "within the estimated background (ambient) gamma radiation levels. ..."[131]

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[126] *Id.*; Darling Prefiled Testimony, p. 10, ll. 24-27.
[127] County's Closing Argument, p. 19 (italics in original) (underlining added).
[128] Exhibit UEC-Holmes 33, at p. 22 (emphasis added).
[129] *Id.*
[130] County's Closing Argument, at 12 (implying that UEC was "busted" for having radiation levels above background at twenty-two of its exploration borehole sites).
[131] Exhibit UEC-Holmes 33, at p. 60.

ATTACHMENT C

DISCUSSION OF PROTESTANTS' MANY ARGUMENT REGARDING PA-1 BASELINE VALVES

C. Baseline water quality table

1. Regulatory Framework

Section 305.49(b)(3) requires that a baseline water table be submitted with an application for a production area authorization. The baseline water table or groundwater analysis report summary, as noted above, serves as the basis for the restoration table.[710] The format of the summary table is dictated by Figure 3, which is attached to the application form.[711] When UEC filed its PAA-1 Application, Section 331.104 required one or more samples from each designated monitor well (production and nonproduction zone) and each designated production well in the production area, to be summarized as follows:

> (1) mine area baseline-the averages and ranges of the parameter values determined for the designated production zone monitor wells;
> (2) production area baseline-the averages and ranges of the parameter values determined from at least five designated production zone wells in the production area; and
> (3) nonproduction zone baseline-the averages and ranges by zone of the parameter values determined for designated nonproduction zone monitor wells.[712]

The new rule requirements are similar in many ways, specifying independent and representative samples from:

> (1) mine area monitor wells completed in the production zone;
> (2) mine area monitor wells completed in nonproduction zones; and

[710] Exhibit UEC-Holmes 20, Application Form, p. 9.
[711] *Id.*; Exhibit UEC-Holmes 40, Figure 3.
[712] 30 TAC § 331.104 (a) (West 2008).

(3) baseline wells completed in the production zone within the production area.[713]

Under the new rule, however, the number of wells must be "a minimum of five baseline wells, or one baseline well for every four acres of production area, whichever is greater . . . completed within the production zone of the production area."[714]

2. UEC's Direct Testimony

UEC's baseline groundwater summary table is contained in Attachments 4A and 4B of the Draft PAA-1[715] and Chapter 6 of its PAA-1 Application.[716] The table contains values derived from (a) 22 mine area monitor wells completed in the production zone (BMWs); (b) nine mine area monitor wells completed in the nonproduction zone (OMWs); and (c) 18 baseline wells completed in the production zone within the production area (PTWs and RBLB Wells).[717] In his direct testimony, Dr. Bennett provided background regarding how groundwater quality is determined and why established sampling methodology is a reliable method for determining representative water quality at the point and time of sampling.[718] More specifically, Mr. Underdown and Mr. Holmes testified that the PA-1 wells were sampled according to accepted protocol.[719]

3. County/District Arguments

As with baseline for the Mine Application, the Protestants made a number of arguments as to why the PA-1 baseline water quality results do not accurately represent baseline.

a. Length of Well Screens

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[713] 30 TAC § 331.104(a).
[714] *Id.* at § 331.104(c).
[715] Exhibit UEC-Holmes 19.
[716] Exhibit UEC-Holmes 20.
[717] Exhibit UEC-Holmes 20, Figure 1.4 and Table 6.1; Exhibit UEC-Holmes 19, Attachments 4 A and 4B.
[718] Bennett Direct Testimony, p. 20, l. 10—p. 24, l. 8.
[719] Underdown Direct Testimony, p. 9, l. 22—p. 11, l.12; Holmes Direct Testimony, p. 97, ll. 7-10.

With respect to screen lengths, Dr. Abitz claimed that samples from the RBLB and PTW wells were not representative of the water quality within the various sands because the wells were not screened across the entire vertical thickness of each sand.[720] At hearing, counsel for the County questioned Mr. Kelley about a 2007 email from a UEC employee, Mr. Yancey, and his recommendations regarding longer screen length in the PA-1 monitor wells.[721]

But, as a matter of fact, Mr. Yancey's comments did not focus on technical validity, but on preempting the arguments of "[d]etractors;" he closed the email by recommending that UEC consult with TCEQ about screen length.[722] TCEQ later made its position on this issue clear during the Chapter 331 rulemaking in 2009 when Dr. Abitz (*i.e.*, a "detractor") submitted comments[723] suggesting a requirement for screening the entire sand thickness. TCEQ considered his comments, but disagreed.[724] Consequently, now, as then, there is no regulatory support for Dr. Abitz's argument.

b. Locations of Wells

The second argument is a variation on the well placement argument made with respect to the Mine Application baseline. According to Dr. Abitz, the baseline wells are again in the wrong places. Instead of being located within the production zone, as required by the applicable rules,[725] Dr. Abitz testified that the wells should be located on a grid over the entire mine area.[726] Dr. Abitz is certainly entitled to his opinion, but since the PAA-1 Application must comply with

[720] Abitz Testimony, p. 16, l. 5—p. 17, l.12.
[721] Goliad County Cross Exhibit 14.
[722] *Id.*
[723] Exhibit UEC-Holmes 34; Exhibit UEC-Holmes 30, p. 104, l. 25—p. 107, l. 1.
[724] Exhibit UEC-Holmes 35, p. 1649.
[725] 30 TAC § 331.104(a)-(b) (mandating that baseline wells "must be completed in the production zone within the production area").
[726] Abitz Testimony, p. 15, l. 5—p. 16, l. 4.

the applicable rules regarding baseline well placement, his opinion has no relevance in this proceeding.

c. Statistical Validity

A third set of arguments against the adequacy of baseline, again championed by the District and Dr. Abitz, is that baseline was inadequate because the treatment of the data was statistically improper due to an insufficient number of samples and because "mathematical manipulation of the analytical results did not follow statistical protocols."[727] There are many points that are wrong with both these arguments and the way in which they were presented by Dr. Abitz.[728] The most glaring weakness in this attack, however, is that it is based in another regulatory framework altogether.[729] Before the 2009 rulemaking, the applicable regulatory scheme—which Dr. Abitz amazingly avoided discussing almost entirely in his testimony—allowed, but did not require, more than one sample.[730] In fact, during the rulemaking, TCEQ specifically stated that it considered one sample set adequate for establishing baseline.[731] The applicable regulations did not allow, however, for the different "statistical treatments" advocated by Dr. Abitz.[732]

Although it remains to be seen exactly how TCEQ will implement the new Section 331.107(a)(1)(B), the recently added language explicitly providing the option of a "statistical analysis of baseline well information" should allow for more flexibility in this regard. This provision was not available when UEC filed its PAA-1 Application. Instead, UEC provided

[727] *Id.* at p. 11, ll. 14-15.
[728] Issue C Rebuttal, Holmes, p. 41, l. 5—p. 43, l. 20; Issue E Rebuttal, Holmes, p. 6, l. 16—p. 7, l. 17.
[729] Issue C Rebuttal Testimony, Holmes, p. 28, ll. 6-15 and p. 30, l. 10—p. 32, l. 14.
[730] 30 TAC § 331.104(a) (West 2008) (stating that "[o]ne or more samples shall be collected from each . . . well . . . .").
[731] Exhibit UEC-Holmes 35, p. 1649.
[732] 30 TAC § 331.104 (West 2008); 30 TAC § 331.107(a) (West 2008); Issue C Rebuttal Testimony, p. 39, ll. 17-18.

more data points by constructing more baseline wells than required by the rules, which was the same methodology used in the authorization of the most recently issued PAA in Texas, located at the Alta Mesa Mine.[733] And with respect to its first PAA, UEC began taking steps—even when it became clear that both applications would be subject to the hearing process—to carry out its original plan of gathering additional data with the intention of filing a restoration table amendment under Section 331.107(a)(1)(B), assuming it received the PAA.[734] Again, following what had been previously approved with the most recently issued PAA at Alta Mesa, UEC took three sample sets or rounds of data.[735]

Despite the innuendo at hearing, there is absolutely no evidence that UEC was hiding the third round of data from the Executive Director's staff or that UEC had any regulatory duty to produce it to TCEQ outside the scope of the hearing process. Parsing the language of Section 305.125—as counsel for the County and District seemed so fond of doing in other contexts—it applies to ***permittees***, *i.e.*, those persons who actually have permits.[736] In fact, the purpose of this Section is to set out conditions "which shall be incorporated into each permit expressly or by reference to this chapter . . . ."[737] The regulations do not contemplate successive updates by applicants embroiled in contested hearing processes.

Mr. Murry testified that the first time he saw the third round of data was when it was produced to all the parties during discovery,[738] and that is exactly as it should be. Indeed, had UEC informally supplemented its applications by producing information and data to TCEQ staff

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[733] Holmes Cross-Examination, Transcript, p. 365, l. 20—p. 366, l. 11; Issue C Rebuttal Testimony, Holmes, p. 48, ll. 3-9.
[734] Issue C Rebuttal Testimony, Holmes, p. 38, l. 17—p. 40, l. 11.
[735] *Id.* at p. 39, ll. 11-19.
[736] 30 TAC § 305.125(19) (providing that "[w]here the *permittee* becomes aware that it failed to submit any relevant facts in a permit application, or in any report to the executive director, it shall promptly submit such facts or information."), emphasis added.
[737] 30 TAC § 305.125.
[738] Murry Cross-Examination, Transcript, p. 1313, ll. 17-21.

outside of the discovery process, the Protestants would have been the first to cry foul. Ultimately, if, as a result of evidence produced by any party in this proceeding, the Executive Director chooses to recommend amendments or conditions to either draft permit, the Executive Director can do so. Moreover, if the Executive Director decides *later* that UEC failed to disclose fully all relevant facts in the application or hearing process, the Executive Director can suspend or revoke UEC's permit.[739] And so, contrary to opposing counsel's insinuations, no one—least of all the Executive Director—is having the wool pulled over his eyes.

d. Well Completion Methodology

The fourth theory propounded by the Protestants, which focused on the well completion methodology, is superficially the most plausible—both because in some cases well completion involved "jetting" with oxygen, and because there is some evidence of a difference of opinion within UEC as to how it should be done. At hearing, opposing counsel introduced an email from Mr. Harry Anthony containing his opinion regarding the "most efficient" procedure for jetting the PA-1 wells.[740] And had UEC actually followed the method suggested by Mr. Anthony, there might be some question as to whether the jetting that was done on some (but not all[741]) of the PA-1 baseline wells could have introduced oxygen that affected uranium levels. Fortunately, Mr. Underdown, the person actually in charge of well development in the field,[742] was present to provide testimony about the procedure that was in fact followed. Mr. Underdown testified that air was not jetted into or near the well screens.[743] Instead, the end of the jetting line was closer to

[739] 30 TAC § 305.66(a)(4).
[740] District Cross Exhibit 1.
[741] Underdown Cross-Examination, Transcript, p. 216, ll. 3-5.
[742] *Id.* at p. 182, ll. 14-17.
[743] Underdown Cross-Examination, Transcript, p. 216, ll. 6-19.

the top of the well and "nowhere near" the screen.[744] Dr. Bennett assessed this methodology and testified that "it would provide no opportunity to inject air into the aquifer."[745]

Opposing counsels' issue with Mr. Underdown's eyewitness testimony regarding how the jetting was conducted appeared to consist of two related points. First, they projected a general disbelief regarding the effectiveness of the jetting methodology described in great detail by Mr. Underdown, which apparently stemmed in part from opposing counsel's inability to visualize how it worked.[746] UEC's counsel sometimes shares this difficulty in comprehending technical or scientific concepts, but respectfully suggests that this is exactly why experts such as Mr. Underdown and Dr. Bennett are enlisted in these matters. In fact, neither Mr. Underdown nor Dr. Bennett expressed any doubt that the methodology described by Mr. Underdown does in fact work.[747] As Mr. Underdown described:

> You have what's a [hydraulic] head. The formation will bring that water level to a given level, an let's say it's 70 feet from the surface. And if I stick an air line down in there 20 or 30 feet, that air bubble, when it's released down the compression, it will come out, it bubbles and there is a slug of water comes up with it. Well, while that water is coming up, the formation gives up more water behind it to take its place. So it's not just blowing that top 20 feet off and then quit; the formation gives you water to replace that.
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> ...
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> As you are pumping the water it's constantly getting water from the formation trying to come back to the given level.[748]

Dr. Bennett explained that there are at least two good technical reasons to use the jetting method described by Mr. Underdown. First, "the deeper the air line is in the aquifer, the higher the column of water, the higher the pressure that's required to push that water out."[749] Second,

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[744] *Id.* at p. 216, ll. 17-19.
[745] Bennett Cross-Examination, Transcript, p. 853, ll. 5-6.
[746] Underdown Cross-Examination, Transcript, p. 216, ll. 20-21, p. 218, ll. 17-18 and p. 219, ll. 17-19.
[747] Underdown Cross-Examination, Transcript, p. 218, ll. 2-12; Bennett Cross-Examination, Transcript, p. 852, l. 14—p. 853, l. 6 and p. 920, l. 210—p. 924, l. 19.
[748] Underdown Cross-Examination, Transcript, p. 218, ll. 2-12 and p. 220, ll. 8-10.
[749] Bennett Cross-Examination, Transcript, p. 924, ll. 17-19.

jetting lower in the wells and nearer to the screens risks collapsing the well screens.[750] In other words, experience shows that Mr. Underdown's method is easier and safer.

The next point that was heavily implied by opposing counsel and apparently bolstered by the general disbelief in the mechanics as described above, was that in light of Mr. Holmes' deposition testimony and the email from Mr. Anthony, Mr. Underdown's recounting of the facts regarding the jetting procedure was not convincing. For several reasons, Mr. Underdown's testimony does not warrant such skepticism. First, as Mr. Holmes made clear at hearing, since he was not personally involved in the well development, his deposition testimony as to the methodology used by UEC was based solely on his own understanding of well development methodology, not what someone at UEC told him.[751] And, significantly, during his deposition, Mr. Holmes also specifically deferred to Dr. Bennett's expertise as to possible effects of the jetting procedure on oxygen levels.[752] Second, as Mr. Holmes confirmed, Mr. Underdown is the person in charge in the field, and he has no problem expressing a difference of opinion to Mr. Anthony regarding operational matters.[753] Third, as Dr. Bennett testified, Mr. Underdown's method makes sense from a practical perspective. Finally, and most importantly, Mr. Underdown responded to all questions regarding the methodology used in the credible, unhesitating and detailed manner one would expect from a person who managed and participated in the actual event.[754]

Interestingly, taking the opposite approach, Dr. Abitz argued that the problem with the samples was not that well development caused oxidation, but that the samples were collected

[750] *Id.* at p. 852, l. 24—p. 853, l. 6 and p. 921, ll. 10-17.
[751] Holmes Cross-Examination, Transcript, p. 378, l. 3—p. 379, l. 7; p. 383, ll. 2-8; and p. 386, l. 17—p.387, l. 4.
[752] Holmes Re-Direct, Transcript, p. 480, l. 4—p. 481, l. 25.
[753] *Id.* at p. 484, l. 20—p. 485, l. 23.
[754] Underdown Cross-Examination, Transcript, p. 215, l. 12—p. 220, l. 10.

prior to the wells being properly developed.[755] As Dr. Erskine testified, this theory is also incorrect.[756] Contrary to Dr. Abitz's assertion, there is no correlation between the levels of radium from the PTW wells and turbidity.[757] In short, the Protestants' arguments that the PA-1 baseline wells were either "overdeveloped" or "underdeveloped" for purposes of establishing baseline both fail.

e. Sampling Methodology

During the hearing, counsel for the County questioned Dr. Bennett regarding the possibility that UEC's groundwater sampling technique could be a "factor in the test results associated with subsurface uranium testing."[758] Counsel specifically asked Dr. Bennett about the use of low flow or micro-purge sampling techniques, implying that lesser perturbation of the groundwater around the well might have resulted in lower uranium levels. Dr. Bennett, however, testified that the methodology used by UEC would actually result in lower, more conservative uranium values than if UEC had used the micro-purge technique.[759]

f. Pump Tests

The sixth and final theory posed at hearing was the idea that the PA-1 pump tests affected the uranium levels in the subsequent water quality sampling. Protestants' sole support for this theory is an out-of-context statement from one of Dr. Galloway's many scholarly publications.[760] Dr. Galloway made it clear that the pumping referenced in that publication was from a municipal well, which is very different from the pumping associated with the kind of tests performed on

[755] Abitz Testimony, p. 11, ll. 13-14 and p. 19, l. 10—p. 21, l.6.
[756] Issue C Rebuttal Testimony, Erskine, p. 43, l. 22—p. 44, l. 14.
[757] *Id.* at p. 44, ll. 4-5.
[758] Bennett Cross-Examination, Transcript, p. 871, ll. 20-22.
[759] *Id.* at p. 871, l. 23—p. 872, l. 1 and p. 873, ll. 10-23.
[760] Goliad County Cross Exhibit 3.

Sand B within PA-1 in both rate, quantity and duration.[761] Moreover, when opposing counsel asked Dr. Bennett what he thought about the pump test theory, he testified that "in [his] best professional judgment, in a porous media aquifer, the gradient that is induced by a pump test . . . is insufficient to mobilize fines [particles of uranium] . . . ."[762]

g. Varying Uranium Levels

The centerpiece of the circumstantial case supporting Theories 4, 5 and 6 is the decreasing levels of uranium in the three rounds of data, framed in the theme that the uranium data from rounds 2 and 3 are closer to what one would expect to find in a reduced aquifer. In response, as discussed under Issue C, UEC's witnesses repeatedly testified that (1) there is no such thing as an on/off switch with respect to oxidation/reduction states; and (2) the uranium and radium values are not outside the ranges typically seen by experts who work with uranium ore bodies.[763]

Furthermore, with respect to the PA-1 values, UEC's experts testified that groundwater quality data "is inherently variable."[764] According to Dr. Bennett, "[t]he actual concentration of dissolved uranium in equilibrium with uranium minerals will be a function of the mineralogy, the water composition, temperature, pH, and redox potential (pe)."[765] Moreover,

> [t]he solubility of every one of these [uranium] minerals is also extremely sensitive to the oxidation state of the water, and this is also much more complicated than simply the amount of oxygen. The real chemistry of uranium, instead of the idealized single mineral system, means that there is no single concentration of uranium expected in all ore bodies.[766]

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[761] Galloway Cross-Examination, Transcript, p. 112, l. 3—p. 113, l. 8; Holmes Re-Direct, Transcript, p. 478, l. 2—p. 479, l. 9.
[762] Bennett Cross-Examination, Transcript, p. 865, ll. 10-13 and p. 890, l. 3—p. 865, l. 14.
[763] *See supra*, Part I.C.
[764] Erskine Cross-Examination, Transcript, p. 133, l. 20.
[765] Issue C Rebuttal Testimony, Bennett, p. 26, ll. 5-7.
[766] *Id.* at p. 27, ll. 14-18.

In addition to natural variance among different locations, UEC's experts also testified that values naturally vary over time, even in the same location.[767] Specifically, Dr. Erskine stated that "[i]f you look at groundwater data over time, and I have got some data sets that are as large as 30 years, you'll see the concentrations just oscillating over a large range."[768] To illustrate his point, Dr. Erskine provided an example of one of the many variables that can affect constituent values: "a small change in flow direction over time could cause you to be drawing from a completely different volume than you drew from when you were sampling previously."[769] And as Dr. Galloway testified, "[t]here is a lot of variability in specific details of flow in a specific aquifer sand . . . . at a more local level."[770] Finally, UEC's experts testified that the variance in uranium levels and the high levels of radium seen in the UEC data is not surprising and is completely consistent with natural conditions.[771]

In sum, although the shear number of theories propounded by the Protestants regarding this Issue is impressive, none of them withstand scrutiny. The preponderance of the evidence shows that UEC met the applicable regulatory requirements regarding establishment of baseline.

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[767] Bennett Cross-Examination, Transcript, p. 833, l. 23—p. 834, l. 7; Erskine Cross-Examination, Transcript, p. 136, ll. 9-23.
[768] Erskine Cross-Examination, Transcript, p. 141, ll. 13-16.
[769] Erskine Cross-Examination, Transcript, p. 137, ll. 9-12.
[770] Galloway Re-Direct, Transcript, p. 94, ll. 3-24; *see also supra* Issue G.3. (discussing Mr. Dohmann's water level exhibits).
[771] *See, e.g.*, Esrkine Cross-Examination, Transcript, p. 138, ll. 10-11 (stating that he "see[s] variations like this all the time; it's common."), p. 144, ll. (observing that "in uranium ore bodies all across the world, radium is high in groundwater.").

DISCUSSION OF SUBSTANTIVE ARGUMENTS REGARDING MINE PERMIT BASELINE

2. Substantive Arguments

a. *Dr. Sass' Ratio*

During the hearing, the Protestants focused almost exclusively on the uranium levels in the three rounds of sampling data. But Dr. Sass' theory has two components—uranium *and* radium-226. According to Dr. Sass, for every 1 mg/L of uranium "liberated" from the ore into the groundwater, there should be a related 335 pCi/L of radium.[207] Dr. Sass provided an example in his prefiled testimony:

> As an example, water quality data collected from the Area of Review wells show average measured uranium levels of 0.003±0.002 mg/l. This would predict a radium level of 1.0±0.7 pCi/l. The actual reported average radium value at the Area of Review wells is 2.3±5.4 pCi/l. Predicted and observed values of radium are low and not significantly different.[208]

In other words, these are the levels of radium that Dr. Sass would expect to see in an "undisturbed" area of the aquifer, which the Protestants indicate they believe to be representative of the true local groundwater quality.[209]

The County asserts that Dr. Sass' theory is fully supported by the water quality data.[210] Simultaneously, though, the County admits that "Goliad County cannot quantify the amount of radium that was released as a result of UEC's actions . . . ."[211] even though, according to Dr. Sass, the ratio between uranium and radium is clear and predictable. The County's theory as to

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[207] Sass Testimony, p. 11, ll. 3-12.
[208] Sass Testimony, p. 16, ll. 14-18.
[209] *See e.g.*, County Closing Argument, Part II.T, p. 76.
[210] County Closing Argument, Part II.C, p. 29.
[211] County Closing Argument, Part II.C, p. 35.

why the radium data does not match Dr. Sass' ratio predictions is "because as Dr. Sass stated in his pre-filed testimony, 'unlike uranium, radium remains in solution and does not precipitate back out.' In other words, because radium is not redox sensitive, the radium will not reduce back towards its natural levels as it encounters reductants."[212] Said another way, the uranium at each well location has undergone an unspecified number of oxidation/reduction cycles while the radium that is released remains in solution and available for measurement.

This is a conveniently squishy explanation for why the radium levels do not track or trend in a similar manner with the uranium values; but, if this explanation is correct, there should be no evidence of elevated radium levels prior to the events that the Protestants allege introduced oxygen into the subsurface, *i.e.*, boreholes and wells left open for more than 48 hours; boreholes and wells left open and rained upon; well jetting; sampling; and pump testing. Moreover, wells that have not been left open, exposed to rain, jetted, or subject to pump tests should have much lower levels of radium than wells that have been subject to these conditions. Significantly, the evidence shows Dr. Sass' theory fails both of these tests.

b. *The Braquet Well*

As was discussed in Part I.B.1 above, one of the County's initial theories was that UEC's exploration activities caused elevated levels of radium in the groundwater at one of the Braquet wells, which is identified as "Braquet 2" in the Mine Application.[213] Groundwater sampling showed a relatively high level of radium-226, as compared to other area wells, in the Braquet 2 well—**29.0 (±1.0)** pCi/L. After reviewing the groundwater data, UEC ran a gamma log on the Braquet 2 well, which revealed that the well was completed in a mineralized area.[214] Obviously,

[212] County Closing Argument, Part II.C, p. 35.
[213] Exhibit UEC-Holmes 13, Table 5.1, p. 5-5.
[214] *See* Exhibit UEC-Holmes 13, p. 5-10.

since the Braquet 2 well is a homeowner well, UEC did not leave it open, expose it to rain, jet it, or subject it to a pump test.

Unfortunately, there is no evidence in the record as to which of the BMWs were jetted and which were not jetted. Therefore, assuming for the sake of argument only, that BMW-20—the nearest UEC well to the Braquet 2 well—was one of the wells jetted, the levels of radium should be much higher than those in the Braquet 2 well. BMW 20, however, showed levels of 40.0, 42.0, and 40.0 pCi/L from the three sampling rounds, with an average value of **40.7** pCi/L.[215] Similarly, BMWs 19, 21 and 22 showed the following values:

- BMW 19: 8.1, 4.3 and 8.5 pCi/L (average = **6.7** pCi/L)
- BMW 21: 34.0, 33.0 and 33.0 pCi/L (average = **33.3** pCi/L)
- BMW 22: 22.0, 17.0 and 19.0 pCi/L (average = **19.3** pCi/L)

The nearest BMWs have radium values that are either considerably lower than the Braquet 2 well (BMW 19) or very similar with average values between approximately 3 to 10 pCi/L higher or lower than the Braquet 2 well radium value.

c. ***Gamma Ray Logs***

As the Railroad Commission explained in one of its reports regarding the site:

> There are three types of radiation associated with uranium deposits/ore bodies – alpha, beta, and gamma. We chose to measure gamma radiation since there is a rough correlation between it and the radium content found in the area (radium is naturally-occurring and produced by decaying uranium and thorium . . . .[216]

And as TCEQ noted during the recent Chapter 331 rulemaking:

> Wells are mechanically logged using conventional geophysical logging tools to measure the natural gamma ray radiation, spontaneous potential, and resistivity of the geologic units penetrated by the borehole.[217]

Thus, whenever a geophysical log shows gamma ray traces in a formation in an area containing uranium mineralization, it is indicating the presence of radium.[218] As shown on the RBL

[215] Sass Testimony, Exhibits 11 and 13.
[216] Exhibit UEC-Holmes 33, p. 23.
[217] Exhibit UEC-Holmes 35, p. 1646.

geophysical logs,[219] the various vertical lines represent different measurements.[220] The second line from the left, which is shown in red on the one color log that is included in the Mine Application,[221] shows the gamma ray trace levels.[222] The geophysical logs for UEC's RBL, BMW, OMW and PTW wells were for the most part taken contemporaneously with the drilling of the original borehole that became the well.[223] The table provided by Dr. Darling (bates stamped UEC-00329401 and UEC -00329402) shows the drilling and logging dates for all of UEC's monitor and baseline wells except for PTW-13, PTW-14 (which is not listed at all), PTW-7, PTW-8, and the Lagarto-1 well.[224] Out of the 63 wells for which both these dates are provided, 47 were drilled and logged on the same day and 59 were logged before they were cemented.[225] The cementing date is significant since, regardless of the specific jetting procedure, the jetting does not occur until after cementing because the purpose of the jetting is to clear any remaining cement and other debris from the well screen.[226]

Of the PTW wells, which were central to Dr. Sass' analysis, the record contains three for which there are both (1) color geophysical logs (which makes the gamma ray lines easier to distinguish from the others) and (2) dates for logging, completion of drilling, and cementing.

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[218] *See also* Blandford Testimony, p. 23, ll. 9-12 (noting that the "gamma log response for this well within the Sand B confining unit shows a high activity . . . . This response would appear to indicate some type of mineralization . . . ."); Murry Cross-Examination, Transcript, p. 1186, l. 21—p. 1187, l. 2 (explaining that "when you look at the gamma ray response in those logs, which is an indication of mineralization, it appeared to me that they do have economic – they do have uranium mineralization in those sands.").
[219] Exhibit UEC-Holmes 13, Appendix B.
[220] *See e.g.*, Exhibit UEC-Holmes 13, Appendix B, p. 6, RBLB-1 log (showing lines labeled, from left to right, "GRADE RAY," "GAMMA RAY," "SP" and "RESISTANCE").
[221] Exhibit UEC-Holmes 13, Appendix B, p. 18, RBLD-3 log.
[222] *See* Exhibit UEC-Holmes 13, Appendix B, p. 6, RBLB-1 log (showing lines labeled, from left to right, "GRADE RAY," "GAMMA RAY," "SP" and "RESISTANCE").
[223] Exhibit Goliad County-Darling 9.
[224] *Id.*
[225] *Id.*
[226] Underdown Cross-Examination, p. 217, ll. 6-20; Holmes Cross-Examination, p. 382, ll. 1-24.

These dates[227] and the radium values in pCi/L for the three rounds of sampling[228] are summarized below for these three wells.

Well	Date Logged	Date Drilling Completed	Date Cemented	Round 1	Round 2	Round 1
PTW-10	7/31/08	8/1/08	8/1/08	68	359	63
PTW-11	8/4/08	8/4/08	8/5/08	296	55	386
PTW-12	8/5/08	8/5/08	8/6/08	477	345	392

The key observations from this collection of data are that (1) each of these wells was drilled, logged and cemented within 48 hours; (2) each of these three wells had high radium values throughout the sampling period; and (3) the gamma ray traces on the geophysical logs from the boreholes each showed gamma ray responses in the Sand B portion of the logs. These facts mean that (1) these wells were not left open and rained upon before being cemented (cased), and (2) the logs were taken *before* any well jetting, sampling, or pump testing occurred with these wells. In short, none of the alleged oxygen introduction mechanisms could have affected these wells, so no "artificial" oxidation could have occurred to solubilize uranium and release radium. **And yet, the presence of radium was still strongly indicated by the gamma ray traces on the logs taken of the boreholes before they were turned into PTWs 10, 11 and 12.**

It is unfortunate that there are not more color logs for the PTWs to provide additional examples, but the point remains that Dr. Sass' explanation, when viewed in the context of ***all*** the data and information—as opposed to only the levels of uranium in the groundwater—is **not** "fully supported by the water quality data."[229]

[227] *See* Exhibit Goliad County-Darling 9.
[228] *See* Exhibit Goliad County-Sass 12.
[229] County Closing Argument, Part II.C, p. 29.

Similarly, the County tries to suggest that the "drastic increase in radium between round 1 and round 2" in the RBLB wells is further proof of its theory because "[i]f the reported baseline data was truly natural, one would certainly expect a more consistent level of radium."[230] But again, when *all* the radium data is considered, this assertion falls apart. An excerpt from Goliad County's Cross-Exhibit 1 is shown below.[231]

PTW	Ra~1 pCi/l	Ra~2 pCi/l	Ra~3 pCi/l	1st Sample	2nd Sample	3rd Sample
1	17.0	38.0	16.0	4/29/08	7/14/09	11/16/09
2	17.0	17.0	10.0	4/29/08	7/15/09	11/10/09
3	38.0	36.0	38.0	5/8/08	7/16/09	11/16/09
4	196.0	217.0	213.0	5/8/08	7/16/09	11/10/09
5	357.0	549.0	830.0	5/12/08	7/21/09	11/16/09
6	202.0	253.0	253.0	5/12/08	7/20/09	11/10/09
7	1684.0	2000.0	1590.0	9/9/08	7/20/09	11/10/09
8	397.0	326.0	311.0	9/3/08	7/15/09	11/10/09
9	394.0	343.0	306.0	9/8/08	7/14/09	11/16/09
10	68.0	359.0	63.0	9/8/08	7/13/09	11/16/09
11	296.0	55.0	386.0	9/10/08	7/9/09	11/16/09
12	477.0	345.0	392.0	9/9/08	7/16/09	11/10/09
13	10.0	324.0	208.0	9/9/08	7/20/09	11/16/09
14	224	198.0	157.0	7/2/08	7/15/09	11/10/09

The radium data shows a number of wells—PTWs 8, 9, 11, 12 and 14—for which the values *decrease* between rounds 1 and rounds 2; indeed, in PTWs 8, 9 and 14, the radium values continue to decrease in round 3. The data also shows that in some wells—PTWs 1, 4, 7, 10, and 13—the highest radium value occurs in the round 2, with both rounds 1 and 3 being lower. All of the experts agree that radium is affected by retardation. And Dr. Erskine testified that because of this retardation factor, radium will move much slower than groundwater. The highest flow rate for groundwater identified by any of the hydrogeologists in this case was 40 feet per year. If radium, at its fastest, is moving 306 years behind the flow of groundwater,[232] under Dr. Sass' theory, there should be no significant decrease between rounds 1 and 2 at all (and certainly no

[230] County Closing Argument, Part II.C, p. 35.
[231] *See* County Closing Argument, Part II.C., p. 30.
[232] Issue C Rebuttal Testimony, Erskine, p. 16, l. 5—p. 17, l. 2.

decreases between rounds 2 and 3) because the radium "remains in solution and does not precipitate back out."[233]

d. ***The "Master Plan"***

The Protestants—particularly the County—not-so-subtly suggest that UEC intentionally elevated uranium values in its RBL wells and PTWs:

- "The situation with regard to baseline reveals a serious issue of integrity and honesty. . . . [UEC] know[s] that oxygen being introduced into ore-bodies releases uranium and radium."[234]
- "The aquifer has oxygen introduced through drilling and jetting and uranium is released from the sand into the water."[235]

UEC's experts have fully addressed the claim that exploratory drilling caused changes in the water quality. They, like the TCEQ and Railroad Commission are unaware of any evidence that the drilling of boreholes "will disturb an aquifer in a manner that affects the concentrations of chemical species in the groundwater."[236] Similarly, there is no evidence for, and considerable common sense logic (and testimony) against, UEC implementing a plan to elevate uranium and radium levels. UEC does indeed know about the effects of oxygen on uranium. UEC also knows about the effects of reductants on uranium. If UEC were determined to elevate baseline uranium levels and could do it simply by leaving wells uncapped or jetting, why would UEC stop doing so after the first round of sampling? If the Protestants' theories are correct, it would have been just as easy to jet the wells or leave them uncapped before each of the three sample sets. Instead, the Protestants suggest—apparently with straight faces—that UEC purposely elevated the uranium levels and then sabotaged its own plan by (1) letting the natural reducing properties of the aquifer take over, and then (2) taking additional sample sets. Brilliant.

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[233] Sass Testimony, p. 10, l. 16.
[234] County Closing Argument, Part II.C, p. 36.
[235] District Closing Argument, Part II.C, p. 18.
[236] Exhibit UEC-Holmes 35, p. 1646 (responding to comments during the recent Chapter 331 rulemaking).

C. Does the application adequately and accurately describe baseline conditions in the proposed permit area under applicable requirements of 30 TAC Chapter 331?

1. Regulatory Framework

No specific Chapter 331 regulation mentions "regional baseline wells" except for the definition of baseline well.[219] And as Mr. Blackburn points out, the regulations regarding baseline for mine applications are somewhat confusing.[220] There is no confusion, however, regarding the purpose of baseline in a mine application: ". . . to get a general idea of the water quality in the area they [UEC] are planning to mine."[221] (In contrast, baseline requirements for PAA applications are quite specific. Part III.C of this Brief contains a discussion of these requirements.)

2. UEC's Direct Testimony

Water quality within the proposed Mine Permit Area is the focus of Chapter 5 of the Mine Application.[222] Chapter 5 contains water quality results for the 20 RBL (baseline) wells and 47 area wells within the area of review ("AOR").[223] Tables in Chapter 5 provide both analytical results and statistical summaries.[224] The locations of the RBL wells largely

[219] Murry Cross-Examination, Transcript, p. 1225, ll. 2-5, p. 1322, ll. 9-19; 30 TAC § 331.2(13).
[220] Murry Cross-Examination, Transcript, p. 1322, l. 20—p. 1323, l.5.
[221] *Id.* at p. 1225, ll. 2-12.
[222] Exhibit UEC-Holmes 13, Chapter 5.
[223] *Id.*
[224] *Id.* at Tables 5.1, 5.2, 5.3, and 5.5.

correspond to areas where UEC anticipates mining, *i.e.*, areas where there is ore.[225] Overall, the data from the RBL wells revealed levels of uranium and radium-226 well above the drinking water standards for those constituents.[226] This fact did not surprise Dr. Galloway or Dr. Bennett, who testified, based on their considerable, highly-specialized experience,[227] that elevated levels of uranium and radium are expected to be found in groundwater in and around areas of uranium mineralization.[228]

3. County/District Arguments

In both their prefiled testimony and cross-examination, the County and District put forth three arguments as to why UEC's description of baseline conditions is not adequate and accurate. First, they argued that the screens in the wells were too short; second, they argued that the wells were located in the wrong places; and third, they claimed that uranium and radium values were artificially elevated by the introduction of oxygen into the ore bodies. Each of these arguments is incorrect and is dealt with in turn below.

a. Length of Screens in RBL Wells

At hearing, counsel for the District questioned Dr. Bennett about the appropriateness of the 20-foot screen length used in the RBL wells. Previously, Dr. Bennett addressed this topic in his direct testimony, explaining that:

> [I]n my opinion the samples obtained from the RBL Wells are representative of the groundwater present in these saturated zones. . . . The RBL Wells use typical 20 foot screens (more precisely, 19.4 feet screens plus sand traps of 0.6 feet), and pumping that well will yield a water sample that averages the water chemistry of at least that 20 foot interval. This is a 'representative' water sample that is in

[225] Exhibit UEC-Holmes 14; Exhibit UEC-Holmes 12, p. 59, Response 90 (noting that "gamma ray logs for these 20 wells indicate each is completed in a uranium-bearing zone.").
[226] Exhibit UEC-Holmes 13, Table 5.3.
[227] Galloway Direct Testimony, p. 5, l.7—p. 9, l. 1; Exhibit UEC-Galloway 1; Bennett Direct Testimony, p. 3, l. 22—p. 5, l. 17; Exhibit UEC-Bennett 1.
[228] Galloway Direct Testimony, p. 25, l. 1—p. 26, l. 15; Bennett Direct Testimony, p. 32, l. 21—p. 33, l. 15.

> every case going to yield a *reduced maximum* concentration of every constituent, including uranium and radium (^{226}Ra). It is not the absolutely highest concentration of an element for any volume of the zone sampled because that volume of water is diluted by adjacent volumes that have lower concentrations of one or more constituents. So the report of 0.080 mg/l U from the RBLB-3 well is not the highest uranium concentration of the volume sampled, it is the depth-integrated uranium concentration, and there are undoubtedly volumes of water that have higher uranium (as well as volumes with lower).[229]

As Dr. Bennett put it, the inquiry depends on the question being asked.[230] Dr. Bennett pointed out that to characterize the uranium in the water, for example, an even shorter screen would actually lead to a better representation "to capture the quality of the water only within the uranium zone and not be pulling in water that may have bypassed the uranium."[231] In this case, as the Executive Director noted, "[n]one of these fours [*sic*] sands is overly thick so the distribution of each of the constituents in the groundwater should be relatively uniform simply from mixing."[232] And since the ultimate question being asked is to characterize the water quality in the area to be mined, screening the wells to encompass the depth to be mined is not only adequate, but essential.[233]

b. Locations of RBL Wells

The County and District also argued that, regardless of well screen length, the RBL wells themselves were not properly located. Counsel for the Protestants seemed to suggest that instead of locating the wells in the areas anticipated to be the focus of mining activities, UEC should have located baseline wells throughout the proposed Mine Permit Area. Although the rules are not explicit or restrictive regarding the establishment of baseline quality for mine applications,

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[229] Bennett Direct Testimony, p. 47, ll. 3-19.
[230] Bennett Cross-Examination, Transcript, p. 959, l. 24.
[231] Bennett Cross-Examination, Transcript, p. 959, l. 19—p. 960, l. 7.
[232] Executive Director Exhibit 10, p. 62, Response 94.
[233] *Id.* at p. 61, Response 93 (observing that "[t]he 20 baseline wells were purposefully drilled and completed in mineralized zones, as the purpose of production zone baseline wells is to establish groundwater quality within a mineralized zone prior to mining of that mineralized zone.").

the definition of "baseline quality" does shed some light on, as Dr. Bennett would say, the question being asked. Baseline quality is defined as "[t]he parameters and their concentrations that describe the local groundwater quality of an aquifer prior to the beginning of injection operations."[234] Local groundwater quality in this instance refers to the portion of the aquifer likely to be impacted after injection operations—in other words, applicants should establish a general understanding of starting conditions before the beginning of operations. The Mine Application summarizes exactly how this "local groundwater quality" has been established:

> Water quality was established by sampling a large number of water wells. Sampling was conducted for all of the wells within the proposed permit area boundary and nearly all of the known wells within 1 km of the permit boundary. ***In addition***, UEC completed 20 baseline wells within the permit boundary . . . . Not including the 20 baseline wells completed by UEC, a total of 47 wells were sampled for 28 water quality constituents. ***As a result of this sampling effort, local water quality is now firmly established.***[235]

Nevertheless, counsel for the County continued to pursue the point with Dr. Bennett at hearing. After Dr. Bennett acknowledged that the designated baseline wells appeared to be targeted at the ore bodies, opposing counsel then asked him whether he had an opinion regarding the water quality in the "white areas," and Dr. Bennett said that he did.[236] Interestingly, opposing counsel did not ask Dr. Bennett to elaborate, perhaps correctly surmising that Dr. Bennett made the same connection[237] as the Executive Director:

> Groundwater samples from the twenty baseline wells were analyzed for 26 constituents and parameters, as were groundwater samples from 47 private wells in the vicinity of the proposed site. ***Data from the baseline wells appears remarkably similar to data from the private wells for all constituents and***

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[234] 30 TAC § 331.2(12).
[235] Exhibit UEC-Holmes 13, p. 5-1 (emphasis added).
[236] Bennett Cross-Examination, Transcript, p. 903, ll. 12-15.
[237] *Id.* at p. 904, ll. 6-11 (indicating that his opinion regarding the "white areas" consists of "inference based on the data that I have of the hydrogeologic system and my understanding of it."), Bennett Re-Direct, p. 988, l. 20—p. 989, l. 12 (asserting that based on the information contained in the Mine Application, he feels he has an understanding of the local water quality).

> ***parameters with the exception of uranium and radium-226***, which are significantly higher in the baseline wells.[238]

In other words, groundwater quality in the rest of the Mine Permit Area is similar to the quality in the RBL wells except for the levels of uranium and Ra-226.

c. Baseline Values for Uranium and Radium-226

During the live hearing, the County and District spent the majority of their time attempting to build a case—as opposing counsel so aptly terms it—of "circumstantial evidence"[239] to support their many theories regarding the artificial elevation of uranium, and by extension, radium, in the baseline sample results. Their first theory was that the drilling of the exploration boreholes somehow disturbed the aquifer or introduced oxygen such that the levels of uranium were elevated in the samples from the RBL wells. In his prefiled testimony, Dr. Sass seemed to suggest a 125-foot impact radius around each RBLB well, but he offered no support for this number, and later admitted he was guessing.[240] As Dr. Bennett explained in his testimony, it is not physically possible for the drilling of the boreholes around the RBLB wells to have elevated the levels of oxygen in these wells.[241]

As a general matter, the effect of drilling extends "at most a few centimeters from the edge of the borehole."[242] Moreover, even if oxygen were introduced into the formation, oxygen is chemically and biologically reactive and would be quickly consumed in the subsurface.[243] More specifically, in this system, Dr. Bennett estimated that oxygen could not be transported more than a foot from the wellbore.[244] With respect to the four RBLB wells referenced by Dr.

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[238] Executive Director Exhibit 10, p. 59, Response 90 (emphasis added).
[239] Murry Cross-Examination, Transcript, p. 1308, ll. 10-14.
[240] Exhibit UEC-Bennett 12, pp. 100-101.
[241] Issue C Rebuttal Testimony, Bennett, p. 21, l. 1—p. 22, l. 13.
[242] *Id.* at p. 21, ll. 6-7.
[243] *Id.* at p. 21, ll. 15-18.
[244] *Id.* at p. 21, ll. 18-19.

Sass, even assuming that oxygen reaching the formation was not consumed by microbes, there is no physical way for oxygen to travel from the adjacent boreholes to the baseline wells in the time between drilling the boreholes and sampling the wells.[245] In other words, even assuming no microbes and large quantities of oxygen, the speed of the groundwater itself makes Dr. Sass' theory impossible.

Next, the Protestants floated the theory that leaving the boreholes and/or RBL wells open for more than 48 hours allowed air into the boreholes or wells, which in turn allowed enough oxygen to contact the formation to oxidize the uranium, and artificially raise uranium values. Again, this theory is foiled by science.[246] As Dr. Bennett explained, oxygen diffusion from the atmosphere consists of at least five steps, with the key step in this situation being the interfacial transfer across the air/water interface:[247]

> A dry sponge will rapidly soak up water, while a completely wet sponge will not soak up any at all. Mud-rotary borehole drilling involves the rapid recirculation of drilling fluid from the advancing borehole, through an open pit, and back into the borehole. The starting condition of the borehole fluid at the end of the drilling activity therefore is saturated with oxygen and in equilibrium with the atmosphere. It is thermodynamically impossible for additional oxygen to diffuse from the atmosphere into a saturated fluid . . . .[248]

Finally, the County and District proposed the theory that leaving the boreholes and/or RBL wells open for more than 48 hours allowed oxygenated rainwater to enter the holes, contact the formation, and oxidize the uranium. Once again, a creative theory, but not a scientifically persuasive one.[249] In his one sentence of testimony on this topic, Dr. Sass did not indicate that he did any calculations as to the quantity of oxygen that might enter a borehole via storm water

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[245] *Id.* at p. 22, l. 4-11.
[246] *Id.* at p. 22, l. 14—p. 23, l. 18; Erskine Cross-Examination, p. 155, l. 12—p. 156, l. 5.
[247] Issue C Rebuttal Testimony, Bennett, p. 23, ll. 1-18.
[248] *Id.* at p. 23, ll. 8-14.
[249] Issue C Rebuttal Testimony, Bennett, p. 23, l. 19—p. 24, l. 8.

runoff.[250] Indeed, despite the fact that there are numerous factors that would play a role in determining how much runoff, if any, actually entered a borehole, Dr. Sass considered only one: whether it rained.[251]

Dr. Bennett did not dispute that it rained. But, he noted that in addition to key factors such as the quantity and rate of rainfall, condition of the soil, gradient, *etc.*, that would determine whether runoff actually formed and entered a borehole, diffusion factors *inside* the borehole—*e.g.*, diffusion through the bentonite/water filled borehole, diffusion across the fluid mudcake/sediment interface, and diffusion through the aquifer—would determine whether the oxygen made it into the surrounding aquifer.[252] After considering these factors, Dr. Bennett concluded that any contribution of oxygen from storm water runoff would be insignificant.[253]

In spite of the fact that the suggested oxygen pathways are not viable, the County and District still insisted—via Dr. Sass' ratio and calculations—that the artificial introduction of oxygen must have happened somehow. Dr. Sass testified that "for every 1 mg/l of uranium liberated from the ore into the groundwater, one would expect to see a related 335 pCi/l of radium."[254] Based on his theory, Dr. Sass concluded that the levels of radium in the RBLB wells indicate the occurrence of repeated, recent, uranium oxidation and reduction (precipitation) events.[255]

While Dr. Sass' formula is tidy, it is also flawed. Fundamentally, it is flawed because it overlooks the structure of the uranium ore body. As Dr. Galloway, a universally-acknowledged

[250] Sass Testimony, p. 26, ll. 10-12.
[251] Exhibit UEC-Bennett 12, pp. 120-121; Issue C Rebuttal Testimony, Bennett, p. 23, l. 19—p. 24, l. 1.
[252] Issue C Rebuttal Testimony, Bennett, p. 23, l. 1-5 and p. 24, ll. 2-7.
[253] *Id.* at p. 23, ll. 7-8.
[254] Sass Testimony, p. 11, ll. 11-12.
[255] *Id.* at p. 17, ll. 7-16.

expert in the field of uranium deposit sedimentology and geohydrology[256] testified, Dr. Sass' characterization of a uranium ore body as being like a concrete barrier to water flow does not appropriately describe the interaction between the uranium and its host aquifer.[257] In reality, "[w]ater flows in and through areas of uranium mineralization. The presence of a uranium ore body has little actual effect on groundwater flow."[258]

This point is important because, due to the crystal structure of uranium minerals, in a natural system, much more of the radium is liberated into groundwater through the decay process than through oxidation of uranium.[259] As Dr. Erskine explained, the alpha recoil effect results in the ejection of radium from the uranium crystal structure.[260] Assuming a concrete-block structure led Dr. Sass to grossly underestimate the amount of uranium that is in contact with groundwater; consequently, he overlooked a major mechanism contributing to the presence of radium in the groundwater.[261] Significantly, the uranium decay process is independent of oxidation,[262] and as Dr. Erskine's calculations showed, could easily account for the levels of radium found in the RBLB wells.[263] In other words, the levels of radium seen in the RBLB samples are not indicative of the artificial introduction of oxygen into the uranium ore body.

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[256] Issue C Rebuttal Testimony, Galloway, p. 5, ll. 7-14 (describing Dr. Galloway's recent career achievement award of the Twenhofel Medal).
[257] Issue C Rebuttal Testimony, Galloway, p. 4, ll. 1-2.
[258] *Id.* at p. 4, ll. 6-7; Galloway Direct Testimony, p. 19, l. 2-3; Issue C Rebuttal Testimony, Erskine, p. 7, ll. 8-12 (agreeing with Dr. Galloway's characterization of South Texas uranium ore bodies and noting that "both Dr. Clark and Dr. Sass similarly acknowledge Dr. Galloway's expertise in this area.").
[259] Issue C Rebuttal Testimony, Erskine, p. 8, l. 4—p. 13, l. 5
[260] *Id.* at p. 9, l. 8—p. 11, l. 2. *See also*, Galloway Direct Testimony, p. 25, l. 23—p. 26, l. 1 (explaining that "as uranium naturally decays, its daughter products (such as radium-226) are displaced from the ore bodies into nearby areas of the aquifer.").
[261] Issue C Rebuttal Testimony, Erskine, p. 11, l. 3—p. 13, l. 5.
[262] *Id.* at p. 8, ll. 1-3.
[263] *Id.* at p. 13, l. 6—p. 14, l. 15.

And the fact remains that, as Dr. Bennett and Dr. Erskine testified, it would be impossible for enough oxygen to have contacted the aquifer, as theorized by the Protestants.[264]

4. Arguments at Hearing

At hearing, cross-examination regarding Issue C consisted mostly of a less elegant version of Dr. Sass' theory—in essence, frequent attempts to get UEC's experts to state that the uranium levels from the RBL wells are not what they would expect to see in an "undisturbed," completely reduced aquifer. (Protestants appeared to adopt Dr. Sass' definition of "undisturbed," meaning that no boreholes or wells had been drilled.[265])

First, opposing counsel attempted to garner agreement regarding Dr. Sass' assertion that "[o]nly trace amounts of uranium would be soluble in its steady state as an ore body."[266] UEC's experts testified, however, that even in undisturbed aquifers, there are three common oxidation states, and within those, "a considerable range" of oxidation potential.[267] For example, Dr. Erskine testified that he would characterize the Goliad aquifer within the Mine Permit Area as "mildly to moderately reducing" based on the presence of dissolved iron and dissolved manganese.[268] Moreover, transitional boundaries exist in aquifers between the oxidized and reduced portions of aquifers.[269] In other words, "[i]t's not an either/or kind of thing."[270] Consequently, "expected" quantities of uranium under undisturbed conditions vary.[271]

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[264] Issue C Rebuttal Testimony, Bennett, p.19, l. 12—p. 24, l. 8; Issue C Rebuttal Testimony, Erskine, p. 14, l. 16—p. 15, l. 4.
[265] Exhibit UEC-Bennett 12, p. 72.
[266] Sass Testimony, p. 12, l. 10.
[267] Galloway Re-Direct, Transcript, p. 94, l. 25—p. 95, l. 14; Bennett Cross-Examination, Transcript, p. 862, ll. 2-6.
[268] Erskine Cross-Examination, Transcript, p. 134, ll. 21-23.
[269] *Id.* at p. 95, ll. 15-23.
[270] Erskine Cross-Examination, Transcript, p. 132, ll. 14-16.
[271] Erskine Cross-Examination, Transcript, p. 128, l. 16—p. 129, l. 17 and p. 134, ll. 12-23.

UEC's experts also testified that the levels of uranium seen in the RBL well samples are levels they have seen elsewhere.[272] Even the highest uranium value, which UEC's experts agreed is not common, is one both Dr. Erskine and Dr. Bennett have seen before.[273] Indeed, a range of values is expected at any site.[274]

Finally, opposing counsel tried to salvage Dr. Sass' ratio theory by asking Dr. Erskine about the thickness of the uranium crystals attached to sand grains in the aquifer. Opposing counsel appeared to be theorizing that if enough of the crystals stacked up together, they might more closely resemble Dr. Sass' impenetrable block of concrete. Dr. Erskine, however, quashed that train of thought by reiterating that the "thickness" of the uranium crystal—even stacked together—is measurable only on a submicron scale.[275] He illustrated his point by referencing one of his exhibits, a photograph of a sand grain covered in a light dusting of uranium minerals that was taken with an electron microscope.[276]

In the end, the Protestants made no further headway with Issue C during the hearing than they did with their prefiled testimony. Without question, the preponderance of the evidence shows that the Mine Application adequately and accurately describe baseline conditions in the proposed permit area under applicable requirements of 30 TAC Chapter 331.

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[272] Galloway Re-Direct, Transcript, p. 96, ll. 8-15; Bennett Cross-Examination, Transcript, p. 932, ll. 3-15.
[273] Erskine Cross-Examination, Transcript, p. 134, l. 14—p. 135, l. 5; Bennett Cross-Examination, Transcript, p. 927, l. 23—p. 928, l. 20 and p. 932, ll. 3-15.
[274] Erskine Cross-Examination, Transcript, p. 151, ll. 11-17.
[275] Erskine Cross Examination, Transcript, p. 144, l. 22—p. 146, l. 16.
[276] Exhibit UEC-Erskine 3; Erskine Re-Direct, Transcript, p. 163, l. 9—p. 164, l. 25.

TESTIMONY REGARDING QUALIFICATIONS AND EXPERTISE OF DR. BENNETT AND DR. ERSKINE

DIRECT TESTIMONY OF DR. PHILIP BENNETT

I.

QUALIFICATIONS AND AREAS OF EXPERTISE

Q: Please state your name, place of employment, and business address for the record.

A: My name is Philip Charles Bennett. I am employed at the University of Texas at Austin, in the Department of Geological Sciences. The address is 1 University Station, C1100, Austin, TX 78712.

Q: What is your role in this proceeding?

A: I am providing expert testimony on behalf of Uranium Energy Corp ("UEC") in the areas of hydrology, hydrogeology, aqueous geochemistry, and geomicrobiology.

Q: What is the scope of your expert testimony?

A: I cover a number of basic hydrogeology concepts, some of which are also discussed by Dr. Galloway in his testimony. Whereas Dr. Galloway approaches these concepts from a primarily geologic framework, I focus more on the specific hydrological features and processes. Using hydrogeologic and geochemical principles, as well as the site-specific data that I have reviewed and my previous experience, I will address matters relevant to the following issues: 1) Issue C (Does the application adequately and accurately describe baseline conditions of the groundwater in the proposed permitted area under applicable requirements of 30 TAC Chapter 331); 2) Issue F (Is the application sufficiently protective of groundwater quality?); 3) Issue G (Does the application adequately characterize and describe the geology and hydrology in the proposed permit area, including fault lines, under the applicable rules?); 4) Issue H (Do the geologic and hydraulic properties of the proposed permit area indicate that the Applicant will be able to comply with rule requirements?); 5) Issue P (Whether the proposed mining is in the

recharge zone of the Gulf Coast Aquifer (Evangeline component)); 6) Issue Q (Whether the Gulf Coast Aquifer is a confined aquifer in the areas of Goliad County where UEC will conduct UIC activities); 7) Issue R (Whether mining fluids will migrate vertically or horizontally and contaminate an USDW (underground source of drinking water)); 8) Issue S (Whether there are any USDWs within the injection zones proposed by UEC); and 9) Issue T (Whether any USDWs within Goliad County will be adversely impacted by UEC's proposed in situ uranium operations).

Q: What is your educational background and work experience?

A: My educational background and work experience is set forth in detail in the *Curriculum Vitae,* which I prepared and have attached to this prefiled testimony as **Exhibit UEC-Bennett 1**.

Q: Please summarize your educational background.

A: I have a Bachelors of Science degree from The Evergreen State College in Olympia Washington, specializing in environmental chemistry. I have a MS degree in Environmental Studies from the State University of New York, College of Environmental Science and Forestry where I studied environmental chemistry and hydrogeology. I have a PhD in Geology from Syracuse University where I studied under Professor Don Siegel, and specialized in hydrogeology and aqueous geochemistry (very generally, the study of chemical and physical processes that occur in groundwater).

Q: Please summarize your work experience.

A: Since 1989 I have been employed by the University of Texas in a tenure stream position in the Department of Geological Sciences. I received early tenure in 1993, and currently hold the rank of full professor with tenure. Beginning August 14, 2009, I also became the Associate Dean for Academic and Student Affairs for the Jackson School for Geosciences. As a professor

I have mentored more than 35 MS and PhD students in the areas of hydrogeology, geochemistry, geochemical kinetics, geomicrobiology, and organic geochemistry. I have 6 students currently working under me for their degrees (4 PhD, 2 MS) and one Post Doctoral Research Associate. I have been a principal investigator for 10 peer-reviewed, funded research projects from the National Science Foundation for investigations in the above scientific disciplines, and I have published more than 50 articles in peer reviewed journals and proceedings volumes.

Q: Are you a member of any professional associations?

A: I am a Fellow of the Geological Society of America, and a member of the National Ground Water Association, The American Geophysical Union, and the American Society for Microbiology. I am a board member at large for the International Symposium for Environmental Microbiology, and a past member of the Geochemical Society, the International Association of Hydrogeologists, and the National Fire Protection Association. In 1997 I was honored to be chosen the Darcy Distinguished Lecturer by the National Ground Water Association. One Darcy Lecturer is chosen each year to travel and present a lecture on their specialty area to hydrogeologists around the world. I was invited by more than 70 institutions to present my lecture on the geochemical ecology of an oil-contaminated aquifer, and I eventually traveled to 52 institutions for the lecture series.

Q: Do you adopt Exhibit UEC-Bennett 1 (*Curriculum Vitae* of Dr. Philip Bennett) as your testimony regarding your qualifications as an expert in hydrology, hydrogeology and aqueous geochemistry, and geomicrobiology?

A: Yes.

Q: Are there any particular projects that you have worked on that you believe make you especially qualified to testify as an expert in this case?

A: In my research activities at the University of Texas I have been involved in many major projects involving multiple investigators with varied specializations where an interdisciplinary approach to solving the problem was essential. For 25 years I have worked with the U.S. Geological Survey at their national point source pollution research site at Bemidji, Minnesota, looking at the geochemistry of oil contamination in groundwater. This study included intensive investigations of microbial geochemistry (*i.e.*, the study of how microorganism influence geological and chemical processes in the subsurface), mineral weathering, oxidation and reduction of metals in water, contaminant transport, gas transport and chemistry, and aquifer properties and groundwater flow. In the aquifer at issue, the microbial degradation of contaminating oil results in the reduction of iron and manganese oxides in a process very similar to the one by which uranium is thought to be reduced to form reduced roll-front deposits. In collaboration with other researchers, I and/or my students have produced more than 25 papers, conference proceedings, theses and dissertations related to this project.

In 2006 I initiated an international investigation of the genesis and geochemistry of uranium-rich, hyper-alkaline lakes in Mongolia. These unusual lakes receive groundwater discharge from a shallow aquifer with naturally elevated uranium, and the uranium accumulates in the lakes as the water evaporates down to an extremely saline residual fluid. We are investigating the source of the uranium in the groundwater, the concentration process in the lakes, the interaction of the uranium with the sediments, and the microbial oxidation and reduction of the uranium.

I have also initiated and managed long term projects to investigate the effects of microbes (i.e., microorganisms) on mineral weathering, the chemistry of arsenic and antimony in hot springs, and the biology and geochemistry of cave formation. I led a 5-year project to investigate

the movement of contaminants, water, and gas through the sediments overlying the Ogallala Aquifer of North Texas. I have additionally investigated oil contamination in the shallow subsurface near Sinton, Texas, metal contaminants in the Beaumont clay formation near Chocolate Bayou (which is near Houston), and oil contamination and gas generation and transport in the Beaumont clay formation under the Kennedy Heights neighborhood of Houston. I have also investigated petroleum contamination of groundwater in Corpus Christi, landfill leaching and contaminant transport in Sinton, and trichloroethylene (TCE) contamination in groundwater near Houston.

During 20 years as a professor at the University of Texas I have taught or co-taught a course in Field Methods in Hydrogeology more than 12 times, with each course involving intensive field work in south or central Texas. Every course involved aquifer testing (*i.e.*, pump testing) in the Carrizo-Wilcox aquifer, either at a well field east of Lockhart, Texas, or at the University of Texas' field training center near Devine, Texas. These courses also involved intensive group projects focused on specific locations in Texas, including hydrogeochemical studies of the island aquifer of South Padre Island and the Wilcox aquifer at Devine, the hydrogeology of lignite mining in the Carrizo-Wilcox aquifer, and several projects in the Trinity aquifer of Hays and Travis counties.

Q: Do you have specific familiarity and expertise with respect to UEC's proposed in situ uranium mining project in Goliad County (the "Goliad Project")?

A: Yes. As part of my activities as an expert witness on behalf of UEC, I reviewed available documents and data on the geology and hydrology for the area that is the site of the Goliad Project, and reviewed groundwater analyses from homeowner and UEC wells. I participated in a field sampling campaign in October 2008 to examine the quality of water from several private

wells, as well as surface conditions and well construction and installation in the Mine Permit Area. I reviewed UEC's Mine Application and PAA-1 Application for Sand B, reports by independent experts, and written communications pertaining to UEC's exploration activities. I have evaluated these data using accepted scientific methods within the bounds of physical laws and constraints, and I have referred to peer-reviewed journal articles, reports, and textbooks.

III.

ISSUE C

A.

REBUTTAL TO THE PREFILED TESTIMONY OF DR. RONALD L. SASS

REBUTTAL TESTIMONY OF DR. DANIEL W. ERSKINE

Q: Please state your name, place of employment, and business address for the record.

A: My name is Daniel W. Erskine and I am employed by INTERA, Inc. with offices at 6000 Uptown Blvd., Albuquerque, NM 87710.

Q: What is your role in this proceeding?

A: Early in the contested case hearing process, I was identified as a potential rebuttal witness for the applicant. It is in that capacity that I am submitting testimony.

Q: What is your educational background and work experience?

A: My educational background and work experience is set forth in detail in the Curriculum Vitae, which I prepared and have attached to my rebuttal testimony as **Exhibit UEC-Erskine 1.**

Q: Please summarize your educational background.

A: I hold a PhD in Earth Sciences from the University of New Mexico which included training in geology and geochemistry.

Q: Please briefly summarize your work experience.

A: I began my career working as a contractor to the US Department of Energy (DOE) working on geochemical issues related to uranium mill tailings at DOE controlled UMTRCA sites. In 1996 I expanded my practice to include work for operators of uranium mining and milling sites. I have focused, in large part, on issues related to fate and transport of radionuclides.

Q: Are there any projects you have worked on that you believe are particularly relevant to your testimony in this case?

A: Among many projects, I have worked to develop background values for a uranium milling site near Blanding Utah and, in another project, on background values for groundwater that is refilling underground mines at Ambrosia Lake, New Mexico. I provided expert testimony on uranium fate and transport to the N.M. Water Quality Control Commission hearings to determine the groundwater quality standard for uranium.

Q: Have you reviewed the direct testimony of Dr. Sass?

A: Yes.

Q: Have you also reviewed the deposition of Dr. Sass that was taken in this contested case proceeding?

A: I actually attended Dr. Sass' deposition by teleconference.

Q: Can you identify the document attached to your rebuttal testimony as Exhibit UEC-Erskine 2?

A: Yes. It is a copy of portions of the transcript of Dr. Sass' deposition. I am including it in my rebuttal testimony as one of the documents I relied upon in evaluating his prefiled testimony.

Q: Have you reviewed Dr. Galloway's rebuttal testimony regarding Dr. Sass' testimony?

A: Yes.

Q: Do you agree with Dr. Galloway's characterization of South Texas Uranium ore bodies?

A: Yes. It comports with my own experience as a geochemist, and I feel very comfortable relying on Dr. Galloway's opinion in this regard. I should add that both Dr. Clark and Dr. Sass similarly acknowledge Dr. Galloway's expertise in this area.

ALTERATION OF
DR. BENNETT'S TESTIMONY

- ***Misrepresentation of Evidence in the Record***

"A couple of months after submitting this testimony, Dr. Bennett was confronted with a second and third round of sampling data showing a drastic decline across the board. If the first round were naturally occurring levels of uranium, how could later rounds show a uniform drastic decrease? Nowhere in his pre-filed or rebuttal testimony does he explain the inconsistency. When questioned about the subsequent data, Dr. Bennett simply answered, 'I believe I had received [rounds two and three before my rebuttal], but again, I have not had a chance to look at it.' One must question why Dr. Bennett had not had a chance to look at these changes."[183]

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[177] County Closing Argument, Part II.C, pp. 30-31 (emphasis added).
[178] 30 TAC § 305.125; *see* UEC's Closing Argument, Part II.C., p. 131.
[179] 30 TAC § 305.2(27).
[180] 30 TAC § 305.125(19).
[181] 30 TAC § 3.2(3); *see also* 30 TAC § 305.2(1) (defining an "application" as "a formal written request for commission action relative to a permit. ...").
[182] *See* Exhibit Goliad County-Sass 12; UEC's Closing Argument, Part I.A.7, p. 4.
[183] County Closing Argument, Part II.C, p. 31 (emphasis added).

First, counsel for the County knows very well that the third round of data was provided to opposing counsel before it was provided to UEC's experts. Due to the timing of receipt of the data and his schedule, Dr. Bennett did not have adequate time to review the third round of data before the filing of his rebuttal testimony. Second, in attempting to make its point, the County ***altered*** Dr. Bennett's quotation:

> Q. And my question to you first of all is, this additional data, I believe, came in -- did you see this data before -- any of this new data before you filed your prefiled testimony?
> A. I'm not sure of the time that I received the data. I did not use it in preparing the prefiled testimony.
> Q. Okay. So you may or may not have been aware of it, but it did not enter into your prefiled it testimony?
> A. It may have been one of many e-mails.
> Q. And then ***when you filed the rebuttal testimony, I know you had the second round of data, because you're talking about Dr. Sass's*** --
> A. Yes.
> Q. ***Did you have the third round of data at that time?***
> A. In looking back, ***I believe that I had received it, but again, I have not had a chance to look at it***.[184]

This excerpt makes it clear that during the hearing (1) the County recognized that Dr. Bennett did in fact address the data "inconsistency" in his rebuttal testimony; and (2) Dr. Bennett's response regarding not having had a chance to look at the data before his rebuttal testimony was filed was in answer to a question regarding the third round of data not "rounds two and three" as represented in the County's parenthetical within the quotation.

[184] Bennett Cross-Examination, Transcript, p. 837, l. 15—p. 838, l. 8 (emphasis added).
[185] County Closing Argument, Part II.C, p. 32 (emphasis added).

ATTACHMENT D

FURTHER DISCUSSION REGARDING WHY PLUGGED BOREHOLES ARE NOT "WELLS"

The second sufficiency argument raised by the County at hearing stems from Section 331.122(2)(B), which requires commission consideration of:

> a tabulation of reasonably available data on all wells within the area of review which penetrate the proposed injection zone. This data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and completion, and any additional information the executive director may require.

Counsel for both the County and the District suggested at hearing that "all wells" in Part (B) includes plugged boreholes. But exhibits provided by Dr. Darling in his prefiled testimony make it clear that once a borehole is plugged, it no longer meets the Chapter 331 definition of a well. These exhibits, along with others related to the Notice of Violation ("NOV") that UEC received

[317] *See e.g.*, Exhibit UEC-Holmes 13, Figure 1.4.
[318] *Id.*
[319] Exhibit UEC-Holmes 13, Figure 5.1.
[320] *Id.* at Figure 9.4.
[321] *Id.* at p. 13-1.
[322] *Id.* at Figures 1.3 and 1.4.
[323] Murry Cross-Examination, Transcript, p. 1188, l. 24—p. 1189, l. 11.
[324] *Id.* at p. 1213, l. 24—p. 1214, l. 5.

from the Railroad Commission ("RCT"), are discussed more fully under Issue L; however, both UEC's revised exploration permit and RCT inspection reports are instructive for purposes of Issue D and Section 331.122(2)(B), as well.

UEC's exploration permit was revised to agree with both existing field practices and corrective action procedures utilized in responding to the NOV.[325] Under the revised exploration permit, the plugging procedure specified that:

> Exploration boreholes must be plugged with cement from total depth to at least 3 feet below ground surface and no closer than 1.5 feet from the surface. . . . The remainder of the hole between the top of the plug and the surface shall be filled with cuttings or non-toxic soil. To ensure that the proper plug depth is achieved, cemented boreholes will be allowed to settle and dry for several days and then re-checked for plug depth. If plug depth is not at the required distance from the surface, additional cement slurry will be added to bring the top of the plug to the required level . . . ."[326]

The post-NOV remediation inspections[327] plus the subsequent monthly inspections provide independent assurance that these procedures were in fact implemented.[328]

Put simply, there is no way that boreholes plugged to the surface with cement and soil meet the Chapter 331 definition of a well.[329] Moreover, there is no doubt that the commission was aware of and considered the existence of these boreholes, since exploration drilling is discussed in both the Mine Application[330] and the Response to Comments.[331]

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[325] *See* Closing Argument Brief, Issue L.
[326] Exhibit Goliad County-Darling 5.
[327] Exhibit UEC-Holmes 33, pp. 31-40.
[328] *Id.* at pp. 41-45; 58-96; and 106-184.
[329] 30 TAC § 331.2(110) (defining a well as "[a] bored, drilled, or driven shaft whose depth is greater than the largest surface dimension, a dug hole whose depth is greater than the largest surface dimension . . . .").
[330] Exhibit UEC-Holmes 13, p. viii (citing UEC's "drilling and logging numerous bore holes" as part of "an aggressive one-year exploration program").
[331] *See e.g.*, Executive Director Exhibit 10, p. 61, Response 92.

ATTACHMENT R

PORTIONS OF DR. BENNETT'S TESTIMONY REGARDING POTENTIAL FOR MIGRATION

Q: Let's first discuss the first potential pathway identified by Mr. Blandford. What boreholes does Mr. Blandford identify as potential pathways for the migration of mining fluids?

A: In his direct testimony, Mr. Blandford states as follows: "Specifically, 487 exploration boreholes were drilled on the UEC properties during 1979 through 1984. Assuming that these boreholes were abandoned in accordance with the Texas Railroad Commission requirements in place at that time, these boreholes are likely conduits for the migration of fluids between the sand units, and vertical migration through these old exploratory boreholes should be expected, particularly in the vicinity of injection wells." Blandford Testimony, p. 13, line 20 - p. 14, line 2.

Q: In your opinion, do all of these 487 boreholes constitute potential pathways for the migration of mining fluids?

A: No.

Q: Why not?

A: First, as established by the rebuttal testimony of Craig Holmes, the majority of the 487 boreholes referenced by Mr. Blandford are not in any proposed production area (where mining fluids will be injected). For example, only thirty-seven of these boreholes are located within the area constituting the production area of PA-1. GCGCD Exhibit Blandford C. Boreholes that are not in or near a proposed production area would not constitute potential pathways for the migration of fluids during mining.

Q: Do all of the old boreholes located in or near proposed production areas constitute potential pathways for the migration of mining fluids?

A: No.

Q: Why not?

A: Mr. Blandford contends that these early boreholes constitute potential pathways for the migration of mining fluids because they were plugged "in accordance with the Texas Railroad

Commission's requirements in place at that time." Blandford Testimony, p. 13, lines 21-23. Mr. Blandford makes the assumption that the boreholes, which were drilled between 1979 and 1984, were plugged in accordance with the requirements in effect in 1979 (Blandford Testimony, p. 13, lines 21-23), which he contends required mining companies simply "to backfill most of the borehole with cuttings" and install a cement surface plug. **Exhibit UEC-Bennett 15, p. 73, lines 6-19**. Relying on the testimony of Craig Holmes, who testifies that the current version of the Texas Railroad Commission rule governing plugging requirements went into effect in 1982, prior to the plugging of many of the Moore Energy boreholes, I conclude that most of these early boreholes do not constitute potential pathways for vertical migration of mining fluids. In reviewing the database provided to me by UEC of the complete borehole history for the site I find only 3 boreholes that were logged before 1982 (the data does not show the drill or plug date), and all three of these boreholes are outside the B-sand mine area. All of the other boreholes, inside and outside the mine area, were at least logged after March 15, 1983, and were likely drilled shortly before that. I conclude that all of the wells in the mine area were plugged according to the Texas Railroad Commission rule that took effect in 1982, and therefore are not a pathway for fluid migration.

Q: Can you identify the document attached to your rebuttal testimony as Exhibit UEC-Bennett 15?

A: Yes. It is a copy of portions of the transcript of Dr. Blandford's deposition. I am including it in my rebuttal testimony as one of the documents I relied upon in evaluating his prefiled testimony.

Q: Does Mr. Blandford contend that there is other evidence of the existence of old, poorly plugged boreholes that could serve as potential pathways for the migration of mining fluids?

A: Mr. Blandford claims that the radium-226 levels in the OMWs (which overlie the production area for PA-1) is evidence not only that such boreholes exist but that groundwater and entrained contaminants has actually migrated from Sand B to Sand A. Specifically, Mr. Blandford points to the fact that the radium-226 levels in the OMW wells generally increases from east to west, although that pattern is not without exception. Mr. Blandford concludes that "[t]he logical source for the observed increases in Ra-226 concentration is upward seepage of Sand B groundwater, which has very high Ra-226 concentrations within the ore zone." Blandford Testimony, p. 15, lines 7-9.

Q: Do you find this evidence plausible?

A: No. It is not even remotely plausible that radium-226 has migrated to Sand A from Sand B through the boreholes as Mr. Blandford contends. In my opinion, this is an example of Mr. Blandford exhibiting bias by drawing a conclusion based upon little or no evidence while discounting the most obvious and likely cause of an observed phenomenon.

Q: What are the bases for your opinion that it is not plausible that radium-226 has migrated to Sand A from Sand B?

A: There are several bases for this opinion. For one thing, as Mr. Blandford admitted in his deposition, these old boreholes are not simply open pathways. **Exhibit UEC-Bennett 15, p. 85, line 9 – p. 86, line 5.** As explained by Craig Holmes in his rebuttal testimony, even if some of these old boreholes were not plugged with cement across the sand units as currently required by the Texas Railroad Commission, there would be drilling mud in the boreholes across the sand units. In his deposition, Mr. Blandford admitted that, even if not plugged in keeping with current standards, these boreholes would contain drilling mud. **Exhibit UEC-Bennett 15, p. 85, line 9 – p. 86, line 5.** The boreholes would likely also contain clay because, as Mr. Blandford noted in his deposition, the walls of uncased boreholes are prone to sloughing and caving in, even in fractured rock formations. *Id.* **Exhibit UEC-Bennett 15, p. 23, line 20 – p. 24, line 6.**

Regardless, even in the absence of clay from a collapsed borehole wall, drilling mud in a borehole, in and of itself, constitutes a significant barrier to groundwater flow, particularly after it has been allowed to gel for a time. While being circulated, drilling mud acts as a high density fluid with suspended colloidal clay particles, and the high density creates a region of high head preventing formation fluid from entering the borehole. But once it is allowed to set it forms a gel with substantially higher resistance to entry of the formation fluids (Collins and Kortum 1989). Further, uncased boreholes will typically collapse, and the thick sequence of clays will move across the borehole, further sealing and preventing migration. Even a few centimeters of clay will substantially retard fluid movement, and for the A/B confining unit, it is 1000 to 1500 centimeters of clay. Even if old, poorly plugged boreholes were to exist in the production area of PA-1, they would not constitute pathways for vertical migration, and the data provided to me does not show such boreholes exist.

Q: Do you have any support for your opinion that drilling mud in a borehole constitutes a significant barrier to groundwater flow?

A: Yes. The sealing effect of drilling mud in boreholes has been the subject of studies and articles such as Collins, R.E. and D. Kortum, *Drilling Mud as a Hyrdraulic Sear in Abandoned Well Bores*, Underground Injection Practices Council, 1989 Winter Meeting, San Antonio, Texas; and K.E. Davis, *Factors Effecting the Area of Review for Hazardous Waste Disposal Wells*, Proceedings of the International Symposium on Subsurface Inspection of Liquid Wastes, New Orleans.

Q: Are there other reasons that you find it implausible that radium-226 could have migrated from Sand B to Sand A via old exploratory boreholes as Mr. Blandford contends?

A: Yes. As I just explained, drilling mud, in a borehole composed of bentonite clay, constitutes a significant barrier to groundwater flow. Beyond the barrier to fluid flow, the clays constitute a *chemical* barrier to migration of Ra-226. Even if one were to assume that some

amount of groundwater had somehow been able to migrate upward from Sand B through the drilling mud and the collapsed clay in an old borehole and all the way into Sand A, that would ***not*** mean that Ra-226 could migrate into Sand A. Radium adsorbs, or attaches, very strongly to clay minerals, displacing other ions present on the surface, and will be substantially *retarded* (a hydrogeological term describing how slow a dissolved component will move compared to water). In rebuttal testimony, Dr. Daniel Erskine testifies that clay adheres to the surface of other minerals, and he also concludes that it is not plausible that radium-226 could have migrated all the way through a forty to forty-five foot column of drilling mud and clay particles.

Q: What is the most logical source of the radium-226 in the OMW wells?

A: I agree with the opinion of Dr. Erskine who states in his rebuttal testimony that the most logical source of radium-226 in the OMW wells is uranium mineralization in Sand A. The mineralization has been present over geological time periods, and radium would have ample opportunity to migrate downgradient of the ore zone in Sand A, even with substantial retardation by the clays present in the aquifer.

Q: Other than the presence of radium-226 in the OMW wells, does Mr. Blandford cite any other evidence of the existence of old, poorly plugged boreholes that could serve as potential pathways for the migration of mining fluids?

A: No, and our review of the drilling records show that there are no such wells inside the production area for PA-1. The three wells drilled before 1982 for which the old plugging rules would have applied are well outside the production area and nowhere near the OMW wells.

Q: You testified that, assuming some contaminants were able to migrate all the way through the confining clay unit between two sands, those contaminants would then have to migrate downgradient past the boundary of the aquifer exemption area and arrive at a USDW in a sufficient enough concentration to contaminate the USDW. Why is that so?

A: As Craig Holmes explains, no mining will occur unless the TCEQ and the EPA approve UEC's request for an aquifer exemption. As Mr. Holmes also explains, upon approval of the aquifer exemption request, none of the sands (Sands A-D) within the aquifer exemption area will be regulated as a USDW. Thus, to contaminate a USDW, contaminants in the mining fluid would not only have to migrate to the overlying or underlying sand, but also have to migrate downgradient past the aquifer exemption boundary in a sufficient quantity to have an adverse impact on the USDW. Thus, contaminants would have to migrate all the way though the overlying or underlying clay confining unit and then migrate downgradient to reach a USDW.

Q: Even if there were some old, poorly plugged borehole in or near one of the other proposed production areas through which mining fluids might migrate, what might prevent the contaminants in the mining fluid from migrating through a confining unit and then downgradient to a USDW?

A: The contaminants would be subject to various geochemical reactions and processes that are known to delay or prevent their migration. As Dr. Erskine, Mr. Blandford, and at least two other expert witnesses for the Protestants have recognized, radium adheres to the surface of iron oxides and clays, which impede it from migrating with groundwater. **Exhibit UEC-Bennett 15, p. 133, line 12 – p. 135, line 3; Exhibit UEC-Bennett 19, p. 74, line 7 – p. 78, line 6; Exhibit UEC-Bennett 20, p. 54, line 8 – p. 55, line 1.** Likewise, uranium is redox sensitive – in other words, it readily participates in reduction-oxidation chemical reactions. When reduced, these constituents precipitate – in other words, it drops out of solution and into mineralized form. Thus, uranium would drop out of solution and into mineralized form upon encountering reductants.

Q: Can you identify the document attached to your rebuttal testimony as Exhibit UEC-Bennett 19?

A: Yes. It is a copy of portions of the transcript of Dr. Darling's deposition. I am including it in my rebuttal testimony as one of the documents I relied upon in evaluating his prefiled testimony.

Q: Can you identify the document attached to your rebuttal testimony as Exhibit UEC-Bennett 20?

A: Yes. It is a copy of portions of the transcript of Dr. Abitz's deposition. I am including it in my rebuttal testimony as one of the documents I relied upon in evaluating his prefiled testimony.

Q: Are there other processes that would prevent contaminants from migrating downgradient and arriving at a USDW in a sufficient enough concentration to adversely impact that USDW?

A: Yes. In addition to retardation (sorption) that I described above, there is also dispersion and decay. The transport of dissolved components in groundwater must include the geochemical and hydrological interactions that act on the water and solutes. As a contaminant moves downgradient by advection, it tends to spread out, occupying an increasingly larger volume of aquifer through a process known as "hydrodynamic dispersion". This occurs because of mixing as water flows around the tortuous paths of a porous medium, and because of diffusion of the solute from regions of high concentration to low concentration. This is a basic concept covered in every hydrogeology textbook. The inevitable result is that the concentration of a dissolved contaminant must decrease downgradient. Depending on the starting concentration, dilution due to dispersion can drop the concentration below the action limit. In addition, for Ra-226, there is also the radioactive decay to daughter products. While the half-life is Ra-226 is relatively long, 1590 years, the transport times for the mine area are also long, with baseline groundwater flow velocities of only 6-10 feet per year. Over the time period required to migrate 400 feet, while also accounting for the retardation that occurs, there will also be a measurable loss of Ra-226 by decay.

Q: Do you have an opinion regarding whether or not mining fluids will migrate vertically along old boreholes and contaminate an USDW?

A: Yes. In my opinion, it is unlikely that a mining fluids will migrate vertically along old boreholes and contaminate an USDW.

Q: Let's discuss the second potential vertical pathway identified by Mr. Blandford -- unspecified potential anomalies in the confining units. What anomalies does Mr. Blandford identify in this regard?

A: Mr. Blandford simply testifies that the clay confining layers "*may* be discontinuous and pinch out at certain locations . . ., or alternatively *could be* offset by additional smaller faults or fault splays not identified by UEC." Blandford Testimony, p. 22, lines 10-12 (emphasis added).

Q: Does Mr. Blandford identify any places where the clay confining layers pinch out or are otherwise discontinuous?

A: No. In his testimony, Mr. Blandford identifies only one "potential anomaly" on one cross section. Based on this so-called anomaly, Mr. Blandford opines that it is "plausible" that the confining layer between Sand B and Sand C pinches out at that location. Blandford Testimony, p. 22, line 21 – p. 23, line 3.

Q: In your opinion, is this location a potential pathway for vertical migration of mining fluids?

A: No.

Q: What are the bases for your opinion?

A: I agree with the rebuttal testimony of Dr. William Galloway, whose experience and expertise in the stratigraphy of the Texas coastal plains is unparalleled. As explained in his rebuttal testimony, Dr. Galloway has examined this so-called anomaly and has concluded that it does not indicate a pinching out of the confining unit.

Q: In his direct testimony, this potential anomaly is classified as "an example" of the places where the clay confining layers pinch out or are otherwise discontinuous. Are there other examples?

A: No. When asked in his deposition to point out other examples, Mr. Blandford was unable to do so. **Exhibit UEC-Bennett 15, p. 99, lines 2-22.** Dr. Galloway has also testified that the confining layers are continuous throughout the Mine Permit Area. Even Dr. H.C. Clark, an expert witness for Protestant Goliad County, admits in his direct testimony that PA-1, which is the area about which the most data is available, "seems to have a continuous clay layer above and below it." Clark Testimony, p. 24, lines 12-16.

Q: On page 22 of his testimony, Mr. Blandford also testifies that there "*could be* offset by additional smaller faults or fault splays not identified by UEC," which could serve as potential pathways for vertical migration of mining fluids. Does Mr. Blandford identify any additional smaller faults or fault splays?

A: No. Mr. Blandford does not identify any additional smaller faults or fault splays in his testimony. He was also unable to identify any additional smaller faults or fault splays when asked in his deposition. **Exhibit UEC-Bennett 15, p. 100, lines 13-24.** Moreover, neither Dr. Galloway nor Dr. Clark have been able to identify any additional faults or fault splays. See Rebuttal Testimony of Dr. Galloway.

Q: Does Mr. Blandford cite any additional evidence of additional faults or places where the confining units pinch out?

A: On page 23 of his testimony, Mr. Blandford states that "other observations based on UEC's cross sections that may be indicative of fluid migration across confining units." The only such additional observation mentioned by Mr. Blandford, however, is the gamma log response for well 30892-99 on cross section D to D.' Mr. Blandford contends that this gamma log response is an anomalous occurrence that indicates some type of mineralization or fluid

movement across the clay unit at this location. **Exhibit UEC-Bennett 15, p. 112, lines 4-8.** I am relying on the rebuttal testimony of Craig Holmes in which he explains that the most obvious and likely cause of the gamma log response is the presence of ore.

Q: Does Mr. Blandford cite any other evidence of additional faults or places where the confining units pinch out?

A: No.

Q: What is the final potential vertical pathway identified by Mr. Blandford?

A: The third potential pathway identified by Mr. Blandford is migration of mining fluids directly through the clay confining units. Specifically, Mr. Blandford opines as follows: "***Using a vertical hydraulic conductivity of 0.056 ft/d*** and other reasonable hydraulic properties and expected field conditions at the proposed mine site, water and associated contaminates could move across a 20 foot clay layer within several months, and across a 40 foot clay layer within a year." Blandford Testimony, page 26, lines 6-8 (emphasis added).

Q: Is 0.056 feet per day a reasonable value for the vertical hydraulic conductivity of the clay confining layers at the Mine Permit Area?

A: No. It is an absurdly high value to assign as the vertical hydraulic conductivity for a clay confining layers.

Q: What is your understanding of how Mr. Blandford arrived at this value for vertical hydraulic conductivity?

A: In his testimony, Mr. Blandford claims that this is the vertical hydraulic conductivity value used for the Burkeville confining unit in the Central Gulf Coast groundwater availability model (GAM) developed for and used by the Texas Water Development Board. Blandford Testimony, p. 25, lines 21-23.

Q: Is he correct?

A: No. As Van Kelley testifies in his rebuttal testimony, the vertical hydraulic conductivity value used in this GAM was 0.0001 feet/day, not 0.056 feet per day as Mr. Blandford claims. In other words, the vertical hydraulic conductivity value used by Mr. Blandford is ***560 times higher*** than the value used for the Burkeville confining unit in Central Gulf Coast GAM on which he relies. Chowdhury, *Groundwater Availability Model of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999* (2004), p. 36 (stating that "[f]or the . . . Burkville Confining System, we used the distributed hydraulic conductivity values as applied in the draft model (Waterstone, 2003)."); Waterstone (2003), p. 4-11 (stating that the vertical hydraulic conductivity value of 0.0001 feet per day was assigned for Layer 3, which is the Burkeville confining unit, "considering the formation materials, the relative potential for flow through [the] layer, and the range of previously reported values.").

Q: Does Mr. Blandford's error affect his conclusion that "water and associated contaminates could move across a 20 foot clay layer within several months, and across a 40 foot clay layer within a year?"

A: Absolutely. It is *only* by using this absurd value for vertical hydraulic conductivity, as well as an absurd value for effective porosity, that Mr. Blandford is able to reach that conclusion.

Q: Despite Mr. Blandford's error regarding the vertical hydraulic conductivity value used in the Central Gulf Coast GAM, is there other support for his assertion that .056 feet per day is a reasonable vertical hydraulic conductivity value for the confining layers at the Mine Permit Area?

A: No. There is no reasonable basis for assigning a vertical hydraulic conductivity value of .056 feet per day to these confining layers. There are a number of commonly-used and highly-trusted publications that provide ranges of representative values for the hydraulic conductivity of clay, and even the highest values in these ranges do not come close to .056 feet per day. *E.g.*, Freeze and Cherry, Groundwater, p. 29 (providing a range of 0.0000001-0.0001 feet per day);

Fetter, Applied Hydrology (4th ed.), p. 85 (providing a range of .0000028 35 to .002835 to feet per day); Domenico and Schwartz, Physical and Chemical Hydrogeology, p. 65 (providing a range of .0000002835 to .000133 feet per day). Moreover, hydraulic conductivity in the vertical direction in aquifers is typically a factor of five lower than in the horizontal direction due to the oriented layering of fluvial sediments that impedes vertical water movement more than lateral.

Q: With regard to his use of a vertical hydraulic conductivity value of .056 feet per day for the clay confining units, does Mr. Blandford have support from other hydrogeology experts in this contested case?

A: None. Dr. Bruce Darling, who is the only other expert witness for the Protestants who is a hydrogeologist, testified that the vertical hydraulic value for clay is typically on the order of .000001 to .00000001 cm. per second, which converts to .002835 to .00002835 feet per day. **Exhibit UEC-Bennett 19, p. 69, line 20 – p. 71, line 4.** The value used by Mr. Blandford is ***200 times*** higher than the highest value included in Dr. Darling's range. In addition, Van Kelley has submitted rebuttal testimony in which he concludes that the vertical hydraulic value for the clay units overlying and underlying Sand B 0.0018 ft/day. Even Mr. Blandford seems to have difficulty believing his own .056 value for the vertical hydraulic conductivity of these confining layers. In his 2007 Model, Mr. Blandford used a similar vertical hydraulic conductivity value of .06. However, in the report regarding that model, Mr. Blandford explained as follows: "In reality, the hydraulic conductivity of the sand layers may be greater than that used in the model, and ***the hydraulic conductivity of the clay layers would be substantially less than that used in the model.***" 2007 Report, p. 4 (emphasis added). Likewise, in his deposition, Mr. Blandford testified as follows:

> Q: And so the question assumes that it's .056 feet per day, but I didn't see in the testimony where you were saying that it was .056 feet per day, so I wanted to make sure that I was clarifying, or we got that clarified.
>
> A: Yeah.

Q: So I understand you to say that you think that .056 feet per day is a reasonable hydraulic conductivity for the Mine Permit Area -- for the, I should say -- well, which particular clay unit are we talking about here?

A: Well, what I would say is I believe there's ***portions*** of these clay units that ***could*** have a conductivity of that value. I'm not saying they all do, I'm not saying it would have that value everywhere.

Q: Okay. 7

A: ***It could also be lower.*** But this is just saying if there was that vertical hydraulic conductivity value, which is not outside a reasonable range, this is how fast fluid could flow across confining units of those thicknesses.

Q: And you think it's -- and in particular, do you think it's a reasonable value to . . . assign to the confining unit between Sand B and Sand A?

A: ***At certain locations it could be.***

Exhibit UEC-Bennett 15, p. 128, line 24 – p. 129, line 24 (emphasis added).

Q: What about Mr. Blandford's argument that the clay confining layers at the Mine Permit Area are actually sandy clay, and thus have a higher hydraulic conductivity value?

A: If the sediments are well-sorted, sandy clay will have a higher *horizontal* hydraulic conductivity value than clay because the interlaying of thin sand lenses will provide preferential pathways for horizontal flow within the clay. The presence of thin sand lenses within a clay unit will not, however, have a significant effect on its *vertical* hydraulic conductivity. Moreover, if the sediments are poorly sorted, the hydraulic conductivity of sandy clay could actually be lower than that of clay as the clays clog pore throats between the sand grains.

Q: In your direct testimony, you discussed a pump test conducted by the USGS (the "USGS Pump Test") and a related finding included in a USGS report (the "USGS Report"). In his direct testimony, Mr. Blandford states that the USGS Report contains an error. Do you agree?

A: I do agree that the USGS Report contains an error. However, Mr. Blandford greatly exaggerates its effect. Even after adjusting the USGS' calculations to correct the error, the

USGS Pump Test ***still*** establishes "estimated velocities that would require centuries for measurable transit through the clay confining units" in the Mine Permit Area, as stated in my direct testimony. Bennett Testimony, p. 36, lines 4-6.

Q: Can you explain the relevant findings of the USGS Report and the error that USGS made?

A: Yes. The USGS determined that there was a hydraulic head difference of approximately thirty feet across a 120-foot thick clay confining unit between two aquifers, which indicated the potential for the downward flow of groundwater from the overlying aquifer to the underlying aquifer. Thus, one of the purposes of the USGS Pump Test was to determine how long it would take for groundwater to travel from the overlying aquifer to the underlying aquifer through the clay confining unit. Based on data obtained from the Pump Test, the USGS first accurately calculated the "specific discharge" of the confining unit, which was .00045 feet per day, or .0054 inches per day. The specific discharge of a confining unit is essentially the rate at which groundwater is expected to flow from the confining unit to a production well via a pipe. USGS then erroneously used that specific discharge value that it had calculated to estimate how long it would take groundwater to actually travel from the overlying aquifer to the underlying aquifer through the clay confining layer – *i.e.*, to travel 120 feet at a rate of .0054 inches per day would take 730 years. Specific discharge, however, is not a true measure of groundwater flow velocity because groundwater does not flow through pipes, but rather through a tortuous porous media filled with solids and pores. This means the actual area is smaller, so the velocity must be greater. To account for that fact, USGS should have first divided the specific discharge value by the effective porosity value of clay.

Q: What is the effective porosity of clay?

A: Porosity is the measure of void space in a porous medium, expressed as a fraction of the total volume of material. The effective porosity is the fraction of the total porosity that

participates in the flow of groundwater through that medium. With some materials there is a difference between total and effective porosity. But with clays, most hydrogeologists would agree that there is no difference between porosity and effective porosity. The porosity (and the effective porosity) of clay is typically about 50 percent.

Q: When you adjust the USGS' calculation to account for the effective porosity of clay, what is the result?

A: As I said, the "specific discharge" of the confining unit was accurately calculated as .00045 feet per day. To obtain the true groundwater velocity through the clay confining unit, you simply divide that number by 0.5, which is the fraction of porosity (effective and total) of clay. The result is a groundwater velocity rate of .0009 feet per day. Thus, it would take 365 years for groundwater to travel through the 120-foot confining layer that was the subject of the USGS Pump Test, given the natural gradient present there. In other words, when you adjust the calculation, the travel time through the confining unit is reduced by a factor of two.

Q: When so adjusted, does the USGS Pump Test and Report still support the conclusion stated in your direct testimony – *i.e.*, that it would require centuries for measurable transit through the clays in the Goliad aquifer?

A: Yes. Even when so adjusted, the USGS Pump Test and Report still supports that conclusion. While the thickness of the confining unit in the mine permit area is less, about a third of that tested by the USGS (40 feet v. 120 feet), the difference in head between the two layers is much less, about a foot on average between the B and A sand. This means that the gradient between the B and A sand is 10 times less than that encountered by the USGS (0.025 v. 0.25 ft/ft). Inserting these numbers into the same equation used by the USGS and Mr. Blandford, and assuming the same hydraulic conductivity, and using the correct effective porosity, we would get a velocity about a third slower than the USGS should have calculated for their study

(one third the thickness, but one tenth the velocity). The travel time is centuries, actually more than 1000 years.

Q: On page 24, lines 22-23 of his direct testimony, Mr. Blandford testifies that if USGS had done the calculation correctly, "the estimated travel times that they discuss would be reduced by a factor of about 10 or 20, or possibly even more." What accounts for this large difference between your adjustment to the USGS's calculation and Mr. Blandford's adjustment?

A: First, let me point out that there is no disagreement among the hydrogeologists in this case regarding the *porosity* of clay. Mr. Blandford (testifying for the GCGCD), Dr. Bruce Darling (testifying for the County) and myself all concur that 50% is a good porosity value for clay. **Exhibit UEC-Bennett 15, p. 116, line 23 - p. 117, line 4; Exhibit UEC-Bennett 19, p. 70, line 20 – p. 71, line 23.** Dr. Darling and I also agree that there is no difference between porosity and effective porosity in clay. In fact, in his deposition in this case, Dr. Darling emphasized this point as follows:

> Q: And so you would expect for a clay that its porosity and its effective porosity would be different or does it just depend?
>
> A: For a clay?
>
> Q: Yeah.
>
> A: ***I think the distinction is crazy.*** Clays – I don't expect clays to yield much of anything, and so the porosity of a clay -- and I'm not so much concerned about the porosity of the clay as I am about the permeability of the clay.
>
> Q: But were you saying that you thought that there is -- for a clay there shouldn't be a distinction between porosity and effective porosity?
>
> A: No, I'm not sure you can really tell the difference.
>
> Q: Okay.
>
> A: I mean, it's much easier to determine that in a sandstone or a gravel, but in clay -- clay is a different animal.

Exhibit UEC-Bennett 19, p. 72, line 22 – p. 73, line 15 (emphasis added). Nevertheless, despite the fact that, according to Dr. Darling, it is "crazy" to make a distinction between porosity and effective porosity in clay, Mr. Blandford does just that. And, not only does he make a distinction between them, he testifies that the effective porosity of clay is only 1% to 10% -- five to fifty times less than its total porosity. This range of values for effective porosity of clay is absurdly low. Moreover, it is only by using these absurdly low values that Mr. Blandford is able to opine that the travel times in the USGS report should be reduced by a factor of 10 to 20 or more.

Q: Mr. Blandford points out that there were two sites that were the subject of the USGS Report -- one twenty miles from the Mine Permit Area and one forty miles from the Mine Permit Area -- and that a pump test was conducted at the site that was forty miles away. In your opinion, are both of these sites equally analogous to the Mine Permit Area?

A: Yes. I used the results of this study to provide directly measured data from the same aquifer that was independent of the UEC data already provided and examined. It was never intended, nor did I ever state, that this was a mine site specific study, only that it is a test of the same aquifer. The USGS conducted its pump test at the further site, and used the results at the nearer site. I am doing the same.

Q: Mr. Blandford also testifies that the caption on your Exhibit UEC-Bennett 9 is inaccurate. Do you have a response?

A: With all due respect, this is a silly comment. This is a widely used diagram to schematically show the relative travel times of local and regional flowpaths in unconfined and confined aquifers. It was provided to give the reader an overview of the types of systems we are talking about and to place the rather dry calculations in a visual context.

Q: Even if mining fluids were able to migrate directly through the confining layers, would it necessarily result in the contamination of a USDW?

A: No. As I discussed previously, even if there were some potential pathway between two sands, contaminants within the mining fluid would have to migrate along that pathway all the way through the confining clay unit between the sands and would then have to migrate downgradient and arrive at a USDW in a sufficient enough concentration to contaminate the USDW. As I also discussed above, the contaminants would be subject to various geochemical reactions and processes that are known to delay or prevent their migration.

Q: In opining regarding the potential for vertical migration directly through the clay confining units, did Mr. Blandford take into account the effect of such geochemical reactions and processes?

A: No. Mr. Blandford opined that "[u]sing a vertical hydraulic conductivity of 0.056 ft/d and other reasonable hydraulic properties and expected field conditions at the proposed mine site, ***water and associated contaminates*** could move across a 20 foot clay layer within several months, and across a 40 foot clay layer within a year." Blandford Testimony, page 26, lines 6-8 (emphasis added). However, he added that "[t]his calculation is for conservative contaminants that migrate at the same velocity as the groundwater." Blandford Testimony, page 26, lines 8-9. In his deposition, Mr. Blandford explained that his calculation would therefore not apply to "radioactive elements" because they "would probably likely have an affinity for the clay material." **Exhibit UEC-Bennett 15, p. 133, line 12 – p. 134, line 7.** Moreover, he further testified that as follows:

> Q. Do you have any feel for what that retardation effect, like the magnitude of that effect would be as compared to -- I know we're saying conservative contaminates, we're talking about several weeks to several decades. Do you -- can you give me a similar range for, you know, after you factor in the -- what you're calling the retardation effect for some of the, you know, radioactive constituents?

A. I don't have an exact range. ***I think it could be pretty significant, though. I don't think it's a small effect, I think it could be a significant effect in terms of slowing down migration of those constituents.***

Exhibit UEC-Bennett 15, p. 137, lines 5-17 (emphasis added).

Q: Have any of the other experts for the Protestants considered the effects of any such geochemical reactions or processes in this context?

A: Yes. Dr. Darling testified in his deposition as follows:

A: It's my opinion -- my opinion that it's not probable that you are going to see leaching or movement of radionuclides through 40 feet of clay. Radium is a divalent cation and it will absorb to mineral surfaces, negatively charged mineral surfaces. So in that case radium isn't highly mobile in the presence of absorption sites or the sites -- mineral sites to which it can absorb.

Q: It isn't or it isn't?

A: It isn't. It isn't. Vertical migration through a 40-foot clay, I'm going to have a problem with that.

Exhibit UEC-Bennett 19, p. 77, line 20 – p. 78, line 6. Even when questioned by his own counsel, Dr. Darling explained, "I'm uneasy about the concept of radium migrating through 40 feet of clay knowing what I know about the chemistry of radium." *Id.* **Exhibit UEC-Bennett 19, pp. 93-94.**

Q: Did Mr. Blandford address redox, decay, or dispersion in his testimony?

A: No, Mr. Blandford completely failed to address these processes in his testimony.

Q: Do you have an opinion regarding whether or not mining fluids will migrate directly through a confining layer in the Mine Permit Area and contaminate an USDW?

A: Yes. In my opinion, for reasons stated previously, it is highly unlikely that mining fluids will migrate through a confining unit and contaminate an USDW.

Q: Let's discuss Mr. Blandford's testimony regarding whether mining fluids will migrate <u>horizontally</u> and contaminate an USDW. In your direct testimony, you conclude

that hydraulic control of mining fluids can be maintained and the horizontal migration of those fluids prevented through use of bleed to create a cone of depression.

A: Yes. As I explained in my direct testimony, the theory and practice of well hydraulics for the purpose of control and prevention of horizontal migration is well established, and the shape and extent of a cone of depression, the effects of an injection well, and the associated flow of water toward the well can be accurately predicted.

Q: Also on page 30 of his testimony, Mr. Blandford explains that "[h]ydraulic capture is highly dependent upon well spacing, relative well injection and pumping rates, the ambient hydraulic gradient within the aquifer and local hydrogeologic conditions." Do you agree?

A: Yes, all of these factors have an effect. Nevertheless, as I explained in my direct testimony, establishing a cone of depression of specific extent and intensity is a basic exercise for any competent hydrogeologist even for complex subsurface architectures. In the sands at issue even a modest withdrawal of water will overcome the initial baseline conditions, resulting in high velocity inward toward the pumping well. Bennett Direct Testimony, pp. 40-41.

Q: On pages 33-39 of his testimony, Mr. Blandford discusses certain groundwater flow modeling that he conducted. Is it your understanding that such modeling was conducted for the purpose of evaluating whether or not hydraulic control of mining fluids can be maintained at PA-1?

A: No. Mr. Blandford does not appear to dispute the fact that hydraulic control of mining fluids can be maintained at PA-1. In fact, on page 30 of his testimony, Mr. Blandford testifies that it is feasible to maintain hydraulic containment of injected fluids using a one percent bleed. According to Mr. Blandford, the purpose of this modeling was "to illustrate likely travel times and potential pathways of fluids in the B Sand aquifer." Blandford Testimony, p. 35, lines 19-

21. To do so, Mr. Blandford simply simulated a release of fluids at the production area boundary. *Id.* p. 36, lines 16-23; Exhibit GCGCD-Blandford J-U.

Q: According to Mr. Blandford, what was his finding from the model runs?

A: According to Mr. Blandford, he determined that "[t]here is extremely little chance, if any" that any fluids will horizontally migrate four hundred feet from the production area during mining operations." Blandford Testimony, p. 39, lines 19-22.

Q: On page 40 of his prefiled testimony, Mr. Blandford testifies that "the major implication" of the finding from his model run is that "a large portion of the Production Zone aquifer between the Production Area and the monitor wells can be contaminated during the mining process, and there is no effective way to monitor whether this portion of the aquifer is restored to baseline conditions. . . ." On page 45 of his prefiled testimony, Mr. Blandford testifies that "if mining operation proceeds as proposed, there is likely to be a significant volume of impacted groundwater that is not reclaimed to baseline conditions between the Production Area and the Production Zone monitor wells." Does Mr. Blandford's modeling or analysis support his conclusion that the proposed mining operations will likely result in contamination of a significant volume the groundwater beyond the production area?

A: No. As Mr. Blandford stated in his testimony, for each of the model simulations, his purpose was to intentionally simulate an imbalance in the injection and extraction wells (by, for example, operating an injection well at the edge of the production area without operating any recovery wells) for the express purpose of tracking the migration of injected fluids as it moved outside the area of hydraulic control. Blandford Testimony, p. 35, lines 19-21; p. 36, lines 16-23. This is a specific case of a hypothetical condition for a specific purpose. This modeling was not designed to determine whether hydraulic control of mining fluids can be maintained, and the results of the model are meaningless for this purpose. There is nothing in Mr. Blandford's

testimony that supports his eventual conclusion that the proposed mining operations will likely result in contamination of the groundwater beyond the production area. In fact, Mr. Blandford himself has opined as to the feasibility of maintaining hydraulic control of mining fluids during mining. There is no real question that an effective containment zone can be created and maintained in the Goliad sands.

Q: On page 45 of his prefiled testimony, Mr. Blandford not only testifies that "if mining operation proceeds as proposed, there is likely to be a significant volume of impacted groundwater," he also testifies that such impacted groundwater will not be "reclaimed to baseline conditions." Does Mr. Blandford's modeling or analysis support this conclusion?

A: No. Mr. Blandford's assertion that restoration will not be effective to reclaim impacted water is likewise completely baseless. As Mr. Blandford admitted in his deposition, his model simulations ended at the termination of mining. He did not simulate the restoration process that follows mining. **Exhibit UEC-Bennett 15, p. 149, line 25 – p. 150, line 7.**

Q: Do you have an opinion as to whether mining fluids will migrate horizontally into areas outside of the mine area during mining in PA-1?

A: As explained in my direct testimony, I do not find any suggestion anywhere that would leave me to believe that there will be horizontal movement of mining fluids into areas outside the mine area.

[p. 33, line 3 – line 18]

XVIII.

ISSUE R

B.

REBUTTAL TO THE PREFILED TESTIMONY OF DR. RICHARD ABITZ

REBUTTAL TESTIMONY OF DR. PHILIP BENNETT

Q: On page 44 of Dr. Abitz's prefiled testimony, he contends that vertical migration of mining fluids through improperly plugged exploration boreholes is likely and will contaminate a USDW. Is there any valid basis for this opinion?

A: No. In his deposition, Dr. Abitz conceded that he does not have evidence to support the existence of any improperly plugged boreholes through which mining fluids could migrate, but that he "know[s] that probably historical ones" were not properly plugged. **Exhibit UEC-Erskine 6, p. 96, line 4 – p. 97, line 1.** I have addressed this issue in detail above, and my analysis and conclusions apply equally here.

Q: On page 44 of Dr. Abitz's prefiled testimony, he opines that mining fluids will migrate horizontally and contaminate a USDW. Has Dr. Abitz presented any valid basis for this opinion?

A: No. Dr. Abitz's opinion is based on speculation and conjecture. He contends that because excursions have occurred at other in-situ operations in the past, one will occur here. He speculates that a preferential flow path could exist, and that its size and location could be such that it passes between two monitoring rings. No actual evidence or data is presented however.

SUMMARY OF EVIDENCE REGARDING ISSUE R

R. Whether mining fluids will migrate vertically or horizontally and contaminate an USDW (underground source of drinking water).

1. Regulatory and Scientific Framework

There are scientific concepts that are highly relevant in assessing Issue R, and which are explained by Dr. Bennett in his direct testimony. First and foremost among these concepts is the

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[607] *Id.*
[608] Blandford Testimony, p. 44, ll. 1-2; Murry Testimony, p. 7, ll. 5-6; Bennett Direct Testimony, p. 28, ll. 9-10.
[609] Blandford Testimony, p. 44, ll. 10-11; Murry Testimony, p. 7, ll. 6-7; Bennett Direct Testimony, p. 28, ll. 10-14.
[610] Clark Testimony, p. 22, ll. 27-28 and p. 23, ll. 3-4.
[611] *Id.* at p. 22, l. 26—p. 23, l. 3.
[612] *Id.* at p. 23, ll. 3-4.

fact that fluid or water movement is, by in large, ***not*** the same as the movement of constituents within the fluid or water. As Dr. Bennett testified,

> most dissolved constituents interact with the minerals and mineral coatings in the aquifer, and participate in adsorption reactions, or ion exchange, and so move more slowly than the average water velocity. This concept is termed "retardation" by hydrogeologists, and intuitively states that dissolved constituents are variably retarded relative to water movement.[613]

This concept applies regardless of the type of material through which the fluid or water is moving, and is particularly relevant in this case with respect to uranium and radium.[614] In other words, because constituents are "subjects to a number of geochemical processes and reactions that are known to retard their movement. . . . these geochemical processes and reactions must be considered."[615]

2. <u>UEC's Direct Testimony</u>

With respect to vertical migration, UEC provided relevant testimony regarding the physical barriers, *i.e.*, the continuous nature of the confining layers within the proposed Mine Permit Area.[616] As discussed under Issue Q, UEC also provided testimony regarding confinement within the Mine Permit Area.[617] Moreover, there is no evidence that Sand A is hydraulically connected with Sands B, C or D,[618] and mining fluids are not likely to migrate vertically during mining operations.[619] As additional protection, and as required by the

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[613] Bennett Direct Testimony, p. 19, ll. 13-16; *see also* Galloway Direct Testimony, p. 13, l. 17—p. 14, l. 9 (explaining that dispersion through the aquifer matrix may also slow the migration rate of dissolved constituents).
[614] *See e.g.*, PAA-1 Rebuttal Testimony, Bennett, p. 9, ll. 8-18 (noting that "[u]ranium is an example of a reactive solute—it is naturally present in the aquifer, it undergoes reaction, and it can be retarded."); Issue R Rebuttal Testimony, Bennett, p. 6, l. 17—p. 7, l. 5 (noting that beyond being a barrier to fluid flow, clay constitutes "a *chemical* barrier to migration of Ra-226"); Issue C Rebuttal Testimony, Erskine, p. 16, l. 1—p. 17, l. 20 (calculating the retardation factor associated with radium moving through sand).
[615] Issue R Rebuttal Testimony, Bennett, p. 2, ll. 7-10.
[616] Galloway Direct Testimony, p. 27, l. 23—p. 28, l. 6.
[617] *Supra* at Part II.Q.
[618] Bennett Direct Testimony, p. 31, l. 5—p. 32, l. 4.
[619] Bennett Direct Testimony, p. 35, l. 16—p. 37, l. 19.

regulations, monitor wells will be placed in aquifers overlying production zones.[620] Finally, mechanical integrity testing will be performed on all production and injection wells to prevent vertical migration.[621]

There are also operational controls designed to prevent horizontal migration during mining such as the use of a cone of depression,[622] monitoring well ring,[623] and corrective action if and an excursion is detected.[624] Due to these operational controls, there is no evidence to suggest that mining fluids will migrate horizontally outside of mine areas during operations.[625] After mining is completed, as discussed under Issue L, UEC will restore each production area.[626]

3. County/District Arguments

a. Vertical Migration Arguments

i. *Conductivity of Confining Units*

Although there is little argument among the Parties regarding the hydraulic confinement of Sands B, C, and D,[627] Protestants argued that mining fluids can and will move through the clay confining layers between the sands. Specifically, they argued that the vertical hydraulic conductivity of the confining units is relatively high due to (1) the heterogeneity of the confining layers themselves and (2) "anomolies" and artificial conduits in and through the layers. The overwhelming preponderance of the evidence shows that both these claims are false.

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[620] Underdown Direct Testimony, p. 8, l. 16—p. 9, l. 6.
[621] Holmes Direct Testimony, p. 9, ll. 9-21.
[622] Underdown Direct Testimony, p. 6, l. 8—p. 7, l. 7; Bennett Direct Testimony, p. 38, l. 1—p. 41, l. 3.
[623] Underdown Direct Testimony, p. 9, ll. 22—p. 10, l. 23 (providing the example of the PA-1 monitor well ring); Exhibit UEC-Holmes 13, pp. 9-15 through 9-17; *see also* at pp. 11-1, 13-1.
[624] Underdown Direct Testimony, p. 7, l. 8—p. 9, l. 21; Bennett Direct Testimony, p. 43, l. 19—p. 44, l. 8; *see also*, Kelley Direct Testimony, p. 26, l. 20—p. 27, l. 3 (discussing how the B-Sand model can be used to help prevent and manage excursions).
[625] Bennett Direct Testimony, p. 42, l. 22—p. 43, l. 18.
[626] Underdown Direct Testimony, p. 22, l. 21—p. 23, l. 6; Holmes Direct Testimony, p. 53, l. 21—p. 54, l. 21 and 70, ll. 5-17.
[627] *Supra* at II.Q.3.

On behalf of the District, Mr. Blandford provided testimony that "[u]sing a vertical hydraulic conductivity of 0.056 ft/d and other reasonable hydraulic properties. . . water and associated contaminates [*sic*] could move across a 20 foot clay layer within several months, and across a 40 foot clay layer within a year."[628] In responding to Mr. Blandford's testimony about vertical hydraulic conductivity, Dr. Bennett testified that, contrary to Mr. Blandford's claims, 0.056 feet per day was "an absurdly high value to assign"[629] to the clay layers. Regardless of the fact that Mr. Blandford was mistaken about the value used in another model that he apparently relied upon,[630] there was "no reasonable basis" for the choice[631] given the body of information regarding hydraulic properties of clay.[632]

At hearing, opposing counsel took a slightly different tack with Dr. Galloway, questioning him about structural issues such as percent sand in the confining layers and the possible existence of sand channels within these layers. Dr. Galloway clarified that although the confining layers are "heterogeneous with a wide range of sediments from clays to silts, to muddy sands, to silty muds, to muds," by percentage, very little of the confining layers are sand.[633] This means that from a qualitative standpoint, the vertical hydraulic conductivity of these layers is "[v]ery, very low."[634] Similarly, with respect to the sand "channels" that Dr. Galloway observed in his review of the geologic cross-sections, "[t]hey constitute a small part of the total volume of the confining layers and there is typically several tens of feet of confining layer either above or

[628] Blandford Testimony, p. 26, ll. 5-8.
[629] Issue R Rebuttal Testimony, Bennett, p. 12, ll. 15-18
[630] Issue R Rebuttal Testimony, Kelley, p. 28, ll. 9-22 (explaining that the vertical hydraulic conductivity used in the model referenced by Mr. Blandford was actually 560 times less than the value Mr. Blandford cited); Issue R Rebuttal Testimony, Bennett, p. 13, ll. 1-17.
[631] Issue R Rebuttal Testimony, Bennett, p. 13, ll. 22-23.
[632] *Id.* at p. 13, l. 23—p. 15, l. 23; Issue R Rebuttal Testimony, Kelley, p. 28, l. 23—p. 29, l. 23.
[633] Galloway Cross-Examination, Transcript, p. 86, l. 6—p. 87, l. 10.
[634] Galloway Cross-Examination, Transcript, p. 87, ll. 11-24.

below or both where the two or three examples of such sands . . . are seen."[635] Moreover, a sandy clay could actually have a ***lower*** vertical hydraulic conductivity than a clay if the sediments are poorly sorted.[636]

Opposing counsel then cross-examined Dr. Bennett about a complaint that Mr. Blandford raised again in his 10-minute testimony summary, *i.e.*, the Mine Application contains qualitative information regarding the clay layers, but does not contain a specific number for the vertical hydraulic conductivity of the confining layers.[637] As Dr. Bennett explained, however, it is not necessary to "reinvent-the-wheel" since "the properties of clays and shales have been evaluated . . . for decades."[638] This is especially true since, by his own admission, even Mr. Blandford's hyperbolic conductivity calculations were applicable only to "conservative contaminants that migrate at the same velocity as the groundwater."[639]

ii. *Northwest Fault*

The Protestants also raised the prospect of vertical migration of mining fluids along the Northwest Fault, an argument with which both Dr. Bennett and Dr. Galloway disagreed.[640] At hearing, counsel for the County added another facet to its argument in the form of Goliad Cross Exhibit 18, an excerpt of some data from a pump test. As with Mr. Kelley and the Figure 3.6 net sand map, the production of this document added momentary confusion to the proceeding—at least for UEC's counsel. After noting numerous times that the graph indicated a malfunctioning

[635] Galloway Re-Direct, Transcript, p. 106, l. 17—p. 107, l. 1.
[636] Issue R Rebuttal Testimony, Bennett, p. 15, ll. 30-33.
[637] Blandford Summary, Transcript, p. 1155, ll. 16-25.
[638] Bennett Cross-Examination, Transcript, p. 937, l. 20—p. 938, l. 21.
[639] Blandford Testimony, p. 26, ll. 8-9.
[640] Bennett Direct Testimony, p. 37, ll. 7-19; Issue G Rebuttal Testimony, Bennett, p. 9, l. 18—p. 11, l. 3; Galloway Direct Testimony, p. 34, l. 18—p. 35, l. 4; Issue G Rebuttal Testimony, Galloway, p. 17, l. 13—p. 18, l. 14.

transducer,[641] Dr. Bennett, who has seen the results of 100s of pump tests,[642] was clearly not confused. The graph had no effect whatsoever on his opinion that all evidence suggests that the Northwest Fault is sealed.[643] His reaffirmation of his opinion is not surprising since this exhibit does ***not*** support the conclusion that the Northwest Fault is transmissive. Instead, it shows, as Dr. Bennett noted, a response to the pumping well—PT-CD (downdip well in Sand C)—in the well designated RBLC-2.[644] Both of these wells are shown on Exhibit UEC-Holmes 14, and ***both are located in the same sand on the same side of the Northwest Fault.***

iii. *Artificial Conduits through Confining Units*

Mr. Blandford also raised the issue of potential "anomolies," which to him indicated a lack of continuity in the clay confining units.[645] The example he provided, however, actually showed the confining unit to be more than 40 feet thick at the location he indicated.[646] Next, Mr. Blandford suggested that older pre-UEC boreholes are likely conduits, assuming that these boreholes were plugged "in accordance with the Texas Railroad Commission regulations in place at that time. . . ."[647] This assumption turned out to be a good one given the fact that the inspector at that time was known for being thorough.[648] Ultimately, however, the primary reason that Mr. Blandford's expressed concern regarding the potential conductivity of these boreholes is warrantless was one he himself alluded to during his deposition. Namely, in discussing the casing of wells, both Mr. Blandford and Mr. Underdown remarked on the need to case boreholes

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[641] Bennett Cross-Examination, Transcript, p. 910, ll. 5-6; p. 911, ll. 6-8; p. 912, ll. 21-22; p. 913, ll. 6-7; p. 914, ll. 1-2; p. 944, ll. 24-25; p. 946, ll. 5-6.
[642] *Id.* at p. 945, ll. 5-7.
[643] *Id.* at p. 989, ll. 13-20.
[644] *Id.* at p. 909, l. 1—p. 912, l. 24.
[645] *Id.* at p. 22, l. 19—p. 23, l. 3.
[646] Issue R Rebuttal Testimony, Galloway, p. 31, ll. 7-17.
[647] Blandford Testimony, p. 13, l. 20—p. 14, l. 2.
[648] Holmes Cross-Examination, p. 331, l. 5—p. 332, l. 3; *see also* Issue R Rebuttal Testimony, Erskine, p. 31, l. 19—p. 32, l. 24.

or risk losing them due to sloughing or collapsing of the borehole walls.[649] As Dr. Bennett elaborated at hearing, a borehole full of drilling mud "has a whole world behind it,"[650] so that the pressure outside the borehole is much greater than inside the hole; in fact, even if a borehole was not plugged to the applicable standards at the time, it would still collapse.[651]

b. Horizontal Migration Arguments

i. *Cone of Depression*

As with vertical migration, the Protestants raised a number of arguments as to why horizontal migration of mining fluids is likely. The majority of these arguments, however, are specific to the PA-1 production area and are therefore covered in Part III of this brief. But the Protestants did reiterate two more general arguments at hearing. First, the Protestants raised the argument about the potential insufficiency of a 1% bleed again with Mr. Murry, even though UEC's experts previously squelched this argument in prefiled testimony.[652] So, Mr. Murry clarified (again) that in Texas, 1% bleed is the norm, not the exception.[653]

Second, in cross-examining both Mr. Underdown and Mr. Kelley, counsel for the District questioned how a production area that is subject to a cone of depression can be kept "in balance" and mining fluids contained. Mr. Underdown described his personal experience, which Mr. Kelley later reiterated, explaining:

> The purpose of balancing a well field is so that you have all the water all the way around the PAA coming into, and we do that with . . . monitoring the water levels. If we are injecting and we see the water level rising on one side of the PAA and

[649] Exhibit UEC-Bennett 15, p. 85, l. 9—p. 86, l. 5; Underdown Cross-Examination, p. 219, ll. 7-9.
[650] Bennett Cross-Examination, Transcript, p. 954, ll. 22-23.
[651] Bennett Cross-Examination, Transcript, p. 947, l. 15—p. 956, l. 3; *see also*, Issue R Rebuttal Testimony, Bennett, p. 2, l. 19—p. 7, l. 17.
[652] Issue R Rebuttal Testimony, Kelley, p. 30, ll. 1—p. 31, l. 3; Issue R Rebuttal Testimony, Bennett, p. 22, l. 5—p. 24, l. 13.
[653] Murry Cross-Examination, Transcript, p. 1399, l. 1—p. 1400, l. 6; Executive Director Exhibit 17, p. 66, Response 93.

> dipping on the other, we know we are out of balance; we throw it back in balance.[654]

In other words, the water levels are monitored regularly and pumping is adjusted where and when needed.

ii. *Northwest Fault*

Protestants' second argument as to why lateral migration of mining fluids is likely to occur again centers around the Northwest Fault. Counsel for the County appeared to be arguing that lateral migration should be presumed based upon the juxtaposition of sands on certain cross-sections.[655] There is, however, strong evidence in the record that overcomes the assumption that partially juxtaposed sand strata means that the Northwest Fault is laterally transmissive. Dr. Bennett testified that the water levels in wells above and below the Northwest Fault show a substantial decrease in static water level elevations along a Northwest to Southeast line across the Northwest Fault. All the sands show a dramatic drop in water level across the fault, with an extremely high gradient (change in water table elevation divided by distance). [656] "Since there are no underground "water falls" in granular porous media, this very steep gradient located over the fault indicates a marked *decrease* in hydraulic conductivity (K)."[657] He supported his conclusion in a graph showing the water levels and the "waterfall" effect,[658] and with examples of citations to supporting peer-reviewed scientific literature, including an article authored by Dr. Galloway.[659] Significantly, this is data that is ***independent*** of the Northwest Fault pump test, but which further supports Dr. Bennett's interpretation the results of that test.[660]

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[654] Underdown Cross-Examination, Transcript, p. 206, ll. 14-20.
[655] Murry Cross-Examination, Transcript, p. 1329, l. 23—p. 1333, l. 15.
[656] Issue G Rebuttal Testimony, Bennett, p. 9, l. 23—p. 10, l. 8.
[657] *Id.* at p. 10, ll. 7-8.
[658] Exhibit UEC-Bennett 14 (demonstrating the substantial decrease in static water level elevations).
[659] Issue G Rebuttal Testimony, Bennett, p. 10, l. 18—p. 11, l. 3.
[660] *See* Bennett Direct Testimony, p. 37, ll. 7-19.

iii. *Migration of Constituents*

While they rarely discussed it directly, the Protestants clearly mean to imply that movement of mining fluids equates to movement of constituents such as uranium and radium.[661] As discussed above, this is in fact not the case. "The transport of dissolved components in groundwater must include the geochemical and hydrological interactions that act on the water and solutes."[662] Generally, as Dr. Bennett explained, all dissolved constituents are subject to hydrodynamic dispersion.[663]

> As a contaminant moves downgradient by advection, it tends to spread out, occupying an increasingly larger volume of aquifer. . . .This occurs because of mixing as water flows around the tortuous paths of a porous medium, and because of diffusion of the solute from regions of high concentration to low concentration. This is a basic concept covered in every hydrogeology textbook. The inevitable result is that the concentration of a dissolved contaminant must decrease downgradient.[664]

In addition, specifically, with respect to uranium and radium, at least two strong geochemical forces are working against their migration: reduction and retardation. Radium is strongly affected by sorption or retardation. As Mr. Blandford, Dr. Darling, Dr. Abitz, Dr. Erskine and Dr. Bennett all testified, radium adheres to the surface of iron oxides and clays, which impedes it from migrating with groundwater.[665] Radium is also affected by decay.

> While the half-life is Ra-226 is relatively long, 1590 years, the transport times for the mine area are also long, with baseline groundwater flow velocities of only 6-10 feet per year. Over the time period required to migrate 400 feet, while also accounting for the retardation that occurs, there will also be a measurable loss of Ra-226 by decay.[666]

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[661] *See e.g.*, Blandford Testimony, p. 22, ll. 13-14 (discussing potential vertical migration of "leach fluids.").
[662] Issue R Rebuttal Testimony, Bennett, p. 9, ll. 9-10.
[663] *Id.* at p. ll. 8-12.
[664] Issue R Rebuttal Testimony, Bennett, p. 9, ll. 10-16.
[665] Exhibit UEC-Bennett 15, p. 133, line 12 – p. 135, line 3; Exhibit UEC-Bennett 19, p. 74, line 7 – p. 78, line 6; Exhibit UEC-Bennett 20, p. 54, line 8 – p. 55, line 1; Issue R Rebuttal Testimony, Bennett, p. 8, ll. 10-15; Issue R Rebuttal Testimony, Erskine, p. 32, ll. 13-15.
[666] Issue R Rebuttal Testimony, Bennett, p. 9, ll. 18-22.

With respect to uranium, as counsel for the County correctly summed up at hearing, "the bulk of the proposed mining area is located" in a geochemically reducing environment.[667] Similarly, Dr. Galloway emphasized the naturally-reducing properties of certain areas within the proposed Mine Permit Area when he testified about the significant amounts of pyrite still present in the area and illustrated his point with photographs of pyrite and core samples from the site.[668]

The effectiveness of these well-known geochemical reactions in the in situ uranium mining context is supported by the anecdotal evidence as well. During hearing, counsel for the County emphasized some of the uranium levels listed in Dr. Darling's report on groundwater restoration.[669] Although there is considerable doubt as to whether those levels of uranium were actually left in place at the amended restoration table levels,[670] for the sake of argument, assume that what Dr. Darling implied is correct, and juxtapose that assumption with the fact that, ***in 30 years of in situ uranium mining, there has been no off-site contamination of groundwater.***[671] A more contemporary example is offered by Dr. Sass and Dr. Abitz who continued to tout the natural reducing powers of the aquifer within the proposed Mine Permit Area during their testimony summaries at hearing.[672]

Overall, the impression opposing counsel desires to leave[673] is that these constituents are free to move with the groundwater and through sands and clays unhindered by dispersion,

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[667] Galloway Cross-Examination, Transcript, p. 31, ll. 15-18.
[668] Galloway Direct Testimony, p. 31, l. 20—p. 32, l. 15; Exhibit UEC-Galloway 6; Exhibit UEC-Galloway 7.
[669] Murry Cross-Examination, Transcript, p. 1270, l. 4—p. 1271, l. 2; Exhibit Goliad County-Darling 13.
[670] *See supra* at Part II.L., Issue L.
[671] Executive Director Exhibit 10, p. 16, Response 14, p. 34, Response 44, and p. 36, Response 48.
[672] Sass Testimony Summary, Transcript, p. 1144, ll. 3-9; Abitz Testimony Summary, Transcript, p. 1116, ll. 7-10.
[673] *See e.g.*, Murry Cross-Examination, Transcript, p. 1296, l. 21—p. 1297, l. 18.

sorption, reduction, decay, *etc.* As the testimony of both the Protestants' experts and UEC's experts shows, that implication is flat-out wrong.[674]

[674] *See also* Executive Director Exhibit 10 p. 75, Response 128 (noting that "[o]utward from the mined zone, naturally-occurring reducing conditions will prevail. As groundwater migrates from the mined zone, it will encounter these reducing conditions, and the concentrations of the constituents dissolved in the groundwater will be reduced to background concentrations.") and pp. 36-37, Response 51.
[675] 30 TAC § 331.2(107).
[676] 40 CFR §146.3.
[677] Bennett Direct Testimony, p. 32, ll. 17-20.
[678] Exhibit UEC-Holmes 13.
[679] *Id.* at Chapter 5; Appendix A.

ATTACHMENT T

ATTACHMENT 4A
BASELINE WATER QUALITY TABLE
GOLIAD PROJECT SAND B PRODUCTION ZONE

			PRODUCTION ZONE						WELL ID BY AREA*	
Parameter		Units	Mine Area**			Production Area			Production Zone	
			Low	Ave.	High	Low	Ave.	High	Mine	Prod.
1	Calcium	mg/l	82	97	110	81	96	110	BMW-1	PTW-1
2	Magnesium	mg/l	14.5	17.5	20	10.9	17.8	20.3	BMW-2	PTW-2
3	Sodium	mg/l	93	105	120	82	97	117	BMW-3	PTW-3
4	Potassium	mg/l	2.92	3.79	5.13	2.5	6.4	16.5	BMW-4	PTW-4
5	Carbonate	mg/l	0	0	0	0	0	3	BMW-5	PTW-5
6	Bicarbonate	mg/l	294	319	350	251	308	368	BMW-6	PTW-6
7	Sulfate	mg/l	15	58	89	1	43.2	82	BMW-7	PTW-7
8	Chloride	mg/l	158	165	172	150	164	180	BMW-8	PTW-8
9	Fluoride	mg/l	0.51	0.58	0.65	0.50	0.58	0.80	BMW-9	PTW-9
10	Nitrate-N	mg/l	<0.01	0.01	0.01	0.01	0.14	1.73	BMW-10	PTW-10
11	Silica	mg/l	12.3	15.7	18.1	0.1	29.8	37.5	BMW-11	PTW-11
12	pH	std. units	7.28	7.58	8.18	7.18	7.18 to 7.96	7.96	BMW-12	PTW-12
13	TDS	mg/l	575	652	705	390	587	698	BMW-13	PTW-13
14	Conductivity	µmhos	1040	1104	1140	950	1084	1190	BMW-14	PTW-14
15	Alkalinity	mg/l	241	262	287	206	254	302	BMW-15	RBLB-1
16	Ammonia-N	mg/l	<0.1	0.1	0.2	0.05	<0.1	0.3	BMW-16	RBLB-3
17	Arsenic	mg/l	<2E-3	8E-3	0.069	0.002	0.010	0.030	BMW-17	RBLB-4
18	Cadmium	mg/l	<1E-3	1E-3	<1E-3	<0.001	<0.007	<1E-2	BMW-18	RBLB-5
19	Iron	mg/l	<3E-2	0.043	0.196	<0.03	0.068	0.320	BMW-19	
20	Lead	mg/l	<2E-3	2E-3	2E-3	<0.002	0.026	0.05	BMW-20	
21	Manganese	mg/l	0.007	0.017	0.050	<0.010	0.027	0.050	BMW-21	
22	Mercury	mg/l	4E-4	<4E-4	<4E-4	<0.0001	<0.002	<0.001	BMW-22	
23	Molybdenum	mg/l	<0.01	0.035	0.481	<0.010	0.185	0.500		
24	Selenium	mg/l	<3E-3	3E-3	6E-3	<0.003	0.007	0.010		
25	Uranium	mg/l	<1E-3	0.020	0.188	<0.003	0.050	0.804		
26	Radium-226	pCi/l	0.9	12.1	41	10.0	391.0	2000.0		

* List the identification numbers of wells used to obtain the high and low values for each parameter

**Monitor Wells

ATTACHMENT 6
RESTORATION TABLE

Parameter	Unit	Concentration
Calcium	mg/l	96
Magnesium	mg/l	17.8
Sodium	mg/l	97
Potassium	mg/l	6.4
Carbonate	mg/l	0
Bicarbonate	mg/l	308
Sulfate	mg/l	43.2
Chloride	mg/l	164
Nitrate-N	mg/l	0.14
Fluoride	mg/l	0.58
Silica	mg/l	29.8
TDS	mg/l	587
Conductivity	µmhos/cm	1084
Alkalinity	mg/l as $CaCO_3$	254
pH	Std. Units	7.18 to 7.96
Arsenic	mg/l	0.010
Iron	mg/l	0.068
Manganese	mg/l	0.027
Molybdenum	mg/l	0.185
Selenium	mg/l	0.007
Uranium	mg/l	0.050
$Radium^{226}$	pCi/l	391.0