



# 2020 Annual Groundwater Monitoring and Corrective Action Report

*Oak Grove Steam Electric Station FGD Ponds - Robertson County, Texas*

Prepared for:

**Oak Grove Management Company LLC**

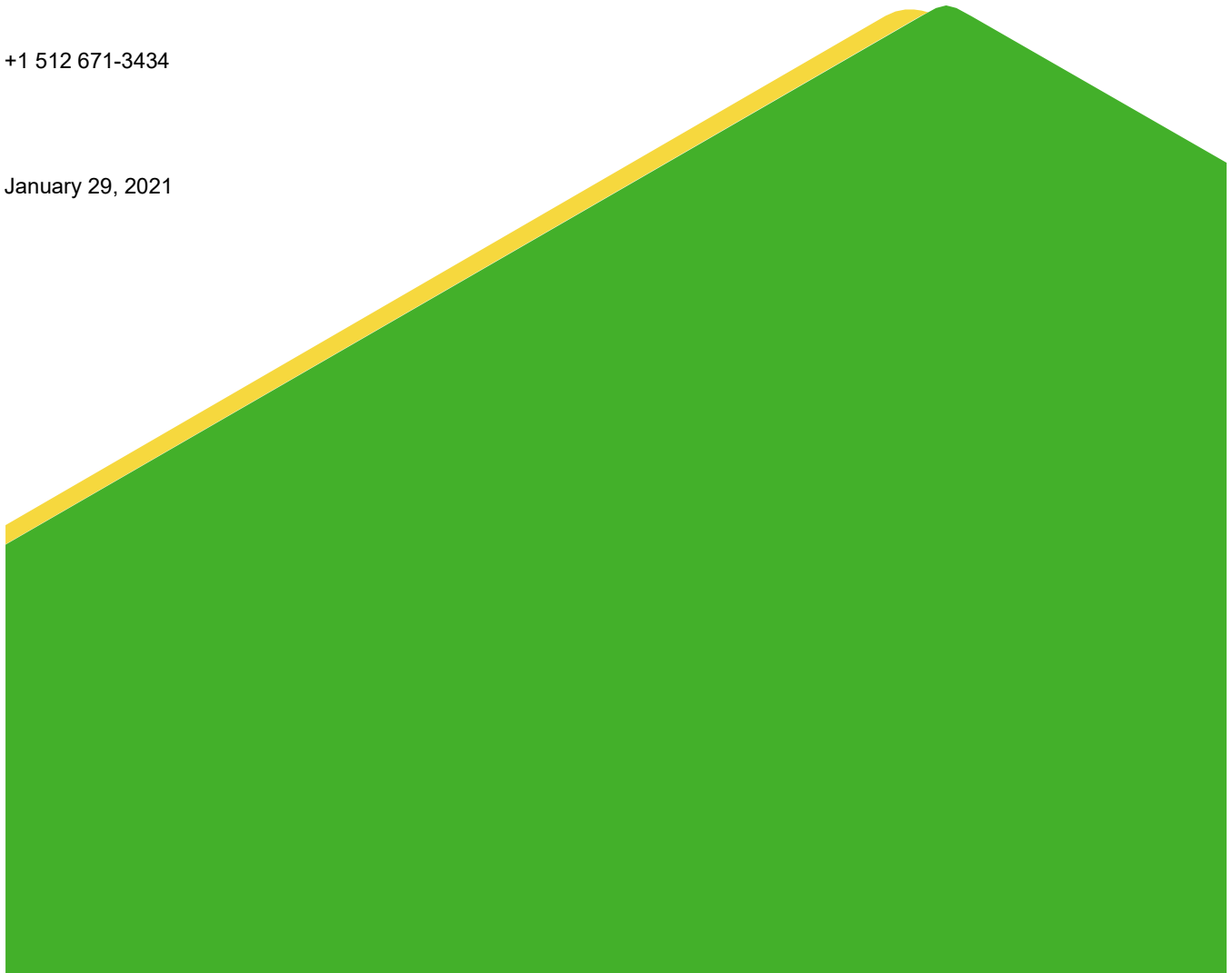
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## **ACRONYMS AND ABBREVIATIONS**

ACM	Assessment of Corrective Measures
ASD	Alternate Source Demonstration
CCR	Coal Combustion Residuals
CFR	Code of Federal Regulations
GWPS	Groundwater Protection Standard
MCL	Maximum Concentration Level
mg/L	Milligrams per Liter
NA	Not Applicable
OGSES	Oak Grove Steam Electric Station
SSI	Statistically Significant Increase
SSL	Statistically Significant Level
USEPA	United States Environmental Protection Agency

## EXECUTIVE SUMMARY

Golder Associates, Inc. (Golder) has prepared this report on behalf of Oak Grove Management Company LLC (Luminant) to satisfy the 2020 annual groundwater monitoring and corrective action reporting requirements of the Coal Combustion Residuals (CCR) Rule (40 CFR 257, Subpart D) for the FGD Ponds (the “CCR units”) at the Oak Grove Steam Electric Station (OGSES) in Robertson County, Texas. The CCR units and CCR monitoring well network are shown on Figure 1.

At the beginning and end of the 2020 reporting period, the CCR units were operating under an Assessment Monitoring Program as described in 40 CFR § 257.95. The Assessment Monitoring Program was established on July 16, 2018. Concentrations of Appendix IV constituents at statistically significant levels (SSLs) above groundwater protection standards (GWPSs) were identified in January 2019 for cobalt and lithium at the FGD Ponds.

An Alternate Source Demonstration (ASD) for lithium was completed in October 2020, which indicated that the lithium SSLs were caused by a source other than the CCR units. In addition, Assessment Monitoring Program data from 2019 and 2020 were incorporated into an updated statistical analysis of cobalt concentrations to evaluate if cobalt concentrations remained at SSLs relative to the GWPS as indicated in January 2019. The updated statistical analyses indicated that cobalt is no longer present at SSLs above the GWPS downgradient of the FGD Ponds.

An Assessment of Corrective Measures (ACM) was initiated on April 8, 2019 and was completed on September 5, 2019 in accordance with 40 CFR § 257.96 to address the cobalt and lithium SSLs identified in January 2019. A public meeting was held on October 29, 2019, pursuant to 40 CFR § 257.96(e), to discuss the results of the ACM. As described above, subsequent to preparation of the ACM, an ASD was completed for lithium in October 2020 and cobalt was found to no longer be present at SSLs above the GWPS based on additional groundwater sample data collected as part of the Assessment Monitoring Program; however, Luminant continues to evaluate remedies pursuant to the remedy selection process under 40 CFR § 257.97.

## 1.0 INTRODUCTION

The CCR Rule (40 CFR 257 Subpart D - *Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments*) has been promulgated by the United States Environmental Protection Agency (USEPA) to regulate the management and disposal of CCRs as solid waste under Resource Conservation and Recovery Act (RCRA) Subtitle D. For existing CCR landfills and surface impoundments, the CCR Rule requires that the owner or operator prepare an annual groundwater monitoring and corrective action report to document the status of the groundwater monitoring and corrective action program for the CCR unit for the previous calendar year. Per 40 CFR 257.90(e) of the CCR Rule, the report should contain the following information, to the extent available:

- (1) A map, aerial image, or diagram showing the CCR unit and all background (or upgradient) and downgradient monitoring wells, to include the well identification numbers, that are part of the groundwater monitoring program for the CCR unit;
- (2) Identification of any monitoring wells that were installed or decommissioned during the preceding year, along with a narrative description of why those actions were taken;
- (3) In addition to all the monitoring data obtained under §§ 257.90 through 257.98, a summary including the number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and whether the sample was required by the detection monitoring or assessment monitoring programs;
- (4) A narrative discussion of any transition between monitoring programs (e.g., the date and circumstances for transitioning from detection monitoring to assessment monitoring in addition to identifying the constituent(s) detected at a statistically significant increase over background levels); and
- (5) Other information required to be included in the annual report as specified in §§ 257.90 through 257.98.
- (6) A section at the beginning of the annual report that provides an overview of the current status of groundwater monitoring and corrective action programs for the CCR unit. At a minimum, the summary must specify all of the following:
  - (i) At the start of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95;
  - (ii) At the end of the current annual reporting period, whether the CCR unit was operating under the detection monitoring program in § 257.94 or the assessment monitoring program in § 257.95;
  - (iii) If it was determined that there was a statistically significant increase over background for one or more constituents listed in Appendix III to this part pursuant to § 257.94(e):
    - (A) Identify those constituents listed in Appendix III to this part and the names of the monitoring wells associated with such an increase; and
    - (B) Provide the date when the assessment monitoring program was initiated for the CCR unit.

- (iv) If it was determined that there was a SSL above the groundwater protection standard for one or more constituents listed in Appendix IV to this part pursuant to § 257.95(g) include all of the following:
  - (A) Identify those constituents listed in Appendix IV to this part and the names of the monitoring wells associated with such an increase;
  - (B) Provide the date when the assessment of corrective measures was initiated for the CCR unit;
  - (C) Provide the date when the public meeting was held for the assessment of corrective measures for the CCR unit; and
  - (D) Provide the date when the assessment of corrective measures was completed for the CCR unit.
- (v) Whether a remedy was selected pursuant to § 257.97 during the current annual reporting period, and if so, the date of remedy selection; and
- (vi) Whether remedial activities were initiated or are ongoing pursuant to § 257.98 during the current annual reporting period.

## 2.0 MONITORING AND CORRECTIVE ACTION PROGRAM STATUS

Golder collected the initial Detection Monitoring Program groundwater samples from the FGD Ponds CCR monitoring well network in October 2017. The evaluation of those data was completed in 2018 using procedures described in the Statistical Analysis Plan (PBW, 2017) to identify statistically significant increases (SSIs) of Appendix III parameters over background concentrations. The Detection Monitoring Program sampling dates and parameters are summarized in the following table:

**Detection Monitoring Program Summary**

Sampling Dates	Parameters	SSIs	Assessment Monitoring Program Established
October 3, 2017	Appendix III	Yes	July 16, 2018

Alternate source evaluations were inconclusive for one or more of the SSIs. Consequently, an Assessment Monitoring Program was initiated and established for the FGD Pond CCR units in 2018 in accordance with 40 CFR § 257.94(e)(2). Golder collected the initial Assessment Monitoring Program groundwater samples in June 2018. Subsequent Assessment Monitoring Program sampling events have been conducted on a semi-annual basis, as required by the CCR Rule.

The statistical background prediction limits used to assess Appendix III data and the GWPSs used to assess Appendix IV data are summarized in Tables 1 and 2, respectively. Appendix III and Appendix IV analytical data are summarized in Tables 3 and 4, respectively. The initial assessment monitoring event was conducted in June 2018 and a subsequent semi-annual assessment monitoring event was conducted in September 2018 in accordance with §257.95(a) and §257.95(d). Using the Appendix IV data collected during the assessment monitoring period through September 2018, SSLs above GWPSs were initially identified in January 2019 for cobalt and lithium. Notification of these SSLs was placed in the operating record on February 6, 2019 and was subsequently placed on the public website in accordance with 40 CFR § 257.107(d). An ACM was initiated on April 8, 2019 pursuant to §257.95(g). A justification letter for a 60-day extension due to site-specific circumstances that delayed work on the ACM was certified on July 3, 2019 in accordance with 40 CFR §257.96(a). A copy of the extension justification letter was provided in the 2019 Annual Groundwater Monitoring and Corrective Action Report. The ACM was completed in September 2019 (Golder 2019) for the parameters detected at SSLs above GWPSs during the 2018 Assessment Monitoring period (cobalt and lithium), pursuant to 40 CFR § 257.96.

Additional semi-annual Assessment Monitoring events were conducted in 2019 and 2020. Statistical analysis of

the 2019 and 2020 data was performed in accordance with the Statistical Analysis Plan for CCR Groundwater Monitoring (PBW 2017) and the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities- Unified Guidance (USEPA 2009). The statistical analysis included an evaluation of confidence intervals for each of the Appendix IV parameter data sets to evaluate whether constituent concentrations were present at concentrations above GWPSs. There were no Appendix IV parameters identified at SSLs above GWPSs during the 2019 Assessment Monitoring period; however, an SSL for lithium was identified at one well (FGD-5) during both 2020 sampling events. An ASD was completed in October 2020, which indicated that a source other than the CCR units caused the lithium SSLs. A copy of the ASD is presented in Attachment 1 of this report as required by 40 CFR 257.94(e)(2).

The following table provides a summary of the Assessment Monitoring Program sampling events:

**Assessment Monitoring Program Summary**

Sampling Dates	Analytical Data Receipt Date	Parameters Collected	SSL(s)	SSL(s) Determination Date	Alternate Source Demonstration	Corrective Measures Assessment Initiated	Corrective Measures Assessment Completed
June 4-5, 2018	July 11, 2018	Appendix III Appendix IV	NA	NA	NA	NA	NA
September 5-6, 2018	October 11, 2018	Appendix III Appendix IV	Co and Li	January 7, 2019	No	April 8, 2019	September 5, 2019
May 16, 2019	June 5, 2019	Appendix III Appendix IV	None	NA	NA	NA	NA
August 19, 2019	September 25, 2019	Appendix III Appendix IV	None	NA	NA	NA	NA
May 6-11, 2020	June 12, 2020	Appendix III Appendix IV	Li	July 22, 2020	October 20, 2020	NA	NA
September 10-15, 2020	October 12, 2020	Appendix III Appendix IV	Li	December 7, 2020	Previous ASD applies	NA	NA

Notes:  
NA: Not Applicable



### 3.0 KEY ACTIONS COMPLETED IN 2020

Assessment Monitoring Program groundwater monitoring events were conducted in May and September 2020. The number of groundwater samples that were collected for analysis for each background and downgradient well, the dates the samples were collected, and the analytical results for the groundwater samples are summarized in Table 3 (Appendix III parameters) and Table 4 (Appendix IV parameters). A map showing the CCR units and monitoring wells is provided as Figure 1.

As noted in Section 2.0, an ASD was completed in accordance with 40 CFR 257.94(e)(2) for the lithium SSLs observed in samples from monitoring well FGD-5 in 2020. The ASD indicated that a source other than the CCR units caused the lithium SSLs. A copy of the ASD is presented in Attachment 1.

## **4.0 PROBLEMS ENCOUNTERED AND ACTIONS TO RESOLVE THE PROBLEMS**

No problems were encountered with the CCR groundwater monitoring program in 2020.

## 5.0 KEY ACTIVITIES PLANNED FOR 2021

The following key activities are planned for 2021:

- Continue the Assessment Monitoring Program in accordance with 40 CFR § 257.95.
- Complete statistical evaluation of Appendix IV analytical data from the downgradient wells and compare results to GWPSs to determine whether an SSL has occurred.
- If an SSL is identified, notification will be prepared as required under 40 CFR § 257.95(g) and will be placed in the operating record per 40 CFR § 257.105(h)(8), and will be subsequently placed on the public website per 40 CFR § 257.107(d). Potential alternate sources (i.e., a source other than the CCR unit caused the SSL or that the SSL resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality) will be evaluated. If an alternate source is identified to be the cause of the SSL, a written demonstration will be completed within 90 days of SSL detection and included in the Annual Groundwater Monitoring and Corrective Action Report (note: the ASD for lithium included in Attachment 1 will apply to similar lithium SSLs identified in the future at monitoring well FGD-5).
- If an alternate source is not identified to be the cause of the SSL, the applicable requirements of 40 CFR §§ 257.94 through 257.98 (e.g., assessment of corrective measures) will be met, including associated recordkeeping/notifications required by 40 CFR §§ 257.105 through 257.108.
- Further evaluation of a remedy for cobalt, which historically was identified but currently is not present at SSLs above the GWPS, is ongoing.

## 6.0 REFERENCES

Golder, 2019. CCR Assessment of Corrective Measures, Oak Grove Steam Electric Station – FGD Ponds, Robertson County, Texas. September.

Pastor, Behling & Wheeler, LLC, 2017. Coal Combustion Residual Rule Statistical Analysis Plan, Oak Grove Steam Electric Station, FGD Pond Area, Robertson County, Texas.

USEPA, 2009. Unified Guidance Document: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, EPA 530-R-09-007, March 2009.

## Signature Page

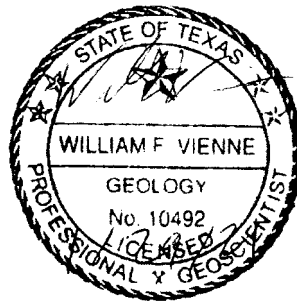
### Golder Associates Inc.



Patrick J. Behling  
*Principal Engineer*

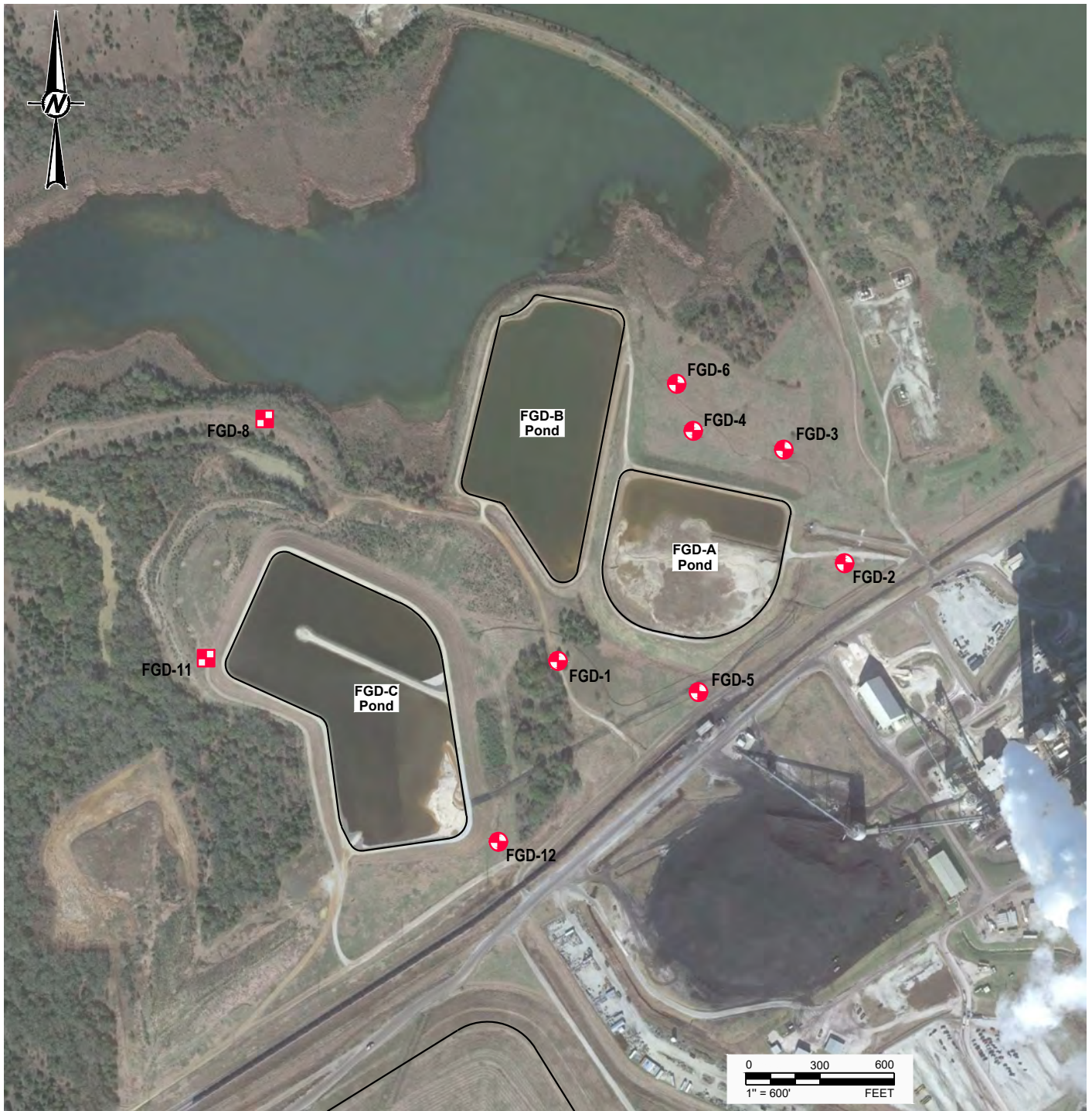


William F. Vienne  
*Senior Hydrogeologist*





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## FIGURES



**LEGEND**

-  DOWNGRADIENT CCR MONITORING WELL
-  BACKGROUND CCR MONITORING WELL

CLIENT  
**LUMINANT**

PROJECT  
**OAK GROVE STEAM ELECTRIC STATION  
ROBERTSON COUNTY, TEXAS**

TITLE  
**DETAILED SITE PLAN - FGD POND AREA**

CONSULTANT



YYYY-MM-DD	2020-01-23
DESIGNED	AJD
PREPARED	AJD
REVIEWED	WVW
APPROVED	WVW

**REFERENCE(S)**

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 12/9/18.

PROJECT NO.  
**19122262**

REV.  
**0**

FIGURE  
**1**

## TABLES



**Table 1**  
**Statistical Background Values**  
**OGSES FGD Ponds**

<b>Parameter</b>	<b>Statistical Background Value</b>
Boron (mg/L)	0.141
Calcium (mg/L)	471
Chloride (mg/L)	6,340
Fluoride (mg/L)	0.781
field pH (s.u.)	6.10 7.23
Sulfate (mg/L)	409
Total Dissolved Solids (mg/L)	13,000

**Table 2**  
**Groundwater Protection Standards**  
**OGSES FGD Ponds**

<b>Parameter</b>	<b>Groundwater Protection Standard</b>
Antimony (mg/L)	0.006
Arsenic (mg/L)	0.0146
Barium (mg/L)	2
Beryllium (mg/L)	0.004
Cadmium (mg/L)	0.005
Chromium (mg/L)	0.1
Cobalt (mg/L)	0.0158
Fluoride (mg/L)	4
Lead (mg/L)	0.015
Lithium (mg/L)	0.149
Mercury (mg/L)	0.002
Molybdenum (mg/L)	0.1
Selenium (mg/L)	0.05
Thallium (mg/L)	0.002
Radium 226+228 (pCi/L)	11.2

**TABLE 3  
APPENDIX III ANALYTICAL DATA  
OGSES FGD PONDS**

Sample Location	Date Sampled	B (mg/L)	Ca (mg/L)	Cl (mg/L)	FI (mg/L)	pH (s.u.)	SO <sub>4</sub> (mg/L)	TDS (mg/L)
<b>Upgradient Wells</b>								
FGD-8	11/04/15	0.0843	69.2	271	0.173 J	6.92	24.4	803
	12/17/15	0.0791	65.2	248	0.361 J	6.67	50.1	721
	02/09/16	0.0721	296	1,910	0.331 J	6.14	110	5,100
	04/14/16	0.0805	323	1920	0.218	6.39	68	6,210
	06/14/16	0.0869	336	2070	<0.100	6.57	476	6,130
	08/24/16	0.119	21.1	107	0.186 J	6.92	41.6	400
	10/05/16	0.0794	394	1,890	0.413	6.68	184	4,470
	12/23/16	0.069	340	1,990	<0.100	6.83	144	4,330
	10/03/17	0.1	378	1,140	<0.100	6.83	9.72	2,550
	06/05/18	0.0826	409	2,180	<0.100	6.12	538	4,450
	09/06/18	0.635	395	2,330	0.362 J	5.93	670	4,910
	05/16/19	0.0687	314	2,040	<0.100	6.67	173	3,970
	08/19/19	0.0756	427	2,260	<0.100	6.89	452	4,600
05/11/20	0.129	381	2,240	<0.100	6.69	188	4,090	
9/9/2020	0.101	329	2,220	<0.100	6.87	58.9	3,890	
FGD-11	11/04/15	0.048	9.57	15	<0.100	6.58	9.96	145
	12/17/15	0.0544	10.7	9.85	0.13 J	6.74	11	115
	02/09/16	0.0912	71.5	438	0.548	6.9	37.5	1,160
	04/14/16	0.0963	72.5	393	0.671	6.34	32.9	1,120
	06/15/16	0.0979	55.1	356	0.331 J	6.57	32.4	900
	08/25/16	0.103	154	759	0.128 J	6.76	68.8	1,960
	10/04/16	0.127	181	894	0.579	6.78	71.8	2,130
	12/22/16	0.125	201	1,150	0.127 J	6.85	89.5	2,870
	10/03/17	0.155	254	1,830	<0.100	6.85	142	4,010
	06/05/18	0.162	170	954	0.836	6.28	82.2	2,240
	09/06/18	0.149	194	1,140	1.09	6.43	93.9	2,770
	05/16/19	0.108	85	566	0.38 J	6.83	50.9	1,350
	08/19/19	0.12	92.5	535	0.63	6.71	44.7	1,430
5/11/2020	0.166	103	560	0.365 J	7	43.3	1,300	
9/9/2020	0.242	101	573	0.575	6.79	44.0	1,320	
<b>Downgradient Wells</b>								
FGD-1	11/03/15	0.065	11	36.4	0.363 J	6.31	32	245
	12/17/15	0.0706	10.6	37.7	0.384 J	6.33	33.3	224
	02/09/16	0.0539	11.4	38.9	0.383 J	6.81	36.3	235
	04/14/16	0.0867	12.2	38.6	0.229	6.24	35.7	77
	06/15/16	0.066	12	39	0.302 J	6.75	41.2	258
	08/24/16	0.0601	13.5	42.1	0.225 J	6.58	46.6	193
	10/05/16	0.0629	14.2	38.7	0.483	6.78	44.2	266
	12/22/16	0.058	13.7	42.6	0.326 J	5.79	49.3	271
	10/03/17	0.0973	18.5	40	0.276 J	6.91	64.7	239
	06/05/18	0.0686	18.3	44.7	0.206 J	5.58	68.6	277
	09/06/18	0.0738	19.9	52.5	0.228 J	5.78	80.8	281
	05/15/19	0.0803	19.5	62.4	0.362 J	6.63	78.7	320
	08/19/19	0.0864	26.1	69.3	0.486	6.49	80.9	328
05/11/20	0.121	37.8	146	0.231 J	6.95	79.5	448	
9/9/2020	0.0871	36.0	320	0.215 J	6.73	158	875	
FGD-2	11/03/15	0.1	77.1	460	0.224 J	6.47	147	1,370
	12/17/15	0.0636	24.8	133	0.347 J	6.77	53.2	515
	02/09/16	0.0885	44.6	250	0.315 J	7.06	98.9	750
	04/14/16	0.136	53.8	285	0.192	6.54	103	924
	06/14/16	0.0729	26.8	138	0.122 J	6.73	62.2	564
	08/24/16	0.219	79.9	421	<0.100	6.75	158	1,060
	10/05/16	0.182	58.3	310	0.243 J	6.76	114	910
	12/22/16	0.251	95.3	570	<0.100	6.70	174	1,450
	10/03/17	0.362	151	813	<0.100	6.81	222	1,920
	06/05/18	0.352	91.6	465	0.185 J	6.06	148	1,190
	09/06/18	0.35	154	902	0.32 J	6.11	196	1,860
	05/16/19	0.105	38.9	260	0.383 J	6.86	70.7	729
	08/19/19	0.192	167	863	0.413	6.88	218	1,890
05/11/20	0.605	217	1,150	<0.100	6.61	286	2,300	
9/9/2020	0.567	193	1,030	<0.100	6.57	301	2,150	

**TABLE 3**  
**APPENDIX III ANALYTICAL DATA**  
**OGSES FGD PONDS**

Sample Location	Date Sampled	B (mg/L)	Ca (mg/L)	Cl (mg/L)	FI (mg/L)	pH (s.u.)	SO <sub>4</sub> (mg/L)	TDS (mg/L)
FGD-3	11/03/15	0.343	108	439	0.505	6.51	479	1,950
	12/17/15	0.255	109	399	<0.100	6.64	478	1,640
	02/09/16	0.214	91.4	326	0.74	6.76	474	1,610
	04/14/16	0.231	98.1	314	0.69	6.59	396	1,980
	06/14/16	0.207	80.1	267	0.173 J	6.59	338	1,440
	08/24/16	0.112	90.4	279	0.463	6.89	357	1,490
	10/05/16	0.212	88.1	264	0.723	6.85	324	1,370
	12/22/16	0.196	82.6	290	1.32	6.07	392	1,490
	10/03/17	0.244	97	245	0.457	6.75	317	1,190
	06/05/18	0.199	82.7	234	1.06	5.99	319	1,260
	09/05/18	0.0379	73.9	227	1.03	6.21	306	1,260
	05/16/19	0.117	60.1	117	0.776	6.73	182	1,100
	08/19/19	0.134	51.1	84.9	0.874	6.72	150	882
05/06/20	0.152	42.3	70.2	0.8	6.62	129	777	
9/9/2020	0.130	36.8	58.5	0.772	6.82	122	709	
FGD-4	11/03/15	0.0694	46.1	200	0.294 J	6.71	37.8	679
	12/17/15	0.0777	47.8	211	0.295 J	6.44	38.2	647
	02/09/16	0.0581	45.3	195	0.32 J	6.85	45	653
	04/14/16	0.0726	50.3	182	0.323	6.59	55.4	726
	06/14/16	0.0728	47.5	210	<0.100	6.68	37.9	689
	08/24/16	0.343	52.5	208	0.148 J	6.74	53.3	704
	10/05/16	0.0672	48.1	182	0.376 J	6.85	56	672
	12/22/16	0.0628	44.5	181	0.251 J	6.29	65.4	676
	10/03/17	0.225	54.9	182	0.219 J	6.82	69.8	659
	06/05/18	0.0839	49.4	200	0.297 J	6.15	46.6	648
	09/05/18	0.108	40.9	193	0.353 J	6.29	55.8	672
	05/16/19	0.0733	41.7	205	0.327 J	6.57	41.7	651
	08/19/19	0.085	42.5	188	0.67	6.69	5.4	681
05/11/20	0.145	40.6	198	0.3 J	6.62	52.9	702	
9/15/2020	0.109	33.6	197	<0.100	6.87	50.1	674	
FGD-5	11/04/15	0.0719	30.2	230	0.334 J	6.92	54.7	1,040
	12/17/15	0.0798	32.5	254	0.333 J	6.74	56.1	845
	02/09/16	0.0926	89.5	356	0.495	6.6	62.8	942
	04/14/16	0.107	101	359	0.491	6.71	50.8	1,510
	06/15/16	0.11	88.9	368	0.284 J	6.73	55.1	735
	08/24/16	0.0394	102	372	0.168 J	6.89	58.8	770
	10/05/16	0.0995	99.9	344	0.38 J	6.92	57.3	1,260
	12/22/16	0.0982	90.6	301	0.291 J	6.06	65.5	893
	10/03/17	0.211	100	309	0.211 J	6.76	60.2	826
	06/05/18	0.11	100	303	0.511	6.13	61.2	795
	09/06/18	0.215	93.1	317	0.548	6.17	64.8	840
	05/16/19	0.108	77.7	287	0.579	6.46	67.2	801
	08/19/19	0.114	90.7	283	0.863	6.76	70.7	816
05/11/20	0.165	100	307	0.413	6.82	83.8	836	
9/10/2020	0.154	96.6	310	0.617	6.84	95.9	845	
FGD-6	11/03/15	0.0968	79.3	355	0.227 J	6.92	33.8	1,070
	12/17/15	0.103	89.9	342	0.469	6.52	65.9	940
	02/09/16	0.0791	31.8	252	0.354 J	7.12	59.5	940
	04/14/16	0.0936	36.4	259	0.442	6.71	57.9	1,140
	06/14/16	0.0955	33.9	237	<0.100	6.48	49.8	813
	08/24/16	0.0355	35.6	285	0.147 J	6.95	64.7	750
	10/05/16	0.102	35.3	275	0.364 J	6.94	60.2	1,010
	12/22/16	0.0847	35.6	286	0.204 J	6.34	64.4	905
	10/03/17	0.139	40.4	255	0.143 J	6.64	58.4	855
	06/05/18	0.0948	36.3	246	0.361 J	6.35	51.7	895
	09/05/18	0.0824	30.4	230	0.405	6.4	51.4	833
	05/16/19	0.116	20.3	170	0.669	6.85	51.3	710
	09/19/19	0.102	23.6	158	0.741	6.72	60.3	754
05/06/20	0.109	27.4	189	0.292	6.75	70.7	746	
9/15/2020	0.112	20.2	144	0.354 J	6.77	89.6	688	

**TABLE 3**  
**APPENDIX III ANALYTICAL DATA**  
**OGSES FGD PONDS**

Sample Location	Date Sampled	B (mg/L)	Ca (mg/L)	Cl (mg/L)	Fl (mg/L)	pH (s.u.)	SO <sub>4</sub> (mg/L)	TDS (mg/L)
FGD-12	11/04/15	0.0651	16.6	19.4	<0.100	6.68	20	217
	12/17/15	0.0671	13.2	15.5	0.159 J	6.47	16.6	161
	2/9/2016	0.065	11.1	13.5	0.157 J	6.99	14.1	179
	04/14/16	0.0753	14.7	25.4	0.109	6.47	15.8	163
	06/15/16	0.0711	11.2	19.5	0.101 J	6.52	13.4	253
	08/25/16	0.0858	52.8	296	<0.100	6.86	33.8	817
	10/04/16	0.0682	12.5	17.8	0.129 J	6.74	10.5	142
	12/23/16	0.0512	260	1,250	0.112 J	6.95	174	3,270
	10/03/17	0.0731	10.4	10	0.154 J	6.76	10.8	134
	06/05/18	0.0812	8.74	12	0.137 J	6.37	13.7	196
	09/06/18	0.0698	6.78	14	<0.100	5.6	13.1	134
	05/16/19	0.0723	6.79	16	<0.100	6.52	15	140
	08/19/19	0.0794	10.5	16	0.145 J	6.71	17.1	209
	05/11/20	0.149	15.6	19.3	<0.100	6.59	19.9	198
9/9/2020	0.120	9.34	13.0	<0.100	6.82	14.1	166	

Notes:

1. Abbreviations: mg/L - milligrams per liter; TDS - total dissolved solids; s.u. - standard units.
2. J - Concentration is below method quantitation limit; result is an estimate.

**TABLE 4**  
**APPENDIX IV ANALYTICAL DATA**  
**OGSES FGD PONDS**

Sample Location	Date Sampled	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	F (mg/L)	Pb (mg/L)	Li (mg/L)	Hg (mg/L)	Mo (mg/L)	Se (mg/L)	TI (mg/L)	Ra 226 (pCi/L)	Ra 228 (pCi/L)	Ra 226/228 Combined^A (pCi/L)
<b>Upgradient Wells</b>																		
FGD-8	11/04/15	<0.0008	<0.002	0.119	<0.0003	<0.0003	0.00542	<0.003	0.173 J	<0.0003	0.149	<0.00008	0.0261	<0.002	<0.0005	0.671	1.38	2.05
	12/17/15	<0.0008	<0.002	0.179	<0.0003	<0.0003	0.00373 J	0.00646	0.361 J	<0.0003	0.116	<0.00008	0.00404 J	<0.002	<0.0005	<0.609	1.32	1.93
	02/09/16	<0.0008	0.0115	0.892	<0.0003	<0.0003	0.00234 J	0.00609	0.331 J	0.000406 J	0.0104	<0.00008	<0.002	0.00231 J	<0.0005	1.77	3.55	5.32
	04/14/16	<0.0008	0.0146	0.965	<0.0003	<0.0003	0.00202 J	0.00876	0.218 J	0.0016	0.016	<0.00008	<0.002	0.00211 J	<0.0005	0.973	8.34	9.31
	06/14/16	<0.0008	0.00639	0.792	<0.0003	<0.0003	<0.002	0.0158	<0.100	0.00137	0.015	<0.00008	<0.002	<0.002	<0.0005	1.93	2.30	4.23
	08/24/16	<0.0008	<0.002	0.102	0.000417 J	<0.0003	0.0107	0.015	0.186 J	0.00381	0.0265	<0.00008	<0.002	<0.002	<0.0005	0.778	<0.491	1.27
	10/05/16	<0.0008	0.00661	0.753	<0.0003	<0.0003	0.00672	0.00899	0.413	0.000908 J	0.0224	<0.00008	<0.002	<0.002	<0.0005	1.35	5.96	7.31
	12/23/16	<0.0008	0.0119	0.894	<0.0003	<0.0003	0.00259 J	0.00745	<0.100	0.00228	0.0185	<0.00008	<0.002	0.00217 J	<0.0005	2.17	3.70	5.87
	06/05/18	<0.0008	0.00839	0.834	<0.0003	<0.0003	<0.002	0.0193	<0.100	0.00039 J	0.0128	<0.00008	<0.002	<0.002	<0.0005	1.5	5.13	6.63
	09/06/18	NA	0.0137	0.635	<0.0003	<0.0003	<0.002	0.0243	0.362 J	<0.0003	0.009 J	NA	<0.002	0.0025 J	<0.0005	0.349	1.4	1.75
	05/16/19	<0.0008	0.0126	0.864	<0.0003	<0.0003	0.003 J	0.0146	<0.100	<0.00194	0.009 J	<0.00008	<0.002	0.0027 J	<0.0005	3.14	5.27	8.41
	08/19/19	<0.0008	0.00645	0.608	<0.0003	<0.0003	<0.002	0.0135	<0.100	0.00134	0.0144	<0.00008	<0.002	0.00252	<0.0005	1.79	6.82	8.61
	05/11/20	<0.000800	0.00663	0.732	<0.000300	<0.000300	<0.00200	0.0084	<0.100	0.000415 J	0.0152	<0.0000800	<0.00200	0.0021 J	<0.000500	2.07	6.58	8.65
	9/15/2020	NA	0.00796	0.777	<0.000300	NA	0.00287 J	0.00379 J	<0.100	0.00107	0.00864 J	NA	<0.00200	<0.00200	<0.000500	2.5	6.2	8.7
FGD-11	11/04/15	<0.0008	<0.002	0.0527	<0.0003	<0.0003	<0.002	<0.003	<0.1	0.000727 J	0.0144	<0.00008	<0.002	<0.002	<0.0005	0.928	<1.41	2.34
	12/17/15	<0.0008	<0.002	0.0676	0.000303 J	<0.0003	<0.002	<0.003	0.13 J	0.000987 J	0.016	<0.00008	<0.002	<0.002	<0.0005	0.786	<1.63	2.42
	02/09/16	<0.0008	<0.002	0.271	<0.0003	<0.0003	<0.002	<0.003	0.548	<0.0003	0.011	<0.00008	<0.002	<0.002	<0.0005	1.39	2.64	4.03
	04/14/16	<0.0008	<0.002	0.26	<0.0003	<0.0003	0.00222 J	<0.003	0.671	0.0012	0.011	<0.00008	<0.002	<0.002	<0.0005	1.69	2.43	4.12
	06/15/16	<0.0008	<0.002	0.216	<0.0003	<0.0003	<0.002	<0.003	0.331 J	0.000407 J	0.0126	<0.00008	0.00238 J	<0.002	<0.0005	2.34	2.06	4.40
	08/25/16	<0.0008	<0.002	0.439	<0.0003	<0.0003	0.00465 J	<0.003	0.128 J	0.00179	0.011	<0.00008	<0.002	<0.002	<0.0005	4.23	3.58	7.81
	10/04/16	<0.0008	<0.002	0.55	<0.0003	<0.0003	<0.002	<0.003	0.579	0.000618 J	0.0124	<0.00008	<0.002	<0.002	<0.0005	1.73	2.53	4.26
	12/22/16	<0.0008	<0.002	0.734	<0.0003	<0.0003	0.00258 J	<0.003	0.127 J	0.000635 J	0.0124	<0.00008	<0.002	<0.002	<0.0005	3.94	5.09	9.03
	06/05/18	<0.0008	<0.002	0.520	<0.0003	<0.0003	0.0372	0.007	0.836	0.00891 J	0.0102	<0.00008	0.00266 J	<0.002	<0.0005	4.64	4.22	8.86
	09/06/18	NA	<0.002	0.702	<0.0003	<0.0003	0.0039 J	<0.003	1.09	<0.0003	0.0121	NA	<0.002	<0.002	<0.0005	6.24	6.47	12.71
	05/16/19	<0.0008	<0.002	0.347	<0.0003	<0.0003	0.028	<0.003	0.38 J	0.000576 J	0.0145	<0.00008	0.00358 J	<0.002	<0.0005	2.39	2.75	5.14
	08/19/19	<0.0008	<0.002	0.310	<0.0003	<0.0003	0.00391 J	<0.003	0.63	<0.0003	0.0136	<0.00008	0.00238 J	<0.002	<0.0005	1.39	2.55	3.95
	05/11/20	<0.000800	<0.00200	0.347	<0.000300	<0.000300	0.0146	<0.00300	0.365 J	0.000658 J	0.0132	<0.0000800	<0.00200	<0.00200	<0.000500	2.39	4.00	6.39
	9/10/2020	NA	<0.00200	0.330	<0.000300	NA	0.0158	<0.00300	0.575	0.000706 J	0.0121	NA	<0.00200	<0.00200	<0.000500	3.35	4.69	8.04
<b>Downgradient Wells</b>																		
FGD-1	11/03/15	<0.0008	<0.002	0.0311	<0.0003	<0.0003	<0.002	<0.003	0.363 J	<0.0003	0.034	<0.00008	<0.002	<0.002	<0.0005	0.718	<1.40	2.12
	12/17/15	<0.0008	<0.002	0.0263	<0.0003	<0.0003	<0.002	<0.003	0.384 J	<0.0003	0.0306	<0.00008	<0.002	<0.002	<0.0005	0.919	<1.43	2.35
	02/09/16	<0.0008	<0.002	0.0315	<0.0003	<0.0003	0.00437 J	0.0033 J	0.383 J	0.000379 J	0.0314	<0.00008	<0.002	<0.002	<0.0005	<0.318	1.42	1.74
	04/14/16	<0.0008	<0.002	0.0296	<0.0003	<0.0003	<0.002	<0.003	0.229 J	<0.0003	0.0338	<0.00008	<0.002	<0.002	<0.0005	<0.439	<1.28	<1.719
	06/15/16	<0.0008	<0.002	0.0276	<0.0003	<0.0003	<0.002	<0.003	0.302 J	<0.0003	0.0321	<0.00008	<0.002	<0.002	<0.0005	<0.258	1.66	1.92
	08/24/16	<0.0008	<0.002	0.0294	<0.0003	<0.0003	<0.002	<0.003	0.225 J	<0.0003	0.033	<0.00008	<0.002	<0.002	<0.0005	0.188	2.24	2.43
	10/05/16	<0.0008	<0.002	0.0319	<0.0003	<0.0003	<0.002	0.00447 J	0.483	<0.0003	0.0331	<0.00008	<0.002	<0.002	<0.0005	0.430	0.507	0.94
	12/22/16	<0.0008	<0.002	0.0418	<0.0003	<0.0003	<0.002	<0.003	0.326 J	<0.0003	0.0385	<0.00008	<0.002	<0.002	<0.0005	<0.273	<0.645	<0.918
	06/05/18	<0.0008	<0.002	0.0422	<0.0003	<0.0003	<0.002	<0.003	0.206 J	<0.0003	0.0426	<0.00008	<0.002	<0.002	<0.0005	0.194	<0.7680	0.962
	09/06/18	NA	<0.002	0.0417	<0.0003	<0.0003	<0.002	0.0033 J	0.228 J	<0.0003	0.0436	NA	<0.002	<0.002	0.0005	0.209	<0.53	0.739
	05/16/19	<0.0008	<0.002	0.0485	<0.0003	<0.0003	<0.002	<0.003	0.362 J	<0.0003	0.0442	<0.00008	<0.002	<0.002	<0.0005	0.33	<0.59	0.923
	08/19/19	<0.0008	<0.002	0.0538	<0.0003	<0.0003	<0.002	<0.003	0.486	<0.0003	0.0441	<0.00008	<0.002	<0.002	<0.0005	0.489	1.09	1.57
	05/11/20	<0.000800	<0.00200	0.131	<0.000300	<0.000300	<0.00200	0.0495	0.231 J	<0.000300	0.0548	<0.0000800	<0.00200	<0.00200	<0.000500	1.08	0.808	1.89
	9/15/2020	NA	<0.00200	0.162	<0.000300	NA	<0.00200	<0.00300	0.215 J	0.000342 J	0.0233	NA	<0.00200	<0.00200	<0.000500	0.664	1.66	2.32

**TABLE 4**  
**APPENDIX IV ANALYTICAL DATA**  
**OGSES FGD PONDS**

Sample Location	Date Sampled	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	F (mg/L)	Pb (mg/L)	Li (mg/L)	Hg (mg/L)	Mo (mg/L)	Se (mg/L)	Tl (mg/L)	Ra 226 (pCi/L)	Ra 228 (pCi/L)	Ra 226/228 Combined^ (pCi/L)
FGD-2	11/03/15	<0.0008	<0.002	0.146	<0.0003	<0.0003	0.00244 J	<0.003	0.224 J	<0.0003	0.0224	<0.00008	<0.002	0.0203	<0.0005	<0.249	1.97	2.22
	12/17/15	<0.0008	<0.002	0.103	<0.0003	<0.0003	0.00386 J	<0.003	0.347 J	0.00145	0.0183	<0.00008	<0.002	0.0127	<0.0005	1.030	<1.24	2.27
	02/09/16	<0.0008	<0.002	0.133	<0.0003	<0.0003	0.00426 J	<0.003	0.315 J	<0.0003	0.0221	<0.00008	<0.002	0.0181	<0.0005	0.669	1.81	2.48
	04/14/16	<0.0008	<0.002	0.129	<0.0003	<0.0003	<0.002	<0.003	0.192 J	<0.0003	0.0196	<0.00008	<0.002	0.0166	<0.0005	0.198	<2.03	2.23
	06/14/16	<0.0008	<0.002	0.091	<0.0003	<0.0003	<0.002	<0.003	0.122 J	<0.0003	0.0243	<0.00008	<0.002	0.0189	<0.0005	0.275	1.66	1.94
	08/24/16	<0.0008	<0.002	0.144	<0.0003	<0.0003	<0.002	<0.003	<0.1	<0.0003	0.019	<0.00008	<0.002	0.0185	<0.0005	2.47	0.769	3.24
	10/05/16	<0.0008	<0.002	0.129	<0.0003	<0.0003	0.00549	<0.003	0.243 J	0.000693 J	0.0199	<0.00008	<0.002	0.0176	<0.0005	0.716	1.70	2.42
	12/22/16	<0.0008	<0.002	0.158	<0.0003	<0.0003	<0.002	<0.003	<0.1	<0.0003	0.0217	<0.00008	<0.002	0.022	<0.0005	0.345	1.79	2.14
	06/05/18	<0.0008	<0.002	0.108	<0.0003	<0.0003	<0.002	<0.003	0.185 J	<0.0003	0.0226	<0.00008	<0.002	0.0185	<0.0005	0.505	1.12	1.63
	09/06/18	NA	<0.002	0.125	<0.0003	<0.0003	<0.002	<0.003	0.32 J	<0.0003	0.0253	NA	<0.002	0.0204	<0.0005	0.641	0.822	1.46
	05/16/19	<0.0008	<0.002	0.0993	<0.0003	<0.0003	0.003 J	<0.003	0.383 J	<0.0003	0.0228	0.00008	<0.002	0.0214	<0.0005	0.648	0.588	1.24
	08/19/19	<0.0008	<0.002	0.181	<0.0003	<0.0003	<0.002	<0.003	0.413	<0.0003	0.0257	<0.00008	<0.002	0.0249	<0.0005	0.456	2.8	3.26
	05/11/20	<0.000800	<0.00200	0.108	<0.000300	<0.000300	0.00234 J	<0.00300	<0.100	<0.000300	0.028	<0.0000800	<0.00200	0.0208	<0.000500	0.677	2.08	2.76
9/10/2020	NA	<0.00200	0.104	<0.000300	NA	0.00239 J	<0.00300	<0.100	<0.000300	0.0250	NA	<0.00200	0.0217	<0.000500	0.744	0.29	1.03	
FGD-3	11/03/15	<0.0008	0.00226 J	0.0417	<0.0003	0.00492	<0.002	0.0436	0.505	<0.0003	0.176	<0.00008	<0.002	0.0881	0.0017	0.930	3.18	4.11
	12/17/15	<0.0008	0.00215 J	0.0371	0.000475 J	0.00372	<0.002	0.0399	<0.1	<0.0003	0.14	<0.00008	<0.002	0.0798	0.0016	1.70	2.66	4.36
	02/09/16	<0.0008	0.00206 J	0.0407	<0.0003	0.00343	<0.002	0.0417	0.74	0.000438 J	0.13	<0.00008	<0.002	0.0907	0.0015 J	1.04	3.37	4.41
	04/14/16	<0.0008	0.00218 J	0.0371	<0.0003	0.00212	<0.002	0.0326	0.69	<0.0003	0.119	<0.00008	<0.002	0.064	0.00137 J	<0.276	<1.35	<1.626
	06/14/16	<0.0008	0.00205 J	0.0392	<0.0003	0.00156	<0.002	0.0261	0.173 J	<0.0003	0.107	<0.00008	<0.002	0.0447	0.00126 J	0.754	1.56	2.31
	08/24/16	<0.0008	0.00221 J	0.0387	<0.0003	0.00146	<0.002	0.0232	0.463	<0.0003	0.0974	<0.00008	<0.002	0.0272	0.00123 J	0.416	2.60	3.02
	10/05/16	<0.0008	0.00225 J	0.039	<0.0003	0.00152	<0.002	0.0226	0.723	<0.0003	0.113	<0.00008	<0.002	0.0276	0.00114 J	0.455	2.44	2.90
	12/22/16	<0.0008	0.00226 J	0.0437	<0.0003	0.00173	<0.002	0.0266	1.32	<0.0003	0.11	<0.00008	<0.002	0.0245	0.00124 J	<0.352	2.46	2.81
	06/05/18	<0.0008	0.00236 J	0.0391	<0.0003	0.00152	<0.002	0.0207	1.06	<0.0003	0.0975	<0.00008	0.00212 J	0.0192	0.000985 J	0.528	2.19	2.72
	09/05/18	NA	0.00208 J	0.0379	<0.0003	0.00146	<0.002	0.0192	1.03	<0.0003	0.0955	NA	0.0021 J	0.0213	0.000925 J	<0.323	0.704	1.03
	05/16/19	<0.0008	0.0023 J	0.051	<0.0003	<0.0003	<0.002	0.0052	0.776	<0.0003	0.057	<0.00008	0.0031 J	0.0423	0.0006 J	<0.403	<0.638	<1.041
	08/19/19	<0.0008	0.00248 J	0.0365	<0.0003	<0.0003	<0.002	0.00364 J	0.874	<0.0003	0.0546	<0.00008	0.00231 J	0.0245	0.000588 J	0.523	0.858	1.38
	05/06/20	<0.000800	0.00209 J	0.0353	<0.000300	<0.000300	0.0117	0.00332 J	0.8	<0.000300	0.0498	<0.0000800	0.00284 J	0.00993	0.000556 J	0.394	0.463	0.857
9/15/2020	NA	0.00225 J	0.0326	<0.000300	NA	<0.00200	<0.00300	0.772	<0.000300	0.0416	NA	0.00245 J	0.00646	0.000534 J	0.257	0.484	0.711	
FGD-4	11/03/15	<0.0008	<0.002	0.126	<0.0003	<0.0003	<0.002	<0.003	0.294 J	<0.0003	0.0433	<0.00008	<0.002	<0.0005	<0.0005	1.01	<1.39	2.40
	12/17/15	<0.0008	<0.002	0.105	<0.0003	<0.0003	<0.002	<0.003	0.295 J	<0.0003	0.0436	0.000229	0.00211 J	0.00214 J	<0.0005	<0.361	<1.73	<2.091
	02/09/16	<0.0008	<0.002	0.113	<0.0003	<0.0003	<0.002	<0.003	0.32 J	<0.0003	0.0419	0.000288	<0.002	<0.002	<0.0005	<0.332	<1.11	<1.442
	04/14/16	<0.0008	<0.002	0.12	<0.0003	<0.0003	0.00208 J	<0.003	0.323 J	0.0271	0.0357	0.000232	<0.002	<0.002	<0.0005	0.560	<1.21	1.77
	06/14/16	<0.0008	<0.002	0.128	<0.0003	0.000561 J	<0.002	<0.003	<0.1	<0.0003	0.0477	<0.00008	<0.002	<0.002	<0.0005	0.437	<0.975	1.41
	08/24/16	<0.0008	<0.002	0.111	<0.0003	<0.0003	<0.002	<0.003	0.148 J	0.000578 J	0.0383	<0.00008	<0.002	<0.002	<0.0005	<0.199	0.625	0.82
	10/05/16	<0.0008	<0.002	0.106	<0.0003	<0.0003	<0.002	<0.003	0.376 J	0.000489 J	0.0353	<0.00008	<0.002	<0.002	<0.0005	0.308	1.30	1.61
	12/22/16	<0.0008	<0.002	0.114	<0.0003	<0.0003	0.0023 J	<0.003	0.251 J	<0.0003	0.0273	<0.00008	<0.002	<0.002	<0.0005	0.227	<0.667	0.89
	06/04/18	<0.0008	<0.002	0.119	<0.0003	<0.0003	<0.002	<0.003	0.297 J	<0.0003	0.0265	<0.00008	<0.002	<0.002	<0.0005	0.261	<0.923	1.184
	09/05/18	NA	<0.002	0.108	<0.0003	<0.0003	<0.002	<0.003	0.353 J	<0.0003	0.0199	NA	<0.002	<0.002	<0.0005	<0.39	0.673	1.063
	05/16/19	<0.0008	<0.002	0.117	<0.0003	<0.0003	<0.002	<0.003	0.327 J	<0.0003	0.0325	<0.00008	<0.002	<0.002	<0.0005	0.627	0.745	1.372
	08/19/19	<0.0008	<0.002	0.1	<0.0003	<0.0003	<0.002	<0.003	0.67	<0.0003	0.019	<0.00008	<0.002	<0.002	<0.0005	0.39	1.58	1.97
	05/11/20	<0.000800	<0.00200	0.104	<0.000300	<0.000300	<0.00200	<0.00300	0.3 J	<0.000300	0.0166	<0.0000800	<0.00200	<0.00200	<0.000500	0.15	1.2	1.35
9/15/2020	NA	<0.00200	0.0899	<0.000300	NA	<0.00200	<0.00300	<0.100	<0.000300	0.0140	NA	<0.00200	<0.00200	<0.000500	0.498	-0.0258	0.498	

**TABLE 4  
APPENDIX IV ANALYTICAL DATA  
OGSES FGD PONDS**

Sample Location	Date Sampled	Sb (mg/L)	As (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Cr (mg/L)	Co (mg/L)	F (mg/L)	Pb (mg/L)	Li (mg/L)	Hg (mg/L)	Mo (mg/L)	Se (mg/L)	TI (mg/L)	Ra 226 (pCi/L)	Ra 228 (pCi/L)	Ra 226/228 Combined <sup>^</sup> (pCi/L)
FGD-5	11/04/15	<0.0008	<0.002	0.13	<0.0003	0.000557 J	0.0121	<0.003	0.227 J	<0.0003	0.17	<0.00008	0.0445	<0.002	<0.0005	0.449	1.52	1.97
	12/17/15	<0.0008	<0.002	0.237	<0.0003	0.000593 J	0.0391	0.0164	0.469	0.000369 J	0.156	<0.00008	0.0203	<0.002	<0.0005	1.23	3.63	4.86
	02/09/16	<0.0008	<0.002	0.261	<0.0003	<0.0003	<0.002	0.00441 J	0.495	<0.0003	0.158	<0.00008	<0.002	<0.002	<0.0005	1.99	1.50	3.49
	04/14/16	<0.0008	<0.002	0.224	<0.0003	0.000392 J	0.00477 J	<0.003	0.491	<0.0003	0.164	<0.00008	0.0183	<0.002	<0.0005	0.951	<1.24	2.19
	06/15/16	<0.0008	<0.002	0.174	<0.0003	<0.0003	0.00599	<0.003	0.284 J	<0.0003	0.162	<0.00008	0.0144	<0.002	<0.0005	0.429	1.25	1.68
	08/24/16	<0.0008	<0.002	0.173	<0.0003	<0.0003	0.0189	<0.003	0.168 J	0.00045 J	0.145	<0.00008	0.00814	<0.002	<0.0005	0.398	<0.643	1.04
	10/05/16	<0.0008	<0.002	0.229	<0.0003	<0.0003	0.00304 J	<0.003	0.38 J	<0.0003	0.153	<0.00008	0.00355 J	<0.002	<0.0005	0.877	1.16	2.04
	12/22/16	<0.0008	<0.002	0.261	<0.0003	<0.0003	<0.002	0.00471 J	0.291 J	<0.0003	0.152	<0.00008	<0.002	<0.002	<0.0005	0.579	<0.76	1.34
	06/05/18	<0.0008	<0.002	0.136	<0.0003	<0.0003	0.00935	<0.003	0.511	<0.0003	0.154	<0.00008	<0.002	<0.002	<0.0005	0.705	<0.765	1.47
	09/06/18	NA	<0.002	0.215	<0.0003	<0.0003	<0.002	<0.003	0.548	<0.0003	0.155	NA	<0.002	<0.002	<0.0005	0.535	1.31	1.845
	05/16/19	<0.0008	<0.002	0.0926	<0.0003	<0.0003	0.024	<0.003	0.579	<0.0003	0.145	<0.00008	0.003 J	<0.002	<0.0005	0.342	<0.506	0.848
	08/19/19	<0.0008	<0.002	0.106	<0.0003	<0.0003	0.0103	<0.003	0.863	<0.0003	0.152	<0.00008	<0.002	<0.002	<0.0005	0.551	0.659	1.21
	05/11/20	<0.000800	<0.00200	0.0959	<0.000300	<0.000300	0.0374	<0.00300	0.413	<0.000300	0.156	<0.0000800	0.00561	<0.00200	<0.000500	0.0983	5.18	5.28
	9/10/2020	NA	<0.00200	0.0929	<0.000300	NA	0.0307	<0.00300	0.617	<0.000300	0.150	NA	0.00362 J	<0.00200	<0.000500	0.132	<0.0787	0.132
FGD-6	11/03/15	<0.0008	<0.002	0.124	<0.0003	<0.0003	0.00253 J	<0.003	0.334 J	<0.0003	0.0112	<0.00008	<0.002	<0.002	<0.0005	0.470	<1.70	2.17
	12/17/15	<0.0008	<0.002	0.135	<0.0003	<0.0003	<0.002	<0.003	0.333 J	<0.0003	0.00964 J	<0.00008	<0.002	<0.002	<0.0005	1.03	<2.13	3.16
	02/09/16	<0.0008	<0.002	0.132	<0.0003	<0.0003	<0.002	<0.003	0.354 J	<0.0003	0.0105	<0.00008	<0.002	<0.002	<0.0005	0.801	<1.71	2.51
	04/14/16	<0.0008	<0.002	0.122	<0.0003	<0.0003	0.0568	<0.003	0.442	<0.0003	0.011	<0.00008	<0.002	<0.002	<0.0005	0.484	2.08	2.56
	06/14/16	<0.0008	<0.002	0.16	0.000309 J	0.000404 J	<0.002	0.00657	<0.1	0.00132	0.0092 J	<0.00008	<0.002	<0.002	<0.0005	1.31	2.16	3.47
	08/24/16	<0.0008	0.00725	0.127	<0.0003	<0.0003	0.00334 J	0.00399 J	0.147 J	0.000656 J	0.00885 J	<0.00008	0.00244 J	<0.002	<0.0005	0.465	0.896	1.36
	10/05/16	<0.0008	0.00536	0.117	<0.0003	<0.0003	0.00427 J	0.00414 J	0.364 J	<0.0003	0.00985 J	<0.00008	<0.002	<0.002	<0.0005	0.489	1.69	2.18
	12/22/16	<0.0008	0.00458 J	0.129	<0.0003	<0.0003	<0.002	0.00352 J	0.204 J	<0.0003	0.0102	<0.00008	<0.002	<0.002	<0.0005	0.349	0.917	1.27
	06/04/18	<0.0008	0.0021 J	0.0854	<0.0003	<0.0003	<0.002	<0.003	0.361 J	<0.0003	0.0098 J	<0.00008	<0.002	<0.002	<0.0005	<0.277	<0.964	<1.241
	09/05/18	NA	<0.002	0.0824	<0.0003	<0.0003	<0.002	<0.003	0.405	<0.0003	0.0094 J	NA	<0.002	<0.002	<0.0005	<0.336	<0.677	<1.013
	05/16/19	<0.0008	0.0294	0.107	<0.0003	<0.0003	<0.002	0.0132	0.669	<0.0003	0.0068 J	<0.00008	0.0077	<0.002	<0.0005	1.43	1.67	3.1
	08/19/19	<0.0008	0.0146	0.0903	<0.0003	<0.0003	<0.002	0.00493 J	0.741	<0.0003	0.0082 J	<0.00008	0.00332 J	<0.002	<0.0005	0.385	2.55	2.93
	05/11/20	<0.000800	0.00286 J	0.0814	<0.000300	<0.000300	<0.00200	<0.00300	0.292 J	<0.000300	0.00877 J	<0.0000800	0.00205 J	<0.00200	<0.000500	0.513	0.845	1.36
	9/15/2020	NA	0.00651	0.0695	<0.000300	NA	<0.00200	0.00615	0.354 J	<0.000300	0.00669 J	NA	<0.00200	<0.00200	<0.000500	0.485	1.08	1.57
FGD-12	11/04/15	<0.0008	<0.002	0.0884	<0.0003	<0.0003	0.0124	<0.003	<0.1	0.000678 J	0.0234	<0.00008	0.00221 J	<0.002	<0.0005	1.07	<1.55	2.62
	12/17/15	<0.0008	<0.002	0.0781	<0.0003	<0.0003	<0.002	<0.003	0.159 J	0.000775 J	0.022	<0.00008	<0.002	<0.002	<0.0005	1.32	<2.57	3.89
	2/9/2016	<0.0008	<0.002	0.0664	<0.0003	<0.0003	<0.002	<0.003	0.157 J	0.000339 J	0.0211	<0.00008	<0.002	<0.002	<0.0005	0.771	<1.53	2.30
	04/14/16	<0.0008	<0.002	0.104	<0.0003	<0.0003	0.00425 J	<0.003	0.109 J	0.00371	0.0255	<0.00008	<0.002	<0.002	<0.0005	0.560	1.46	2.02
	06/15/16	<0.0008	<0.002	0.107	0.00039 J	<0.0003	0.00269 J	0.00323 J	0.101 J	0.00513	0.0192	0.000134 J	<0.002	<0.002	<0.0005	2.01	2.06	4.07
	08/25/16	<0.0008	0.00451 J	0.262	0.000629 J	<0.0003	0.0135	0.00412 J	<0.1	0.00842	0.0204	<0.00008	<0.002	<0.002	<0.0005	1.59	1.84	3.43
	10/04/16	<0.0008	0.00402 J	0.122	0.00062 J	<0.0003	0.0133	0.00395 J	0.129 J	0.0084	0.0259	<0.00008	<0.002	0.00292 J	<0.0005	1.41	<0.76	2.17
	12/23/16	<0.0008	0.00938	0.557	<0.0003	<0.0003	0.00435 J	0.00609	0.112 J	0.00216	0.0755	<0.00008	<0.002	0.00786	<0.0005	1.89	3.54	5.43
	06/05/18	<0.0008	<0.002	0.0777	0.00031	<0.0003	0.00578	<0.003	0.137 J	0.0029	0.0213	<0.00008	<0.002	<0.002	<0.0005	1.68	<0.526	2.206
	09/06/18	NA	<0.002	0.0517	<0.0003	<0.0003	0.0024 J	<0.003	<0.10	0.0005 J	0.0188	NA	<0.002	<0.002	<0.0005	<0.304	<0.5450	<0.849
	05/16/19	0.0008	<0.002	0.0474	<0.0003	<0.0003	0.0030 J	<0.003	<0.10	0.0003 J	0.0221	<0.00008	<0.002	<0.002	<0.0005	0.385	1.43	1.82
	08/19/19	<0.0008	<0.002	0.0631	<0.0003	<0.0003	0.00218 J	<0.003	0.145 J	0.00139	0.0251	<0.00008	<0.002	<0.002	<0.0005	1.12	3.52	4.64
	05/11/20	<0.000800	0.0116	0.23	0.00166	<0.000300	0.037	0.00883	<0.100	0.0249	0.0371	<0.0000800	<0.00200	0.00678	0.000651	5.96	10.7	16.6
	9/10/2020	NA	0.00252 J	0.0922	0.000375 J	NA	0.00723	<0.00300	<0.100	0.00402	0.0235	NA	<0.00200	0.00254 J	<0.000500	2.59	6.72	9.31

Notes:

- Abbreviations: mg/l - milligrams per liter; pCi/L - picocuries per liter.
- <sup>^</sup> - Sum of Ra 226 and Ra 228 concentrations. Non-detect isotope results were assigned a value equal to the minimum detectable concentration.
- J - Concentration is below method quantitation limit; result is an estimate.
- NA - not analyzed. Groundwater sample analyses for the second semi-annual sampling events were in some instances limited to Appendix IV parameters detected during the preceding first semi-annual sampling event in accordance with 40 CFR § 257.95(d)(1).



**ATTACHMENT 1**  
**ALTERNATE SOURCE DEMONSTRATION REPORT**



## Alternate Source Demonstration

*Oak Grove Steam Electric Station*

*FGD Ponds - Robertson County, Texas*

Submitted to:

**Oak Grove Management Company LLC**

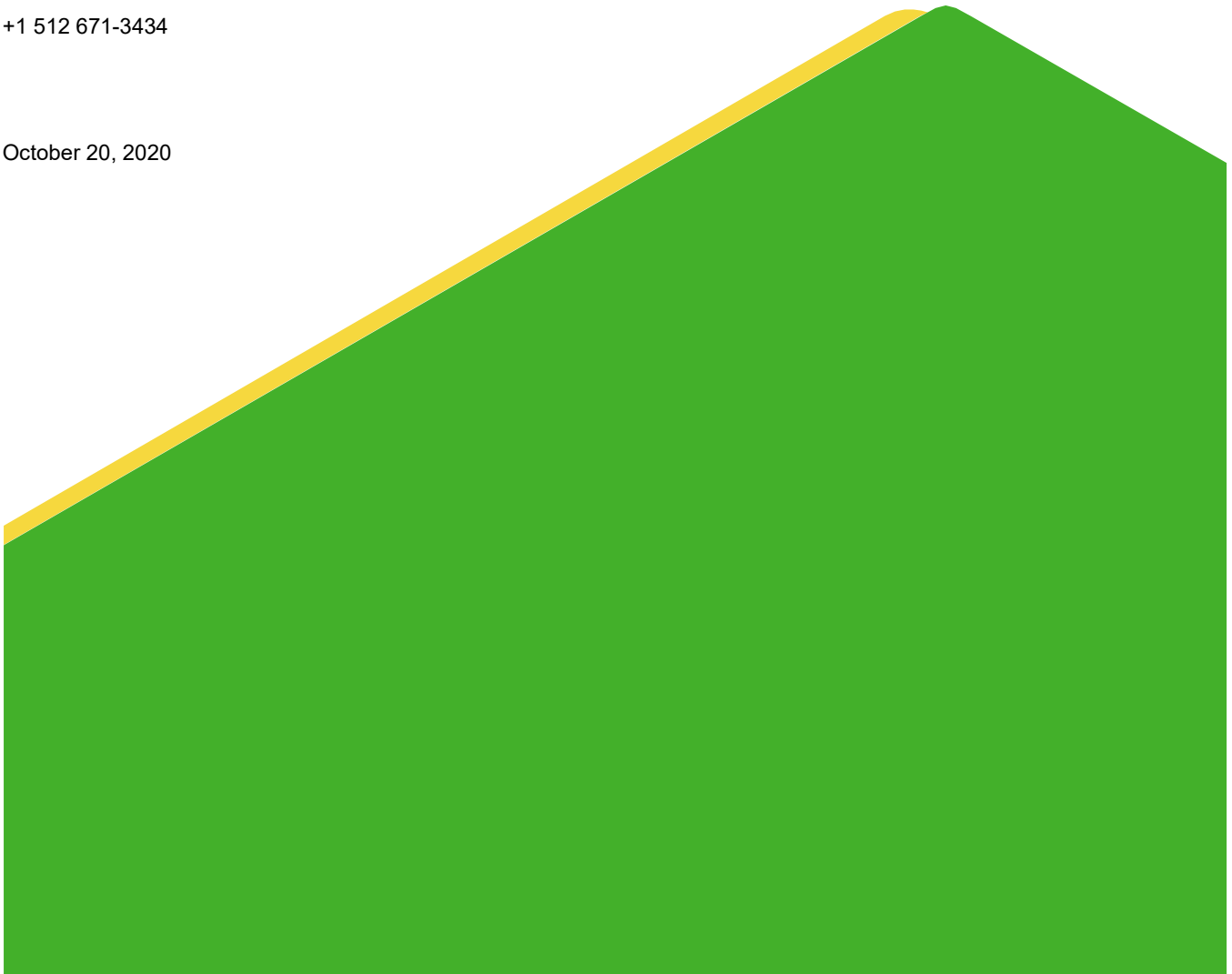
Submitted by:

**Golder Associates Inc.**

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October 20, 2020



## Executive Summary

In accordance with the United States Environmental Protection Agency (US EPA) Coal Combustion Residual (CCR) Rule (40 C.F.R. Part 257 Subpart D; 80 Fed. Reg. 21302 (April 17, 2015) (CCR Rule or The Rule), this Alternate Source Demonstration (ASD) was prepared to document that a source other than the FGD Ponds at the Oak Grove Steam Electric Station (the Site) caused a Statistically Significant Level (SSL) of lithium identified in monitoring well FGD-5 during the first semi-annual assessment monitoring event in 2020.

The following lines of evidence support the conclusion that the SSL of lithium in groundwater samples collected from FGD-5 of the FGD Ponds (FDG Pond A, FDG Pond B and FDG Pond C) monitoring well network is not caused by a release of CCR porewater/leachate, but instead results from an alternate source:

- The range of lithium concentrations in samples collected from FGD-5 (0.145 to 0.170 mg/L) is similar to that of samples in upgradient wells FGD-8 and FGD-11 (max 0.149 mg/L since 2015). The groundwater at FGD-5 is of the sodium-chloride type, which is the same type as the upgradient wells (FGD-8 and FGD-11), whereas samples from the FGD ponds indicate water of a magnesium-chloride dominant water type, indicating different water types for the groundwater system and FGD ponds.
- Concentrations of CCR tracers boron, chloride and sulfate, and ratios of boron to lithium differ significantly between FGD pond water and groundwater in the vicinity of FGD-5. Therefore, lithium in groundwater at FGD-5 cannot have originated from CCR porewater as selective dilution of lithium cannot occur.
- FGD-5 is downgradient from FGD Pond C and cross-gradient (and at times upgradient) from FGD Pond A and B. FGD Pond C has only been in operation since 2016. However, lithium concentrations in groundwater at FGD-5 have remained consistent since 2015 (0.145 to 0.170 mg/L). Therefore, lithium concentrations were already elevated in groundwater at FGD-5 prior to ash additions to FGD Pond C, which is the only FGD pond upgradient of FGD-5. Since FGD-5 is not directly downgradient from FGD Ponds A or B, it would not receive porewater from these ponds unless diluted with natural groundwater flowing to FGD-5 from upgradient areas. In groundwater samples collected from FGD-5, concentrations of CCR tracers (boron, sulfate and chloride) that are elevated in FGD Pond A and B water are similar to concentrations in background wells FGD-8 and FGD-11. Furthermore, lithium SSLs have not been observed in CCR monitoring wells directly downgradient of FGD Pond A or B (e.g., FGD-2, FGD-3, FGD-4 and FGD-6), or CCR monitoring wells FGD-1 and FGD-12, which are downgradient and more proximal to FGD Pond C than FGD-5. Thus, it is highly unlikely that lithium measured in FGD-5 groundwater originates from a release from any of the FGD ponds.
- Lithium is naturally occurring in soils at the Site. Sequential extraction of lithium from soil samples indicate total lithium concentrations ranging from 9 to 20 mg/kg, with the majority (76 to 97%) of lithium present in the non-environmentally available acid/sulfide and residual/refractory fractions.

In accordance with §257.95(g)(3), this ASD demonstrates that a source other than the FGD Ponds caused the SSL of lithium identified at monitoring well FGD-5.

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Table 1: Analytical Results: Groundwater and Pond Samples

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- Figure 1: Lithium Concentrations in Groundwater Samples Collected from FGD-5
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## EXHIBITS

- Exhibit 1: Site Location Map
- Exhibit 2: Potentiometric Surface Map, May 2020

## APPENDICES

Appendix A: Sequential Extraction Results

## Certification

This document and all attachments were prepared by Golder Associates Inc. under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I hereby certify that the alternative source demonstration at the referenced facility meets the requirements of 40 C.F.R. § 257.94(e)(2) of the CCR Rule.

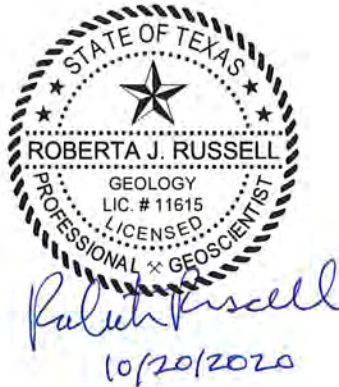
### Golder Associates Inc.



Patrick J. Behling, P.E.  
Principal Engineer



Roberta Russell, P.G.  
Senior Geologist



## 1.0 INTRODUCTION

In accordance with the United States Environmental Protection Agency (US EPA) Coal Combustion Residual (CCR) Rule (40 C.F.R. Part 257 Subpart D; 80 Fed. Reg. 21302 (April 17, 2015) (CCR Rule or The Rule), this Alternate Source Demonstration (ASD) was prepared to document that a source other than the FGD Ponds at the Oak Grove Steam Electric Station (the Site) caused a Statistically Significant Level (SSL) of lithium identified in monitoring well FGD-5 during the first semi-annual assessment monitoring event in 2020. This document satisfies the requirements of § 257.95(g)(3)(ii) which allows the owner or operator to demonstrate that a source other than the CCR Unit has caused an SSL and that the SSL was the result of an alternate source or resulted from errors in sampling, analysis, statistical evaluation, or natural variation in groundwater quality.

As documented by this report, the SSL for lithium at the FGD Pond monitoring well FGD-5 is attributed to naturally occurring sources in subsurface aquifer materials and is not caused by the CCR unit.

## 2.0 SITE DESCRIPTION AND BACKGROUND

Oak Grove Management Company LLC owns OGSES located approximately 10 miles north of Franklin, Robertson County, Texas (Exhibit 1). The OGSES consists of two 800-megawatt power generation units which burn lignite and coal. CCR, including fly ash, bottom ash, and gypsum are generated as part of OGSES unit operations. Currently, CCRs generated at the OGSES are managed by Luminant in part within the FGD Pond Area (PBW, 2017a).

The FGD-A Pond, FGD-B Pond, and FGD-C Pond (collectively referred to as the “FGD Ponds”) are located approximately 2,500 feet northwest of the power generation units at the Site (Exhibit 1). FGD-A Pond and FGD-B Pond were placed in service during approximately 2007. Use of FGD-C Pond began in 2016 (PBW, 2017a).

### 2.1 FGD Pond Area Monitoring Network

The monitoring well network for the FGD Pond Area consists of 9 monitoring wells (FGD-1, FGD-2, FGD-3, FGD-4, FGD-5, FGD-6, FGD-8, FGD-11 and FGD-12) screened within the uppermost groundwater-bearing unit. Two wells, FGD-8 and FGD-11, are considered background monitoring wells. Monitoring well locations are shown on Exhibit 1.

### 2.2 Geologic and Hydrogeologic Setting

The FGD Ponds are located in the outcrop area of the Eocene-aged Wilcox Group (Barnes, 1970). Previous boring investigations indicate the geology in the FGD Pond Area primarily consists of an upper zone of relatively thick, interbedded sand and clay strata and a lower zone of interbedded silty to clayey sand and well sorted sand. The uppermost groundwater-bearing unit at the Site occurs in the lower zone of interbedded silty to clayey sand (PBW, 2017a).

## 3.0 STATISTICAL ANALYSIS METHODS

The following sections summarize the assessment monitoring at the FGD Pond Area, present the statistical analysis method for evaluation of assessment monitoring constituents (i.e., Appendix IV parameters) as they pertain to this ASD, discuss the test methods used for soil samples, and describe the geochemical evaluation.

During assessment monitoring, concentrations of Appendix IV constituents are compared to an applicable Groundwater Protection Standard (GWPS). As specified in 40 C.F.R. § 257.95(h), the GWPS is the higher of the

Maximum Contaminant Level (MCL) or the background concentration. For lithium, the GWPS is the background concentration of 0.15 mg/L, which is calculated as the upper prediction limit (UPL) of data collected from upgradient wells during the background period, prior to the start of the detection and assessment monitoring period.

Statistical analysis of the data was performed in accordance with the Statistical Analysis Plan for CCR Groundwater Monitoring (PBW, 2017b) and the USEPA Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-Unified Guidance (USEPA, 2009). The statistical analysis included an evaluation of confidence intervals for each of the Appendix IV parameter data sets for each well to evaluate whether constituent concentrations were present at concentrations above GWPSs.

Figure 1 shows the lithium concentrations in FGD-5 since 2015 compared to the GWPS. The calculated lower and upper confidence limits for lithium based on sample data collected from FGD-5 are 0.152 mg/L and 0.156 mg/L, respectively. An SSL was indicated at FGD-5 because the lower confidence limit based on the lithium data set from FGD-5 exceeded the GWPS of 0.152 mg/L. As indicated on Figure 1, lithium concentrations exceeded the GWPS in FGD-5 during two sampling events conducted in 2015, prior to the completion of FGD Pond C (in 2016), which is the only FGD pond that is directly upgradient of FGD-5. Furthermore, the highest sample concentration (0.170 mg/L) in FGD-5 occurred in November 2015, prior to the completion of FGD-C.

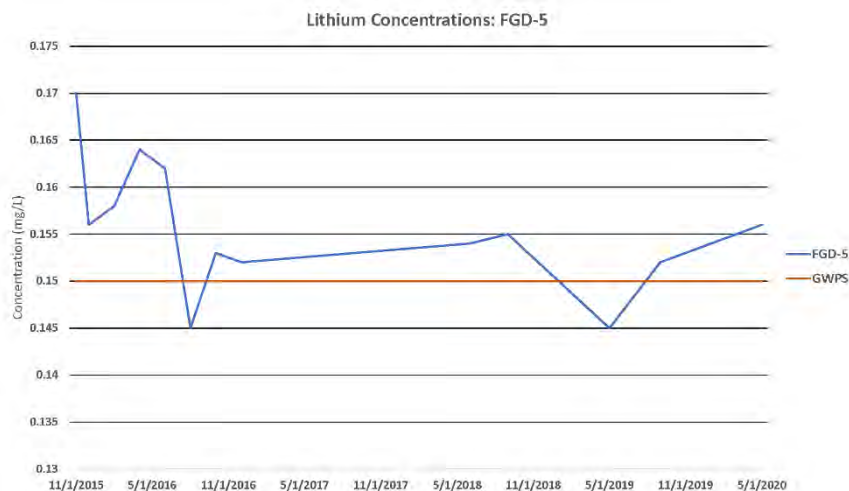


Figure 1: Lithium concentrations in groundwater samples collected from FGD-5.

### 3.1 Assessment Monitoring

Pursuant to 40 C.F.R. § 257.95(a), FGD Pond Area monitoring wells are sampled for all Appendix IV parameters. The 2015 through 2020 Appendix IV groundwater sample data were compared to the GWPS using confidence intervals.

### 3.2 Statistically Significant Levels

As stated in the Appendix IV SSL notification dated February 6, 2019, SSLs for cobalt and lithium were identified at the FGD Ponds during 2018 assessment monitoring completed in accordance with 40 C.F.R. § 257.95. No SSLs were identified for cobalt in subsequent semi-annual assessment monitoring completed during 2019 and 2020. No SSLs were identified for lithium in subsequent semi-annual assessment monitoring events in 2019;

however, an SSL notification for lithium was posted on August 21, 2020 based on the first 2020 semi-annual assessment monitoring event results.

### 3.3 Test Methods for Soil

#### 3.3.1 Sequential Extraction

Chemical analysis of soils for total metals and sequential extraction analysis was conducted on three soil samples collected from FGD Pond Area within the groundwater-bearing unit (Appendix A). The sequential extraction procedure (SEP) consists of a seven-step metals extraction from solids to determine their potential environmental stability. The seven-step SEP is defined by specific extraction steps as illustrated and described (based on a modified Tessier et al. 1979 method) in Figure 2.

SEQUENTIAL EXTRACTION PROCEDURE			
ENVIRONMENTALLY AVAILABLE ↑ Increasing Availability	Step 1	Exchangeable Fraction:	This extraction includes trace elements that are electrostatically adsorbed to overburden minerals
	Step 2	Carbonate Fraction:	This extraction targets trace elements that are adsorbed or otherwise bound to carbonate minerals
	Step 3	Non-Crystalline Materials Fraction:	This extraction targets trace elements that are complexed by amorphous minerals
	Step 4	Metal Hydroxide Fraction:	This extraction targets trace elements bound to hydroxides of iron, manganese, and/or aluminum
	Step 5	Organic Fraction:	This extraction targets trace elements strongly bound via chemisorption to organic material
NON-ENVIRONMENTALLY AVAILABLE ↓ Increasing Extraction Strength	Step 6	Acid/Sulfide Fraction:	The extraction is used to identify trace elements precipitated as sulfide minerals
	Step 7	Residual Fraction:	Trace elements remaining in the overburden after the previous extractions will be distributed between silicates, phosphates, and refractory oxide

Figure 2: Overview of sequential extraction procedure.

Steps 1 through 7 represent an increasing amount of target metals that can be removed into solution from the solid phase. For instance, metals bound in the carbonate fraction are much more likely to become mobile due to changes in groundwater chemistry than metals bound in a sulfide or residual fraction. The total concentration of a metal measured from all seven steps can be compared to the concentration determined from the total metal analysis for compositional accountability. Metals extracted in Steps 1 through 5 are considered environmentally available, whereas metals extracted in Steps 6 and 7 are present in non-environmentally available fractions and are not expected to be released under conditions typically encountered in aquifers, except in the case of acidification or other excursions from typical groundwater conditions (Tessier et al., 1979).



## 4.0 ALTERNATE SOURCE DEMONSTRATION

The May 2020 SSL of lithium in groundwater at the monitoring well FGD-5 is not caused by a release of CCR porewater/leachate but instead results from an alternate source. The following lines of evidence support this conclusion:

- **The range of lithium concentrations in samples collected from FGD-5 is similar to that of samples in background wells. Additionally, the FGD pond water is a magnesium-chloride type water whereas water at FGD-5 is of the sodium-chloride type, which is the same type as background wells.**

Lithium concentrations in groundwater samples from FGD-5 range from 0.145 to 0.170 mg/L, which is similar to the upper range of concentrations in background well FGD-8 (max of 0.149 mg/L). In addition, as shown on the Piper diagram presented on Figure 3, the groundwater at FGD-5 is a sodium-chloride type, which is the same water type of the groundwater encountered within the background wells FGD-8 and FGD-11. The FGD pond water samples from FGD Pond A and FGD Pond B are the magnesium-chloride type. Because the lithium concentrations and water chemistry in groundwater samples collected from FGD-5 are similar to those encountered in background wells, it is more likely that groundwater at FGD-5 is representative of background conditions, including the presence of naturally-occurring lithium in groundwater. Groundwater and pond water ASD data are summarized in Table 1.

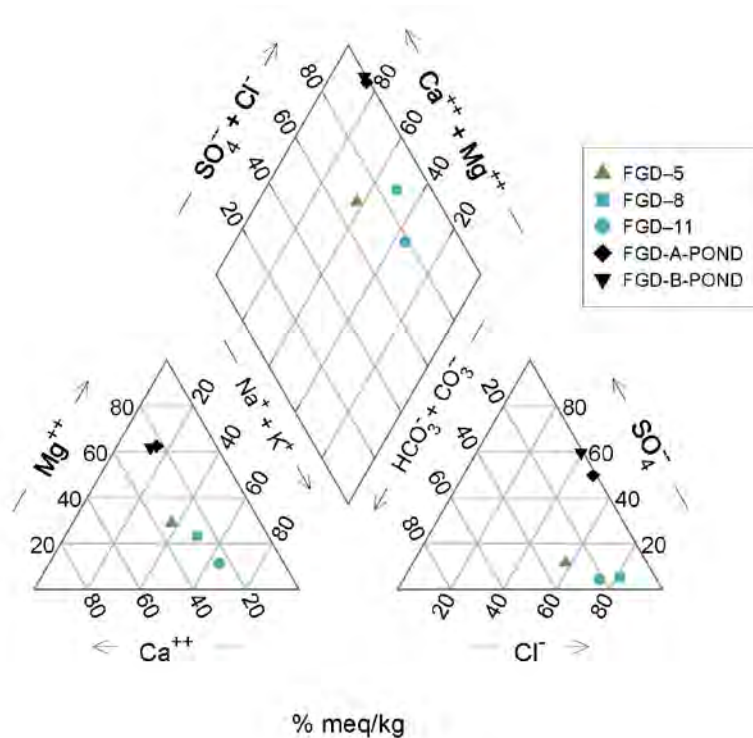
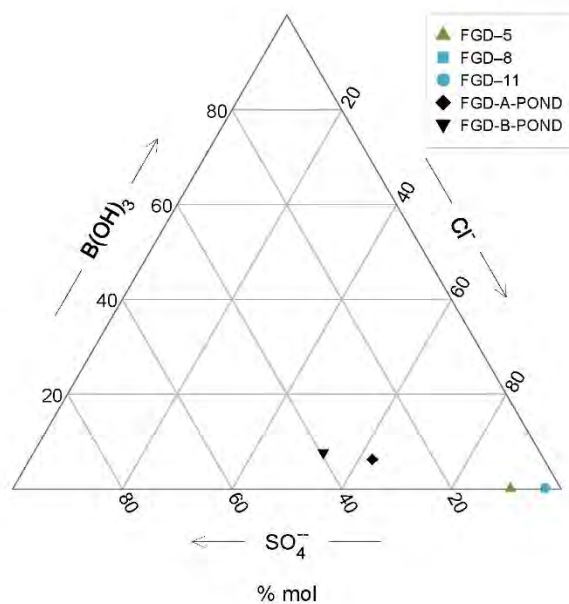


Figure 3: Piper diagram showing water chemistry of FGD-5, FGD-8, FGD-11 and FGD-A Pond and FGD-B Pond samples.

- **Concentrations of CCR tracers boron, chloride and sulfate, and ratios of boron to lithium differ significantly between FGD pond water and groundwater in the vicinity of FGD-5.**

Boron has been historically elevated in FGD pond samples (>72 mg/L). However, boron in groundwater samples collected from FGD-5 has never exceeded 0.2 mg/L since 2015 (when sampling started). Boron at well FGD-5 has also remained well below the maximum measured in background wells FGD-8 and FGD-11 (0.635 mg/L). Similarly, sulfate (max 83.8 mg/L) and chloride (max 307 mg/L) concentrations in FGD-5 are low compared to FGD pond samples (max of 4,680 mg/L and 3,440 mg/L, respectively). These differences are shown graphically in the ternary diagram presented in Figure 3. It should be noted that lithium concentrations in FGD pond water samples are generally similar to FGD-5. However, if lithium in groundwater at FGD-5 originated from the FGD ponds, sulfate, chloride and boron would also be expected to be comparatively higher. Additionally, the ratio of lithium to boron in FGD pond samples was approximately 1:500, while the ratio in groundwater from FGD-5 was approximately 1:1. Therefore, lithium at FGD-5 did not originate from CCR porewater as selective dilution of lithium cannot occur, assuming conservative transport.



**Figure 4: Ternary diagram showing relative molar concentrations of boron, chloride and sulfate for FGD ponds, FGD-5, and background wells FGD-8 and FGD-11.**

- **FGD-5 is down-gradient from FGD Pond C, which has only been in operation since 2016. However, lithium in groundwater at FGD-5 has remained consistent since sampling began in 2015.**

Monitoring well FGD-5 is cross-gradient (and at times upgradient) to FGD Ponds A and B and directly down-gradient from FGD Pond C (Exhibit 2). FGD-5 has been sampled since 2015 and, as shown on Figure 1, lithium concentrations have remained consistently between 0.145 and 0.170 mg/L. If the lithium occurrence were due to a plume originating from FGD Pond C, its concentrations would be expected to increase. FGD Pond C was not in operation until 2016; thus, lithium concentrations were already within ranges normal for FGD-5 before CCR was placed in FGD Pond C. Since FGD-5 is cross-gradient to FGD Ponds A and B, any porewater reaching FGD-5 from FGD Ponds A or B would be significantly diluted with natural groundwater flowing to FGD-5 from upgradient areas. Furthermore, lithium SSLs have not been observed in CCR monitoring wells directly downgradient of FGD Pond A or B (e.g., FGD-2, FGD-3, FGD-4 and FGD-6), or CCR monitoring wells FGD-1 and FGD-12, which are downgradient and more proximal to FGD Pond C than FGD-5. As discussed previously, concentrations of boron,

chloride and sulfate, which are mobile constituents and elevated in FGD Pond water, are similar to concentrations in background wells FGD-8 and FGD-11. Thus, it is very unlikely that lithium measured in FGD-5 groundwater originates from FGD Ponds A or B.

■ **Lithium is naturally occurring at the Site based on sequential extraction of lithium from soil.**

Total lithium concentrations in the three soil samples range from 9 to 20 mg/kg, which is within the range of naturally-occurring lithium in the Earth's crust and soils (18 to 65 mg/kg and 5 to 130 mg/kg, respectively; Smith and Huyck (1999)). Most of the lithium (between 76 and 97% of the total) is sequestered in the acid sulfide and refractory component of the soil material (SEP Steps 6 and 7). The environmentally-available fraction of lithium (which could contribute to concentrations observed at FGD-5) is less than 24% of the total, the largest of which is represented by the metal hydroxide phase.

## 5.0 ALTERNATE SOURCE DEMONSTRATION SUMMARY

The evaluation presented in this document demonstrates the statistically significant level of lithium identified in groundwater is due to the presence of naturally-occurring lithium and not caused by releases from the CCR unit. The following lines of evidence demonstrate the natural occurrence of lithium in groundwater at FGD-5:

- FGD-5 lithium concentrations are similar in range to concentrations in background wells. Additionally, the water type at FGD-5 is the same as background wells and different from FGD pond water.
- Concentrations of near-conservative CCR tracers boron, chloride and sulfate, and ratios of boron to lithium differ significantly between FGD pond water and groundwater in the vicinity of FGD-5.
- FGD-5 is located downgradient from FGD Pond C. However, lithium concentrations in FGD-5 have remained consistent since before FGD Pond C was put in operation.
- Lithium is naturally occurring at the Site based on sequential extraction of lithium from soil samples collected in the uppermost groundwater-bearing unit.

Based on these findings, the FGD Ponds are not the source for the SSL of lithium in FGD-5 samples. Instead, the SSL can be attributed to the presence of naturally-occurring lithium in subsurface aquifer materials

## 6.0 CONCLUSION

In accordance with 40 C.F.R. § 257.95(g)(3), this ASD addresses the SSL of lithium at FGD-5. Review of geochemical data indicates that the exceedance of lithium identified at FGD-5 is not the result of a release from the associated ash ponds at OGSES FGD Pond Area but can be attributed to the presence of naturally-occurring lithium in subsurface aquifer materials

## 7.0 REFERENCES

- Barnes, Virgil.E, 1970. Geologic Atlas of Texas, Waco Sheet. Texas Bureau of Economic Geology.
- Pastor, Behling and Wheeler, LLC (PBW), 2017a. Coal Combustion Residual Rule Groundwater Monitoring System Certification, Oak Grove Steam Electric Station FGD Pond Area, Robertson County, Texas. October 16.
- PBW, 2017b. Coal Combustion Residual Rule Statistical Analysis Plan, Oak Grove Steam Electric Station FGD Pond Area, Robertson County, Texas.
- Smith, K. and Huyck, H., 1999. An overview of the abundance, relative mobility, bioavailability, and human toxicity of metals. In: Plumlee and Logsdon (eds.): The Environmental Geochemistry of Mineral Deposits, Reviews in Economic Geology Vol. 6A, pp.29-70.
- Tessier, A., Campbell, P.G. and Bisson, M., 1979. Sequential extraction procedure for the speciation of particulate trace metals. Analytical chemistry, 51(7), pp.844-851.
- United States Environmental Protection Agency (USEPA), 2009. Unified Guidance Document: Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, EPA 530-R-09-007. March.
- USEPA. Federal Register. Volume 80. No. 74. Friday April 17, Part II. Environmental Protection Agency. 40 CFR Parts 257 and 261. Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule/ [EPA-HQ-RCRA-2009-0640; FRL-9919-44-OSWER] (2015).

## Table

**Table 1**  
**Analytical Results**  
**Groundwater and Pond Samples**  
**Oak Grove Steam Electric Station FGD Pond Area**

Sample Location	Sample Date	Calcium mg/L	Magnesium mg/L	Potassium mg/L	Sodium mg/L	Alkalinity mg/L	Chloride mg/L	Sulfate mg/L	Fluoride mg/L	Boron mg/L	Lithium mg/L	Cobalt mg/L	Iron mg/L
FGD-1	5/16/2019	19.5	11.2	2.11	49.4	52.8	62.4	78.7	0.362 J	0.0803	0.0442	0.003	0.186
FGD-2	5/16/2019	38.9	16.7	2.57	198	157	260	70.7	0.383 J	0.105	0.0228	0.003	0.0799
FGD-3	5/16/2019	60.1	33.6	2.5	277	533	117	182	0.776	0.117	0.057	0.0052	0.126
FGD-4	5/16/2019	41.7	18.6	1.62	160	201	205	41.7	0.327 J	0.0733	0.0325	0.003	0.103
FGD-5	5/16/2019	77.7	50	3.46	123	237	287	67.2	0.579	0.108	0.145	0.003	0.03
FGD-6	5/16/2019	20.3	6.61	0.706	225	262	170	51.3	0.669	0.116	0.0068 J	0.0132	4.86
FGD-8	5/16/2019	314	204	19.2	792	516	2040	173	0.1	0.0687	0.0086 J	0.0146	263
FGD-11	5/16/2019	85	30.6	4.13	328	256	566	50.9	0.38 J	0.108	0.0145	0.003	1.28
FGD-12	5/16/2019	6.79	2.97	1.55	20.1	36.6	15.6	15	<0.100	0.0723	0.0221	0.003	0.425
FGD-A-POND	6/6/2019	487	809	82.1	270	58.6	1510	3260	17.2	72.1	0.167	0.003	0.03
FGD-B-POND	6/6/2019	458	796	86.9	287	68	1470	3040	17.5	73.3	0.172	0.003	0.03
FGD-1	5/11/2020	37.8	17.1	2.56	82	67.6	146	79.5	0.231 J	0.121	0.0548	0.0495	1.09
FGD-2	5/11/2020	217	74.2	5.73	507	114	1150	286	<0.100	0.605	0.028	0.003	0.0636
FGD-3	5/11/2020	42.3	23.5	2.14	230	434	70.2	129	0.8	0.152	0.0498	0.00332	0.0395
FGD-4	5/11/2020	40.6	14.7	1.53	204	247	198	52.9	0.3 J	0.145	0.0166	0.003	0.12
FGD-5	5/11/2020	100	52	3.64	125	232	307	83.8	0.413	0.165	0.156	0.003	0.0483
FGD-6	5/11/2020	27.4	7.17	0.743	235	275	189	70.7	0.292 J	0.109	0.0088 J	0.003	0.582
FGD-8	5/11/2020	381	198	19.9	801	518	2240	188	0.1	0.129	0.0152	0.0084	220
FGD-11	5/11/2020	103	28.5	4.42	306	230	560	43.3	0.365 J	0.166	0.0132	0.003	0.225
FGD-12	5/11/2020	15.6	8.03	5.31	22.1	34.6	19.3	19.9	<0.100	0.149	0.0371	0.00883	32.5
FGD-A-POND	5/11/2020	895	1490	195	563	134	3440	4680	20.6	104	0.422	0.00625	0.15
FGD-B-POND	5/11/2020	696	1020	106	351	68.8	1940	3930	15.6	84.4	0.182	0.003	0.17

Notes:

mg/L - milligrams per liter

SU - standard units

J - estimated value

**Table 1**  
**Analytical Results**  
**Groundwater and Pond Samples**  
**Oak Grove Steam Electric Station FGD Pond Area**

Sample Location	Sample Date	Iron (Fe3+) mg/L	Iron (Fe2+) mg/L	Selenium mg/L	Nitrate-N mg/L	Phosphorus mg/L	pH SU	Eh mV	TDS mg/L
FGD-1	5/16/2019	0.186	0.05	0.002	0.1	0.473	6.63	-32	320
FGD-2	5/16/2019	0.0799	0.05	0.0214	1.54	0.237	6.86	-91	729
FGD-3	5/16/2019	0.126	0.05	0.0423	1.41	0.096	6.73	-56	1100
FGD-4	5/16/2019	0.103	0.05	0.002	0.1	0.251	6.57	-41	651
FGD-5	5/16/2019	0.05	0.05	0.002	0.859	0.176	6.46	-31	801
FGD-6	5/16/2019	4.86	0.05	0.002	0.1	0.714	6.85	-28	710
FGD-8	5/16/2019	61	202	0.00274	0.107	0.219	6.67	-42	3970
FGD-11	5/16/2019	1.28	0.05	0.002	0.1	0.2	6.83	-48	1350
FGD-12	5/16/2019	0.425	0.05	0.002	1.42	0.168	6.52	-19	140
FGD-A-POND	6/6/2019	0.05	0.05	1.3	1.87	0.03	6.52	--	7410
FGD-B-POND	6/6/2019	0.00427	0.05	1.2	3.24	0.03	6.57	--	7240
FGD-1	5/11/2020	0.732	0.358	0.002	0.1	0.37	6.95	-55	448
FGD-2	5/11/2020	0.0636	0.05	0.0208	2.52	0.052	6.61	-27	2300
FGD-3	5/11/2020	0.05	0.05	0.00993	0.535	0.053	6.62	16	777
FGD-4	5/11/2020	0.12	0.05	0.002	0.1	0.139	6.62	-46	702
FGD-5	5/11/2020	0.05	0.05	0.002	0.563	0.03	6.82	-15	836
FGD-6	5/11/2020	0.582	0.05	0.002	0.129	0.076	6.75	-17	746
FGD-8	5/11/2020	68	152	0.0021	1.64	0.03	6.69	-14	4090
FGD-11	5/11/2020	0.225	0.05	0.002	0.1	0.064	6.74	-45	1300
FGD-12	5/11/2020	32.5	0.05	0.00678	1.22	0.056	6.59	-33	198
FGD-A-POND	5/11/2020	0.15	0.05	4.71	6.27	0.03	6.59	--	13200
FGD-B-POND	5/11/2020	0.17	0.05	0.681	2.23	0.03	6.64	--	8890

Notes:

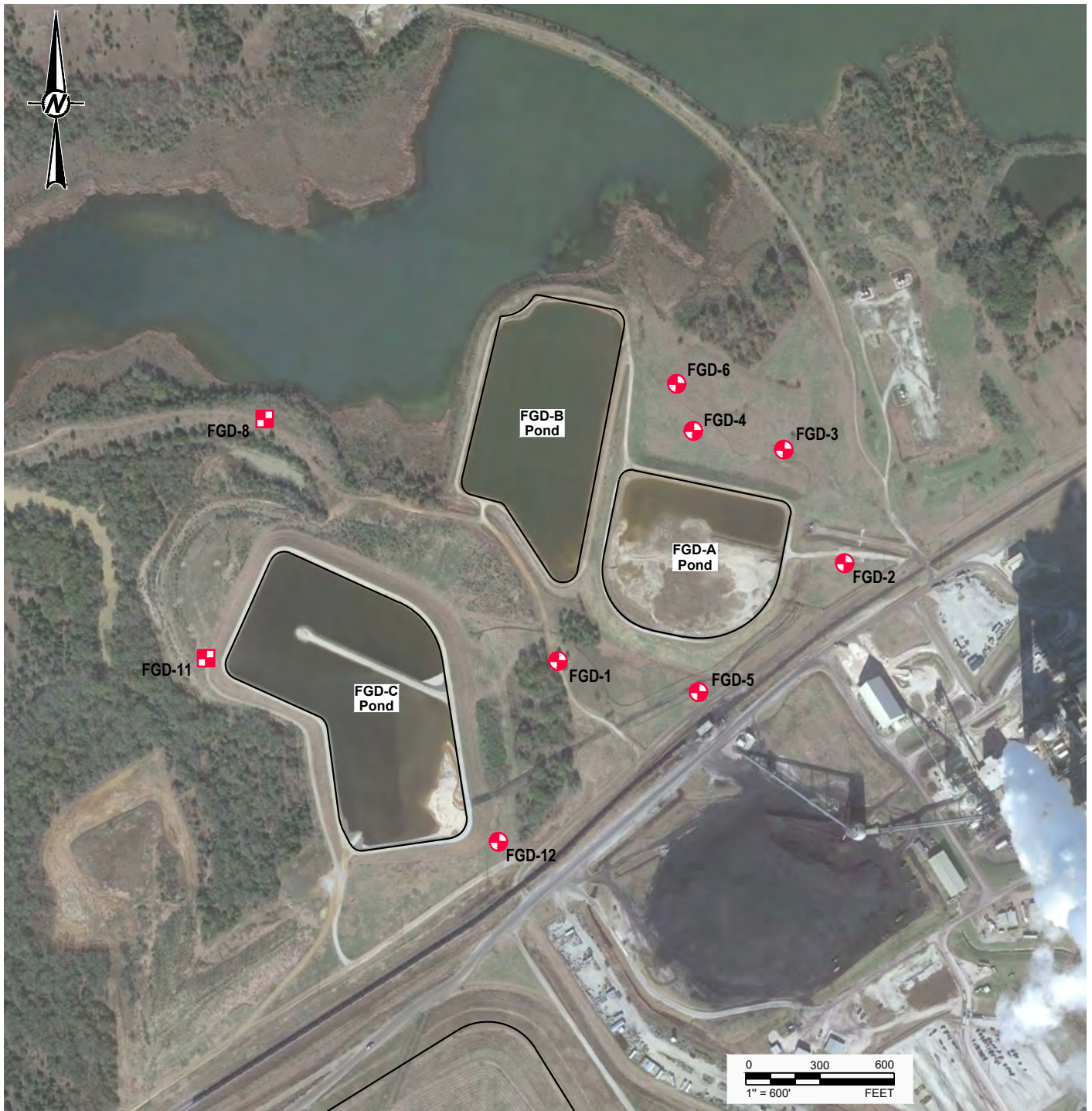
mg/L - milligrams per liter

SU - standard units



J -estimated value

## Exhibits





**LEGEND**

-  DOWNGRADIENT CCR MONITORING WELL
-  BACKGROUND CCR MONITORING WELL

CLIENT  
**LUMINANT**

PROJECT  
**OAK GROVE STEAM ELECTRIC STATION  
ROBERTSON COUNTY, TEXAS**

TITLE  
**SITE LOCATION MAP**

CONSULTANT



YYYY-MM-DD	2020-01-23
DESIGNED	AJD
PREPARED	AJD
REVIEWED	WVW
APPROVED	WVW

REFERENCE(S)  
BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 12/9/18.

PROJECT NO.  
**1912262**

REV.  
**0**

EXHIBIT  
**1**





**LEGEND**

- CCR MONITORING WELL
- BACKGROUND CCR MONITORING WELL
- CCR DELINEATION WELL
- (410.06)** GROUNDWATER POTENTIOMETRIC SURFACE (FT MSL)
- 400** GROUNDWATER POTENTIOMETRIC SURFACE CONTOUR (C.I. = 1 FT)

**NOTE(S)**

1. NATURE AND EXTENT DELINEATION IS NOT NECESSARY BASED ON THE UPDATED STATISTICAL EVALUATION.

**REFERENCE(S)**

BASE MAP TAKEN FROM GOOGLE EARTH, IMAGERY DATED 12/9/18.

CLIENT  
**LUMINANT**

PROJECT  
**OAK GROVE STEAM ELECTRIC STATION  
ROBERTSON COUNTY, TEXAS**

TITLE  
**FGD PONDS  
POTENTIOMETRIC SURFACE MAP  
MAY 2020**

CONSULTANT



PROJECT NO.  
**19134019**

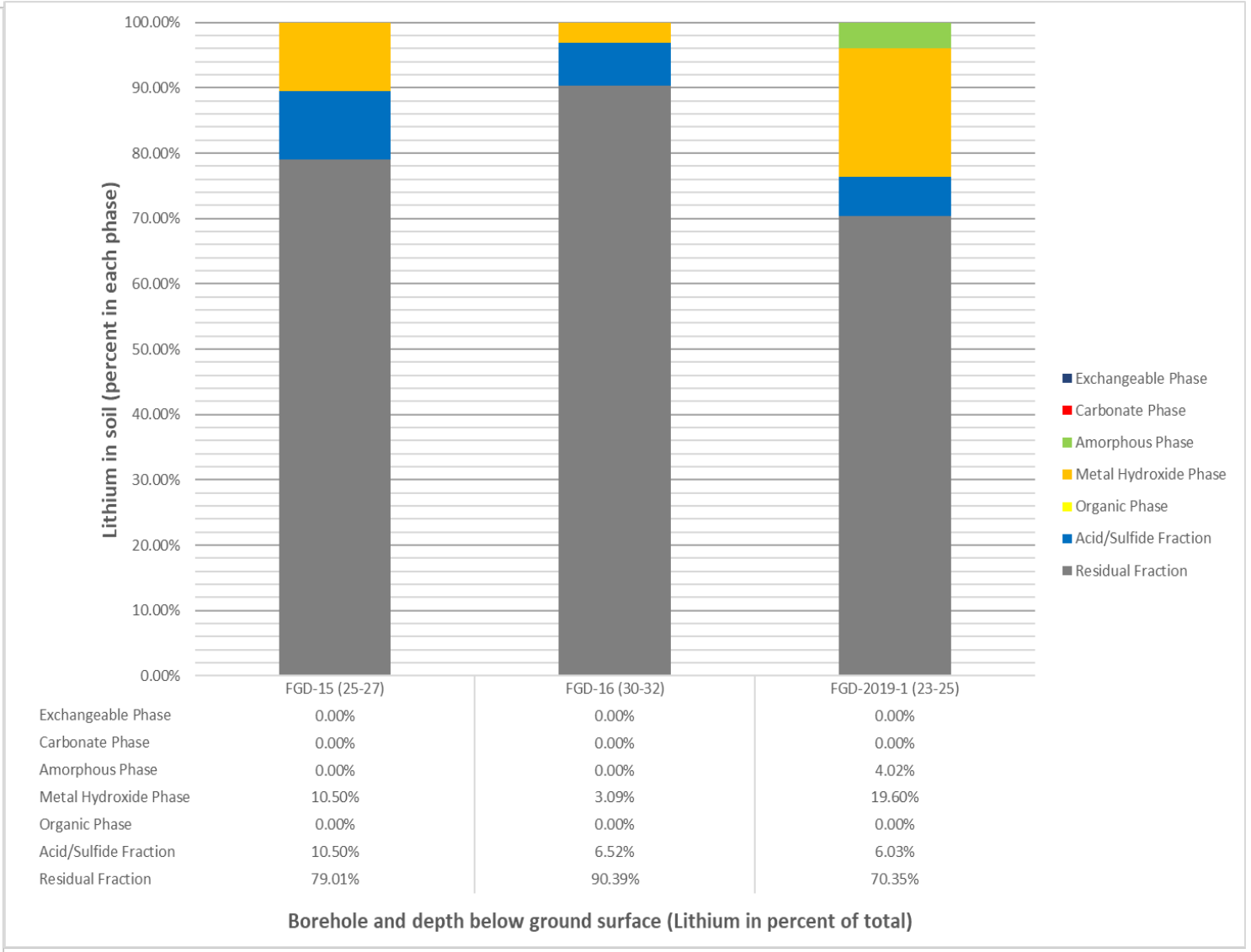
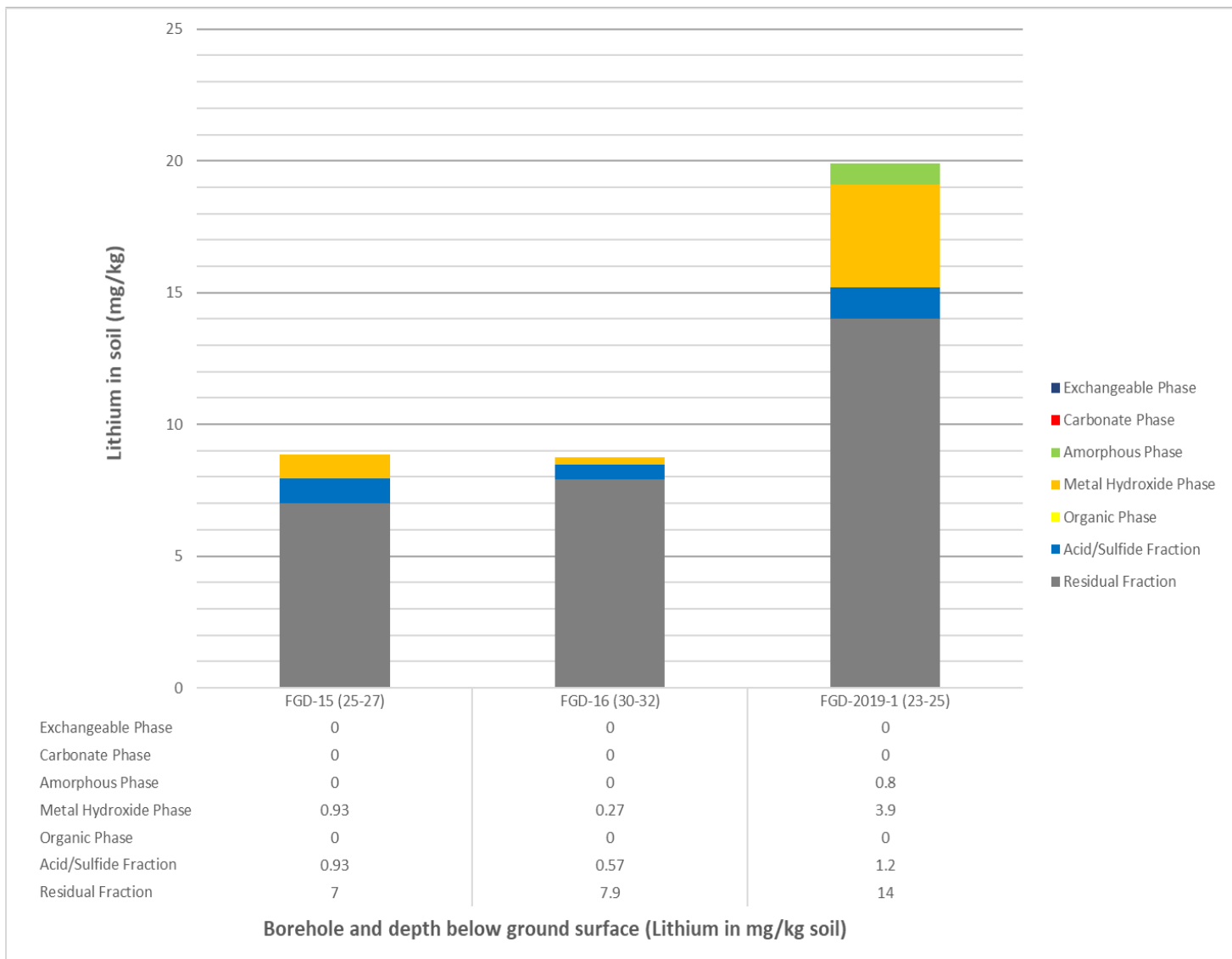
YYYY-MM-DD	2020-09-30
DESIGNED	AJD
PREPARED	AJD
REVIEWED	WVW
APPROVED	WVW

REV.  
**0**

EXHIBIT  
**2**

**APPENDIX A**

# Sequential Extraction Results



CLIENT  
LUMINANT OAK GROVE SES  
FGD POND AREA

CONSULTANT



PROJECT  
ASSESSMENT OF CORRECTIVE MEASURES  
GEOCHEMICAL ASSESSMENT

TITLE  
SEQUENTIAL EXTRACTION

PROJECT NO.  
19134019

PHASE  
1000

REV.  
A

FIGURE



[golder.com](http://golder.com)