



RE: 1809-N

April 6, 2018

Certified Mail 7016 2070 0000 2490 8439  
Return Receipt Requested

Ken Kalman, Project Manager  
Fuel Cycle Facilities Branch  
Division of Fuel Cycle Safety and Safeguards  
Office of Nuclear Material Safety  
U.S. Nuclear Regulatory Commission  
Two White Flint North, Mail Stop T8F5  
Washington, D.C. 20852-2738

RE: License No. SUB-1010; Docket No. 40-8027  
Ammonium Nitrate Fertilizer Program  
2017 Completion Report

Dear Mr. Kalman:

Please find enclosed one (1) copy of the 2017 Completion Report for the Ammonium Nitrate Fertilizer Program conducted by Sequoyah Fuels Corporation (SFC).

In accordance with License No. SUB-1010 requirements, the report describes the application of facility produced ammonium nitrate fertilizer on SFC lands near Gore, Oklahoma, and the results obtained from comprehensive soil and vegetation monitoring programs.

Should you require further information, please contact me at 918-489-5511. (Ext. 226)

Sincerely,

John H. Ellis  
President

Enclosure

cc: Angie Radcliffe (ODEQ)

**AMMONIUM NITRATE  
FERTILIZER APPLICATION PROGRAM**

***2017 Completion Report***

***License SUB-1010; Docket 40-8027***

***April 6, 2018***

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## **2017 FERTILIZER PROGRAM COMPLETION REPORT**

**Sequoyah Fuels Corporation  
Gore, Oklahoma**

### **1.0 INTRODUCTION**

Source Material License SUB-1010, issued to Sequoyah Fuels Corporation (SFC), authorizes the application of fertilizer onto SFC owned or controlled lands for the production of forage, utilized by cattle for grazing, or for growing crops that are not used directly as human food, such as hay or seed production. On October 1, 2015 a new Oklahoma Pollution Discharge Elimination System (OPDES) permit became effective. This new OPDES permit includes sampling and application requirements for the fertilizer program. In accordance with license and permit requirements, this completion report describes the 2017 Fertilizer Application Program.

SFC monitors a control plot as specified in the license in order to implement good programmatic control and ensure that the program is being operated in accordance with best agricultural practices. In September 1996, an NRC License Amendment which changed the fertilizer program control plot was approved. This report contains the fertilizer program monitoring results as described in the amended license.

The 2017 Fertilizer Application Program included oversight by the Cooperative Extension Service, Oklahoma State University. The Cooperative Extension Service provided recommendations to ensure maximum plant nutrient utilization and forage production while limiting impact to the environment. Additionally, the Cooperative Extension Service is available to assist in investigations of anomalous monitoring data.

Fertilizer application began on August 15, 2017 and concluded on August 29, 2107. A total of 1.5 million gallons of ammonium nitrate fertilizer was applied. Storm water volume requiring land application has been reduced significantly. This is reflected in the fertilizer volume and amount of nitrogen applied. Application amounts ranged from 3.1 to 4.5 lbs-N/acre. The 2018 schedule for the Ammonium Nitrate Fertilizer Program is provided in Table 1.

## **2.0 APPLICATION AREA**

In 2017, SFC's ammonium nitrate fertilizer was applied to the control plot which is located within the facility boundary. This application area is referred to as Agland #1 (Previously identified as Agland XVII) and is comprised of approximately 91 acres of which approximately 30 acres were utilized for application. Fertilizer was also applied to the North Meadow and Timber South #2. Figure 1 shows the location of the fertilizer application sites.

## **3.0 AMMONIUM NITRATE APPLICATION**

Pre-growing season soil samples were collected early in the year prior to implementation of fertilizer application. Nitrate analysis of these samples provided a basis for application rates and scheduling. The Cooperative Extension Service provides SFC with supplemental fertilizer (phosphorus and potassium) requirements.

Application rates were monitored based upon monthly nitrate analysis of the fertilizer solution. Applications were completed during August. A total of 1.5 million gallons was applied utilizing Kifco Ag-Rain A-Series irrigation system. The 2017 fertilizer application summary is presented in Table 2.

Analytical results of a representative composite of the fertilizer solution are provided in Table 3. In addition, samples were also collected from fertilizer sources as they were being transferred to the fertilizer storage ponds. These analytical results for these sources, which include Clarifier Basin 3A, Monitor Well MW095A Collection Trench, Monitor Well MW095A Collection Pit and Catchment No. 3 are included in Table 4.

## **4.0 PROGRAM MONITORING RESULTS**

### **4.1 Soil**

The 2017 pre-, mid- and post-growing season soil samples for the fertilizer application areas were collected in March, September and November, respectively. The analysis results for these sampling events are provided in Table 5. The top six inches of soil was characterized for nitrate content by collecting and compositing at least twenty samples from different locations in the Agland tract (one-inch diameter cores). In addition, profile samples were collected from one location in the Agland tract at six inch increments from surface to 48". Review of the 2017 pre-season soil profiles, and the top six inch soil composite, provided the basis for recommended application rates for the 2017 Fertilizer Program.

Soil samples were also collected as required by the OPDES permit. This permit requires that background soil samples be collected from each land application site and be analyzed for soil pH; the nutrients Total Kjeldahl Nitrogen, nitrogen, ammonia, nitrate, potassium and phosphorus; and the metals included in 40 CFR 503, "Standards for the Use or Disposal of Sewage Sludge." The analyses for background sampling are included in Table 6. Figure 1 shows the location of each fertilizer application site. The analyses of post season samples collected on November 13, 2017, from each land application site that received fertilizer solution are included in Table 7.

### **4.2 Vegetation**

Forage samples were collected and analyzed from the Agland area only. Analytical data for the forage cuttings from the Agland is provided in Table 8.

Forage collected during 2017 had elevated molybdenum concentrations. SFC determined that use of the hay should be restricted.

## **5.0 FORAGE MANAGEMENT PROGRAM**

Hay was harvested three times during 2017. Hay yields and harvest were dependent upon the weather and forage growing conditions. A total of approximately 1060 round bales were produced from the SFC property. Round hay bales average approximately 1040 pounds.

The Oklahoma State University Extension Service continues to provide oversight of the land application program.

## TABLES



**Sequoyah Fuels Corporation**  
**Projected 2018 Ammonium Nitrate Fertilizer Application**

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**TABLE 2**

**2017 Fertilizer Application Data**

LOCATION	APPL	CONC g/l N	GALS APPLIED	Acres Applied To	LBS/ ACRE
Agland No. 1 (XVII (AGLAND ))	1	0.013	1,113,700	28.7	4.2
TOTAL			1,113,700		4.2
Agland No. 3 (160A Province 5)					
TOTAL					
Agland No. 2 (XVII (South))					
TOTAL					
Pond / Timber / Meadow Areas	1	0.013	365,900	12.3	3.2
TOTAL			361,900		3.2

Notes: Total Volume Applied to All Areas: 1,475,600 gallons

N = Total Nitrogen

**TABLE 3**  
**2017 Fertilizer Composite Analyses**

Element		Composite
As	mg/l	0.0319
Ba	mg/l	0.0322
B	mg/l	< 0.2
Cd	mg/l	< 0.002
Co	mg/l	< 0.01
Cr	mg/l	< 0.01
Cu	mg/l	< 0.01
Fe	mg/l	< 0.1
Mg	mg/l	17.9
Mn	mg/l	0.521
Mo	mg/l	0.244
Ni	mg/l	< 0.01
Pb	mg/l	< 0.005
Se	mg/l	< 0.01
V	mg/l	< 0.02
Zn	mg/l	< 0.05
Hg	mg/l	< 0.0002
NO <sub>3</sub> (N)	mg/l	3.31
NH <sub>3</sub> (N)	mg/l	0.971
U	ug/l	36.1
Ra226	pCi/l	0.0838 ± 0.243
Th230	pCi/l	1.49 ± 0.528

**Table 4**  
**2017 Fertilizer Source Analyses**

Parameter	Clarifier Basin 3A	MW095A Coll. Trench	MW095A Coll. Pit	Catchment No. 3
<b>Inorganic Analyses</b>				
Ammonia (as N), mg/l	< 0.1	< 0.1	< 0.1	145
Nitrate (as N), mg/l	1.67	760	204	520
TKN, mg/l	3.46	< 0.25	< 0.25	37.6
<b>Radiochemical Analyses</b>				
Radium-226 pCi/l	0.174 ± 0.138	0.631 ± 0.215	-0.10 ± 0.106	0.240 ± 0.155
Uranium, µg/l	144	< 1	< 1	6.71
<b>Metals Analyses</b>				
Arsenic, mg/l	0.0199	0.0518	0.0179	0.200
Cadmium, mg/l	< 0.002	< 0.002	< 0.002	< 0.002
Chromium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
Copper, mg/l	< 0.01	< 0.01	< 0.01	0.0126
Lead, mg/l	< 0.005	< 0.005	< 0.005	0.0193
Mercury, mg/l	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Molybdenum, mg/l	0.0937	< 0.005	< 0.005	< 0.005
Nickel, mg/l	< 0.01	0.0159	< 0.01	0.413
Phosphorus, mg/l	1.47	< 0.1	< 0.1	< 0.1
Potassium, mg/l	2.73	4.58	2.51	9.01
Selenium, mg/l	< 0.01	< 0.01	< 0.01	< 0.01
Zinc, mg/l	< 0.05	< 0.05	< 0.05	< 0.05

**TABLE 5**  
**Soil Nitrate Analyses (mg/kg)**

## Sequoyah Acreage

[illegible]

**Table 6**  
**Background Soil Analyses - Fertilizer Application Sites**

Parameter	Agland # 1	Agland # 2	Agland # 3	Agland # 4	North Meadow	South Meadow
<b>Inorganic Analyses</b>						
Ammonia (as N), mg/kg	6.6	3.9	3.6	4.5	3.1	2.2
Nitrate (as N), mg/kg	28.2	33.1	31.6	17.4	15.4	26
TKN, mg/kg	1790	1880	1640	1740	1500	2340
pH	4.34	5.83	6.32	5.18	6.02	6.33
<b>Radiochemical Analyses</b>						
Radium-226 pCi/g	0.779 ± 0.142	1.42 ± 0.221	0.730 ± 0.144	1.07 ± 0.202	1.28 ± 0.197	1.73 ± 0.219
Uranium, µg/g	1.92	1.99	1.93	3.26	9.55	2.47
<b>Metals Analyses</b>						
Arsenic, mg/kg	2.39	1.62	1.53	2.25	2.62	2.2
Cadmium, mg/kg	0.728	0.505	0.612	0.819	0.805	0.838
Chromium, mg/kg	1.14	2.02	3.57	4.09	7.55	5.45
Copper, mg/kg	6.24	3.13	1.02	2.05	2.21	1.36
Lead, mg/kg	8.65	7.09	5.54	7.38	10.7	10.1
Mercury, mg/kg	< 0.24	< 0.24	< 0.24	< 0.24	< 0.24	< 0.24
Molybdenum, mg/kg	21.9	12.7	5.3	< 0.716	2.42	1.57
Nickel, mg/kg	5.72	3.43	5.61	1.33	0.906	1.57
Phosphorus, mg/kg	274	55.9	139	221	207	221
Potassium, mg/kg	731	268	324	453	293	298
Selenium, mg/kg	< 0.520	< 0.505	< 0.510	< 0.512	< 0.503	< 0.524
Zinc, mg/kg	19.8	9.19	7.95	13.9	13.3	11

Parameter	Pond Area	Timber North # 1	Timber North # 2	Timber South # 1	Timber South # 2	Timber South # 3
<b>Inorganic Analyses</b>						
Ammonia (as N), mg/kg	2.1	2.7	3.7	3.0	1.8	1.8
Nitrate (as N), mg/kg	14.2	9.6	22.3	27.4	25.5	13.2
TKN, mg/kg	2020	2470	1850	2290	2090	1740
pH	6.35	5.4	4.9	5.28	5.2	5.5
<b>Radiochemical Analyses</b>						
Radium-226 pCi/g	1.04 ± 0.163	1.57 ± 0.249	1.07 ± 0.188	1.58 ± 0.243	1.29 ± 0.189	1.27 ± 0.201
Uranium, µg/g	2.41	5.24	16.8	12.2	9.78	2.12
<b>Metals Analyses</b>						
Arsenic, mg/kg	2.94	1.2	3.85	1.98	4.33	2.81
Cadmium, mg/kg	1.01	< 0.502	1.77	0.991	1.54	1.35
Chromium, mg/kg	6.9	< 0.703	11.4	4.46	6.8	11.2
Copper, mg/kg	0.913	< 0.602	3.02	2.78	1.54	1.04
Lead, mg/kg	9.66	< 0.390	15.1	14.8	13.6	10.7
Mercury, mg/kg	< 0.24	< 0.24	< 0.23	< 0.24	< 0.24	< 0.24
Molybdenum, mg/kg	< 0.710	< 0.703	1.14	< 0.694	< 0.721	< 0.729
Nickel, mg/kg	< 0.710	< 0.703	8.94	0.892	< 0.721	16.9
Phosphorus, mg/kg	< 10.1	192	282	280	224	168
Potassium, mg/kg	326	17.3	564	574	381	542
Selenium, mg/kg	< 0.507	< 0.502	< 0.520	< 0.496	< 0.515	< 0.521
Zinc, mg/kg	12.4	< 0.703	37.8	23.3	17.1	14.2

Note: Samples collected during August 2005.

**Table 7**  
**Annual Post-Season Soil Analyses - Fertilizer Application Sites**

Page 1 of 1

Parameter	Agland #1 Composite	Agland #2 Composite	Agland #3 Composite	Pond Area Composite	N. Meadow Composite	Timber S#2 Composite
<b>Inorganic Analyses</b>						
Ammonia (as N), mg/kg	6.00	7.20	6.55	< 5.0	< 5.0	< 5.0
Nitrate (as N), mg/kg	< 2.0	< 2.0	< 2.0	2.64	< 2.0	< 2.0
TKN, mg/kg	916	776	456	1100	1360	1070
pH						
<b>Radiochemical Analyses</b>						
Radium-226 pCi/g	0.275 ± 0.0983	0.189 ± 0.0860	0.216 ± 0.0962	0.308 ± 0.101	0.332 ± 0.0983	0.268 ± 0.115
Uranium, µg/g	1.62	2.12	1.80	2.68	8.25	5.36
<b>Metals Analyses</b>						
Arsenic, mg/kg	2.14	< 2.0	3.11	3.04	3.32	3.09
Cadmium, mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium, mg/kg	6.01	7.53	15.4	17.7	15.0	15.1
Copper, mg/kg	4.05	2.54	2.65	5.73	2.68	2.86
Lead, mg/kg	5.78	12.7	7.54	11.1	11.4	11.3
Mercury, mg/kg	< 0.02	< 0.02	< 0.02	< 0.02	0.0207	< 0.02
Molybdenum, mg/kg	12.1	6.86	9.77	7.49	8.02	9.49
Nickel, mg/kg	5.43	4.69	5.08	12.0	5.21	5.19
Phosphorus, mg/kg	169	152	178	375	164	158
Potassium, mg/kg	788	454	488	1140	480	517
Selenium, mg/kg	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Zinc, mg/kg	15.7	10.1	10.4	31.9	13.3	13.5

Parameter	S. Meadow Composite					
<b>Inorganic Analyses</b>						
Ammonia (as N), mg/kg	< 5.0					
Nitrate (as N), mg/kg	3.28					
TKN, mg/kg	1350					
pH						
<b>Radiochemical Analyses</b>						
Radium-226 pCi/g	0.331 ± 0.113					
Uranium, µg/g	2.84					
<b>Metals Analyses</b>						
Arsenic, mg/kg	3.01					
Cadmium, mg/kg	< 0.5					
Chromium, mg/kg	13.3					
Copper, mg/kg	2.91					
Lead, mg/kg	12.5					
Mercury, mg/kg	0.0228					
Molybdenum, mg/kg	5.94					
Nickel, mg/kg	5.47					
Phosphorus, mg/kg	215					
Potassium, mg/kg	522					
Selenium, mg/kg	< 2.0					
Zinc, mg/kg	14.8					

TABLE 8

## Forage Analyses

Location (Cutting)	Sample Date	As mg/kg	B mg/kg	Co mg/kg	Cu mg/kg	Fe mg/kg	Mn mg/kg	Mo mg/kg	Ni mg/kg	Pb mg/kg	V mg/kg	Zn mg/kg	U mg/kg	Th-230 pCi/g	Ra-226 pCi/g	NO <sub>3</sub> -N mg/kg
<b>Sequoyah Acreage</b>																
Agland (1 <sup>st</sup> )	6/12/17	< 2.0	< 10.0	< 1.0	5.62	43.5	35.0	49.8	< 2.0	< 0.5	< 2.0	26.3	0.048	0.058±0.034	0.020 ± 0.009	3.34
Agland (2 <sup>nd</sup> )	7/31/17	< 2.0	< 10.0	< 1.0	3.59	32.3	59.9	50.6	< 2.0	< 0.5	< 2.0	13.6	0.023	0.068±0.029	0.015 ± 0.008	16.9
Agland (3 <sup>rd</sup> )	9/28/17	< 2.0	< 10.0	< 1.0	5.18	45.0	156	35.3	< 2.0	< 0.5	< 2.0	35.0	0.054	1.22±0.557	0.018±0.013	< 2.0
Caution Levels <sup>1</sup>		100	150	10	100	1000	1000	20	50	30	50	500	-	-	-	2800

<sup>1</sup> Caution Levels do not mean that forage with higher concentrations cannot be safely fed to livestock, but that certain precautions and additional treatments and supplements may be prudent.



**Figure 1**

**Fertilizer Application Sites  
Background Soil Sample Locations  
Collected on 04 Aug 2005**



