

Derenzo and Associates, Inc.

Environmental Consultants

April 26, 2011

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**BUREAU OF
AIR REGULATION**

Ms. Trina Vielhauer, Bureau Chief
Bureau of Air Regulation
Department of Environmental Protection
STATE OF FLORIDA
2600 Blair Stone Road, MS 5505
Tallahassee, FL 32399-2400

Subject: Seminole Energy, LLC
DEP File No. 1170084-008-AC (PSD-FL-376A)
LFG Monitoring Sulfur Contents

Dear Ms. Vielhauer:

Condition 3.C. of Section III – Emission Unit(s) Specific Conditions of Air Construction Permit 1170084-008-AC (PSD-FL-376A) issued Seminole Energy, LLC (Seminole Energy) specifies that *The permittee shall comply with the following requirements to monitor the sulfur and chlorine content of the landfill gas:*

... the permittee shall sample and analyze the landfill gas for sulfur and chlorine content. The gas sample collected for the analyses shall be a composite sample and collected under normal operating conditions ... The gas sample collection and analyses for sulfur and chlorine content shall be done semi-annually ... Results shall be reported as SO₂ and HCl emission factors in terms of lb/MMscf of landfill gas.

The initial gas sample collection and analyses were completed in February 2007. Therefore, Derenzo and Associates, Inc. (Derenzo and Associates), on behalf of Seminole Energy, is submitting to the Florida Department of Environmental Protection, Division of Air Resource Management (FDEP-DARM) results of the sulfur analysis that was performed on a sample of landfill gas (LFG) obtained from the Osceola Road Solid Waste Management Facility in April 2011 (semi-annual collection and analyses). The required SO₂ emission factors (in terms of lb/MMscf of landfill gas) and supporting analytical data are provided in the attached documents. The required HCL analysis and emission factors were previously provided in a report dated April 22, 2011.

The air permit application for Seminole Energy developed (based on USEPA AP-42 default LFG composition data) an SO₂ emission factor of 27.5 lb/MMscf of LFG.

The SO₂ emission factor developed from analyses of the April 19, 2011 sample of LFG obtained from the Osceola Road Solid Waste Management Facility is 15.2 lb/MMscf of LFG (<19.27 lb/MMscf of LFG with the incorporation of all non-measured chemicals at its reporting limit).

Derenzo and Associates, Inc.

Ms. Trina Vielhauer
FDEP-DARM

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Please contact us if you have questions or require clarifications

Sincerely,

DERENZO AND ASSOCIATES, INC.



Charles Scamp
Environmental consultant

attachments

- c: Mike Laframboise, Landfill Energy Systems
- Garry Kuberski, FDEP Central District Office
- Kimberly Russell, Seminole County Solid Waste Management Division

Sulfur Dioxide Emission Factor for LFG Combustion

LFG Influent Sulfur Compound	Analytical Report Concentrations ^A (ppmv)	Molecular Formula	No. Sulfur Atoms	Sulfur Content ^B as H ₂ S (ppmv)	Resulting SO ₂ Emission Rate (lb./MMcf)
Hydrogen sulfide	74.0	H ₂ S	1	74.0	12.25 *
Carbonyl sulfide	<1.20	CSO	1	<1.20	<0.20
Methyl mercaptan	7.80	CH ₄ S	1	7.80	1.29
Ethyl mercaptan	<1.20	C ₂ H ₆ S	1	<1.20	<0.20
Dimethyl sulfide	10.0	C ₂ H ₆ S	1	10.0	1.66
Carbon disulfide	<1.50	CS ₂	2	<3.00	<0.50
Isopropyl mercaptan	<1.20	C ₃ H ₆ S	1	<1.20	<0.20
tert-Butyl mercaptan	<1.20	C ₄ H ₁₀ S	1	<1.20	<0.20
n-Propyl mercaptan	<1.20	C ₃ H ₈ S	1	<1.20	<0.20
Ethyl methyl sulfide	<1.20	C ₃ H ₈ S	1	<1.20	<0.20
Thiophene	<1.20	C ₄ H ₄ S	1	<1.20	<0.20
Isobutyl mercaptan	<1.20	C ₄ H ₁₀ S	1	<1.20	<0.20
Diethyl sulfide	<1.20	CH ₃ CH ₂ SCH ₂ CH ₃	1	<1.20	<0.20
n-Butyl mercaptan	<1.20	C ₄ H ₁₀ S	1	<1.20	<0.20
3-Methyl Thiophene	<1.20	C ₃ H ₆ S	1	<1.20	<0.20
Dimethyl disulfide	<1.20	CH ₃ SSCH ₃	2	<2.40	<0.40
Tetrahydrothiophene	<1.20	C ₄ H ₈ O ₂ S	1	<1.20	<0.20
2-Ethylthiophene	<1.20	C ₆ H ₈ S	1	<1.20	<0.20
2,5-Dimethylthiophene	<1.20	C ₆ H ₈ S	1	<1.20	<0.20
Diethyl disulfide	<1.20	CH ₃ SSCH ₃	2	<2.40	<0.40
Total				<116.4	<19.27^C

Notes

- A. April 20, 2011 LFG sample laboratory analytical results (see Attachment)
- B. Determined by multiplying concentration by number of sulfur atoms in the molecule.
- C. Calculation of SO₂ emission factor from sulfur content, as H₂S:

$$(116.4 \text{ scf H}_2\text{S/MMcf LFG}) (1 \text{ scf SO}_2/\text{scf H}_2\text{S}) (64.06 \text{ lb. SO}_2/\text{mol}) / (387 \text{ ft}^3/\text{mol})$$

$$= 19.3 \text{ lb SO}_2/\text{MMcf LFG}$$
- * Sample calculation: SO₂ generation from hydrogen sulfide (H₂S):

$$(74.0 \text{ scf H}_2\text{S/MMcf LFG}) (1 \text{ scf SO}_2/\text{scf H}_2\text{S}) (64.06 \text{ lb. SO}_2/\text{mol}) / (387 \text{ ft}^3/\text{mol})$$

$$= 12.30 \text{ lb SO}_2/\text{MMcf LFG}$$

Seminole Energy, LLC (April 19, 2011 Sample)

Sulfur Dioxide Emission Factor for LFG Combustion

LFG Influent Sulfur Compound	Measured Concentrations ^A (ppmv)	Molecular Formula	No. Sulfur Atoms	Sulfur Content ^B as H ₂ S (ppmv)	Resulting SO ₂ Emission Rate (lb./MMcf)
Hydrogen sulfide	74.0	H ₂ S	1	74.0	12.25 *
Methyl mercaptan	7.80	CH ₄ S	1	7.80	1.29
Dimethyl sulfide	10.0	C ₂ H ₆ S	1	10.0	1.66
Total				91.8	15.20

Notes

A. April 20, 2011 LFG sample laboratory analytical results (see Attachment)

B. Determined by multiplying concentration by number of sulfur atoms in the molecule.

* Sample calculation: SO₂ generation from hydrogen sulfide (H₂S):
 (74.0 scf H₂S/MMcf LFG) (1 scf SO₂/scf H₂S) (64.06 lb.SO₂/mol) / (387 ft³/mol)
 = 12.30 lb SO₂/MMcf LFG

LABORATORY NARRATIVE
ASTM D-5504
Derenzo & Associates
Workorder# 1104394

Two 1 Liter Tedlar Bag samples were received on April 20, 2011. The laboratory performed the analysis of sulfur compounds via ASTM D-5504 using GC/SCD. The method involves direct injection of the air sample into the GC via a fixed 2.0 mL sampling loop. See the data sheets for the reporting limits for each compound.

Receiving Notes

The Chain of Custody (COC) was not relinquished properly. A signature and date were not provided by the field sampler.

Sample SE 2 was placed on hold per client's request.

Analytical Notes

There were no analytical discrepancies.

Definition of Data Qualifying Flags

Seven qualifiers may have been used on the data analysis sheets and indicate as follows:

B - Compound present in laboratory blank greater than reporting limit.

J - Estimated value.

E - Exceeds instrument calibration range.

S - Saturated peak.

Q - Exceeds quality control limits.

U - Compound analyzed for but not detected above the detection limit.

M - Reported value may be biased due to apparent matrix interferences.

File extensions may have been used on the data analysis sheets and indicates as follows:

a-File was requantified

b-File was quantified by a second column and detector

r1-File was requantified for the purpose of reissue



Summary of Detected Compounds
SULFUR GASES BY ASTM D-5504 GC/SCD

Client Sample ID: SE 1

Lab ID#: 1104394-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	1200	74000
Methyl Mercaptan	1200	7800
Dimethyl Sulfide	1200	10000



Client Sample ID: SE 1

Lab ID#: 1104394-01A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	k042010	Date of Collection:	4/19/11 3:30:00 PM
Dil. Factor:	300	Date of Analysis:	4/20/11 11:35 AM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	1200	74000
Carbonyl Sulfide	1200	Not Detected
Methyl Mercaptan	1200	7800
Ethyl Mercaptan	1200	Not Detected
Dimethyl Sulfide	1200	10000
Carbon Disulfide	1500	Not Detected
Isopropyl Mercaptan	1200	Not Detected
tert-Butyl Mercaptan	1200	Not Detected
n-Propyl Mercaptan	1200	Not Detected
Ethyl Methyl Sulfide	1200	Not Detected
Thiophene	1200	Not Detected
Isobutyl Mercaptan	1200	Not Detected
Diethyl Sulfide	1200	Not Detected
n-Butyl Mercaptan	1200	Not Detected
Dimethyl Disulfide	1200	Not Detected
3-Methylthiophene	1200	Not Detected
Tetrahydrothiophene	1200	Not Detected
2-Ethylthiophene	1200	Not Detected
2,5-Dimethylthiophene	1200	Not Detected
Diethyl Disulfide	1200	Not Detected

Container Type: 1 Liter Tedlar Bag



Client Sample ID: Lab Blank

Lab ID#: 1104394-03A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	k042006	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 4/20/11 10:07 AM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	4.0	Not Detected
Carbonyl Sulfide	4.0	Not Detected
Methyl Mercaptan	4.0	Not Detected
Ethyl Mercaptan	4.0	Not Detected
Dimethyl Sulfide	4.0	Not Detected
Carbon Disulfide	5.0	Not Detected
Isopropyl Mercaptan	4.0	Not Detected
tert-Butyl Mercaptan	4.0	Not Detected
n-Propyl Mercaptan	4.0	Not Detected
Ethyl Methyl Sulfide	4.0	Not Detected
Thiophene	4.0	Not Detected
Isobutyl Mercaptan	4.0	Not Detected
Diethyl Sulfide	4.0	Not Detected
n-Butyl Mercaptan	4.0	Not Detected
Dimethyl Disulfide	4.0	Not Detected
3-Methylthiophene	4.0	Not Detected
Tetrahydrothiophene	4.0	Not Detected
2-Ethylthiophene	4.0	Not Detected
2,5-Dimethylthiophene	4.0	Not Detected
Diethyl Disulfide	4.0	Not Detected

Container Type: NA - Not Applicable



Client Sample ID: LCS

Lab ID#: 1104394-04A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	k042003	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 4/20/11 09:00 AM

Compound	%Recovery
Hydrogen Sulfide	71
Carbonyl Sulfide	88
Methyl Mercaptan	76
Ethyl Mercaptan	84
Dimethyl Sulfide	80
Carbon Disulfide	83
Isopropyl Mercaptan	77
tert-Butyl Mercaptan	79
n-Propyl Mercaptan	81
Ethyl Methyl Sulfide	79
Thiophene	81
Isobutyl Mercaptan	82
Diethyl Sulfide	88
n-Butyl Mercaptan	81
Dimethyl Disulfide	81
3-Methylthiophene	81
Tetrahydrothiophene	89
2-Ethylthiophene	82
2,5-Dimethylthiophene	83
Diethyl Disulfide	81

Container Type: NA - Not Applicable



Client Sample ID: LCSD

Lab ID#: 1104394-04AA

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	k042005	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 4/20/11 09:46 AM

Compound	%Recovery
Hydrogen Sulfide	75
Carbonyl Sulfide	91
Methyl Mercaptan	84
Ethyl Mercaptan	88
Dimethyl Sulfide	86
Carbon Disulfide	90
Isopropyl Mercaptan	84
tert-Butyl Mercaptan	85
n-Propyl Mercaptan	87
Ethyl Methyl Sulfide	86
Thiophene	88
Isobutyl Mercaptan	90
Diethyl Sulfide	93
n-Butyl Mercaptan	84
Dimethyl Disulfide	87
3-Methylthiophene	87
Tetrahydrothiophene	93
2-Ethylthiophene	89
2,5-Dimethylthiophene	87
Diethyl Disulfide	87

Container Type: NA - Not Applicable



CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

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Project Manager Charles Scamp
 Collected by: (Print and Sign) NGOC PHAN
 Company Derenzo and Associates Email cscamp@derenzo.com
 Address 39395 Schoolcraft City Livonia State MI Zip 48150
 Phone 734-464-3880 Fax 734-464-4368

Project Info: P.O. # <u>1383</u> Project # <u>1101021/1101024</u> Project Name <u>Seminole/Trail Ridge LFG</u>	Turn Around Time: <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Rush <small>specify</small>	Lab Use Only Pressurized by: Date: Pressurization Gas: <u>N₂ He</u>
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Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum			
						Initial	Final	Receipt	Final (psi)
<u>01A</u>	<u>SE 1</u>		<u>4/19/11</u>	<u>3:30 pm</u>	<u>Modified ASTM D-5504</u>				
<u>02A</u>	<u>SE 2</u>		<u>4/19/11</u>	<u>3:30 pm</u>	<u>Modified ASTM D-5504</u>				
	<u>TRE 1</u>				<u>Modified ASTM D-5504</u>				
	<u>TRE 2</u>				<u>Modified ASTM D-5504</u>				

Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time <u>B. W. [Signature] ATC 4/20/11 1000</u>	Notes: 2 samples are provided. Analyze only one. The second sample is provided in case 1 of 2 is damaged.
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time	
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time	

Lab Use Only	Shipper Name <u>UPS</u>	Air Bill #	Temp (°C) <u>N/A</u>	Condition <u>SDR</u>	Custody Seals Intact? Yes No <u>None</u>	Work Order # <u>1104394</u>
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