

Derenzo and Associates, Inc.

Environmental Consultants

April 26, 2011

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

RECEIVED

MAY 02 2011

**BUREAU OF
AIR REGULATION**

Subject: Trail Ridge Energy, LLC
DEP File No. 0310358-011-AC (PSD-FL-374B)
LFG Monitoring Sulfur Contents

Dear Ms Vielhauer:

Condition 3.C. of Section III – Emission Unit(s) Specific Conditions of Air Construction Permit 0310358-011-AC (PSD-FL-374B) issued Trail Ridge Energy, LLC (Trail Ridge 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 Trail Ridge 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 Trail Ridge Landfill in April 2011 (semi-annual collection and analyses). The required SO₂ emission factor (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 Trail Ridge 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 gas obtained from the Trail Ridge Landfill is 6.719 lb/MMscf of LFG (<7.944 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.

A handwritten signature in black ink, appearing to read 'Charles Scamp', written in a cursive style.

Charles Scamp
Environmental Consultant

attachments

- c: Mike Laframboise, Landfill Energy Systems
- Christopher L. Kirts, Northeast District Office
- Jacksonville Environmental Quality Division

Trail Ridge Energy, LLC (April 19, 2011 Sample)

Sulfur Dioxide Emission Factor for LFG Combustion

LFG Influent Sulfur Compound	Analytical Report		No. Sulfur Atoms	Sulfur Content ^B as H ₂ S (ppmv)	Resulting SO ₂ Emission Rate (lb./MMcf)
	Concentrations ^A (ppmv)	Molecular Formula			
Hydrogen sulfide	24.0	H ₂ S	1	24.0	3.973 *
Carbonyl sulfide	<0.40	CSO	1	0.40	0.066
Methyl mercaptan	4.50	CH ₄ S	1	4.50	0.745
Ethyl mercaptan	<0.40	C ₂ H ₆ S	1	<0.40	<0.066
Dimethyl sulfide	11.0	C ₂ H ₆ S	1	11.0	1.821
Carbon disulfide	<0.50	CS ₂	2	<1.00	<0.166
Isopropyl mercaptan	0.53	C ₃ H ₆ S	1	0.53	0.088
tert-Butyl mercaptan	<0.40	C ₄ H ₁₀ S	1	<0.40	<0.066
n-Propyl mercaptan	<0.40	C ₃ H ₈ S	1	<0.40	<0.066
Ethyl methyl sulfide	<0.40	C ₃ H ₈ S	1	<0.40	<0.066
Thiophene	0.56	C ₄ H ₄ S	1	0.56	0.093
Isobutyl mercaptan	<0.40	C ₄ H ₁₀ S	1	<0.40	<0.066
Diethyl sulfide	<0.40	CH ₃ CH ₂ SCH ₂ CH ₃	1	<0.40	<0.066
n-Butyl mercaptan	<0.40	C ₄ H ₁₀ S	1	<0.40	<0.066
3-Methyl Thiophene	<0.40	C ₅ H ₆ S	1	<0.40	<0.066
Dimethyl disulfide	<0.40	CH ₃ SSCH ₃	2	<0.80	<0.132
Tetrahydrothiophene	<0.40	C ₄ H ₈ O ₂ S	1	<0.40	<0.066
2-Ethylthiophene	<0.40	C ₆ H ₈ S	1	<0.40	<0.066
2,5-Dimethylthiophene	<0.40	C ₆ H ₈ S	1	<0.40	<0.066
Diethyl disulfide	<0.40	CH ₃ SSCH ₃	2	<0.80	<0.132
Total				<48.0	<7.944^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:

$$(48.0 \text{ scf H}_2\text{S/MMcf LFG}) (1 \text{ scf SO}_2\text{/scf H}_2\text{S}) (64.06 \text{ lb. SO}_2\text{/mol}) / (387 \text{ ft}^3\text{/mol})$$

$$7.94 \text{ lb SO}_2\text{/MMcf LFG}$$
- * Sample calculation: SO₂ generation from hydrogen sulfide (H₂S):

Trail Ridge 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	24.0	H ₂ S	1	24.0	3.973 *
Methyl mercaptan	4.50	CH ₄ S	1	4.50	0.745
Dimethyl sulfide	11.0	C ₂ H ₆ S	1	11.0	1.821
Isopropyl mercaptan	0.53	C ₃ H ₆ S	1	0.53	0.088
Thiophene	0.56	C ₄ H ₄ S	1	0.56	0.093
Total				40.6	6.719

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):

$$(24.0 \text{ scf H}_2\text{S/MMcf LFG}) (1 \text{ scf SO}_2\text{/scf H}_2\text{S}) (64.06 \text{ lb. SO}_2\text{/mol}) / (387 \text{ ft}^3\text{/mol})$$

$$= 3.99 \text{ lb SO}_2\text{/MMcf LFG}$$

LABORATORY NARRATIVE
ASTM D-5504
Derenzo & Associates
Workorder# 1104395

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 TRE2 was placed on hold per the 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: TRE1

Lab ID#: 1104395-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	400	24000
Methyl Mercaptan	400	4500
Dimethyl Sulfide	400	11000
Isopropyl Mercaptan	400	530
Thiophene	400	560



Client Sample ID: TRE1

Lab ID#: 1104395-01A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	k042012	Date of Collection: 4/19/11 5:00:00 PM
Dil. Factor:	100	Date of Analysis: 4/20/11 12:28 PM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	400	24000
Carbonyl Sulfide	400	Not Detected
Methyl Mercaptan	400	4500
Ethyl Mercaptan	400	Not Detected
Dimethyl Sulfide	400	11000
Carbon Disulfide	500	Not Detected
Isopropyl Mercaptan	400	530
tert-Butyl Mercaptan	400	Not Detected
n-Propyl Mercaptan	400	Not Detected
Ethyl Methyl Sulfide	400	Not Detected
Thiophene	400	560
Isobutyl Mercaptan	400	Not Detected
Diethyl Sulfide	400	Not Detected
n-Butyl Mercaptan	400	Not Detected
Dimethyl Disulfide	400	Not Detected
3-Methylthiophene	400	Not Detected
Tetrahydrothiophene	400	Not Detected
2-Ethylthiophene	400	Not Detected
2,5-Dimethylthiophene	400	Not Detected
Diethyl Disulfide	400	Not Detected

Container Type: 1 Liter Tedlar Bag



Client Sample ID: Lab Blank

Lab ID#: 1104395-03A

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#: 1104395-04A

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#: 1104395-04AA

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) Matt Nichols
 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:	Turn Around Time:	Lab Use Only
P.O. # <u>1383</u>	<input checked="" type="checkbox"/> Normal	Pressurized by:
Project # <u>1101021/1101024</u>	<input type="checkbox"/> Rush	Date:
Project Name <u>Seminole/Trail Ridge LFG</u>	specify _____	Pressurization Gas: <u>N₂</u> <u>He</u>

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)
	SE 1				Modified ASTM D-5504				
	SE 2				Modified ASTM D-5504				
<u>01A</u>	TRE 1		<u>4/19/11</u>	<u>1700</u>	Modified ASTM D-5504				
<u>02A</u>	TRE 2		<u>4/19/11</u>	<u>1700</u>	Modified ASTM D-5504				

Relinquished by: (signature) _____ Date/Time _____	Received by: (signature) <u>B. Whittaker</u> Date/Time <u>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>Good</u>	Custody Seals Intact? Yes No <u>None</u>	Work Order # <u>1104395</u>
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