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TITLE V PERMIT APPLICATION
CO AND PM_{10} EMISSION FACTOR MODIFICATIONS
FOR
LANDFILL GAS–FUELED
RECIPROCATING ENGINE GENERATORS
AT
BREVARD ENERGY, LLC

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1.0 INTRODUCTION

Brevard Energy, LLC (Brevard Energy) has prepared this air permit application to request permit emission factor modifications to its landfill gas (LFG) fueled electricity generation facility, which will result in the continued beneficial use of LFG that is generated by the Brevard County Central Disposal Facility (Central Disposal Facility). This application proposes changes to the permitted carbon monoxide (CO) and particulate matter (PM_{10}) emission rates based on experience obtained through the operation of these engines. No new equipment is being proposed for the existing Brevard Energy facility. The existing LFG fueled electricity generation facility:

1. Has been issued Air Construction Permit 0090069-004-AC (PSD-FL-378) that has been incorporated into Title V Air Operations Permit No. 0090069-008-AV;

2. Uses LFG (exclusively) to fuel its reciprocating internal combustion (IC) engine – generator operations (i.e., LFG that is generated at the Central Disposal Facility as a result of the degradation of solid wastes placed in the facility);

3. Consists of six (6) Caterpillar, Inc. (CAT®) Model G3520C lean-burn IC engine – generator sets and ancillary equipment that support the electricity generation processes. The IC engine generators are identified in the Title V Air Operations Permit as emission units EU-004, EU-005, EU-006, EU-007, EU008, and EU-009;

4. Has the potential to generate 9.6 megawatts (MW) of electricity under base load operating conditions; and

5. Interconnects to the local electric authority distribution network through a nearby power line.

Brevard Energy requests that Title V Air Operations Permit No. 0090069-008-AV be modified to incorporate appropriate CO and PM_{10} emission rate limitations that can be maintained and achieved over all fuel quality and engine wear / maintenance operating conditions for the existing CAT® Model G3520C IC engine - generator sets.

The electricity generated by the existing facility is sold under the provisions of a Power Purchase Agreement with Seminole Electric Cooperative, Inc.

Existing facilities located in the State of Florida that operate equipment with significant increases in regulated air pollutant emissions are required to submit permit application documents (Appendix A) to the Florida Department of Environmental Protection Division of Air Resource Management (FDEP-DARM) for its review and approval through the issuance of:

1. An Air Construction Permit prior to the start of construction in accordance with the regulatory provisions of *62-4.210 Construction Permits,* Florida Administrative Code (F.A.C.), and *62-210.300 Permits Required,* F.A.C; or

2. A modification to an existing Air Operations Permit in accordance with the regulatory provisions of *Chapter 62-213 Operation Permits For Major Sources of Air Pollutants*, F.A.C.

This technical support document contains data and information required by the regulatory agency to support the issuance of a modified Title V Air Operations Permit for the proposed permit modifications for the existing LFG fueled IC engine electricity generation facility in accordance with application submittal provisions of *62-210.900 Forms and Instructions*, F.A.C., *62-212.300 General Preconstruction Review Requirements*, F.A.C., and *62-212.400 Prevention of Significant Deterioration*, F.A.C.

Derenzo and Associates, Inc. has been retained by Brevard Energy to prepare permit application documents for the proposed emission factor modifications for its existing LFG fueled electricity generation facility.

Mr. Scott Salisbury, President of Landfill Energy Systems (parent company of Brevard Energy), authorized and certified the preparation of the permit application documents.

Appendix A provides a complete *Department of Environmental Protection Division of Air Resource Management Application for Air Permit – Long Form* for the proposed modification to its existing LFG fueled electricity generation facility.

Appendix B provides a copy of the Title V Air Operations Permit No. 0090069-008-AV.

2.0 PERMITTED ELECTRICITY GENERATION FACILITY

The constructed and operated existing electricity generation facility consists of:

1 LFG treatment equipment (gas dewatering, filtration and compression processes and equipment);

2 Six (6) identical LFG (treated gas) fueled CAT® Model G3520C IC engines connected to individual electricity generators, each with a power generation rating of 2,233 brake horsepower (bhp), which are identified in the Air Operations Permit (0090069-008-AV) as emission units (EU) EU–004, EU-005, EU-006, EU-007, EU-008, and EU-009; and

3 Ancillary equipment that supports the electricity generation operations.

   a. Each of the permitted and operated IC engines is equipped with a stand-alone fan-cooled radiator.

   b. Engine radiator coolant is stored onsite in drum quantities.

   c. Engine lube oil (new and used) is stored in separate above ground holding tanks positioned on the premises of Brevard Energy. The installed new lube oil storage tank has a capacity of 3,000 gallons. The installed used oil storage tank has a capacity of 2,250 gallons.

The existing LFG fueled IC engines are housed in a single building constructed in an area (at the landfill facility on leased land) near the LFG collection system header and existing flaring stations (i.e., open utility flares that are owned and operated by the landfill). A gas transmission (fuel supply) line (pipe) has been connected to the header of the existing LFG collection system and a dedicated gas blower/compressor is used to draw LFG (fuel) from the existing LFG collection system to the electricity generation facility.

A single meter (flow totalizer) is operated at the existing electricity generation facility to measure the total amount of LFG fuel that is supplied to power the installed IC engines (i.e., individual engine fuel use meters have not been installed).

2.1 Engine Specifications

Six (6) identical lean-burn CAT® G3520C gas IC engines are used to power electricity generators. These engines:

1. Each has a power generation rating of 2,233 bhp.

2. Have been designed to fire low-pressure, lean fuel mixtures and produce low combustion by-product emissions;

3. Are equipped with an air-to-fuel ratio controller that monitors engine performance parameters and automatically adjusts the air-to-fuel ratio to maintain efficient fuel combustion, which minimizes air pollutant emissions; and

4. Are fueled exclusively with treated LFG received from the Central Disposal Facility (natural gas is not, and will not be, used to fuel the IC engine operations).

2.2 Electricity Generator Specifications

Each of the LFG fueled CAT® G3520C IC engines are connected to an individual 1,600 kW (1.6 MW) electricity generator. The six (6) CAT® G3520C gas IC engine – generator sets result in a total electricity capacity of 9,600 kW (9.6 MW).

2.3 Engine Exhaust Configuration

Emissions produced by the combustion of treated gas fuel in the six (6) existing CAT® G3520C IC engines will be released into the ambient air through individual stacks connected to the engine exhaust manifolds. Noise mufflers (for noise control) are installed on each engine exhaust stack.

The engine exhaust stacks and noise mufflers are located on the roof of the building that houses the electricity generation engines.

Appendix C provides site drawings that illustrate the location of the existing electricity generation operations at Brevard Energy.

Appendix D provides process flow diagrams for the processes and equipment at Brevard Energy.

3.0 ELECTRICITY GENERATION FACILITY OPERATIONS

IC engine operation and emissions are dependent on the properties of the treated LFG that is used as fuel and the length of time that the engines are in service. Properties of the supplied LFG are variable and have an impact upon the emissions from the source. This section describes the operations of the existing electricity generation facility.

3.1 Landfill Gas

3.1.1 Physical Properties

LFG primarily consists of methane, carbon dioxide and nitrogen. Oxygen, sulfur-bearing compounds, nonmethane organic compounds (NMOC) and hazardous air pollutants (HAPs) are present in the generated LFG in much smaller quantities. The quantities and types of compounds that are present in LFG are dependent on the composition of the wastes placed in the landfill and site-specific conditions (e.g., climatological influences).

The properties of the treated LFG used to fuel its existing electricity generation operations are monitored on a regular basis by Brevard Energy. Data from December 2009 through June 2010 were used in evaluating the recent fuel quality provided to the IC engines. This data was chosen since it was representative of near maximum operating capacity of the facility. Data maintained by the facility indicates that the methane content ranges from 46.8 to 52.6 % by volume and the corresponding heat content ranges from 474 British thermal units per standard cubic foot (Btu/scf) to 533 Btu/scf on a higher heating value (HHV) basis. The average HHV heat content since Brevard Energy has been in operation is 516.8 Btu/scf.

The LFG fuel heat content on a lower heating value (LHV) basis ranges from 426 Btu/scf to 479 Btu/scf. The average LHV heat content is 464.3 Btu/scf.

Table 1 presents heat content values for the treated gas fuel used at the existing Brevard Energy facility.

The LFG recovered from the Central Disposal Facility is sampled twice per year to determine sulfur and chlorinated compound content as required by the conditions of Construction Permit 0090069-004-AC (PSD-FL-374) and Air Operations Permit 0090069-008-AV.

The maximum LFG chlorinated compound content for samples obtained in calendar years 2008, 2009, and 2010 results in a calculated (average) hydrogen chloride (HCl) emission factor of 1.08 pounds per million cubic feet (lb/MMcf) based on the complete conversion of chlorine to HCl in the combustion process.

The hydrogen sulfide (H_2S) concentration for LFG samples obtained in calendar years 2008, 2009 and 2010 ranged from 217.8 to 501 parts per million by volume (ppmv). The maximum H_2S concentration results in a calculated sulfur dioxide (SO_2) emission factor of 57.55 lb/MMcf based on the complete conversion of sulfur to SO_2 (the maximum emission factor includes non-detect sulfur compounds at the method detection limit).

Table 2 presents a summary of the calculated hydrogen chloride and sulfur dioxide emission factors for the combustion of the LFG recovered from the Central Disposal Facility.

3.1.2 Treatment

The equipment and processes used to treat (dewater, filter and compress) the LFG received from the Central Disposal Facility (prior to its combustion as fuel in the existing IC engines) consist of:

1. Initial two-stage inlet gas dewatering/filter vessels (the bottom chambers are used for moisture knock-out, top chambers are equipped with coalescing filter media to remove gas particles having diameters of 0.3-microns and larger).
2. A gas compressor/blower.
3. Air-to-gas coolers, which will reduce the temperature of the LFG after compression to approximately 10°F above ambient temperature.
4. Final two-stage gas dewatering/filter vessels (the bottom chambers are used for moisture knock out, top chambers are equipped with coalescing filter media to remove gas particles having diameters of 0.3-microns and larger).

Components of the specified gas treatment system are not equipped with atmospheric vents. Therefore, all of the LFG received by the system is/will be directed to the existing IC engines for use as a fuel.

Appendix D provides a process flow diagram and engineering specifications for the existing LFG treatment system.

Appendix E provides historical LFG analytical data for the treated LFG.

3.2 CAT® G3520C IC Engine Operations

Appendix F provides the Gas Engine Technical Data sheet for the CAT® G3520C.

The manufacturer's technical data specifies that the CAT® G3520C gas IC engine heat input at baseload operations is 242,216 Btu/min LHV, which is equivalent to14.53 million Btu per hour (MMBtu/hr) LHV. This specification has been revised upward by the manufacturer since Brevard Energy requested a permit for its existing operations. The footnote presented in the CAT® data sheet indicates that the LHV rate specification has a tolerance of 2.5% (i.e., actual normal operating condition values may vary from those specified by the manufacturer by 2.5%).

Data obtained by Landfill Energy Systems from actual LFG (treated gas) fueled CAT® G3520C IC engine base load operations indicate that the heat input rate value of the equipment is typically higher than the value of 14.53 MMBtu/hr specified in the revised technical data sheet. Data maintained by Brevard Energy on a monthly basis indicates that the average engine heat input rate is 14.89 MMBtu/hr LHV (16.57 MMBtu/hr HHV), which is comparable to the upper range of the published heat input tolerance (14.53 MMBtu/hr * 1.025 = 14.89 MMBtu/hr LHV). Therefore, a heat input value of 14.89 MMBtu/hr LHV will be used in this application to calculate LFG fuel use. Data from December 2009 through June 2010 was selected in evaluating engine fuel use requirements since the facility operated near maximum capacity during this time period.

At the specified IC engine LHV input rate of approximately 14.89 MMBtu/hr and the:

1. Minimum fuel heating value of 426 Btu/scf LHV recorded by Brevard Energy, the existing CAT® G3520C gas IC engines operated at Brevard Energy each have a maximum fuel use rate of approximately 583 scfm and 35,000 standard cubic feet per hour (scfh).

2. Average LHV for the LFG recovered from the Central Disposal Facility of approximately 464 Btu/scf, the existing CAT® G3520C gas IC engines in operation at Brevard Energy each have an average fuel use rate that is expected to be approximately 535 scfm and 32,100 scfh.

Appendix E provides the LFG properties and IC engine operations from December 2009 through June 2010.

3.3 Exhaust Flowrate

3.3.1 Calculated Value

Over the operating cycle of the engine, more fuel is required to operate the CAT® G3520C gas IC engine than is specified in the technical data published by the equipment manufacturer (as presented in the previous section). Therefore, the actual exhaust flowrate of the engine is greater than the value of 12,476 actual cubic foot per minute (acfm) that is also presented in the published technical data and has been revised upward since Brevard Energy requested a permit for its existing operations. A higher engine exhaust flowrate occurs as a result of the use of greater amounts of gaseous fuel and the associated increases in combustion air requirements.

Calculations performed by Derenzo and Associates (which are based on the specified higher fuel use rates) indicate that the CAT® G3520C gas IC engine exhaust flowrate is approximately 13,700 acfm at an exhaust oxygen content of 8.4% (not the 12,476 acfm value presented in the technical data published by the equipment manufacturer). The calculated 13,700 acfm value is equivalent to a dry scfm (dscfm) value of approximately 4,700 (based on exhaust gases with 11% moisture content).

3.3.2 Manufacturer / Dealer Information

The observed increases in heat input rate and engine exhaust flow have resulted in measured emission rates that exceed permitted limits for LFG fueled CAT® G3520C IC engine - generator sets operated at MRPC Holdings (Ocean Energy Corp., another facility operated by the parent company Landfill Energy Systems). Based on the compliance demonstration issues that have arisen at the Ocean Energy Corp. facility, representatives of Landfill Energy Systems:

1. Made multiple contacts to Caterpillar, Inc., from April 24 to July 21, 2008 (through Michigan CAT) to request updated details on operating and performance specifications for the CAT® G3520C gas IC engine (e.g., proper engine exhaust flowrates and CO emission rates); and

2. Performed their own research and analyses to obtain information on correct and appropriate exhaust flowrates (and corresponding CO emission rates) for the operation of the LFG fueled CAT® G3520C IC engine.

The information issued by Caterpillar, Inc. only specifies that the:

1. Exhaust flowrate of this engine should be 22,318 lb/hr (based on the technical data published for the equipment by Caterpillar, Inc., which is equivalent to approximately 4,330 dscfm based on calculations performed by Derenzo and Associates).

2. The only reason it (Caterpillar, Inc.) could offer for the non-compliance conditions is that the air pollutant emission measurement and airflow equipment used for the tests have a great deal of tolerance (both in the equipment and way it is used), which results in high concentration and mass emission rate determinations.

The 4,330 dscfm exhaust gas value specified by Caterpillar, Inc. is significantly less than the calculated 4,700 dscfm value, which is based on the documented higher fuel use rate.

3.3.3 Compliance Test Flowrate Measurements

Compliance testing has been performed September 2008, March 2009, and May 2010 on individual LFG fueled CAT® G3520C IC engines that are operated at Brevard Energy, LLC. The average measured exhaust flowrate for the Brevard Energy, LLC CAT® G3520C IC engines is 4,501dscfm. A summary of these results are presented in Appendix G.

In addition, compliance tests have been performed at several facilities owned by Landfill Energy Systems (parent company of Brevard Energy). Appendix G also provides a summary of:

1. July 2007 compliance test measurements that were performed on six (6) LFG fueled CAT® G3520C IC engines that are operated at Ocean Energy Corp.

2. April 2008 compliance test measurements performed on one (1) LFG fueled CAT® G3520C IC engine that is operated at Ocean Energy Corp (which was a retest of particulate emissions from engine No. 7).

3. April 2008, March 2009, and April 2010 compliance test measurements performed on individual LFG fueled CAT® G3520C IC engines that are operated at Seminole Energy, LLC (in Seminole County, FL).

4. March 2009 and May 2010 compliance test measurements performed on individual LFG fueled CAT® G3520C IC engines that are operated at Trail Ridge Energy.

The average exhaust flowrate for the Ocean Energy Corp. CAT® G3520C IC engines calculated from the July 2007 test results is 4,668 dscfm (which is based on 18 individual exhaust flowrate measurements obtained from engine Nos. 7 – 12).

The average exhaust flowrate for the Ocean Energy Corp. CAT® G3520C IC engine calculated from the April 2008 test results is 4,734 dscfm.

The average exhaust flowrate for the Seminole Energy, LLC CAT® G3520C IC engines tested in April 2008, March 2009, and April 2010 is 4,691 dscfm.

The average exhaust flowrate for the Trail Ridge Energy CAT® G3520C IC engines tested in March 2009 and May 2010 is 4,540 dscfm.

Table 3 presents a summary of the LFG fueled CAT® G3520C IC engine exhaust flowrate data that are provided in Appendix G (and presented in the previous text).

3.3.4 Additional Engine Exhaust Flowrate Measurements

Landfill Energy Systems has obtained test data for other LFG fueled CAT® G3520C IC engine operations in which the measured exhaust flowrate results are similar to those that are presented in this document (i.e., actual measured exhaust flowrates are significantly higher than the manufacturer published value of 12,476 acfm and 4,330 dscfm).

3.3.5 Appropriate Engine Exhaust Flowrate

The LFG fueled CAT® G3520C IC engine individual exhaust flowrate measurements (Appendix G, which represents approximately 78 individual measurements) range from 4,419 to 5,260 dscfm.

The average exhaust flowrate for all of the measurements performed on the specified CAT® G3520C IC engines identified in Section 3.3.3 of this document is approximately 4,660 dscfm.

The assembled measurements provide a sufficient amount of data to establish an appropriate exhaust flowrate for the LFG fueled CAT® G3520C IC engine, which is a value of approximately 4,700 dscfm (the average measurement of all the assembled data, 4,660 dscfm, rounded to two significant digits) or approximately 13,700 acfm. This value is:

- Approximately 10% greater than the value published by the equipment manufacturer (12,476 acfm or 22,318 lb/hr), which is estimated to be equivalent to 4,330 dscfm.
- Consistent with theoretical calculations performed by Derenzo and Associates presented in Section 3.3.1 of this document based on the observed, increased fuel use data.

Table 4 presents a summary of equipment design, performance and operating specifications for the CAT® G3520C gas IC engines and electricity generators.

4.0 LANDFILL FACILITY

The Central Disposal Facility is:

1. Owned and operated by Brevard County Solid Waste Management Department; and
2. Located at 2250 Adamson Road in Cocoa, Brevard County.

4.1 Gas Collection / Control System

LFG produced from the decomposition of disposed waste materials at both active and capped cells is being collected by an active gas recovery system at the Central Disposal Facility. A blower station connected to the gas recovery system moves the collected LFG to a central location. LFG that is not currently being used for its energy value is directed to open utility flare(s) where methane, NMOC and HAPs contained in the gas are destroyed (oxidized) at high temperatures.

The Central Disposal Facility operates three (3) open flares with maximum LFG capacities of 2,360 cubic feet per minute (scfm), 2,360 scfm, and 2,080 scfm of landfill gas (i.e., total LFG control capacity of 6,800 scfm or 9.79 MMscf/day).

4.2 MSW Landfill NSPS

The Central Disposal Facility is subject to the regulatory requirements of federal New Source Performance Standards for Municipal Solid Waste (MSW) Landfills (MSW Landfill NSPS, 40 CFR Part 60 Subpart WWW). The provisions of the MSW Landfill NSPS require that an adequate number of wells and sufficiently sized equipment be installed and operated to control all of the LFG generated at the facility. The Central Disposal Facility collects the LFG using a wellfield and either combusts the gas in the open flare(s) or transfers it to Brevard Energy where it is treated and used as fuel to power the IC engine electricity generation facility.

5.0 AIR POLLUTANT EMISSIONS

The existing IC engine electricity generation facility is a pollution control project (PCP) where emission reductions are provided for the LFG generated by the Central Disposal Facility through its beneficial utilization as fuel by Brevard Energy.

Brevard Energy is requesting modifications to the permitted CO and PM_{10} emission rates that can be achieved throughout the maintenance cycle of the engine and account for variations in LFG fuel properties.

5.1 Engine CO Emissions

5.1.1 Manufacturer / Dealer Information

The Gas Engine Technical Data Sheet (Appendix F) specifies a CO:

- Emissions guarantee of 2.5 grams per brake horsepower hour (g/bhp-hr) upon startup of the engine; and
- Not-to-exceed (NTE) limit of 4.13 g/bhp-hr over the maintenance cycle of the engine.

Calculations indicate that at the 4.13 g/bhp-hr NTE limit and 4,330 dscfm exhaust flow rate value (updated value provided by Caterpillar, Inc., see Section 3.3.2 Engine Manufacturer / Dealer Information of this document), the maximum CO emission concentration produced by the LFG fueled CAT® G3520C IC engine would be approximately 1,050 ppmvd (parts per million by volume, dry basis). At an exhaust gas oxygen content of 9% oxygen, this is equivalent to 520 ppmvd at 15% oxygen.

5.1.2 Engine Maintenance

Minor engine maintenance is performed on a regular basis by facility operators. Major maintenance is performed on the CAT® G3520C gas IC engine at intervals of approximately

16,000 hours of operation, which is specified in the equipment maintenance manual published by Caterpillar, Inc. Parts that become worn are replaced during the 16,000 hour equipment maintenance activities, which affects the amount of CO that is produced by the engine (i.e., after the specified maintenance is completed, CO emissions produced by the engine are typically reduced).

5.1.3 Ocean Energy Corp. Periodic Engine CO Monitoring Results

Ocean Energy Corp. (OEC) has been monitoring exhaust oxygen (O_2) content and concentrations of CO and NO_X emitted by its six (6) LFG fueled CAT® G3520C IC engines since operations commenced in April 2007, which is a requirement of its Air Pollution Control Operating Permit.

Appendix H provides Ocean Energy Corp CAT® G3520C IC engine CO, NO_X and O_2 monitoring results for April 2007 through September 2010. The records provided in Appendix H present measured CO concentration values at stack conditions and corrected to 15% O_2.

The Ocean Energy Corp. monitoring data indicate that the average concentration of CO:

1. Is approximately 250 ppmvd at 15% O_2 when the LFG fueled CAT® G3520C IC engine is initially placed in operation.

2. Produced by the LFG fueled CAT® G3520C IC engine increases with increased operating hours.

3. Produced by the CAT® G3520C IC engine increases to a maximum of 361 ppmvd at 15% O_2 throughout the maintenance cycle of the engine.

5.1.4 Compliance Test Results

CO compliance testing has been performed September 2008, March 2009, and May 2010 on individual LFG fueled CAT® G3520C IC engines that are operated at Brevard Energy, LLC. The average measured CO concentrations range from 247.9 to 270.6 ppmvd at 15% O_2, resulting in a calculated CO emission rate between 2.23 and 2.40 g/bhp-hr.

Compliance tests have been performed at several other facilities owned by Landfill Energy Systems (parent company of Brevard Energy). Appendix G provides a summary of:

1. July 2007 compliance test measurements that were performed on six (6) LFG fueled CAT® G3520C IC engines that are operated at Ocean Energy Corp.

2. April 2008, March 2009, November 2009, and April 2010 compliance test measurements performed on individual LFG fueled CAT® G3520C IC engine that are operated at Seminole Energy, LLC (in Seminole County, FL).

3. March 2009 and May 2010 compliance test measurements performed on individual LFG fueled CAT® G3520C IC engines that are operated at Trail Ridge Energy (in Duval County, FL).

The average CO emission rate for the Ocean Energy Corp. CAT® G3520C IC engines calculated from the July 2007 test results ranged from 2.40 to 2.85 g/bhp-hr (which is based on 18 individual emission measurements obtained from engine Nos. 7 – 12).

The average measured CO emission rate for the Seminole Energy, LLC CAT® G3520C IC engines ranges from 2.61 g/bhp-hr to 2.66 g/bhp-hr.

The average measured CO emission rate for the Trail Ridge Energy CAT® G3520C IC engines ranges from 2.56 to 2.70 g/bhp-hr.

5.1.5 Estimated Maximum CO Emissions

Calculations based on the appropriate engine exhaust flowrate of approximately 4,700 dscfm (see Section 3.3.5 Appropriate Exhaust Flowrate of this document) and the projected estimated maximum CO emission concentration of approximately 360 ppmvd at 15% O_2 indicate that the LFG fueled CAT® G3520C IC engines have an estimated maximum mass emission rate of 16.25 pounds per hour (lb/hr), which is equivalent to 3.30 g/bhp-hr.

5.2 Engine PM_{10} Emissions

5.2.1 Compliance Test Results

PM_{10} compliance testing has been performed September 2008, March 2009, and May 2010 on individual LFG fueled CAT® G3520C IC engines that are operated at Brevard Energy, LLC. The average measured PM_{10} emission rates range between 1.06 and 1.18 lb/hr, resulting in a calculated PM_{10} emission factor between 0.217 and 0.238 g/bhp-hr.

Compliance tests have been performed at several facilities owned by Landfill Energy Systems (parent company of Brevard Energy). Appendix G provides a summary of:

1. April 2008, March 2009 and April 2010 compliance test measurements performed on individual LFG fueled CAT® G3520C IC engine that are operated at Seminole Energy, LLC (in Seminole County, FL).

2. March 2009 and May 2010 compliance test measurements performed on one LFG fueled CAT® G3520C IC engine that is operated at Trail Ridge Energy.

The average measured PM_{10} emission rate for the Seminole Energy, LLC CAT® G3520C IC engines ranges from 0.57 and 1.25 lb/hr, resulting in a calculated PM_{10} emission factor between 0.117 and 0.253 g/bhp-hr.

The average measured PM_{10} emission rate for the Trail Ridge Energy, LLC CAT® G3520C IC engines ranges from 0.57 and 0.59 lb/hr, resulting in a calculated PM_{10} emission factor between 0.117 and 0.122 g/bhp-hr.

5.2.2 *PM_{10} Test Methodology*

PM_{10} emission measurements are performed using USEPA Methods 5 and 202. USEPA Method 5 measures filterable particulate matter and USEPA Method 202 measures condensable particulate matter (total PM_{10} emissions are based on the sum of the filterable and condensable fractions). The condensable particulate can be further divided between organic and inorganic fractions. The organic condensable and filterable particulates concentrations are generally low in comparison to the inorganic condensable fraction. Based on a review of test results for several LFG-fueled IC engines, the measured mass emission rate for inorganic condensable particulate is generally five times as great as the combined organic condensable and filterable particulate matter mass emission rate.

5.2.2.1 Sulfur and PM_{10} Relationship

The LFG recovered from the Brevard Central Disposal Facility contains relatively large concentrations of hydrogen sulfide and related sulfur-bearing compounds as compared to similar landfill sites. The increased levels of hydrogen sulfide have been attributed to bacterial reduction of calcium sulfate (gypsum drywall) placed in the landfill during the disposal of hurricane debris. In a typical Method 202 impinger train, the sulfates will become artifacts that are measured as particulate matter even after purging the sample train with nitrogen as required by USEPA Method 202. These artifacts are measured and reported as inorganic condensable PM_{10} concentration. The inorganic condensable fraction is also hydrophilic in nature which increases the particulate mass weight due to the absorption of water in the impinger train.

Landfill Energy Systems (the parent company of Brevard Energy) operates three (3) LFG-fueled electricity generating facilities in Florida that have a range of hydrogen sulfide LFG content and particulate emissions. The most recent particulate emission and hydrogen sulfide LFG content testing performedresulted in measured PM_{10} emissions of:

- 1.06 lb/hr for LFG fuel with a hydrogen sulfide content of 252 ppmv at Brevard Energy in 2010;

- 1.03 lb/hr for LFG fuel with a hydrogen sulfide content of 119.0 ppmv at Seminole Energy in 2010;
- 0.59 lb/hr for LFG fuel with a hydrogen sulfide content of 48.3 ppmv at Trail Ridge Energy in 2010;
- 1.07 lb/hr for LFG fuel with a hydrogen sulfide content of 338.8 ppmv at Brevard Energy in 2009;
- 1.05 lb/hr for LFG fuel with a hydrogen sulfide content of 148.8 ppmv at Seminole Energy in November 2009;
- 0.57 lb/hr for LFG fuel with a hydrogen sulfide content of 42.3 ppmv at Trail Ridge Energy in March 2009;

These results indicate that as the hydrogen sulfide content increases, the particulate matter emissions from the IC engines increases at a nonlinear rate.

Table 5 presents the comparison of hydrogen sulfide gas content and PM_{10} emissions from the Brevard Energy, Seminole Energy, and Trail Ridge Energy locations

5.2.2.2 USEPA Documentation

The USEPA is aware that the Method 202 collection and analysis procedures can artificially increase the measured condensable particulate matter (CPM) emission rate from combustion sources, and created a special workgroup that included USEPA, air emission test companies, and industry to provide recommendations for improving the Method 202 sampling and analysis procedures. The USEPA and this work group are developing an alternate method that is anticipated to reduce this sulfur influence, but until that time Brevard Energy is requesting an adjustment of the permitted PM_{10} emission rate measured with Method 202.

The "Battelle Paper", under EPA Contract No. 68-D-02-061, Work Assignment 3-14, presented information regarding Method 202:

- *Under EPA Contract No. 68-D-02-061, Work Assignment 3-14, a literature search on CPM issues was conducted and is summarized in Appendix A. One of the literature search papers [1] succinctly summarized the sulfur dioxide chemistry taking place in the impingers during sampling observing that sulfur dioxide ($SO2$) and molecular oxygen ($O2$) both are soluble in water. The dissolved $SO2$ can form hydrated $SO2$ ($SO2$ - $H2O$) and sulfite ($SO3^{-2}$) and bisulfite ($HSO3^{-}$) ions in aqueous solution. At the pH range of* *interest (pH 2 through 7),* $HSO3^-$ *is the referred state. The individual dissociations are very fast, so aqueous-phase equilibria are established instantaneously. The dissociation of the dissolved species enhances its aqueous solubility so that the total amount of dissolved sulfate always exceeds that predicted by Henry's Law for SO2 alone. There are several pathways for sulfate formation by reaction of these ions with dissolved O2, ozone, and hydrogen peroxide (the latter two are of no importance in flue gas sampling), which can be catalyzed by many substances such as iron and manganese. Free NH3 in the samples can increase the amount of dissolved SO2 and, thereby, increase artifact sulfate formation, since it instantly reacts in aqueous solution forming ammonium sulfite/bisulfite ions and additional SO2 must dissolve to maintain equilibrium.*

- *There are two main mechanisms for impinger sulfate formation:*
  - *Gaseous SO2 dissolves in the impinger water to form H2SO3-, which may then oxidize by means of molecular O2 or other compounds dissolved in the water to form H2SO4.*
  - *Compared to the actual exhaust plume that cools with atmospheric dilution, condensation of vapors in the impingers is excessive, since the impingers cool the gas stream without dilution.*

From the document "Optimized Method 202 Sampling Train to Minimize the Biases Associated with Method 202 Measurement of Condensable Particulate Matter Emissions," the information regarding Method 202 biases was presented:

- *Air emission testing experience since the promulgation of Method 202 in 1991 has demonstrated that it is inappropriate to use water-filled impingers to cool the sample gas stream for CPM combustion sources having SO2, NO2, and/or soluble organic compound emissions. These gaseous contaminants can partially absorb in the impingers and chemically oxidize to form material counted as CPM in Method 202. These artifact reaction products are not related to the primary emission of CPM from the source.*

  The potentially significant problems affecting Method 202 accuracy include the following:

  1. *Dissolution of sulfur dioxide and nitrogen oxides into water with subsequent oxidation to form sulfates and nitrates in the impingers*
  2. *Dissolution of soluble organic compounds into water*
  3. *Penetration of submicrometer sized condensed particles through the impingers of the Method 202 sampling train*
  4. *Gas phase homogeneous reactions between ammonia and hydrogen chloride and/or between ammonia and sulfur dioxide in the cold, water-filled impingers*

These documents indicate that there is a definite bias acknowledged by the USEPA regarding the sulfur (as SO2) content in the sampled gas stream and resulting in artifact particulate emissions. These artifact particulates are created in the impinger solutions and analyzed with the inorganic portion of the condensable particulate matter.

Appendix I presents the USEPA Method 202 FAQ discussion and selected documents from the USEPA website.

5.2.3 Appropriate PM_{10} Emissions Limits

The LFG collection and fuel treatment systems operated at Brevard Energy, Seminole Energy and Trail Ridge Energy are nearly identical, yet particulate matter emissions measured for the Brevard Energy and Seminole Energy engines are nearly twice as high as those measured for the Trail Ridge Energy engines. Based on a review of these test data and the documents posted by USEPA in regards to Method 202, the observed increase in PM_{10} emissions is more likely the result of test method influences than actual PM_{10} emissions. It is suspected that the artifact formation and the hydrophilic nature of the oxidized gaseous contaminants is the reason that the PM_{10} concentrations are higher than anticipated.

USEPA has indicated that it intends to revise the Method 202 sampling procedures to address the test method bias. However, until that time, Brevard Energy requests that the permitted emission rates be increased from 1.18 lb/hr and 0.24 g/bhp-hr to 1.44 lb/hr and 0.29 g/bhp-hr to correct for the Method 202 sampling bias. This will alleviate any unnecessary compliance issues that may arise from future test results that may exceed the existing permitted PM_{10} emission rates.

5.3 Proposed CO and PM_{10} Emission Rates

The quantity of air pollutants that are emitted by the CAT® G3520C gas IC engine is dependent on fuel quality, fuel properties, accumulated engine operating hours and the operating parameter specifications at which the equipment is set. Based on data provided by the engine manufacturer (which are provided in Appendix F), experience obtained by Landfill Energy Systems from the operation of numerous similar LFG fueled IC engines and results of emission control analyses presented in Section 8.0 (Best Available Control Technology) of this document, the CAT® G3520C gas IC engine has the following maximum CO and $PM_{10}/PM_{2.5}$ emission rates:

- 3.30 g/bhp-hr for CO; and
- 0.29 g/bhp-hr for $PM_{10}/PM_{2.5}$.

The 3.30 g/bhp-hr CO value specified for the CAT® G3520C gas IC engine emissions is based on the information presented in Section 5.1 of this document and the results of Best Available Control Technology (BACT) analyses (Section 8.3.1 CO BACT of this document). Analyses presented in this document indicate that the CO emission rate tends to increase with increased operating hours throughout the engine maintenance cycle. By increasing the permitted CO emission rate from 2.75 to 3.30 g/bhp-hr, the engines will be able to maintain compliance with the allowable CO emission rate over all fuel quality and engine wear / maintenance operating conditions.

The 0.29 g/bhp-hr $PM_{10}/PM_{2.5}$ value specified for the CAT® G3520C gas IC engine emissions is based on the information presented in Section 5.2 of this document and the results of BACT analyses (Section 8.3.2 $PM_{10}/PM_{2.5}$ BACT of this document). Analyses presented in this document indicate that the $PM_{10}/PM_{2.5}$ emission rate:

- Tends to increase throughout the engine maintenance cycle; and
- Measured using the existing promulgated test methods is influenced by the high sulfur content in the LFG.

By increasing the permitted $PM_{10}/PM_{2.5}$ emission rate from 0.24 to 0.29 g/bhp-hr, the engines will be able to maintain compliance with the allowable emission rate over all fuel quality and engine wear / maintenance operating conditions using the promulgated test methods specified in the operating permit.

Table 6 presents a summary of the CAT® G3520C gas IC engine potential CO and $PM_{10}/PM_{2.5}$ emission factors.

The operation of the CAT® G3520C gas IC engine at the specified pollutant emission rates under base load conditions (100% design capacity, 2,233 bhp) will result in maximum potential emissions of:

- 16.25 pounds per hour (lb/hr) and 71.2 TpY of CO (one engine);
  97.47 lb/hr and 426.9 TpY of CO (six engines);
- 1.44 lb/hr and 6.31 TpY of $PM_{10}/PM_{2.5}$ (one engine); and
  8.64 lb/hr and 37.83 TpY of $PM_{10}/PM_{2.5}$ (six engines).

Table 7 presents proposed and existing CO and $PM_{10}/PM_{2.5}$ emission rates for the Brevard Energy facility.

Appendix J provides regulated air pollutant emission rate calculations for the existing CAT® G3520C gas IC engine operations.

5.4 Permit Condition Modifications

Brevard Energy is requesting that permitted (allowable) CO emission rates specified in Condition B.13 for the LFG fueled IC engine generators (EU002, EU003, EU004, EU005, EU006, and EU007) be increased from:

- 2.75 g/bhp-hr to 3.30 g/bhp-hr;
- 13.54 lb/hr to 16.25 lb/hr; and
- 59.3 TpY to 71.2 TpY.

Brevard Energy is also requesting that the permitted (allowable) PM_{10} emission rates specified in Condition B.14 for the LFG fueled IC engine generators (EU002, EU003, EU004, EU005, EU006, and EU007) be increased from:

- 0.24 g/bhp-hr to 0.29 g/bhp-hr per engine;
- 1.18 lb/hr to 1.44 lb/hr per engine;
- 5.16 TpY to 6.31 TpY per engine; and
- 31.0 TpY to 37.8 TpY.

6.0 FLORIDA RULES AND REGULATIONS

The following text presents Florida Administrative Code (F.A.C.), Chapter 62 regulatory requirements and associated compliance information that are applicable to the permitting and operation of the LFG fueled IC engine electricity generation facility operated by Brevard Energy.

6.1 Air Pollution Permit Application Procedure

62-4.050 Procedure to Obtain Permits and Other Authorizations; Applications., F.A.C, specifies that:

(1) Any person desiring to obtain a permit ... shall apply on forms prescribed by the Department and shall submit ... additional information as the Department ... may require.

> Appendix A provides a completed Application for Air Permit – Long Form documents for the existing Brevard Energy LFG fueled IC engine electricity generation facility.

(2) All applications and supporting documents shall be filed in quadruplicate ...

(3) ... All applications for a Department permit shall be certified by a professional engineer registered in the State of Florida ...

> Appendix A provides a State of Florida professional engineer certification for the Title V Air Operation Permit modification.

(4) Processing fees are as follows:
(a) Air Pollution Permits.
1. Construction Permit Fee for an Emission Unit Requiring a Prevention of Significant Deterioration ... Preconstruction Review ... shall be $7,500.

> The source is currently a major PSD source and pays Title V fees annually to the Florida DEP District. The proposed change is not physical in nature and does not change the operation of the process. However, the source is assuming that PSD Review will be required since the CO emission rate will be increasing. The fee for updating the emission factor is [redacted] for PSD significant sources.

6.2 Facility

62-204.200 Definitions., F.A.C., specifies that:
(16) "Facility" means *... All of the emission units which are located on one or more contiguous or adjacent properties and which are under the control of the same person (or persons under common control).*

> While the Brevard Energy electricity generation facility is located on leased land at the Central Disposal Facility, the electricity generation equipment and processes is owned and operated by Brevard Energy and not under the supervisory control of the Brevard County Solid Waste Management Department, which owns and operates the landfill.
>
> However, Brevard Energy is fueled exclusively with LFG generated by the Central Disposal Facility (i.e., no natural gas capabilities). Since all of the fuel utilized by Brevard Energy is and will be supplied by the Central Disposal Facility, the landfill has an implied control over the electricity generation operations of the facility (i.e., Brevard Energy would not have the capability to generate electricity without the existence of the landfill). Therefore, Brevard Energy is part of the stationary source and its sources have been incorporated into the landfill Title V Operating Permit.

6.3 NAAQS Attainment / Nonattainment / Maintenance Areas

62-204.340 Designation of Attainment, Nonattainment, and Maintenance Areas., F.A.C, specifies that:

(1) Designation of Areas Meeting Ambient Air Quality Standards (Attainment Areas).

(b) All of the state except those areas designated as nonattainment under paragraph 62-204.340(2)(b), F.A.C., ... is designated as attainment for the air pollutant PM_{10}.

62-204.340(2)(b), F.A.C, does not list any PM_{10} nonattainment areas.

(d) All of the state except those areas designated as nonattainment under paragraph 62-204.340(2)(d), F.A.C., is designated as attainment for the air pollutant carbon monoxide.

62-204.340(2)(d), F.A.C, does not list any carbon monoxide nonattainment areas.

6.4 Prevention of Significant Deterioration Area Designations

62-204.360 Designation of Prevention of Significant Deterioration Area., F.A.C, specifies that:

(4) All areas of the state shall be classified as Class I, Class II, or Class III.
(a) ... All areas of the state are classified as Class II except ...
(b) ... The following areas of the state are designated as Class I ...
1. Everglades National Park.
2. Chassahowitzka Wilderness Area.
3. St. Marks National Wilderness Area.
4. Bradwell Bay National Wilderness Area.

(5) Federally designated Class I areas outside of Florida but within 100 kilometers of the state are as follows:.
(a) Okefenokee National Wilderness Area.
(b) Wolf Island National Wilderness Area.

Brevard Energy located in Cocoa, Florida is at least 175 kilometers from all national wilderness areas. The closest Class I area is Chassahowitzka National Wildlife Refuge Wilderness Area at 175 kilometers. Analyses to evaluate air quality impacts within this area are presented in Appendix K.

6.5 Adopted Federal Regulations

62-204.800 Federal Regulations Adopted by Reference., F.A.C., lists the following federal regulations that are applicable to the reciprocating internal combustion engines (RICE) and LFG fuel generated by a landfill that is subject to the requirements of 40 CFR 60, Subpart WWW (i.e., a LFG NMOC control device):

(3) ... Approval and Promulgation of Implementation Plans ...

*(b) ...Subpart K, Florida ...*Delegation of Authority to issue federal PSD permits.

(8) ... Standards of Performance for New Stationary Sources ...
(b) ...72. 40 CFR 60, Subpart WWW, Municipal Solid Waste Landfills ...

The existing electricity generation facility is fueled with treated LFG. Therefore, the IC engines are not subject to the specific NMOC reduction requirements of the MSW landfill NSPS (40 CFR 60 Subpart WWW) since LFG received from the Central Disposal Facility is routed to a treatment system that processes the collected gas for subsequent sale or reuse. Section 7.1 (MSW Landfill NSPS) of this document provides additional information.

(11) ... National Emission Standards for Hazardous Air Pollutants ...

The NESHAP applicability for the IC engines was determined when the IC engines were initially permitted to be installed at Brevard Energy.

(16) ... Part 72, Permits Regulation ...
(a) ...
1. 40 CFR 72, Subpart A, Acid Rain Program General Provisions ...

Section 7.2 (Federal Acid Rain Program) of this document provides information that indicates the LFG fueled IC engine electricity generation facility is exempt from the 40 CFR 72, requirements. The federal Acid Rain Program is not applicable since the engine-generator sets are:

1. Fueled exclusively with LFG, which is excluded from the definition of natural gas and is not a fossil fuel.

2. Not an affected unit under the regulation, which is defined as a fossil fuel-fired combustion device.

6.6 Permits Required (Exempt Emission Units)

62-210.300 Permits Required., F.A.C., specifies that ...

(3) Exemptions ...
(a) Categorical Exemptions ...
(30) Petroleum lubrication systems. ...
(b) Generic and Temporary Exemptions.

(1) Generic Emission Unit Exemptions. An emission unit or pollutant-emitting activity that is not entitled to a categorical exemption ... shall be exempt from the permitting requirements of this chapter ... if it meets all of the following criteria:

a. It would be subject to no unit-specific applicable requirements.

b. It would neither emit nor have the potential to emit:

(i) 500 pounds per year or more of lead ...

(ii) 1,000 pounds per year or more of any HAP;

(iii) 2,500 pounds per year or more of total HAP; or

(iv) 5.0 tons per year or more of any other regulated pollutant

c. Its emissions, in combination with the emissions of other units and activities at the facility, would cause the facility to emit or have the potential to emit any pollutant in such amount as to make the facility a Title V source.

d. In the case of a proposed new emission unit at an existing facility, the emissions of such unit, in combination with the emissions of any other proposed new or modified units and activities at the facility, would result in a modification subject to the preconstruction review requirements ...

e. In the case of a proposed new pollutant emitting activity, such activity would not constitute a modification of any existing non-exempt emissions unit at a non-Title V source or any existing non-insignificant emissions unit at a Title V source.

The IC engine lube oil (new and used) storage tanks are permit exempt emission units based on the type and quantities of stored material (and its very low vapor pressures) and the regulatory provisions specified in the preceding text.

6.7 Public Notice and Comment

62-210.350 Public Notice and Comment., F.A.C., specifies that:

(1) Public Notice of Proposed Agency Action.

(a) A notice of proposed agency action on permit applications, where the proposed agency action is to issue the permit, shall be published by the applicant for:

1. An air construction permit.

(2) Additional Public Notice Requirements for Emission Units Subject to Prevention of Significant Deterioration ...

(a) Before taking final agency action on a construction permit application for any new or modified facility ...

2. A 30-day period for submittal of public comments ...

3. ... notifying the public of the opportunity for submitting comments and requesting a public hearing ...

Based on the potential (permitted) emissions, the facility is a major stationary source of CO emissions. The source is not major for PM_{10} emissions. However, the proposed emissions change exceeds the PSD significance level at a major stationary source. Therefore, the source is required to assist the Florida DEP in the public notification process and the results of a public comment period are required to be considered in the permit approval process.

6.8 Stack Height Policy

62-4.550 Stack Height Policy., F.A.C, specifies that:

(1) ... The degree of emission limitation required of any emission unit for control of any air pollutant on a continuous basis shall not be affected by so much of any emission unit's stack height that exceeds good engineering practice ...

The LFG fueled IC engines are housed in a single building with dimensions of 62.67 feet wide by 108.67 feet long by 15 feet high. Therefore, good engineering practice stack height for the emission units is 37.5 feet (i.e., the building height plus 1.5 times the lesser dimension of building height or width). The overall height of the IC engine exhaust stacks is designed for 20 feet (information from Table 4), which is 17.5 feet less than the specified good engineering practice stack height.

6.9 Forms and Instructions

62-210.900 Forms and Instructions., F.A.C., specifies that:

The forms used by the Department in the stationary source control program are adopted and incorporated by reference in this section ...

(1) Application for Air Permit – Long Form, Form and Instructions ...

Appendix A provides a completed Application for Air Permit – Long Form documents for the proposed modification to the Brevard Energy LFG fueled IC engine electricity generation facility.

6.10 Prevention of Significant Deterioration

62-212.400 Prevention of Significant Deterioration (PSD)., F.A.C, specifies that:

(2) Applicability ...
(d) New and Modified Facilities ...
2. New Major Facilities.
Unless exempt ... a proposed new major facility shall be subject to the preconstruction review requirements of this rule if:
a. For any pollutant regulated under the Act, except lead, the sum of ... the potential emissions of all emission units ... would be equal to or greater than 250 tons per year ....

3. Modifications to Minor Facilities.
Unless exempt ... a proposed modification to a minor facility shall be subject to the preconstruction review requirements of this rule only if the modification would be a physical changes which, in and of itself, would constitute a new major facility subject to preconstruction review requirements ....

> Section 5.3 (CO and PM_{10} pollutant emissions) of this document and Table 6 present information that indicate the LFG fueled IC engine electricity generation facility is subject to federal PSD permitting requirements (the existing facility is a major PSD source and the proposed modifications to the emission factors will be treated as if the CO and PM_{10} /$PM_{2.5}$ requires PSD review). The total CO and PM_{10} /$PM_{2.5}$ emissions were modeled to verify compliance with PSD air quality requirements.

(f) Pollutants Subject to PSD Preconstruction.
1. ... for a proposed new facility or modification subject to the preconstruction review requirements of this rule ... the preconstruction review requirement shall apply to all pollutants regulated under the Act for which the sum of potential emissions ... of the facility or modification would be greater than the significant emission rates listed in Table 212.400-2, Regulated Air Pollutants – Significant Emission Rates ...which specifies that:

> 100 TpY of carbon monoxide is a significant emission rate.
> 40 TpY of nitrogen oxides is a significant emission rate.
> 40 TpY of sulfur dioxide is a significant emission rate.
> 40 TpY of VOC is a significant emission rate.
> 15 TpY of PM_{10} is a significant emission rate.
> 10 TpY of $PM_{2.5}$ is a significant emission rate.

> Sections 5.1 and 5.2 (CO and PM_{10} pollutant emissions) of this document and Table 6 present information that indicate the LFG fueled IC engine electricity generation facility is subject to federal PSD permitting requirements. The total CO and PM_{10} /$PM_{2.5}$ emissions were modeled to verify compliance with PSD air quality requirements.

(4) General Provisions.
(a) Facilities or Modifications Affecting Class I Areas.
1. Additional Notification Requirements.
a. The Department shall comply with ... additional notification requirements for a proposed new facility or modification that would be located within 100 kilometers of, or whose emissions may affect, any Federal Class I area ... (Federal Land Manager Participation)

> The distance to the nearest Class I area is over 175 kilometers from the facility. Based upon guidance from Florida DEP, Federal Land Manager and USEPA, a Class I screening modeling analyses was performed to evaluate particulate impacts at 50 km in

the direction of the nearest Class I location from the site. The predicted impacts are below the Class I significance concentration; therefore, no additional modeling was performed using a long range transport model.

The CO Class II modeling indicated that the CO ambient impacts were insignificant and the distance to the nearest Class I area is over 175 kilometers. Due to the low ambient air impacts and distance, the Class I ambient air impacts will not be performed for CO.

A visibility screening analyses was performed to demonstrate that the proposed particulate emissions will not result in visibility degradation within the Class I area.

(5) Preconstruction Review Requirements.
(a) General. ...
2. No owner or operator of a facility or modification subject to the preconstruction review requirements of this subjection shall begin construction prior to obtaining a permit to construct in accordance with applicable regulations ....
(b) Technology Review.
The proposed facility or modification shall comply with all applicable emission limitations contained in Part VI of this chapter and 40 CFR Parts 60 (New Source Performance Standards) and 61 (National Emission Standards for Hazardous Air Pollutants).
(c) Best Available Control Technology
The proposed facility or modification shall apply Best Available Control Technology (BACT) for each pollutant subject to preconstruction review requirements ...

Section 8.0 (Best Available Control Technology) of this document provides information that indicates the LFG fueled IC engine electricity generation facility proposed emission limit modifications comply with CO and PM_{10} BACT.

(d) Ambient Impact Analyses.
The owner or operator of the proposed facility or modification shall demonstrate to the Department that the increase in federally enforceable allowable emissions from the proposed facility or modification ... will not cause or contribute to a violation of any ambient air quality standard or maximum allowable increase.

62-204.240 Ambient Air Quality Standards., F.A.C., and *62-204.260 Prevention of Significant Deterioration Increments.*, F.A.C., present applicable limits for the Ambient Air Impact Analyses.

Appendix K provides Ambient Impact Analyses for the LFG fueled IC engine electricity generation facility. The proposed CO and PM_{10} /$PM_{2.5}$ emission rates were modeled to demonstrate compliance with applicable air quality standards. Air quality impact analyses for all criteria pollutants were submitted with previous construction permit applications.

(e) Additional Impact Analyses.
1. The owner or operator of the proposed facility or modification shall provide the Department with analyses of:
a. The impairment to visibility and soils, and vegetation ...
b The air quality impact projected for the area as a result of general commercial, residential, industrial and other growth associated with the facility or modification; and.
c. The impairment to visibility of ... any Federal Class I area within 100 kilometers of the facility ...
(f) Preconstruction Air Quality Monitoring and Analysis.
The owner or operator of the proposed facility or modification shall provide the Department with an analysis of ambient air quality in the area that the facility or modification would affect for each pollutant subject to NSR requirements ...

Appendix K provides the Class II ambient air analyses, Class I screening analyses, and the visibility screening analyses for the proposed modified CO and PM_{10} /$PM_{2.5}$ emission rates. Class II modeling indicated that the predicted CO ambient impacts are insignificant, and PM_{10} /$PM_{2.5}$ ambient impacts are significant. Screening analysis for pollutant impacts and visibility degradation within the Class I area demonstrate compliance with applicable insignificant concentration levels and visibility impairment thresholds. A Class I Ambient Air Impact Analyses Particulate Screen and the Visibility Degradation Analyses were performed and submitted. Section 9.0 (Air Impact Analyses) of this document provides additional information.

(h) Permit Application Information Required ...
1. A description of the nature, location, design capacity and typical operating schedule of the facility or modification, including specifications and drawings showing its design and plant layout;
2. A detailed schedule for construction of the facility or modification;
3. A detailed description of the system of continuous emission reduction proposed by the facility or modification as BACT, emission estimates and any other information as necessary to determine BACT would be applied ...
4. Information relating to the air quality impacts of the facility or modification ...
5. Information relating to the air quality impacts of, and the nature and extent of, all general commercial, residential, industrial and other growth ...in the area the facility or modification would affect.
6. A good-engineering-practice stack height ... analysis ...

Sections 1.0 (Introduction) to 9.0 (Additional Impact Analyses) of this document provides the Permit Application Information Required for the modified LFG fueled IC engine electricity generation facility.

(6) Best Available Control Technology (BACT)..
(a) BACT Determination ...

Section 8.0 (Best Available Control Technology) of this document provides the CO and PM_{10} BACT analyses.

(7) Construction/Operation Permit Requirements.
(a) Construction Permits.
Any construction permit issued pursuant to this rule shall contain all of the conditions and provisions necessary to insure that the construction and operation of the facility or modification shall be in accordance with the requirements of this rule.

6.11 General Pollutant Emission Limiting Standards

62-296.320 General Pollutant Emission Limiting Standards., F.A.C, specifies that ...

(2) Objectionable Odor Prohibited – No person shall cause, suffer, allow or permit the discharge of air pollutants which cause or contribute to an objectionable odor.

The proposed permit modification is for adjustment of the CO and PM_{10} emission factors only. No new equipment or sources of odor emissions are being installed. Therefore, the current permit has already incorporated appropriate conditions to mitigate objectionable odors.

(4) General Particulate Emission Limiting Standards ...
(b) General Visible Emission Standard.
1. No person shall cause, let, permit, suffer or allow to be discharged into the atmosphere the emissions of air pollutants from any activity, the density of which is equal to or greater than ...(20 percent opacity).

The proposed permit modification is for adjustment of the CO and PM_{10} emission factors. No new equipment or sources of particulate matter emissions are being installed. Therefore, the current permit has already incorporated appropriate conditions to mitigate excess opacity. The relatively small proposed increase in exhaust gas particulate matter is not expected to have any observable impact on exhaust plume opacity.

(c) Unconfined Emissions of Particulate Matter.

1. No person shall cause, let, permit, suffer or allow the emission of unconfined particulate matter from any activity ...without taking reasonable precautions to prevent such emissions...

3. Reasonable precautions include the following:

a. Paving and maintenance of roads, parking areas and yards.

b. Application of water or chemicals to control emissions from such activities as ... grading roads, construction, and land clearing.

The proposed permit modification is for adjustment of the CO and PM_{10} emission factors. No new equipment or sources of fugitive particulate matter are being installed. Therefore, the current permit has already incorporated appropriate conditions to mitigate sources of fugitive particulate matter emissions.

6.12 General Compliance Test Requirements

62-297.310 General Compliance Test Requirements., F.A.C, specifies that ...

(6) Required Stack Sampling Facilities ...

(a) Permanent Test Facilities. The owner or operator of an emission unit for which a compliance test, other than a visible emissions test, is required on at least an annual basis, shall install and maintain permanent stack sampling facilities.

Brevard Energy has installed stack sampling facilities in accordance with the general compliance test requirements for all six (6) IC engines.

(7) Frequency of Compliance Tests ...

(a) General Compliance Testing...

4. During each federal fiscal year (October 1 – September 30), unless otherwise specified ... the owner or operator of each emission unit shall have a formal compliance test conducted for:

a. Visible emissions, if there is any applicable standard;

b. Each of the following pollutants, if there is an applicable standard, and if the emission units or has that potential to emit ... 100 tons per year or more of any regulated air pollutant...

The permit issued to the existing Brevard Energy IC engine operations specifies emission testing for CO, NO_X, PM_{10}, SO_2, NMOC and HCl (one compliance test per year) for one engine per year with a different engine tested each year. The permit condition for the testing requirements is B.20 of Permit No. 0090069-008AV.

6.13 Operation and Maintenance Plan

Section I. Emission Unit Additional Information Item 5. of the Florida DEP Application for Air Permit – Long Form requires that all permit applications provide an Operation and Maintenance Plan.

> The Operation and Maintenance Plan developed for the CAT® G3520C gas IC engine was submitted with the previous permit package. This permit modification for the CO and PM_{10} emission factor changes does not include any new equipment or changes to existing equipment. Therefore, the Operation and Maintenance plan will not be included with this permit application since there are no changes with the equipment that would require new operations and maintenance procedures to be generated and submitted.

7.0 APPLICABLE FEDERAL REGULATIONS

7.1 New Source Performance Standards

7.1.1 Municipal Solid Waste Landfill NSPS

Standards of Performance for MSW Landfills (MSW Landfill NSPS, 40 CFR Part 60 Subpart WWW) regulate NMOC emissions that are generated by affected landfills. *§60.752 Standards for air emissions from municipal solid waste landfills* specifies that:

(b)(2) ... the owner or operator shall: (iii) route all of the collected gas to a control system that complies with either ...

(A) An open flare ...

(B) A control system designed and operated to reduce NMOC by 98 weight-percent, or, when an enclosed combustion device is used for control, to either reduce NMOC by 98 weight percent or reduce the outlet NMOC concentration to less than 20 parts per million by volume, dry basis as hexane at 3 percent oxygen ...

(C) Route the collected gas to a treatment system that processes the collected gas for subsequent sale or use ...

Equipment that utilizes treated LFG, which is collected for subsequent sale or reuse, is not subject to the NMOC emission reduction requirements of the MSW Landfill NSPS (98% reduction or 20 ppmvd exhaust).

Brevard Energy has an approval from USEPA Region IV that specifies the MSW Landfill NSPS requirements are not applicable to the IC engine operations at the electricity generation facility since the combustion equipment uses treated gas as fuel. The USEPA determination issued for Brevard Energy, dated October 19, 2006, (Appendix L) approves the use of LFG treatment equipment, which processes the collected gas for subsequent sale or reuse, as an appropriate LFG emissions control method. These determinations specify that USEPA ... *has stated in the Federal Register Proposed Rule Amendments dated May 23, 2002,* (67 FR 36476-36481) *that compression, de-watering, and filtering the LFG down to at least 10 microns is considered treatment for the purposes of 60.752 (b) (2) (iii) (C).* Therefore, equipment that achieves these specifications is compliant with the emission standards of the MSW Landfill NSPS.

Based on the preceding information, the existing electricity generation facility is fueled with treated LFG. Therefore, the IC engines are not subject to the specific NMOC reduction requirements of the MSW landfill NSPS since LFG received from the Central Disposal Facility is routed to a treatment system that processes the collected gas for subsequent sale or reuse.

7.1.2 <u>Spark Ignition IC Engine NSPS</u>

40 CFR Part 60 Subpart JJJJ Standards of Performance for Stationary Spark Ignition Internal Combustion Engines specifies that *Owners and operators who purchase stationary landfill ... SI engines that are manufactured after July 1, 2007, that are greater than or equal to 500 HP must limit their exhaust emissions of* NO_X *to 3.0 g/HP-hr, emissions of CO to 5.0 g/HP-hr, and emissions of VOC to 1.0 g/HP-hr ...*

The LFG fueled CAT® G3520 IC engines that are at Brevard Energy were manufactured prior to July 1, 2007. Therefore, the source is not subject to the requirements of 40 CFR Part 60 Subpart JJJJ.

7.2 Federal Acid Rain Program

The federal Acid Rain Program (40 CFR Part 72) has been promulgated pursuant to requirements of Title IV of the 1990 Clean Air Act Amendments.

40 CFR 72.6(a), Applicability, specifies that ... *Each of the following units shall be an affected unit, and any source that includes such a unit shall be an affected source, subject to the requirements of the Acid Rain Program . . .*

According to the definitions in 40 CFR 72.2:

- *Unit means a fossil fuel-fired combustion device.*

- *Fossil fuel means natural gas, petroleum, coal, or any form of solid, liquid, or gaseous fuel derived from such material.*

- *Natural gas means a naturally occurring fluid mixture of hydrocarbons (e.g., methane, ethane, or propane) produced in geological formations beneath the Earth's surface that maintains a gaseous state at standard atmospheric temperature and pressure under ordinary conditions ... Natural gas does not include the following gaseous fuels: landfill gas ...*

Based on these regulatory definitions, the federal Acid Rain Program is not applicable since the engine-generator sets are:

1. Fueled exclusively with LFG, which is excluded from the definition of natural gas and is not a fossil fuel.

2. Not an affected unit under the regulation, which is defined as a fossil fuel-fired combustion device.

8.0 BEST AVAILABLE CONTROL TECHNOLOGY

The following text provides analyses of process design, operating practices and best available emission control technologies (BACT) that were considered in determining CO and $PM_{10}/PM_{2.5}$ emission limits for the proposed permitted emission rate adjustments.

8.1 LFG Treatment

Brevard Energy will continue to treat the recovered landfill gas for use as a fuel in the existing IC engine – generator sets. This treatment system dewaters, filters and compresses LFG recovered from the landfill and satisfies the control system criteria of the MSW Landfill NSPS. Therefore, the fuel used to operate the CAT® G3520C IC engines is treated for subsequent sale and use as a fuel as defined by the MSW Landfill NSPS NMOC air emission standards.

The use of treated gas reduces the presence of moisture and particulate matter in the fuel that have the potential to produce adverse affects on combustion.

8.2 Add-on Emission Controls

8.2.1 General Information

Siloxanes (cyclic organic silicon monomers, which are used in the manufacture of personal hygiene, health care and industrial silicone products) are one of the primary impurities in LFG that form combustion byproducts that significantly poison catalyst-based post combustion control systems. Therefore, vendors and suppliers are not willing to guarantee the performance of add-on control equipment when it is used in applications to reduce emissions from LFG combustion projects.

Air Construction Permit 0090069-004-AC was issued for the (6) six existing IC engines. The permit included the Florida DEP Technical Evaluation and Preliminary Determination document dated January 16, 2007, which specifies BACT and other requirements. The Florida DEP BACT review document specifies that:

- *Emission standards requiring after treatment controls from such engines have typically not been required due to poisoning of catalyst leading to poor reduction efficiency and eventually destroying the add-on control device* (page 10).
- *BACT for CO is therefore represented by combustor design (lean-burn) and good combustion practices (air and fuel ratio control) to minimize CO emissions* (page 13).
- *PM_{10} emissions will be minimized through the pretreatment of the landfill gas prior to combustion and proper equipment maintenance of the engines* (page 14).
- *Permits issued LFG-fueled IC Engines have limited their the PM_{10} emissions to rates that range from 0.04 to 0.34 g/bhp-hr* (page 14).

Independent CO and PM_{10} emission limit research was performed for the processes and equipment at Brevard Energy. The results of these analyses verify that emission controls developed for stationary diesel engines (i.e., catch and burn technology) and natural gas fired reciprocating IC engines or turbine engines continue to rely on catalyst-based systems that are subject to fouling when used to control emissions from LFG combustion applications.

Information presented in the USEPA RBLC (RACT, BACT, LAER Clearinghouse) emission and control technology determination database (through June 14, 2010) indicates that no add-on emission controls have been established as BACT for LFG fueled IC engines. The USEPA RBLC data contain 28 emission and control technology determinations for LFG fueled IC engine operations (as of June 14, 2010).

Appendix M provides USEPA RBLC data and supporting information for LFG fueled IC engine operations.

8.2.2 Caterpillar, Inc. Recommendation

Information published by Caterpillar, Inc. (document *G3600-G3300 Low Energy Fuels* that has been developed to present manufacturer experience with operating spark-ignited engines on medium and low energy fuels) has not been revised since October 2006 and still specifies (as of June 2010) that:

Several attempts have been made to control exhaust emissions of reciprocating engines operating on LFG or digester gas with an exhaust gas catalyst. LFG contains contaminants such as chlorine, fluorine, and silicon that have proven to be detrimental to exhaust catalysts ... In addition, many users select lubricating oils that have high ash content. The ash tends to coat the catalyst, making the catalyst ineffective in a short period of time. For these reasons, we do not recommend the use of catalysts in conjunction with landfill or digester applications.

8.2.3 Ameresco Ox Mountain Project

Ameresco Half Moon Bay, LLC (Ameresco) has constructed and operates a LFG fueled spark-ignited reciprocating internal combustion engine electricity generation facility in northern California. The project consists of six (6) GE Jenbacher JGS 616 GS-L.L gensets. Each genset includes a GE Jenbacher model J 616 GS-E22 engine rated at 2,677 bhp that drives a generator to produce approximately 1.9 MW. Based on documents obtained by Derenzo and Associates, GE Jenbacher has provided CO emissions guarantees as low as 2.1 g/bhp-hr. However, the guarantee is specified for startup only, and does not extend beyond that point.

Each engine is equipped with a CO oxidation catalyst (OC) and one engine is equipped with a Selective Catalytic Reduction (SCR) system for NOx control. Since these catalytic abatement devices have not been successfully used on a long term basis for LFG fired engines, the Bay Area Air Quality Management District (BAAQMD) has provided the company with limited flexibility in the issued permit for the engines to be operated without the specified emission controls. Ameresco has installed a LFG treatment system (activated carbon) to remove moisture and contaminants, especially volatile siloxanes that accelerate catalyst failure.

The Ameresco permit evaluation documents specify that "This technology [oxidation catalysts] has not been successfully demonstrated on an engine fueled solely with LFG. However, if successfully demonstrated at this facility, it will establish a new BACT. Since the successful operation has not been demonstrated, Ameresco may request approval to increase the abated emissions level if the oxidation catalysts performance results in CO emissions above 0.52 g/bhp-hr and/or Ameresco may request approval to remove the oxidation catalyst if it fails prematurely." The permit defines premature failure as less than 16,000 hours.

Based on initial discussions with BAAQMD personnel in August 2009, the engines at Ox Mountain were approaching 3,500 operating hours (as of early August 2009); the catalyst emission controls (connected to the unit that has also been equipped with a CEM) also had approximately 3,500 operating hours on them (as of early August).

Information obtained from the facility operator indicates that there is evidence of siloxane breakthrough in the carbon treatment system and the carbon may be getting near the end of its useful life. CO emissions are observed to increase with increased operating hours up to the point when the carbon in the siloxane removal system undergoes regeneration. When regenerated carbon is placed in operation, lower CO emissions are observed at the exhaust of the OC.

While the monitored CO emission rate was initially relatively low with the commencement of the OC operations, the CO emissions from the units has drifted up and are consistently greater than the permit limit value of 0.52 g/bhp-hr (and are drifting higher).

In November 2009, representatives of the BAAQMD were contacted to obtain an update on the Ameresco Ox Mountain project. The BAAQMD representatives indicated that the OC is variable in its CO control effectiveness and that the OC catalyst may be poisoned. The SCR catalyst (for NO_X control) appears to be retaining its efficacy better than the OC, but more information will need to be obtained before BAAQMD can determine whether or not the OC or SCR are acceptable control options (i.e., a final BACT determination has not been made). No updates relative to equipment operating time were available from the BAAQMD at the time, though it can be assumed that the engines and control devices have operated on a consistent basis since August 2009.

Based on the preceding information, it is not possible to make a determination that siloxane pretreatment with OC for CO emission reductions has been proven to be technologically feasible on a long-term basis. The OC placed in operation at Ox Mountain with the use of siloxane pretreatment has experienced performance degradation beginning in early August between the 3,000 - 3,500 hour operating period when the system was only at 30% of the 16,000 hour mark. Information obtained from BAAQMD indicates that the catalyst may be poisoned as of November 2009 (which is 35% of the 16,000 hour time period, which the BAAQMD has established as the criteria for premature failure). While the NO_X emissions from the SCR have remained relatively constant since the equipment has been placed in operation, it also has been in operation less than the 16,000 hour premature failure criteria established by the regulatory agency.

8.3 Related BACT Determinations and Information

8.3.1 BAAQMD BACT

BAAQMD has made a BACT Determination for RICE fueled by LFG with a horsepower output greater than 250 horsepower. This determination was published March 5, 2009 and remains in effect while the Ox Mountain project is under evaluation. The BAAQMD categorized engines as either Low NO_x or Low CO bias engines and specifies that BACT for a:

- Low NO_x bias engine is 0.5 g/bhp-hr NO_X with a CO NTE value of 3.9 g/bhp-hr;
- Low CO bias engine is 0.6 g/bhp-hr NO_X with a CO NTE value of 3.6 g/bhp-hr; and

- BAAQMD considers LFG filtration as BACT for PM_{10} emissions. No PM_{10} BACT emission value is specified in the document.

The BAAQMD CO BACT determination was published as a not-to-exceed (NTE) value since BAAQMD recognized that CO emissions tend to increase with increased engine operating hours and between engine overhauls.

The BAAQMD considers the filtration of the fuel supply as PM_{10} BACT to remove the particulate in the LFG. By removing particulates, the IC engine combusts a cleaner gaseous fuel.

Appendix N presents a printout of the BAAQMD BACT determination for LFG fueled IC engines.

8.3.2 SCAQMD Rule 1110.2

The South Coast Air Quality Management District (SCAQMD) has promulgated rules (Rule 1110.2 Emissions From Gaseous – and Liquid – Fueled Engines) that reduce CO and NO_X from engines. This rule states that:

> *(d) Requirements ...*
>
> *(1) Stationary Engines*
>
> *(C) ... the operator of any stationary engine fired with LFG ... (biogas) shall not operate the engine in a manner that exceeds ...* 11 ppmvd for NO_X and 250 ppmvd for CO corrected to 15% O_2 *provided the facility monthly average biogas usage by biogas engines is 90% or more ...*
>
> *The concentration limits effective on and after July 1, 2012 shall become effective provided the Executive Officer conducts a technology assessment that confirms that the limits are achievable and reports to the Governing Board by July 2010 ...*

The regulatory analyses considered by the SCAQMD in the promulgation of Rule 1110.2 (which was amended on July 9, 2010 with the specified requirements) indicate that:

1. Add-on controls to reduce CO and NO_X emissions from LFG fueled engines are not currently technically feasible; and

2. An appropriate time period to address the technical feasibility component of the emission control requirement (for LFG fueled engines) is July 2010.

Information obtained by organizations that operate LFG fueled IC engines in the SCAQMD indicates that the July 1, 2012 applicability date of the rule would be extended if the technology assessment due July 2010 does not confirm that the specified emission limits are technically achievable.

The 11 ppmvd NO_X and 250 ppmvd CO (corrected to 15% O_2) concentration limits are equivalent to mass emission rates of 0.16 and 2.2 g/bhp-hr (respectively) for the LFG fueled CAT® G3520C IC engine (based on an exhaust flowrate of 4,700 dscfm and horsepower rating of 2,233). These values are well below the emission limits that are proposed in this permit application, and can not be achieved by LFG (treated gas) fueled CAT® G3520C IC engine operations without the use of add-on controls (which, at this time, has not been determined to be feasible on a long-term basis).

8.3.3 USEPA RBLC CO BACT Data

Information presented in the USEPA RBLC emission and control technology determination data base (through June 14, 2010) indicates that BACT for CO emissions from LFG fueled IC engines:

1. Range from 2.5 to 3.0 g/bhp-hr; and
2. Are applicable to the operation of lean burn engines with air to fuel ratio control or simply specified as 'clean burn engine' (i.e., no add-on emission controls).

Due to the presence of siloxanes (and other chemicals) in the LFG fuel (see Section 8.1.2 Siloxanes and Section 8.1.3 Add-on Emission Controls of this document), the utilization of Non-Selective Catalytic Reduction (NSCR), Selective Catalyst Reduction (SCR) and oxidation catalysts (OC) to control CO in the exhaust of LFG fueled IC engines have not been determined to be technically feasible on a long term basis.

Information obtained from the BAAQMD (see Section 8.2.3 Ameresco Ox Mountain) and SCAQMD Rules (see Section 8.2.4 SCAQMD Rule 1110.2 of this document) also indicate that the use of add-on controls to reduce CO emissions from LFG fueled engines is not currently been determined to be technically feasible on a long term basis.

8.3.4 USEPA RBLC PM_{10} BACT Data

Information presented in the USEPA RBLC emission and control technology determination data base (through June 14, 2010) indicates that BACT for PM_{10} emissions from LFG fueled IC engines range from 0.05 to 0.34 g/bhp-hr. It is unclear whether all of these determinations included both filterable and condensable particulates in the analysis.

Currently, the LFG is treated by dewatering and then filtering before the IC engines combust the fuel. Fuel treatment is specified in the MSW NSPS and reduces the particulate and results in a cleaner burning engine.

8.3.5 Fuel Sulfur Content

Sulfur oxide emissions (SO_X) have the potential to be produced during the combustion of LFG since it contains sulfur-bearing compounds that are oxidized at normal engine operating temperatures. Therefore, the magnitude of potential SO_X emissions produced by the CAT® G3520C gas IC engine is dependent on the sulfur content of the fuel (as opposed to being dependent on combustion technology and controls). To date, the LFG sampling performed at the Central Disposal Facility has resulted in measured H_2S values averaging 326 ppmv.

The LFG used as fuel for the Brevard Energy IC engines contains greater concentration of H_2S that becomes SO_X under combustion than other landfills due to the hurricane debris placed at the Central Disposal Facility. It has been presented in USEPA literature that USEPA Method 202 erroneously converts the SO_X to artifact particulates. This occurs even when the nitrogen purge is performed as required in the method. Since this method artificially inflates the $PM_{10}/PM_{2.5}$ emissions and the concentrations of PM_{10} have been steadily increasing during the maintenance cycle and biological degradation of the landfill material, the $PM_{10}/PM_{2.5}$ BACT should be increased to compensate for the artifact particulates created with USEPA Method 202.

Currently, USEPA and a workgroup are developing a new method to replace Method 202 and correct these biases. It is not known when the method will be promulgated.

8.4 BACT Determinations

8.4.1 CO BACT

Data collected by Landfill Energy Systems representatives, which are based on data that are representative of engine operations over the maintenance cycle of the engine, indicate that CO emissions from the LFG (treated gas) fueled CAT® G3520C IC engines operated at Ocean Energy Corp. increase to a maximum:

1. Concentration of approximately 360 ppmvd corrected to 15% O_2 (during the operating period between which major maintenance is required to be performed on the equipment).

2. Mass emission rate of 16.25 lb/hr (3.3 g/bhp-hr) based on the use of an engine exhaust flowrate of 4,700 dscfm.

Based on the information presented in this section, CO BACT for the existing LFG (treated gas) fueled CAT® G3520C IC engines at Brevard Energy is 3.3 g/bhp-hr, which is:

1. Less than the manufacturer's NTE guarantee of 4.13 g/bhp-hr;

2. Based on the data that are presented in this permit application and representative of actual equipment emission and operation conditions (for the CAT® G3520C gas IC engine);

3. Less than the BAAQMD BACT determination for a low-CO bias engine.

8.4.2 $PM_{10}/PM_{2.5}$ BACT

Since the completion and approval of the specified PSD BACT analyses, Landfill Energy Systems (the parent company of Trail Ridge Energy, Seminole Energy, Brevard Energy, and Ocean Energy Corp.) has performed PM_{10} emission compliance tests on 8 of the 16 LFG (treated gas) fueled CAT® G3520C IC engines that it currently operates in Florida.

The results of these compliance tests are provided in Appendix G. The average PM_{10} emission rate obtained from all the CAT® G3520C IC engine tests is 0.159 g/bhp-hr. The highest PM_{10} emission rate obtained from the CAT® G3520C IC engine tests available and summarized in Appendix G is 0.238 g/bhp-hr (which excludes one outlier measurement of 0.253 g/bhp-hr at Seminole Energy).

Each of the tested IC engines is a Caterpillar G3520C IC engine and the LFG treatment systems that supply the LFG fuel to the IC engines are identical. The only variable between these locations is the LFG supplied to the engines as fuel. The LFG sulfur content varies from site to site and from year to year depending upon the biological degradation and the material in the landfill.

As discussed in this document, the inorganic condensable particulate fraction measured with USEPA Method 202 has a direct relationship with certain gases (e.g., SOx) in the IC engine exhaust gas. Therefore, the measured PM_{10} emission rate is dependent upon the sulfur content in the LFG. As the sulfur content increases so does the inorganic fraction of particulate matter measured by the Method 202 sample train. Emissions testing at Brevard Energy have resulted in measured PM_{10} emission rates that approach, but have not yet exceeded, the permitted limit. The relatively high LFG sulfur content for the LFG fired by the Brevard Energy IC engines indicate that the increased PM_{10} emission rates are the result of test method influences as opposed to actual PM_{10} emissions from engine operation.

USEPA is currently working with stakeholders to develop an alternate method that would replace and correct the biases of USEPA Method 202. Until that new method is promulgated, Brevard Energy requests that the permitted limit be increased to 0.29 g/bhp-hr PM_{10} based upon the bias from Method 202 and the relatively high sulfur content of the LFG fuel.

9.0 AIR IMPACT ANALYSES

Federal and State of Florida PSD regulations require (in addition to appropriate air pollutant emission BACT and air quality impact demonstrations) that new major sources address air quality issues that pertain to visibility degradation, and vegetation, soil and growth impacts.

The nearest Class I area to the Brevard Energy electricity generation facility (Cocoa, Florida) is the Chassahowitzka Wilderness Area, which approximately 175 kilometers (109 miles) west-northwest of the site. The Everglades National Park (Florida), St. Marks National Wilderness Area (Florida), Okefenokee Wilderness Area (Georgia) and Wolf Island National Wilderness Area (South Carolina) are all Class I areas that are located over 200 kilometers from the site of the proposed electricity generation facility.

The CO Class II modeling indicated that the CO ambient impacts were insignificant and the distance to the nearest Class I area is over 175 kilometers. Due to the low ambient air impacts and distance, the Class I ambient air impacts will not be performed for CO.

The PM_{10} Class II modeling indicated that the PM_{10} ambient impacts were significant and the distance to the nearest Class I area is over 175 kilometers. The Class I ambient air impact screen was performed for PM_{10} which indicated that the Class I ambient impact was not required per Florida DEP guidance. Additionally, the Class I Ambient Air Impact Analyses and the Visibility Degradation Analyses were performed and submitted with a previous permit application, and issued as 0090069-004-AC.

CO and PM_{10} emissions are the only emissions which have changed and are being modeled for completeness as a Class II Ambient Air Impact Analyses. Appendix K presents in this permit application the Class II Ambient Air Impact Analyses. Additionally, PM_{10} emissions were modeled for the Class I Ambient Air Impact screen which is presented in Appendix K.

9.1 Visibility Degradation

Visibility degradation was performed using VISCREEN. No visibility issues were noted from the increase in PM_{10} and CO emissions. However, visibility analyses was performed at Class I areas during the permitting of these six (6) engines without any exceedances of the visibility criteria.

9.2 Vegetation and Soil Impacts

The effects that air pollutants have on vegetation can be classified into three general categories: acute, chronic and long term. Acute effects are those that result from relatively short exposures (i.e., less than one month) to high concentrations of pollutant emissions. Chronic effects occur when organisms are exposed for months or even years to certain threshold levels of pollutants.

Long-term effects include abnormal changes in ecosystems and subtle physiological alterations in organisms. Acute and chronic effects are caused by pollutants acting directly on the organism, whereas, long-term effects can be indirectly caused by secondary agents such as changes in the pH of the soil.

The USEPA Air Quality Planning and Standards, Air Strategies and Standards Division, has developed secondary NAAQS for the protection of *the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air.* The values set for the secondary NAAQS incorporate the protection of ecosystems, which includes vegetation and soil.

The results of Ambient Impact Analyses (Appendix K) present maximum predicted CO pollutant impacts, which are estimated to occur from the proposed electricity generation facility emissions and are below the associated secondary NAAQS. The modified electricity generation facility will be a pollution control project (PCP) where control is provided for LFG generated by the Central Disposal Facility through its treatment and beneficial utilization. Control of the LFG will result in reductions in the amounts of total VOC and NMOC that are generated by the landfill.

A time-dependent amount of LFG is generated at the Central Disposal Facility, which is required to be controlled through its combustion. Both flaring and IC engines create LFG combustion by-product air pollutant emissions. Therefore, the effect on air quality that surrounds the facilities is similar whether the LFG is flared or burned as IC engine fuel (a specific quantity of LFG will be combusted in either device).

Therefore, based on the preceding information, no significant or adverse impact on vegetation and soil is expected to occur from the proposed electricity generation facility.

9.3 Growth Impacts

Growth impacts were discussed in the construction technical source document of the six (6) IC engines. The proposed emission limitation modifications will not affect growth impacts.

9.4 Alternative Sites Analysis

An analysis of alternative sites was presented in the original construction permit application for the six (6) IC engines. The proposed emission limitation modifications do no impact the alternative sites analysis.

Application Prepared By:

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Engineering Services Manager

Table 1. Heat Content Values for the Treated Gas Fuel Used at the Existing Brevard Energy Facility

Parameter	Minimum (Btu/scf)	Maximum (Btu/scf)	Average (Btu/scf)
Lower heating value (LHV)*	426	479	464
Higher heating value (HHV)**	474	533	517

* Based on a methane LHV of 910 Btu/scf.

** Based on a methane HHV of 1010 Btu/scf

Table 2. Hydrogen Chloride and Sulfur Dioxide Emission Factors for LFG Combustion Based on Sampling Results for Gas Recovered from the Central Disposal Facility

	Emission Factor (lb/MMcf)					
Pollutant	May 2008	Nov. 2008	Mar. 2009	Nov. 2009	May 2010	Average
HCl	0.73	0.50	0.33	0.79	0.98	0.67
HCl*	<1.57	<0.69	<0.78	<1.34	<2.60	<1.08
SO_2	47.95	42.40	56.20	27.50	41.94	43.20
SO_2**	<54.60	<96.26	<56.40	<38.31	<42.18	<57.55

* Includes all 'non-detect' chlorinated compounds at the method detection limits.

** Includes all 'non-detect' sulfur compounds at the method detection limits.

Table 3. Summary of LFG Fueled CAT® G3520C IC Engine Exhaust Flowrate Measurement Data[1]

Source	Exhaust Flowrate (dscfm)*
Ocean Energy Corp. – July 2007 (CO/NOx/PM)	4,668
Ocean Energy Corp. – April 2008 (PM10)	4,734
Seminole Energy – April 2008 (CO / NOx)	4,591
Seminole Energy – April 2008 (PM10)	5,260
Seminole Energy – April 2008 (HCl)	4,964
Seminole Energy – March 2009 (CO / NOx)	4,508
Seminole Energy – March 2009 (PM10)	4,520
Seminole Energy – March 2009 (HCl)	4,562
Seminole Energy – April 2010 (PM10/ CO/ NOx)	4,581
Seminole Energy – April 2010 (HCl)	4,546
Brevard Energy – September 2008 (HCl)	4,839
Brevard Energy – March 2009 (CO / NOx)	4,432
Brevard Energy – March 2009 (PM10)	4,419
Brevard Energy – March 2009 (HCl)	4,521
Brevard Energy – May 2010 (PM10)	4,412
Brevard Energy – May 2010 (HCl)	4,453
Brevard Energy – May 2010 (CO/NOx)	4,432
Trail Ridge Energy – March 2009	4,503
Trail Ridge Energy – March 2009 (PM10)	4,612
Trail Ridge Energy – March 2009 (HCl)	4,594
Trail Ridge Energy – May 2010 (PM10)	4,527
Trail Ridge Energy – May 2010 (HCl)	4,496
Trail Ridge Energy – May 2010 (CO/NOx)	4,512
Weighted Average[2]	4,660

Notes

1. From Appendix G
2 Weighted based on number of individual test measurements (not by the average calculated for each facility or event)
* 100% Load

Table 4. Design and Operating Specifications for the LFG Fueled IC Engine Generator Sets

Specification per unit	CAT® G3520C IC Engine Generator Set	
Number of identical units	1	6
Power generation (bhp)	2,233	13,398
Electricity generation (kW)	1,600	9,600
Heat input rate (LHV MMBtu/hr) Mfg. Data[1]	14.53	-
Heat input rate (LHV MMBtu/hr) Actual Data	14.89	89.34
Fuel consumption[2] (scfm)	583	3,498
Exhaust gas temperature (°F)	900	-
Average exhaust flowrate (acfm)	13,700	-
Average exhaust flowrate[3] (dscfm)	4,700	-
Average exhaust oxygen content (% dry)	8.5	-
Average exhaust exist velocity (fps)	129	-
Exhaust stack diameter (inches)	18	-
Exhaust stack release height (feet)	23	-
Building height (feet)	15	-

Notes

1. See Appendix F Technical Data Sheet (242,216 Btu/min LHV).
2. Based on minimum fuel LHV of 426 Btu/scf and maximum engine LHV input rate of 14.89 MMBtu/hr.
3. Corrected to dry standards conditions (70°F).

Table 5. 2010 Hydrogen Sulfide Content and Particulate Test Results at Three (3) Florida Landfill Sites

LFGTE Site	Treated LFG H_2S Concentration (ppmv as H_2S)	PM_{10} Inorganic Conentration[1] (mg/m^3)	PM_{10} Total Concentration[2] (mg/m^3)	PM_{10} Mass Emission Rates (lb/hr)
Brevard Energy	252.3	58.89	73.13	1.06
Seminole Energy	119.0	52.81	60.15	1.03
Trail Ridge Energy	48.3	26.84	34.84	0.59

1 – PM_{10} inorganic concentration is based upon the inorganic particulate fraction from USEPA Method 202 and the sample gas volume for the testing performed.

2 – PM_{10} total concentration is based upon filterable particulate results (USEPA Method 5) condensable (USEPA Method 202) particulate results, and the sample gas volume for the testing performed.

Table 6. Proposed CO and PM Emission Factors for the LFG Fueled CAT® G3520C IC Engine Operations

Air Pollutant	Emission	Factor	Single ICE (lb/hr)	Single ICE (TpY)
CO	3.30	g/bhp-hr	16.25	71.2
PM10 / PM2.5	0.29	g/bhp-hr	1.44	6.31

Table 7. Proposed CO and PM Emission Rates for the Existing CAT® G3520C Gas IC Engine Electricity Generation Facility

	Permitted Emission Rates (6 engines)		Proposed Modification[1,2] (6 engines)	
Air Pollutant	(lb/hr)	(TpY)	(lb/hr)	(TpY)
CO	81.24	355.8	97.50	426.9
$PM_{10}/PM_{2.5}$	7.08	31	8.64	37.8

Notes
1. Based on continuous operation of the CAT® G3520C at maximum capacity.
2. Air pollutant emission rate calculations are provided in Appendix J.

APPENDIX A

FDEP-DARM APPLICATION FOR AIR PERMIT - LONG FORM

Department of Environmental Protection

Division of Air Resource Management

APPLICATION FOR AIR PERMIT - LONG FORM

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I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit for a proposed project:

- subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- at an existing federally enforceable state air operation permit (FESOP) or Title V permitted facility.

Air Operation Permit – Use this form to apply for:

- an initial federally enforceable state air operation permit (FESOP); or
- an initial/revised/renewal Title V air operation permit.

Air Construction Permit & Revised/Renewal Title V Air Operation Permit (Concurrent Processing Option) – Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: Brevard County Commissioners
2. Site Name: Central Disposal Facility
3. Facility Identification Number: 0090069
4. Facility Location...
   Street Address or Other Locator: 2250 Adamson Road
   City: Cocoa County: Brevard Zip Code: 32926
5. Relocatable Facility? ☐ Yes ☒ No
6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: Scott Stacy
2. Application Contact Mailing Address...
   Organization/Firm: Derenzo and Associates, Inc.
   Street Address: 39395 Schoolcraft Road
   City: Livonia State: MI Zip Code: 48150
3. Application Contact Telephone Numbers...
   Telephone: (734) 464 - 3880 ext. Fax: (734) 464 - 4368
4. Application Contact Email Address: sstacy@derenzo.com

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	
2. Project Number(s):	
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

APPLICATION INFORMATION

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☐ Air construction permit.

Air Operation Permit

☐ Initial Title V air operation permit.
☐ Title V air operation permit revision.
☐ Title V air operation permit renewal.
☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.
☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

☒ Air construction permit and Title V permit revision, incorporating the proposed project.
☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

☒ I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

Facility is subject to Federal Prevention of Significant Deterioration Permitting (PSD) program and Title V program.

Six (6) existing engines CO emission factor is requested to be modified from 2.75 g/bhp-hr CO to 3.3 g/bhp-hr CO.

Six (6) existing engines PM10 emission factor is requested to be modified from 0.24 g/bhp-hr PM10 to 0.29 g/bhp-hr PM10.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	**Description of Emissions Unit**	**Air Permit Type**	**Air Permit Proc. Fee**
EU-004, EU-005, EU-006. EU-007, EU-008 and EU-009	Landfill gas fueled IC engine electricity generation facility (6 identical engine-generator sets)	AC1A	$7,500

Application Processing Fee

Check one: ☒ Attached - Amount: $ 7,500 ☐ Not Applicable

APPLICATION INFORMATION

Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1. Application Responsible Official Name:
Scott Salisbury, Managing Member/Secondary Responsible Official, Brevard Energy, LLC

2. Application Responsible Official Qualification (Check one or more of the following options, as applicable):

☒ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C.

☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively.

☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official.

☐ The designated representative at an Acid Rain source.

3. Application Responsible Official Mailing Address...
Organization/Firm: Brevard Energy, LLC
Street Address: 29261 Wall Street
City: Wixom State: MI Zip Code: 48393

4. Application Responsible Official Telephone Numbers...
Telephone: (248) 380 - 3920 ext. Fax: (248) 380 - 2038

5. Application Responsible Official Email Address: Scott.Salisbury@landfillenergy.com

6. Application Responsible Official Certification:

I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.

Signature

11/15/10
Date

Professional Engineer Certification

1. Professional Engineer Name: Rob Harvey, P.E.
Registration Number: License No. 68151, Expiration February 28, 2011

2. Professional Engineer Mailing Address...
Organization/Firm: Derenzo and Associates, Inc.
Street Address: 4970 Northwind Drive, Suite 120
City: Lansing State: MI Zip Code: 48823

3. Professional Engineer Telephone Numbers...
Telephone: (517) 324 - 1880 ext. Fax: (517) 324 - 5409

4. Professional Engineer Email Address: rharvey@derenzo.com

5. Professional Engineer Statement:

I, the undersigned, hereby certify, except as particularly noted herein, that:*

(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and

(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.

(3) If the purpose of this application is to obtain a Title V air operation permit (check here ☐, if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.

(4) If the purpose of this application is to obtain an air construction permit (check here ☒, if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here ☐, if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.

(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here , if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.

Signature

11/16/10
Date

(seal)

*Attach any exception to certification statement.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone 17 East (km) 516.749 North (km) 3140.571		2. Facility Latitude/Longitude... Latitude (DD/MM/SS) 28/23/35.63 Longitude (DD/MM/SS) 80/49/43.80	
3. Governmental Facility Code: 0	4. Facility Status Code: C	5. Facility Major Group SIC Code: 49	6. Facility SIC(s): 4953
7. Facility Comment : Existing electricity generation facility is located on leased land at the Brevard County Central Disposal Facility.			

Facility Contact

1. Facility Contact Name:
William Brown

2. Facility Contact Mailing Address...
Organization/Firm: Seminole Energy, LLC
Street Address: 5110 US Highway 301 South
City: Baldwin State: FL Zip Code: 32234

3. Facility Contact Telephone Numbers:
Telephone: (321) 698 - 1586 ext. Fax: ( ) –

4. Facility Contact Email Address: lestrailridge@live.com

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name:
Euripides Rodriguez

2. Facility Primary Responsible Official Mailing Address...
Organization/Firm: Brevard County Board of Commissioners
Street Address: 2725 Judge Fran Jamieson Way, A118
City: Viera State: FL Zip Code: 32940

3. Facility Primary Responsible Official Telephone Numbers...
Telephone: (321) 633 - 2042 ext. Fax: ( ) –

4. Facility Primary Responsible Official Email Address:
euripides.rodriguez@brevarddounty.us

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☒ Unknown
2. ☐ Synthetic Non-Title V Source	
3. ☒ Title V Source	
4. ☒ Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☐ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☒ Synthetic Minor Source of HAPs	
8. ☒ One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☐ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☒ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	

12. Facility Regulatory Classifications Comment:

The permitted electricity generation facility is:

1. A PSD major source for CO
2. Modification for PM_{10}
3. Operate devices that provide control for gas (NMOC) generated by the Brevard County Central Disposal Facility, which is subject to the MSW Landfill NSPS and NESHAP.

FACILITY INFORMATION

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
CO	A	N
NOX	B	N
VOC	B	Y
PM10	B	N
SO2	B	N
HAPS	B	N
H106	SM	Y

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

1. Pollutant Subject to Emissions Cap	2. Facility Wide Cap [Y or N]? (all units)	3. Emissions Unit ID No.s Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap
H106	Y			12	ESCMACT
VOC	Y			36	ESCPSD

7. Facility-Wide or Multi-Unit Emissions Cap Comment:

Current Permitted facility, the only changes are the emission factors for CO and PM_{10} emissions.

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☒ Attached, Document ID: Appendix C ☐ Previously Submitted, Date:________

2. Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☒ Attached, Document ID: Appendix D ☐ Previously Submitted, Date:_______

3. Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
☐ Attached, Document ID: ☒ Previously Submitted, Date: June 2, 2006

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location:
☒ Attached, Document ID: Appendix C ☐ Not Applicable (existing permitted facility)

2. Description of Proposed Construction or Modification:
☒ Attached, Document ID: Sections 3-5

3. Rule Applicability Analysis:
☒ Attached, Document ID: Sections 6-8

4. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.):
☒ Attached, Document ID: Sections 2-3 ☐ Not Applicable (no exempt units at facility)

5. Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.):
☐ Attached, Document ID:__________ ☒ Not Applicable

6. Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.):
☒ Attached, Document ID: Section 9/Appendix K ☐ Not Applicable

7. Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.):
☒ Attached, Document ID: Section 9/Appendix K ☐ Not Applicable

8. Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.):
☒ Attached, Document ID Section 9/Appendix K ☐ Not Applicable

9. Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.):
☒ Attached, Document ID: Section 9/ Appendix K ☐ Not Applicable

10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.):
☐ Attached, Document ID:__________ ☒ Not Applicable

Additional Requirements for FESOP Applications

1. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.):
   ☐ Attached, Document ID:________ ☐ Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications

1. List of Insignificant Activities (Required for initial/renewal applications only):
   ☐ Attached, Document ID:________ ☒ Not Applicable (revision application)
2. Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought):
   ☒ Attached, Document ID: Sections 6-8
   ☐ Not Applicable (revision application with no change in applicable requirements)
3. Compliance Report and Plan (Required for all initial/revision/renewal applications):
   ☐ Attached, Document ID:________
   Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.
4. List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only):
   ☐ Attached, Document ID:________
   ☐ Equipment/Activities On site but Not Required to be Individually Listed
   ☒ Not Applicable
5. Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only) :
   ☐ Attached, Document ID:__________ ☒ Not Applicable
6. Requested Changes to Current Title V Air Operation Permit:
   ☒ Attached, Document ID: Sections 1, 3, and 5 ☐ Not Applicable

Additional Requirements Comment

A. GENERAL EMISSIONS UNIT INFORMATION

Title V Air Operation Permit Emissions Unit Classification

1. Regulated or Unregulated Emissions Unit? (Check one, if applying for an initial, revised or renewal Title V air operation permit. Skip this item if applying for an air construction permit or FESOP only.)

   ☒ The emissions unit addressed in this Emissions Unit Information Section is a regulated emissions unit.

   ☐ The emissions unit addressed in this Emissions Unit Information Section is an unregulated emissions unit.

Emissions Unit Description and Status

1. Type of Emissions Unit Addressed in this Section: (Check one)

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, a single process or production unit, or activity, which produces one or more air pollutants and which has at least one definable emission point (stack or vent).

   ☒ This Emissions Unit Information Section addresses, as a single emissions unit, a group of process or production units and activities which has at least one definable emission point (stack or vent) but may also produce fugitive emissions.

   ☐ This Emissions Unit Information Section addresses, as a single emissions unit, one or more process or production units and activities which produce fugitive emissions only.

2. Description of Emissions Unit Addressed in this Section:

Six (6) CAT G3520C IC engine electricity generator sets (each with its own exhaust stack)

3. Emissions Unit Identification Number: EU004, EU005, EU006, EU007, EU008, and EU009

4. Emissions Unit Status Code: C	5. Commence Construction Date: 2006	6. Initial Startup Date: 2007	7. Emissions Unit Major Group SIC Code: 49	8. Acid Rain Unit? ☐ Yes ☒ No

9. Package Unit:
Manufacturer: Caterpillar, Inc. Model Number: G3520C

10. Generator Nameplate Rating: 1.6 MW (each engine generator set, 9.6 MW total capacity)

11. Emissions Unit Comment:

EU004 – stack 04 (1.6 MW)
EU005 – stack 05 (1.6 MW)
EU006 – stack 06 (1.6 MW)
EU007 – stack 07 (1.6 MW)
EU008 – stack 08 (1.6 MW)
EU009 – stack 09 (1.6 MW)

Emissions Unit Control Equipment

1. Control Equipment/Method(s) Description:

Add-on air pollutant emission controls will not be installed on the electricity generation facility IC engines.

The CAT® G3520C gas IC engine 3.3 g/bhp-hr CO emission rate is based on the results of Best Available Control Technology (BACT) analyses (Section 8 CO BACT of the permit application documents).

The CAT® G3520C gas IC engine 0.29 g/bhp-hr PM_{10} emission rate is based on the results of Best Available Control Technology (BACT) analyses (Section 8 PM_{10} BACT of the permit application documents).

2. Control Device or Method Code(s):

B. EMISSIONS UNIT CAPACITY INFORMATION

(Optional for unregulated emissions units.)

Emissions Unit Operating Capacity and Schedule

1. Maximum Process or Throughput Rate: 35,000 scf/hr (LFG fuel) per engine basis
2. Maximum Production Rate: 1.6 MW per engine, 9.6 MW all engines
3. Maximum Heat Input Rate: 14.89 million Btu/hr (per engine) 89.34 million Btu/hr (LHV) (all proposed engines)
4. Maximum Incineration Rate: pounds/hr tons/day
5. Requested Maximum Operating Schedule: hours/day 24 days/week 7 weeks/year 52 hours/year 8,760
6. Operating Capacity/Schedule Comment: 14.89 MMBtu (LHV)/hr/engine maximum heat input 1.6 MW/hr/engine maximum electricity generation 35,000 scf/hr/engine maximum LFG fuel use Base load (100% design capacity) engine –generator operations. The facility will not produce electricity under partial load engine – generator operating conditions.

C. EMISSION POINT (STACK/VENT) INFORMATION
(Optional for unregulated emissions units.)

Emission Point Description and Type

1. Identification of Point on Plot Plan or Flow Diagram: EU004 – EU009	2. Emission Point Type Code: 1

3. Descriptions of Emission Points Comprising this Emissions Unit for VE Tracking: Six (6) identical IC engine generators (which comprise the emission unit), each engine has an exhaust stack (6 exhaust stacks, 1 for each engine).
4. ID Numbers or Descriptions of Emission Units with this Emission Point in Common: (EU004-stack04, EU005-stack05, EU0006-stack06,EU007-stack07, EU008-stack08, EU009-stack09)

5. Discharge Type Code: V	6. Stack Height: feet 20	7. Exit Diameter: feet 1.5
8. Exit Temperature: °F 900	9. Actual Volumetric Flow Rate: acfm 13,700	10. Water Vapor: 11 %

11. Maximum Dry Standard Flow Rate: dscfm 4,700	12. Nonstack Emission Point Height: feet
13. Emission Point UTM Coordinates... Zone: 17 East (km): 516.749 North (km): 3140.571	14. Emission Point Latitude/Longitude... Latitude (DD/MM/SS) 28/23/35.63 Longitude (DD/MM/SS) 80/49/43.80

15. Emission Point Comment: Stack04-EU004 Stack05-EU005 Stack06-EU006 Stack07-EU007 Stack08-EU008 Stack09-EU009

D. SEGMENT (PROCESS/FUEL) INFORMATION

Segment Description and Rate: Segment 1 of 1

1. Segment Description (Process/Fuel Type): Landfill gas used exclusively to fuel 6 IC engines Air pollutant emissions (g/bhp-hr) are related to engine base load horsepower (2233 hp/hr) or maximum fuel use pound per million cubic feet of gas consumed (lb/MMscf).		
2. Source Classification Code (SCC): 20100802	3. SCC Units: MMcf of gas	
4. Maximum Hourly Rate: 0.21	5. Maximum Annual Rate: 1840	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: 0.051	8. Maximum % Ash: 0	9. Million Btu per SCC Unit: 426 (LHV)
10. Segment Comment: Hourly and annual maximum fuel use rates for the operation of 6 IC engines based on fuel heating value of 426 Btu/scf (LHV).		

E. EMISSIONS UNIT POLLUTANTS

List of Pollutants Emitted by Emissions Unit

1. Pollutant Emitted	2. Primary Control Device Code	3. Secondary Control Device Code	4. Pollutant Regulatory Code
CO			EL
NOX			EL
VOC			EL
PM10			EL
SO2			EL
HAPS			EL
H106			EL

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: CO	2. Total Percent Efficiency of Control:
3. Potential Emissions: on 6 engine basis 97.5 lb/hour 426.9 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 3.3 g/bhp-hr Reference: BACT	7. Emissions Method Code: 5
8. Calculation of Emissions: Refer to Appendix J of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 16.25 lb/hour/engine, 71.2 tons/year/engine (refer to Section 5.0 and Appendix J of the permit application documents).	

F1. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION – POTENTIAL/ESTIMATED FUGITIVE EMISSIONS

(Optional for unregulated emissions units.)

Potential/Estimated Fugitive Emissions

Complete for each pollutant identified in Subsection E if applying for an air construction permit or concurrent processing of an air construction permit and a revised or renewal Title V permit. Complete for each emissions-limited pollutant identified in Subsection E if applying for an air operation permit.

1. Pollutant Emitted: PM10	2. Total Percent Efficiency of Control:
3. Potential Emissions: on 6 engine basis 8.64 lb/hour 37.8 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 0.29 g/bhp-hr Reference: BACT	7. Emissions Method Code: 5
8. Calculation of Emissions: Refer to Appendix J of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 1.44 lb/hour/engine, 6.31 tons/year/engine (refer to Section 5.0 and Appendix J of the permit application documents).	

F2. EMISSIONS UNIT POLLUTANT DETAIL INFORMATION - ALLOWABLE EMISSIONS

Complete if the pollutant identified in Subsection F1 is or would be subject to a numerical emissions limitation.

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: CO 3.3 g/bhp-hr	4. Equivalent Allowable Emissions: 97.5lb/hour 426.9 tons/year
5. Method of Compliance: Engine exhaust stack emissions testing (annual)	
6. Allowable Emissions Comment (Description of Operating Method): Rule 62-212.400	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code: RULE	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: PM10 0.29 g/bhp-hr	4. Equivalent Allowable Emissions: 8.64 lb/hr 37.8 tons/year
5. Method of Compliance: Engine exhaust stack emissions testing (annual)	
6. Allowable Emissions Comment (Description of Operating Method): Rule 62-212.400	

Allowable Emissions Allowable Emissions 1 of 1

1. Basis for Allowable Emissions Code:	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units:	4. Equivalent Allowable Emissions:
5. Method of Compliance:	
6. Allowable Emissions Comment (Description of Operating Method):	

EMISSIONS UNIT INFORMATION
Section [1] of [1]

I. EMISSIONS UNIT ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1. Process Flow Diagram (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID: Appendix D ☐ Previously Submitted, Date _________

2. Fuel Analysis or Specification (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID: Appendix E ☐ Previously Submitted, Date _________

3. Detailed Description of Control Equipment (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☒ Attached, Document ID: Section 3 - 4 ☐ Previously Submitted, Date _________

4. Procedures for Startup and Shutdown (Required for all operation permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☐ Attached, Document ID: _________ ☒ Previously Submitted, Date June 2006
   ☐ Not Applicable (construction application)

5. Operation and Maintenance Plan (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought)
   ☐ Attached, Document ID:_ ☒ Previously Submitted, Date June 2006
   ☐ Not Applicable

6. Compliance Demonstration Reports/Records
   ☐ Attached, Document ID: _________
   Test Date(s)/Pollutant(s) Tested: ____________________
   ☐ Previously Submitted, Date: _______
   Test Date(s)/Pollutant(s) Tested: ____________________
   ☐ To be Submitted, Date (if known):__________
   Test Date(s)/Pollutant(s) Tested: ____________________
   ☒ Not Applicable

   Note: For FESOP applications, all required compliance demonstration records/reports must be submitted at the time of application. For Title V air operation permit applications, all required compliance demonstration reports/records must be submitted at the time of application, or a compliance plan must be submitted at the time of application.

7. Other Information Required by Rule or Statute
☒ Attached, Document ID: Sections 1 - 9 ☐ Not Applicable

Additional Requirements for Air Construction Permit Applications

1. Control Technology Review and Analysis (Rules 62-212.400(6) and 62-212.500(7), F.A.C.; 40 CFR 63.43(d) and (e))
   ☒ Attached, Document ID: Section 8.0 ☐ Not Applicable
2. Good Engineering Practice Stack Height Analysis (Rule 62-212.400(5)(h)6., F.A.C., and Rule 62-212.500(4)(f), F.A.C.)
   ☒ Attached, Document ID: Section 6.8 ☐ Not Applicable
3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only)
   ☒ Attached, Document ID: Section 6.12 ☐ Not Applicable

Additional Requirements for Title V Air Operation Permit Applications

1. Identification of Applicable Requirements
   ☐ Attached, Document ID: __________
2. Compliance Assurance Monitoring
   ☐ Attached, Document ID: __________ ☐ Not Applicable
3. Alternative Methods of Operation
   ☐ Attached, Document ID: __________ ☐ Not Applicable
4. Alternative Modes of Operation (Emissions Trading)
   ☐ Attached, Document ID: __________ ☐ Not Applicable
5. Acid Rain Part Application
   ☐ Certificate of Representation (EPA Form No. 7610-1)
      ☐ Copy Attached, Document ID:_
   ☐ Acid Rain Part (Form No. 62-210.900(1)(a))
      ☐ Attached, Document ID:___________
      ☐ Previously Submitted, Date:________
   ☐ Repowering Extension Plan (Form No. 62-210.900(1)(a)1.)
      ☐ Attached, Document ID:___________
      ☐ Previously Submitted, Date:________
   ☐ New Unit Exemption (Form No. 62-210.900(1)(a)2.)
      ☐ Attached, Document ID:___________
      ☐ Previously Submitted, Date:________
   ☐ Retired Unit Exemption (Form No. 62-210.900(1)(a)3.)
      ☐ Attached, Document ID:___________
      ☐ Previously Submitted, Date:________
   ☐ Phase II NOx Compliance Plan (Form No. 62-210.900(1)(a)4.)
      ☐ Attached, Document ID:___________
      ☐ Previously Submitted, Date:________
   ☐ Phase II NOx Averaging Plan (Form No. 62-210.900(1)(a)5.)
      ☐ Attached, Document ID:___________
      ☐ Previously Submitted, Date:________
   ☐ Not Applicable

APPENDIX B

AIR TITLE V PERMIT 0090069-008-AV

Florida Department of
Environmental Protection

Central District Office
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

ELECTRONIC MAIL
euripides.rodriguez@brevardcounty.us

NOTICE OF FINAL PERMIT

In the Matter of an
Application for Permit by:

Euripides Rodriguez, Director
Brevard County Board of County Commissioners
2725 Judge Fran Jamieson Way, A118
Viera, Florida 32940

Re: **FINAL** Title V Permit No.: 0090069-008-AV
Brevard County Central Disposal Facility

Dear Mr. Rodriguez:

Enclosed is **FINAL** Permit Number 0090069-008-AV for the operation of the Brevard County Central Disposal Facility located at 2250 Adamson Road, Cocoa, Brevard County, issued pursuant to Chapter 403, Florida Statutes (F.S.).

Any party to this order (permit) has the right to seek judicial review of the permit pursuant to Section 120.68, F.S., by the filing of a Notice of Appeal pursuant to Rule 9.110, Florida Rules of Appellate Procedure, with the Clerk of the permitting authority in the Legal Office; and with the clerk of the Department of Environmental Protection in the Office of General Counsel, 3900 Commonwealth Boulevard, Mail Station #35, Tallahassee, Florida, 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 (thirty) days from the date this Notice is filed with the Clerk of the permitting authority.

Executed in Orlando, Florida.

STATE OF FLORIDA DEPARTMENT
OF ENVIRONMENTAL PROTECTION

Caroline Shine

Caroline Shine
Program Administrator
Air Resource Management

CS/azf

CERTIFICATE OF SERVICE

The undersigned duly designated deputy agency clerk hereby certifies that this NOTICE OF FINAL PERMIT (including the FINAL Permit) and all copies were sent by certified mail or electronically (with Received Receipt) before the close of business on 7-9-09 to the person(s) listed:

Robert L. Harvey, P.E., **(rharvey@derenzo.com)**

In addition, the undersigned duly designated deputy agency clerk hereby certifies that copies of this NOTICE OF FINAL PERMIT (including the FINAL Permit) were sent by certified mail or electronically (with Received Receipt) on the same date to the person(s) listed:

Barbara Friday, BAR **[Barbara.Friday@dep.state.fl.us]** (for posting with Region 4, U.S. EPA)

Clerk Stamp

FILED, on this date, pursuant to Section 120.52, F. S., with the designated Department Clerk, receipt of which is hereby acknowledged.

(Clerk) 7/9/09 (Date)

FINAL Determination

Title V Air Operation Permit
FINAL Permit No.: 0090069-008-AV
Brevard County Board of County Commissioners
Brevard County Central Disposal Facility
Page 1 of 1

I. Comment(s).

No comments were received from the USEPA during their 45 day review period of the PROPOSED Permit.

II. Conclusion.

In conclusion, the permitting authority hereby issues the FINAL Permit.

Florida Department of Environmental Protection Permit

Permit Issued to:

Brevard County Board of County Commissioners
2725 Judge Fran Jamieson Way, A118
Viera, Brevard County, Florida

Telephone (321) 633-2042

Facility ID No.: 0090069

Air Operating Permit
FINAL Permit No.: 0090069-008-AV
(Revision of Permit No. 0090069-005-AV)
Permit Expires: September 30, 2012

Permitting/Compliance Authority
Florida Department of Environmental Protection
Central District Office
3319 Maguire Blvd., Suite 232
Orlando, Florida 32803
Telephone (407) 893-3333
Fax: (407) 897-5963

Title V Air Operation Permit Revision

FINAL Permit No.: **0090069-008-AV**

Table of Contents

Florida Department of
Environmental Protection

Central District Office
3319 Maguire Boulevard, Suite 232
Orlando, Florida 32803-3767

Charlie Crist
Governor

Jeff Kottkamp
Lt. Governor

Michael W. Sole
Secretary

Permittee:
Brevard County
Board of County Commissioners
2725 Judge Fran Jamieson Way, A118
Viera, FL 32940

FINAL Permit No.: 0090069-008-AV
Facility ID No.: 0090069
SIC No(s).: 49, 4953
Project: Brevard County Central Disposal Facility

The purpose of this permit is to revise Title V Air Operation Permit No. 0090069-005-AV. This existing landfill facility is located at 2250 Adamson Road, Cocoa, Florida; UTM Coordinates: Zone 17, 516.73 km East and 3141.04 km North; and, Latitude: 28° 23' 50" North and Longitude: 80° 49' 45" West.

This Title V Air Operation Permit **Revision** is issued under the provisions of Chapter 403, Florida Statutes (F.S.), and Florida Administrative Code (F.A.C.) Chapters 62-4, 62-210 and 62-213. The above named permittee is hereby authorized to operate the facility shown on the application and approved drawing(s), plans, and other documents, attached hereto or on file with the permitting authority, in accordance with the terms and conditions of this permit.

Referenced attachments made a part of this permit:
Appendix B, 40CFR60, Subpart WWW; 40CFR63 Subpart AAAA, Combined General Provisions
Appendix C, 40CFR60, Subpart WWW; 40CFR63 Subpart AAAA, Combined Standard Conditions
Appendix D-1, Definitions for Subpart WWW – Municipal Solid Waste Landfills
Appendix E, 40CFR60 and 61, Subpart A, Flares, General Provisions
Appendix I-1, List of Insignificant Emissions Units and/or Activities
APPENDIX TV-6, TITLE V CONDITIONS
Tables 1, 2, and 3, Summaries of Requirements for Municipal Solid Waste Landfills

Effective Date:	**June 21, 2009**
Renewal Application Due Date:	**February 13, 2012**
Expiration Date:	**September 30, 2012**

FLORIDA DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Caroline Shine

Caroline Shine
Program Administrator
Air Resource Management

CS/az/jt OJ

Section I. Facility Information.

Subsection A. Facility Description.

This facility consists of slurry-walled municipal solid waste facility (landfill), identified as emission unit 003, with an active gas collection system. The collection system terminates in a flaring station consisting of three (3) blowers and three (3) candlestick flare destruction devices. Also included in this permit are miscellaneous insignificant emission units and/or activities.

The facility also includes six (6) Caterpillar, Model G3520C, 2,233 bhp landfill gas-fired internal combustion engines for the generation of up to 9.6 total megawatts (nominal rating) of electricity (1.6 megawatts each).

Based on the Title V Air Operation Permit Revision Application received December 30, 2008, this facility is **not** a major source of hazardous air pollutants (HAPs).

Subsection B. Summary of Emissions Unit ID No(s). and Brief Description(s).

E.U. ID No.	**Brief Description**
003	Municipal solid waste landfill with three flares
004 - 009	Six (6) Internal Combustion Engines

Please reference the Permit No., Facility ID No., and appropriate Emissions Unit(s) ID No(s). on all correspondence, test report submittals, applications, etc.

Subsection C. Relevant Documents.

The documents listed below are not a part of this permit; however, they are specifically related to this permitting action.

These documents are provided to the permittee for information purposes only:
Appendix A-1, Abbreviations, Acronyms, Citations, and Identification Numbers
Appendix H-1, Permit History
Statement of Basis

These documents are on file with the permitting authority:

Revision Title V Air Operation Permit Application received June 4, 2004
Initial Title V Air Operation Permit issued May 28, 1998
Renewal Title V Air Operation Permit issued June 23, 2003
Application for a Title V Air Operation Permit Renewal received March 29, 2002
Additional Information Request dated May 28, 2002
Additional Information Response received August 14, 2002
Additional Information Request dated September 11, 2002
Additional Information Response received October 21, 2002
Additional Information Request dated November 6, 2002
Additional Information Response received December 20, 2002
Application for a Title V Air Operation Permit Revision received June 4, 2004

Title V Air Operation Permit Revision issued December 15, 2004
Application for a Title V Air Operation Permit Renewal received April 2, 2007
Title V Air Operation Permit Renewal issued September 26, 2007
Application for a Title V Air Operation Permit Revision received December 30, 2008

Subsection D. Miscellaneous.

The use of 'Permitting Notes' throughout this permit are for informational purposes only and are not permit conditions.

Section II. Facility-wide Conditions.

The following conditions apply facility-wide:

1. APPENDIX TV-6, TITLE V CONDITIONS are a part of this permit.

2. General Pollutant Emission Limiting Standards. Objectionable Odor Prohibited. The permittee shall not cause, suffer, allow, or permit the discharge of air pollutants which cause or contribute to an objectionable odor.
[Rule 62-296.320(2), F.A.C.]

3. General Particulate Emission Limiting Standards. General Visible Emissions Standard. Except for emissions units that are subject to a particulate matter or opacity limit set forth or established by rule and reflected by conditions in this permit, no person shall cause, let, permit, suffer or allow to be discharged into the atmosphere the emissions of air pollutants from any activity, the density of which is equal to or greater than that designated as Number 1 on the Ringelmann Chart (20 percent opacity).
[Rule 62-296.320(4)(b)1., F.A.C.]

4. Prevention of Accidental Releases (Section 112(r) of CAA).
a. The permittee shall submit its Risk Management Plan (RMP) to the Chemical Emergency Preparedness and Prevention Office (CEPPO) RMP Reporting Center when, and if, such requirement becomes applicable. Any Risk Management Plans, original submittals, revisions or updates to submittals, should be sent to:

RMP Reporting Center
Post Office Box 1515
Lanham-Seabrook, Maryland 20703-1515
Telephone: 301/429-5018

b. The permittee shall submit to the permitting authority Title V certification forms or a compliance schedule in accordance with Rule 62-213.440(2), F.A.C.
[40 CFR 68]

5. Insignificant Emissions Units and/or Activities. Appendix I-1, List of Insignificant Emissions Units and/or Activities, is a part of this permit.
[Rules 62-213.440(1), 62-213.430(6), and 62-4.040(1)(b), F.A.C.]

6. General Pollutant Emission Limiting Standards. Volatile Organic Compounds (VOC) Emissions or Organic Solvents (OS) Emissions. The permittee shall allow no person to store, pump, handle, process, load, unload or use in any process or installation, VOC or OS without applying known and existing vapor emission control devices or systems deemed necessary and ordered by the Department. To comply, procedures to minimize pollutant emissions shall include the following:

a. Tightly cover or close all VOC containers when they are not in use;
b. Tightly cover, where possible, all open troughs, basins, baths, tanks, etc.;
c. Maintain all piping, valves, fittings, etc. in good operating condition;
d. Prevent excessive air turbulence across exposed VOC; and
e. Immediately confine and clean up spills of VOC containing materials.

[Rule 62-296.320(1)(a), F.A.C.]

7. Emissions of Unconfined Particulate Matter. Reasonable precautions to prevent emissions of unconfined particulate matter at this facility include:

a. Application of asphalt, water, chemicals or other dust suppressants to unpaved roads, yards, open stock piles and similar activities;
b. Removal of particulate matter from roads and other paved areas under the control of the owner or operator of the facility to prevent reentrainment, and from buildings or work areas to prevent particulate from becoming airborne;
c. Landscaping or planting of vegetation; and
d. Other techniques, as necessary.

[Rule 62-296.320(4)(c)2., F.A.C.]

8. When appropriate, any recordings, monitoring, or reporting requirements that are time-specific shall be in accordance with the effective date of the permit, which defines day one.
[Rule 62-213.440, F.A.C.]

9. The permittee shall submit all compliance related notifications and reports required of this permit to the air compliance section of this office:

Florida Department of Environmental Protection
3319 Maguire Blvd., Suite 232
Orlando, Florida 32803
Telephone: 407/893-3336
Fax: 407/897-5963

10. Any reports, data, notifications, certifications, and requests required to be sent to the United States Environmental Protection Agency, Region 4, should be sent to:

United States Environmental Protection Agency
Region 4
Air, Pesticides & Toxics Management Division
Air & EPCRA Enforcement Branch, Air Enforcement Section
61 Forsyth Street
Atlanta, Georgia 30303-8960
Telephone: 404/562-9155
Fax: 404/562-9163

11. Annual Statement of Compliance. The annual statement of compliance pursuant to Rule 62-213.440(3)(a)2., F.A.C., shall be submitted to the air compliance section of this office and EPA within 60 (sixty) days after the end of the calendar year using DEP Form No. 62-213.900(7), F.A.C.
[Rules 62-213.440(3) and 62-213.900, F.A.C.]
{Permitting note: This condition implements the requirements of Rules 62-213.440(3)(a)2. &3., F.A.C. (see Condition 51 of APPENDIX TV-6, TITLE V CONDITIONS)}

12. Certification by Responsible Official (RO). In addition to the professional engineering certification required for applications by Rule 62-4.050(3), F.A.C., any application form, report, compliance statement, compliance plan and compliance schedule submitted pursuant to Chapter 62-213, F.A.C., shall contain a certification signed by a responsible official that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete. Any responsible official who fails to submit any required information or who has submitted incorrect information shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary information or correct information. [Rule 62.213.420(4), F.A.C.]

13. Annual Operating Report. The owner or operator shall complete DEP Form No. 62-210.900(5), F.A.C., "Annual Operating Report for Air Pollutant Emitting Facility," for each calendar year and submit it either electronically using the latest Department Annual Operating Report software or by hard copy to the air compliance section of this office **by April 1** of the following year in accordance with Rule 62-210.370(3), F.A.C. The emissions shall be computed in accordance with the provisions of Rule 62-210.370(2), F.A.C., for the purposes of the annual operating report.
[Rule 62-210.370(3), F.A.C.]

14. At least 225 days prior to the expiration date of this operation permit, the permittee shall submit to this office four copies of the air permit application, DEP Form No. 62-210.900(1).
[Rule 62-4.090(1), F.A.C.]

Section III. Emissions Unit(s) and Conditions.

Subsection A. This section addresses the following emissions unit(s).

E.U. ID No.	**Brief Description**
003	Municipal solid waste landfill with three flares

{Permitting note: This emissions unit is regulated under: NSPS - 40 CFR 60, Subpart A, General Provisions, 40 CFR 60 Subpart WWW, Standards of Performance for Municipal Solid Waste Landfills; NESHAP - 40 CFR Part 63, Subpart A, General Provisions and 40 CFR Part 63, Subpart AAAA, National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills adopted and incorporated by reference in Rule 62-204.800, F.A.C.,.}

The following specific conditions apply to the emissions unit(s) listed above:

Essential Potential to Emit (PTE) Parameters

A1. This emissions unit is allowed to operate continuously, i.e., 8,760 hours per year.
[Rule 62-210.200(PTE), F.A.C.]

Emission Limitations and Standards

A2. The flare control system shall be designed for and operated with no visible emissions except for periods not to exceed a total of five minutes during any two consecutive hours.
[Rule 40 CFR 60.18(c)(1)]

A3. The flare control system shall be operated with a flame present at all times, as determined by a thermocouple or any other equivalent device to detect the presence of a flame.
[40 CFR 60.18(c)(2)]

Test Methods and Procedures; Monitoring

{Permitting note: Table 3, Summary of Compliance Requirements for Municipal Solid Waste Landfills, summarizes information for convenience purposes only. This table does not supersede any of the terms or conditions of this permit.}

A4. Each flare must be tested for visible emissions in accordance with EPA Method 22 and including 40 CFR 60.18(d)(e)&(f). The test period is 2 hours. Testing shall be conducted annually.
[Rules 62-4.070 and 62-297.401(22), F.A.C.]

A5. The permittee shall notify the Central District Office of the DEP, in writing, at least 15 days prior to the date on which the formal compliance test is to begin. The notification shall include the date, time and place of each such test, as well as the name of the contact person who will be responsible for coordinating and having such tests conducted for the owner.
[Rule 62-297.310(7)(a)9., F.A.C.]

A6. The required test report shall be filed with the Department as soon as practical but no later than 45 days after the last sampling run of each test is completed.
[Rule 62-297.310(8)(b), F.A.C.]

A7. The owner or operator of an emission unit for which compliance tests are required shall install, operate, and maintain equipment or instruments necessary to determine process variables, such as process weight input or heat input, when such data are needed in conjunction with emissions data to determine the compliance of the emissions unit with applicable emission limiting standards. Equipment or instruments used to directly or indirectly determine process variables, including devices such as belt scales, weigh hoppers, flow meters, and tank scales, shall be calibrated and adjusted to indicate the true value of the parameter being measured with sufficient accuracy to be determined within 10 percent of its true value.
[Rule 62-297.310(5), F.A.C.]

A8. This emission unit is subject to the following requirements from title 40 of the CFR Part 60 (see attached Appendix B and C):

40 CFR 60.7	**Notification and record keeping**
40 CFR 60.8	**Performance tests**
40 CFR 60.11	**Compliance with standards and maintenance requirements**
40 CFR 60.13	**Monitoring requirements**
40 CFR 60.14	**Modification**
40 CFR 60.15	**Reconstruction**
40 CFR 60.752(b)	**Standards for air emissions from municipal solid waste landfills**
40 CFR 60.757	**Reporting requirements**
40 CFR 60.758(a)	**Record keeping requirements**

A9. This emission unit is subject to the applicable requirements of 40 CFR 60, Subpart WWW (see attached Appendix B, C, and D-1); 40 CFR 63, Subpart AAAA (see attached Appendix B and C); and 40 CFR 60.18 (see attached Appendix E).

A10. The source is required to submit a **semi-annual compliance report** by 40 CFR 63.1980(a) and included in attached Table 3.

Subsection B. This section addresses the following emissions unit(s).

E.U. ID No.	**Brief Description**
004 - 009	Six (6) Internal Combustion Engines – Caterpillar Model G3520C engines and electrical generators. Each engine has a power generation rating of 2,233 brake horsepower at 100% load. The generator has a power rating of 1,600 kw. The engines will be fueled exclusively with landfill gas (LFG) generated by and received from the Central Disposal Facility. The landfill gas will go through a gas treatment system prior to combustion in the engines.

{Permitting Note: The following specific conditions B1. through B30. are from air construction permit 0090069-004-AC and 0090069-006-AC}

The following specific conditions apply to the emissions unit(s) listed above:

Control Technology

B1. H$_2$S Continuous Monitoring System (CMS) Equipment: Within 30 days of startup of any new or replacement continuous H$_2$S monitoring unit performance evaluations shall be done using Performance Specification 7. EPA Methods 11,15,15A, or 16 shall be used for conducting the relative accuracy evaluations. The span value for this instrument is 1000 ppmv H$_2$S. The CMS shall be calibrated, maintained, and operated according to the manufacturer specifications. **The monitoring requirements are subject to 40 CFR 63.8 sections (c),(d), and(g).**
[Design; Rules 62-210.200 (BACT) and 62-4.070(3), F.A.C.]

Fuel Specifications and Work Practices

B2. NSPS and NESHAP Requirements: Emissions Units Nos. 004 – 009 are subject to 40 CFR 60 Subpart WWW and certain sections of 40 CFR 63 Subpart AAAA adopted by the Department at Rule 62-204.800(8)(b) and 62-204.800(11)(b), F.A.C.
[Rules 62-204.800 and 62-210.300, F.A.C.]

B3. Each engine/generator set is allowed to operate continuously, i.e., 8,760 hours per year.
[Rule 62-210.200(232), F.A.C.]

B4. Fuel fired in the engines is limited to treated LFG generated by and received from the Central Disposal Facility. The use of any other fuel will require an amendment to this permit.
[Rule 62-212.400, F.A.C.]

B5. The permittee shall operate each engine at the air-to-fuel ratio that the tested engine demonstrated compliance during the most recent performance test. [Rule 62-212.400, F.A.C.]

B6. The permittee shall operate each engine within 0.5% of the O$_2$ content in the exhaust gas at the air-to-fuel ratio that the tested engine demonstrated compliance during the most recent performance test.[Rule 62-212.400, F.A.C.]

B7. The permittee shall install and maintain an automatic fail-safe block valve on each engine. The fail-safe block valve must stop the flow of LFG in the event of an engine failure.
[Rule 62-4.070, F.A.C.]

B8. Excess LFG not used as fuel in an engine must be flared in accordance with the requirements of 40 CFR 60 Subpart WWW. [Rule 62-4.070, F.A.C.]

B9. Unless otherwise indicated, the modification/construction and operation of the Caterpillar internal combustion engines shall be in accordance with the capacities and specifications stated in the application.
[Rule 62-210.300, F.A.C.]

B10. No person shall circumvent any air pollution control device, or allow the emission of air pollutants without the applicable air pollution control device operating properly.
[Rule 62-210.650, F.A.C.]

B11. The emissions units shall be subject to the following:

a. Excess emissions resulting from startup, shutdown or malfunction of any source shall be permitted providing (1) best operational practices to minimize emissions are adhered to and (2) the duration of excess emissions shall be minimized but in no case exceed two hours in any 24 hour period unless specifically authorized by the Department for longer duration. [Rule 62-210.700, F.A.C.]

b. Excess emissions which are caused entirely or in part by poor maintenance, poor operation, or any other equipment or process failure which may reasonably be prevented during startup, shutdown, or malfunction shall be prohibited. [Rule 62-210.700, F.A.C.]

c. In case of excess emissions resulting from malfunctions, each source shall notify the Department in accordance with Rule 62-4.130, F.A.C. A full written report on the malfunctions shall be submitted in a quarterly report, if requested by the Department. [Rule 62-210.700, F.A.C.]

Emission and Performance Requirements

B12. Nitrogen oxides (NOx): The emission rate of NOx from each engine/generator set exhaust shall not exceed 0.60 gram per brake horsepower hour (g/bhp-hr) and a maximum of 2.95 pounds per hour (lb/hr) and 12.94 tons per year (TPY). [Rule 62-212.400(12), F.A.C.]

B13. Carbon Monoxide (CO): The emission rate of CO from each engine/generator set exhaust shall not exceed 2.75 g/bhp-hr and a maximum of 13.54 lb/hr and 59.30 TPY. [Rule 62-212.400(12), F.A.C.]

B14. Particulate Matter less than 10 microns (PM_{10}): The emission rate of PM_{10} from each engine/generator set exhaust shall not exceed 0.24 g/bhp-hr and a maximum of 1.18 lb/hr and 5.17 TPY.
[Rule 62-212.400(12), F.A.C.]

B15. Volatile Organic Compounds (VOC): The emission rate of total VOC from each engine/generator set exhaust shall not exceed 0.28 g/bhp-hr and a maximum of 1.37 lb/hr and 5.99 TPY.
[Rule 62-212.400(12), F.A.C.]
{Permitting Note: Project avoids PSD review for VOC based on emission limits.}

B16. Hydrogen Chloride (HCl): The emission rate of HCl from each engine/generator set shall not exceed 10.9 lb/MMscf and 1.66 TPY.
[Rule 62-210.200(184), F.A.C.]
{Permitting Note: Facility remains a minor source of HAP emissions based on permit limits.}

B17. Sulfur Dioxide (SO_2): The emission rate of SO_2 from each engine/generator set shall not exceed 2.64 lbs/hr and 11.55 tons/year (TPY). The total SO_2 emissions from the six engines shall not exceed 69.3 TPY.
[Rule 62-212.400, F.A.C.]
{Permitting Note: Project avoids PSD review based on emission limits.}

B18. Hydrogen Sulfide H_2S: The concentration of H_2S in the landfill gas used as fuel in the engines shall not exceed 455 ppmv on a weekly rolling average, calculated on a calendar day basis, nor shall it exceed 550 ppmv on a 24-hour rolling average basis, calculated on an hourly basis. The concentration of H_2S shall be measured by the continuous monitoring system.
[Rules 62-212.400 and 62-4.070(3), F.A.C.]

B19. Visible emissions from each engine/generator set exhaust shall not exceed 10% opacity.
[Rule 62-212.400, F.A.C.]

Test Methods and Procedures

B20. Performance Test Methods
Initial (I), Annual (A) and permit renewal (R) compliance tests shall be performed in accordance with the following reference methods as described in 40 CFR 60, Appendix A and 40 CFR 51 Appendix M, adopted by reference in Chapter 62-204.800, F.A.C. Initial, annual and renewal compliance tests shall be conducted on only one of the six engines. A different engine shall be tested each year such that all engines are tested during the six-year cycle.

(a) EPA Method 7 or 7E – Determination of NOx Emissions from Stationary Sources (I,A);
(b) EPA Method 9 – Visual Determination of the Opacity of Emissions from Stationary Sources (I,A);
(c) EPA Method 10 – Determination of CO Emissions from Stationary Sources (I,A);
(d) EPA Method 18, 25, 25A or 25C – Measurement of Gaseous Organic Compounds Emissions (I,R);
(e) EPA Method 26 or 26A – Determination of HCl Emissions from Stationary Sources (I,A);
(f) EPA Method 5, 201 or a combined Method 5/202 as an alternate test method – Determinations of PM_{10} Emissions (I,A)
(g) EPA Reference Method 6, 6C or 19 – Determinations of SO_2 Emissions (I, A).

EPA Methods 1 through 4 shall be used as necessary to support other test methods. No other test methods may be used for compliance testing unless prior DEP approval is received, in writing, from the Department.
[Rule 62-297.310(7), F.A.C. and FDEP Emissions Monitoring Section Memo dated February 4, 2008.]

B21. The permittee shall comply with the following requirements to monitor the sulfur and chlorine content of the landfill gas:

a. The permittee shall sample and analyze the landfill gas for H_2S and chlorine content. The gas sample collected for the analyses shall be a composite sample and collected under normal operating conditions (i.e., with valves open for all operating cells). The gas sample collection and analyses for chlorine content shall be done semi-annually. Landfill gas sulfur (as H_2S) sampling and analysis under this condition shall be required for one year period (two semi-annual analyses) once the CMS equipment specified by this permit is installed and operational. Based on the sampling results and Rule 62-297.310(7)(b), F.A.C., the Department may request additional gas sampling and analyses. Results shall be reported as SO_2 and HCl emission factors in terms of lb/MMscf (equivalent in ppmv) and lb/MMBtu of landfill gas.
b. During each required compliance test conducted for HCl, the permittee shall sample and analyze the landfill gas for the chlorine content. Results for the compliance test shall be reported in terms of HCl emissions in lb/hr and the sample analysis result shall be reported as HCl emission factor in terms of lb/MMscf of landfill gas.
c. Analysis of the chlorine content shall be used to track changes in the landfill gas. Based on the analysis, the Compliance Authority may require additional stack testing for HCl emissions to determine compliance with the emissions standard.
d. Compliance with the fuel sulfur specification shall be determined based on each analysis for the sulfur content of the landfill gas.

[Rules 62-210.200(184), 62-210.200(232) and 62-212.400(12), F.A.C.]

B22. Annually, the subject emissions units shall be tested for compliance with the applicable emission limits. For the duration of all tests the emission units shall be operating at permitted capacity. Permitted capacity is defined as 90-100 percent of the maximum operating rate allowed by the permit. If it is impracticable to test at permitted capacity, then the emission unit may be tested at less than permitted capacity (i.e., 90% of the maximum operating rate allowed by the permit); in this case, subsequent emission unit operation is limited to 110 percent of the test load until a new test is conducted. Once the emission unit is so limited, then operation at higher capacities is allowed for no more than 15 consecutive days for the purposes of additional compliance testing to regain the permitted capacity in the permit.
[Rule 62-297.310(2), F.A.C.]

Recordkeeping, Reporting, and Monitoring Requirements

B23. Total landfill gas flow to the engines shall be continuously measured and recorded.
[Rule 62-210.200 (232), F.A.C.]

B24. Gross electrical power generation (kw-hrs) shall be continuously measured and recorded for each engine individually and for the six engines combined.
[Rule 62-210.200(232), F.A.C.]

B25. Each engine/generator set shall be equipped with a non-resetable elapsed time meter to indicate, in cumulative hours, the elapsed engine operating time..
[Rule 62-210.200(232), F.A.C.]

B26. The permittee shall maintain the following records on a monthly basis:

a. The hours of operation of each engine/generator set, including any start-up, shutdown or malfunction in the operations of the engine/generator set.

b. The total landfill gas flow to each engine.

c. Gross electrical power generation in kw-hr for each engine and the six engines combined.

d. Exceedances of the allowed H_2S ppmv concentrations:
   - The date the exceedance occurred;
   - An explanation of the exceedance;
   - A description of the action taken, if any.
   - For any periods for which monitoring data are not available, any changes made in operation of the CMS system during the period of data unavailability which could affect the ability of the system to meet the applicable H_2S limit. Operations of the CMS system and affected facility during periods of data unavailability are to be compared with operations of the CMS system and affected facility before and following the period of data unavailability.
   - A written statement, signed by a responsible official, certifying the accuracy and completeness of the information contained in the report.

[Rules 62-210.200(BACT), and 62-4.070(3), F.A.C.]

B27. The permittee shall submit the results and the corresponding data of the site-specific HCl emission factor and the SO_2 emission factor within 45 days of gas sampling to the Bureau of Air Regulation. The results shall also be submitted to the Central District Office.
[Rules 62-210.200(232) and 62-210.200(264), F.A.C.]

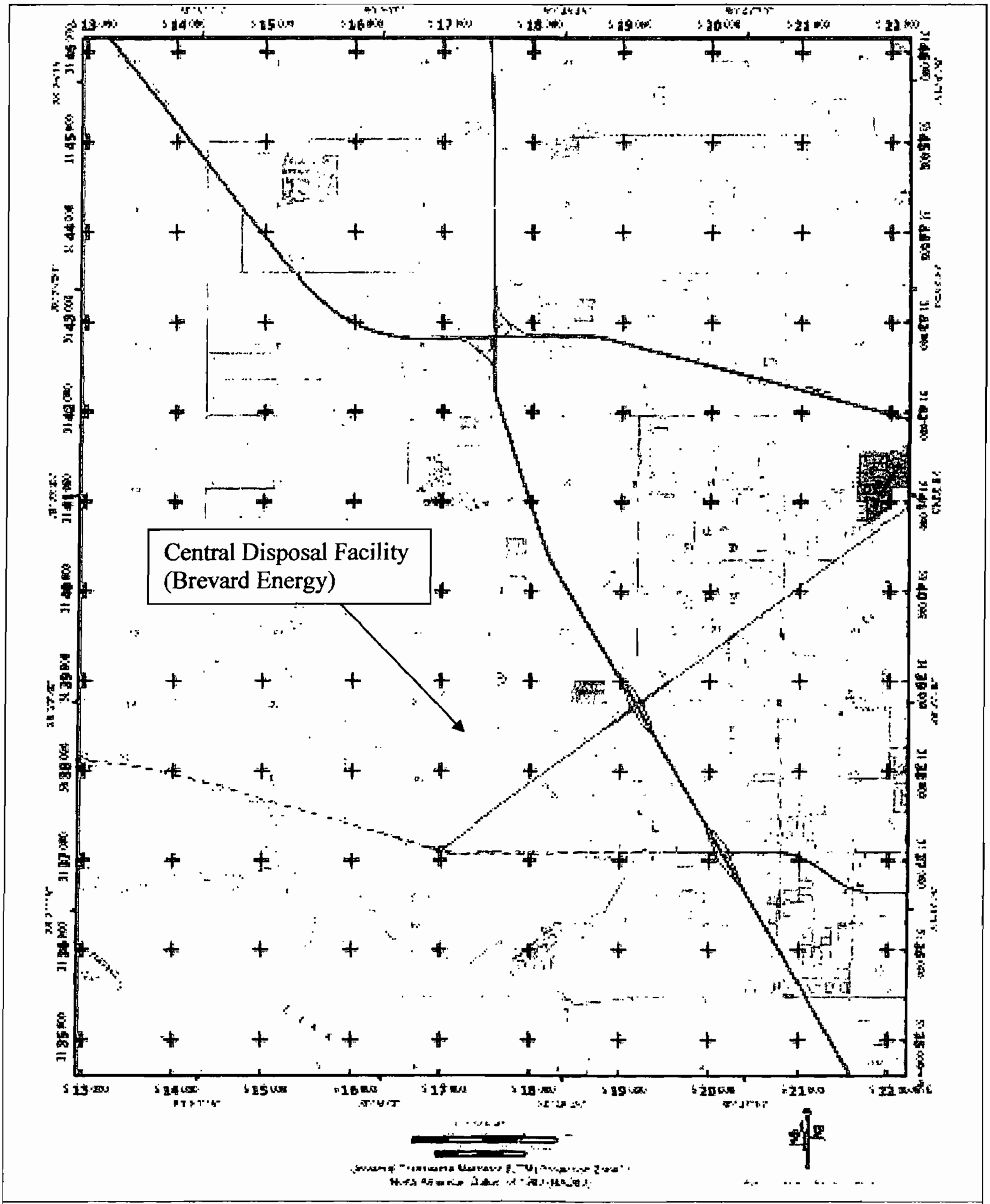
B28. The permittee shall notify the Central District Office of the DEP, in writing, at least 15 days prior to the date on which the formal compliance test is to begin. The notification shall include the date, time and place of each such test, as well as the name of the contact person who will be responsible for coordinating and having such tests conducted for the owner.
[Rule 62-297.310(7)(a)9., F.A.C.]

B29. The required test report shall be filed with the Department as soon as practical but no later than 45 days after the last sampling run of each test is completed.
[Rule 62-297.310(8)(b), F.A.C.]

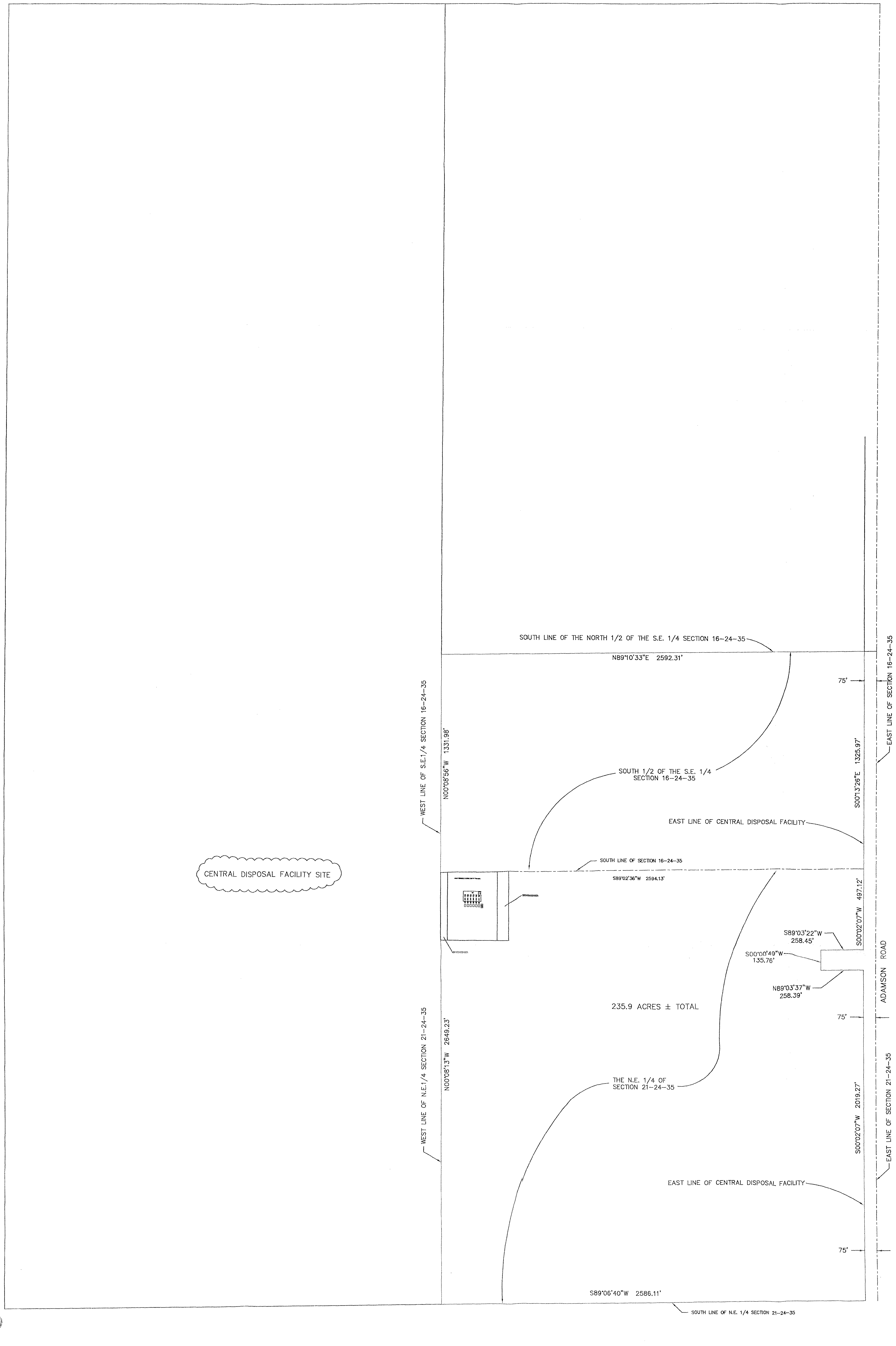
B30. In order to demonstrate compliance with condition number **B12** through **B18**, the permittee shall maintain a log at the facility for a period of at least five years from the date the data is recorded. The log shall contain the monthly emission rates of the specified pollutants.
[Rules 62-4.070(3), and 62-213.440(1)(b)2.b., F.A.C.]

APPENDIX C

AREA LOCATION AND SITE DRAWINGS



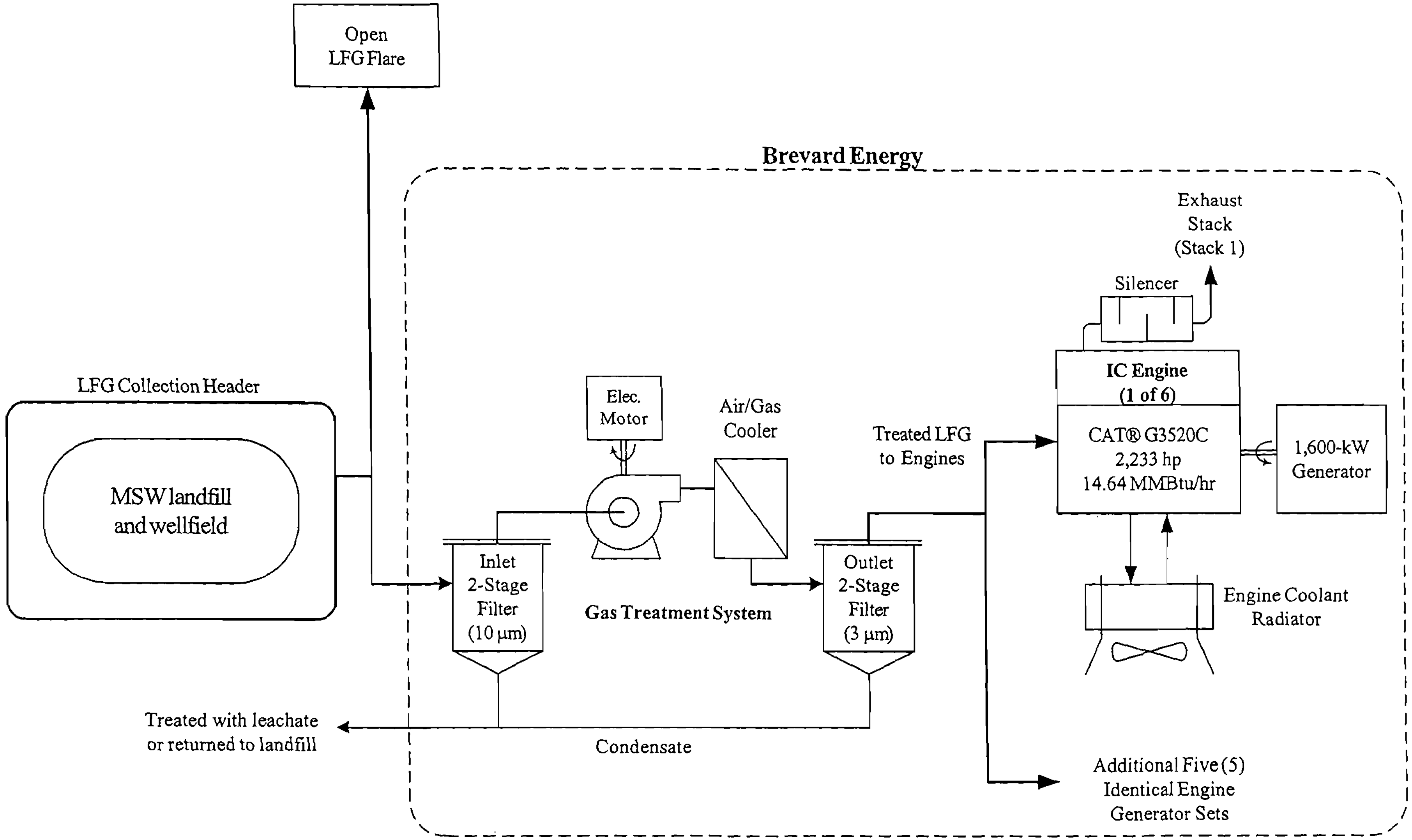
Central Disposal Facility (Landfill) Site Map



2005 AERIAL DATE

APPENDIX D

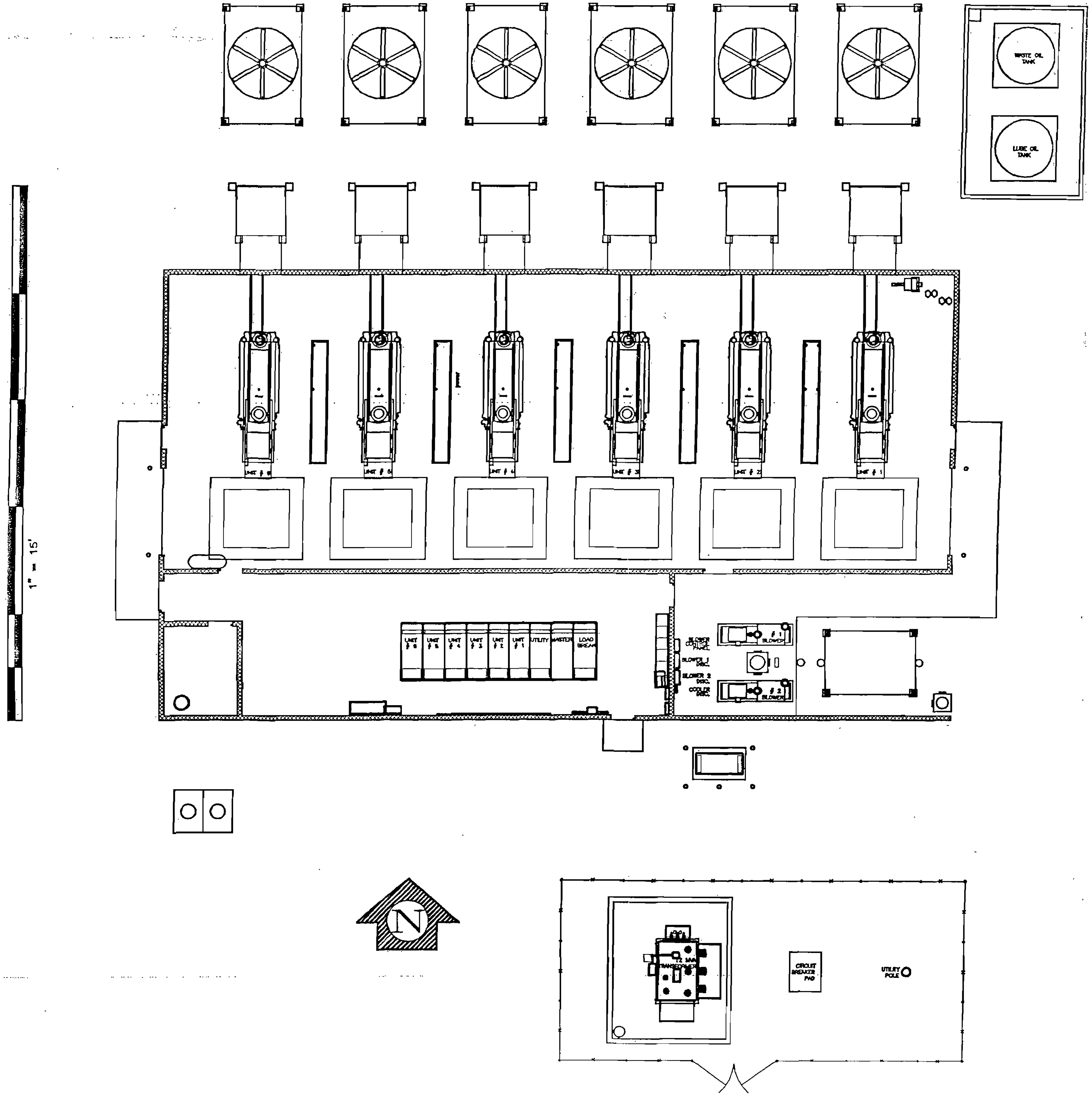
PROCESS FLOW AND ENGINEERING SPECIFICATIONS



05/17/06

Brevard Energy, L.L.C.
LFG Electricity Generation Facility

Scale	Sheet	Derenzo and Associates Project No.
None	1 of 1	0603003



BREVARD COUNTY
GAS-TO-ENERGY PROJECT
2250 ADAMSON RD.
COCOA, FL. 32926
PROJECT

SHEET TITLE BUILDING PLAN

DRAWING STATUS CONCEPTUAL

Landfill Energy Systems
29261 WALL ST.
WIXOM, MI. 48393

SCALE:
TAG #: N/A
DRAWN BY: MKL
CHECKED BY: MKL

REMARKS		
REV	DATE	COMMENTS

SHEET
C-1

APPENDIX E

CENTRAL DISPOSAL FACILITY LFG ANALYSES

Month	Methane Content (%)	Hours (hours)	BTU Value (BTU/SCF) HHV	LHV	Heat Content (MMBtu/mnth) HHV	LHV	Heat Content (MMBtu/hr) HHV	LHV	Volume of Gas Consumed SCF	Energy Produced kW	Maximum Energy Available to be Produced kW	Maximum Available Hours hours	% of Maximum Hours %	% Maximum Plant Capacity %
Dec-09	51.8	3592	524	471	55,282.97	49,661.99	15.39	13.83	105,439,476	5,498,581	7,142,400	4464	80.47%	76.99%
Jan-10	46.8	4318	474	426	71,321.36	64,069.21	16.52	14.84	150,397,200	6,810,018	7,142,400	4464	96.73%	95.35%
Feb-10	50.2	3979	509	457	61,225.15	54,999.49	15.39	13.82	120,349,000	6,330,149	6,451,200	3979	100.00%	98.12%
Mar-10	51	4398	517	464	68,495.20	61,530.58	15.57	13.99	132,609,000	7,009,101	7,142,400	4458	98.65%	98.13%
Apr-10	52.6	4189	533	479	69,735.58	62,644.58	16.65	14.95	130,782,000	6,648,066	6,912,000	4320	96.97%	96.18%
May-10	52.1	4131	528	474	74,919.77	67,321.27	18.14	16.30	142,028,000	6,496,401	7,142,400	4464	92.54%	90.96%
Jun-10	52.6	3891	533	479	71,334.90	64,081.28	18.33	16.47	133,781,373	6,101,253	6,912,000	4320	90.07%	88.27%
AVERAGE	51.01	4071.14	516.82	464.29	67473.56	60615.49	16.57	14.89	130,769,436	6,413,367	6,977,829	4353	94%	92%
TOTAL	---	28498.00	3617.72	3250.00	472314.93	424308.40	115.99	104.20	915,386,049	44,893,569	48,844,800	30469	---	---
MINIMUM	46.80	3592.00	474.22	426.00	55282.97	49661.99	15.39	13.82	105,439,476	5,498,581	6,451,200	3979	80%	77%
MAXIMUM	52.60	4398.00	533.22	479.00	74919.77	67321.27	18.33	16.47	150,397,200	7,009,101	7,142,400	4464	100%	98%

Brevard Energy, LLC (May 5, 2008 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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	280.0	H_2S	1	280.0	46.55 *
Methyl mercaptan	4.6	CH_4S	1	4.6	0.76
Dimethyl sulfide	3.8	C_2H_6S	1	3.8	0.63
Total				**288.4**	**47.95** [C]

Notes

A. May 5, 2008 LFG sample laboratory analytical results (see Attachment)

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

C. Calculation of SO_2 emission factor from sulfur content, as H_2S:

(288.4 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 47.9 lb SO_2/MMcf LFG

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(280.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 46.55 lb SO_2/MMcf LFG

Brevard Energy, LLC (May 5, 2008 Sample)

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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	280.0	H_2S	1	280.0	46.55 *
Carbonyl sulfide	<1.6	CSO	1	<1.6	<0.27
Methyl mercaptan	4.6	CH_4S	1	4.6	0.76
Ethyl mercaptan	<1.6	C_2H_6S	1	<1.6	<0.27
Dimethyl sulfide	3.8	C_2H_6S	1	3.8	0.63
Carbon disulfide	<2.0	CS_2	2	<4.0	<1.33
Isopropyl mercaptan	<1.6	C_3H_6S	1	<1.6	<0.27
tert-Butyl mercaptan	<1.6	$C_4H_{10}S$	1	<1.6	<0.27
n-Propyl mercaptan	<1.6	C_3H_8S	1	<1.6	<0.27
Thiophene	<1.6	C_4H_4S	1	<1.6	<0.27
Isobutyl mercaptan	<1.6	$C_4H_{10}S$	1	<1.6	<0.27
Diethyl sulfide	<1.6	$CH_3CH_2SCH_2CH_3$	1	<1.6	<0.27
3-Methyl Thiophene	<1.6	C_5H_6S	1	<1.6	<0.27
Dimethyl disulfide	<1.6	CH_3SSCH_3	2	<3.2	<1.06
Tetrahydrothiophene	<1.6	$C_4H_8O_2S$	1	<1.6	<0.27
2-Ethylthiophene	<1.6	C_6H_8S	1	<1.6	<0.27
2,5-Dimethylthiopene	<1.6	C_6H_8S	1	<1.6	<0.27
Diethyl disulfide	<1.6	CH_3SSCH_3	2	<3.2	<1.06
Total				**<318.0**	**<54.60** [C]

Notes

A. May 5, 2008 LFG sample laboratory analytical results (see Attachment)

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

C. Calculation of SO_2 emission factor from sulfur content, as H_2S:

(318.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 54.6 lb SO_2/MMcf LFG

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(280.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 46.55 lb SO_2/MMcf LFG

Brevard Energy, LLC (May 5, 2008 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Coumpounds	Analytical Report Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.56	CCl_2F_2	2	0.106 *
Freon 114 (Dichlorotetrafluroethane)	<0.10	$C_2Cl_2F_4$	2	<0.019
Chloromethane	<0.40	CH_3Cl	1	<0.038
Vinyl Chloride	<0.10	C_2HCl	1	<0.009
Chloroethane	<0.10	C_2H_5Cl	1	<0.009
Freon 11 (Fluorotrichloromethane)	<0.10	$CFCl_3$	3	<0.028
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	<0.10	$C_2Cl_2F_3$	2	<0.019
1,1-dichloroethene	<0.10	$C_2H_2Cl_2$	2	<0.019
3-Chloropropene	<0.40	C_3H_5Cl	1	<0.038
Methylene Chloride (Dichloromethane)	0.12	CH_2Cl_2	2	0.023
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.73	$C_2H_2Cl_2$	2	0.138
1,1-Dichloroethane	<0.10	$C_2H_4Cl_2$	2	<0.019
Chloroform	<0.10	$CHCl_3$	3	<0.028
1,1,1-Trichloroethane	<0.10	$C_2H_3Cl_3$	3	<0.028
Carbon Tetrachloride	<0.10	CCl_4	4	<0.038
1,2-Dichloroethane	<0.10	$C_2H_4Cl_2$	2	<0.019
Trichloroethene	1.1	C_2HCl_3	3	0.311
1,2-dichloropropane	<0.10	$C_3H_6Cl_2$	2	<0.019
Bromodichloromethane	<0.10	$CBrCl_2$	2	<0.019
1,3-Dichloropropene	<0.10	$C_3H_4Cl_2$	2	<0.019
1,1,2-Trichloroethane	<0.10	$C_2H_3Cl_3$	3	<0.028
Tetrachloroethene (Perchloroethene)	0.30	C_2Cl_4	4	0.113
Dibromochloromethane	<0.10	$CHBr_2Cl$	1	<0.009
Chlorobenzene	<0.10	C_6H_5Cl	1	<0.009
1,1,2,2-Tetrachloroethane	<0.10	$C_2H_2Cl_4$	4	<0.04
1,3-Dichlorobenzene	<0.10	$C_6H_4Cl_2$	2	<0.02
1,4-Dichlorobenzene	0.24	$C_6H_4Cl_2$	2	0.045
alpha-Chlorotoluene	<0.10	C_7H_7Cl	1	<0.01
1,2-Dichlorobenzene	<0.10	$C_6H_4Cl_2$	2	<0.02
1,2,4-Trichlorobenzene	<0.40	$C_6H_3Cl_3$	3	<0.11
Hexachlorobutadiene	<0.40	C_4Cl_6	6	<0.23
Total hydrogen chloride emission factor (lb./MMcf)				**<1.57**

Notes

1. May 5, 2008 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl

(0.56 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)

= 0.106 lb. HCl/MMcf LFG

Brevard Energy, LLC (May 5, 2008 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Compounds[1]	Measured Concentration (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.560	CCl_2F_2	2	0.106 *
Methylene Chloride (Dichloromethane)	0.120	CH_2Cl_2	2	0.023
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.730	$C_2H_2Cl_2$	2	0.138
Trichloroethene	1.100	C_2HCl_3	3	0.311
Tetrachloroethene (Perchloroethene)	0.300	C_2Cl_4	4	0.113
1,4-Dichlorobenzene	0.240	$C_6H_4Cl_2$	2	0.045
Total hydrogen chloride emission factor (lb./MMcf)				**0.73**

Notes

1. October 4, 2007 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl
(0.56 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.106 lb. HCl/MMcf LFG

Air Toxics LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

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- Work order Summary;
- Laboratory Narrative;
- Results; and
- Chain of Custody (copy).

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Hours 8:00 A.M to 6:00 P.M. Pacific

Air Toxics LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 0805103A

Work Order Summary

CLIENT:	Mr. David Derenzo Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150	**BILL TO:**	Ms. Donna Povich Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150
PHONE:	734-464-3880	**P.O. #**	10955
FAX:	734-464-4368	**PROJECT #**	0710013 Brevard Energy
DATE RECEIVED:	05/06/2008	**CONTACT:**	Brandon Dunmore
DATE COMPLETED:	05/19/2008		

FRACTION #	**NAME**	**TEST**	**RECEIPT VAC./PRES.**	**FINAL PRESSURE**
01A	BE1	Modified TO-15	Tedlar Bag	Tedlar Bag
02A(on hold)	BE2	Modified TO-15	Tedlar Bag	Tedlar Bag
03A	Lab Blank	Modified TO-15	NA	NA
04A	CCV	Modified TO-15	NA	NA
05A	LCS	Modified TO-15	NA	NA

CERTIFIED BY: Linda L. Freeman

Laboratory Director

DATE: 05/19/08

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/07, Expiration date: 06/30/08
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

LABORATORY NARRATIVE
Modified TO-15
Derenzo & Associates
Workorder# 0805103A

Two 1 Liter Tedlar Bag samples were received on May 06, 2008. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode. The method involves concentrating up to 0.2 liters of air. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes directly into the GC/MS for analysis.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	*TO-15*	*ATL Modifications*
Daily CCV	+- 30% Difference	</= 30% Difference with two allowed out up to </=40%.; flag and narrate outliers
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

Sample BE2 was placed on hold per the client's request.

According to the original Chain of Custody (COC), samples BE1 and BE 2 were collected on 5/1/08. However, a revised COC was received showing a collection date of 5/5/08. Therefore the date from the revised COC was used to calculate the sample holding time.

Analytical Notes

The reported results for cis-1,2-Dichloroethene and Trichloroethene in sample BE1 may be biased high due to co-elution with non target compounds with similar characteristic ions.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction not performed).

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 reporting limit.
UJ- Non-detected compound associated with low bias in the CCV
N - The identification is based on presumptive evidence.

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
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: BE1

Lab ID#: 0805103A-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 12	100	560	490	2800
Ethanol	400	17000	750	31000
Acetone	400	7900	950	19000
2-Propanol	400	6100	980	15000
Carbon Disulfide	100	260	310	820
Methylene Chloride	100	120	350	400
Hexane	100	340	350	1200
2-Butanone (Methyl Ethyl Ketone)	100	8300	290	24000
cis-1,2-Dichloroethene	100	730	400	2900
Tetrahydrofuran	100	1700	290	5000
Cyclohexane	100	300	340	1000
2,2,4-Trimethylpentane	100	180	470	820
Benzene	100	1600	320	5200
Heptane	100	690	410	2800
Trichloroethene	100	1100	540	5800
4-Methyl-2-pentanone	100	670	410	2700
Toluene	100	8600	380	32000
Tetrachloroethene	100	300	680	2100
Ethyl Benzene	100	4200	430	18000
m,p-Xylene	100	5200	430	22000
o-Xylene	100	1800	430	8000
Styrene	100	400	420	1700
Propylbenzene	100	270	490	1300
4-Ethyltoluene	100	1000	490	4900
1,3,5-Trimethylbenzene	100	390	490	1900
1,2,4-Trimethylbenzene	100	950	490	4700
1,4-Dichlorobenzene	100	240	600	1400

Client Sample ID: BE1

Lab ID#: 0805103A-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050608	Date of Collection: 5/5/08	
Dil. Factor:	200	Date of Analysis: 5/6/08 02:20 PM	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 12	100	560	490	2800
Freon 114	100	Not Detected	700	Not Detected
Chloromethane	400	Not Detected	830	Not Detected
Vinyl Chloride	100	Not Detected	260	Not Detected
1,3-Butadiene	100	Not Detected	220	Not Detected
Bromomethane	100	Not Detected	390	Not Detected
Chloroethane	100	Not Detected	260	Not Detected
Freon 11	100	Not Detected	560	Not Detected
Ethanol	400	17000	750	31000
Freon 113	100	Not Detected	770	Not Detected
1,1-Dichloroethene	100	Not Detected	400	Not Detected
Acetone	400	7900	950	19000
2-Propanol	400	6100	980	15000
Carbon Disulfide	100	260	310	820
3-Chloropropene	400	Not Detected	1200	Not Detected
Methylene Chloride	100	120	350	400
Methyl tert-butyl ether	100	Not Detected	360	Not Detected
trans-1,2-Dichloroethene	100	Not Detected	400	Not Detected
Hexane	100	340	350	1200
1,1-Dichloroethane	100	Not Detected	400	Not Detected
2-Butanone (Methyl Ethyl Ketone)	100	8300	290	24000
cis-1,2-Dichloroethene	100	730	400	2900
Tetrahydrofuran	100	1700	290	5000
Chloroform	100	Not Detected	490	Not Detected
1,1,1-Trichloroethane	100	Not Detected	540	Not Detected
Cyclohexane	100	300	340	1000
Carbon Tetrachloride	100	Not Detected	630	Not Detected
2,2,4-Trimethylpentane	100	180	470	820
Benzene	100	1600	320	5200
1,2-Dichloroethane	100	Not Detected	400	Not Detected
Heptane	100	690	410	2800
Trichloroethene	100	1100	540	5800
1,2-Dichloropropane	100	Not Detected	460	Not Detected
1,4-Dioxane	400	Not Detected	1400	Not Detected
Bromodichloromethane	100	Not Detected	670	Not Detected
cis-1,3-Dichloropropene	100	Not Detected	450	Not Detected
4-Methyl-2-pentanone	100	670	410	2700
Toluene	100	8600	380	32000
trans-1,3-Dichloropropene	100	Not Detected	450	Not Detected

Client Sample ID: BE1

Lab ID#: 0805103A-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050608	Date of Collection:	5/5/08
Dil. Factor:	200	Date of Analysis:	5/6/08 02:20 PM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
1,1,2-Trichloroethane	100	Not Detected	540	Not Detected
Tetrachloroethene	100	300	680	2100
2-Hexanone	400	Not Detected	1600	Not Detected
Dibromochloromethane	100	Not Detected	850	Not Detected
1,2-Dibromoethane (EDB)	100	Not Detected	770	Not Detected
Chlorobenzene	100	Not Detected	460	Not Detected
Ethyl Benzene	100	4200	430	18000
m,p-Xylene	100	5200	430	22000
o-Xylene	100	1800	430	8000
Styrene	100	400	420	1700
Bromoform	100	Not Detected	1000	Not Detected
Cumene	100	Not Detected	490	Not Detected
1,1,2,2-Tetrachloroethane	100	Not Detected	690	Not Detected
Propylbenzene	100	270	490	1300
4-Ethyltoluene	100	1000	490	4900
1,3,5-Trimethylbenzene	100	390	490	1900
1,2,4-Trimethylbenzene	100	950	490	4700
1,3-Dichlorobenzene	100	Not Detected	600	Not Detected
1,4-Dichlorobenzene	100	240	600	1400
alpha-Chlorotoluene	100	Not Detected	520	Not Detected
1,2-Dichlorobenzene	100	Not Detected	600	Not Detected
1,2,4-Trichlorobenzene	400	Not Detected	3000	Not Detected
Hexachlorobutadiene	400	Not Detected	4300	Not Detected

Container Type: 1 Liter Tedlar Bag

Surrogates	%Recovery	Method Limits
Toluene-d8	97	70-130
1,2-Dichloroethane-d4	116	70-130
4-Bromofluorobenzene	101	70-130

Client Sample ID: Lab Blank

Lab ID#: 0805103A-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050606	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/6/08 12:19 PM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 12	0.50	Not Detected	2.5	Not Detected
Freon 114	0.50	Not Detected	3.5	Not Detected
Chloromethane	2.0	Not Detected	4.1	Not Detected
Vinyl Chloride	0.50	Not Detected	1.3	Not Detected
1,3-Butadiene	0.50	Not Detected	1.1	Not Detected
Bromomethane	0.50	Not Detected	1.9	Not Detected
Chloroethane	0.50	Not Detected	1.3	Not Detected
Freon 11	0.50	Not Detected	2.8	Not Detected
Ethanol	2.0	Not Detected	3.8	Not Detected
Freon 113	0.50	Not Detected	3.8	Not Detected
1,1-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Acetone	2.0	Not Detected	4.8	Not Detected
2-Propanol	2.0	Not Detected	4.9	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
3-Chloropropene	2.0	Not Detected	6.3	Not Detected
Methylene Chloride	0.50	Not Detected	1.7	Not Detected
Methyl tert-butyl ether	0.50	Not Detected	1.8	Not Detected
trans-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Hexane	0.50	Not Detected	1.8	Not Detected
1,1-Dichloroethane	0.50	Not Detected	2.0	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.50	Not Detected	1.5	Not Detected
cis-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.50	Not Detected	2.4	Not Detected
1,1,1-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Cyclohexane	0.50	Not Detected	1.7	Not Detected
Carbon Tetrachloride	0.50	Not Detected	3.1	Not Detected
2,2,4-Trimethylpentane	0.50	Not Detected	2.3	Not Detected
Benzene	0.50	Not Detected	1.6	Not Detected
1,2-Dichloroethane	0.50	Not Detected	2.0	Not Detected
Heptane	0.50	Not Detected	2.0	Not Detected
Trichloroethene	0.50	Not Detected	2.7	Not Detected
1,2-Dichloropropane	0.50	Not Detected	2.3	Not Detected
1,4-Dioxane	2.0	Not Detected	7.2	Not Detected
Bromodichloromethane	0.50	Not Detected	3.4	Not Detected
cis-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected
4-Methyl-2-pentanone	0.50	Not Detected	2.0	Not Detected
Toluene	0.50	Not Detected	1.9	Not Detected
trans-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected

Client Sample ID: Lab Blank

Lab ID#: 0805103A-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050606	Date of Collection: NA	
Dil. Factor:	1.00	Date of Analysis: 5/6/08 12:19 PM	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
1,1,2-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Tetrachloroethene	0.50	Not Detected	3.4	Not Detected
2-Hexanone	2.0	Not Detected	8.2	Not Detected
Dibromochloromethane	0.50	Not Detected	4.2	Not Detected
1,2-Dibromoethane (EDB)	0.50	Not Detected	3.8	Not Detected
Chlorobenzene	0.50	Not Detected	2.3	Not Detected
Ethyl Benzene	0.50	Not Detected	2.2	Not Detected
m,p-Xylene	0.50	Not Detected	2.2	Not Detected
o-Xylene	0.50	Not Detected	2.2	Not Detected
Styrene	0.50	Not Detected	2.1	Not Detected
Bromoform	0.50	Not Detected	5.2	Not Detected
Cumene	0.50	Not Detected	2.4	Not Detected
1,1,2,2-Tetrachloroethane	0.50	Not Detected	3.4	Not Detected
Propylbenzene	0.50	Not Detected	2.4	Not Detected
4-Ethyltoluene	0.50	Not Detected	2.4	Not Detected
1,3,5-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,2,4-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,3-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,4-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
alpha-Chlorotoluene	0.50	Not Detected	2.6	Not Detected
1,2-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,2,4-Trichlorobenzene	2.0	Not Detected	15	Not Detected
Hexachlorobutadiene	2.0	Not Detected	21	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	91	70-130
1,2-Dichloroethane-d4	117	70-130
4-Bromofluorobenzene	99	70-130

Client Sample ID: CCV

Lab ID#: 0805103A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050602	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/6/08 08:40 AM

Compound	%Recovery
Freon 12	109
Freon 114	108
Chloromethane	119
Vinyl Chloride	103
1,3-Butadiene	103
Bromomethane	102
Chloroethane	84
Freon 11	107
Ethanol	90
Freon 113	100
1,1-Dichloroethene	96
Acetone	86
2-Propanol	91
Carbon Disulfide	86
3-Chloropropene	86
Methylene Chloride	95
Methyl tert-butyl ether	89
trans-1,2-Dichloroethene	87
Hexane	87
1,1-Dichloroethane	94
2-Butanone (Methyl Ethyl Ketone)	93
cis-1,2-Dichloroethene	103
Tetrahydrofuran	98
Chloroform	106
1,1,1-Trichloroethane	110
Cyclohexane	90
Carbon Tetrachloride	118
2,2,4-Trimethylpentane	100
Benzene	102
1,2-Dichloroethane	127
Heptane	104
Trichloroethene	107
1,2-Dichloropropane	107
1,4-Dioxane	100
Bromodichloromethane	120
cis-1,3-Dichloropropene	111
4-Methyl-2-pentanone	110
Toluene	98
trans-1,3-Dichloropropene	118

Client Sample ID: CCV

Lab ID#: 0805103A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050602	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/6/08 08:40 AM

Compound	%Recovery
1,1,2-Trichloroethane	99
Tetrachloroethene	106
2-Hexanone	110
Dibromochloromethane	121
1,2-Dibromoethane (EDB)	113
Chlorobenzene	102
Ethyl Benzene	97
m,p-Xylene	97
o-Xylene	97
Styrene	101
Bromoform	127
Cumene	97
1,1,2,2-Tetrachloroethane	106
Propylbenzene	100
4-Ethyltoluene	101
1,3,5-Trimethylbenzene	97
1,2,4-Trimethylbenzene	96
1,3-Dichlorobenzene	105
1,4-Dichlorobenzene	106
alpha-Chlorotoluene	120
1,2-Dichlorobenzene	104
1,2,4-Trichlorobenzene	90
Hexachlorobutadiene	82

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	97	70-130
1,2-Dichloroethane-d4	123	70-130
4-Bromofluorobenzene	107	70-130

Air Toxics LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

Client Sample ID: LCS

Lab ID#: 0805103A-05A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050603	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/6/08 09:29 AM

Compound	%Recovery
Freon 12	106
Freon 114	108
Chloromethane	125
Vinyl Chloride	106
1,3-Butadiene	106
Bromomethane	108
Chloroethane	90
Freon 11	109
Ethanol	99
Freon 113	114
1,1-Dichloroethene	115
Acetone	91
2-Propanol	100
Carbon Disulfide	94
3-Chloropropene	90
Methylene Chloride	110
Methyl tert-butyl ether	96
trans-1,2-Dichloroethene	94
Hexane	96
1,1-Dichloroethane	103
2-Butanone (Methyl Ethyl Ketone)	100
cis-1,2-Dichloroethene	112
Tetrahydrofuran	103
Chloroform	113
1,1,1-Trichloroethane	113
Cyclohexane	96
Carbon Tetrachloride	121
2,2,4-Trimethylpentane	106
Benzene	107
1,2-Dichloroethane	130
Heptane	108
Trichloroethene	108
1,2-Dichloropropane	110
1,4-Dioxane	102
Bromodichloromethane	124
cis-1,3-Dichloropropene	114
4-Methyl-2-pentanone	113
Toluene	107
trans-1,3-Dichloropropene	122

Client Sample ID: LCS
Lab ID#: 0805103A-05A
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7050603	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/6/08 09:29 AM

Compound	%Recovery
1,1,2-Trichloroethane	104
Tetrachloroethene	111
2-Hexanone	115
Dibromochloromethane	124
1,2-Dibromoethane (EDB)	112
Chlorobenzene	107
Ethyl Benzene	100
m,p-Xylene	100
o-Xylene	102
Styrene	104
Bromoform	131
Cumene	103
1,1,2,2-Tetrachloroethane	112
Propylbenzene	106
4-Ethyltoluene	105
1,3,5-Trimethylbenzene	99
1,2,4-Trimethylbenzene	97
1,3-Dichlorobenzene	105
1,4-Dichlorobenzene	106
alpha-Chlorotoluene	124
1,2-Dichlorobenzene	103
1,2,4-Trichlorobenzene	100
Hexachlorobutadiene	87

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	96	70-130
1,2-Dichloroethane-d4	121	70-130
4-Bromofluorobenzene	104	70-130

@ Air Toxics LTD.

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

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Page 1 of 1

Project Manager David Derenzo
Collected by: (Print and Sign) Mike Laframboise
Company Derenzo & Associates Email dderenzo@derenzo.com
Address 39395 Schoolcraft Rd City Livonia State MI Zip 48150
Phone 734-464-3880 Fax 734-464-4368

Project Info:
P.O. # 1095
Project # 0710013
Project Name Brevard Energy

Turn Around Time:
☐ Normal
☐ Rush
specify

Lab Use Only
Pressurized by:
Date:
Pressurization Gas:
N2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final	Receipt	Final (psi)
01A	BE1	NA	5-5-08	15:05	modified ASTM D-5504				
02A	BE2	NA	5-5-08	15:05	EPA TO-15				
					analyzed only 1 of the 2				
					samples provided (samples				
					are identical)				

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:
2 samples are provided (analyze only 1); second sample is provided in case one of the two is damaged.

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
					Yes No None	0805163

Form 1293 rev.11

Revised COC received 5/13/08

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

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FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Page ____ of ____

Project Manager: David Derenzo
Collected by: (Print and Sign) Mike Laframboise
Company: Derenzo & Assoc. Email: ______
Address: 39395 Schoolcraft Rd City: Livonia State: MI Zip: 48150
Phone: 734-464-3800 Fax: 734-464-4368

Project Info:
P.O. # 10955
Project # 0710013
Project Name: Brevard Energy

Turn Around Time:
☐ Normal
☐ Rush
______ specify

	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final
01A	BE1	NA	5-1-08	1505	Modified ASTM D-5504		
02A	BE2	NA	5-1-08	1505	EPA TO-15		
					Analyze only 1 of the 2		
					samples provided (samples		
					are identical)		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
	5/5/08 1505	Monica Gregen ATL	5/6/08 850

Notes:
2 samples are provided (analyze only `1); second sample is provided in case one of the two is damaged

Fed Ex		MA	Good

0805103

Form 1293 rev.11

Air Toxics LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

Air Toxics Ltd. Introduces the Electronic Report

Thank you for choosing Air Toxics Ltd. To better serve our customers, we are providing your report by e-mail. This document is provided in Portable Document Format which can be viewed with Acrobat Reader by Adobe.

This electronic report includes the following:

- Work order Summary;
- Laboratory Narrative;
- Results; and
- Chain of Custody (copy).

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630

(916) 985-1000 .FAX (916) 985-1020
Hours 8:00 A.M to 6:00 P.M. Pacific

Air Toxics LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 0805103B

Work Order Summary

CLIENT:	Mr. David Derenzo Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150	**BILL TO:**	Ms. Donna Povich Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150
PHONE:	734-464-3880	**P.O. #**	10955
FAX:	734-464-4368	**PROJECT #**	0710013 Brevard Energy
DATE RECEIVED:	05/06/2008	**CONTACT:**	Brandon Dunmore
DATE COMPLETED:	05/08/2008		

FRACTION #	**NAME**	**TEST**	**RECEIPT VAC./PRES.**	**FINAL PRESSURE**
01A	BE1	ASTM D-5504	Tedlar Bag	Tedlar Bag
02A(on hold)	BE2	ASTM D-5504	Tedlar Bag	Tedlar Bag
03A	Lab Blank	ASTM D-5504	NA	NA
04A	LCS	ASTM D-5504	NA	NA

CERTIFIED BY: Linda L. Freeman DATE: 05/09/08

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/07, Expiration date: 06/30/08
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

LABORATORY NARRATIVE
ASTM D-5504
Derenzo & Associates
Workorder# 0805103B

Two 1 Liter Tedlar Bag samples were received on May 06, 2008. 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 1.0 mL sampling loop. See the data sheets for the reporting limits for each compound.

Receiving Notes

Sample BE2 was placed on hold per the client's request.

According to the Chain of Custody (COC), samples BE1 and BE 2 were collected on 5/1/08. However, the date we were given from the client reflects a collection date of 5/5/08. Therefore the date from the client was used to calculate the sample holding time.

Analytical Notes

Ethyl Methyl Sulfide and n-Butyl Mercaptan coelute with 3-Methyl Thiophene.

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: BE1

Lab ID#: 0805103B-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	1600	280000
Methyl Mercaptan	1600	4600
Dimethyl Sulfide	1600	3800

Client Sample ID: BE1

Lab ID#: 0805103B-01A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	I050606	Date of Collection: 5/5/08	
Dil. Factor:	400	Date of Analysis: 5/6/08 10:40 AM	

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	1600	280000
Carbonyl Sulfide	1600	Not Detected
Methyl Mercaptan	1600	4600
Ethyl Mercaptan	1600	Not Detected
Dimethyl Sulfide	1600	3800
Carbon Disulfide	2000	Not Detected
Isopropyl Mercaptan	1600	Not Detected
tert-Butyl Mercaptan	1600	Not Detected
n-Propyl Mercaptan	1600	Not Detected
Thiophene	1600	Not Detected
Isobutyl Mercaptan	1600	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	1600	Not Detected
Diethyl Sulfide	1600	Not Detected
Dimethyl Disulfide	1600	Not Detected
Tetrahydrothiophene	1600	Not Detected
2-Ethylthiophene	1600	Not Detected
2,5-Dimethylthiophene	1600	Not Detected
Diethyl Disulfide	1600	Not Detected

Container Type: 1 Liter Tedlar Bag

Client Sample ID: Lab Blank

Lab ID#: 0805103B-03A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	I050603	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/5/08 09:26 PM

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
Thiophene	4.0	Not Detected
Isobutyl Mercaptan	4.0	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	4.0	Not Detected
Diethyl Sulfide	4.0	Not Detected
Dimethyl Disulfide	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#: 0805103B-04A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	I050602	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 5/5/08 08:54 PM

Compound	%Recovery
Hydrogen Sulfide	111
Carbonyl Sulfide	83
Methyl Mercaptan	93
Ethyl Mercaptan	100
Dimethyl Sulfide	115
Carbon Disulfide	75
Isopropyl Mercaptan	106
tert-Butyl Mercaptan	105
n-Propyl Mercaptan	111
Thiophene	101
Isobutyl Mercaptan	120
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	99
Diethyl Sulfide	99
Dimethyl Disulfide	94
Tetrahydrothiophene	120
2-Ethylthiophene	102
2,5-Dimethylthiophene	107
Diethyl Disulfide	101

Container Type: NA - Not Applicable

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

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Page 1 of 1

Project Manager David Derenzo
Collected by: (Print and Sign) Mike Laframboise
Company Derenzo & Associates Email dderenzo@derenzo.com
Address 39395 Schoolcraft Rd City Livonia State MI Zip 48150
Phone 734-464-3880 Fax 734-464-4368

Project Info:
P.O. # 1095
Project # 0700013
Project Name Brevard Energy

Turn Around Time:
☐ Normal
☐ Rush
specify

Lab Use Only
Pressurized by:
Date:
Pressurization Gas:
N2 He

	Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Final	Receipt	Final (psig)
01A		BE1	NA	5-5-08	15:05	modified ASTM D-5504				
02A		BE2	NA	5-5-08	15:05	EPA TO-15				
						analyzed only 1 of the 2				
						samples provided (samples				
						are identical)				

Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time

Notes:
2 samples are provided (analyze only 1); second sample is provided in case one of the two is damaged.

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
					Yes No None	0805143

Form 1293 rev.11

Revised COC received 5/13/08

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice
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FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Page ____ of ____

Project Manager David Derenzo
Collected by: (Print and Sign) Mike Laframboise
Company Derenzo & Assoc. Email
Address 39395 Schoolcraft Rd. City Livonia State MI Zip 48150
Phone 734-464-3880 Fax 734-464-4368

Project Info:
P.O. # 10965
Project # 07100143
Project Name Brevard Energy

Turn Around Time:
☐ Normal
☐ Rush
specify

		Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final
01A		BE1	NA	5-1-08	1505	Modified ASTM D-5504		
02A		BE2	NA	5-1-08	1505	EPA TO-15		
						Analyze only 1 of the 2		
						samples provided (samples		
						are identical)		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
	5/5/08 1505	Monica Gegen ATL	5/6/08 850
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time

Notes:
2 samples are provided (analyze only '1); second sample is provided in case one of the two is damaged

Fed Ex NA Good 0805103

Form 1293 rev. 11

Brevard Energy, LLC (November 18, 2008 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Compounds[1]	Measured Concentration (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.270	CCl_2F_2	2	0.051 *
Freon 114 (Dichlorotetrafluroethane)	0.040	$C_2Cl_2F_4$	2	0.008
Vinyl Chloride	0.050	C_2HCl	1	0.005
Methylene Chloride (Dichloromethane)	0.028	CH_2Cl_2	2	0.005
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.410	$C_2H_2Cl_2$	2	0.077
1,2-Dichloroethane	0.030	$C_2H_4Cl_2$	2	0.006
Trichloroethene	0.990	C_2HCl_3	3	0.280
Tetrachloroethene (Perchloroethene)	0.130	C_2Cl_4	4	0.049
Chlorobenzene	0.043	C_6H_5Cl	1	0.004
1,4-Dichlorobenzene	0.072	$C_6H_4Cl_2$	2	0.014
Total hydrogen chloride emission factor (lb./MMcf)				**0.50**

Notes

1. December 4, 2008 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl
(0.27 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.051 lb. HCl/MMcf LFG

Brevard Energy, LLC (November 18, 2008 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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	255.0	H_2S	1	255.0	42.40 *
Total				**255.0**	**42.40**

Notes

A. Average of November 21, 2008 LFG sample laboratory analytical results (see Attachment)

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

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(255.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)

= 42.40 lb SO_2/MMcf LFG

Brevard Energy, LLC (November 18, 2008 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Coumpounds	Analytical Report Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.270	CCl_2F_2	2	0.051 *
Freon 114 (Dichlorotetrafluroethane)	0.040	$C_2Cl_2F_4$	2	0.008
Chloromethane	<0.098	CH_3Cl	1	<0.009
Vinyl Chloride	0.050	C_2HCl	1	0.005
Chloroethane	<0.024	C_2H_5Cl	1	<0.002
Freon 11 (Fluorotrichloromethane)	<0.024	$CFCl_3$	3	<0.007
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	<0.024	$C_2Cl_2F_3$	2	<0.005
1,1-dichloroethene	<0.024	$C_2H_2Cl_2$	2	<0.005
3-Chloropropene	<0.098	C_3H_5Cl	1	<0.009
Methylene Chloride (Dichloromethane)	0.028	CH_2Cl_2	2	0.005
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.410	$C_2H_2Cl_2$	2	0.077
1,1-Dichloroethane	<0.024	$C_2H_4Cl_2$	2	<0.005
1,1-Dichloroethene	<0.024	$C_2H_2Cl_2$	2	<0.005
Chloroform	<0.024	$CHCl_3$	3	<0.007
1,1,1-Trichloroethane	<0.024	$C_2H_3Cl_3$	3	<0.007
Carbon Tetrachloride	<0.024	CCl_4	4	<0.009
1,2-Dichloroethane	0.030	$C_2H_4Cl_2$	2	0.006
Trichloroethene	0.990	C_2HCl_3	3	0.280
1,2-dichloropropane	<0.024	$C_3H_6Cl_2$	2	<0.005
Bromodichloromethane	<0.024	$CBrCl_2$	2	<0.005
1,3-Dichloropropene	<0.024	$C_3H_4Cl_2$	2	<0.005
1,1,2-Trichloroethane	<0.024	$C_2H_3Cl_3$	3	<0.007
Tetrachloroethene (Perchloroethene)	0.130	C_2Cl_4	4	0.049
Dibromochloromethane	<0.024	$CHBr_2Cl$	1	<0.002
Chlorobenzene	0.043	C_6H_5Cl	1	0.004
1,1,2,2-Tetrachloroethane	<0.024	$C_2H_2Cl_4$	4	<0.01
1,3-Dichlorobenzene	<0.024	$C_6H_4Cl_2$	2	<0.00
1,4-Dichlorobenzene	0.072	$C_6H_4Cl_2$	2	0.014
alpha-Chlorotoluene	<0.024	C_7H_7Cl	1	<0.00
1,2-Dichlorobenzene	<0.024	$C_6H_4Cl_2$	2	<0.00
1,2,4-Trichlorobenzene	<0.098	$C_6H_3Cl_3$	3	<0.03
Hexachlorobutadiene	<0.098	C_4Cl_6	6	<0.06
Total hydrogen chloride emission factor (lb./MMcf)				**<0.69**

Notes

1. December 4, 2008 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl

(0.27 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)

= 0.051 lb. HCl/MMcf LFG

Brevard Energy, LLC (November 18, 2008 Sample)

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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	255.0	H_2S	1	255.0	42.40 *
Carbonyl sulfide	<12.0	CSO	1	<12.0	<2.00
Methyl mercaptan	<12.0	CH_4S	1	<12.0	<2.00
Ethyl mercaptan	<12.0	C_2H_6S	1	<12.0	<2.00
Dimethyl sulfide	<12.0	C_2H_6S	1	<12.0	<2.00
Carbon disulfide	<15.0	CS_2	2	<30.0	<9.98
Isopropyl mercaptan	<12.0	C_3H_6S	1	<12.0	<2.00
tert-Butyl mercaptan	<12.0	$C_4H_{10}S$	1	<12.0	<2.00
n-Propyl mercaptan	<12.0	C_3H_8S	1	<12.0	<2.00
Thiophene	<12.0	C_4H_4S	1	<12.0	<2.00
Isobutyl mercaptan	<12.0	$C_4H_{10}S$	1	<12.0	<2.00
Diethyl sulfide	<12.0	$CH_3CH_2SCH_2CH_3$	1	<12.0	<2.00
3-Methyl Thiophene	<12.0	C_5H_6S	1	<12.0	<2.00
Dimethyl disulfide	<12.0	CH_3SSCH_3	2	<24.0	<7.98
Tetrahydrothiophene	<12.0	$C_4H_8O_2S$	1	<12.0	<2.00
2-Ethylthiophene	<12.0	C_6H_8S	1	<12.0	<2.00
2,5-Dimethylthiopene	<12.0	C_6H_8S	1	<12.0	<2.00
Diethyl disulfide	<12.0	CH_3SSCH_3	2	<24.0	<7.98
Total				**<501.0**	**<96.26** [C]

Notes

A. November 21, 2008 LFG sample laboratory analytical results (see Attachment)

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

C. Calculation of SO_2 emission factor from sulfur content, as H_2S:

(501.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 96.3 lb SO_2/MMcf LFG

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(255.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 42.40 lb SO_2/MMcf LFG

Air Toxics LTD.

AN ENVIRONMENTAL ANALYTICAL LABRATORY

12/4/2008
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road

Livonia MI 48150

Project Name: Brevard Energy
Project #: 0811001

Dear Mr. David Derenzo

The following report includes the data for the above referenced project for sample(s) received on 11/19/2008 at Air Toxics Ltd.

The data and associated QC analyzed by Modified TO-15 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for you air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Brandon Dunmore at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Brandon M. Dunmore

Brandon Dunmore
Project Manager

Air Toxics LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 0811393A

Work Order Summary

CLIENT:	Mr. David Derenzo Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150	**BILL TO:**	Ms. Donna Povich Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150
PHONE:	734-464-3880	**P.O. #**	1138
FAX:	734-464-4368	**PROJECT #**	0811001 Brevard Energy
DATE RECEIVED:	11/19/2008	**CONTACT:**	Brandon Dunmore
DATE COMPLETED:	12/04/2008		

FRACTION #	**NAME**	**TEST**	**RECEIPT VAC./PRES.**	**FINAL PRESSURE**
01A	BE1	Modified TO-15	Tedlar Bag	Tedlar Bag
02A(on hold)	BE2	Modified TO-15	Tedlar Bag	Tedlar Bag
03A	Lab Blank	Modified TO-15	NA	NA
04A	CCV	Modified TO-15	NA	NA
05A	LCS	Modified TO-15	NA	NA

CERTIFIED BY: Linda d. Freeman DATE: 12/04/08

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/08, Expiration date: 06/30/09
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

This report shall not be reproduced, except in full, without the written approval of Air Toxics Ltd.

LABORATORY NARRATIVE
Modified TO-15
Derenzo & Associates
Workorder# 0811393A

Two 1 Liter Tedlar Bag samples were received on November 19, 2008. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode. The method involves concentrating up to 0.2 liters of air. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes directly into the GC/MS for analysis.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	*TO-15*	*ATL Modifications*
Daily CCV	</= 30% Difference	</= 30% Difference; Compounds exceeding this criterion and associated data are flagged and narrated.
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

The Chain of Custody (COC) information for samples BE1 and BE2 did not match the entries on the sample tags with regard to sample identification. Therefore the information on the COC was used to process and report the samples.

Sample BE2 was placed on hold per the client's request.

Analytical Notes

The reported result for Cumene in sample BE1 may be biased high due to co-elution with a non target compound with similar characteristic ions. Both the primary and secondary ion for Cumene exhibited potential interference.

Sample BE1 was transferred from a Tedlar bag into a summa canister to extend the hold time from 72 hours to 14 days. Canister pressurization resulted in a dilution factor which was applied to all analytical results.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction no performed).
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 reporting limit.
UJ- Non-detected compound associated with low bias in the CCV
N - The identification is based on presumptive evidence.

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
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: BE1

Lab ID#: 0811393A-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 12	24	270	120	1300
Freon 114	24	40	170	280
Vinyl Chloride	24	50	62	130
Ethanol	98	7200	180	14000
Acetone	98	10000 E	230	24000 E
2-Propanol	98	4800	240	12000
Carbon Disulfide	24	160	76	510
Methylene Chloride	24	28	85	97
Hexane	24	210	86	750
2-Butanone (Methyl Ethyl Ketone)	24	8500	72	25000
cis-1,2-Dichloroethene	24	410	97	1600
Tetrahydrofuran	24	1500	72	4400
Cyclohexane	24	230	84	790
2,2,4-Trimethylpentane	24	120	110	590
Benzene	24	860	78	2700
1,2-Dichloroethane	24	30	99	120
Heptane	24	430	100	1700
Trichloroethene	24	990	130	5300
4-Methyl-2-pentanone	24	560	100	2300
Toluene	24	6000	92	22000
Tetrachloroethene	24	130	160	910
Chlorobenzene	24	43	110	200
Ethyl Benzene	24	2800	110	12000
m,p-Xylene	24	3300	110	14000
o-Xylene	24	1100	110	4700
Styrene	24	190	100	800
Cumene	24	900	120	4400
Propylbenzene	24	160	120	770
1,3,5-Trimethylbenzene	24	200	120	1000
1,2,4-Trimethylbenzene	24	450	120	2200
1,4-Dichlorobenzene	24	72	150	430

Client Sample ID: BE1

Lab ID#: 0811393A-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**7120320**	**Date of Collection: 11/18/08**
Dil. Factor:	**48.9**	**Date of Analysis: 12/4/08 01:52 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 12	24	270	120	1300
Freon 114	24	40	170	280
Chloromethane	98	Not Detected	200	Not Detected
Vinyl Chloride	24	50	62	130
1,3-Butadiene	24	Not Detected	54	Not Detected
Bromomethane	24	Not Detected	95	Not Detected
Chloroethane	24	Not Detected	64	Not Detected
Freon 11	24	Not Detected	140	Not Detected
Ethanol	98	7200	180	14000
Freon 113	24	Not Detected	190	Not Detected
1,1-Dichloroethene	24	Not Detected	97	Not Detected
Acetone	98	10000 E	230	24000 E
2-Propanol	98	4800	240	12000
Carbon Disulfide	24	160	76	510
3-Chloropropene	98	Not Detected	310	Not Detected
Methylene Chloride	24	28	85	97
Methyl tert-butyl ether	24	Not Detected	88	Not Detected
trans-1,2-Dichloroethene	24	Not Detected	97	Not Detected
Hexane	24	210	86	750
1,1-Dichloroethane	24	Not Detected	99	Not Detected
2-Butanone (Methyl Ethyl Ketone)	24	8500	72	25000
cis-1,2-Dichloroethene	24	410	97	1600
Tetrahydrofuran	24	1500	72	4400
Chloroform	24	Not Detected	120	Not Detected
1,1,1-Trichloroethane	24	Not Detected	130	Not Detected
Cyclohexane	24	230	84	790
Carbon Tetrachloride	24	Not Detected	150	Not Detected
2,2,4-Trimethylpentane	24	120	110	590
Benzene	24	860	78	2700
1,2-Dichloroethane	24	30	99	120
Heptane	24	430	100	1700
Trichloroethene	24	990	130	5300
1,2-Dichloropropane	24	Not Detected	110	Not Detected
1,4-Dioxane	98	Not Detected	350	Not Detected
Bromodichloromethane	24	Not Detected	160	Not Detected
cis-1,3-Dichloropropene	24	Not Detected	110	Not Detected
4-Methyl-2-pentanone	24	560	100	2300
Toluene	24	6000	92	22000
trans-1,3-Dichloropropene	24	Not Detected	110	Not Detected

Client Sample ID: BE1

Lab ID#: 0811393A-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**7120320**	**Date of Collection:**	**11/18/08**
Dil. Factor:	**48.9**	**Date of Analysis:**	**12/4/08 01:52 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
1,1,2-Trichloroethane	24	Not Detected	130	Not Detected
Tetrachloroethene	24	130	160	910
2-Hexanone	98	Not Detected	400	Not Detected
Dibromochloromethane	24	Not Detected	210	Not Detected
1,2-Dibromoethane (EDB)	24	Not Detected	190	Not Detected
Chlorobenzene	24	43	110	200
Ethyl Benzene	24	2800	110	12000
m,p-Xylene	24	3300	110	14000
o-Xylene	24	1100	110	4700
Styrene	24	190	100	800
Bromoform	24	Not Detected	250	Not Detected
Cumene	24	900	120	4400
1,1,2,2-Tetrachloroethane	24	Not Detected	170	Not Detected
Propylbenzene	24	160	120	770
4-Ethyltoluene	24	Not Detected	120	Not Detected
1,3,5-Trimethylbenzene	24	200	120	1000
1,2,4-Trimethylbenzene	24	450	120	2200
1,3-Dichlorobenzene	24	Not Detected	150	Not Detected
1,4-Dichlorobenzene	24	72	150	430
alpha-Chlorotoluene	24	Not Detected	130	Not Detected
1,2-Dichlorobenzene	24	Not Detected	150	Not Detected
1,2,4-Trichlorobenzene	98	Not Detected	720	Not Detected
Hexachlorobutadiene	98	Not Detected	1000	Not Detected

E = Exceeds instrument calibration range.

Container Type: 1 Liter Tedlar Bag

Surrogates	%Recovery	Method Limits
Toluene-d8	101	70-130
1,2-Dichloroethane-d4	97	70-130
4-Bromofluorobenzene	100	70-130

Client Sample ID: Lab Blank

Lab ID#: 0811393A-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**7120305**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 12/3/08 12:16 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
Freon 12	0.50	Not Detected	2.5	Not Detected
Freon 114	0.50	Not Detected	3.5	Not Detected
Chloromethane	2.0	Not Detected	4.1	Not Detected
Vinyl Chloride	0.50	Not Detected	1.3	Not Detected
1,3-Butadiene	0.50	Not Detected	1.1	Not Detected
Bromomethane	0.50	Not Detected	1.9	Not Detected
Chloroethane	0.50	Not Detected	1.3	Not Detected
Freon 11	0.50	Not Detected	2.8	Not Detected
Ethanol	2.0	Not Detected	3.8	Not Detected
Freon 113	0.50	Not Detected	3.8	Not Detected
1,1-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Acetone	2.0	Not Detected	4.8	Not Detected
2-Propanol	2.0	Not Detected	4.9	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
3-Chloropropene	2.0	Not Detected	6.3	Not Detected
Methylene Chloride	0.50	Not Detected	1.7	Not Detected
Methyl tert-butyl ether	0.50	Not Detected	1.8	Not Detected
trans-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Hexane	0.50	Not Detected	1.8	Not Detected
1,1-Dichloroethane	0.50	Not Detected	2.0	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.50	Not Detected	1.5	Not Detected
cis-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.50	Not Detected	2.4	Not Detected
1,1,1-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Cyclohexane	0.50	Not Detected	1.7	Not Detected
Carbon Tetrachloride	0.50	Not Detected	3.1	Not Detected
2,2,4-Trimethylpentane	0.50	Not Detected	2.3	Not Detected
Benzene	0.50	Not Detected	1.6	Not Detected
1,2-Dichloroethane	0.50	Not Detected	2.0	Not Detected
Heptane	0.50	Not Detected	2.0	Not Detected
Trichloroethene	0.50	Not Detected	2.7	Not Detected
1,2-Dichloropropane	0.50	Not Detected	2.3	Not Detected
1,4-Dioxane	2.0	Not Detected	7.2	Not Detected
Bromodichloromethane	0.50	Not Detected	3.4	Not Detected
cis-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected
4-Methyl-2-pentanone	0.50	Not Detected	2.0	Not Detected
Toluene	0.50	Not Detected	1.9	Not Detected
trans-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected

Client Sample ID: Lab Blank

Lab ID#: 0811393A-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**7120305**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 12/3/08 12:16 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (uG/m3)	Amount (uG/m3)
1,1,2-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Tetrachloroethene	0.50	Not Detected	3.4	Not Detected
2-Hexanone	2.0	Not Detected	8.2	Not Detected
Dibromochloromethane	0.50	Not Detected	4.2	Not Detected
1,2-Dibromoethane (EDB)	0.50	Not Detected	3.8	Not Detected
Chlorobenzene	0.50	Not Detected	2.3	Not Detected
Ethyl Benzene	0.50	Not Detected	2.2	Not Detected
m,p-Xylene	0.50	Not Detected	2.2	Not Detected
o-Xylene	0.50	Not Detected	2.2	Not Detected
Styrene	0.50	Not Detected	2.1	Not Detected
Bromoform	0.50	Not Detected	5.2	Not Detected
Cumene	0.50	Not Detected	2.4	Not Detected
1,1,2,2-Tetrachloroethane	0.50	Not Detected	3.4	Not Detected
Propylbenzene	0.50	Not Detected	2.4	Not Detected
4-Ethyltoluene	0.50	Not Detected	2.4	Not Detected
1,3,5-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,2,4-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,3-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,4-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
alpha-Chlorotoluene	0.50	Not Detected	2.6	Not Detected
1,2-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,2,4-Trichlorobenzene	2.0	Not Detected	15	Not Detected
Hexachlorobutadiene	2.0	Not Detected	21	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	96	70-130
1,2-Dichloroethane-d4	95	70-130
4-Bromofluorobenzene	102	70-130

Client Sample ID: CCV

Lab ID#: 0811393A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	7120302	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 12/3/08 09:39 AM

Compound	%Recovery
Freon 12	98
Freon 114	98
Chloromethane	97
Vinyl Chloride	90
1,3-Butadiene	84
Bromomethane	92
Chloroethane	82
Freon 11	100
Ethanol	77
Freon 113	99
1,1-Dichloroethene	88
Acetone	80
2-Propanol	79
Carbon Disulfide	88
3-Chloropropene	84
Methylene Chloride	81
Methyl tert-butyl ether	91
trans-1,2-Dichloroethene	93
Hexane	81
1,1-Dichloroethane	89
2-Butanone (Methyl Ethyl Ketone)	89
cis-1,2-Dichloroethene	90
Tetrahydrofuran	85
Chloroform	96
1,1,1-Trichloroethane	101
Cyclohexane	92
Carbon Tetrachloride	104
2,2,4-Trimethylpentane	89
Benzene	97
1,2-Dichloroethane	103
Heptane	98
Trichloroethene	103
1,2-Dichloropropane	97
1,4-Dioxane	99
Bromodichloromethane	106
cis-1,3-Dichloropropene	99
4-Methyl-2-pentanone	96
Toluene	100
trans-1,3-Dichloropropene	99

Client Sample ID: CCV

Lab ID#: 0811393A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name: 7120302		**Date of Collection: NA**
Dil. Factor: 1.00		**Date of Analysis: 12/3/08 09:39 AM**

Compound	%Recovery
1,1,2-Trichloroethane	100
Tetrachloroethene	105
2-Hexanone	93
Dibromochloromethane	108
1,2-Dibromoethane (EDB)	102
Chlorobenzene	100
Ethyl Benzene	100
m,p-Xylene	99
o-Xylene	99
Styrene	98
Bromoform	107
Cumene	98
1,1,2,2-Tetrachloroethane	97
Propylbenzene	98
4-Ethyltoluene	99
1,3,5-Trimethylbenzene	95
1,2,4-Trimethylbenzene	97
1,3-Dichlorobenzene	101
1,4-Dichlorobenzene	103
alpha-Chlorotoluene	102
1,2-Dichlorobenzene	103
1,2,4-Trichlorobenzene	114
Hexachlorobutadiene	107

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	100	70-130
1,2-Dichloroethane-d4	97	70-130
4-Bromofluorobenzene	102	70-130

Client Sample ID: LCS

Lab ID#: 0811393A-05A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**7120303**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 12/3/08 10:26 AM**

Compound	**%Recovery**
Freon 12	96
Freon 114	96
Chloromethane	96
Vinyl Chloride	90
1,3-Butadiene	83
Bromomethane	94
Chloroethane	85
Freon 11	97
Ethanol	102
Freon 113	108
1,1-Dichloroethene	100
Acetone	90
2-Propanol	89
Carbon Disulfide	90
3-Chloropropene	89
Methylene Chloride	90
Methyl tert-butyl ether	95
trans-1,2-Dichloroethene	93
Hexane	84
1,1-Dichloroethane	93
2-Butanone (Methyl Ethyl Ketone)	94
cis-1,2-Dichloroethene	93
Tetrahydrofuran	94
Chloroform	98
1,1,1-Trichloroethane	101
Cyclohexane	94
Carbon Tetrachloride	103
2,2,4-Trimethylpentane	91
Benzene	99
1,2-Dichloroethane	105
Heptane	98
Trichloroethene	102
1,2-Dichloropropane	98
1,4-Dioxane	124
Bromodichloromethane	105
cis-1,3-Dichloropropene	99
4-Methyl-2-pentanone	98
Toluene	103
trans-1,3-Dichloropropene	101

Client Sample ID: LCS

Lab ID#: 0811393A-05A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**7120303**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 12/3/08 10:26 AM**

Compound	%Recovery
1,1,2-Trichloroethane	100
Tetrachloroethene	105
2-Hexanone	98
Dibromochloromethane	108
1,2-Dibromoethane (EDB)	98
Chlorobenzene	100
Ethyl Benzene	98
m,p-Xylene	97
o-Xylene	98
Styrene	99
Bromoform	107
Cumene	100
1,1,2,2-Tetrachloroethane	96
Propylbenzene	98
4-Ethyltoluene	98
1,3,5-Trimethylbenzene	92
1,2,4-Trimethylbenzene	95
1,3-Dichlorobenzene	99
1,4-Dichlorobenzene	100
alpha-Chlorotoluene	105
1,2-Dichlorobenzene	99
1,2,4-Trichlorobenzene	110
Hexachlorobutadiene	100

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	100	70-130
1,2-Dichloroethane-d4	98	70-130
4-Bromofluorobenzene	102	70-130

Air Toxics LTD.

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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(916) 985-1000 FAX (916) 985-1020

Page ____ of ____

Project Manager: David Derenzo

Collected by: (Print and Sign) Kathie A. Giozzo

Company: Derenzo & Associates

Email: dderenzo@derenzo.com

Address: 39395 Schoolcraft City: Livonia State: MI Zip: 48150

Phone: 734-464-3880 Fax: 734-464-4368

Project Info:

P.O. #: 1138

Project #: 0811001

Project Name: Brevard Energy

Turn Around Time:

☒ Normal

☐ Rush

______ specify

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final
01A	BE1	01	11-18-08	12:55	D-5504 (modified ASTM		
02A	BE2	02	11-18-08	13:00	D-5504)		
					EPA TO-15 (modified TO-15)		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
Kathie A. Giozzo	11/18/08 (3:00)	ATL	11/19/08 0915

Notes:

2 samples are provided, analyze only one. Second sample is provide in case 1 of 2 is damaged

FED EX	8675 25444 8042	N/A	GOOD	0811393

Form 1293 rev. 1

0811393

Air Toxics LTD.

AN ENVIRONMENTAL ANALYTICAL LABRATORY

11/21/2008
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road

Livonia MI 48150

Project Name: Brevard Energy
Project #: 0811001

Dear Mr. David Derenzo

The following report includes the data for the above referenced project for sample(s) received on 11/19/2008 at Air Toxics Ltd.

The data and associated QC analyzed by ASTM D-5504 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for you air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Brandon Dunmore at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Brandon M. Dunmore

Brandon Dunmore
Project Manager

Air Toxics LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 0811393B

Work Order Summary

CLIENT:	Mr. David Derenzo Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150	**BILL TO:**	Ms. Donna Povich Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150
PHONE:	734-464-3880	**P.O. #**	1138
FAX:	734-464-4368	**PROJECT #**	0811001 Brevard Energy
DATE RECEIVED:	11/19/2008	**CONTACT:**	Brandon Dunmore
DATE COMPLETED:	11/21/2008		

FRACTION #	**NAME**	**TEST**	**RECEIPT VAC./PRES.**	**FINAL PRESSURE**
01A	BE1	ASTM D-5504	Tedlar Bag	Tedlar Bag
01AA	BE1 Lab Duplicate	ASTM D-5504	Tedlar Bag	Tedlar Bag
02A(on hold)	BE2	ASTM D-5504	Tedlar Bag	Tedlar Bag
03A	Lab Blank	ASTM D-5504	NA	NA
04A	LCS	ASTM D-5504	NA	NA

CERTIFIED BY: Linda d. Freeman DATE: 11/21/08

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/08, Expiration date: 06/30/09
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

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LABORATORY NARRATIVE
ASTM D-5504
Derenzo & Associates
Workorder# 0811393B

Two 1 Liter Tedlar Bag samples were received on November 19, 2008. 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) information for samples BE1 and BE2 did not match the entries on the sample tags with regard to sample identification. Therefore the information on the COC was used to process and report the samples.

Sample BE2 was placed on hold per the client's request.

Analytical Notes

2-Ethyl Thiophene and Diethyl Sulfide coelute therefore, the percent recovery is calculated as an average recovery for both compounds.

Ethyl Methyl Sulfide and n-Butyl Mercaptan coelute with 3-Methyl Thiophene.

Samples BE1 and BE1 Lab Duplicate were received with insufficient time remaining to analyze within the method specified 24 hour hold time.

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: BE1

Lab ID#: 0811393B-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	12000	260000

Client Sample ID: BE1 Lab Duplicate

Lab ID#: 0811393B-01AA

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	12000	250000

Client Sample ID: BE1

Lab ID#: 0811393B-01A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name: b111919		**Date of Collection: 11/18/08**
Dil. Factor: 3000		**Date of Analysis: 11/19/08 02:21 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	12000	260000
Carbonyl Sulfide	12000	Not Detected
Methyl Mercaptan	12000	Not Detected
Ethyl Mercaptan	12000	Not Detected
Dimethyl Sulfide	12000	Not Detected
Carbon Disulfide	15000	Not Detected
Isopropyl Mercaptan	12000	Not Detected
tert-Butyl Mercaptan	12000	Not Detected
n-Propyl Mercaptan	12000	Not Detected
Thiophene	12000	Not Detected
Isobutyl Mercaptan	12000	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	12000	Not Detected
Diethyl Sulfide	12000	Not Detected
Dimethyl Disulfide	12000	Not Detected
Tetrahydrothiophene	12000	Not Detected
2-Ethylthiophene	12000	Not Detected
2,5-Dimethylthiophene	12000	Not Detected
Diethyl Disulfide	12000	Not Detected

Container Type: 1 Liter Tedlar Bag

Client Sample ID: BE1 Lab Duplicate

Lab ID#: 0811393B-01AA

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	**b111920**	**Date of Collection:**	**11/18/08**
Dil. Factor:	**3000**	**Date of Analysis:**	**11/19/08 02:45 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	12000	250000
Carbonyl Sulfide	12000	Not Detected
Methyl Mercaptan	12000	Not Detected
Ethyl Mercaptan	12000	Not Detected
Dimethyl Sulfide	12000	Not Detected
Carbon Disulfide	15000	Not Detected
Isopropyl Mercaptan	12000	Not Detected
tert-Butyl Mercaptan	12000	Not Detected
n-Propyl Mercaptan	12000	Not Detected
Thiophene	12000	Not Detected
Isobutyl Mercaptan	12000	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	12000	Not Detected
Diethyl Sulfide	12000	Not Detected
Dimethyl Disulfide	12000	Not Detected
Tetrahydrothiophene	12000	Not Detected
2-Ethylthiophene	12000	Not Detected
2,5-Dimethylthiophene	12000	Not Detected
Diethyl Disulfide	12000	Not Detected

Container Type: 1 Liter Tedlar Bag

Client Sample ID: Lab Blank

Lab ID#: 0811393B-03A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	**b111904**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 11/19/08 08:50 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
Thiophene	4.0	Not Detected
Isobutyl Mercaptan	4.0	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	4.0	Not Detected
Diethyl Sulfide	4.0	Not Detected
Dimethyl Disulfide	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#: 0811393B-04A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	b111902	**Date of Collection: NA**
Dil. Factor:	1.00	**Date of Analysis: 11/19/08 08:09 AM**

Compound	%Recovery
Hydrogen Sulfide	114
Carbonyl Sulfide	96
Methyl Mercaptan	111
Ethyl Mercaptan	108
Dimethyl Sulfide	107
Carbon Disulfide	114
Isopropyl Mercaptan	116
tert-Butyl Mercaptan	99
n-Propyl Mercaptan	116
Thiophene	103
Isobutyl Mercaptan	105
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	108
Diethyl Sulfide	108
Dimethyl Disulfide	99
Tetrahydrothiophene	113
2-Ethylthiophene	108
2,5-Dimethylthiophene	100
Diethyl Disulfide	103

Container Type: NA - Not Applicable

Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

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Page ____ of ____

Project Manager David Derenzo

Collected by: (Print and Sign) Kathie A. Giozzo

Company Derenzo & Associates Email dderenzo@derenzo.com

Address 39395 Schoolcraft City Livonia State MI Zip 48150

Phone 734-464-3880 Fax 734-464-4368

Project Info:

P.O. # 1138

Project # 0811001

Project Name Brevard Energy

Turn Around Time:

☒ Normal

☐ Rush

______ specify

	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final
01A	BE1	01	11-18-08	12:55	D-5504 (modified ASTM		
02A	BE2	02	11-18-08	13:00	D-5504)		
					EPA TO-15 (modified TO-15)		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
	11/18/08 13:00	ATL	11/19/08 0915

Notes:

2 samples are provided, analyze only one. Second sample is provide in case 1 of 2 is damaged

FED EX	8675 2444 8042	N/A	Good	0811393

Form 1293 rev. 1

0811393

Brevard Energy, LLC (March 19, 2009 Sample)

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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	320.0	H_2S	1	320.0	53.20 *
Carbonyl sulfide	0.5	CSO	1	0.5	0.09
Methyl mercaptan	8.9	CH_4S	1	8.9	1.48
Ethyl mercaptan	0.2	C_2H_6S	1	0.2	0.04
Dimethyl sulfide	6.3	C_2H_6S	1	6.3	1.05
Carbon disulfide	0.1	CS_2	2	0.2	0.07
Isopropyl mercaptan	0.7	C_3H_6S	1	0.7	0.12
tert-Butyl mercaptan	0.1	$C_4H_{10}S$	1	0.1	0.02
n-Propyl mercaptan	<0.1	C_3H_8S	1	<0.1	<0.02
Thiophene	0.8	C_4H_4S	1	0.8	0.14
Isobutyl mercaptan	<0.1	$C_4H_{10}S$	1	<0.1	<0.02
Diethyl sulfide	<0.1	$CH_3CH_2SCH_2CH_3$	1	<0.1	<0.02
3-Methyl Thiophene	<0.1	C_5H_6S	1	<0.1	<0.02
Dimethyl disulfide	<0.1	CH_3SSCH_3	2	<0.1	<0.03
Tetrahydrothiophene	<0.1	$C_4H_8O_2S$	1	<0.1	<0.02
2-Ethylthiophene	<0.1	C_6H_8S	1	<0.1	<0.02
2,5-Dimethylthiophene	<0.1	C_6H_8S	1	<0.1	<0.02
Diethyl disulfide	<0.1	CH_3SSCH_3	2	<0.1	<0.03
Ethyl Methyl Sulfide	<0.1	C_3H_8S	1	<0.1	<0.01
n-Butyl Mercaptan	<0.1	$C_4H_{10}S$	1	<0.1	<0.01
Total				**<338.8**	**<56.40** [C]

Notes

A. March 20, 2009 LFG sample laboratory analytical results (see Attachment)

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

C. Calculation of SO_2 emission factor from sulfur content, as H_2S:

(338.8 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 56.4 lb SO_2/MMcf LFG

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(320.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 53.20 lb SO_2/MMcf LFG

Brevard Energy, LLC (March 19, 2009 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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	320.0	H_2S	1	320.0	53.20 *
Carbonyl sulfide	0.5	CSO	1	0.5	0.09
Methyl mercaptan	8.9	CH_4S	1	8.9	1.48
Ethyl mercaptan	0.2	C_2H_6S	1	0.2	0.04
Dimethyl sulfide	6.3	C_2H_6S	1	6.3	1.05
Carbon disulfide	0.1	CS_2	2	0.2	0.07
Isopropyl mercaptan	0.7	C_3H_6S	1	0.7	0.12
tert-Butyl mercaptan	0.1	$C_4H_{10}S$	1	0.1	0.02
Thiophene	0.8	C_4H_4S	1	0.8	0.14
Total				**337.8**	**56.20**

Notes

A. March 20, 2009 LFG sample laboratory analytical results (see Attachment)

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

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(320.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 53.20 lb SO_2/MMcf LFG

Brevard Energy, LLC (March 19, 2009 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Coumpounds	Analytical Report Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.380	CCl_2F_2	2	0.072 *
Freon 114 (Dichlorotetrafluroethane)	0.047	$C_2Cl_2F_4$	2	0.009
Chloromethane	<0.150	CH_3Cl	1	<0.014
Vinyl Chloride	0.047	C_2HCl	1	0.004
Chloroethane	<0.037	C_2H_5Cl	1	<0.003
Freon 11 (Fluorotrichloromethane)	0.050	$CFCl_3$	3	0.014
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	<0.037	$C_2Cl_2F_3$	2	<0.007
1,1-dichloroethene	<0.037	$C_2H_2Cl_2$	2	<0.007
3-Chloropropene	<0.150	C_3H_5Cl	1	<0.014
Methylene Chloride (Dichloromethane)	<0.037	CH_2Cl_2	2	<0.007
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.240	$C_2H_2Cl_2$	2	0.045
1,2-Dichloroethene (as trans-1,2-Dichloroethene)	<0.037	$C_2H_2Cl_2$	2	<0.007
1,1-Dichloroethane	<0.037	$C_2H_4Cl_2$	2	<0.007
1,1-Dichloroethene	<0.037	$C_2H_2Cl_2$	2	<0.007
Chloroform	<0.037	$CHCl_3$	3	<0.010
1,1,1-Trichloroethane	<0.037	$C_2H_3Cl_3$	3	<0.010
Carbon Tetrachloride	<0.037	CCl_4	4	<0.014
1,2-Dichloroethane	<0.037	$C_2H_4Cl_2$	2	<0.007
Trichloroethene	0.150	C_2HCl_3	3	0.042
1,2-dichloropropane	<0.370	$C_3H_6Cl_2$	2	<0.070
Bromodichloromethane	<0.370	$CBrCl_2$	2	<0.070
1,3-Dichloropropene (as cis-1,3-Dichloropropene)	<0.037	$C_3H_4Cl_2$	2	<0.007
1,3-Dichloropropene (as trans-1,3-Dichloropropene)	<0.037	$C_3H_4Cl_2$	2	<0.007
1,1,2-Trichloroethane	<0.037	$C_2H_3Cl_3$	3	<0.010
Tetrachloroethene (Perchloroethene)	0.250	C_2Cl_4	4	0.094
Dibromochloromethane	<0.037	$CHBr_2Cl$	1	<0.003
Chlorobenzene	0.082	C_6H_5Cl	1	0.008
1,1,2,2-Tetrachloroethane	<0.037	$C_2H_2Cl_4$	4	<0.01
1,3-Dichlorobenzene	<0.037	$C_6H_4Cl_2$	2	<0.01
1,4-Dichlorobenzene	0.240	$C_6H_4Cl_2$	2	0.045
alpha-Chlorotoluene	<0.037	C_7H_7Cl	1	<0.00
1,2-Dichlorobenzene	<0.037	$C_6H_4Cl_2$	2	<0.01
1,2,4-Trichlorobenzene	<0.150	$C_6H_3Cl_3$	3	<0.04
Hexachlorobutadiene	<0.150	C_4Cl_6	6	<0.08
Total hydrogen chloride emission factor (lb./MMcf)				**<0.78**

Notes

1. April 2, 2009 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl
(0.38 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.072 lb. HCl/MMcf LFG

Brevard Energy, LLC (March 19, 2009 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Compounds[1]	Measured Concentration (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.380	CCl_2F_2	2	0.072 *
Freon 114 (Dichlorotetrafluroethane)	0.047	$C_2Cl_2F_4$	2	0.009
Vinyl Chloride	0.047	C_2HCl	1	0.004
Freon 11 (Fluorotrichloromethane)	0.050	$CFCl_3$	3	0.014
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.240	$C_2H_2Cl_2$	2	0.045
Trichloroethene	0.150	C_2HCl_3	3	0.042
Tetrachloroethene (Perchloroethene)	0.250	C_2Cl_4	4	0.094
Chlorobenzene	0.082	C_6H_5Cl	1	0.008
1,4-Dichlorobenzene	0.240	$C_6H_4Cl_2$	2	0.045
Total hydrogen chloride emission factor (lb./MMcf)				**0.33**

Notes

1. April 2, 2009 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl
(0.38 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.072 lb. HCl/MMcf LFG

2655 Park Center Drive, Suite A Simi Valley, California 93065 (805) 526-7161 (805) 526-7270 fax

Columbia Analytical Services INC.
An Employee - Owned Company

LABORATORY REPORT

April 3, 2009

Robert Harvey
Derenzo and Associates, Inc.
39395 Schoolcraft Rd
Livonia, MI 48150

RE: Brevard Energy

Dear Robert:

Enclosed are the results of the samples submitted to our laboratory on March 20, 2009. For your reference, these analyses have been assigned our service request number P0901000.

All analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein. Your report contains 12 pages.

Columbia Analytical Services, Inc. is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661; Department of the Navy (NFESC); Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-08-TX. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

Columbia Analytical Services, Inc.

John Yokoyama

John Yokoyama
Laboratory Director

Client: Derenzo and Associates, Inc.
Project: Brevard Energy

CAS Project No: P0901000

CASE NARRATIVE

The samples were received intact under chain of custody on March 20, 2009 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results.

C2 through C6 Hydrocarbon Analysis

The samples were analyzed according to modified EPA Method TO-3 for C2 through >C6 hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID).

Fixed Gases Analysis

The samples were also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to modified EPA Method 3C (single injection) using a gas chromatograph equipped with a thermal conductivity detector (TCD).

Sulfur Analysis

Samples U3-BTU-1 (P0901000-001) and U3-BTU-2 (P0901000-002) were received with insufficient hold time remaining to complete the analysis within the recommended limit. The analysis was performed as soon as possible after receipt by the laboratory and the data flagged to indicate the holding time exceedances.

The samples were also analyzed for twenty sulfur compounds per ASTM D 5504-01 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

Client: Derenzo and Associates, Inc.
Project: Brevard Energy

Service Request: P0901000

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
P0901000-001	U3-BTU-1	3/19/09	10:10
P0901000-002	U3-BTU-2	3/19/09	12:10
P0901000-003	U3-BTU-3	3/19/09	14:30

Columbia Analytical Services INC.
An Employee - Owned Company

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Air - Chain of Custody Record & Analytical Service Request

Page ____ of _____

PO Number LAN-0199

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No. P0901000

CAS Contact

Company Name & Address (Reporting Information)
Brevard Energy Sys.
2250 Adamson Rd
Cocoa FL 32926

Project Name: Brevard Energy

Project Number: 1

Project Manager: Mike Laframboise

Phone: 313 949 1023

Fax: 866 402 9010

P.O. # / Billing Information
LES
29261 Wall st.
Wixom Mi 48393

Email Address for Result Reporting: michael.laframboise@landfillenergy.com

Sampler (Print & Sign): Mike Laframboise

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/ Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume					Comments e.g. Actual Preservative or specific instructions
03-BTU-1	①	3/19/09	10:10					05504	D3588			
03-BTU-2	②	3/19/09	12:10					05504	D3588			
03-BTU-3	③	3/19/09	14:30					05504	D3588			

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier II - (Results + QC) _____
Tier V - (client specified) _____

EDD required Yes / No
Type: ______________
EDD Units: __________

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date: 3/19/09	Time: 15:10	Received by: (Signature)	Date: 3/20	Time: 0940
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank

4

Columbia Analytical Services, Inc.

Sample Acceptance Check Form

Client: Derenzo and Associates, Inc. Work order: P0901000

Project: Brevard Energy

Sample(s) received on: 03/20/09 Date opened: 03/20/09 by: MZAMORA

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Container(s) **supplied by CAS**?	☒	☐	☐
3	Did **sample containers** arrive in good condition?	☒	☐	☐
4	Was a **chain-of-custody** provided?	☒	☐	☐
5	Was the **chain-of-custody** properly completed?	☒	☐	☐
6	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
7	Was **sample volume** received adequate for analysis?	☒	☐	☐
8	Are samples within specified holding times?	☒	☐	☐
9	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☐	☐	☒
	Cooler Temperature ____ °C Blank Temperature ____ °C			
10	Was a **trip blank** received?	☐	☒	☐
	Trip blank supplied by CAS: ____			
11	Were **custody seals** on outside of cooler/Box?	☐	☒	☐
	Location of seal(s)? ____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
	Were custody seals on outside of sample container?	☐	☐	☒
	Location of seal(s)? ____ Sealing Lid?	☐	☒	☐
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
12	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☐	☐	☒
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☐	☒
	Were VOA vials checked for presence/absence of air bubbles?	☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
13	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
	Do they contain moisture?	☐	☐	☒
14	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P0901000-001.01	1.0 L Tedlar Bag					
P0901000-002.01	1.0 L Tedlar Bag					
P0901000-003.01	1.0 L Tedlar Bag					

Explain any discrepancies: (include lab sample ID numbers): ____

*Required pH: Phenols/COD/NH3/TOC/TOX/NO3+NO2/TKN/T.PHOS, H2SO4 (pH<2); Metals, HNO3 (pH<2); CN (NaOH or NaOH/Asc Acid) (pH>12);

Diss. Sulfide, NaOH (pH>12); T. Sulfide, NaOH/ZnAc (pH>12) RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **U3-BTU-1** CAS Project ID: P0901000
Client Project ID: **Brevard Energy** CAS Sample ID: P0901000-001

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton/Chris Cornett Date Collected: 3/19/09
Sampling Media: 1.0 L Tedlar Bag Date Received: 3/20/09
Test Notes:

Components	**Result Volume %**	**Result Weight %**	Data Qualifier
Hydrogen	0.05	< 0.01	
Oxygen + Argon	0.88	0.99	
Nitrogen	12.26	12.05	
Carbon Monoxide	< 0.01	< 0.01	
Methane	48.02	27.02	
Carbon Dioxide	38.71	59.77	
Hydrogen Sulfide	0.03	0.04	H1
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	< 0.01	
Hexanes	< 0.01	< 0.01	
> Hexanes	0.02	0.10	
TOTALS	99.99	99.99	

Components	**Mole %**	**Weight %**
Carbon	22.67	36.64
Hydrogen	50.27	6.82
Oxygen + Argon	20.65	44.45
Nitrogen	6.40	12.05
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9841
Specific Volume	ft3/lb	13.31
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	488.6
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	439.9
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	478.7
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	431.1
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,504.7
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	5,857.4
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9972

H1 = Sample analysis performed past holding time. See case narrative.

Verified By: ________ Date: 4/2/09

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**U3-BTU-2**	CAS Project ID:	P0901000
Client Project ID:	**Brevard Energy**	CAS Sample ID:	P0901000-002

Test Code:	ASTM D3588-98		
Analyst:	Zheng Wang/Wade Henton/Chris Cornett	Date Collected:	3/19/09
Sampling Media:	1.0 L Tedlar Bag	Date Received:	3/20/09
Test Notes:			

Components	**Result Volume %**	**Result Weight %**	Data Qualifier
Hydrogen	0.06	< 0.01	
Oxygen + Argon	0.74	0.84	
Nitrogen	11.80	11.60	
Carbon Monoxide	< 0.01	< 0.01	
Methane	48.42	27.27	
Carbon Dioxide	38.90	60.11	
Hydrogen Sulfide	0.03	0.04	H1
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	< 0.01	
Hexanes	< 0.01	< 0.01	
> Hexanes	0.03	0.11	
TOTALS	99.99	99.99	

Components	**Mole %**	**Weight %**
Carbon	22.75	36.93
Hydrogen	50.52	6.88
Oxygen + Argon	20.60	44.55
Nitrogen	6.13	11.61
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9833
Specific Volume	ft3/lb	13.33
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	492.8
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	443.8
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	482.9
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	434.8
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,567.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	5,913.7
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9972

H1 = Sample analysis performed past holding time. See case narrative.

Verified By: ____________ Date: 4/2/09

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**U3-BTU-3**	CAS Project ID:	P0901000
Client Project ID:	**Brevard Energy**	CAS Sample ID:	P0901000-003
Test Code:	ASTM D3588-98		
Analyst:	Zheng Wang/Wade Henton/Chris Cornett	Date Collected:	3/19/09
Sampling Media:	1.0 L Tedlar Bag	Date Received:	3/20/09
Test Notes:			

Components	**Result Volume %**	**Result Weight %**	Data Qualifier
Hydrogen	0.05	< 0.01	
Oxygen + Argon	0.83	0.93	
Nitrogen	11.78	11.58	
Carbon Monoxide	< 0.01	< 0.01	
Methane	48.34	27.21	
Carbon Dioxide	38.92	60.11	
Hydrogen Sulfide	0.03	0.04	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	< 0.01	
Hexanes	< 0.01	< 0.01	
> Hexanes	0.03	0.11	
TOTALS	99.99	99.99	

Components	**Mole %**	**Weight %**
Carbon	22.75	36.88
Hydrogen	50.46	6.87
Oxygen + Argon	20.67	44.64
Nitrogen	6.12	11.58
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9840
Specific Volume	ft3/lb	13.32
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	492.0
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	443.1
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	482.1
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	434.1
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,551.5
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	5,899.6
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9972

Verified By: ______ Date: 4/2/09

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS
Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **U3-BTU-1**
Client Project ID: **Brevard Energy**

CAS Project ID: P0901000
CAS Sample ID: P0901000-001

Test Code: ASTM D 5504-01
Instrument ID: Agilent 6890A/GC13/SCD
Analyst: Chris Cornett
Sampling Media: 1.0 L Tedlar Bag
Test Notes: **H1**

Date Collected: 3/19/09
Time Collected: 10:10
Date Received: 3/20/09
Date Analyzed: 3/20/09
Time Analyzed: 16:36
Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	**Hydrogen Sulfide**	**450,000**	140	**320,000**	100	
463-58-1	**Carbonyl Sulfide**	**1,300**	250	**540**	100	
74-93-1	**Methyl Mercaptan**	**18,000**	200	**8,900**	100	
75-08-1	**Ethyl Mercaptan**	**570**	250	**230**	100	
75-18-3	**Dimethyl Sulfide**	**16,000**	250	**6,300**	100	
75-15-0	**Carbon Disulfide**	**310**	160	**99**	50	
75-33-2	**Isopropyl Mercaptan**	**2,200**	310	**710**	100	
75-66-1	**tert-Butyl Mercaptan**	**490**	370	**130**	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	**Thiophene**	**2,800**	340	**820**	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.
H1 = Sample analysis performed past holding time. See case narrative.

Verified By:____________ Date: 4/2/09

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**U3-BTU-2**	CAS Project ID:	P0901000
Client Project ID:	**Brevard Energy**	CAS Sample ID:	P0901000-002

Test Code:	ASTM D 5504-01	Date Collected:	3/19/09
Instrument ID:	Agilent 6890A/GC13/SCD	Time Collected:	12:10
Analyst:	Chris Cornett	Date Received:	3/20/09
Sampling Media:	1.0 L Tedlar Bag	Date Analyzed:	3/20/09
Test Notes:	**H1**	Time Analyzed:	16:59
		Volume(s) Analyzed:	0.050 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	**Hydrogen Sulfide**	**450,000**	140	**320,000**	100	
463-58-1	**Carbonyl Sulfide**	**1,300**	250	**540**	100	
74-93-1	**Methyl Mercaptan**	**18,000**	200	**9,100**	100	
75-08-1	**Ethyl Mercaptan**	**540**	250	**210**	100	
75-18-3	**Dimethyl Sulfide**	**15,000**	250	**6,100**	100	
75-15-0	**Carbon Disulfide**	**600**	160	**190**	50	
75-33-2	**Isopropyl Mercaptan**	**2,200**	310	**710**	100	
75-66-1	**tert-Butyl Mercaptan**	**520**	370	**140**	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	**Thiophene**	**2,600**	340	**750**	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

H1 = Sample analysis performed past holding time. See case narrative.

Verified By: ______ Date: 4/2/09

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**U3-BTU-3**	CAS Project ID:	P0901000
Client Project ID:	**Brevard Energy**	CAS Sample ID:	P0901000-003

Test Code:	ASTM D 5504-01	Date Collected:	3/19/09
Instrument ID:	Agilent 6890A/GC13/SCD	Time Collected:	14:30
Analyst:	Chris Cornett	Date Received:	3/20/09
Sampling Media:	1.0 L Tedlar Bag	Date Analyzed:	3/20/09
Test Notes:		Time Analyzed:	14:16
		Volume(s) Analyzed:	0.050 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	**Hydrogen Sulfide**	**410,000**	140	**290,000**	100	
463-58-1	**Carbonyl Sulfide**	**1,000**	250	**410**	100	
74-93-1	**Methyl Mercaptan**	**16,000**	200	**8,300**	100	
75-08-1	**Ethyl Mercaptan**	**580**	250	**230**	100	
75-18-3	**Dimethyl Sulfide**	**14,000**	250	**5,600**	100	
75-15-0	**Carbon Disulfide**	**160**	160	**53**	50	
75-33-2	**Isopropyl Mercaptan**	**1,900**	310	**590**	100	
75-66-1	tert-Butyl Mercaptan	ND	370	ND	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	**Thiophene**	**2,600**	340	**750**	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: ______ Date: 4/2/09

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**Method Blank**	CAS Project ID:	P0901000
Client Project ID:	**Brevard Energy**	CAS Sample ID:	P090320-MB

Test Code:	ASTM D 5504-01	Date Collected:	NA
Instrument ID:	Agilent 6890A/GC13/SCD	Time Collected:	NA
Analyst:	Chris Cornett	Date Received:	NA
Sampling Media:	1.0 L Tedlar Bag	Date Analyzed:	3/20/09
Test Notes:		Time Analyzed:	07:45
		Volume(s) Analyzed:	1.0 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: ______ Date: 4/2/09

Air Toxics LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

4/9/2009
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road

Livonia MI 48150

Project Name: Brevard
Project #: 0901016
Workorder #: 0903721A

Dear Mr. David Derenzo

The following report includes the data for the above referenced project for sample(s) received on 3/27/2009 at Air Toxics Ltd.

The data and associated QC analyzed by Modified TO-15 (5&20 ppbv) are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for you air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Ausha Scott at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Ausha Scott
Project Manager

WORK ORDER #: 0903721A

Work Order Summary

CLIENT:
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road
Livonia, MI 48150

BILL TO:
Ms. Donna Povich
Derenzo & Associates
39395 Schoolcraft Road
Livonia, MI 48150

PHONE: 734-464-3880
FAX: 734-464-4368
DATE RECEIVED: 03/27/2009
DATE COMPLETED: 04/09/2009

P.O. # 1002
PROJECT # 0901016 Brevard
CONTACT: Ausha Scott

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	FINAL PRESSURE
01A	BE-1	Modified TO-15 (5&20 ppbv)	2.5 "Hg	5 psi
02A	Lab Blank	Modified TO-15 (5&20 ppbv)	NA	NA
03A	CCV	Modified TO-15 (5&20 ppbv)	NA	NA
04A	LCS	Modified TO-15 (5&20 ppbv)	NA	NA

CERTIFIED BY: Linda d. Fruman

Laboratory Director

DATE: 04/09/09

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/08, Expiration date: 06/30/09
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

LABORATORY NARRATIVE
Modified TO-15 Soil Gas
Derenzo & Associates
Workorder# 0903721A

One 6 Liter Summa Canister sample was received on March 27, 2009. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode. The method involves concentrating up to 50 mLs of air. The concentrated aliquot is then flash vaporized and swept through a water management system to remove water vapor. Following dehumidification, the sample passes directly into the GC/MS for analysis.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	*TO-15*	*ATL Modifications*
Daily CCV	+- 30% Difference	</= 30% Difference with two allowed out up to </=40%.; flag and narrate outliers
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

There were no receiving discrepancies.

Analytical Notes

The canisters in this work order were pressurized with Helium prior to sampling, per client request. Dilution factors have been adjusted accordingly.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction no performed).

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 reporting limit.
UJ- Non-detected compound associated with low bias in the CCV
N - The identification is based on presumptive evidence.

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
MODIFIED EPA METHOD TO-15 GC/MS

Client Sample ID: BE-1

Lab ID#: 0903721A-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	37	380	180	1900
Freon 114	37	47	260	330
Vinyl Chloride	37	47	95	120
Freon 11	37	50	210	280
Ethanol	150	7000	280	13000
Acetone	150	17000	350	41000
2-Propanol	150	5000	370	12000
Carbon Disulfide	37	55	120	170
Hexane	37	270	130	960
2-Butanone (Methyl Ethyl Ketone)	37	11000	110	34000
cis-1,2-Dichloroethene	37	240	150	970
Tetrahydrofuran	37	1900	110	5600
Cyclohexane	37	240	130	830
2,2,4-Trimethylpentane	37	120	170	560
Benzene	37	1300	120	4300
Heptane	37	420	150	1700
Trichloroethene	37	150	200	820
4-Methyl-2-pentanone	37	640	150	2600
Toluene	37	8200	140	31000
Tetrachloroethene	37	250	250	1700
Chlorobenzene	37	82	170	380
Ethyl Benzene	37	4900	160	21000
m,p-Xylene	37	6000	160	26000
o-Xylene	37	2000	160	8600
Styrene	37	460	160	2000
Cumene	37	420	180	2100
Propylbenzene	37	280	180	1400
4-Ethyltoluene	37	1000	180	5100
1,3,5-Trimethylbenzene	37	450	180	2200
1,2,4-Trimethylbenzene	37	1100	180	5400
1,4-Dichlorobenzene	37	240	220	1400

Client Sample ID: BE-1

Lab ID#: 0903721A-01A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	**b040216**	**Date of Collection:**	**3/19/09 6:32:00 PM**
Dil. Factor:	**7.46**	**Date of Analysis:**	**4/2/09 05:48 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	37	380	180	1900
Freon 114	37	47	260	330
Chloromethane	150	Not Detected	310	Not Detected
Vinyl Chloride	37	47	95	120
1,3-Butadiene	37	Not Detected	82	Not Detected
Bromomethane	37	Not Detected	140	Not Detected
Chloroethane	37	Not Detected	98	Not Detected
Freon 11	37	50	210	280
Ethanol	150	7000	280	13000
Freon 113	37	Not Detected	280	Not Detected
1,1-Dichloroethene	37	Not Detected	150	Not Detected
Acetone	150	17000	350	41000
2-Propanol	150	5000	370	12000
Carbon Disulfide	37	55	120	170
3-Chloropropene	150	Not Detected	470	Not Detected
Methylene Chloride	37	Not Detected	130	Not Detected
Methyl tert-butyl ether	37	Not Detected	130	Not Detected
trans-1,2-Dichloroethene	37	Not Detected	150	Not Detected
Hexane	37	270	130	960
1,1-Dichloroethane	37	Not Detected	150	Not Detected
2-Butanone (Methyl Ethyl Ketone)	37	11000	110	34000
cis-1,2-Dichloroethene	37	240	150	970
Tetrahydrofuran	37	1900	110	5600
Chloroform	37	Not Detected	180	Not Detected
1,1,1-Trichloroethane	37	Not Detected	200	Not Detected
Cyclohexane	37	240	130	830
Carbon Tetrachloride	37	Not Detected	230	Not Detected
2,2,4-Trimethylpentane	37	120	170	560
Benzene	37	1300	120	4300
1,2-Dichloroethane	37	Not Detected	150	Not Detected
Heptane	37	420	150	1700
Trichloroethene	37	150	200	820
1,2-Dichloropropane	37	Not Detected	170	Not Detected
1,4-Dioxane	150	Not Detected	540	Not Detected
Bromodichloromethane	37	Not Detected	250	Not Detected
cis-1,3-Dichloropropene	37	Not Detected	170	Not Detected
4-Methyl-2-pentanone	37	640	150	2600
Toluene	37	8200	140	31000
trans-1,3-Dichloropropene	37	Not Detected	170	Not Detected

Client Sample ID: BE-1

Lab ID#: 0903721A-01A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	**b040216**	**Date of Collection:**	**3/19/09 6:32:00 PM**
Dil. Factor:	**7.46**	**Date of Analysis:**	**4/2/09 05:48 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
1,1,2-Trichloroethane	37	Not Detected	200	Not Detected
Tetrachloroethene	37	250	250	1700
2-Hexanone	150	Not Detected	610	Not Detected
Dibromochloromethane	37	Not Detected	320	Not Detected
1,2-Dibromoethane (EDB)	37	Not Detected	290	Not Detected
Chlorobenzene	37	82	170	380
Ethyl Benzene	37	4900	160	21000
m,p-Xylene	37	6000	160	26000
o-Xylene	37	2000	160	8600
Styrene	37	460	160	2000
Bromoform	37	Not Detected	380	Not Detected
Cumene	37	420	180	2100
1,1,2,2-Tetrachloroethane	37	Not Detected	260	Not Detected
Propylbenzene	37	280	180	1400
4-Ethyltoluene	37	1000	180	5100
1,3,5-Trimethylbenzene	37	450	180	2200
1,2,4-Trimethylbenzene	37	1100	180	5400
1,3-Dichlorobenzene	37	Not Detected	220	Not Detected
1,4-Dichlorobenzene	37	240	220	1400
alpha-Chlorotoluene	37	Not Detected	190	Not Detected
1,2-Dichlorobenzene	37	Not Detected	220	Not Detected
1,2,4-Trichlorobenzene	150	Not Detected	1100	Not Detected
Hexachlorobutadiene	150	Not Detected	1600	Not Detected

Container Type: 6 Liter Summa Canister

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	101	70-130
Toluene-d8	104	70-130
4-Bromofluorobenzene	100	70-130

Client Sample ID: Lab Blank

Lab ID#: 0903721A-02A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	b040206	Date of Collection: NA
Dil. Factor:	1.00	Date of Analysis: 4/2/09 11:58 AM

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	5.0	Not Detected	25	Not Detected
Freon 114	5.0	Not Detected	35	Not Detected
Chloromethane	20	Not Detected	41	Not Detected
Vinyl Chloride	5.0	Not Detected	13	Not Detected
1,3-Butadiene	5.0	Not Detected	11	Not Detected
Bromomethane	5.0	Not Detected	19	Not Detected
Chloroethane	5.0	Not Detected	13	Not Detected
Freon 11	5.0	Not Detected	28	Not Detected
Ethanol	20	Not Detected	38	Not Detected
Freon 113	5.0	Not Detected	38	Not Detected
1,1-Dichloroethene	5.0	Not Detected	20	Not Detected
Acetone	20	Not Detected	48	Not Detected
2-Propanol	20	Not Detected	49	Not Detected
Carbon Disulfide	5.0	Not Detected	16	Not Detected
3-Chloropropene	20	Not Detected	63	Not Detected
Methylene Chloride	5.0	Not Detected	17	Not Detected
Methyl tert-butyl ether	5.0	Not Detected	18	Not Detected
trans-1,2-Dichloroethene	5.0	Not Detected	20	Not Detected
Hexane	5.0	Not Detected	18	Not Detected
1,1-Dichloroethane	5.0	Not Detected	20	Not Detected
2-Butanone (Methyl Ethyl Ketone)	5.0	Not Detected	15	Not Detected
cis-1,2-Dichloroethene	5.0	Not Detected	20	Not Detected
Tetrahydrofuran	5.0	Not Detected	15	Not Detected
Chloroform	5.0	Not Detected	24	Not Detected
1,1,1-Trichloroethane	5.0	Not Detected	27	Not Detected
Cyclohexane	5.0	Not Detected	17	Not Detected
Carbon Tetrachloride	5.0	Not Detected	31	Not Detected
2,2,4-Trimethylpentane	5.0	Not Detected	23	Not Detected
Benzene	5.0	Not Detected	16	Not Detected
1,2-Dichloroethane	5.0	Not Detected	20	Not Detected
Heptane	5.0	Not Detected	20	Not Detected
Trichloroethene	5.0	Not Detected	27	Not Detected
1,2-Dichloropropane	5.0	Not Detected	23	Not Detected
1,4-Dioxane	20	Not Detected	72	Not Detected
Bromodichloromethane	5.0	Not Detected	34	Not Detected
cis-1,3-Dichloropropene	5.0	Not Detected	23	Not Detected
4-Methyl-2-pentanone	5.0	Not Detected	20	Not Detected
Toluene	5.0	Not Detected	19	Not Detected
trans-1,3-Dichloropropene	5.0	Not Detected	23	Not Detected

Client Sample ID: Lab Blank

Lab ID#: 0903721A-02A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	**b040206**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 4/2/09 11:58 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
1,1,2-Trichloroethane	5.0	Not Detected	27	Not Detected
Tetrachloroethene	5.0	Not Detected	34	Not Detected
2-Hexanone	20	Not Detected	82	Not Detected
Dibromochloromethane	5.0	Not Detected	42	Not Detected
1,2-Dibromoethane (EDB)	5.0	Not Detected	38	Not Detected
Chlorobenzene	5.0	Not Detected	23	Not Detected
Ethyl Benzene	5.0	Not Detected	22	Not Detected
m,p-Xylene	5.0	Not Detected	22	Not Detected
o-Xylene	5.0	Not Detected	22	Not Detected
Styrene	5.0	Not Detected	21	Not Detected
Bromoform	5.0	Not Detected	52	Not Detected
Cumene	5.0	Not Detected	24	Not Detected
1,1,2,2-Tetrachloroethane	5.0	Not Detected	34	Not Detected
Propylbenzene	5.0	Not Detected	24	Not Detected
4-Ethyltoluene	5.0	Not Detected	24	Not Detected
1,3,5-Trimethylbenzene	5.0	Not Detected	24	Not Detected
1,2,4-Trimethylbenzene	5.0	Not Detected	24	Not Detected
1,3-Dichlorobenzene	5.0	Not Detected	30	Not Detected
1,4-Dichlorobenzene	5.0	Not Detected	30	Not Detected
alpha-Chlorotoluene	5.0	Not Detected	26	Not Detected
1,2-Dichlorobenzene	5.0	Not Detected	30	Not Detected
1,2,4-Trichlorobenzene	20	Not Detected	150	Not Detected
Hexachlorobutadiene	20	Not Detected	210	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	98	70-130
Toluene-d8	100	70-130
4-Bromofluorobenzene	94	70-130

Client Sample ID: CCV

Lab ID#: 0903721A-03A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	b040202	**Date of Collection: NA**
Dil. Factor:	1.00	**Date of Analysis: 4/2/09 10:40 AM**

Compound	%Recovery
Freon 12	96
Freon 114	92
Chloromethane	106
Vinyl Chloride	98
1,3-Butadiene	96
Bromomethane	105
Chloroethane	98
Freon 11	96
Ethanol	103
Freon 113	93
1,1-Dichloroethene	97
Acetone	92
2-Propanol	86
Carbon Disulfide	98
3-Chloropropene	94
Methylene Chloride	99
Methyl tert-butyl ether	98
trans-1,2-Dichloroethene	94
Hexane	96
1,1-Dichloroethane	97
2-Butanone (Methyl Ethyl Ketone)	96
cis-1,2-Dichloroethene	95
Tetrahydrofuran	101
Chloroform	95
1,1,1-Trichloroethane	92
Cyclohexane	96
Carbon Tetrachloride	87
2,2,4-Trimethylpentane	98
Benzene	99
1,2-Dichloroethane	96
Heptane	100
Trichloroethene	94
1,2-Dichloropropane	95
1,4-Dioxane	92
Bromodichloromethane	93
cis-1,3-Dichloropropene	93
4-Methyl-2-pentanone	94
Toluene	97
trans-1,3-Dichloropropene	89

Client Sample ID: CCV

Lab ID#: 0903721A-03A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	**b040202**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 4/2/09 10:40 AM**

Compound	%Recovery
1,1,2-Trichloroethane	96
Tetrachloroethene	95
2-Hexanone	92
Dibromochloromethane	92
1,2-Dibromoethane (EDB)	95
Chlorobenzene	95
Ethyl Benzene	95
m,p-Xylene	96
o-Xylene	96
Styrene	96
Bromoform	88
Cumene	95
1,1,2,2-Tetrachloroethane	96
Propylbenzene	94
4-Ethyltoluene	97
1,3,5-Trimethylbenzene	94
1,2,4-Trimethylbenzene	91
1,3-Dichlorobenzene	91
1,4-Dichlorobenzene	88
alpha-Chlorotoluene	83
1,2-Dichlorobenzene	90
1,2,4-Trichlorobenzene	107
Hexachlorobutadiene	103

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	97	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	98	70-130

Client Sample ID: LCS

Lab ID#: 0903721A-04A

MODIFIED EPA METHOD TO-15 GC/MS

File Name:	**b040203**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 4/2/09 10:59 AM**

Compound	%Recovery
Freon 12	98
Freon 114	97
Chloromethane	98
Vinyl Chloride	100
1,3-Butadiene	94
Bromomethane	112
Chloroethane	100
Freon 11	99
Ethanol	76
Freon 113	98
1,1-Dichloroethene	102
Acetone	92
2-Propanol	102
Carbon Disulfide	95
3-Chloropropene	88
Methylene Chloride	104
Methyl tert-butyl ether	104
trans-1,2-Dichloroethene	91
Hexane	91
1,1-Dichloroethane	101
2-Butanone (Methyl Ethyl Ketone)	93
cis-1,2-Dichloroethene	99
Tetrahydrofuran	93
Chloroform	99
1,1,1-Trichloroethane	97
Cyclohexane	91
Carbon Tetrachloride	85
2,2,4-Trimethylpentane	91
Benzene	102
1,2-Dichloroethane	99
Heptane	92
Trichloroethene	100
1,2-Dichloropropane	99
1,4-Dioxane	88
Bromodichloromethane	90
cis-1,3-Dichloropropene	102
4-Methyl-2-pentanone	89
Toluene	100
trans-1,3-Dichloropropene	99

Client Sample ID: LCS

Lab ID#: 0903721A-04A

MODIFIED EPA METHOD TO-15 GC/MS

File Name: b040203		**Date of Collection: NA**
Dil. Factor: 1.00		**Date of Analysis: 4/2/09 10:59 AM**

Compound	%Recovery
1,1,2-Trichloroethane	102
Tetrachloroethene	99
2-Hexanone	90
Dibromochloromethane	91
1,2-Dibromoethane (EDB)	100
Chlorobenzene	98
Ethyl Benzene	100
m,p-Xylene	100
o-Xylene	100
Styrene	106
Bromoform	92
Cumene	101
1,1,2,2-Tetrachloroethane	101
Propylbenzene	89
4-Ethyltoluene	92
1,3,5-Trimethylbenzene	96
1,2,4-Trimethylbenzene	97
1,3-Dichlorobenzene	96
1,4-Dichlorobenzene	93
alpha-Chlorotoluene	104
1,2-Dichlorobenzene	94
1,2,4-Trichlorobenzene	104
Hexachlorobutadiene	102

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
1,2-Dichloroethane-d4	98	70-130
Toluene-d8	102	70-130
4-Bromofluorobenzene	98	70-130

Air Toxics LTD.

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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FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Page 1 of 1

Project Manager Michael Brack

Collected by: (Print and Sign) Michael Brack

Company Derenzo Email mbrack@derenzo.com

Address 39395 Schoolcraft City Livonia State MI Zip 48150

Phone 734-464-3880 Fax 734-464-4368

Project Info:

P.O. #

Project # 0901016

Project Name Brevard

Turn Around Time:

☑ Normal

☐ Rush

specify

Lab Use Only

Pressurized by:

Date:

Pressurization Gas:

N_2 He

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)
01A	BE-1	05404	3/19/09	1132-1832	TO-15	25	3		

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
	3/26/09 1200		3/27/09 910 AL

Notes:

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	Fedex		NA	Good	Yes No [✓ None]	0903721

Form 1293 rev.11

Brevard Energy, LLC (November 10, 2009 Sample)

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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	160.0	H_2S	1	160.0	26.60 *
Carbonyl sulfide	<2.4	CSO	1	<2.4	<0.40
Methyl mercaptan	5.4	CH_4S	1	5.4	0.90
Ethyl mercaptan	<2.4	C_2H_6S	1	<2.4	<0.40
Dimethyl sulfide	8.0	C_2H_6S	1	8.0	1.33
Carbon disulfide	<3.0	CS_2	2	<6.0	<2.00
Isopropyl mercaptan	<2.4	C_3H_6S	1	<2.4	<0.40
tert-Butyl mercaptan	<2.4	$C_4H_{10}S$	1	<2.4	<0.40
n-Propyl mercaptan	<2.4	C_3H_8S	1	<2.4	<0.40
Thiophene	<2.4	C_4H_4S	1	<2.4	<0.40
Isobutyl mercaptan	<2.4	$C_4H_{10}S$	1	<2.4	<0.40
Diethyl sulfide	<2.4	$CH_3CH_2SCH_2CH_3$	1	<2.4	<0.40
3-Methyl Thiophene	<2.4	C_5H_6S	1	<2.4	<0.40
Dimethyl disulfide	<2.4	CH_3SSCH_3	2	<4.8	<1.60
Tetrahydrothiophene	<2.4	$C_4H_8O_2S$	1	<2.4	<0.40
2-Ethylthiophene	<2.4	C_6H_8S	1	<2.4	<0.40
2,5-Dimethylthiophene	<2.4	C_6H_8S	1	<2.4	<0.40
Diethyl disulfide	<2.4	CH_3SSCH_3	2	<4.8	<1.60
Total				**<217.8**	**<38.81** [C]

Notes

A. November 10, 2009 LFG sample laboratory analytical results (see Attachment)

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

C. Calculation of SO_2 emission factor from sulfur content, as H_2S:

(217.8 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 38.8 lb SO_2/MMcf LFG

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(160.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 26.60 lb SO_2/MMcf LFG

Brevard Energy, LLC (November 10, 2009 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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	160.0	H_2S	1	160.0	26.60 *
Methyl mercaptan	5.4	CH_4S	1	5.4	0.90
Dimethyl sulfide	8.0	C_2H_6S	1	<8.0	1.33
Total				**165.4**	**27.50**

Notes

A. November 10, 2009 LFG sample laboratory analytical results (see Attachment)

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

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(160.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 26.60 lb SO_2/MMcf LFG

Brevard Energy, LLC (November 10, 2009 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Coumpounds	Analytical Report Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.510	CCl_2F_2	2	0.096 *
Freon 114 (Dichlorotetrafluroethane)	<0.066	$C_2Cl_2F_4$	2	<0.012
Chloromethane	<0.270	CH_3Cl	1	<0.025
Vinyl Chloride	0.081	C_2HCl	1	0.008
Chloroethane	0.240	C_2H_5Cl	1	0.023
Freon 11 (Fluorotrichloromethane)	0.240	$CFCl_3$	3	0.068
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	<0.066	$C_2Cl_2F_3$	2	<0.012
1,1-dichloroethene	<0.020	$C_2H_2Cl_2$	2	<0.004
3-Chloropropene	<0.270	C_3H_5Cl	1	<0.025
Methylene Chloride (Dichloromethane)	0.810	CH_2Cl_2	2	0.153
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	<0.066	$C_2H_2Cl_2$	2	<0.012
1,2-Dichloroethene (as trans-1,2-Dichloroethene)	<0.066	$C_2H_2Cl_2$	2	<0.012
1,1-Dichloroethane	<0.066	$C_2H_4Cl_2$	2	<0.012
1,1-Dichloroethene	<0.066	$C_2H_2Cl_2$	2	<0.012
Chloroform	<0.066	$CHCl_3$	3	<0.019
1,1,1-Trichloroethane	<0.066	$C_2H_3Cl_3$	3	<0.019
Carbon Tetrachloride	<0.066	CCl_4	4	<0.025
1,2-Dichloroethane	0.230	$C_2H_4Cl_2$	2	0.043
Trichloroethene	0.320	C_2HCl_3	3	0.090
1,2-dichloropropane	<0.066	$C_3H_6Cl_2$	2	<0.012
Bromodichloromethane	<0.066	$CBrCl_2$	2	<0.012
1,3-Dichloropropene (as cis-1,3-Dichloropropene)	<0.066	$C_3H_4Cl_2$	2	<0.012
1,3-Dichloropropene (as trans-1,3-Dichloropropene)	<0.066	$C_3H_4Cl_2$	2	<0.012
1,1,2-Trichloroethane	<0.066	$C_2H_3Cl_3$	3	<0.019
Tetrachloroethene (Perchloroethene)	0.520	C_2Cl_4	4	0.196
Dibromochloromethane	<0.066	$CHBr_2Cl$	1	<0.006
Chlorobenzene	0.110	C_6H_5Cl	1	0.010
1,1,2,2-Tetrachloroethane	<0.066	$C_2H_2Cl_4$	4	<0.025
1,3-Dichlorobenzene	<0.066	$C_6H_4Cl_2$	2	<0.012
1,4-Dichlorobenzene	0.560	$C_6H_4Cl_2$	2	0.106
alpha-Chlorotoluene	<0.066	C_7H_7Cl	1	<0.006
1,2-Dichlorobenzene	<0.066	$C_6H_4Cl_2$	2	<0.012
1,2,4-Trichlorobenzene	<0.270	$C_6H_3Cl_3$	3	<0.076
Hexachlorobutadiene	<0.270	C_4Cl_6	6	<0.153
Total hydrogen chloride emission factor (lb./MMcf)				**<1.34**

Notes

1. November 10, 2009 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl

(0.51 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)

= 0.096 lb. HCl/MMcf LFG

Brevard Energy, LLC (November 10, 2009 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Compounds	Measured Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.510	CCl_2F_2	2	0.096 *
Vinyl Chloride	0.081	C_2HCl	1	0.008
Chloroethane	0.240	C_2H_5Cl	1	0.023
Freon 11 (Fluorotrichloromethane)	0.240	$CFCl_3$	3	0.068
Methylene Chloride (Dichloromethane)	0.810	CH_2Cl_2	2	0.153
1,2-Dichloroethane	0.230	$C_2H_4Cl_2$	2	0.043
Trichloroethene	0.320	C_2HCl_3	3	0.090
Tetrachloroethene (Perchloroethene)	0.520	C_2Cl_4	4	0.196
Chlorobenzene	0.110	C_6H_5Cl	1	0.010
1,4-Dichlorobenzene	0.560	$C_6H_4Cl_2$	2	0.106
Total hydrogen chloride emission factor (lb./MMcf)				**0.79**

Notes

1. November 10, 2009 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl
(0.51 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.096 lb. HCl/MMcf LFG

Air
Toxics LTD.
Laboratory Services Since 1989

11/16/2009
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road

Livonia MI 48150

Project Name: Brevard Energy
Project #: 0911005
Workorder #: 0911216B

Dear Mr. David Derenzo

The following report includes the data for the above referenced project for sample(s) received on 11/11/2009 at Air Toxics Ltd.

The data and associated QC analyzed by ASTM D-5504 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for your air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Ausha Scott at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

AT Scott

Ausha Scott
Project Manager

WORK ORDER #: 0911216B

Work Order Summary

CLIENT: Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road
Livonia, MI 48150

BILL TO: Ms. Donna Povich
Derenzo & Associates
39395 Schoolcraft Road
Livonia, MI 48150

PHONE: 734-464-3880

FAX: 734-464-4368

DATE RECEIVED: 11/11/2009

DATE COMPLETED: 11/16/2009

P.O. # 1221

PROJECT # 0911005 Brevard Energy

CONTACT: Ausha Scott

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	FINAL PRESSURE
01A	BVD-1	ASTM D-5504	Tedlar Bag	Tedlar Bag
02A	Lab Blank	ASTM D-5504	NA	NA
03A	LCS	ASTM D-5504	NA	NA

CERTIFIED BY: Linda L. Freeman

Laboratory Director

DATE: 11/16/09

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/09, Expiration date: 06/30/10
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630
(916) 985-1000 . (800) 985-5955 . FAX (916) 985-1020

LABORATORY NARRATIVE
ASTM D-5504
Derenzo & Associates
Workorder# 0911216B

One 1 Liter Tedlar Bag sample was received on November 11, 2009. 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 year was not provided.

Analytical Notes

Ethyl Methyl Sulfide and n-Butyl Mercaptan coelute with 3-Methyl Thiophene.

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: BVD-1

Lab ID#: 0911216B-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	2400	160000
Methyl Mercaptan	2400	5400
Dimethyl Sulfide	2400	8000

Client Sample ID: BVD-1

Lab ID#: 0911216B-01A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	**I111110**	**Date of Collection:**	**11/10/09 3:00:00 PM**
Dil. Factor:	**600**	**Date of Analysis:**	**11/11/09 10:02 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)
Hydrogen Sulfide	2400	160000
Carbonyl Sulfide	2400	Not Detected
Methyl Mercaptan	2400	5400
Ethyl Mercaptan	2400	Not Detected
Dimethyl Sulfide	2400	8000
Carbon Disulfide	3000	Not Detected
Isopropyl Mercaptan	2400	Not Detected
tert-Butyl Mercaptan	2400	Not Detected
n-Propyl Mercaptan	2400	Not Detected
Thiophene	2400	Not Detected
Isobutyl Mercaptan	2400	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	2400	Not Detected
Diethyl Sulfide	2400	Not Detected
Dimethyl Disulfide	2400	Not Detected
Tetrahydrothiophene	2400	Not Detected
2-Ethylthiophene	2400	Not Detected
2,5-Dimethylthiophene	2400	Not Detected
Diethyl Disulfide	2400	Not Detected

Container Type: 1 Liter Tedlar Bag

Client Sample ID: Lab Blank

Lab ID#: 0911216B-02A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	**I111103**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 11/11/09 07:25 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
Thiophene	4.0	Not Detected
Isobutyl Mercaptan	4.0	Not Detected
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	4.0	Not Detected
Diethyl Sulfide	4.0	Not Detected
Dimethyl Disulfide	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#: 0911216B-03A

SULFUR GASES BY ASTM D-5504 GC/SCD

File Name:	**I111102**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 11/11/09 07:03 AM**

Compound	%Recovery
Hydrogen Sulfide	82
Carbonyl Sulfide	107
Methyl Mercaptan	97
Ethyl Mercaptan	104
Dimethyl Sulfide	103
Carbon Disulfide	92
Isopropyl Mercaptan	107
tert-Butyl Mercaptan	108
n-Propyl Mercaptan	105
Thiophene	92
Isobutyl Mercaptan	104
3-Methyl Thiophene/n-Butyl Mercaptan/Ethyl Methyl Sulfide	103
Diethyl Sulfide	110
Dimethyl Disulfide	97
Tetrahydrothiophene	114
2-Ethylthiophene	87
2,5-Dimethylthiophene	84
Diethyl Disulfide	94

Container Type: NA - Not Applicable

Air Toxics LTD.

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

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX (916) 985-1020

Page ____ of ____

Project Manager David Derenzo

Collected by: (Print and Sign) Alaine Grogan

Company Derenzo + Assoc. Email

Address 39395 Schoolcraft Rd City Livonia State MI Zip 48150

Phone (734) 216-4614 Fax

Project Info:

P.O. # 1221

Project # 0911005

Project Name Brezard Energy

Turn Around Time:

☐ Normal

☐ Rush

____ specify

Lab Use Only

Pressurized by: ____

Date: ____

Pressurization Gas:

N2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final	Canister Pressure/Vacuum Receipt	Canister Pressure/Vacuum Final (psi)
01A	BUD-1		11-10-09	15:00	ASTM D-5504				
					EPA-TO-15				

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time	Notes:
	15:30 / 11-10	Monica Wagen ATL	11/11/09 850	

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	Fed Ex		NA	Good	Yes No [✓ None]	0911216

Air Toxics LTD.
Laboratory Services Since 1989

11/18/2009
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road

Livonia MI 48150

Project Name: Brevard Energy
Project #: 0911005
Workorder #: 0911216A

Dear Mr. David Derenzo

The following report includes the data for the above referenced project for sample(s) received on 11/11/2009 at Air Toxics Ltd.

The data and associated QC analyzed by Modified TO-15 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for your air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Ausha Scott at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

AT Scott

Ausha Scott
Project Manager

WORK ORDER #: 0911216A

Work Order Summary

CLIENT:	Mr. David Derenzo Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150	**BILL TO:**	Ms. Donna Povich Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150
PHONE:	734-464-3880	**P.O. #**	1221
FAX:	734-464-4368	**PROJECT #**	0911005 Brevard Energy
DATE RECEIVED:	11/11/2009	**CONTACT:**	Ausha Scott
DATE COMPLETED:	11/18/2009		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	FINAL PRESSURE
01A	BVD-1	Modified TO-15	Tedlar Bag	Tedlar Bag
02A	Lab Blank	Modified TO-15	NA	NA
03A	CCV	Modified TO-15	NA	NA
04A	LCS	Modified TO-15	NA	NA

CERTIFIED BY: Linda d. Freeman DATE: 11/18/09

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763, NJ NELAP - CA004
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/09, Expiration date: 06/30/10
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

LABORATORY NARRATIVE
Modified TO-15
Derenzo & Associates
Workorder# 0911216A

One 1 Liter Tedlar Bag sample was received on November 11, 2009. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	*TO-15*	*ATL Modifications*
Daily CCV	</= 30% Difference	</= 30% Difference; Compounds exceeding this criterion and associated data are flagged and narrated.
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

The Chain of Custody (COC) was not relinquished properly. A year was not provided.

Analytical Notes

All Quality Control Limit exceedences and affected sample results are noted by flags. Each flag is defined at the bottom of this Case Narrative and on each Sample Result Summary page. Target compound non-detects in the samples that are associated with high bias in QC analyses have not been flagged.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction no performed).
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 reporting limit.

UJ- Non-detected compound associated with low bias in the CCV
N - The identification is based on presumptive evidence.

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
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: BVD-1

Lab ID#: 0911216A-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	66	510	330	2500
Vinyl Chloride	66	81	170	210
Chloroethane	66	240	180	640
Freon 11	66	240	370	1400
Ethanol	270	38000 E	500	71000 E
Acetone	270	23000	630	55000
2-Propanol	270	18000	650	44000
Carbon Disulfide	66	150	210	480
Methylene Chloride	66	810	230	2800
Methyl tert-butyl ether	66	130	240	470
Hexane	66	960	230	3400
2-Butanone (Methyl Ethyl Ketone)	66	23000	200	68000
Tetrahydrofuran	66	5300	200	16000
Cyclohexane	66	820	230	2800
2,2,4-Trimethylpentane	66	650	310	3000
Benzene	66	1800	210	5900
1,2-Dichloroethane	66	230	270	930
Heptane	66	1500	270	6300
Trichloroethene	66	320	360	1700
4-Methyl-2-pentanone	66	2700 J	270	11000 J
Toluene	66	18000	250	67000
Tetrachloroethene	66	520	450	3500
Chlorobenzene	66	110	310	530
Ethyl Benzene	66	9100	290	40000
m,p-Xylene	66	13000	290	57000
o-Xylene	66	4200	290	18000
Styrene	66	1200	280	4900
Propylbenzene	66	730	330	3600
4-Ethyltoluene	66	3000	330	14000
1,3,5-Trimethylbenzene	66	1100	330	5500
1,2,4-Trimethylbenzene	66	3000	330	14000
1,4-Dichlorobenzene	66	560	400	3300

Client Sample ID: BVD-1

Lab ID#: 0911216A-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**t111220**	**Date of Collection:**	**11/10/09 3:00:00 PM**
Dil. Factor:	**133**	**Date of Analysis:**	**11/12/09 10:49 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	66	510	330	2500
Freon 114	66	Not Detected	460	Not Detected
Chloromethane	270	Not Detected	550	Not Detected
Vinyl Chloride	66	81	170	210
1,3-Butadiene	66	Not Detected	150	Not Detected
Bromomethane	66	Not Detected	260	Not Detected
Chloroethane	66	240	180	640
Freon 11	66	240	370	1400
Ethanol	270	38000 E	500	71000 E
Freon 113	66	Not Detected	510	Not Detected
1,1-Dichloroethene	66	Not Detected	260	Not Detected
Acetone	270	23000	630	55000
2-Propanol	270	18000	650	44000
Carbon Disulfide	66	150	210	480
3-Chloropropene	270	Not Detected	830	Not Detected
Methylene Chloride	66	810	230	2800
Methyl tert-butyl ether	66	130	240	470
trans-1,2-Dichloroethene	66	Not Detected	260	Not Detected
Hexane	66	960	230	3400
1,1-Dichloroethane	66	Not Detected	270	Not Detected
2-Butanone (Methyl Ethyl Ketone)	66	23000	200	68000
cis-1,2-Dichloroethene	66	Not Detected	260	Not Detected
Tetrahydrofuran	66	5300	200	16000
Chloroform	66	Not Detected	320	Not Detected
1,1,1-Trichloroethane	66	Not Detected	360	Not Detected
Cyclohexane	66	820	230	2800
Carbon Tetrachloride	66	Not Detected	420	Not Detected
2,2,4-Trimethylpentane	66	650	310	3000
Benzene	66	1800	210	5900
1,2-Dichloroethane	66	230	270	930
Heptane	66	1500	270	6300
Trichloroethene	66	320	360	1700
1,2-Dichloropropane	66	Not Detected	310	Not Detected
1,4-Dioxane	270	Not Detected	960	Not Detected
Bromodichloromethane	66	Not Detected	440	Not Detected
cis-1,3-Dichloropropene	66	Not Detected	300	Not Detected
4-Methyl-2-pentanone	66	2700 J	270	11000 J
Toluene	66	18000	250	67000
trans-1,3-Dichloropropene	66	Not Detected	300	Not Detected

Client Sample ID: BVD-1

Lab ID#: 0911216A-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**t111220**	**Date of Collection:**	**11/10/09 3:00:00 PM**
Dil. Factor:	**133**	**Date of Analysis:**	**11/12/09 10:49 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
1,1,2-Trichloroethane	66	Not Detected	360	Not Detected
Tetrachloroethene	66	520	450	3500
2-Hexanone	270	Not Detected	1100	Not Detected
Dibromochloromethane	66	Not Detected	570	Not Detected
1,2-Dibromoethane (EDB)	66	Not Detected	510	Not Detected
Chlorobenzene	66	110	310	530
Ethyl Benzene	66	9100	290	40000
m,p-Xylene	66	13000	290	57000
o-Xylene	66	4200	290	18000
Styrene	66	1200	280	4900
Bromoform	66	Not Detected	690	Not Detected
Cumene	66	Not Detected	330	Not Detected
1,1,2,2-Tetrachloroethane	66	Not Detected	460	Not Detected
Propylbenzene	66	730	330	3600
4-Ethyltoluene	66	3000	330	14000
1,3,5-Trimethylbenzene	66	1100	330	5500
1,2,4-Trimethylbenzene	66	3000	330	14000
1,3-Dichlorobenzene	66	Not Detected	400	Not Detected
1,4-Dichlorobenzene	66	560	400	3300
alpha-Chlorotoluene	66	Not Detected	340	Not Detected
1,2-Dichlorobenzene	66	Not Detected	400	Not Detected
1,2,4-Trichlorobenzene	270	Not Detected	2000	Not Detected
Hexachlorobutadiene	270	Not Detected	2800	Not Detected

E = Exceeds instrument calibration range.
J = Estimated value due to bias in the CCV.
Container Type: 1 Liter Tedlar Bag

Surrogates	%Recovery	Method Limits
Toluene-d8	103	70-130
1,2-Dichloroethane-d4	92	70-130
4-Bromofluorobenzene	96	70-130

Client Sample ID: Lab Blank

Lab ID#: 0911216A-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**t111207**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 11/12/09 12:38 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	0.50	Not Detected	2.5	Not Detected
Freon 114	0.50	Not Detected	3.5	Not Detected
Chloromethane	2.0	Not Detected	4.1	Not Detected
Vinyl Chloride	0.50	Not Detected	1.3	Not Detected
1,3-Butadiene	0.50	Not Detected	1.1	Not Detected
Bromomethane	0.50	Not Detected	1.9	Not Detected
Chloroethane	0.50	Not Detected	1.3	Not Detected
Freon 11	0.50	Not Detected	2.8	Not Detected
Ethanol	2.0	Not Detected	3.8	Not Detected
Freon 113	0.50	Not Detected	3.8	Not Detected
1,1-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Acetone	2.0	Not Detected	4.8	Not Detected
2-Propanol	2.0	Not Detected	4.9	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
3-Chloropropene	2.0	Not Detected	6.3	Not Detected
Methylene Chloride	0.50	Not Detected	1.7	Not Detected
Methyl tert-butyl ether	0.50	Not Detected	1.8	Not Detected
trans-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Hexane	0.50	Not Detected	1.8	Not Detected
1,1-Dichloroethane	0.50	Not Detected	2.0	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.50	Not Detected	1.5	Not Detected
cis-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.50	Not Detected	2.4	Not Detected
1,1,1-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Cyclohexane	0.50	Not Detected	1.7	Not Detected
Carbon Tetrachloride	0.50	Not Detected	3.1	Not Detected
2,2,4-Trimethylpentane	0.50	Not Detected	2.3	Not Detected
Benzene	0.50	Not Detected	1.6	Not Detected
1,2-Dichloroethane	0.50	Not Detected	2.0	Not Detected
Heptane	0.50	Not Detected	2.0	Not Detected
Trichloroethene	0.50	Not Detected	2.7	Not Detected
1,2-Dichloropropane	0.50	Not Detected	2.3	Not Detected
1,4-Dioxane	2.0	Not Detected	7.2	Not Detected
Bromodichloromethane	0.50	Not Detected	3.4	Not Detected
cis-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected
4-Methyl-2-pentanone	0.50	Not Detected	2.0	Not Detected
Toluene	0.50	Not Detected	1.9	Not Detected
trans-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected

Client Sample ID: Lab Blank

Lab ID#: 0911216A-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**t111207**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis:**	**11/12/09 12:38 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
1,1,2-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Tetrachloroethene	0.50	Not Detected	3.4	Not Detected
2-Hexanone	2.0	Not Detected	8.2	Not Detected
Dibromochloromethane	0.50	Not Detected	4.2	Not Detected
1,2-Dibromoethane (EDB)	0.50	Not Detected	3.8	Not Detected
Chlorobenzene	0.50	Not Detected	2.3	Not Detected
Ethyl Benzene	0.50	Not Detected	2.2	Not Detected
m,p-Xylene	0.50	Not Detected	2.2	Not Detected
o-Xylene	0.50	Not Detected	2.2	Not Detected
Styrene	0.50	Not Detected	2.1	Not Detected
Bromoform	0.50	Not Detected	5.2	Not Detected
Cumene	0.50	Not Detected	2.4	Not Detected
1,1,2,2-Tetrachloroethane	0.50	Not Detected	3.4	Not Detected
Propylbenzene	0.50	Not Detected	2.4	Not Detected
4-Ethyltoluene	0.50	Not Detected	2.4	Not Detected
1,3,5-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,2,4-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,3-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,4-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
alpha-Chlorotoluene	0.50	Not Detected	2.6	Not Detected
1,2-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,2,4-Trichlorobenzene	2.0	Not Detected	15	Not Detected
Hexachlorobutadiene	2.0	Not Detected	21	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	104	70-130
1,2-Dichloroethane-d4	93	70-130
4-Bromofluorobenzene	99	70-130

Client Sample ID: CCV

Lab ID#: 0911216A-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	t111202	**Date of Collection: NA**
Dil. Factor:	1.00	**Date of Analysis: 11/12/09 08:34 AM**

Compound	%Recovery
Freon 12	100
Freon 114	113
Chloromethane	110
Vinyl Chloride	111
1,3-Butadiene	116
Bromomethane	110
Chloroethane	108
Freon 11	105
Ethanol	115
Freon 113	106
1,1-Dichloroethene	117
Acetone	114
2-Propanol	115
Carbon Disulfide	121
3-Chloropropene	117
Methylene Chloride	103
Methyl tert-butyl ether	112
trans-1,2-Dichloroethene	113
Hexane	115
1,1-Dichloroethane	116
2-Butanone (Methyl Ethyl Ketone)	123
cis-1,2-Dichloroethene	115
Tetrahydrofuran	118
Chloroform	109
1,1,1-Trichloroethane	103
Cyclohexane	116
Carbon Tetrachloride	121
2,2,4-Trimethylpentane	119
Benzene	119
1,2-Dichloroethane	120
Heptane	129
Trichloroethene	122
1,2-Dichloropropane	126
1,4-Dioxane	123
Bromodichloromethane	122
cis-1,3-Dichloropropene	127
4-Methyl-2-pentanone	134 Q
Toluene	121
trans-1,3-Dichloropropene	128

Client Sample ID: CCV

Lab ID#: 0911216A-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	t111202	**Date of Collection: NA**
Dil. Factor:	1.00	**Date of Analysis: 11/12/09 08:34 AM**

Compound	%Recovery
1,1,2-Trichloroethane	118
Tetrachloroethene	119
2-Hexanone	125
Dibromochloromethane	124
1,2-Dibromoethane (EDB)	118
Chlorobenzene	118
Ethyl Benzene	123
m,p-Xylene	123
o-Xylene	121
Styrene	121
Bromoform	122
Cumene	115
1,1,2,2-Tetrachloroethane	122
Propylbenzene	119
4-Ethyltoluene	118
1,3,5-Trimethylbenzene	107
1,2,4-Trimethylbenzene	109
1,3-Dichlorobenzene	108
1,4-Dichlorobenzene	105
alpha-Chlorotoluene	118
1,2-Dichlorobenzene	112
1,2,4-Trichlorobenzene	84
Hexachlorobutadiene	92

Q = Exceeds Quality Control limits.

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	106	70-130
1,2-Dichloroethane-d4	93	70-130
4-Bromofluorobenzene	100	70-130

Client Sample ID: LCS

Lab ID#: 0911216A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**t111204**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 11/12/09 10:10 AM**

Compound	%Recovery
Freon 12	99
Freon 114	98
Chloromethane	109
Vinyl Chloride	111
1,3-Butadiene	109
Bromomethane	113
Chloroethane	112
Freon 11	102
Ethanol	65
Freon 113	117
1,1-Dichloroethene	128
Acetone	115
2-Propanol	122
Carbon Disulfide	113
3-Chloropropene	119
Methylene Chloride	101
Methyl tert-butyl ether	114
trans-1,2-Dichloroethene	115
Hexane	118
1,1-Dichloroethane	123
2-Butanone (Methyl Ethyl Ketone)	127
cis-1,2-Dichloroethene	118
Tetrahydrofuran	120
Chloroform	112
1,1,1-Trichloroethane	105
Cyclohexane	118
Carbon Tetrachloride	121
2,2,4-Trimethylpentane	121
Benzene	120
1,2-Dichloroethane	121
Heptane	130
Trichloroethene	120
1,2-Dichloropropane	124
1,4-Dioxane	120
Bromodichloromethane	122
cis-1,3-Dichloropropene	126
4-Methyl-2-pentanone	137
Toluene	126
trans-1,3-Dichloropropene	127

Client Sample ID: LCS

Lab ID#: 0911216A-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**t111204**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis:**	**11/12/09 10:10 AM**

Compound	%Recovery
1,1,2-Trichloroethane	117
Tetrachloroethene	119
2-Hexanone	127
Dibromochloromethane	122
1,2-Dibromoethane (EDB)	112
Chlorobenzene	115
Ethyl Benzene	120
m,p-Xylene	121
o-Xylene	120
Styrene	121
Bromoform	118
Cumene	109
1,1,2,2-Tetrachloroethane	112
Propylbenzene	115
4-Ethyltoluene	124
1,3,5-Trimethylbenzene	110
1,2,4-Trimethylbenzene	114
1,3-Dichlorobenzene	113
1,4-Dichlorobenzene	108
alpha-Chlorotoluene	123
1,2-Dichlorobenzene	113
1,2,4-Trichlorobenzene	134 Q
Hexachlorobutadiene	132 Q

Q = Exceeds Quality Control limits.

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	107	70-130
1,2-Dichloroethane-d4	94	70-130
4-Bromofluorobenzene	100	70-130

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CHAIN-OF-CUSTODY RECORD

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Page ____ of ____

Project Manager David Derenzo

Collected by: (Print and Sign) Alaina Gragan

Company Derenzo + Assoc. Email

Address 39395 Schoolcraft Rd City Livonia State MI Zip 48150

Phone (734) 216-4614 Fax

Project Info:

P.O. # 1221

Project # 0911005

Project Name Breezed Energy

Turn Around Time:

☐ Normal

☐ Rush

specify

Lab Use Only

Pressurized by:

Date:

Pressurization Gas:

N_2 He

Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum Initial	Canister Pressure/Vacuum Final	Canister Pressure/Vacuum Receipt	Canister Pressure/Vacuum Final (psi)
01A	BUD-1		11-10-09	15:00	ASTM D-5504				
					EPA-TO-15				

Relinquished by: (signature)	Date/Time	Received by: (signature)	Date/Time
	1530 / 11-10	Monica Green ATL	11/11/09 850

Notes:

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	Fed Ex		NA	Good	Yes No [✓ None]	0911216

Brevard Energy, LLC (May 3, 2010 Sample)

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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	233	H_2S	1	233	38.8 *
Carbonyl sulfide	0.38	CSO	1	0.38	0.06
Methyl mercaptan	6.90	CH_4S	1	6.90	1.15
Ethyl mercaptan	0.13	C_2H_6S	1	0.13	0.02
Dimethyl sulfide	10.3	C_2H_6S	1	10.3	1.71
Carbon disulfide	<0.05	CS_2	2	<0.10	<0.03
Isopropyl mercaptan	<0.57	C_3H_6S	1	<0.57	0.09
tert-Butyl mercaptan	<0.12	$C_4H_{10}S$	1	<0.12	0.02
n-Propyl mercaptan	<0.10	C_3H_8S	1	<0.10	<0.02
Ethyl methyl sulfide	<0.05	C_3H_8S	1	<0.05	<0.01
Thiophene	<0.58	C_4H_4S	1	<0.58	0.10
Isobutyl mercaptan	<0.10	$C_4H_{10}S$	1	<0.10	<0.02
Diethyl sulfide	<0.10	$CH_3CH_2SCH_2CH_3$	1	<0.10	<0.02
n-Butyl mercaptan	<0.05	$C_4H_{10}S$	1	<0.05	<0.01
3-Methyl Thiophene	<0.10	C_5H_6S	1	<0.10	<0.02
Dimethyl disulfide	<0.05	CH_3SSCH_3	2	<0.10	<0.03
Tetrahydrothiophene	<0.10	$C_4H_8O_2S$	1	<0.10	<0.02
2-Ethylthiophene	<0.10	C_6H_8S	1	<0.10	<0.02
2,5-Dimethylthiophene	<0.10	C_6H_8S	1	<0.10	<0.02 [C]
Diethyl disulfide	<0.05	CH_3SSCH_3	2	<0.10	<0.03
Total				**<253.4**	**<42.18**

Notes

A. May 4, 2010 LFG sample laboratory analytical results (see Attachment)

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

C. Calculation of SO_2 emission factor from sulfur content, as H_2S:

$$(253.4 \text{ scf } H_2S/\text{MMcf LFG})\ (1 \text{ scf } SO_2/\text{scf } H_2S)\ (64.06 \text{ lb.}SO_2/\text{mol}) / (385.3 \text{ ft}^3/\text{mol})$$
$$= 42.2 \text{ lb } SO_2/\text{MMcf LFG}$$

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

Brevard Energy, LLC (May 3, 2010 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_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	233	H_2S	1	233	38.8 *
Carbonyl sulfide	0.38	CSO	1	0.38	0.06
Methyl mercaptan	6.90	CH_4S	1	6.90	1.15
Ethyl mercaptan	0.13	C_2H_6S	1	0.13	0.02
Dimethyl sulfide	10.3	C_2H_6S	1	10.3	1.71
Isopropyl mercaptan	0.57	C_3H_6S	1	0.57	0.09
tert-Butyl mercaptan	0.12	$C_4H_{10}S$	1	0.12	0.02
Thiophene	0.58	C_4H_4S	1	0.58	0.10
Total				**252.3**	**41.94**

Notes

A. May 4, 2010 LFG sample laboratory analytical results (see Attachment)

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

* Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(233.3 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 38.79 lb SO_2/MMcf LFG

Brevard Energy, LLC (May 3, 2010 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Coumpounds	Analytical Report Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.430	CCl_2F_2	2	0.081 *
Freon 114 (Dichlorotetrafluroethane)	<0.180	$C_2Cl_2F_4$	2	<0.034
Chloromethane	<0.730	CH_3Cl	1	<0.069
Vinyl Chloride	<0.180	C_2HCl	1	<0.017
Chloroethane	<0.180	C_2H_5Cl	1	<0.017
Freon 11 (Fluorotrichloromethane)	<0.180	$CFCl_3$	3	<0.051
Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane)	<0.180	$C_2Cl_2F_3$	2	<0.034
1,1-dichloroethene	<0.180	$C_2H_2Cl_2$	2	<0.034
3-Chloropropene	<0.730	C_3H_5Cl	1	<0.069
Methylene Chloride (Dichloromethane)	<0.180	CH_2Cl_2	2	<0.034
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.450	$C_2H_2Cl_2$	2	0.085
1,2-Dichloroethene (as trans-1,2-Dichloroethene)	<0.180	$C_2H_2Cl_2$	2	<0.034
1,1-Dichloroethane	<0.180	$C_2H_4Cl_2$	2	<0.034
1,1-Dichloroethene	<0.180	$C_2H_2Cl_2$	2	<0.034
Chloroform	<0.180	$CHCl_3$	3	<0.051
1,1,1-Trichloroethane	<0.180	$C_2H_3Cl_3$	3	<0.051
Carbon Tetrachloride	<0.180	CCl_4	4	<0.068
1,2-Dichloroethane	0.190	$C_2H_4Cl_2$	2	0.036
Trichloroethene	1.600	C_2HCl_3	3	0.452
1,2-dichloropropane	<0.180	$C_3H_6Cl_2$	2	<0.034
Bromodichloromethane	<0.180	$CBrCl_2$	2	<0.034
1,3-Dichloropropene (as cis-1,3-Dichloropropene)	<0.180	$C_3H_4Cl_2$	2	<0.034
1,3-Dichloropropene (as trans-1,3-Dichloropropene)	<0.180	$C_3H_4Cl_2$	2	<0.034
1,1,2-Trichloroethane	<0.180	$C_2H_3Cl_3$	3	<0.051
Tetrachloroethene (Perchloroethene)	0.470	C_2Cl_4	4	0.177
Dibromochloromethane	<0.180	$CHBr_2Cl$	1	<0.017
Chlorobenzene	<0.180	C_6H_5Cl	1	<0.017
1,1,2,2-Tetrachloroethane	<0.180	$C_2H_2Cl_4$	4	<0.068
1,3-Dichlorobenzene	<0.180	$C_6H_4Cl_2$	2	<0.034
1,4-Dichlorobenzene	0.810	$C_6H_4Cl_2$	2	0.153
alpha-Chlorotoluene	<0.180	C_7H_7Cl	1	<0.017
1,2-Dichlorobenzene	<0.180	$C_6H_4Cl_2$	2	<0.034
1,2,4-Trichlorobenzene	<0.730	$C_6H_3Cl_3$	3	<0.206
Hexachlorobutadiene	<0.730	C_4Cl_6	6	<0.413
Total hydrogen chloride emission factor (lb./MMcf)				**<2.60**

Notes

1. May 16, 2010 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl

(0.430 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)

= 0.081 lb. HCl/MMcf LFG

Brevard Energy, LLC (May 3, 2010 Sample)

LFG Combustion Hydrogen Chloride Emission Factor

LFG Influent Chlorine Compounds	Measured Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
Freon 12 (Dichlorodifluoromethane)	0.430	CCl_2F_2	2	0.081 *
1,2-Dichloroethene (as cis-1,2-Dichloroethene)	0.450	$C_2H_2Cl_2$	2	0.085
1,2-Dichloroethane	0.190	$C_2H_4Cl_2$	2	0.036
Trichloroethene	1.600	C_2HCl_3	3	0.452
Tetrachloroethene (Perchloroethene)	0.470	C_2Cl_4	4	0.177
1,4-Dichlorobenzene	0.810	$C_6H_4Cl_2$	2	0.153
Total hydrogen chloride emission factor (lb./MMcf)				**0.98**

Notes

1. May 16, 2010 laboratory analytical results (see Attachment)

* Example calculation for Freon 12 that assumes complete conversion of chloride to HCl
(0.430 ft^3 Freon 12/MMcf LFG) (2 mol HCl/mol Freon 12) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.081 lb. HCl/MMcf LFG

Air Toxics LTD.
Laboratory Services Since 1989

5/26/2010
Mr. David Derenzo
Derenzo & Associates
39395 Schoolcraft Road

Livonia MI 48150

Project Name: Brevard Energy
Project #: 1001036
Workorder #: 1005308

Dear Mr. David Derenzo

The following report includes the data for the above referenced project for sample(s) received on 5/13/2010 at Air Toxics Ltd.

The data and associated QC analyzed by Modified TO-15 are compliant with the project requirements or laboratory criteria with the exception of the deviations noted in the attached case narrative.

Thank you for choosing Air Toxics Ltd. for your air analysis needs. Air Toxics Ltd. is committed to providing accurate data of the highest quality. Please feel free to contact the Project Manager: Jacquelyn Luta at 916-985-1000 if you have any questions regarding the data in this report.

Regards,

Jacquelyn Luta
Project Manager

180 BLUE RAVINE ROAD, SUITE B FOLSOM, CA - 95630
(916) 985-1000 .FAX (916) 985-1020
Hours 6:30 A.M to 5:30 PST

WORK ORDER #: 1005308

Work Order Summary

CLIENT:	Mr. David Derenzo Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150	**BILL TO:**	Ms. Donna Povich Derenzo & Associates 39395 Schoolcraft Road Livonia, MI 48150
PHONE:	734-464-3880	**P.O. #**	1268
FAX:	734-464-4368	**PROJECT #**	1001036 Brevard Energy
DATE RECEIVED:	05/13/2010	**CONTACT:**	Jacquelyn Luta
DATE COMPLETED:	05/26/2010		

FRACTION #	**NAME**	**TEST**	**RECEIPT VAC./PRES.**	**FINAL PRESSURE**
01A	BEH-1	Modified TO-15	3.0 "Hg	5 psi
02A	Lab Blank	Modified TO-15	NA	NA
03A	CCV	Modified TO-15	NA	NA
04A	LCS	Modified TO-15	NA	NA

CERTIFIED BY: Linda L. Freeman DATE: 05/26/10

Laboratory Director

Certfication numbers: CA NELAP - 02110CA, LA NELAP/LELAP- AI 30763,
NY NELAP - 11291, UT NELAP - 9166389892, AZ Licensure AZ0719
Name of Accrediting Agency: NELAP/Florida Department of Health, Scope of Application: Clean Air Act,
Accreditation number: E87680, Effective date: 07/01/09, Expiration date: 06/30/10
Air Toxics Ltd. certifies that the test results contained in this report meet all requirements of the NELAC standards

LABORATORY NARRATIVE
Modified TO-15
Derenzo & Associates
Workorder# 1005308

One 6 Liter Summa Canister sample was received on May 13, 2010. The laboratory performed analysis via modified EPA Method TO-15 using GC/MS in the full scan mode.

This workorder was independently validated prior to submittal using 'USEPA National Functional Guidelines' as generally applied to the analysis of volatile organic compounds in air. A rules-based, logic driven, independent validation engine was employed to assess completeness, evaluate pass/fail of relevant project quality control requirements and verification of all quantified amounts.

Method modifications taken to run these samples are summarized in the table below. Specific project requirements may over-ride the ATL modifications.

Requirement	*TO-15*	*ATL Modifications*
Daily CCV	</= 30% Difference	</= 30% Difference; Compounds exceeding this criterion and associated data are flagged and narrated.
Sample collection media	Summa canister	ATL recommends use of summa canisters to insure data defensibility, but will report results from Tedlar bags at client request
Method Detection Limit	Follow 40CFR Pt.136 App. B	The MDL met all relevant requirements in Method TO-15 (statistical MDL less than the LOQ). The concentration of the spiked replicate may have exceeded 10X the calculated MDL in some cases

Receiving Notes

There were no receiving discrepancies.

Analytical Notes

The canister in this work order was pressurized with Helium prior to sampling, per client request. Dilution factors have been adjusted accordingly.

Definition of Data Qualifying Flags

Eight qualifiers may have been used on the data analysis sheets and indicates as follows:

B - Compound present in laboratory blank greater than reporting limit (background subtraction not performed).
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 reporting limit.
UJ- Non-detected compound associated with low bias in the CCV
N - The identification is based on presumptive evidence.

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
MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

Client Sample ID: BEH-1

Lab ID#: 1005308-01A

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	180	430	900	2100
Ethanol	730	110000 E	1400	200000 E
Acetone	730	22000	1700	52000
2-Propanol	730	23000	1800	56000
Hexane	180	340	640	1200
2-Butanone (Methyl Ethyl Ketone)	180	22000	540	66000
cis-1,2-Dichloroethene	180	450	720	1800
Tetrahydrofuran	180	4900	540	14000
Cyclohexane	180	450	630	1600
2,2,4-Trimethylpentane	180	240	850	1100
Benzene	180	1600	580	5000
1,2-Dichloroethane	180	190	740	780
Heptane	180	840	750	3400
Trichloroethene	180	1600	980	8800
4-Methyl-2-pentanone	180	1500	750	6200
Toluene	180	16000	690	61000
Tetrachloroethene	180	470	1200	3200
Ethyl Benzene	180	8000	790	35000
m,p-Xylene	180	13000	790	55000
o-Xylene	180	3800	790	16000
Styrene	180	1300	780	5400
Propylbenzene	180	670	900	3300
4-Ethyltoluene	180	2500	900	12000
1,3,5-Trimethylbenzene	180	960	900	4700
1,2,4-Trimethylbenzene	180	2700	900	13000
1,4-Dichlorobenzene	180	810	1100	4900

Client Sample ID: BEH-1

Lab ID#: 1005308-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**x051618**	**Date of Collection:**	**5/3/10 3:55:00 PM**
Dil. Factor:	**366**	**Date of Analysis:**	**5/16/10 07:51 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
Freon 12	180	430	900	2100
Freon 114	180	Not Detected	1300	Not Detected
Chloromethane	730	Not Detected	1500	Not Detected
Vinyl Chloride	180	Not Detected	470	Not Detected
1,3-Butadiene	180	Not Detected	400	Not Detected
Bromomethane	180	Not Detected	710	Not Detected
Chloroethane	180	Not Detected	480	Not Detected
Freon 11	180	Not Detected	1000	Not Detected
Ethanol	730	110000 E	1400	200000 E
Freon 113	180	Not Detected	1400	Not Detected
1,1-Dichloroethene	180	Not Detected	720	Not Detected
Acetone	730	22000	1700	52000
2-Propanol	730	23000	1800	56000
Carbon Disulfide	180	Not Detected	570	Not Detected
3-Chloropropene	730	Not Detected	2300	Not Detected
Methylene Chloride	180	Not Detected	640	Not Detected
Methyl tert-butyl ether	180	Not Detected	660	Not Detected
trans-1,2-Dichloroethene	180	Not Detected	720	Not Detected
Hexane	180	340	640	1200
1,1-Dichloroethane	180	Not Detected	740	Not Detected
2-Butanone (Methyl Ethyl Ketone)	180	22000	540	66000
cis-1,2-Dichloroethene	180	450	720	1800
Tetrahydrofuran	180	4900	540	14000
Chloroform	180	Not Detected	890	Not Detected
1,1,1-Trichloroethane	180	Not Detected	1000	Not Detected
Cyclohexane	180	450	630	1600
Carbon Tetrachloride	180	Not Detected	1200	Not Detected
2,2,4-Trimethylpentane	180	240	850	1100
Benzene	180	1600	580	5000
1,2-Dichloroethane	180	190	740	780
Heptane	180	840	750	3400
Trichloroethene	180	1600	980	8800
1,2-Dichloropropane	180	Not Detected	840	Not Detected
1,4-Dioxane	730	Not Detected	2600	Not Detected
Bromodichloromethane	180	Not Detected	1200	Not Detected
cis-1,3-Dichloropropene	180	Not Detected	830	Not Detected
4-Methyl-2-pentanone	180	1500	750	6200
Toluene	180	16000	690	61000
trans-1,3-Dichloropropene	180	Not Detected	830	Not Detected

Client Sample ID: BEH-1

Lab ID#: 1005308-01A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**x051618**	**Date of Collection:**	**5/3/10 3:55:00 PM**
Dil. Factor:	**366**	**Date of Analysis:**	**5/16/10 07:51 PM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
1,1,2-Trichloroethane	180	Not Detected	1000	Not Detected
Tetrachloroethene	180	470	1200	3200
2-Hexanone	730	Not Detected	3000	Not Detected
Dibromochloromethane	180	Not Detected	1600	Not Detected
1,2-Dibromoethane (EDB)	180	Not Detected	1400	Not Detected
Chlorobenzene	180	Not Detected	840	Not Detected
Ethyl Benzene	180	8000	790	35000
m,p-Xylene	180	13000	790	55000
o-Xylene	180	3800	790	16000
Styrene	180	1300	780	5400
Bromoform	180	Not Detected	1900	Not Detected
Cumene	180	Not Detected	900	Not Detected
1,1,2,2-Tetrachloroethane	180	Not Detected	1200	Not Detected
Propylbenzene	180	670	900	3300
4-Ethyltoluene	180	2500	900	12000
1,3,5-Trimethylbenzene	180	960	900	4700
1,2,4-Trimethylbenzene	180	2700	900	13000
1,3-Dichlorobenzene	180	Not Detected	1100	Not Detected
1,4-Dichlorobenzene	180	810	1100	4900
alpha-Chlorotoluene	180	Not Detected	950	Not Detected
1,2-Dichlorobenzene	180	Not Detected	1100	Not Detected
1,2,4-Trichlorobenzene	730	Not Detected	5400	Not Detected
Hexachlorobutadiene	730	Not Detected	7800	Not Detected

E = Exceeds instrument calibration range.

Container Type: 6 Liter Summa Canister

Surrogates	%Recovery	Method Limits
Toluene-d8	101	70-130
1,2-Dichloroethane-d4	87	70-130
4-Bromofluorobenzene	119	70-130

Client Sample ID: Lab Blank

Lab ID#: 1005308-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**x051604**	**Date of Collection: NA**	
Dil. Factor:	**1.00**	**Date of Analysis:**	**5/16/10 10:19 AM**

Compound	**Rpt. Limit (ppbv)**	**Amount (ppbv)**	**Rpt. Limit (ug/m3)**	**Amount (ug/m3)**
Freon 12	0.50	Not Detected	2.5	Not Detected
Freon 114	0.50	Not Detected	3.5	Not Detected
Chloromethane	2.0	Not Detected	4.1	Not Detected
Vinyl Chloride	0.50	Not Detected	1.3	Not Detected
1,3-Butadiene	0.50	Not Detected	1.1	Not Detected
Bromomethane	0.50	Not Detected	1.9	Not Detected
Chloroethane	0.50	Not Detected	1.3	Not Detected
Freon 11	0.50	Not Detected	2.8	Not Detected
Ethanol	2.0	Not Detected	3.8	Not Detected
Freon 113	0.50	Not Detected	3.8	Not Detected
1,1-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Acetone	2.0	Not Detected	4.8	Not Detected
2-Propanol	2.0	Not Detected	4.9	Not Detected
Carbon Disulfide	0.50	Not Detected	1.6	Not Detected
3-Chloropropene	2.0	Not Detected	6.3	Not Detected
Methylene Chloride	0.50	Not Detected	1.7	Not Detected
Methyl tert-butyl ether	0.50	Not Detected	1.8	Not Detected
trans-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Hexane	0.50	Not Detected	1.8	Not Detected
1,1-Dichloroethane	0.50	Not Detected	2.0	Not Detected
2-Butanone (Methyl Ethyl Ketone)	0.50	Not Detected	1.5	Not Detected
cis-1,2-Dichloroethene	0.50	Not Detected	2.0	Not Detected
Tetrahydrofuran	0.50	Not Detected	1.5	Not Detected
Chloroform	0.50	Not Detected	2.4	Not Detected
1,1,1-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Cyclohexane	0.50	Not Detected	1.7	Not Detected
Carbon Tetrachloride	0.50	Not Detected	3.1	Not Detected
2,2,4-Trimethylpentane	0.50	Not Detected	2.3	Not Detected
Benzene	0.50	Not Detected	1.6	Not Detected
1,2-Dichloroethane	0.50	Not Detected	2.0	Not Detected
Heptane	0.50	Not Detected	2.0	Not Detected
Trichloroethene	0.50	Not Detected	2.7	Not Detected
1,2-Dichloropropane	0.50	Not Detected	2.3	Not Detected
1,4-Dioxane	2.0	Not Detected	7.2	Not Detected
Bromodichloromethane	0.50	Not Detected	3.4	Not Detected
cis-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected
4-Methyl-2-pentanone	0.50	Not Detected	2.0	Not Detected
Toluene	0.50	Not Detected	1.9	Not Detected
trans-1,3-Dichloropropene	0.50	Not Detected	2.3	Not Detected

Client Sample ID: Lab Blank

Lab ID#: 1005308-02A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**x051604**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 5/16/10 10:19 AM**

Compound	Rpt. Limit (ppbv)	Amount (ppbv)	Rpt. Limit (ug/m3)	Amount (ug/m3)
1,1,2-Trichloroethane	0.50	Not Detected	2.7	Not Detected
Tetrachloroethene	0.50	Not Detected	3.4	Not Detected
2-Hexanone	2.0	Not Detected	8.2	Not Detected
Dibromochloromethane	0.50	Not Detected	4.2	Not Detected
1,2-Dibromoethane (EDB)	0.50	Not Detected	3.8	Not Detected
Chlorobenzene	0.50	Not Detected	2.3	Not Detected
Ethyl Benzene	0.50	Not Detected	2.2	Not Detected
m,p-Xylene	0.50	Not Detected	2.2	Not Detected
o-Xylene	0.50	Not Detected	2.2	Not Detected
Styrene	0.50	Not Detected	2.1	Not Detected
Bromoform	0.50	Not Detected	5.2	Not Detected
Cumene	0.50	Not Detected	2.4	Not Detected
1,1,2,2-Tetrachloroethane	0.50	Not Detected	3.4	Not Detected
Propylbenzene	0.50	Not Detected	2.4	Not Detected
4-Ethyltoluene	0.50	Not Detected	2.4	Not Detected
1,3,5-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,2,4-Trimethylbenzene	0.50	Not Detected	2.4	Not Detected
1,3-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,4-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
alpha-Chlorotoluene	0.50	Not Detected	2.6	Not Detected
1,2-Dichlorobenzene	0.50	Not Detected	3.0	Not Detected
1,2,4-Trichlorobenzene	2.0	Not Detected	15	Not Detected
Hexachlorobutadiene	2.0	Not Detected	21	Not Detected

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	96	70-130
1,2-Dichloroethane-d4	94	70-130
4-Bromofluorobenzene	100	70-130

Client Sample ID: CCV

Lab ID#: 1005308-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	x051602	**Date of Collection: NA**
Dil. Factor:	1.00	**Date of Analysis: 5/16/10 09:04 AM**

Compound	%Recovery
Freon 12	92
Freon 114	94
Chloromethane	91
Vinyl Chloride	93
1,3-Butadiene	98
Bromomethane	95
Chloroethane	87
Freon 11	92
Ethanol	96
Freon 113	96
1,1-Dichloroethene	94
Acetone	92
2-Propanol	93
Carbon Disulfide	94
3-Chloropropene	93
Methylene Chloride	88
Methyl tert-butyl ether	94
trans-1,2-Dichloroethene	92
Hexane	89
1,1-Dichloroethane	89
2-Butanone (Methyl Ethyl Ketone)	96
cis-1,2-Dichloroethene	92
Tetrahydrofuran	90
Chloroform	88
1,1,1-Trichloroethane	91
Cyclohexane	93
Carbon Tetrachloride	94
2,2,4-Trimethylpentane	94
Benzene	90
1,2-Dichloroethane	87
Heptane	95
Trichloroethene	93
1,2-Dichloropropane	93
1,4-Dioxane	96
Bromodichloromethane	97
cis-1,3-Dichloropropene	99
4-Methyl-2-pentanone	104
Toluene	95
trans-1,3-Dichloropropene	87

Client Sample ID: CCV

Lab ID#: 1005308-03A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**x051602**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 5/16/10 09:04 AM**

Compound	%Recovery
1,1,2-Trichloroethane	84
Tetrachloroethene	88
2-Hexanone	90
Dibromochloromethane	96
1,2-Dibromoethane (EDB)	93
Chlorobenzene	90
Ethyl Benzene	96
m,p-Xylene	99
o-Xylene	99
Styrene	107
Bromoform	108
Cumene	101
1,1,2,2-Tetrachloroethane	94
Propylbenzene	97
4-Ethyltoluene	101
1,3,5-Trimethylbenzene	98
1,2,4-Trimethylbenzene	100
1,3-Dichlorobenzene	95
1,4-Dichlorobenzene	99
alpha-Chlorotoluene	105
1,2-Dichlorobenzene	95
1,2,4-Trichlorobenzene	90
Hexachlorobutadiene	96

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	103	70-130
1,2-Dichloroethane-d4	96	70-130
4-Bromofluorobenzene	115	70-130

Client Sample ID: LCS

Lab ID#: 1005308-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	x051603	**Date of Collection:**	**NA**
Dil. Factor:	1.00	**Date of Analysis:**	**5/16/10 09:40 AM**

Compound	%Recovery
Freon 12	93
Freon 114	97
Chloromethane	94
Vinyl Chloride	94
1,3-Butadiene	100
Bromomethane	97
Chloroethane	90
Freon 11	94
Ethanol	92
Freon 113	87
1,1-Dichloroethene	86
Acetone	91
2-Propanol	91
Carbon Disulfide	93
3-Chloropropene	92
Methylene Chloride	82
Methyl tert-butyl ether	96
trans-1,2-Dichloroethene	93
Hexane	92
1,1-Dichloroethane	89
2-Butanone (Methyl Ethyl Ketone)	99
cis-1,2-Dichloroethene	93
Tetrahydrofuran	93
Chloroform	88
1,1,1-Trichloroethane	92
Cyclohexane	96
Carbon Tetrachloride	97
2,2,4-Trimethylpentane	97
Benzene	89
1,2-Dichloroethane	87
Heptane	95
Trichloroethene	94
1,2-Dichloropropane	95
1,4-Dioxane	95
Bromodichloromethane	97
cis-1,3-Dichloropropene	101
4-Methyl-2-pentanone	103
Toluene	91
trans-1,3-Dichloropropene	89

Client Sample ID: LCS

Lab ID#: 1005308-04A

MODIFIED EPA METHOD TO-15 GC/MS FULL SCAN

File Name:	**x051603**	**Date of Collection: NA**
Dil. Factor:	**1.00**	**Date of Analysis: 5/16/10 09:40 AM**

Compound	%Recovery
1,1,2-Trichloroethane	86
Tetrachloroethene	89
2-Hexanone	91
Dibromochloromethane	97
1,2-Dibromoethane (EDB)	97
Chlorobenzene	92
Ethyl Benzene	98
m,p-Xylene	103
o-Xylene	102
Styrene	110
Bromoform	110
Cumene	103
1,1,2,2-Tetrachloroethane	100
Propylbenzene	100
4-Ethyltoluene	107
1,3,5-Trimethylbenzene	103
1,2,4-Trimethylbenzene	106
1,3-Dichlorobenzene	100
1,4-Dichlorobenzene	105
alpha-Chlorotoluene	109
1,2-Dichlorobenzene	101
1,2,4-Trichlorobenzene	89
Hexachlorobutadiene	97

Container Type: NA - Not Applicable

Surrogates	%Recovery	Method Limits
Toluene-d8	102	70-130
1,2-Dichloroethane-d4	97	70-130
4-Bromofluorobenzene	118	70-130

Columbia Analytical Services™ 2655 Park Center Drive, Suite A | Simi Valley, CA 93065 | 805 526 7161 | 805 526 7270 fax | www.caslab.com

LABORATORY REPORT

May 18, 2010

Charles Scamp
Derenzo and Associates, Inc.
39395 Schoolcraft Rd
Livonia, MI 48150

RE: Brevard Energy / 1001036

Dear Charles:

Enclosed are the results of the samples submitted to our laboratory on May 4, 2010. For your reference, these analyses have been assigned our service request number P1001545.

All analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.caslab.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein. Your report contains 12 pages.

Columbia Analytical Services, Inc. is certified by the California Department of Health Services, NELAP Laboratory Certificate No. 02115CA; Arizona Department of Health Services, Certificate No. AZ0694; Florida Department of Health, NELAP Certification E871020; New Jersey Department of Environmental Protection, NELAP Laboratory Certification ID #CA009; New York State Department of Health, NELAP NY Lab ID No: 11221; Oregon Environmental Laboratory Accreditation Program, NELAP ID: CA20007; The American Industrial Hygiene Association, Laboratory #101661; United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP), Certificate No. L10-3; Pennsylvania Registration No. 68-03307; TX Commission of Environmental Quality, NELAP ID T104704413-09-TX; Minnesota Department of Health, Certificate No. 11495AA. Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact me for information corresponding to a particular certification.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

Columbia Analytical Services, Inc.

Sue Anderson

Sue Anderson
Project Manager

Client:	Derenzo and Associates, Inc.	CAS Project No:	P1001545
Project:	Brevard Energy / 1001036		

CASE NARRATIVE

The samples were received intact under chain of custody on May 4, 2010 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

BTU and CHONS Analysis

The results for BTU and CHONS were generated according to ASTM D 3588-98. The following analyses were performed and used to calculate the BTU and CHONS results.

C2 through C6 Hydrocarbon Analysis

The samples were analyzed according to modified EPA Method TO-3 for C2 through >C6 hydrocarbons using a gas chromatograph equipped with a flame ionization detector (FID).

Fixed Gases Analysis

The samples were also analyzed for fixed gases (hydrogen, oxygen/argon, nitrogen, carbon monoxide, methane and carbon dioxide) according to modified EPA Method 3C (single injection) using a gas chromatograph equipped with a thermal conductivity detector (TCD).

Hydrogen Sulfide Analysis

The samples were also analyzed for hydrogen sulfide per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD).

Sulfur Analysis

The samples were also analyzed for twenty sulfur compounds per ASTM D 5504-08 using a gas chromatograph equipped with a sulfur chemiluminescence detector (SCD). All compounds with the exception of hydrogen sulfide and carbonyl sulfide are quantitated against the initial calibration curve for methyl mercaptan.

The results of analyses are given in the attached laboratory report. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for utilization of less than the complete report.

Client: Derenzo and Associates, Inc.
Project: Brevard Energy/1001036

Service Request: P1001545

SAMPLE CROSS-REFERENCE

SAMPLE #	CLIENT SAMPLE ID	DATE	TIME
P1001545-001	BE-1	5/3/10	16:40
P1001545-002	BE-2	5/3/10	16:50
P1001545-003	BE-3	5/3/10	17:00

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Sample Receiving **Air - Chain of Custody Record & Analytical Service Request**

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Columbia Analytical Services INC
An Employee - Owned Company

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No. P1001545

CAS Contact

Company Name & Address (Reporting Information)
Derenzo and Associates
39395 Schoolcraft Rd
Livonia, MI 48150

Project Name: Brevard Energy

Project Number: 1001036

Project Manager: Charles Scamp

Phone: 734-464-3880

Fax: 734-464-4368

P.O. # / Billing Information: 1265

Email Address for Result Reporting: cscamp@derenzo.com

Sampler (Print & Sign): M. Brack M/B

Analysis Method and/or Analytes

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume	D5504	D3588-98			Comments e.g. Actual Preservative or specific instructions
BE-1		5/3/10	1640	Tedlar				X	X			
BE-2		↓	1650	↓				X	X			
BE-3		↓	1700	↓				X	X			

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier II - (Results + QC) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier V - (client specified) ____

EDD required Yes / No
Type: ____________
EDD Units: ____________

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature) M/B	Date: 5/3/10	Time: 1710	Received by: (Signature)	Date: 05/04/10	Time: 0735
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank

Columbia Analytical Services, Inc.
Sample Acceptance Check Form

Client: Derenzo and Associates, Inc. Work order: P1001545
Project: Brevard Energy / 1001036
Sample(s) received on: 5/4/2010 Date opened: 5/4/2010 by: SSTAPLES

Note: This form is used for all samples received by CAS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Container(s) **supplied by CAS**?	☐	☒	☐
3	Did **sample containers** arrive in good condition?	☒	☐	☐
4	Was a **chain-of-custody** provided?	☒	☐	☐
5	Was the **chain-of-custody** properly completed?	☒	☐	☐
6	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
7	Was **sample volume** received adequate for analysis?	☒	☐	☐
8	Are samples within specified holding times?	☒	☐	☐
9	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☐	☐	☒
	Cooler Temperature ______ °C Blank Temperature ______ °C			
10	Was a **trip blank** received?	☐	☒	☐
	Trip blank supplied by CAS: ______			
11	Were **custody seals** on outside of cooler/Box?	☐	☒	☐
	Location of seal(s)? ______ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
	Were custody seals on outside of sample container?	☐	☒	☐
	Location of seal(s)? ______ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
12	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☐	☐	☒
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☐	☒
	Were VOA vials checked for presence/absence of air bubbles?	☐	☐	☒
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
13	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
	Do they contain moisture?	☐	☐	☒
14	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1001545-001.01	1.0 L Tedlar Bag					
P1001545-002.01	1.0 L Tedlar Bag					
P1001545-003.01	1.0 L Tedlar Bag					

Explain any discrepancies: (include lab sample ID numbers): ______

*Required pH: Phenols/COD/NH3/TOC/TOX/NO3+NO2/TKN/T.PHOS, H2SO4 (pH<2); Metals, HNO3 (pH<2); CN (NaOH or NaOH/Asc Acid) (pH>12);
Diss. Sulfide, NaOH (pH>12); T. Sulfide, NaOH/ZnAc (pH>12) RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS
Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **BE-1**
Client Project ID: **Brevard Energy / 1001036**

CAS Project ID: P1001545
CAS Sample ID: P1001545-001

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton
Sampling Media: 1.0 L Tedlar Bag
Test Notes:

Date Collected: 5/3/10
Date Received: 5/4/10

Components	**Result Volume %**	**Result Weight %**	Data Qualifier
Hydrogen	0.12	< 0.01	
Oxygen + Argon	1.66	1.88	
Nitrogen	8.50	8.42	
Carbon Monoxide	< 0.01	< 0.01	
Methane	50.71	28.78	
Carbon Dioxide	38.90	60.56	
Hydrogen Sulfide	0.02	0.03	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	0.01	
Hexanes	< 0.01	0.01	
> Hexanes	0.07	0.29	
TOTALS	99.99	99.99	

Components	**Mole %**	**Weight %**
Carbon	22.96	38.33
Hydrogen	52.07	7.30
Oxygen + Argon	20.65	45.92
Nitrogen	4.32	8.42
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9759
Specific Volume	ft3/lb	13.43
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	519.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	467.6
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	508.6
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	458.1
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,970.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,277.4
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9971

Verified By:________________ Date: 5/7/10

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **BE-2**
Client Project ID: **Brevard Energy / 1001036**

CAS Project ID: P1001545
CAS Sample ID: P1001545-002

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton
Sampling Media: 1.0 L Tedlar Bag
Test Notes:

Date Collected: 5/3/10
Date Received: 5/4/10

Components	**Result Volume %**	**Result Weight %**	Data Qualifier
Hydrogen	0.12	< 0.01	
Oxygen + Argon	1.42	1.61	
Nitrogen	7.67	7.61	
Carbon Monoxide	< 0.01	< 0.01	
Methane	51.48	29.27	
Carbon Dioxide	39.18	61.13	
Hydrogen Sulfide	0.02	0.03	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	0.01	
Hexanes	< 0.01	0.01	
> Hexanes	0.07	0.29	
TOTALS	99.99	99.99	

Components	**Mole %**	**Weight %**
Carbon	23.07	38.87
Hydrogen	52.51	7.42
Oxygen + Argon	20.53	46.07
Nitrogen	3.88	7.62
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		0.9740
Specific Volume	ft3/lb	13.45
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	527.2
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	474.8
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	516.4
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	465.1
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	7,091.5
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	6,386.7
Compressibility Factor "Z" (60 F, 14.696 psia)		0.9970

Verified By: ______ Date: 5/7/10

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS
Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **BE-3**
Client Project ID: **Brevard Energy / 1001036**

CAS Project ID: P1001545
CAS Sample ID: P1001545-003

Test Code: ASTM D3588-98
Analyst: Zheng Wang/Wade Henton
Sampling Media: 1.0 L Tedlar Bag
Test Notes:

Date Collected: 5/3/10
Date Received: 5/4/10

Components	**Result Volume %**	**Result Weight %**	Data Qualifier
Hydrogen	**0.12**	< 0.01	
Oxygen + Argon	**1.61**	**1.82**	
Nitrogen	**8.29**	**8.22**	
Carbon Monoxide	< 0.01	< 0.01	
Methane	**51.00**	**28.99**	
Carbon Dioxide	**38.87**	**60.61**	
Hydrogen Sulfide	**0.03**	**0.03**	
Ethane	< 0.01	< 0.01	
Propane	< 0.01	< 0.01	
Butanes	< 0.01	< 0.01	
Pentanes	< 0.01	**0.01**	
Hexanes	< 0.01	**0.01**	
> Hexanes	**0.07**	**0.28**	
TOTALS	**99.99**	**99.99**	

Components	**Mole %**	**Weight %**
Carbon	**22.97**	**38.50**
Hydrogen	**52.25**	**7.35**
Oxygen + Argon	**20.56**	**45.90**
Nitrogen	**4.21**	**8.23**
Sulfur	< 0.10	< 0.10

Specific Gravity (Air = 1)		**0.9745**
Specific Volume	ft3/lb	**13.45**
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	**522.0**
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/ft3	**470.1**
Gross Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	**511.4**
Net Heating Value (Water Saturated at 0.25636 psia)	BTU/ft3	**460.6**
Gross Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	**7,018.5**
Net Heating Value (Dry Gas @ 60 F, 14.696 psia)	BTU/lb	**6,320.9**
Compressibility Factor "Z" (60 F, 14.696 psia)		**0.9971**

Verified By: ______________ Date: 5/17/10

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **BE-1**
Client Project ID: **Brevard Energy / 1001036**

CAS Project ID: P1001545
CAS Sample ID: P1001545-001

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Zheng Wang
Sampling Media: 1.0 L Tedlar Bag
Test Notes:

Date Collected: 5/3/10
Time Collected: 16:40
Date Received: 5/4/10
Date Analyzed: 5/4/10
Time Analyzed: 10:28
Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	**Hydrogen Sulfide**	**310,000**	140	**220,000**	100	
463-58-1	**Carbonyl Sulfide**	**880**	250	**360**	100	
74-93-1	**Methyl Mercaptan**	**13,000**	200	**6,600**	100	
75-08-1	**Ethyl Mercaptan**	**310**	250	**120**	100	
75-18-3	**Dimethyl Sulfide**	**25,000**	250	**10,000**	100	
75-15-0	Carbon Disulfide	ND	160	ND	50	
75-33-2	**Isopropyl Mercaptan**	**1,700**	310	**540**	100	
75-66-1	**tert-Butyl Mercaptan**	**520**	370	**140**	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	**Thiophene**	**1,900**	340	**550**	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: ____________ Date: 5/7/10

RESULTS OF ANALYSIS

Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**BE-2**	CAS Project ID:	P1001545
Client Project ID:	**Brevard Energy / 1001036**	CAS Sample ID:	P1001545-002

Test Code:	ASTM D 5504-08	Date Collected:	5/3/10
Instrument ID:	Agilent 7890A/GC22/SCD	Time Collected:	16:50
Analyst:	Zheng Wang	Date Received:	5/4/10
Sampling Media:	1.0 L Tedlar Bag	Date Analyzed:	5/4/10
Test Notes:		Time Analyzed:	10:48
		Volume(s) Analyzed:	0.050 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	**Hydrogen Sulfide**	**320,000**	140	**230,000**	100	
463-58-1	**Carbonyl Sulfide**	**910**	250	**370**	100	
74-93-1	**Methyl Mercaptan**	**13,000**	200	**6,700**	100	
75-08-1	**Ethyl Mercaptan**	**320**	250	**120**	100	
75-18-3	**Dimethyl Sulfide**	**26,000**	250	**10,000**	100	
75-15-0	Carbon Disulfide	ND	160	ND	50	
75-33-2	**Isopropyl Mercaptan**	**1,700**	310	**560**	100	
75-66-1	tert-Butyl Mercaptan	ND	370	ND	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	**Thiophene**	**2,000**	340	**580**	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: ____________ Date: 5/7/10

COLUMBIA ANALYTICAL SERVICES, INC.

RESULTS OF ANALYSIS

Page 1 of 1

Client: **Derenzo and Associates, Inc.**
Client Sample ID: **BE-3**
Client Project ID: **Brevard Energy / 1001036**

CAS Project ID: P1001545
CAS Sample ID: P1001545-003

Test Code: ASTM D 5504-08
Instrument ID: Agilent 7890A/GC22/SCD
Analyst: Zheng Wang
Sampling Media: 1.0 L Tedlar Bag
Test Notes:

Date Collected: 5/3/10
Time Collected: 17:00
Date Received: 5/4/10
Date Analyzed: 5/4/10
Time Analyzed: 11:10
Volume(s) Analyzed: 0.050 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	**Hydrogen Sulfide**	**350,000**	140	**250,000**	100	
463-58-1	**Carbonyl Sulfide**	**1,000**	250	**420**	100	
74-93-1	**Methyl Mercaptan**	**15,000**	200	**7,500**	100	
75-08-1	**Ethyl Mercaptan**	**380**	250	**150**	100	
75-18-3	**Dimethyl Sulfide**	**29,000**	250	**11,000**	100	
75-15-0	Carbon Disulfide	ND	160	ND	50	
75-33-2	**Isopropyl Mercaptan**	**1,900**	310	**600**	100	
75-66-1	**tert-Butyl Mercaptan**	**420**	370	**110**	100	
107-03-9	n-Propyl Mercaptan	ND	310	ND	100	
624-89-5	Ethyl Methyl Sulfide	ND	310	ND	100	
110-02-1	**Thiophene**	**2,100**	340	**620**	100	
513-44-0	Isobutyl Mercaptan	ND	370	ND	100	
352-93-2	Diethyl Sulfide	ND	370	ND	100	
109-79-5	n-Butyl Mercaptan	ND	370	ND	100	
624-92-0	Dimethyl Disulfide	ND	190	ND	50	
616-44-4	3-Methylthiophene	ND	400	ND	100	
110-01-0	Tetrahydrothiophene	ND	360	ND	100	
638-02-8	2,5-Dimethylthiophene	ND	460	ND	100	
872-55-9	2-Ethylthiophene	ND	460	ND	100	
110-81-6	Diethyl Disulfide	ND	250	ND	50	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.

MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By:________ Date: 5/7/10

RESULTS OF ANALYSIS
Page 1 of 1

Client:	**Derenzo and Associates, Inc.**		
Client Sample ID:	**Method Blank**	CAS Project ID:	P1001545
Client Project ID:	**Brevard Energy / 1001036**	CAS Sample ID:	P100504-MB

Test Code:	ASTM D 5504-08	Date Collected:	NA
Instrument ID:	Agilent 7890A/GC22/SCD	Time Collected:	NA
Analyst:	Zheng Wang	Date Received:	NA
Sampling Media:	1.0 L Tedlar Bag	Date Analyzed:	5/04/10
Test Notes:		Time Analyzed:	09:05
		Volume(s) Analyzed:	1.0 ml(s)

CAS #	Compound	Result µg/m³	MRL µg/m³	Result ppbV	MRL ppbV	Data Qualifier
7783-06-4	Hydrogen Sulfide	ND	7.0	ND	5.0	
463-58-1	Carbonyl Sulfide	ND	12	ND	5.0	
74-93-1	Methyl Mercaptan	ND	9.8	ND	5.0	
75-08-1	Ethyl Mercaptan	ND	13	ND	5.0	
75-18-3	Dimethyl Sulfide	ND	13	ND	5.0	
75-15-0	Carbon Disulfide	ND	7.8	ND	2.5	
75-33-2	Isopropyl Mercaptan	ND	16	ND	5.0	
75-66-1	tert-Butyl Mercaptan	ND	18	ND	5.0	
107-03-9	n-Propyl Mercaptan	ND	16	ND	5.0	
624-89-5	Ethyl Methyl Sulfide	ND	16	ND	5.0	
110-02-1	Thiophene	ND	17	ND	5.0	
513-44-0	Isobutyl Mercaptan	ND	18	ND	5.0	
352-93-2	Diethyl Sulfide	ND	18	ND	5.0	
109-79-5	n-Butyl Mercaptan	ND	18	ND	5.0	
624-92-0	Dimethyl Disulfide	ND	9.6	ND	2.5	
616-44-4	3-Methylthiophene	ND	20	ND	5.0	
110-01-0	Tetrahydrothiophene	ND	18	ND	5.0	
638-02-8	2,5-Dimethylthiophene	ND	23	ND	5.0	
872-55-9	2-Ethylthiophene	ND	23	ND	5.0	
110-81-6	Diethyl Disulfide	ND	12	ND	2.5	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

Verified By: Date: 5/17/10

@Air Toxics LTD.

CHAIN-OF-CUSTODY RECORD

Sample Transportation Notice

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Page 2 of 3

Project Manager MICHAEL Brack

Collected by: (Print and Sign) T. Sitarski

Company Derenzo & Assoc. Email MBRACK@Derenzo.Com

Address 39395 Schoolcraft City Livonia State Mi Zip 48150

Phone 734-464-3880 Fax 734-464-4368

Project Info:

P.O. # 1268

Project # 1001036

Project Name Brevard Energy

Turn Around Time:

☒ Normal

☐ Rush

specify

Lab Use Only

Pressurized by:

Date:

Pressurization Gas:

N_2 He

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)
02A	BEH-1	2329	5/3/10	1455-1555	TO-15 for LFG	29	≈3		

Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time
5/10/10 - 1680	Leonardo Jucolo ATL 5/13/10 9:00
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time
Relinquished by: (signature) Date/Time	Received by: (signature) Date/Time

Notes:

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
	Fed ex		N/A	good	Yes No [✓ None]	1005308

Form 1293 rev.11

APPENDIX F

CAT® MODEL 3520C GAS IC ENGINE AND GENERATOR SET TECHNICAL DATA

G3520C

GAS ENGINE TECHNICAL DATA

CATERPILLAR®

ENGINE SPEED:	1200	FUEL.	LOW ENERGY (1.43 CH4:CO2 RATIO)
COMPRESSION RATIO:	11.3:1	FUEL SYSTEM:	CAT LOW PRESSURE WITH AIR FUEL RATIO CONTROL
AFTERCOOLER - STAGE 1 MAX. INLET (°F):	218		
AFTERCOOLER - STAGE 2 MAX. INLET (°F):	130	FUEL PRESS. RANGE (PSIG):	1.5 - 5.0
JACKET WATER - MAX. OUTLET (°F):	230	MIN. METHANE NUMBER:	135
COOLING SYSTEM:	JW+1AC, OC+2AC	RATED ALTITUDE (FT):	1378
IGNITION SYSTEM:	ADEM3	AT AIR TO TURBO. TEMP. (°F):	77
SPARK PLUG TYPE:	J-GAP	NOx EMISSION LEVEL:	0.5 g/bhp-hr
EXHAUST MANIFOLD:	DRY	FUEL LHV (BTU/SCF):	456
COMBUSTION:	LOW EMISSION	APPLICATION:	GENSET

RATING AND EFFICIENCY		NOTES	LOAD	100%	75%	50%
ENGINE POWER	(WITHOUT FAN)	(1)	BHP	2233	1675	1116
GENERATOR POWER	(WITHOUT FAN)	(2)	EKW	1600	1200	800
ENGINE EFFICIENCY	**(ISO 3046/1)**	(3)	%	**40.1**	**38.6**	**36.1**
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	39.1	37.7	35.2
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	41.3	40.6	42.2
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	80.4	78.3	77.4

ENGINE DATA						
FUEL CONSUMPTION	**(ISO 3046/1)**	(6)	**BTU/bhp-hr**	**6354**	**6592**	**7047**
FUEL CONSUMPTION	(NOMINAL)	(6)	BTU/bhp-hr	6509	6753	7219
AIR FLOW (77 °F, 14.7 psi)		(7)	SCFM	4512	3415	2286
AIR FLOW		(7)	lb/hr	20006	15141	10136
COMPRESSOR OUT PRESSURE			in. HG (abs)	105.8	80.8	55.5
COMPRESSOR OUT TEMPERATURE			°F	375	306	220
AFTERCOOLER AIR OUT TEMPERATURE			°F	142	138	135
INLET MAN. PRESSURE		(8)	in. HG (abs)	94.4	71.5	48.9
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°F	142	138	135
TIMING		(10)	°BTDC	27	27	27
EXHAUST STACK TEMPERATURE		(11)	°F	898	943	984
EXHAUST GAS FLOW (@ stack temp.)		(12)	CFM	12476	9780	6770
EXHAUST MASS FLOW		(12)	lb/hr	22318	16940	11418

EMISSIONS DATA					
NOx (as NO2)	(13)	g/bhp-hr	0.5	0.5	0.5
NTE CO	(14)	g/bhp-hr	4.13	4.25	4.4
NOMINAL CO	(15)	g/bhp-hr	2.5	2.5	2.5
THC (molecular weight of 15.84)	(14)	g/bhp-hr	5.84	6.49	7.51
NMHC (molecular weight of 15.84)	(14)	g/bhp-hr	0.88	0.98	1.13
EXHAUST O2	(16)	% DRY	9.0	8.8	8.6
LAMBDA	(16)		1.71	1.67	1.57

HEAT BALANCE DATA					
LHV INPUT	(17)	BTU/min	242216	188451	134313
HEAT REJECTION TO JACKET	(18)	BTU/min	28738	23806	21929
HEAT REJECTION TO ATMOSPHERE	(19)	BTU/min	7210	6034	4857
HEAT REJECTION TO LUBE OIL	(20)	BTU/min	10108	9524	8917
HEAT REJECTION TO EXHAUST (LHV to 77°F)	(21)	BTU/min	76779	65253	45101
HEAT REJECTION TO EXHAUST (LHV to 350°F)	(21)	BTU/min	57574	47602	34587
HEAT REJECTION TO A/C - STAGE 1	(22)	BTU/min	13823	5157	102
HEAT REJECTION TO A/C - STAGE 2	(23)	BTU/min	8895	5684	4086

CONDITIONS AND DEFINITIONS

ENGINE RATING OBTAINED AND PRESENTED IN ACCORDANCE WITH ISO 3046/1. DATA REPRESENTS CONDITIONS OF 77°F, 29.6 IN HG BAROMETRIC PRESSURE, 30% RELATIVE HUMIDITY, 10 IN H2O AIR FILTER RESTRICTION, AND 20 IN H2O EXHAUST STACK PRESSURE. ENGINE EFFICIENCY AND FUEL CONSUMPTION SPECIFICALLY NOTED AS ISO 3046/1 ARE REPRESENTED WITH 5 IN H2O AIR FILTER RESTRICTION AND 0 IN H2O EXHAUST STACK PRESSURE. CONSULT ALTITUDE CURVES FOR APPLICATIONS ABOVE MAXIMUM RATED ALTITUDE AND/OR TEMPERATURE. NO OVERLOAD PERMITTED AT RATING SHOWN.

EMISSION LEVELS ARE BASED ON THE ENGINE OPERATING AT STEADY STATE CONDITIONS AND ADJUSTED TO THE SPECIFIED NOx LEVEL AT 100% LOAD. EMISSION TOLERANCES SPECIFIED ARE DEPENDENT UPON FUEL QUALITY. METHANE NUMBER CANNOT VARY MORE THAN ± 3. PUBLISHED PART LOAD DATA IS WITH AIR FUEL RATIO CONTROL.

ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS. PUMP POWER IS NOT INCLUDED IN HEAT BALANCE DATA.

FOR NOTES INFORMATION CONSULT PAGE THREE.

FUEL USAGE GUIDE

CAT METHANE NUMBER	40	50	60	70	80	90	100	110	120	130	140	150
IGNITION TIMING	-	-	-	-	-	-	-	-	24	26	28	30
DERATION FACTOR	0	0	0	0	0	0	0	0	1.00	1.00	1.00	1.00

ALTITUDE DERATION FACTORS

AIR TO TURBO (°F)	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	0.96	0.93	0.89	0.86	0.83	0.79	0.76	0.74	0.71	0.68	0.65	0.63	0.60
120	0.98	0.94	0.91	0.87	0.84	0.81	0.78	0.75	0.72	0.69	0.66	0.64	0.61
110	0.99	0.96	0.92	0.89	0.86	0.82	0.79	0.76	0.73	0.70	0.68	0.65	0.62
100	1.00	0.97	0.94	0.90	0.87	0.84	0.81	0.77	0.74	0.72	0.69	0.66	0.63
90	1.00	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.65
80	1.00	1.00	0.97	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.68	0.66
70	1.00	1.00	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.76	0.73	0.70	0.67
60	1.00	1.00	1.00	0.97	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.71	0.68
50	1.00	1.00	1.00	0.99	0.96	0.92	0.88	0.85	0.82	0.79	0.76	0.73	0.70

ALTITUDE (FEET ABOVE SEA LEVEL)

AFTERCOOLER HEAT REJECTION FACTORS

AIR TO TURBO (°F)	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000	11000	12000
130	1.33	1.37	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
120	1.26	1.31	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33	1.33
110	1.19	1.24	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26
100	1.13	1.17	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
90	1.06	1.11	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
80	1.00	1.04	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06
70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

ALTITUDE (FEET ABOVE SEA LEVEL)

FREE FIELD MECHANICAL & EXHAUST NOISE

100% Load Data			dB(A)	(dB)							
Free Field Mechanical	DISTANCE FROM THE ENGINE (FEET)	3.2	108.5	51.5	78.7	88.2	92.9	99.9	97.3	93.2	99.2
		22.9	91.6	34.6	59.0	68.1	74.0	83.0	79.4	75.1	85.2
		49.2	85.0	28.0	55.2	64.7	69.4	76.4	73.8	69.7	75.7
Free Field Exhaust	DISTANCE FROM THE ENGINE (FEET)	4.9	106.1	67.5	86.5	96.0	88.5	88.7	90.1	95.6	92.7
		22.9	92.7	54.1	73.1	82.6	75.1	75.3	76.7	82.2	79.3
		49.2	86.1	47.5	66.5	76.0	68.5	68.7	70.1	75.6	72.7
			Overal SPL	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 khz

Octave Band Center Frequency (OBCF)

FUEL USAGE GUIDE:

This table shows the derate factor required for a given fuel. Note that deration occurs as the methane number decreases. Methane number is a scale to measure detonation characteristics of various fuels. The methane number of a fuel is determined by using the Caterpillar Methane Number Calculation program.

ALTITUDE DERATION FACTORS:

This table shows the deration required for various air inlet temperatures and altitudes. Use this information along with the fuel usage guide chart to help determine actual engine power for your site.

INLET AND EXHAUST RESTRICTION CORRECTIONS FOR ALTITUDE CAPABILITY:

To determine the appropriate altitude derate factor to be applied to this engine for inlet or exhaust restrictions differering from the standard conditions listed on page 1, a correction to the site altitude can be made to adjust for this difference. Add 141 feet to the site altitude for each additional inch of H2O of exhaust stack pressure greater than spec sheet conditions. Add 282 feet to the site altitude for each additional inch of H2O of inlet restriction greater than spec sheet conditions. If site inlet restriction or exhaust stack pressure are less than spec sheet conditions, the same trends apply to lower the site altitude.

ACTUAL ENGINE RATING:

It is important to note that the Altitude/Temperature deration and the Fuel Usage Guide deration are not cumulative. They are not to be added together. The same is true for the Low Energy Fuel deration (reference the Caterpillar Methane Number Program) and the Fuel Usage Guide deration. However, the Altitude/Temperature deration and Low Energy Fuel deration are cumulative; and they must be added together in the method shown below. To determine the actual power available, take the lowest rating between 1) and 2).

1) (Altitude/Temperature Deration) + (Low Energy Fuel Deration)
2) Fuel Usage Guide Deration

Note: For NA's always add the Low Energy Fuel deration to the Altitude/Temperature deration. For TA engines only add the Low Energy Fuel deration to the Altitude/Temperature deration whenever the Altitude/Temperature deration is less than 1.0 (100%). This will give the actual rating for the engine at the conditions specified.

AFTERCOOLER HEAT REJECTION FACTORS:

Aftercooler heat rejection is given for standard conditions of 77°F and 500 ft altitude. To maintain a constant air inlet manifold temperature, as the air to turbo temperature goes up, so must the heat rejection. As altitude increases, the turbocharger must work harder to overcome the lower atmospheric pressure. This increases the amount of heat that must be removed from the inlet air by the aftercooler. Use the aftercooler heat rejection factor to adjust for ambient and altitude conditions. Multiply this factor by the standard aftercooler heat rejection. Failure to properly account for these factors could result in detonation and cause the engine to shutdown or fail. For 2 Stage Aftercoolers with separate circuits, the 1st stage will collect 90% of the additional heat.

SOUND DATA:

Data determined by methods similar to ISO Standard DIS-8528-10. Accuracy Grade 3. SPL = Sound Pressure Level.

NOTES

1 ENGINE RATING IS WITH 2 ENGINE DRIVEN WATER PUMPS. TOLERANCE IS ± 3% OF FULL LOAD.

2 GENERATOR POWER DETERMINED WITH AN ASSUMED GENERATOR EFFICIENCY OF 96.1% AND POWER FACTOR OF 0.8 [GENERATOR POWER = ENGINE POWER x GENERATOR EFFICIENCY].

3 ISO 3046/1 ENGINE EFFICIENCY TOLERANCE IS (+)0, (-)5% OF FULL LOAD % EFFICIENCY VALUE. NOMINAL ENGINE EFFICIENCY TOLERANCE IS ± 2.5% OF FULL LOAD % EFFICIENCY VALUE.

4 THERMAL EFFICIENCY: JACKET HEAT + STAGE 1 A/C HEAT + EXH. HEAT TO 350°F.

5 TOTAL EFFICIENCY = ENGINE EFF. + THERMAL EFF. TOLERANCE IS ± 10% OF FULL LOAD DATA.

6 ISO 3046/1 FUEL CONSUMPTION TOLERANCE IS (+)5, (-)0% OF FULL LOAD DATA. NOMINAL FUEL CONSUMPTION TOLERANCE IS ± 2.5 % OF FULL LOAD DATA.

7 UNDRIED AIR. FLOW TOLERANCE IS ± 5 %

8 INLET MANIFOLD PRESSURE TOLERANCE IS ± 5 %

9 INLET MANIFOLD TEMPERATURE TOLERANCE IS ± 9°F.

10 TIMING INDICATED IS FOR USE WITH THE MINIMUM FUEL METHANE NUMBER SPECIFIED. CONSULT THE APPROPRIATE FUEL USAGE GUIDE FOR TIMING AT OTHER METHANE NUMBERS.

11 EXHAUST STACK TEMPERATURE TOLERANCE IS (+)63°F, (-)54°F.

12 WET EXHAUST. FLOW TOLERANCE IS ± 6 %

13 NOX TOLERANCES ARE ± 18 % OF SPECIFIED VALUE.

14 NTE CO, CO2, THC, and NMHC VALUES ARE "NOT TO EXCEED".

15 NOMINAL CO IS A NOMINAL VALUE AND IS REPRESENTATIVE OF A NEW ENGINE DURING THE FIRST 100 HOURS OF ENGINE OPERATION.

16 O2% TOLERANCE IS ± 0.5; LAMBDA TOLERANCE IS ± 0.05. LAMBDA AND O2 LEVEL ARE THE RESULT OF ADJUSTING THE ENGINE TO OPERATE AT THE SPECIFIED NOX LEVEL.

17 LHV RATE TOLERANCE IS ± 2.5%.

18 TOTAL JW HEAT (based on treated water) = JACKET HEAT + STAGE 1 A/C HEAT + 0.90 x (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 10 % OF FULL LOAD DATA.

19 RADIATION HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 50% OF FULL LOAD DATA.

20 LUBE OIL HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 20% OF FULL LOAD DATA.

21 EXHAUST HEAT RATE BASED ON TREATED WATER. TOLERANCE IS ± 10% OF FULL LOAD DATA.

22 STAGE 1 A/C HEAT (based on treated water) = STAGE 1 A/C HEAT + 0.90 x (STAGE 1 + STAGE 2) x (ACHRF-1). TOLERANCE IS ± 5 % OF FULL LOAD DATA.

23 STAGE 2 A/C HEAT (based on treated water) = (STAGE 2 A/C HEAT + (STAGE 1 + STAGE 2) x 0.10 x (ACHRF - 1)) + LUBE OIL HEAT. TOLERANCE IS ± 5 % OF FULL LOAD DATA.

APPENDIX G

SUMMARY OF 3520 C COMPLIANCE TEST DATA

Appendix H-1, Summary of Compliance Test Results for Cat G3520C Engines

CAT G3520C IC Engine	Date	CO Emission Rate (g/bhp-hr)	CO Exhaust Concentration (ppmvd)	PM-10 Emission Rate (Filterable and Condensible) (lb/hr)	PM-10 Emission Rate (Filterable and Condensible) (g/bhp*hr)	PM-10 Exhaust Concentration (Filterable and Condensible) (mg/dscf))	NOx Emission Rate (lb/hr)	NOx Emission Rate (g/bhp*hr)	NOx Exhaust Concentration (ppmvd)	VOC Emission Rate (lb/hr)	VOC Emission Rate (g/bhp*hr)	THC Exhaust Concentration (ppmvw as propane)	HCl (lb/MMSCF)	HCl (lb/hr)	Exhaust O2 (%)	Exhaust Flowrate (dscfm)	Design Capacity (kW)	Tested Output (kW)*
Brevard Energy #5	09/24/08	2.40	599	1.17	0.24	1.97	2.12	0.43	65.72	0.92	0.19	566.77	0.96	0.032	8.0	4,765	1,600	1,600
Brevard Energy #3	03/19/09	2.40	610	1.07	0.22	1.83	2.24	0.45	70.49	0.00	0.00	440.00	0.34	0.011	7.6	4,457	1,600	1,600
Brevard Energy #9	05/03/10	2.23	563	1.06	0.22	1.82	1.80	0.37	56.51	---	---	---	0.04	1.340	7.5	4,412	1,600	1,582
Ocean Energy Corp. #7	07/16/07	2.62	636	1.05	0.22	1.71	2.06	0.42	61.77	0.00	0.00	426.00	---	---	7.8	4,647	1,600	1,577
Ocean Energy Corp. #8	07/16/07	2.65	651	0.76	0.15	1.23	2.05	0.41	61.80	0.00	0.00	411.00	---	---	7.7	4,665	1,600	1,604
Ocean Energy Corp. #9	07/17/07	2.71	655	0.72	0.14	1.13	1.82	0.37	53.23	0.14	0.03	469.00	---	---	7.7	4,777	1,600	1,610
Ocean Energy Corp. #10	07/18/07	2.72	658	0.70	0.14	1.11	1.74	0.35	50.83	0.00	0.00	462.00	---	---	7.5	4,769	1,600	1,613
Ocean Energy Corp. #11	07/18/07	2.53	627	0.64	0.13	1.06	1.63	0.33	49.53	0.00	0.00	468.00	---	---	7.7	4,579	1,600	1,611
Ocean Energy Corp. #12	07/19/07	2.57	644	0.66	0.13	1.10	1.34	0.27	40.77	0.00	0.00	496.00	---	---	7.9	4,571	1,600	1,614
Ocean Energy Corp. #7	04/23/08	---	---	0.68	0.15	1.09	---	---	---	---	---	---	---	---	8.5	4,734	1,600	1,522
Seminole Energy # 4	04/17/08	2.61	647	0.57	0.12	0.84	1.37	0.28	41.68	1.15	0.24	780.88	0.58	0.020	8.6	4,938	1,600	1,589
Seminole Energy #1	03/18/09	2.54	653	1.25	0.25	1.40	2.58	0.52	78.20	---	---	---	0.81	0.029	7.9	4,562	1,600	1,602
Seminole Energy #3	04/29/10	2.61	629	1.03	0.22	1.70	1.85	0.39	56.66	---	---	---	1.06	0.040	7.9	4,581	1,600	1,550
Trail Ridge Energy #4	03/25/09	2.70	649	0.57	0.12	0.93	2.09	0.43	63.18	0.00	0.00	604.00	0.68	0.020	8.3	4,611	1,600	1,577
Trail Ridge Energy #9	05/05/10	2.56	632	0.59	0.12	0.99	2.24	0.46	69.23	---	---	---	1.40	0.044	7.7	4,527	1,600	1,581
Average															7.9	4,640		

* All of the engines were tested at base load opertions (i.e., approximately design capacity)

g/bhp*hr - grams per brakehorsepower hour
ppmvd - parts per million by volume, dry
ppmvw - parts per million by volume, wet
lb/hr - pounds per hour
mg/dscf - milligrams per dry standard cubic foot
lb/MMSCF - pounds per million standard cubic foot
% - percent by volume
dscfm - dry standard cubic feet per minute
--- - not tested

CAT G3520C IC Engine	Date	CO Emission Rate (g/bhp-hr)	CO Exhaust Concentration (ppmvd)	PM-10 Filter and Acetone weight (Method 5) gain (mg)	PM-10 Organic Weight (Method 202) Gain (mg)	PM-10 Inorganic Weight (Method 202) Gain (mg)	PM-10 Total Weight Gain (mg)	PM-10 Total Weight Gain (mg) Blank Corrected	PM-10 Exhaust Concentration (Filterable and Condensible) (mg/dscf)	PM-10 Emission Rate (Filterable and Condensible) (lb/hr)	PM-10 Emission Rate (Filterable and Condensible) (g/bhp*hr)	SO_2 Emissions (lb/MMscf)	SO_2 Emissions (ppmv)	SO_2 Emissions (lb/hr)	SO_2 Gas Sample Date
Brevard Energy No. 5 Run 1	09/24/08			4.1	0.1	71.1	75.3	73.7	1.87	1.12	0.227				
Brevard Energy No. 5 Run 2	09/24/08			10.0	0.6	76.4	87.0	85.5	2.07	1.23	0.249				
Brevard Energy No. 5 Run 3	09/24/08			4.7	0.2	79.5	84.3	82.8	1.98	1.18	0.240				
Brevard Energy No. 5 AVG	09/24/08	2.40	599	6.2	0.3	75.6	82.2	80.7	1.97	1.18	0.238	42.40	255.0	NA	11/18/2008
Brevard Energy No. 3 Run 1	03/19/09			9.5	19.0	74.0	102.5	94.8	2.38	1.38	0.280				
Brevard Energy No. 3 Run 2	03/19/09			8.3	14.0	45.0	67.3	59.6	1.46	0.87	0.176				
Brevard Energy No. 3 Run 3	03/19/09			5.8	16.0	51.0	72.8	65.1	1.63	0.96	0.194				
Brevard Energy No. 3 AVG	03/19/09	2.40	610	7.9	16.3	56.7	80.9	73.2	1.82	1.07	0.217	56.20	337.8	NA	3/19/2009
Brevard Energy No. 6 Run 1	05/03/10			9.0	8.4	62.0	79.4	77.9	2.01	1.16	0.238	39.60	238.3	1.19	05/03/10
Brevard Energy No. 6 Run 2	05/03/10			7.7	7.3	56.0	71.0	69.5	1.79	1.04	0.214	41.30	248.3	1.23	05/03/10
Brevard Energy No. 6 Run 3	05/03/10			6.0	3.8	57.0	66.8	65.2	1.67	0.99	0.204	45.00	270.4	1.33	05/03/10
Brevard Energy No. 6 AVG	05/03/10	2.23	563	7.6	6.5	58.3	72.4	70.9	1.82	1.06	0.219	41.97	252.3	1.25	05/03/10
Seminole Energy No. 4 Run 1	04/17/08			6.7	Inorganic	28.20	34.90	34.90	0.84	0.58	0.120				
Seminole Energy No. 4 Run 2	04/17/08			5.8	& organic	29.60	35.40	35.40	0.84	0.58	0.120				
Seminole Energy No. 4 Run 3	04/17/08			5.0	not diffrentiated	27.60	32.60	32.60	0.84	0.54	0.110				
Seminole Energy No. 4 AVG	04/17/08	2.61	647	5.83	#DIV/0!	28.47	34.30	34.30	0.84	0.57	0.117	6.87	41.3	NA	4/30/2008
Seminole Energy No. 1 Run 1	03/23/09			11.3	7.0	33	51	51	1.26	0.75	0.153				
Seminole Energy No. 1 Run 2	03/23/09			63.0	45.0	51	159	159	3.94	2.36	0.476				
Seminole Energy No. 1 Run 3	03/23/09			5.1	5.2	33	43	43	1.06	0.64	0.129				
Seminole Energy No. 1 AVG	03/23/09	2.66	666	26.47	19.1	39.00	84.53	84.53	2.09	1.25	0.253	18.45	111.0	NA	3/24/2009
Seminole Energy No. 1 Run 1	11/18/09			11.3					2.10	1.08	0.222				
Seminole Energy No. 1 Run 2	11/18/09			63.0	Not Availalble				1.81	0.93	0.190				
Seminole Energy No. 1 Run 3	11/18/09			5.1					2.23	1.15	0.236				
Seminole Energy No. 1 AVG	11/18/09	Not Applicable	Not Applicable	26.47	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	2.05	1.05	0.216	19.82	119.2	NA	11/11/2009
Seminole Energy No. 2 Run 1	04/29/10			6.7	2.1	63	72	72	1.75	1.08	0.226				
Seminole Energy No. 2 Run 2	04/29/10			6.2	2.1	60	68	68	1.71	1.03	0.216				
Seminole Energy No. 2 Run 3	04/29/10			6.3	1.5	56	64	64	1.63	0.97	0.205				
Seminole Energy No. 2 AVG	04/29/10	2.61	629	6.40	1.9	59.67	67.97	67.97	1.70	1.03	0.216	19.79	119.0	NA	4/28/2010
Trail Ridge Energy No. 4 Run 1	03/25/09			8.1	8	19	35	35	0.86	0.53	0.110				
Trail Ridge Energy No. 4 Run 2	03/25/09			8	9	19	36	36	0.89	0.54	0.11				
Trail Ridge Energy No. 4 Run 3	03/25/09			11.2	4.9	27	43.1	43.1	1.04655	0.647	0.131				
Trail Ridge Energy No. 4 AVG	03/25/09	2.70	649	9.17	7.3	21.67	38.10	38.10	0.93	0.57	0.117	7.10	42.7	NA	3/25/2009
Trail Ridge Energy No. 6 Run 1	05/05/10			9.9	1.9	28	40	40	1.01	0.60	0.124				
Trail Ridge Energy No. 6 Run 2	05/05/10			6.5	1.5	29	37	37	0.91	0.55	0.113				
Trail Ridge Energy No. 6 Run 3	05/05/10			5.9	1.4	34	41	41	1.05	0.63	0.129				
Trail Ridge Energy No. 6 AVG	05/05/10	2.56	632	7.43	1.6	30.33	39.37	39.37	0.99	0.59	0.122	8.03	48.3	NA	5/5/2010

APPENDIX H

OCEAN ENERGY CORPORATION 3520C MONITORING DATA

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
7	4/27/07	506	53.1	8.4	1,592	513.9	53.22	8.39	242.3	25.1	233
8	4/27/07	544	69.5	8.2	1,590	553.4	69.63	8.23	257.7	32.4	233
9	4/27/07	548	74.9	8.3	1,581	557.3	75.12	8.26	260.1	35.1	233
10	4/27/07	560	75.8	8.3	1,584	569.3	76.01	8.25	265.6	35.5	233
11	4/27/07	532	74.1	8.3	1,588	540.4	74.22	8.31	253.3	34.8	233
12	4/27/07	573	71.3	8.3	1,613	582.4	71.49	8.34	273.5	33.6	233
7	4/30/07	537	68.6	8.3	1,594	541.9	68.17	8.31	254.0	32.0	303
8	4/30/07	547	72.2	8.3	1,598	552.0	71.79	8.28	258.0	33.6	303
9	4/30/07	524	58.7	8.4	1,605	528.2	58.34	8.38	249.0	27.5	303
10	4/30/07	532	67.6	8.3	1,586	536.8	67.15	8.33	252.1	31.5	303
11	4/30/07	528	74.3	8.3	1,593	532.1	73.86	8.28	248.9	34.5	303
12	4/30/07	594	73.3	8.3	1,615	599.4	72.89	8.33	281.4	34.2	303
7	5/1/07	534	70.4	8.5	1,584	542.9	70.46	8.45	257.3	33.4	326
8	5/1/07	549	74.5	8.4	1,583	557.9	74.60	8.38	263.0	35.2	326
9	5/1/07	532	58.1	8.5	1,587	540.6	58.14	8.53	257.9	27.7	326
10	5/1/07	560	74.0	8.4	1,584	569.7	74.09	8.39	268.7	35.0	326
12	5/1/07	562	61.0	8.6	1,610	571.4	61.01	8.55	273.0	29.2	326
7	5/2/07	527	62.3	8.4	1,586	535.6	62.38	8.39	252.6	29.4	349
8	5/2/07	539	67.2	8.4	1,582	547.1	67.25	8.34	257.0	31.6	349
9	5/2/07	531	57.2	8.5	1,533	538.8	57.30	8.47	255.7	27.2	349
10	5/2/07	553	67.1	8.4	1,580	561.7	67.14	8.41	265.3	31.7	349
12	5/2/07	569	62.9	8.5	1,613	577.5	62.95	8.48	274.3	29.9	349
7	5/3/07	526	66.5	8.6	1,584	533.4	66.12	8.55	254.9	31.6	372
8	5/3/07	529	66.2	8.5	1,590	536.2	65.79	8.52	255.6	31.4	372
9	5/3/07	529	60.1	8.6	1,585	535.9	59.77	8.59	256.8	28.6	372
10	5/3/07	548	68.0	8.5	1,595	555.4	67.65	8.48	263.8	32.1	372
11	5/3/07	469	59.5	8.6	1,595	475.8	59.14	8.58	227.9	28.3	372
12	5/3/07	564	64.5	8.6	1,616	571.8	64.09	8.60	274.2	30.7	372
7	5/4/07	525	63.1	8.6	1,579	533.5	63.05	8.55	254.9	30.1	396
8	5/4/07	531	64.5	8.5	1,598	539.1	64.49	8.54	257.3	30.8	396
9	5/4/07	527	62.6	8.6	1,586	535.6	62.58	8.55	255.9	29.9	396
10	5/4/07	543	69.6	8.5	1,582	551.8	69.53	8.49	262.3	33.1	396
11	5/4/07	495	63.6	8.6	1,586	502.9	63.60	8.61	241.4	30.5	396
12	5/4/07	566	65.8	8.6	1,604	575.2	65.75	8.58	275.5	31.5	396
7	5/7/07	537	69.8	8.5	1,585	543.9	68.95	8.50	258.9	32.8	466
8	5/7/07	544	67.9	8.5	1,589	551.3	67.03	8.50	262.4	31.9	466
9	5/7/07	542	63.6	8.5	1,586	549.8	62.75	8.52	262.1	29.9	466
10	5/7/07	569	70.4	8.5	1,590	576.9	69.50	8.44	273.2	32.9	466
11	5/7/07	518	62.5	8.6	1,576	524.9	61.68	8.56	251.0	29.5	466
12	5/7/07	582	68.3	8.5	1,614	590.3	67.43	8.51	281.1	32.1	466
7	5/8/07	548	72.2	8.3	1,578	558.4	72.59	8.34	262.3	34.1	489
8	5/8/07	548	67.8	8.4	1,581	558.3	68.17	8.37	262.8	32.1	489
9	5/8/07	554	68.4	8.4	1,600	563.9	68.84	8.40	266.1	32.5	489
10	5/8/07	571	71.2	8.4	1,576	581.8	71.57	8.36	273.7	33.7	489
11	5/8/07	512	63.9	8.5	1,588	521.9	64.30	8.48	247.8	30.5	489
12	5/8/07	586	68.8	8.5	1,623	597.1	69.16	8.49	283.8	32.9	489
7	5/9/07	551	62.5	8.3	1,588	557.7	63.24	8.27	260.4	29.5	512
8	5/9/07	567	67.1	8.3	1,583	573.7	67.94	8.24	267.4	31.7	512
9	5/9/07	567	64.9	8.3	1,593	573.8	65.76	8.24	267.4	30.6	512
10	5/9/07	562	64.7	8.2	1,593	569.2	65.56	8.16	263.5	30.3	512
11	5/9/07	544	69.0	8.3	1,596	550.6	69.85	8.27	257.1	32.6	512
12	5/9/07	595	65.7	8.3	1,615	602.3	66.54	8.24	280.6	31.0	512
7	5/10/07	576	59.3	8.2	1,600	582.2	59.00	8.25	271.4	27.5	535
8	5/10/07	587	67.9	8.2	1,579	593.0	67.56	8.19	275.2	31.4	535
9	5/10/07	564	60.5	8.2	1,578	569.5	60.17	8.25	265.6	28.1	535
10	5/10/07	563	59.3	8.2	1,592	568.4	58.96	8.23	264.8	27.5	535
11	5/10/07	552	73.2	8.2	1,577	557.3	72.80	8.16	258.0	33.7	535
12	5/10/07	570	65.9	8.2	1,612	576.3	65.50	8.21	267.8	30.4	535
7	5/11/07	559	60.6	8.2	1,580	568.2	60.47	8.23	264.7	28.2	559
8	5/11/07	576	69.0	8.2	1,587	584.8	68.86	8.17	271.1	31.9	559
9	5/11/07	559	62.7	8.2	1,584	567.7	62.62	8.17	263.1	29.0	559
10	5/11/07	580	63.0	8.2	1,596	588.9	62.93	8.18	273.0	29.2	559
11	5/11/07	551	63.0	8.2	1,586	560.0	62.95	8.22	260.6	29.3	559
12	5/11/07	603	66.3	8.3	1,616	612.6	66.19	8.29	286.5	31.0	559

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
7	5/14/07	576	67.6	8.5	1,587	581.5	67.52	8.49	276.4	32.1	629
8	5/14/07	570	64.8	8.5	1,594	576.0	64.73	8.52	274.4	30.8	629
9	5/14/07	568	67.3	8.5	1,580	573.6	67.26	8.54	273.7	32.1	629
10	5/14/07	553	63.9	8.5	1,586	558.4	63.88	8.51	265.8	30.4	629
11	5/14/07	516	63.6	8.5	1,599	520.9	63.49	8.52	248.2	30.2	629
12	5/14/07	566	70.4	8.5	1,601	571.3	70.39	8.53	272.6	33.6	629
7	5/15/07	582	62.1	8.4	1,590	586.0	62.01	8.36	275.8	29.2	652
8	5/15/07	588	69.5	8.3	1,600	592.2	69.38	8.33	277.9	32.6	652
9	5/15/07	568	65.7	8.3	1,585	571.6	65.57	8.31	267.9	30.7	652
10	5/15/07	564	62.0	8.3	1,591	567.7	61.85	8.28	265.3	28.9	652
11	5/15/07	534	64.8	8.3	1,601	537.8	64.74	8.29	251.5	30.3	652
12	5/15/07	587	72.9	8.3	1,602	590.7	72.88	8.33	277.2	34.2	652
7	5/16/07	568	61.1	8.3	1,596	573.1	61.12	8.27	267.8	28.6	675
8	5/16/07	567	58.6	8.3	1,598	571.8	58.64	8.31	267.9	27.5	675
9	5/16/07	579	65.8	8.2	1,588	584.5	65.83	8.20	271.5	30.6	675
10	5/16/07	576	57.9	8.3	1,594	581.8	57.85	8.24	271.2	27.0	675
11	5/16/07	558	60.2	8.2	1,608	563.4	60.21	8.20	261.7	28.0	675
12	5/16/07	616	68.5	8.2	1,621	622.2	68.58	8.21	289.2	31.9	675
7	5/17/07	598	68.9	8.3	1,587	598.8	68.24	8.26	279.6	31.9	698
8	5/17/07	574	59.3	8.4	1,587	574.5	58.62	8.37	270.6	27.6	698
9	5/17/07	596	74.3	8.3	1,592	596.6	73.57	8.34	280.2	34.5	698
10	5/17/07	574	63.3	8.3	1,604	574.8	62.61	8.32	269.7	29.4	698
11	5/17/07	535	61.6	8.3	1,603	535.4	60.89	8.29	250.5	28.5	698
12	5/17/07	587	71.3	8.3	1,609	587.1	70.64	8.25	273.8	32.9	698
7	5/18/07	563	70.5	8.3	1,593	570.6	70.52	8.32	267.5	33.1	722
8	5/18/07	556	65.0	8.4	1,584	563.3	64.97	8.41	266.1	30.7	722
9	5/18/07	583	75.3	8.3	1,589	590.6	75.33	8.37	278.1	35.5	722
10	5/18/07	574	64.7	8.4	1,601	581.9	64.66	8.44	275.5	30.6	722
11	5/18/07	555	62.7	8.4	1,600	562.8	62.69	8.48	267.3	29.8	722
12	5/18/07	616	72.2	8.5	1,604	624.3	72.23	8.50	297.1	34.4	722
7	5/21/07	567	72.9	8.3	1,597	577.4	72.98	8.28	270.0	34.1	792
8	5/21/07	549	59.9	8.4	1,588	559.7	60.00	8.38	263.8	28.3	792
9	5/21/07	567	64.1	8.4	1,581	577.7	64.21	8.40	272.7	30.3	792
10	5/21/07	588	65.4	8.4	1,584	598.7	65.54	8.40	282.7	30.9	792
11	5/21/07	560	63.5	8.4	1,588	570.7	63.60	8.39	269.2	30.0	792
12	5/21/07	605	67.9	8.5	1,603	616.9	68.04	8.47	292.8	32.3	792
7	5/22/07	611	73.3	8.3	1,580	616.4	73.03	8.29	288.4	34.2	815
8	5/22/07	571	55.2	8.5	1,587	575.9	54.79	8.45	273.0	26.0	815
9	5/22/07	573	63.8	8.4	1,583	578.4	63.43	8.39	272.7	29.9	815
10	5/22/07	571	64.3	8.3	1,581	575.6	63.99	8.33	270.2	30.0	815
11	5/22/07	535	64.5	8.3	1,591	539.5	64.20	8.33	253.2	30.1	815
12	5/22/07	572	68.0	8.4	1,648	576.8	67.65	8.44	273.2	32.0	815
7	5/23/07	601	66.4	8.3	1,589	607.6	65.97	8.30	284.4	30.9	838
8	5/23/07	612	73.2	8.2	1,582	618.7	72.80	8.22	288.0	33.9	838
9	5/23/07	569	57.7	8.3	1,588	574.8	57.34	8.31	269.4	26.9	838
10	5/23/07	592	66.5	8.2	1,582	598.0	66.15	8.22	278.3	30.8	838
11	5/23/07	554	65.3	8.2	1,590	559.7	64.93	8.24	260.7	30.2	838
12	5/23/07	588	65.9	8.3	1,592	594.8	65.57	8.33	279.2	30.8	838
7	5/24/07	572	66.1	8.2	1,591	575.0	65.46	8.16	266.4	30.3	861
8	5/24/07	579	65.3	8.3	1,586	581.6	64.71	8.24	271.0	30.1	861
9	5/24/07	560	56.4	8.3	1,583	562.8	55.83	8.30	263.6	26.1	861
10	5/24/07	597	67.5	8.2	1,584	600.1	66.84	8.21	279.0	31.1	861
11	5/24/07	561	62.9	8.3	1,587	563.9	62.32	8.27	263.4	29.1	861
12	5/24/07	619	66.4	8.4	1,612	621.9	65.76	8.34	292.1	30.9	861
7	5/25/07	557	65.2	8.2	1,592	561.1	64.56	8.20	260.8	30.0	885
8	5/25/07	563	56.4	8.4	1,586	567.8	55.78	8.33	266.5	26.2	885
9	5/25/07	566	62.2	8.2	1,586	570.8	61.61	8.19	265.0	28.6	885
10	5/25/07	595	65.9	8.1	1,589	599.7	65.22	8.11	276.7	30.1	885
11	5/25/07	574	60.2	8.2	1,590	578.4	59.57	8.19	268.6	27.7	885
12	5/25/07	606	66.0	8.3	1,614	610.5	65.32	8.30	286.0	30.6	885
7	5/29/07	590	66.4	8.2	1,593	592.9	65.01	8.18	275.0	30.2	978
8	5/29/07	563	52.2	8.4	1,592	566.2	51.11	8.35	266.1	24.0	978
9	5/29/07	558	62.7	8.3	1,596	560.6	61.42	8.24	261.4	28.6	978
10	5/29/07	624	66.1	8.3	1,592	627.4	64.81	8.25	292.6	30.2	978

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
11	5/29/07	587	66.1	8.2	1,576	589.9	64.76	8.20	274.0	30.1	978
12	5/29/07	624	72.6	8.3	1,622	627.5	71.11	8.33	294.5	33.4	978
7	5/30/07	609	62.9	8.2	1,585	615.7	62.31	8.19	285.7	28.9	1,001
8	5/30/07	584	51.0	8.4	1,597	591.0	50.51	8.35	277.8	23.7	1,001
9	5/30/07	573	57.5	8.3	1,588	579.4	56.88	8.25	270.2	26.5	1,001
10	5/30/07	571	58.1	8.3	1,596	577.5	57.55	8.25	269.4	26.8	1,001
11	5/30/07	570	68.8	8.2	1,587	576.0	68.13	8.19	267.4	31.6	1,001
12	5/30/07	584	64.6	8.3	1,628	591.1	64.03	8.28	276.2	29.9	1,001
7	5/31/07	559	56.8	8.2	1,586	564.4	56.98	8.22	262.6	26.5	1,024
8	5/31/07	570	51.3	8.2	1,597	575.7	51.44	8.17	266.9	23.9	1,024
9	5/31/07	584	70.9	8.1	1,587	589.5	71.29	8.15	272.7	33.0	1,024
10	5/31/07	585	54.6	8.2	1,585	590.8	54.83	8.17	273.8	25.4	1,024
11	5/31/07	562	65.9	8.1	1,597	567.3	66.26	8.16	262.7	30.7	1,024
12	5/31/07	624	60.4	8.2	1,628	629.8	60.67	8.20	292.5	28.2	1,024
7	6/1/07	592	64.0	8.1	1,596	595.9	64.06	8.10	274.7	29.5	1,048
8	6/1/07	602	65.1	8.1	1,609	606.8	65.11	8.13	280.4	30.1	1,048
9	6/1/07	601	70.6	8.0	1,583	605.0	70.70	8.02	277.0	32.4	1,048
10	6/1/07	590	61.9	8.0	1,595	594.2	61.95	8.02	272.3	28.4	1,048
11	6/1/07	583	63.8	8.1	1,597	586.9	63.84	8.07	269.9	29.4	1,048
12	6/1/07	617	55.1	8.2	1,612	621.6	55.07	8.21	288.9	25.6	1,048
7	6/4/07	585	70.3	8.1	1,599	595.3	69.18	8.11	274.7	31.9	1,117
8	6/4/07	586	66.0	8.1	1,588	596.6	64.93	8.12	275.4	30.0	1,117
9	6/4/07	584	61.3	8.2	1,595	593.7	60.27	8.17	275.1	27.9	1,117
10	6/4/07	608	70.5	8.0	1,586	618.3	69.35	8.03	283.5	31.8	1,117
11	6/4/07	582	58.3	8.1	1,599	592.1	57.32	8.12	273.4	26.5	1,117
12	6/4/07	619	55.5	8.3	1,623	629.3	54.58	8.29	294.4	25.5	1,117
7	6/5/07	588	65.9	8.2	1,594	595.9	66.88	8.18	276.3	31.0	1,141
8	6/5/07	587	71.3	8.1	1,596	594.3	72.35	8.08	273.6	33.3	1,141
9	6/5/07	597	67.9	8.2	1,598	605.3	68.86	8.16	280.3	31.9	1,141
10	6/5/07	614	71.7	8.0	1,597	621.6	72.76	8.00	284.2	33.3	1,141
11	6/5/07	601	66.8	8.0	1,598	609.3	67.79	8.01	279.0	31.0	1,141
12	6/5/07	625	55.9	8.2	1,620	633.5	56.71	8.21	294.6	26.4	1,141
7	6/7/07	538	61.3	8.3	1,601	541.7	60.79	8.32	254.1	28.5	1,187
8	6/7/07	600	72.5	8.2	1,602	604.1	71.99	8.24	281.5	33.5	1,187
9	6/7/07	578	74.9	8.2	1,606	582.1	74.35	8.15	269.4	34.4	1,187
10	6/7/07	549	60.8	8.3	1,610	553.2	60.29	8.27	258.4	28.2	1,187
11	6/7/07	570	69.6	8.2	1,595	573.8	69.06	8.19	266.3	32.0	1,187
12	6/7/07	615	70.8	8.2	1,608	619.8	70.29	8.23	288.7	32.7	1,187
7	6/8/07	559	62.1	8.1	1,605	564.9	62.37	8.08	260.0	28.7	1,211
8	6/8/07	597	66.1	8.1	1,619	602.9	66.45	8.14	278.7	30.7	1,211
9	6/8/07	593	71.6	7.9	1,604	599.4	71.99	7.95	273.1	32.8	1,211
10	6/8/07	561	57.0	8.0	1,606	567.3	57.22	8.03	260.0	26.2	1,211
11	6/8/07	591	68.8	7.9	1,586	597.0	69.15	7.95	272.0	31.5	1,211
12	6/8/07	641	73.9	8.0	1,606	648.1	74.31	7.97	295.6	33.9	1,211
7	6/11/07	559	66.4	8.2	1,590	562.3	65.98	8.21	261.5	30.7	1,280
8	6/11/07	608	68.7	8.2	1,606	611.8	68.26	8.17	283.6	31.6	1,280
9	6/11/07	579	69.2	8.1	1,612	582.0	68.74	8.13	268.9	31.8	1,280
10	6/11/07	585	66.0	8.2	1,604	588.0	65.55	8.16	272.4	30.4	1,280
11	6/11/07	573	62.1	8.2	1,590	576.2	61.69	8.16	266.9	28.6	1,280
12	6/11/07	624	65.1	8.3	1,609	627.4	64.62	8.30	293.8	30.3	1,280
11	6/12/07	614	70.2	8.1	1,598	615.6	69.50	8.07	283.1	32.0	1,304
11	6/13/07	609	67.1	8.1	1,580	608.6	66.42	8.14	281.3	30.7	1,327
7	6/21/07	590	69.3	8.2	1,596	592.2	68.12	8.19	275.0	31.6	1,513
8	6/21/07	622	72.0	8.2	1,601	623.8	70.77	8.21	290.1	32.9	1,513
9	6/21/07	612	71.0	8.2	1,603	614.2	69.79	8.15	284.1	32.3	1,513
10	6/21/07	624	67.2	8.2	1,600	625.6	66.02	8.17	289.9	30.6	1,513
11	6/21/07	635	73.9	8.2	1,598	636.6	72.62	8.15	294.5	33.6	1,513
12	6/21/07	648	71.7	8.2	1,602	650.2	70.49	8.22	302.5	32.8	1,513
7	6/27/07	585	70.3	8.1	1,598	580.2	69.28	8.11	267.6	32.0	1,653
8	6/27/07	618	71.1	8.0	1,597	612.6	70.12	8.00	280.2	32.1	1,653
9	6/27/07	613	63.2	8.1	1,601	607.7	62.27	8.08	279.6	28.7	1,653
10	6/27/07	640	66.8	7.9	1,596	634.3	65.79	7.92	288.2	29.9	1,653
11	6/27/07	639	65.9	8.0	1,594	633.1	64.99	8.00	289.6	29.7	1,653
12	6/27/07	675	74.2	7.9	1,608	669.2	73.18	7.90	303.7	33.2	1,653

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
7	7/3/07	526	66.5	8.6	1,601	533.4	66.12	8.55	254.9	31.6	1,793
8	7/3/07	529	66.2	8.5	1,598	536.2	65.79	8.52	255.6	31.4	1,793
9	7/3/07	529	60.1	8.6	1,596	535.9	59.77	8.59	256.8	28.6	1,793
10	7/3/07	548	68.0	8.5	1,600	555.4	67.65	8.48	263.8	32.1	1,793
11	7/3/07	469	59.5	8.6	1,602	475.8	59.14	8.58	227.9	28.3	1,793
12	7/3/07	564	64.5	8.6	1,610	571.8	64.09	8.60	274.2	30.7	1,793
7	7/11/07	632	72.8	7.9	1,598	633.9	72.35	7.89	287.5	32.8	1,979
8	7/11/07	642	73.3	7.9	1,597	643.6	72.86	7.90	292.2	33.1	1,979
9	7/11/07	651	72.3	7.9	1,601	652.5	71.83	7.93	296.8	32.7	1,979
10	7/11/07	638	65.7	8.0	1,596	639.6	65.29	7.95	291.3	29.7	1,979
11	7/11/07	657	72.7	7.9	1,594	658.5	72.23	7.93	299.5	32.9	1,979
12	7/11/07	684	65.2	8.0	1,608	685.8	64.79	7.99	313.3	29.6	1,979
7	7/26/07	636	73.2	7.8	1,607	648.0	72.92	8.12	299.3	33.7	2,328
8	7/26/07	654	71.4	7.9	1,617	666.4	71.12	8.18	309.1	33.0	2,328
9	7/26/07	665	72.8	7.8	1,604	677.8	72.48	8.12	312.9	33.5	2,328
10	7/26/07	667	73.6	7.7	1,608	679.5	73.33	8.03	311.6	33.6	2,328
11	7/26/07	637	66.4	7.9	1,610	649.2	66.09	8.14	300.2	30.6	2,328
12	7/26/07	678	54.2	8.1	1,614	690.3	53.89	8.35	324.5	25.3	2,328
7	8/2/07	538	61.0	8.3	1,610	536.4	60.58	8.32	251.6	28.4	2,491
8	8/2/07	597	71.4	8.2	1,616	595.5	70.90	8.24	277.5	33.0	2,491
9	8/2/07	613	63.2	8.1	1,610	611.8	62.73	8.08	281.6	28.9	2,491
10	8/2/07	549	60.8	8.3	1,613	548.0	60.35	8.27	256.0	28.2	2,491
11	8/2/07	570	69.6	8.2	1,615	568.4	69.11	8.19	263.8	32.1	2,491
7	8/9/07	589	68.5	8.1	1,609	598.3	68.22	8.07	275.2	31.4	2,654
8	8/9/07	612	63.0	8.2	1,606	621.0	62.69	8.22	289.0	29.2	2,654
9	8/9/07	610	68.4	8.2	1,605	618.8	68.05	8.17	286.8	31.5	2,654
10	8/9/07	614	64.6	8.0	1,614	623.7	64.31	8.03	286.0	29.5	2,654
11	8/9/07	630	66.9	8.2	1,616	639.4	66.58	8.16	296.2	30.8	2,654
12	8/9/07	639	62.7	8.0	1,621	648.5	62.38	8.03	297.4	28.6	2,654
7	8/15/07	594	61.7	8.3	1,597	603.2	61.23	8.32	283.0	28.7	2,794
8	8/15/07	617	61.4	8.3	1,597	626.7	60.93	8.26	292.6	28.5	2,794
9	8/15/07	592	62.9	8.2	1,596	601.6	62.46	8.18	279.1	29.0	2,794
10	8/15/07	613	62.8	8.0	1,600	622.7	62.32	8.03	285.4	28.6	2,794
11	8/15/07	645	69.1	8.2	1,605	655.3	68.65	8.21	304.6	31.9	2,794
12	8/15/07	658	63.6	8.1	1,606	668.6	63.15	8.13	308.8	29.2	2,794
7	8/22/07	562	70.0	8.3	1,608	568.8	69.95	8.27	265.8	32.7	2,957
8	8/22/07	556	64.8	8.4	1,606	562.9	64.78	8.37	265.0	30.5	2,957
9	8/22/07	581	73.3	8.3	1,602	588.3	73.25	8.33	276.1	34.4	2,957
10	8/22/07	574	64.3	8.4	1,604	581.1	64.24	8.40	274.2	30.3	2,957
11	8/22/07	554	61.7	8.4	1,605	561.2	61.62	8.44	265.6	29.2	2,957
12	8/22/07	564	64.5	8.6	1,609	571.4	64.41	8.59	274.0	30.9	2,957
7	8/30/07	626	67.0	8.1	1,600	635.5	67.84	8.09	292.7	31.2	3,143
8	8/30/07	638	65.6	8.1	1,601	647.9	66.43	8.09	298.3	30.6	3,143
9	8/30/07	645	65.7	8.1	1,600	655.2	66.54	8.09	301.8	30.6	3,143
10	8/30/07	656	67.5	8.1	1,611	666.1	68.36	8.13	307.8	31.6	3,143
11	8/30/07	601	66.8	8.0	1,602	610.8	67.72	8.02	279.7	31.0	3,143
12	8/30/07	678	63.0	8.3	1,607	689.1	63.81	8.26	321.6	29.8	3,143
7	9/5/07	622	63.1	8.3	1,600	631.3	63.79	8.25	294.4	29.7	3,282
8	9/5/07	654	67.2	8.3	1,601	663.8	67.98	8.26	309.7	31.7	3,282
9	9/5/07	637	60.4	8.4	1,602	646.8	61.03	8.38	304.8	28.8	3,282
10	9/5/07	654	65.7	8.3	1,603	663.8	66.47	8.28	310.2	31.1	3,282
11	9/5/07	658	70.7	8.3	1,603	668.1	71.50	8.25	311.6	33.3	3,282
12	9/5/07	670	65.7	8.3	1,609	679.8	66.47	8.27	317.4	31.0	3,282
7	9/14/07	589	68.5	8.1	1,606	593.6	68.20	8.07	273.0	31.4	3,492
8	9/14/07	612	63.0	8.2	1,604	616.0	62.68	8.22	286.7	29.2	3,492
9	9/14/07	610	68.4	8.2	1,604	613.9	68.04	8.17	284.4	31.5	3,492
10	9/14/07	614	64.6	8.0	1,608	618.8	64.31	8.03	283.7	29.5	3,492
11	9/14/07	630	66.9	8.2	1,610	634.4	66.57	8.16	293.8	30.8	3,492
12	9/14/07	639	62.7	8.0	1,610	643.3	62.38	8.03	295.0	28.6	3,492
7	9/20/07	636	73.2	7.8	1,613	648.0	72.92	8.12	299.3	33.7	3,632
8	9/20/07	654	71.4	7.9	1,612	666.4	71.12	8.18	309.1	33.0	3,632
9	9/20/07	665	72.8	7.8	1,609	677.8	72.48	8.12	312.9	33.5	3,632
10	9/20/07	667	73.6	7.7	1,610	679.5	73.33	8.03	311.6	33.6	3,632
11	9/20/07	637	66.4	7.9	1,610	649.2	66.09	8.14	300.2	30.6	3,632

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
12	9/20/07	678	54.2	8.1	1,613	690.3	53.89	8.35	324.5	25.3	3,632
7	9/26/07	643	73.1	8.4	1,603	655.8	73.88	8.91	322.6	36.3	3,771
8	9/26/07	675	77.3	8.3	1,602	689.1	78.18	8.83	336.9	38.2	3,771
9	9/26/07	666	70.2	8.4	1,609	679.7	70.87	8.90	334.1	34.8	3,771
10	9/26/07	684	76.3	8.3	1,613	697.5	77.07	8.77	339.1	37.5	3,771
11	9/26/07	699	74.4	8.2	1,613	713.6	75.23	8.69	344.8	36.3	3,771
12	9/26/07	627	63.0	8.1	1,623	640.0	63.59	8.63	307.8	30.6	3,771
7	10/5/07	622	63.1	8.3	1,605	631.3	63.75	8.25	294.4	29.7	3,981
8	10/5/07	654	67.2	8.3	1,607	663.8	67.94	8.26	309.7	31.7	3,981
9	10/5/07	637	60.4	8.4	1,604	646.8	60.99	8.38	304.8	28.7	3,981
10	10/5/07	654	65.7	8.3	1,609	663.8	66.43	8.28	310.2	31.0	3,981
11	10/5/07	658	70.7	8.3	1,606	668.1	71.46	8.25	311.6	33.3	3,981
12	10/5/07	670	65.7	8.3	1,610	679.8	66.43	8.27	317.4	31.0	3,981
7	10/12/07	626	67.0	8.1	1,606	635.5	67.96	8.09	292.7	31.3	4,144
8	10/12/07	638	65.6	8.1	1,607	647.9	66.55	8.09	298.3	30.6	4,144
9	10/12/07	645	65.7	8.1	1,603	655.2	66.66	8.09	301.8	30.7	4,144
10	10/12/07	656	67.5	8.1	1,608	666.1	68.48	8.13	307.8	31.6	4,144
11	10/12/07	601	66.8	8.0	1,609	610.8	67.84	8.02	279.7	31.1	4,144
12	10/12/07	678	63.0	8.3	1,613	689.1	63.93	8.26	321.6	29.8	4,144
7	10/18/07	633	74.3	8.4	1,603	650.1	75.92	8.42	307.2	35.9	4,284
8	10/18/07	642	74.4	8.4	1,604	659.1	75.99	8.42	311.6	35.9	4,284
9	10/18/07	646	66.9	8.5	1,602	663.2	68.31	8.48	315.1	32.5	4,284
10	10/18/07	642	67.5	8.4	1,609	659.4	68.92	8.39	311.1	32.5	4,284
11	10/18/07	649	72.2	8.2	1,613	666.8	73.78	8.23	310.4	34.3	4,284
12	10/18/07	680	70.7	8.3	1,614	698.0	72.17	8.28	326.4	33.7	4,284
7	10/26/07	636	73.2	7.8	1,610	648.0	72.92	8.12	299.3	33.7	4,470
8	10/26/07	654	71.4	7.9	1,614	666.4	71.12	8.18	309.1	33.0	4,470
9	10/26/07	665	72.8	7.8	1,611	677.8	72.48	8.12	312.9	33.5	4,470
10	10/26/07	667	73.6	7.7	1,612	679.5	73.33	8.03	311.6	33.6	4,470
11	10/26/07	637	66.4	7.9	1,613	649.2	66.09	8.14	300.2	30.6	4,470
12	10/26/07	678	54.2	8.1	1,616	690.3	53.89	8.35	324.5	25.3	4,470
7	10/31/07	633	74.3	8.4	1,609	650.1	75.92	8.42	307.2	35.9	4,586
8	10/31/07	642	74.4	8.4	1,612	659.1	75.99	8.42	311.6	35.9	4,586
9	10/31/07	646	66.9	8.5	1,610	663.2	68.31	8.48	315.1	32.5	4,586
10	10/31/07	642	67.5	8.4	1,614	659.4	68.92	8.39	311.1	32.5	4,586
11	10/31/07	649	72.2	8.2	1,615	666.8	73.78	8.23	310.4	34.3	4,586
12	10/31/07	680	70.7	8.3	1,613	698.0	72.17	8.28	326.4	33.7	4,586
7	11/8/07	633	74.3	8.4	1,609	650.1	75.92	8.42	307.2	35.9	4,772
8	11/8/07	642	74.4	8.4	1,606	659.1	75.99	8.42	311.6	35.9	4,772
9	11/8/07	646	66.9	8.5	1,604	663.2	68.31	8.48	315.1	32.5	4,772
10	11/8/07	642	67.5	8.4	1,607	659.4	68.92	8.39	311.1	32.5	4,772
11	11/8/07	649	72.2	8.2	1,611	666.8	73.78	8.23	310.4	34.3	4,772
12	11/8/07	680	70.7	8.3	1,612	698.0	72.17	8.28	326.4	33.7	4,772
7	11/16/07	643	73.1	8.4	1,605	655.8	73.88	8.91	322.6	36.3	4,959
8	11/16/07	675	77.3	8.3	1,602	689.1	78.18	8.83	336.9	38.2	4,959
9	11/16/07	666	70.2	8.4	1,610	679.7	70.87	8.90	334.1	34.8	4,959
10	11/16/07	684	76.3	8.3	1,611	697.5	77.07	8.77	339.1	37.5	4,959
11	11/16/07	699	74.4	8.2	1,610	713.6	75.23	8.69	344.8	36.3	4,959
12	11/16/07	627	63.0	8.1	1,612	640.0	63.59	8.63	307.8	30.6	4,959
7	12/20/07	523	63.8	8.0	1,601	537.7	63.19	8.04	246.7	29.0	5,750
8	12/20/07	619	74.8	8.2	1,602	636.5	74.17	8.20	295.7	34.5	5,750
9	12/20/07	651	73.7	8.3	1,600	669.2	73.09	8.37	315.0	34.4	5,750
10	12/20/07	641	72.2	9.0	1,604	659.2	71.56	9.06	328.6	35.7	5,750
11	12/20/07	611	72.3	8.4	1,604	627.9	71.67	8.41	296.7	33.9	5,750
12	12/20/07	639	69.2	8.5	1,606	657.5	68.59	8.51	313.0	32.7	5,750
7	12/20/07	523	63.8	8.0	1,601	537.7	63.19	8.04	246.7	29.0	5,750
8	12/20/07	619	74.8	8.2	1,602	636.5	74.17	8.20	295.7	34.5	5,750
9	12/20/07	651	73.7	8.3	1,600	669.2	73.09	8.37	315.0	34.4	5,750
10	12/20/07	641	72.2	9.0	1,604	659.2	71.56	9.06	328.6	35.7	5,750
11	12/20/07	611	72.3	8.4	1,604	627.9	71.67	8.41	296.7	33.9	5,750
12	12/20/07	639	69.2	8.5	1,606	657.5	68.59	8.51	313.0	32.7	5,750
7	1/23/08	601	71.5	9.3	1,601	614.6	70.72	9.32	313.0	36.0	6,542
8	1/23/08	668	73.0	8.5	1,605	683.1	72.21	8.53	325.8	34.4	6,542
9	1/23/08	678	73.7	8.9	1,605	692.9	72.88	8.83	338.8	35.6	6,542

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
10	1/23/08	664	70.0	8.7	1,606	679.3	69.21	8.67	327.7	33.4	6,542
11	1/23/08	632	75.2	8.7	1,609	645.9	74.34	8.73	313.1	36.0	6,542
12	1/23/08	672	76.2	8.9	1,609	687.6	75.38	8.83	336.1	36.8	6,542
7	2/27/08	635	75.5	10.1	1,601	638.5	76.12	10.14	350.0	41.7	7,356
8	2/27/08	668	69.6	9.5	1,603	671.8	70.14	9.58	350.1	36.6	7,356
9	2/27/08	664	68.5	9.1	1,604	667.6	69.03	9.14	335.0	34.6	7,356
10	2/27/08	680	73.8	8.9	1,602	683.1	74.40	9.00	338.6	36.9	7,356
11	2/27/08	647	76.4	9.4	1,608	650.1	77.07	9.49	336.2	39.9	7,356
12	2/27/08	666	69.0	9.6	1,605	669.2	69.57	9.64	350.7	36.5	7,356
10	3/26/08	598	71.7	8.1	1,601	612.8	71.18	8.02	280.6	32.6	8,008
11	3/26/08	598	70.9	9.4	1,604	613.0	70.43	9.41	314.7	36.2	8,008
12	3/26/08	678	69.7	9.1	1,613	694.1	69.19	9.09	346.9	34.6	8,008
7	3/27/08	616	72.6	9.2	1,601	631.4	72.04	9.14	316.9	36.2	8,032
8	3/27/08	661	74.4	9.5	1,607	677.2	73.86	9.44	348.7	38.0	8,032
9	3/27/08	678	55.5	9.6	1,602	694.8	55.01	9.57	361.7	28.6	8,032
7	4/24/08	583	64.0	8.5	1,615	593.5	64.28	8.49	282.2	30.6	8,683
8	4/24/08	629	66.1	8.8	1,601	640.1	66.39	8.73	310.3	32.2	8,683
9	4/24/08	629	74.9	8.1	1,591	640.8	75.25	8.07	294.7	34.6	8,683
10	4/24/08	603	66.9	8.5	1,606	614.3	67.22	8.42	290.5	31.8	8,683
11	4/24/08	620	70.2	8.7	1,610	631.7	70.56	8.63	303.9	33.9	8,683
12	4/24/08	675	72.8	8.8	1,617	687.2	73.13	8.79	334.9	35.6	8,683
7	5/29/08	610	71.7	8.2	1,607	620.9	72.44	8.19	288.3	33.6	9,498
8	5/29/08	661	74.2	8.7	1,604	673.5	74.94	8.66	324.6	36.1	9,498
9	5/29/08	657	79.0	8.2	1,606	668.8	79.79	8.16	309.7	36.9	9,498
10	5/29/08	648	82.0	7.9	1,607	660.0	82.80	7.84	298.2	37.4	9,498
11	5/29/08	687	79.7	8.5	1,608	699.5	80.53	8.45	331.5	38.2	9,498
12	5/29/08	687	59.8	8.9	1,606	699.4	60.41	8.85	342.4	29.6	9,498
7	6/24/08	635	82.4	8.2	1,604	645.5	82.81	8.20	299.9	38.5	10,104
8	6/24/08	676	77.5	8.5	1,601	687.1	77.89	8.46	325.9	36.9	10,104
9	6/24/08	640	69.0	8.3	1,603	650.9	69.25	8.31	305.0	32.4	10,104
10	6/24/08	625	76.8	8.3	1,602	635.8	77.16	8.27	297.1	36.1	10,104
11	6/24/08	619	72.7	8.3	1,604	629.0	73.01	8.24	293.1	34.0	10,104
12	6/24/08	682	54.1	8.6	1,618	694.1	54.24	8.62	333.5	26.1	10,104
7	7/31/08	579	73.4	8.4	1,602	586.2	73.29	8.40	276.7	34.6	10,965
8	7/31/08	673	75.2	9.2	1,609	681.6	75.10	9.22	344.3	37.9	10,965
9	7/31/08	609	68.2	9.3	1,601	616.8	68.04	9.32	314.3	34.7	10,965
10	7/31/08	616	74.2	8.6	1,607	623.6	74.10	8.61	299.3	35.6	10,965
11	7/31/08	634	68.6	8.5	1,614	642.1	68.45	8.50	305.6	32.6	10,965
12	7/31/08	671	70.9	7.8	1,611	679.6	70.77	7.79	305.8	31.8	10,965
7	8/28/08	620	70.2	8.7	1,603	631.8	70.49	8.84	309.1	34.5	11,617
8	8/28/08	629	74.9	8.1	1,605	640.8	75.24	8.23	298.3	35.0	11,617
9	8/28/08	675	72.8	8.8	1,610	687.2	73.12	8.94	339.1	36.1	11,617
10	8/28/08	583	64.0	8.5	1,607	593.5	64.22	8.64	285.5	30.9	11,617
11	8/28/08	603	66.9	8.5	1,604	614.3	67.15	8.64	295.5	32.3	11,617
12	8/28/08	629	66.1	8.8	1,612	640.1	66.34	8.94	315.8	32.7	11,617
7	10/1/08	590	71.5	8.5	1,610	605.5	71.57	8.50	288.1	34.1	12,408
8	10/1/08	615	74.2	8.6	1,603	630.6	74.28	8.60	302.5	35.6	12,408
9	10/1/08	584	76.5	8.6	1,608	599.4	76.59	8.60	287.5	36.7	12,408
10	10/1/08	552	71.5	8.6	1,613	566.7	71.57	8.60	271.8	34.3	12,408
11	10/1/08	548	71.7	8.6	1,611	562.3	71.77	8.60	269.7	34.4	12,408
12	10/1/08	577	72.5	8.5	1,613	592.1	72.58	8.50	281.7	34.5	12,408
7	10/30/08	583	79.9	8.5	1,601	599.8	79.50	8.60	287.8	38.1	13,083
8	10/30/08	642	79.7	8.7	1,601	660.8	79.30	8.81	322.3	38.7	13,083
9	10/30/08	609	72.4	10.5	1,601	626.6	72.02	10.63	359.9	41.4	13,083
10	10/30/08	569	77.8	8.8	1,600	585.2	77.41	8.91	287.9	38.1	13,083
11	10/30/08	587	70.5	8.7	1,604	604.2	70.13	8.81	294.7	34.2	13,083
12	10/30/08	606	70.0	8.7	1,610	622.9	69.63	8.81	303.9	34.0	13,083
7	11/19/08	508	72.1	8.7	1,605	522.5	72.20	8.70	252.7	34.9	13,549
8	11/19/08	525	75.3	8.8	1,601	540.2	75.42	8.80	263.4	36.8	13,549
9	11/19/08	535	74.0	8.8	1,613	551.3	74.11	8.80	268.8	36.1	13,549
10	11/19/08	535	72.7	8.7	1,611	551.3	72.80	8.70	266.6	35.2	13,549
11	11/19/08	591	75.7	8.7	1,603	608.3	75.82	8.70	294.2	36.7	13,549
12	11/19/08	570	70.9	8.7	1,601	587.4	70.99	8.70	284.1	34.3	13,549
7	12/29/08	535	73.3	8.7	1,610	545.1	71.47	8.68	263.2	34.5	14,480

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
8	12/29/08	532	76.1	8.7	1,612	541.3	74.21	8.68	261.4	35.8	14,480
9	12/29/08	559	74.2	8.5	1,607	569.1	72.35	8.48	270.4	34.4	14,480
10	12/29/08	563	75.3	8.6	1,612	573.2	73.43	8.58	274.6	35.2	14,480
11	12/29/08	588	75.7	8.6	1,614	598.4	73.82	8.58	286.6	35.4	14,480
12	12/29/08	605	73.5	8.7	1,607	616.6	71.66	8.68	297.8	34.6	14,480
7	1/27/09	608	75.6	8.7	1,520	627.0	74.58	8.73	303.8	36.1	15,155
8	1/27/09	601	74.1	8.7	1,520	620.1	73.09	8.73	300.5	35.4	15,155
9	1/27/09	592	75.5	8.7	1,520	610.6	74.48	8.73	295.9	36.1	15,155
10	1/27/09	585	74.4	8.7	1,520	603.3	73.38	8.73	292.4	35.6	15,155
11	1/27/09	580	74.1	9.4	1,520	597.5	73.09	9.44	307.5	37.6	15,155
12	1/27/09	625	75.1	8.9	1,607	644.4	74.08	8.93	317.6	36.5	15,155
7	2/25/09	614	76.9	8.8	1,520	631.6	75.86	8.76	307.0	36.9	15,830
8	2/25/09	609	78.8	8.7	1,520	625.8	77.76	8.66	301.7	37.5	15,830
9	2/25/09	594	79.9	8.6	1,520	610.7	78.85	8.56	292.0	37.7	15,830
10	2/25/09	588	80.4	8.6	1,520	604.7	79.35	8.56	289.2	37.9	15,830
11	2/25/09	584	79.7	8.5	1,520	600.5	78.66	8.46	284.8	37.3	15,830
12	2/25/09	584	80.4	8.5	1,520	600.6	79.35	8.46	284.9	37.6	15,830
7	3/27/09	565	72.7	8.4	1,560	583.5	71.92	8.37	274.8	33.9	16,529
8	3/27/09	558	71.5	8.4	1,565	576.9	70.72	8.36	271.5	33.3	16,529
9	3/27/09	549	72.7	8.4	1,560	567.1	71.92	8.33	266.2	33.8	16,529
10	3/27/09	542	72.3	8.4	1,560	559.4	71.52	8.32	262.4	33.5	16,529
11	3/27/09	542	74.4	8.4	1,560	559.7	73.61	8.31	262.3	34.5	16,529
12	3/27/09	539	73.9	8.4	1,560	557.1	73.11	8.36	262.1	34.4	16,529
7	4/30/09	504	74.8	8.5	1,560	516.8	74.38	8.49	245.7	35.4	17,320
8	4/30/09	492	78.0	8.5	1,565	503.9	77.59	8.47	239.2	36.8	17,320
9	4/30/09	498	76.8	8.5	1,560	510.2	76.39	8.46	242.0	36.2	17,320
10	4/30/09	542	77.2	8.4	1,560	555.1	76.79	8.37	261.4	36.2	17,320
11	4/30/09	492	77.0	8.5	1,560	503.8	76.59	8.47	239.1	36.4	17,320
12	4/30/09	489	77.2	8.5	1,560	500.8	76.79	8.46	237.5	36.4	17,320
7	6/24/09	611	78.3	7.9	1,560	628.1	78.00	7.93	285.7	35.5	18,601
8	6/24/09	619	78.7	7.9	1,565	637.2	78.40	7.91	289.4	35.6	18,601
9	6/24/09	612	79.9	7.9	1,560	629.7	79.60	7.90	285.8	36.1	18,601
10	6/24/09	597	78.9	7.9	1,560	614.2	78.60	7.88	278.3	35.6	18,601
11	6/24/09	606	79.7	7.9	1,560	623.5	79.40	7.91	283.2	36.1	18,601
12	6/24/09	593	79.3	7.9	1,560	610.3	79.00	7.87	276.4	35.8	18,601
7	7/30/09	623	77.2	7.9	1,560	623.0	76.65	7.95	283.8	34.9	19,439
8	7/30/09	620	78.1	7.9	1,565	620.0	77.56	7.93	282.0	35.3	19,439
9	7/30/09	622	78.3	7.9	1,560	622.2	77.74	7.95	283.4	35.4	19,439
10	7/30/09	624	80.7	7.9	1,560	623.6	80.12	7.99	284.9	36.6	19,439
11	7/30/09	617	78.9	7.9	1,560	616.8	78.33	7.94	280.7	35.6	19,439
12	7/30/09	614	78.3	7.9	1,560	614.1	77.72	7.99	280.6	35.5	19,439
7	8/27/09	642	80.9	7.9	1,560	671.4	79.93	7.60	297.7	35.4	20,091
8	8/27/09	610	78.0	8.0	1,565	638.0	76.98	7.78	286.9	34.6	20,091
9	8/27/09	533	82.2	7.8	1,560	557.3	81.19	7.49	245.2	35.7	20,091
10	8/27/09	538	78.6	7.7	1,560	563.1	77.66	7.48	247.6	34.1	20,091
11	8/27/09	553	79.3	8.1	1,560	578.0	78.29	7.81	260.5	35.3	20,091
12	8/27/09	543	77.4	8.0	1,560	568.2	76.43	7.70	253.9	34.2	20,091
7	9/29/09	627	77.8	8.75	1,560	646.39	76.35	8.63	310.88	36.7	20,859
8	9/29/09	618	77.2	8.72	1,565	636.71	75.76	8.60	305.47	36.3	20,859
9	9/29/09	602	77.3	8.70	1,560	619.92	75.86	8.58	296.93	36.3	20,859
10	9/29/09	593	77.4	8.7	1,560	610.44	75.96	8.58	292.39	36.4	20,859
11	9/29/09	585	78.0	8.7	1,560	603.12	76.55	8.58	288.88	36.7	20,859
12	9/29/09	593	77.4	8.7	1,560	610.44	75.96	8.58	292.39	36.4	20,859
7	11/16/09	619	79.0	8.67	1,560	651.47	78.94	8.55	311.28	37.7	21,976
8	11/16/09	593	77.9	8.83	1,565	624.00	77.84	8.71	302.10	37.7	21,976
9	11/16/09	547	78.1	8.72	1,560	575.26	78.04	8.60	275.99	37.4	21,976
10	11/16/09	560	79.7	8.9	1,560	589.05	79.65	8.78	286.85	38.8	21,976
11	11/16/09	567	77.8	8.7	1,560	597.16	77.74	8.53	284.86	37.1	21,976
12	11/16/09	560	78.0	8.6	1,560	588.95	77.94	8.52	280.71	37.1	21,976
7	12/3/09	573	77.3	8.63	1,520	573.74	77.15	8.63	275.88	37.1	22,372
8	12/3/09	600	77.7	8.83	1,520	600.31	77.55	8.83	293.44	37.9	22,372
9	12/3/09	580	78.8	8.61	1,520	580.35	78.65	8.61	278.61	37.8	22,372
10	12/3/09	565	79.5	8.9	1,520	565.41	79.35	8.94	278.92	39.1	22,372

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
11	12/3/09	592	78.1	8.7	1,520	592.39	77.95	8.69	286.25	37.7	22,372
12	12/3/09	619	77.2	8.7	1,520	619.66	77.05	8.68	299.18	37.2	22,372
7	1/14/10	526	79.1	8.71	1,560	541.04	79.15	8.71	261.87	38.3	23,350
8	1/14/10	526	80.2	8.71	1,565	541.35	80.25	8.71	262.02	38.8	23,350
9	1/14/10	526	79.1	8.75	1,560	541.25	79.15	8.75	262.83	38.4	23,350
10	1/14/10	528	78.6	8.8	1,560	543.21	78.65	8.75	263.78	38.2	23,350
11	1/14/10	529	78.2	8.8	1,560	543.83	78.25	8.75	264.08	38.0	23,350
12	1/14/10	528	78.7	8.8	1,560	543.21	78.75	8.75	263.78	38.2	23,350
7	2/24/10	613	81.7	8.62	1,560	617.04	82.65	8.62	296.57	39.7	24,304
8	2/24/10	610	79.9	8.63	1,565	614.20	80.86	8.63	295.34	38.9	24,304
9	2/24/10	604	79.7	8.62	1,560	608.36	80.65	8.62	292.29	38.8	24,304
10	2/24/10	591	78.8	8.5	1,560	595.06	79.74	8.50	283.13	37.9	24,304
11	2/24/10	581	78.3	8.2	1,560	585.29	79.24	8.18	271.48	36.8	24,304
12	2/24/10	610	80.3	8.6	1,560	613.60	81.26	8.63	295.05	39.1	24,304
7	3/11/10	602	78.9	8.71	1,560	603.29	78.65	8.71	292.00	38.1	24,654
8	3/11/10	606	77.0	8.74	1,565	607.30	76.75	8.74	294.66	37.2	24,654
9	3/11/10	600	79.6	8.53	1,560	600.99	79.35	8.53	286.65	37.8	24,654
10	3/11/10	607	76.5	8.7	1,560	607.60	76.25	8.71	294.08	36.9	24,654
11	3/11/10	598	78.8	8.7	1,560	598.88	78.55	8.71	289.86	38.0	24,654
12	3/11/10	572	78.0	8.6	1,560	572.82	77.75	8.63	275.44	37.4	24,654
7	4/20/10	611	78.0	8.34	1,560	623.02	77.46	8.34	292.66	36.4	25,585
8	4/20/10	602	78.2	8.35	1,565	613.63	77.67	8.35	288.48	36.5	25,585
9	4/20/10	594	78.9	8.41	1,560	605.56	78.35	8.41	286.05	37.0	25,585
10	4/20/10	584	77.9	8.5	1,560	595.76	77.36	8.47	282.78	36.7	25,585
11	4/20/10	580	78.2	8.5	1,560	591.27	77.66	8.48	280.88	36.9	25,585
12	4/20/10	574	77.9	8.4	1,560	585.76	77.36	8.38	276.04	36.5	25,585
7	5/28/10	655	79.4	8.01	1,560	641.90	76.36	8.05	294.69	35.1	26,469
8	5/28/10	651	78.6	7.70	1,555	638.27	75.59	7.74	286.09	33.9	26,469
9	5/28/10	630	79.7	7.11	1,560	617.68	76.65	7.14	264.93	32.9	26,469
10	5/28/10	613	79.4	7.4	1,548	600.82	76.36	7.46	263.67	33.5	26,469
11	5/28/10	632	78.6	8.2	1,565	619.15	75.59	8.25	288.76	35.3	26,469
12	5/28/10	610	78.2	8.0	1,560	598.07	75.20	8.07	275.00	34.6	26,469
7	6/15/10	603	78.0	8.45	1,570	606.58	76.84	8.42	286.77	36.3	26,888
8	6/15/10	588	77.5	8.34	1,568	591.28	76.34	8.31	277.09	35.8	26,888
9	6/15/10	575	78.4	8.29	1,560	577.99	77.23	8.26	269.79	36.0	26,888
10	6/15/10	568	79.3	8.3	1,548	570.95	78.12	8.30	267.34	36.6	26,888
11	6/15/10	564	77.8	8.4	1,565	567.22	76.64	8.33	266.24	36.0	26,888
12	6/15/10	566	77.9	8.5	1,560	569.64	76.74	8.42	269.30	36.3	26,888
7	7/28/10	671	79.1	7.90	1,530	673.79	78.24	7.87	305.06	35.4	27,889
8	7/28/10	659	78.9	7.85	1,555	661.63	78.04	7.82	298.41	35.2	27,889
9	7/28/10	655	78.4	7.82	1,546	657.51	77.53	7.79	295.87	34.9	27,889
10	7/28/10	654	78.5	7.8	1,548	656.61	77.61	7.73	294.10	34.8	27,889
11	7/28/10	652	78.0	7.9	1,540	654.60	77.15	7.89	296.75	35.0	27,889
12	7/28/10	647	78.3	7.9	1,560	648.88	77.46	7.92	294.84	35.2	27,889
7	8/25/10	613	79.1	7.91	1,530	613.86	78.48	7.91	278.75	35.6	28,541
8	8/25/10	600	79.1	7.89	1,555	600.79	78.48	7.89	272.49	35.6	28,541
9	8/25/10	581	77.4	7.91	1,546	581.06	76.71	7.91	263.83	34.8	28,541
10	8/25/10	608	79.6	7.9	1,548	608.58	78.93	7.90	276.21	35.8	28,541
11	8/25/10	603	79.8	7.9	1,540	604.00	79.18	7.87	273.49	35.9	28,541
12	8/25/10	600	79.4	7.9	1,560	600.69	78.79	7.85	271.67	35.6	28,541
7	9/22/10	699	79.5	7.93	1,545	697.68	79.63	7.90	316.61	36.1	29,193
8	9/22/10	690	79.9	7.91	1,530	689.38	80.05	7.88	312.45	36.3	29,193
9	9/22/10	685	79.2	7.92	1,546	684.57	79.34	7.89	310.45	36.0	29,193
10	9/22/10	689	79.7	7.9	1,552	688.52	79.80	7.85	311.30	36.1	29,193
11	9/22/10	686	77.8	7.9	1,535	685.19	77.92	7.83	309.32	35.2	29,193
12	9/22/10	686	78.0	7.9	1,571	685.51	78.12	7.84	309.58	35.3	29,193
							Maximum		**361.7**	**41.7**	

Appendix I-2

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
7	4/27/07	506	53.1	8.4	1,592	513.86	53.22	8.39	242.29	25.1	233
7	4/30/07	537	68.6	8.3	1,594	541.92	68.17	8.31	253.98	32.0	303
7	5/1/07	534	70.4	8.5	1,584	542.94	70.46	8.45	257.33	33.4	326
7	5/2/07	527	62.3	8.4	1,586	535.64	62.38	8.39	252.59	29.4	349
7	5/3/07	526	66.5	8.6	1,584	533.42	66.12	8.55	254.87	31.6	372
7	5/4/07	525	63.1	8.6	1,579	533.52	63.05	8.55	254.94	30.1	396
7	5/7/07	537	69.8	8.5	1,585	543.90	68.95	8.50	258.87	32.8	466
7	5/8/07	548	72.2	8.3	1,578	558.43	72.59	8.34	262.33	34.1	489
7	5/9/07	551	62.5	8.3	1,588	557.66	63.24	8.27	260.42	29.5	512
7	5/10/07	576	59.3	8.2	1,600	582.16	59.00	8.25	271.42	27.5	535
7	5/11/07	559	60.6	8.2	1,580	568.23	60.47	8.23	264.70	28.2	559
7	5/14/07	576	67.6	8.5	1,587	581.46	67.52	8.49	276.44	32.1	629
7	5/15/07	582	62.1	8.4	1,590	586.00	62.01	8.36	275.76	29.2	652
7	5/16/07	568	61.1	8.3	1,596	573.11	61.12	8.27	267.82	28.6	675
7	5/17/07	598	68.9	8.3	1,587	598.80	68.24	8.26	279.59	31.9	698
7	5/18/07	563	70.5	8.3	1,593	570.57	70.52	8.32	267.52	33.1	722
7	5/21/07	567	72.9	8.3	1,597	577.41	72.98	8.28	270.00	34.1	792
7	5/22/07	611	73.3	8.3	1,580	616.39	73.03	8.29	288.44	34.2	815
7	5/23/07	601	66.4	8.3	1,589	607.60	65.97	8.30	284.44	30.9	838
7	5/24/07	572	66.1	8.2	1,591	574.97	65.46	8.16	266.37	30.3	861
7	5/25/07	557	65.2	8.2	1,592	561.13	64.56	8.20	260.78	30.0	885
7	5/29/07	590	66.4	8.2	1,593	592.86	65.01	8.18	274.97	30.2.	978
7	5/30/07	609	62.9	8.2	1,585	615.74	62.31	8.19	285.72	28.9	1,001
7	5/31/07	559	56.8	8.2	1,586	564.44	56.98	8.22	262.62	26.5	1,024
7	6/1/07	592	64.0	8.1	1,596	595.85	64.06	8.10	274.71	29.5	1,048
7	6/4/07	585	70.3	8.1	1,599	595.33	69.18	8.11	274.70	31.9	1,117
7	6/5/07	588	65.9	8.2	1,594	595.90	66.88	8.18	276.30	31.0	1,141
7	6/7/07	538	61.3	8.3	1,601	541.69	60.79	8.32	254.09	28.5	1,187
7	6/8/07	559	62.1	8.1	1,605	564.89	62.37	8.08	259.98	28.7	1,211
7	6/11/07	559	66.4	8.2	1,590	562.29	65.98	8.21	261.46	30.7	1,280
7	6/21/07	590	69.3	8.2	1,596	592.24	68.12	8.19	274.97	31.6	1,513
7	6/27/07	585	70.3	8.1	1,598	580.17	69.28	8.11	267.60	32.0	1,653
7	7/3/07	526	66.5	8.6	1,601	533.42	66.12	8.55	254.87	31.6	1,793
7	7/11/07	632	72.8	7.9	1,598	633.88	72.35	7.89	287.53	32.8	1,979
7	7/26/07	636	73.2	7.8	1,607	648.02	72.92	8.12	299.26	33.7	2,328
7	8/2/07	538	61.0	8.3	1,610	536.37	60.58	8.32	251.59	28.4	2,491
7	8/9/07	589	68.5	8.1	1,609	598.32	68.22	8.07	275.20	31.4	2,654
7	8/15/07	594	61.7	8.3	1,597	603.20	61.23	8.32	282.99	28.7	2,794
7	8/22/07	562	70.0	8.3	1,608	568.82	69.95	8.27	265.79	32.7	2,957
7	8/30/07	626	67.0	8.1	1,600	635.53	67.84	8.09	292.68	31.2	3,143
7	9/5/07	622	63.1	8.3	1,600	631.28	63.79	8.25	294.41	29.7	3,282
7	9/14/07	589	68.5	8.1	1,606	593.58	68.20	8.07	272.97	31.4	3,492
7	9/20/07	636	73.2	7.8	1,613	648.02	72.92	8.12	299.26	33.7	3,632
7	9/26/07	643	73.1	8.4	1,603	655.76	73.88	8.91	322.64	36.3	3,771
7	10/5/07	622	63.1	8.3	1,605	631.28	63.75	8.25	294.41	29.7	3,981
7	10/12/07	626	67.0	8.1	1,606	635.53	67.96	8.09	292.68	31.3	4,144
7	10/18/07	633	74.3	8.4	1,603	650.11	75.92	8.42	307.23	35.9	4,284
7	10/26/07	636	73.2	7.8	1,610	648.02	72.92	8.12	299.26	33.7	4,470
7	10/31/07	633	74.3	8.4	1,609	650.11	75.92	8.42	307.23	35.9	4,586
7	11/8/07	633	74.3	8.4	1,609	650.11	75.92	8.42	307.23	35.9	4,772
7	11/16/07	643	73.1	8.4	1,605	655.76	73.88	8.91	322.64	36.3	4,959
7	12/20/07	523	63.8	8.0	1,601	537.66	63.19	8.04	246.69	29.0	5,750
7	12/20/07	523	63.8	8.0	1,601	537.66	63.19	8.04	246.69	29.0	5,750
7	1/23/08	601	71.5	9.3	1,601	614.56	70.72	9.32	313.03	36.0	6,542
7	2/27/08	635	75.5	10.1	1,601	638.53	76.12	10.14	350.04	41.7	7,356
7	3/27/08	616	72.6	9.2	1,601	631.37	72.04	9.14	316.85	36.2	8,032
7	4/24/08	583	64.0	8.5	1,615	593.50	64.28	8.49	282.24	30.6	8,683
7	5/29/08	610	71.7	8.2	1,607	620.90	72.44	8.19	288.29	33.6	9,498
7	6/24/08	635	82.4	8.2	1,604	645.45	82.81	8.20	299.86	38.5	10,104
7	7/31/08	579	73.4	8.4	1,602	586.22	73.29	8.40	276.72	34.6	10,965
7	8/28/08	620	70.2	8.7	1,603	631.78	70.49	8.84	309.09	34.5	11,617
7	10/1/08	590	71.5	8.5	1,610	605.54	71.57	8.50	288.12	34.1	12,408
7	10/30/08	583	79.9	8.5	1,601	599.76	79.50	8.60	287.76	38.1	13,083
7	11/19/08	508	72.1	8.7	1,605	522.52	72.20	8.70	252.69	34.9	13,549
7	12/29/08	535	73.3	8.7	1,610	545.06	71.47	8.68	263.23	34.5	14,480
7	1/27/09	608	75.6	8.7	1,520	626.98	74.58	8.73	303.84	36.1	15,155
7	2/25/09	614	76.9	8.8	1,520	631.62	75.86	8.76	307.04	36.9	15,830
7	3/27/09	565	72.7	8.4	1,560	583.46	71.92	8.37	274.76	33.9	16,529
7	4/30/09	504	74.8	8.5	1,560	516.78	74.38	8.49	245.69	35.4	17,320
7	6/24/09	611	78.3	7.9	1,560	628.14	78.00	7.93	285.74	35.5	18,601
7	7/30/09	623	77.2	7.9	1,560	623.03	76.65	7.95	283.79	34.9	19,439
7	8/27/09	642	80.9	7.9	1,560	671.42	79.93	7.60	297.74	35.4	20,091
7	9/29/09	627	77.8	8.75	1,560	646.39	76.35	8.63	310.88	36.7	20,859

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
7	11/16/09	619	79.0	8.67	1,560	651.47	78.94	8.55	311.28	37.7	21,976
7	12/3/09	573	77.3	8.63	1,520	573.74	77.15	8.63	275.88	37.1	22,372
7	1/14/10	526	79.1	8.71	1,560	541.04	79.15	8.71	261.87	38.3	23,350
7	2/24/10	613	81.7	8.62	1,560	617.04	82.65	8.62	296.57	39.7	24,304
7	3/11/10	602	78.9	8.71	1,560	603.29	78.65	8.71	292.00	38.1	24,654
7	4/20/10	611	78.0	8.34	1,560	623.02	77.46	8.34	292.66	36.4	25,585
7	5/28/10	655	79.4	8.01	1,560	641.90	76.36	8.05	294.69	35.1	26,469
7	6/15/10	603	78.0	8.45	1,570	606.58	76.84	8.42	286.77	36.3	26,888
7	7/28/10	671	79.1	7.90	1,530	673.79	78.24	7.87	305.06	35.4	27,889
7	8/25/10	613	79.1	7.91	1,530	613.86	78.48	7.91	278.75	35.6	28,541
7	9/22/10	699	79.5	7.93	1,545	697.68	79.63	7.90	316.61	36.1	29,193

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
8	4/27/07	544	69.5	8.2	1,590	553.41	69.63	8.23	257.73	32.4	233
8	4/30/07	547	72.2	8.3	1,598	552.00	71.79	8.28	257.99	33.6	303
8	5/1/07	549	74.5	8.4	1,583	557.92	74.60	8.38	263.00	35.2	326
8	5/2/07	539	67.2	8.4	1,582	547.10	67.25	8.34	257.05	31.6	349
8	5/3/07	529	66.2	8.5	1,590	536.16	65.79	8.52	255.56	31.4	372
8	5/4/07	531	64.5	8.5	1,598	539.14	64.49	8.54	257.34	30.8	396
8	5/7/07	544	67.9	8.5	1,589	551.29	67.03	8.50	262.36	31.9	466
8	5/8/07	548	67.8	8.4	1,581	558.25	68.17	8.37	262.84	32.1	489
8	5/9/07	567	67.1	8.3	1,583	573.71	67.94	8.24	267.40	31.7	512
8	5/10/07	587	67.9	8.2	1,579	593.02	67.56	8.19	275.22	31.4	535
8	5/11/07	576	69.0	8.2	1,587	584.83	68.86	8.17	271.08	31.9	559
8	5/14/07	570	64.8	8.5	1,594	575.96	64.73	8.52	274.45	30.8	629
8	5/15/07	588	69.5	8.3	1,600	592.21	69.38	8.33	277.93	32.6	652
8	5/16/07	567	58.6	8.3	1,598	571.83	58.64	8.31	267.91	27.5	675
8	5/17/07	574	59.3	8.4	1,587	574.52	58.62	8.37	270.57	27.6	698
8	5/18/07	556	65.0	8.4	1,584	563.31	64.97	8.41	266.12	30.7	722
8	5/21/07	549	59.9	8.4	1,588	559.66	60.00	8.38	263.80	28.3	792
8	5/22/07	571	55.2	8.5	1,587	575.91	54.79	8.45	272.98	26.0	815
8	5/23/07	612	73.2	8.2	1,582	618.72	72.80	8.22	287.97	33.9	838
8	5/24/07	579	65.3	8.3	1,586	581.60	64.71	8.24	270.96	30.1	861
8	5/25/07	563	56.4	8.4	1,586	567.82	55.78	8.33	266.53	26.2	885
8	5/29/07	563	52.2	8.4	1,592	566.21	51.11	8.35	266.14	24.0	978
8	5/30/07	584	51.0	8.4	1,597	591.01	50.51	8.35	277.75	23.7	1,001
8	5/31/07	570	51.3	8.2	1,597	575.68	51.44	8.17	266.91	23.9	1,024
8	6/1/07	602	65.1	8.1	1,609	606.84	65.11	8.13	280.43	30.1	1,048
8	6/4/07	586	66.0	8.1	1,588	596.55	64.93	8.12	275.44	30.0	1,117
8	6/5/07	587	71.3	8.1	1,596	594.31	72.35	8.08	273.60	33.3	1,141
8	6/7/07	600	72.5	8.2	1,602	604.10	71.99	8.24	281.49	33.5	1,187
8	6/8/07	597	66.1	8.1	1,619	602.90	66.45	8.14	278.75	30.7	1,211
8	6/11/07	608	68.7	8.2	1,606	611.77	68.26	8.17	283.56	31.6	1,280
8	6/21/07	622	72.0	8.2	1,601	623.76	70.77	8.21	290.06	32.9	1,513
8	6/27/07	618	71.1	8.0	1,597	612.59	70.12	8.00	280.22	32.1	1,653
8	7/3/07	529	66.2	8.5	1,598	536.16	65.79	8.52	255.56	31.4	1,793
8	7/11/07	642	73.3	7.9	1,597	643.65	72.86	7.90	292.20	33.1	1,979
8	7/26/07	654	71.4	7.9	1,617	666.36	71.12	8.18	309.07	33.0	2,328
8	8/2/07	597	71.4	8.2	1,616	595.49	70.90	8.24	277.53	33.0	2,491
8	8/9/07	612	63.0	8.2	1,606	620.95	62.69	8.22	289.03	29.2	2,654
8	8/15/07	617	61.4	8.3	1,597	626.67	60.93	8.26	292.61	28.5	2,794
8	8/22/07	556	64.8	8.4	1,606	562.91	64.78	8.37	265.00	30.5	2,957
8	8/30/07	638	65.6	8.1	1,601	647.93	66.43	8.09	298.32	30.6	3,143
8	9/5/07	654	67.2	8.3	1,601	663.82	67.98	8.26	309.74	31.7	3,282
8	9/14/07	612	63.0	8.2	1,604	616.04	62.68	8.22	286.69	29.2	3,492
8	9/20/07	654	71.4	7.9	1,612	666.36	71.12	8.18	309.07	33.0	3,632
8	9/26/07	675	77.3	8.3	1,602	689.09	78.18	8.83	336.92	38.2	3,771
8	10/5/07	654	67.2	8.3	1,607	663.82	67.94	8.26	309.74	31.7	3,981
8	10/12/07	638	65.6	8.1	1,607	647.93	66.55	8.09	298.32	30.6	4,144
8	10/18/07	642	74.4	8.4	1,604	659.10	75.99	8.42	311.59	35.9	4,284
8	10/26/07	654	71.4	7.9	1,614	666.36	71.12	8.18	309.07	33.0	4,470
8	10/31/07	642	74.4	8.4	1,612	659.10	75.99	8.42	311.59	35.9	4,586
8	11/8/07	642	74.4	8.4	1,606	659.10	75.99	8.42	311.59	35.9	4,772
8	11/16/07	675	77.3	8.3	1,602	689.09	78.18	8.83	336.92	38.2	4,959
8	12/20/07	619	74.8	8.2	1,602	636.52	74.17	8.20	295.69	34.5	5,750
8	12/20/07	619	74.8	8.2	1,602	636.52	74.17	8.20	295.69	34.5	5,750
8	1/23/08	668	73.0	8.5	1,605	683.15	72.21	8.53	325.75	34.4	6,542
8	2/27/08	668	69.6	9.5	1,603	671.83	70.14	9.58	350.13	36.6	7,356
8	3/27/08	661	74.4	9.5	1,607	677.24	73.86	9.44	348.72	38.0	8,032
8	4/24/08	629	66.1	8.8	1,601	640.13	66.39	8.73	310.30	32.2	8,683
8	5/29/08	661	74.2	8.7	1,604	673.52	74.94	8.66	324.65	36.1	9,498
8	6/24/08	676	77.5	8.5	1,601	687.13	77.89	8.46	325.94	36.9	10,104
8	7/31/08	673	75.2	9.2	1,609	681.57	75.10	9.22	344.30	37.9	10,965
8	8/28/08	629	74.9	8.1	1,605	640.84	75.24	8.23	298.35	35.0	11,617
8	10/1/08	615	74.2	8.6	1,603	630.57	74.28	8.60	302.47	35.6	12,408
8	10/30/08	642	79.7	8.7	1,601	660.75	79.30	8.81	322.33	38.7	13,083
8	11/19/08	525	75.3	8.8	1,601	540.16	75.42	8.80	263.38	36.8	13,549
8	12/29/08	532	76.1	8.7	1,612	541.29	74.21	8.68	261.41	35.8	14,480
8	1/27/09	601	74.1	8.7	1,520	620.06	73.09	8.73	300.48	35.4	15,155
8	2/25/09	609	78.8	8.7	1,520	625.85	77.76	8.66	301.73	37.5	15,830
8	3/27/09	558	71.5	8.4	1,565	576.94	70.72	8.36	271.47	33.3	16,529
8	4/30/09	492	78.0	8.5	1,565	503.88	77.59	8.47	239.17	36.8	17,320
8	6/24/09	619	78.7	7.9	1,565	637.20	78.40	7.91	289.41	35.6	18,601
8	7/30/09	620	78.1	7.9	1,565	620.01	77.56	7.93	281.97	35.3	19,439
8	8/27/09	610	78.0	8.0	1,565	638.04	76.98	7.78	286.90	34.6	20,091
8	9/29/09	618	77.2	8.72	1,565	636.71	75.76	8.60	305.47	36.3	20,859

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
8	11/16/09	593	77.9	8.83	1,565	624.00	77.84	8.71	302.10	37.7	21,976
8	12/3/09	600	77.7	8.83	1,520	600.31	77.55	8.83	293.44	37.9	22,372
8	1/14/10	526	80.2	8.71	1,565	541.35	80.25	8.71	262.02	38.8	23,350
8	2/24/10	610	79.9	8.63	1,565	614.20	80.86	8.63	295.34	38.9	24,304
8	3/11/10	606	77.0	8.74	1,565	607.30	76.75	8.74	294.66	37.2	24,654
8	4/20/10	602	78.2	8.35	1,565	613.63	77.67	8.35	288.48	36.5	25,585
8	5/28/10	651	78.6	7.70	1,555	638.27	75.59	7.74	286.09	33.9	26,469
8	6/15/10	588	77.5	8.34	1,568	591.28	76.34	8.31	277.09	35.8	26,888
8	7/28/10	659	78.9	7.85	1,555	661.63	78.04	7.82	298.41	35.2	27,889
8	8/25/10	600	79.1	7.89	1,555	600.79	78.48	7.89	272.49	35.6	28,541
8	9/22/10	690	79.9	7.91	1,530	689.38	80.05	7.88	312.45	36.3	29,193

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
9	4/27/07	548	74.9	8.3	1,581	557.30	75.12	8.26	260.05	35.1	233
9	4/30/07	524	58.7	8.4	1,605	528.21	58.34	8.38	248.99	27.5	303
9	5/1/07	532	58.1	8.5	1,587	540.65	58.14	8.53	257.87	27.7	326
9	5/2/07	531	57.2	8.5	1,533	538.84	57.30	8.47	255.74	27.2	349
9	5/3/07	529	60.1	8.6	1,585	535.88	59.77	8.59	256.76	28.6	372
9	5/4/07	527	62.6	8.6	1,586	535.63	62.58	8.55	255.90	29.9	396
9	5/7/07	542	63.6	8.5	1,586	549.76	62.75	8.52	262.08	29.9	466
9	5/8/07	554	68.4	8.4	1,600	563.88	68.84	8.40	266.12	32.5	489
9	5/9/07	567	64.9	8.3	1,593	573.80	65.76	8.24	267.42	30.6	512
9	5/10/07	564	60.5	8.2	1,578	569.51	60.17	8.25	265.55	28.1	535
9	5/11/07	559	62.7	8.2	1,584	567.68	62.62	8.17	263.09	29.0	559
9	5/14/07	568	67.3	8.5	1,580	573.56	67.26	8.54	273.75	32.1	629
9	5/15/07	568	65.7	8.3	1,585	571.59	65.57	8.31	267.86	30.7	652
9	5/16/07	579	65.8	8.2	1,588	584.48	65.83	8.20	271.50	30.6	675
9	5/17/07	596	74.3	8.3	1,592	596.62	73.57	8.34	280.16	34.5	698
9	5/18/07	583	75.3	8.3	1,589	590.60	75.33	8.37	278.14	35.5	722
9	5/21/07	567	64.1	8.4	1,581	577.73	64.21	8.40	272.65	30.3	792
9	5/22/07	573	63.8	8.4	1,583	578.40	63.43	8.39	272.74	29.9	815
9	5/23/07	569	57.7	8.3	1,588	574.81	57.34	8.31	269.39	26.9	838
9	5/24/07	560	56.4	8.3	1,583	562.75	55.83	8.30	263.58	26.1	861
9	5/25/07	566	62.2	8.2	1,586	570.76	61.61	8.19	264.95	28.6	885
9	5/29/07	558	62.7	8.3	1,596	560.64	61.42	8.24	261.36	28.6	978
9	5/30/07	573	57.5	8.3	1,588	579.42	56.88	8.25	270.22	26.5	1,001
9	5/31/07	584	70.9	8.1	1,587	589.54	71.29	8.15	272.75	33.0	1,024
9	6/1/07	601	70.6	8.0	1,583	605.01	70.70	8.02	277.04	32.4	1,048
9	6/4/07	584	61.3	8.2	1,595	593.67	60.27	8.17	275.11	27.9	1,117
9	6/5/07	597	67.9	8.2	1,598	605.34	68.86	8.16	280.27	31.9	1,141
9	6/7/07	578	74.9	8.2	1,606	582.05	74.35	8.15	269.44	34.4	1,187
9	6/8/07	593	71.6	7.9	1,604	599.45	71.99	7.95	273.07	32.8	1,211
9	6/11/07	579	69.2	8.1	1,612	581.97	68.74	8.13	268.93	31.8	1,280
9	6/21/07	612	71.0	8.2	1,603	614.23	69.79	8.15	284.14	32.3	1,513
9	6/27/07	613	63.2	8.1	1,601	607.68	62.27	8.08	279.59	28.7	1,653
9	7/3/07	529	60.1	8.6	1,596	535.88	59.77	8.59	256.76	28.6	1,793
9	7/11/07	651	72.3	7.9	1,601	652.51	71.83	7.93	296.81	32.7	1,979
9	7/26/07	665	72.8	7.8	1,604	677.77	72.48	8.12	312.89	33.5	2,328
9	8/2/07	613	63.2	8.1	1,610	611.80	62.73	8.08	281.62	28.9	2,491
9	8/9/07	610	68.4	8.2	1,605	618.80	68.05	8.17	286.76	31.5	2,654
9	8/15/07	592	62.9	8.2	1,596	601.58	62.46	8.18	279.07	29.0	2,794
9	8/22/07	581	73.3	8.3	1,602	588.32	73.25	8.33	276.11	34.4	2,957
9	8/30/07	645	65.7	8.1	1,600	655.19	66.54	8.09	301.75	30.6	3,143
9	9/5/07	637	60.4	8.4	1,602	646.77	61.03	8.38	304.85	28.8	3,282
9	9/14/07	610	68.4	8.2	1,604	613.90	68.04	8.17	284.44	31.5	3,492
9	9/20/07	665	72.8	7.8	1,609	677.77	72.48	8.12	312.89	33.5	3,632
9	9/26/07	666	70.2	8.4	1,609	679.66	70.87	8.90	334.09	34.8	3,771
9	10/5/07	637	60.4	8.4	1,604	646.77	60.99	8.38	304.85	28.7	3,981
9	10/12/07	645	65.7	8.1	1,603	655.19	66.66	8.09	301.75	30.7	4,144
9	10/18/07	646	66.9	8.5	1,602	663.16	68.31	8.48	315.08	32.5	4,284
9	10/26/07	665	72.8	7.8	1,611	677.77	72.48	8.12	312.89	33.5	4,470
9	10/31/07	646	66.9	8.5	1,610	663.16	68.31	8.48	315.08	32.5	4,586
9	11/8/07	646	66.9	8.5	1,604	663.16	68.31	8.48	315.08	32.5	4,772
9	11/16/07	666	70.2	8.4	1,610	679.66	70.87	8.90	334.09	34.8	4,959
9	12/20/07	651	73.7	8.3	1,600	669.15	73.09	8.37	314.98	34.4	5,750
9	12/20/07	651	73.7	8.3	1,600	669.15	73.09	8.37	314.98	34.4	5,750
9	1/23/08	678	73.7	8.9	1,605	692.88	72.88	8.83	338.81	35.6	6,542
9	2/27/08	664	68.5	9.1	1,604	667.63	69.03	9.14	335.04	34.6	7,356
9	3/27/08	678	55.5	9.6	1,602	694.80	55.01	9.57	361.74	28.6	8,032
9	4/24/08	629	74.9	8.1	1,591	640.81	75.25	8.07	294.72	34.6	8,683
9	5/29/08	657	79.0	8.2	1,606	668.83	79.79	8.16	309.70	36.9	9,498
9	6/24/08	640	69.0	8.3	1,603	650.93	69.25	8.31	304.96	32.4	10,104
9	7/31/08	609	68.2	9.3	1,601	616.75	68.04	9.32	314.32	34.7	10,965
9	8/28/08	675	72.8	8.8	1,610	687.17	73.12	8.94	339.06	36.1	11,617
9	10/1/08	584	76.5	8.6	1,608	599.38	76.59	8.60	287.51	36.7	12,408
9	10/30/08	609	72.4	10.5	1,601	626.61	72.02	10.63	359.88	41.4	13,083
9	11/19/08	535	74.0	8.8	1,613	551.30	74.11	8.80	268.82	36.1	13,549
9	12/29/08	559	74.2	8.5	1,607	569.14	72.35	8.48	270.39	34.4	14,480
9	1/27/09	592	75.5	8.7	1,520	610.55	74.48	8.73	295.88	36.1	15,155
9	2/25/09	594	79.9	8.6	1,520	610.70	78.85	8.56	292.02	37.7	15,830
9	3/27/09	549	72.7	8.4	1,560	567.11	71.92	8.33	266.20	33.8	16,529
9	4/30/09	498	76.8	8.5	1,560	510.17	76.39	8.46	241.96	36.2	17,320
9	6/24/09	612	79.9	7.9	1,560	629.68	79.60	7.90	285.78	36.1	18,601
9	7/30/09	622	78.3	7.9	1,560	622.19	77.74	7.95	283.40	35.4	19,439
9	8/27/09	533	82.2	7.8	1,560	557.27	81.19	7.49	245.24	35.7	20,091
9	9/29/09	602	77.3	8.70	1,560	619.92	75.86	8.58	296.93	36.3	20,859

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
9	11/16/09	547	78.1	8.72	1,560	575.26	78.04	8.60	275.99	37.4	21,976
9	12/3/09	580	78.8	8.61	1,520	580.35	78.65	8.61	278.61	37.8	22,372
9	1/14/10	526	79.1	8.75	1,560	541.25	79.15	8.75	262.83	38.4	23,350
9	2/24/10	604	79.7	8.62	1,560	608.36	80.65	8.62	292.29	38.8	24,304
9	3/11/10	600	79.6	8.53	1,560	600.99	79.35	8.53	286.65	37.8	24,654
9	4/20/10	594	78.9	8.41	1,560	605.56	78.35	8.41	286.05	37.0	25,585
9	5/28/10	630	79.7	7.11	1,560	617.68	76.65	7.14	264.93	32.9	26,469
9	6/15/10	575	78.4	8.29	1,560	577.99	77.23	8.26	269.79	36.0	26,888
9	7/28/10	655	78.4	7.82	1,546	657.51	77.53	7.79	295.87	34.9	27,889
9	8/25/10	581	77.4	7.91	1,546	581.06	76.71	7.91	263.83	34.8	28,541
9	9/22/10	685	79.2	7.92	1,546	684.57	79.34	7.89	*310.45*	*36.0*	*29,193*

Appendix I-5

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
10	4/27/07	560	75.8	8.3	1,584	569.27	76.01	8.25	265.61	35.5	233
10	4/30/07	532	67.6	8.3	1,586	536.85	67.15	8.33	252.05	31.5	303
10	5/1/07	560	74.0	8.4	1,584	569.71	74.09	8.39	268.73	35.0	326
10	5/2/07	553	67.1	8.4	1,580	561.69	67.14	8.41	265.26	31.7	349
10	5/3/07	548	68.0	8.5	1,595	555.36	67.65	8.48	263.75	32.1	372
10	5/4/07	543	69.6	8.5	1,582	551.78	69.53	8.49	262.32	33.1	396
10	5/7/07	569	70.4	8.5	1,590	576.93	69.50	8.44	273.21	32.9	466
10	5/8/07	571	71.2	8.4	1,576	581.84	71.57	8.36	273.74	33.7	489
10	5/9/07	562	64.7	8.2	1,593	569.23	65.56	8.16	263.51	30.3	512
10	5/10/07	563	59.3	8.2	1,592	568.44	58.96	8.23	264.77	27.5	535
10	5/11/07	580	63.0	8.2	1,596	588.87	62.93	8.18	273.05	29.2	559
10	5/14/07	553	63.9	8.5	1,586	558.37	63.88	8.51	265.83	30.4	629
10	5/15/07	564	62.0	8.3	1,591	567.66	61.85	8.28	265.33	28.9	652
10	5/16/07	576	57.9	8.3	1,594	581.79	57.85	8.24	271.19	27.0	675
10	5/17/07	574	63.3	8.3	1,604	574.83	62.61	8.32	269.68	29.4	698
10	5/18/07	574	64.7	8.4	1,601	581.86	64.66	8.44	275.49	30.6	722
10	5/21/07	588	65.4	8.4	1,584	598.72	65.54	8.40	282.68	30.9	792
10	5/22/07	571	64.3	8.3	1,581	575.56	63.99	8.33	270.20	30.0	815
10	5/23/07	592	66.5	8.2	1,582	598.03	66.15	8.22	278.27	30.8	838
10	5/24/07	597	67.5	8.2	1,584	600.07	66.84	8.21	279.02	31.1	861
10	5/25/07	595	65.9	8.1	1,589	599.68	65.22	8.11	276.71	30.1	885
10	5/29/07	624	66.1	8.3	1,592	627.37	64.81	8.25	292.60	30.2	978
10	5/30/07	571	58.1	8.3	1,596	577.53	57.55	8.25	269.42	26.8	1,001
10	5/31/07	585	54.6	8.2	1,585	590.79	54.83	8.17	273.82	25.4	1,024
10	6/1/07	590	61.9	8.0	1,595	594.19	61.95	8.02	272.26	28.4	1,048
10	6/4/07	608	70.5	8.0	1,586	618.29	69.35	8.03	283.51	31.8	1,117
10	6/5/07	614	71.7	8.0	1,597	621.64	72.76	8.00	284.23	33.3	1,141
10	6/7/07	549	60.8	8.3	1,610	553.17	60.29	8.27	258.39	28.2	1,187
10	6/8/07	561	57.0	8.0	1,606	567.27	57.22	8.03	260.03	26.2	1,211
10	6/11/07	585	66.0	8.2	1,604	587.96	65.55	8.16	272.39	30.4	1,280
10	6/21/07	624	67.2	8.2	1,600	625.59	66.02	8.17	289.91	30.6	1,513
10	6/27/07	640	66.8	7.9	1,596	634.30	65.79	7.92	288.22	29.9	1,653
10	7/3/07	548	68.0	8.5	1,600	555.36	67.65	8.48	263.75	32.1	1,793
10	7/11/07	638	65.7	8.0	1,596	639.61	65.29	7.95	291.29	29.7	1,979
10	7/26/07	667	73.6	7.7	1,608	679.48	73.33	8.03	311.61	33.6	2,328
10	8/2/07	549	60.8	8.3	1,613	547.99	60.35	8.27	255.97	28.2	2,491
10	8/9/07	614	64.6	8.0	1,614	623.73	64.31	8.03	285.99	29.5	2,654
10	8/15/07	613	62.8	8.0	1,600	622.72	62.32	8.03	285.41	28.6	2,794
10	8/22/07	574	64.3	8.4	1,604	581.06	64.24	8.40	274.16	30.3	2,957
10	8/30/07	656	67.5	8.1	1,611	666.10	68.36	8.13	307.77	31.6	3,143
10	9/5/07	654	65.7	8.3	1,603	663.76	66.47	8.28	310.24	31.1	3,282
10	9/14/07	614	64.6	8.0	1,608	618.79	64.31	8.03	283.67	29.5	3,492
10	9/20/07	667	73.6	7.7	1,610	679.48	73.33	8.03	311.61	33.6	3,632
10	9/26/07	684	76.3	8.3	1,613	697.50	77.07	8.77	339.13	37.5	3,771
10	10/5/07	654	65.7	8.3	1,609	663.76	66.43	8.28	310.24	31.0	3,981
10	10/12/07	656	67.5	8.1	1,608	666.10	68.48	8.13	307.77	31.6	4,144
10	10/18/07	642	67.5	8.4	1,609	659.39	68.92	8.39	311.05	32.5	4,284
10	10/26/07	667	73.6	7.7	1,612	679.48	73.33	8.03	311.61	33.6	4,470
10	10/31/07	642	67.5	8.4	1,614	659.39	68.92	8.39	311.05	32.5	4,586
10	11/8/07	642	67.5	8.4	1,607	659.39	68.92	8.39	311.05	32.5	4,772
10	11/16/07	684	76.3	8.3	1,611	697.50	77.07	8.77	339.13	37.5	4,959
10	12/20/07	641	72.2	9.0	1,604	659.19	71.56	9.06	328.56	35.7	5,750
10	1/23/08	664	70.0	8.7	1,606	679.28	69.21	8.67	327.73	33.4	6,542
10	2/27/08	680	73.8	8.9	1,602	683.12	74.40	9.00	338.57	36.9	7,356
10	3/26/08	598	71.7	8.1	1,601	612.75	71.18	8.02	280.62	32.6	8,008
10	4/24/08	603	66.9	8.5	1,606	614.26	67.22	8.42	290.50	31.8	8,683
10	5/29/08	648	82.0	7.9	1,607	659.96	82.80	7.84	298.20	37.4	9,498
10	6/24/08	625	76.8	8.3	1,602	635.76	77.16	8.27	297.08	36.1	10,104
10	7/31/08	616	74.2	8.6	1,607	623.65	74.10	8.61	299.29	35.6	10,965
10	8/28/08	583	64.0	8.5	1,607	593.49	64.22	8.64	285.51	30.9	11,617
10	10/1/08	552	71.5	8.6	1,613	566.66	71.57	8.60	271.81	34.3	12,408
10	10/30/08	569	77.8	8.8	1,600	585.15	77.41	8.91	287.86	38.1	13,083
10	11/19/08	535	72.7	8.7	1,611	551.30	72.80	8.70	266.61	35.2	13,549
10	12/29/08	563	75.3	8.6	1,612	573.22	73.43	8.58	274.56	35.2	14,480
10	1/27/09	585	74.4	8.7	1,520	603.32	73.38	8.73	292.38	35.6	15,155
10	2/25/09	588	80.4	8.6	1,520	604.73	79.35	8.56	289.17	37.9	15,830
10	3/27/09	542	72.3	8.4	1,560	559.45	71.52	8.32	262.39	33.5	16,529
10	4/30/09	542	77.2	8.4	1,560	555.05	76.79	8.37	261.36	36.2	17,320
10	6/24/09	597	78.9	7.9	1,560	614.24	78.60	7.88	278.34	35.6	18,601
10	7/30/09	624	80.7	7.9	1,560	623.56	80.12	7.99	284.91	36.6	19,439
10	8/27/09	538	78.6	7.7	1,560	563.11	77.66	7.48	247.63	34.1	20,091
10	9/29/09	593	77.4	8.7	1,560	610.44	75.96	8.58	292.39	36.4	20,859
10	11/16/09	560	79.7	8.9	1,560	589.05	79.65	8.78	286.85	38.8	21,976

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
10	12/3/09	565	79.5	8.9	1,520	565.41	79.35	8.94	278.92	39.1	22,372
10	1/14/10	528	78.6	8.8	1,560	543.21	78.65	8.75	263.78	38.2	23,350
10	2/24/10	591	78.8	8.5	1,560	595.06	79.74	8.50	283.13	37.9	24,304
10	3/11/10	607	76.5	8.7	1,560	607.60	76.25	8.71	294.08	36.9	24,654
10	4/20/10	584	77.9	8.5	1,560	595.76	77.36	8.47	282.78	36.7	25,585
10	5/28/10	613	79.4	7.4	1,548	600.82	76.36	7.46	263.67	33.5	26,469
10	6/15/10	568	79.3	8.3	1,548	570.95	78.12	8.30	267.34	36.6	26,888
10	7/28/10	654	78.5	7.8	1,548	656.61	77.61	7.73	294.10	34.8	27,889
10	8/25/10	608	79.6	7.9	1,548	608.58	78.93	7.90	276.21	35.8	28,541
10	9/22/10	689	79.7	7.9	1,552	688.52	79.80	7.85	311.30	36.1	29,193

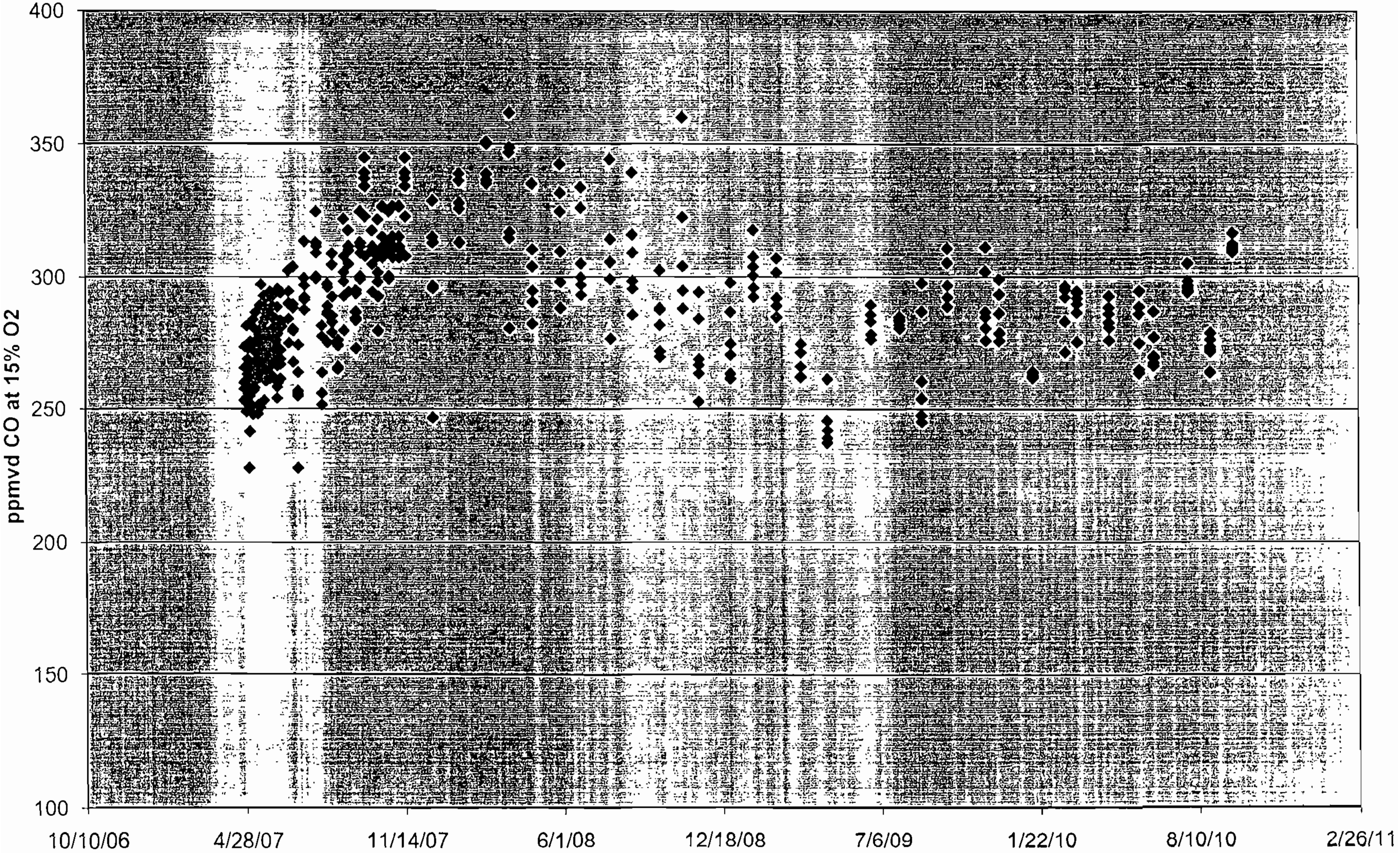
ICE	Date	Measured Stack Concentrations			Generator Output (kW)	Corrected for Instrument Calibration			Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
		CO (ppm)	NOx (ppm)	O2 (% Vol)		CO (ppm)	NOx (ppm)	O2 (% Vol)			
11	4/27/07	532	74.1	8.3	1,588	540.45	74.22	8.31	253.32	34.8	233
11	4/30/07	528	74.3	8.3	1,593	532.13	73.86	8.28	248.87	34.5	303
11	5/3/07	469	59.5	8.6	1,595	475.79	59.14	8.58	227.89	28.3	372
11	5/4/07	495	63.6	8.6	1,586	502.92	63.60	8.61	241.38	30.5	396
11	5/7/07	518	62.5	8.6	1,576	524.94	61.68	8.56	251.01	29.5	466
11	5/8/07	512	63.9	8.5	1,588	521.89	64.30	8.48	247.85	30.5	489
11	5/9/07	544	69.0	8.3	1,596	550.61	69.85	8.27	257.13	32.6	512
11	5/10/07	552	73.2	8.2	1,577	557.33	72.80	8.16	258.00	33.7	535
11	5/11/07	551	63.0	8.2	1,586	559.98	62.95	8.22	260.62	29.3	559
11	5/14/07	516	63.6	8.5	1,599	520.93	63.49	8.52	248.18	30.2	629
11	5/15/07	534	64.8	8.3	1,601	537.80	64.74	8.29	251.54	30.3	652
11	5/16/07	558	60.2	8.2	1,608	563.39	60.21	8.20	261.71	28.0	675
11	5/17/07	535	61.6	8.3	1,603	535.43	60.89	8.29	250.52	28.5	698
11	5/18/07	555	62.7	8.4	1,600	562.79	62.69	8.48	267.33	29.8	722
11	5/21/07	560	63.5	8.4	1,588	570.70	63.60	8.39	269.21	30.0	792
11	5/22/07	535	64.5	8.3	1,591	539.49	64.20	8.33	253.21	30.1	815
11	5/23/07	554	65.3	8.2	1,590	559.67	64.93	8.24	260.73	30.2	838
11	5/24/07	561	62.9	8.3	1,587	563.92	62.32	8.27	263.38	29.1	861
11	5/25/07	574	60.2	8.2	1,590	578.41	59.57	8.19	268.58	27.7	885
11	5/29/07	587	66.1	8.2	1,576	589.93	64.76	8.20	273.98	30.1	978
11	5/30/07	570	68.8	8.2	1,587	575.96	68.13	8.19	267.45	31.6	1,001
11	5/31/07	562	65.9	8.1	1,597	567.34	66.26	8.16	262.68	30.7	1,024
11	6/1/07	583	63.8	8.1	1,597	586.89	63.84	8.07	269.89	29.4	1,048
11	6/4/07	582	58.3	8.1	1,599	592.10	57.32	8.12	273.41	26.5	1,117
11	6/5/07	601	66.8	8.0	1,598	609.27	67.79	8.01	278.98	31.0	1,141
11	6/7/07	570	69.6	8.2	1,595	573.79	69.06	8.19	266.27	32.0	1,187
11	6/8/07	591	68.8	7.9	1,586	597.03	69.15	7.95	272.01	31.5	1,211
11	6/11/07	573	62.1	8.2	1,590	576.25	61.69	8.16	266.93	28.6	1,280
11	6/12/07	614	70.2	8.1	1,598	615.65	69.50	8.07	283.09	32.0	1,304
11	6/13/07	609	67.1	8.1	1,580	608.61	66.42	8.14	281.34	30.7	1,327
11	6/21/07	635	73.9	8.2	1,598	636.59	72.62	8.15	294.54	33.6	1,513
11	6/27/07	639	65.9	8.0	1,594	633.13	64.99	8.00	289.56	29.7	1,653
11	7/3/07	469	59.5	8.6	1,602	475.79	59.14	8.58	227.89	28.3	1,793
11	7/11/07	657	72.7	7.9	1,594	658.51	72.23	7.93	299.53	32.9	1,979
11	7/26/07	637	66.4	7.9	1,610	649.16	66.09	8.14	300.25	30.6	2,328
11	8/2/07	570	69.6	8.2	1,615	568.42	69.11	8.19	263.78	32.1	2,491
11	8/9/07	630	66.9	8.2	1,616	639.43	66.58	8.16	296.17	30.8	2,654
11	8/15/07	645	69.1	8.2	1,605	655.28	68.65	8.21	304.63	31.9	2,794
11	8/22/07	554	61.7	8.4	1,605	561.21	61.62	8.44	265.64	29.2	2,957
11	8/30/07	601	66.8	8.0	1,602	610.82	67.72	8.02	279.71	31.0	3,143
11	9/5/07	658	70.7	8.3	1,603	668.11	71.50	8.25	311.58	33.3	3,282
11	9/14/07	630	66.9	8.2	1,610	634.37	66.57	8.16	293.77	30.8	3,492
11	9/20/07	637	66.4	7.9	1,610	649.16	66.09	8.14	300.25	30.6	3,632
11	9/26/07	699	74.4	8.2	1,613	713.65	75.23	8.69	344.79	36.3	3,771
11	10/5/07	658	70.7	8.3	1,606	668.11	71.46	8.25	311.58	33.3	3,981
11	10/12/07	601	66.8	8.0	1,609	610.82	67.84	8.02	279.71	31.1	4,144
11	10/18/07	649	72.2	8.2	1,613	666.76	73.78	8.23	310.40	34.3	4,284
11	10/26/07	637	66.4	7.9	1,613	649.16	66.09	8.14	300.25	30.6	4,470
11	10/31/07	649	72.2	8.2	1,615	666.76	73.78	8.23	310.40	34.3	4,586
11	11/8/07	649	72.2	8.2	1,611	666.76	73.78	8.23	310.40	34.3	4,772
11	11/16/07	699	74.4	8.2	1,610	713.65	75.23	8.69	344.79	36.3	4,959
11	12/20/07	611	72.3	8.4	1,604	627.92	71.67	8.41	296.66	33.9	5,750
11	12/20/07	611	72.3	8.4	1,604	627.92	71.67	8.41	296.66	33.9	5,750
11	1/23/08	632	75.2	8.7	1,609	645.91	74.34	8.73	313.07	36.0	6,542
11	2/27/08	647	76.4	9.4	1,608	650.10	77.07	9.49	336.22	39.9	7,356
11	3/26/08	598	70.9	9.4	1,604	612.99	70.43	9.41	314.66	36.2	8,008
11	4/24/08	620	70.2	8.7	1,610	631.75	70.56	8.63	303.89	33.9	8,683
11	5/29/08	687	79.7	8.5	1,608	699.46	80.53	8.45	331.53	38.2	9,498
11	6/24/08	619	72.7	8.3	1,604	629.00	73.01	8.24	293.13	34.0	10,104
11	7/31/08	634	68.6	8.5	1,614	642.11	68.45	8.50	305.61	32.6	10,965
11	8/28/08	603	66.9	8.5	1,604	614.26	67.15	8.64	295.51	32.3	11,617
11	10/1/08	548	71.7	8.6	1,611	562.25	71.77	8.60	269.70	34.4	12,408
11	10/30/08	587	70.5	8.7	1,604	604.18	70.13	8.81	294.73	34.2	13,083
11	11/19/08	591	75.7	8.7	1,603	608.35	75.82	8.70	294.20	36.7	13,549
11	12/29/08	588	75.7	8.6	1,614	598.42	73.82	8.58	286.63	35.4	14,480
11	1/27/09	580	74.1	9.4	1,520	597.54	73.09	9.44	307.51	37.6	15,155
11	2/25/09	584	79.7	8.5	1,520	600.51	78.66	8.46	284.82	37.3	15,830
11	3/27/09	542	74.4	8.4	1,560	559.65	73.61	8.31	262.28	34.5	16,529
11	4/30/09	492	77.0	8.5	1,560	503.78	76.59	8.47	239.12	36.4	17,320
11	6/24/09	606	79.7	7.9	1,560	623.50	79.40	7.91	283.19	36.1	18,601
11	7/30/09	617	78.9	7.9	1,560	616.84	78.33	7.94	280.75	35.6	19,439
11	8/27/09	553	79.3	8.1	1,560	578.02	78.29	7.81	260.52	35.3	20,091
11	9/29/09	585	78.0	8.7	1,560	603.12	76.55	8.58	288.88	36.7	20,859

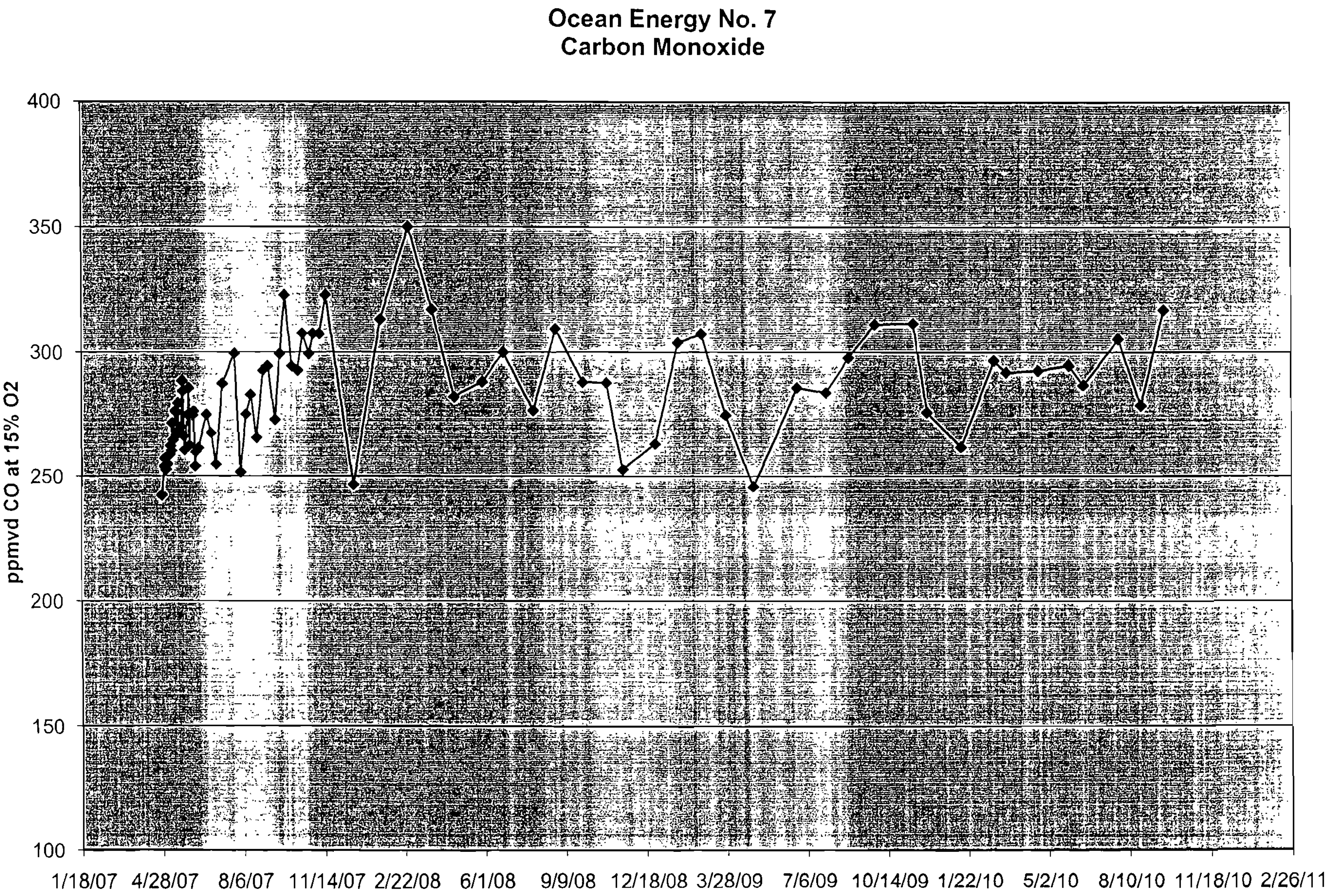
		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
11	11/16/09	567	77.8	8.7	1,560	597.16	77.74	8.53	284.86	37.1	21,976
11	12/3/09	592	78.1	8.7	1,520	592.39	77.95	8.69	286.25	37.7	22,372
11	1/14/10	529	78.2	8.8	1,560	543.83	78.25	8.75	264.08	38.0	23,350
11	2/24/10	581	78.3	8.2	1,560	585.29	79.24	8.18	271.48	36.8	24,304
11	3/11/10	598	78.8	8.7	1,560	598.88	78.55	8.71	289.86	38.0	24,654
11	4/20/10	580	78.2	8.5	1,560	591.27	77.66	8.48	280.88	36.9	25,585
11	5/28/10	632	78.6	8.2	1,565	619.15	75.59	8.25	288.76	35.3	26,469
11	6/15/10	564	77.8	8.4	1,565	567.22	76.64	8.33	266.24	36.0	26,888
11	7/28/10	652	78.0	7.9	1,540	654.60	77.15	7.89	296.75	35.0	27,889
11	8/25/10	603	79.8	7.9	1,540	604.00	79.18	7.87	273.49	35.9	28,541
11	9/22/10	686	77.8	7.9	1,535	685.19	77.92	7.83	309.32	35.2	29,193

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
12	4/27/07	573	71.3	8.3	1,613	582.41	71.49	8.34	273.55	33.6	233
12	4/30/07	594	73.3	8.3	1,615	599.40	72.89	8.33	281.40	34.2	303
12	5/1/07	562	61.0	8.6	1,610	571.35	61.01	8.55	272.97	29.2	326
12	5/2/07	569	62.9	8.5	1,613	577.55	62.95	8.48	274.26	29.9	349
12	5/3/07	564	64.5	8.6	1,616	571.77	64.09	8.60	274.16	30.7	372
12	5/4/07	566	65.8	8.6	1,604	575.20	65.75	8.58	275.49	31.5	396
12	5/7/07	582	68.3	8.5	1,614	590.25	67.43	8.51	281.14	32.1	466
12	5/8/07	586	68.8	8.5	1,623	597.05	69.16	8.49	283.83	32.9	489
12	5/9/07	595	65.7	8.3	1,615	602.27	66.54	8.24	280.62	31.0	512
12	5/10/07	570	65.9	8.2	1,612	576.27	65.50	8.21	267.83	30.4	535
12	5/11/07	603	66.3	8.3	1,616	612.56	66.19	8.29	286.54	31.0	559
12	5/14/07	566	70.4	8.5	1,601	571.31	70.39	8.53	272.60	33.6	629
12	5/15/07	587	72.9	8.3	1,602	590.71	72.88	8.33	277.16	34.2	652
12	5/16/07	616	68.5	8.2	1,621	622.15	68.58	8.21	289.20	31.9	675
12	5/17/07	587	71.3	8.3	1,609	587.13	70.64	8.25	273.82	32.9	698
12	5/18/07	616	72.2	8.5	1,604	624.35	72.23	8.50	297.11	34.4	722
12	5/21/07	605	67.9	8.5	1,603	616.95	68.04	8.47	292.81	32.3	792
12	5/22/07	572	68.0	8.4	1,648	576.82	67.65	8.44	273.17	32.0	815
12	5/23/07	588	65.9	8.3	1,592	594.79	65.57	8.33	279.23	30.8	838
12	5/24/07	619	66.4	8.4	1,612	621.89	65.76	8.34	292.05	30.9	861
12	5/25/07	606	66.0	8.3	1,614	610.54	65.32	8.30	285.95	30.6	885
12	5/29/07	624	72.6	8.3	1,622	627.53	71.11	8.33	294.52	33.4	978
12	5/30/07	584	64.6	8.3	1,628	591.07	64.03	8.28	276.22	29.9	1,001
12	5/31/07	624	60.4	8.2	1,628	629.78	60.67	8.20	292.53	28.2	1,024
12	6/1/07	617	55.1	8.2	1,612	621.61	55.07	8.21	288.90	25.6	1,048
12	6/4/07	619	55.5	8.3	1,623	629.34	54.58	8.29	294.38	25.5	1,117
12	6/5/07	625	55.9	8.2	1,620	633.49	56.71	8.21	294.63	26.4	1,141
12	6/7/07	615	70.8	8.2	1,608	619.77	70.29	8.23	288.66	32.7	1,187
12	6/8/07	641	73.9	8.0	1,606	648.11	74.31	7.97	295.63	33.9	1,211
12	6/11/07	624	65.1	8.3	1,609	627.38	64.62	8.30	293.81	30.3	1,280
12	6/21/07	648	71.7	8.2	1,602	650.21	70.49	8.22	302.45	32.8	1,513
12	6/27/07	675	74.2	7.9	1,608	669.24	73.18	7.90	303.72	33.2	1,653
12	7/3/07	564	64.5	8.6	1,610	571.77	64.09	8.60	274.16	30.7	1,793
12	7/11/07	684	65.2	8.0	1,608	685.78	64.79	7.99	313.31	29.6	1,979
12	7/26/07	678	54.2	8.1	1,614	690.29	53.89	8.35	324.52	25.3	2,328
12	8/9/07	639	62.7	8.0	1,621	648.47	62.38	8.03	297.39	28.6	2,654
12	8/15/07	658	63.6	8.1	1,606	668.62	63.15	8.13	308.84	29.2	2,794
12	8/22/07	564	64.5	8.6	1,609	571.38	64.41	8.59	273.96	30.9	2,957
12	8/30/07	678	63.0	8.3	1,607	689.06	63.81	8.26	321.65	29.8	3,143
12	9/5/07	670	65.7	8.3	1,609	679.76	66.47	8.27	317.43	31.0	3,282
12	9/14/07	639	62.7	8.0	1,610	643.33	62.38	8.03	294.98	28.6	3,492
12	9/20/07	678	54.2	8.1	1,613	690.29	53.89	8.35	324.52	25.3	3,632
12	9/26/07	627	63.0	8.1	1,623	640.01	63.59	8.63	307.80	30.6	3,771
12	10/5/07	670	65.7	8.3	1,610	679.76	66.43	8.27	317.43	31.0	3,981
12	10/12/07	678	63.0	8.3	1,613	689.06	63.93	8.26	321.65	29.8	4,144
12	10/18/07	680	70.7	8.3	1,614	698.01	72.17	8.28	326.39	33.7	4,284
12	10/26/07	678	54.2	8.1	1,616	690.29	53.89	8.35	324.52	25.3	4,470
12	10/31/07	680	70.7	8.3	1,613	698.01	72.17	8.28	326.39	33.7	4,586
12	11/8/07	680	70.7	8.3	1,612	698.01	72.17	8.28	326.39	33.7	4,772
12	11/16/07	627	63.0	8.1	1,612	640.01	63.59	8.63	307.80	30.6	4,959
12	12/20/07	639	69.2	8.5	1,606	657.51	68.59	8.51	313.00	32.7	5,750
12	12/20/07	639	69.2	8.5	1,606	657.51	68.59	8.51	313.00	32.7	5,750
12	1/23/08	672	76.2	8.9	1,609	687.62	75.38	8.83	336.13	36.8	6,542
12	2/27/08	666	69.0	9.6	1,605	669.20	69.57	9.64	350.74	36.5	7,356
12	3/26/08	678	69.7	9.1	1,613	694.11	69.19	9.09	346.90	34.6	8,008
12	4/24/08	675	72.8	8.8	1,617	687.17	73.13	8.79	334.90	35.6	8,683
12	5/29/08	687	59.8	8.9	1,606	699.37	60.41	8.85	342.43	29.6	9,498
12	6/24/08	682	54.1	8.6	1,618	694.11	54.24	8.62	333.55	26.1	10,104
12	7/31/08	671	70.9	7.8	1,611	679.64	70.77	7.79	305.78	31.8	10,965
12	8/28/08	629	66.1	8.8	1,612	640.13	66.34	8.94	315.85	32.7	11,617
12	10/1/08	577	72.5	8.5	1,613	592.10	72.58	8.50	281.73	34.5	12,408
12	10/30/08	606	70.0	8.7	1,610	622.90	69.63	8.81	303.86	34.0	13,083
12	11/19/08	570	70.9	8.7	1,601	587.41	70.99	8.70	284.07	34.3	13,549
12	12/29/08	605	73.5	8.7	1,607	616.57	71.66	8.68	297.77	34.6	14,480
12	1/27/09	625	75.1	8.9	1,607	644.43	74.08	8.93	317.59	36.5	15,155
12	2/25/09	584	80.4	8.5	1,520	600.61	79.35	8.46	284.87	37.6	15,830
12	3/27/09	539	73.9	8.4	1,560	557.07	73.11	8.36	262.12	34.4	16,529
12	4/30/09	489	77.2	8.5	1,560	500.79	76.79	8.46	237.51	36.4	17,320
12	6/24/09	593	79.3	7.9	1,560	610.33	79.00	7.87	276.36	35.8	18,601
12	7/30/09	614	78.3	7.9	1,560	614.13	77.72	7.99	280.61	35.5	19,439
12	8/27/09	543	77.4	8.0	1,560	568.16	76.43	7.70	253.90	34.2	20,091
12	9/29/09	593	77.4	8.7	1,560	610.44	75.96	8.58	292.39	36.4	20,859
12	11/16/09	560	78.0	8.6	1,560	588.95	77.94	8.52	280.71	37.1	21,976

		Measured Stack Concentrations				Corrected for Instrument Calibration					
ICE	Date	CO (ppm)	NOx (ppm)	O2 (% Vol)	Generator Output (kW)	CO (ppm)	NOx (ppm)	O2 (% Vol)	Corrected CO (ppm 15%O2)	Corrected NOx (ppm 15%O2)	Estimated Hours
12	12/3/09	619	77.2	8.7	1,520	619.66	77.05	8.68	299.18	37.2	22,372
12	1/14/10	528	78.7	8.8	1,560	543.21	78.75	8.75	263.78	38.2	23,350
12	2/24/10	610	80.3	8.6	1,560	613.60	81.26	8.63	295.05	39.1	24,304
12	3/11/10	572	78.0	8.6	1,560	572.82	77.75	8.63	275.44	37.4	24,654
12	4/20/10	574	77.9	8.4	1,560	585.76	77.36	8.38	276.04	36.5	25,585
12	5/28/10	610	78.2	8.0	1,560	598.07	75.20	8.07	275.00	34.6	26,469
12	6/15/10	566	77.9	8.5	1,560	569.64	76.74	8.42	269.30	36.3	26,888
12	7/28/10	647	78.3	7.9	1,560	648.88	77.46	7.92	294.84	35.2	27,889
12	8/25/10	600	79.4	7.9	1,560	600.69	78.79	7.85	271.67	35.6	28,541
12	9/22/10	686	78.0	7.9	1,571	685.51	78.12	7.84	309.58	35.3	29,193

Ocean Energy (all units)
Carbon Monoxide




Ocean Energy No. 7
Carbon Monoxide
ppmvd CO at 15% O2
400
350
300
250
200
150
100
1/18/07
4/28/07
8/6/07
11/14/07
2/22/08
6/1/08
9/9/08
12/18/08
3/28/09
7/6/09
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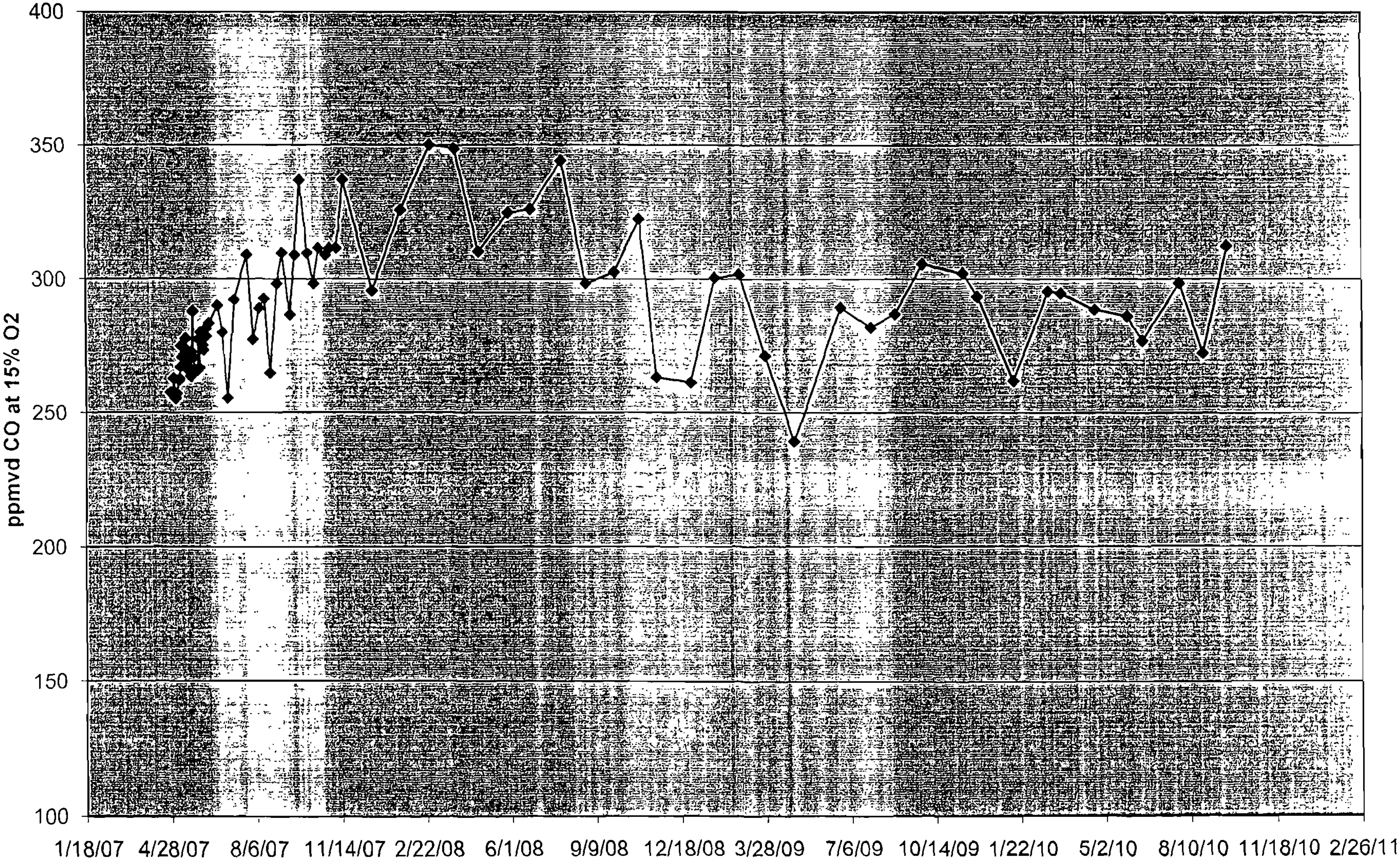
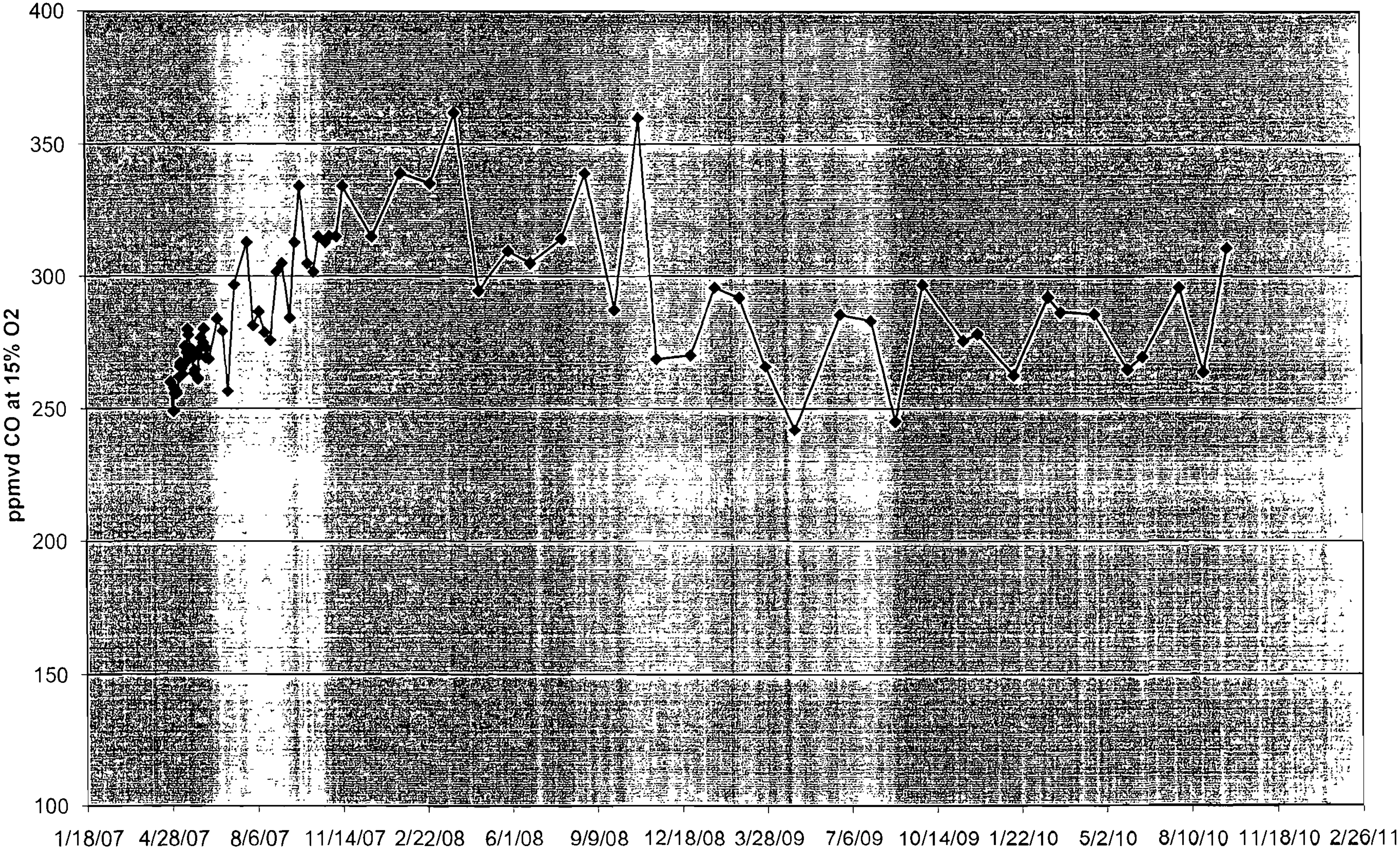
11/18/10
2/26/11

Ocean Energy No. 8
Carbon Monoxide



Ocean Energy No. 9
Carbon Monoxide



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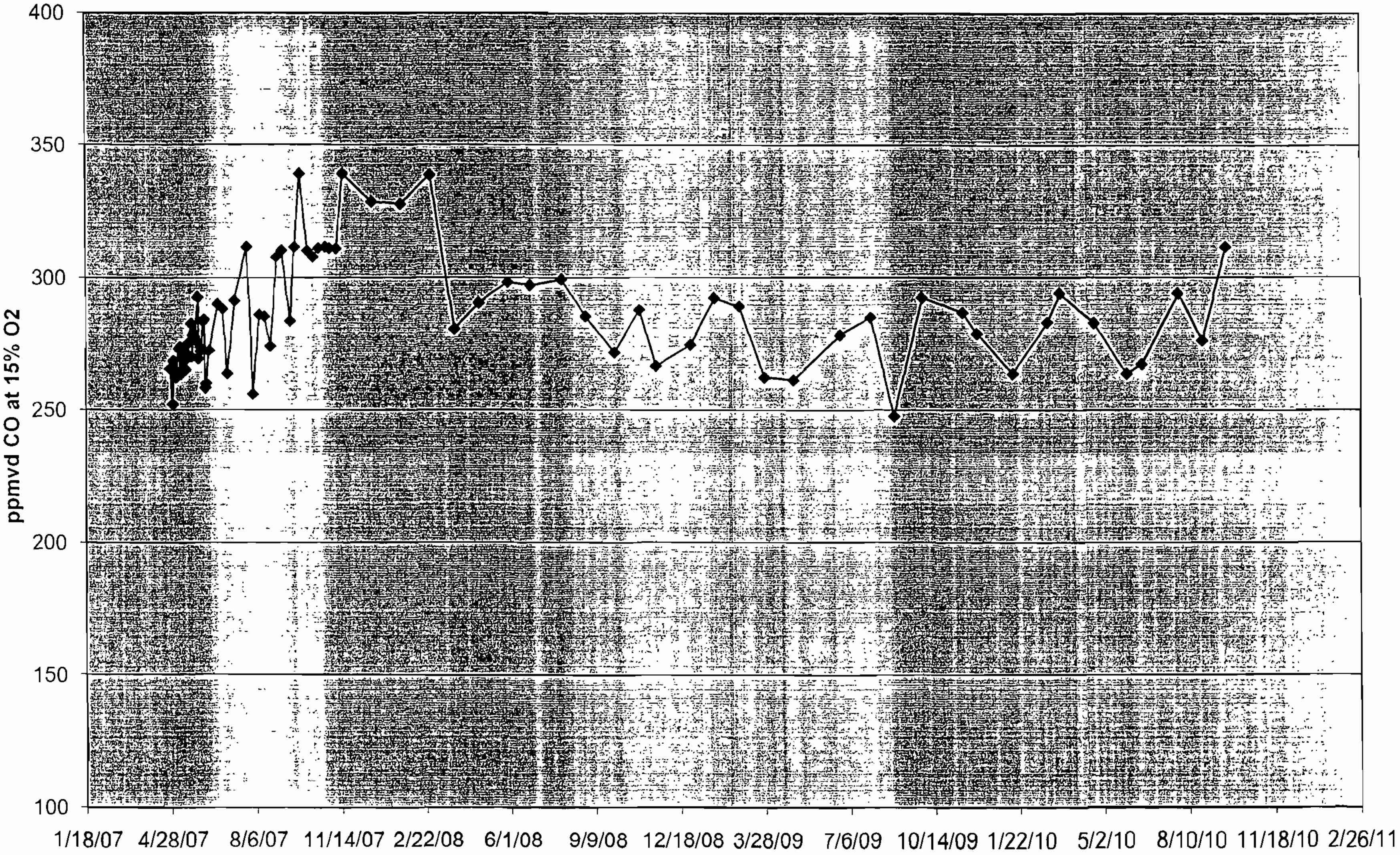
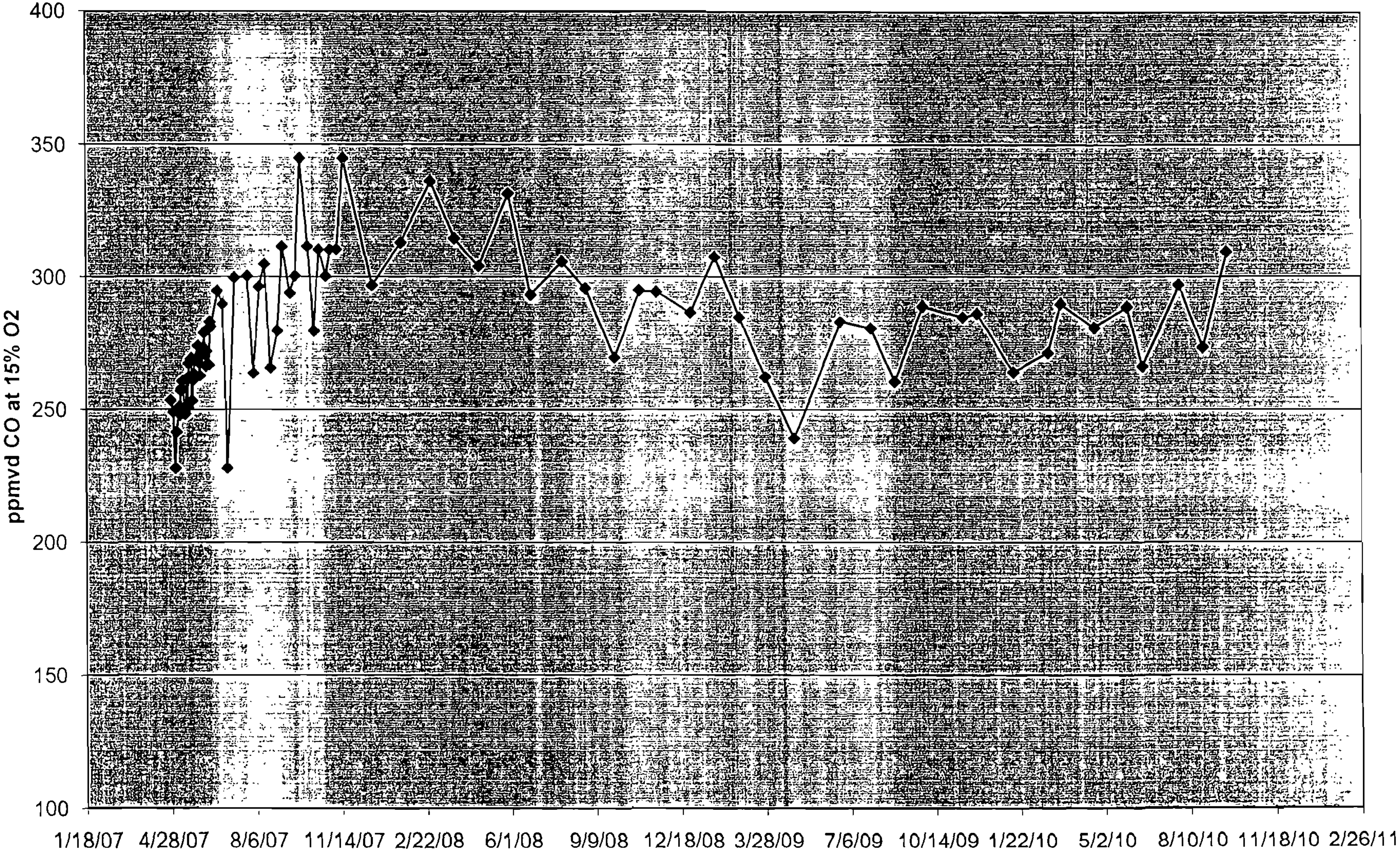
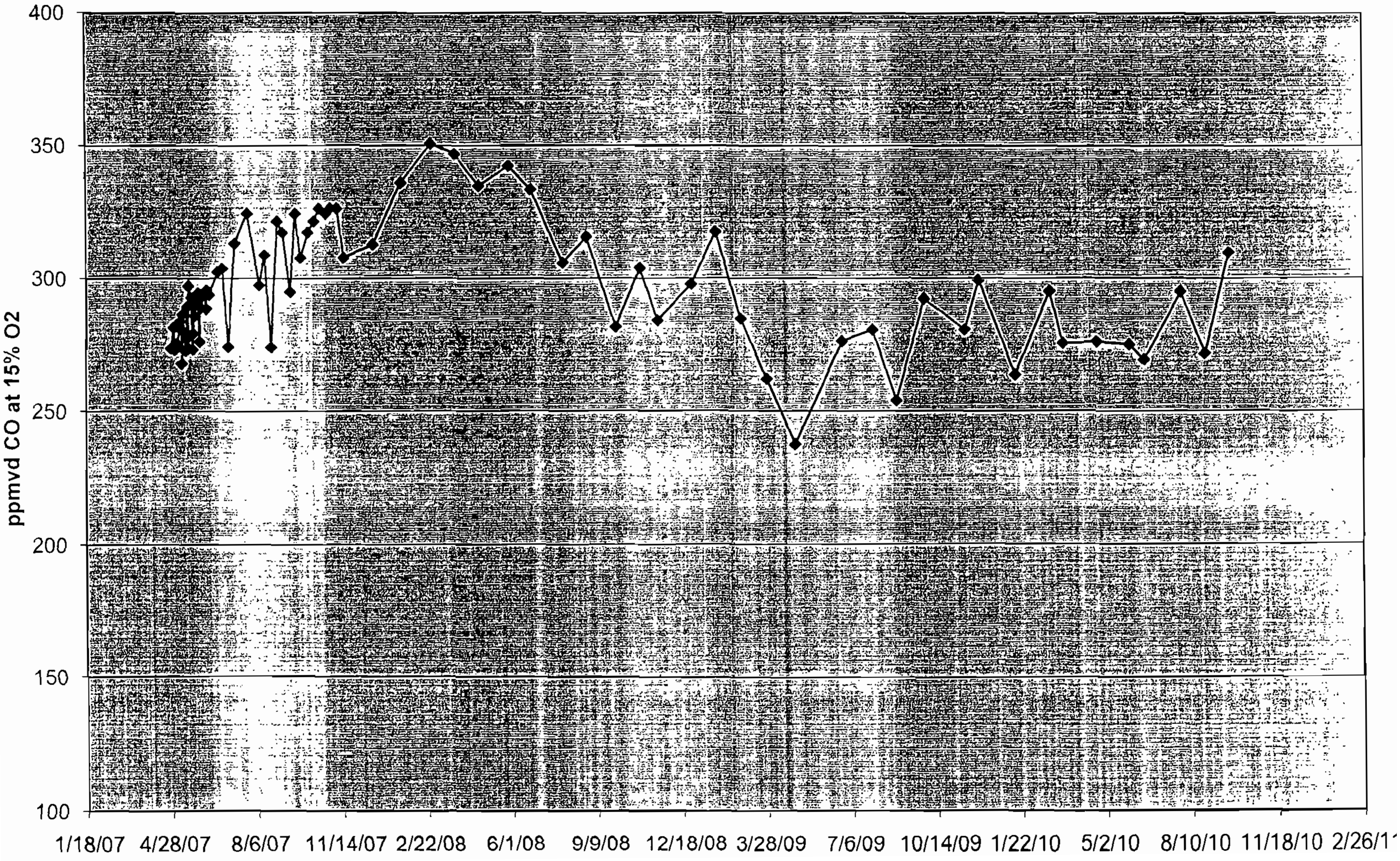
Carbon Monoxide



Ocean Energy No. 11
Carbon Monoxide



Ocean Energy No. 12
Carbon Monoxide



APPENDIX I

USEPA METHOD 202 DOCUMENTS

Method 202 - Condensible Particulate Matter

Text of Test Method 202 - Condensible Particulate Matter

Electronic Stack Testing & Assessment Tool. 10/05

FREQUENTLY ASKED QUESTIONS (FAQS) for Method 202

- Does EPA Method 202 provide reproducible results?
- Some consultants control the variability of EPA Method 202 by using EPA Method 8 as an alternate test method. Can Method 8 be used as an alternative to EPA Method 202?
- Which of the several procedures mentioned in EPA Method 202 should be used to provide the best measurement of particulate matter emissions that would be created by dilution and cooling in the ambient air?
- I have heard of instances where EPA Method 202 does not provide reproducible results when the same procedures are used for all source tests. What are some of the reasons for this problem?
- Do I have to use Method 202 to measure emissions of condensable particulate?
- What is EPA doing to assess and reduce artifact formation in Method 202?

Does EPA Method 202 provide reproducible results?

When conducted consistently and carefully, EPA Method 202 does provide acceptable precision for most emission sources. However, several options are allowed by the method to accommodate State/local test methods that existed at the time the method was proposed and promulgated in the Federal Register. Each of these options may change the mass that would be counted as condensable particulate matter. As a result, when the same source is tested using different options allowed by the method there may appear to be a large variation of the condensable particulate emissions. In addition, the flue gas characteristics may exacerbate the perception of the amount of variation that is introduced by the optional procedure. For example, under specified conditions, EPA Method 202 allows the one hour nitrogen purge to be replaced with air or not conducted when specified conditions exist. Each of these options results in more SO2 remaining dissolved in the impinger water. The dissolved SO2 slowly converts to SO3 and then to H2SO4. While the SO2 should not be counted as condensable particulate matter, both SO3 and H2SO4 form particulate matter. As a result, EPA Method 202 should not be considered to be a single standardized test method, but should be considered to be a collection of test methods. Therefore, when EPA Method 202 is specified as the applicable test method, any optional procedures should also be specified in order to achieve results that are more in agreement with the basis of the specified emission limitation.

Some consultants control the variability of EPA Method 202 by using EPA Method 8 as an alternate test method. Can Method 8 be used as an alternative to EPA Method 202?

EPA has not approved the use of Method 8 as an alternative for Method 202. There are several differences between Method 8 and Method 202 that would result in significant differences in the mass collected and analyzed. First, Method 8 has no extraction and analysis for the organic material. Second, in addition to missing any organic material, Method 8 would miss some of the inorganic particulate that was transferred from the first impinger to the second and third impinger. A lot of the water that shows up in the second (and third) impinger is mist created in the first impinger that is collected in the subsequent impingers. Also, impingers are not 99+% efficient at capturing particulate in the water. Analysis of only the first impinger would miss any particulate that would be in the second and third impingers. The amount of particulate missed by analyzing only the first impingers and the collection efficiency of the impingers with standard tips. Our guess is that the collection efficiency is less than 90%.

Which of the several procedures mentioned in EPA Method 202 should be used to provide the best measurement of particulate matter emissions that would be created by dilution and cooling in the ambient air?

To obtain the best measurement of particulate matter resulting from the dilution cooling of the sampled gas stream, the following procedures should be used:The one hour purge with dry nitrogen should be performed immediately following the final leak check of the system. Reducing purge duration, using air as a purge gas and eliminating the purge step of EPA Method 202 introduces a positive bias as a result of the conversion of SO2 to SO3 and then eventually to H2SO4. Even low concentrations of SO2 in the exhaust gas will dissolve into the impinger solution and if not removed by nitrogen purging will result in a positive bias. Use the alternative procedure describe in section 8.1 to neutralize the H2SO4. Neutralizing the inorganic portion to a PH of 7.0 determines the un-neutralized sulfuric acid content of the sample without over correcting the amount of neutralized sulfate in the inorganic portion. These neutralized sulfates (such as (NH4)2SO4 or NH4SO4) would be created in the exhaust gas upon dilution cooling in the ambient air and result in fine particulate formation. Ion chromatography, for SO4 measures both the amount of neutralized and un-neutralized SO4 contained in the impinger solution prior to the addition of NH4OH and therefore introduces a negative bias. Evaporate the last 1 ml of the inorganic fraction by air drying following evaporation of the bulk of the impinger water in a 105 degrees C oven as described in the first sentence of section 5.3.2.3. The presence of free ammonia and HCl in the exhaust gas will form Ammonium Chloride that produces fine particulate upon dilution and cooling in the ambient air. While the above procedures should arrive at the best measurement of the particulate matter emissions that are created by dilution and cooling in the ambient air, many State and local agencies have established applicable limits based upon the application of other options that are included in EPA Method 202. Because of the close connection between the applicable emission limits and the method used to demonstrate compliance, the above procedures may result in different values than would be achieved using other options in Method 202. In order to measure the emissions that are specified by the State requirements, the procedures specified in the State test method should be followed.

I have heard of instances where EPA Method 202 does not provide reproducible results when the same procedures are used for all source tests. What are some of the reasons for this problem?

During the evaluation of the method, we initially encountered excessive imprecision. However, by the use of improved preparation and clean up procedures, introduction of contaminants were reduced and precision improved to acceptable levels. Pre-test preparation of the glassware must be impeccable to remove inorganic and organic contaminants on the surfaces of the impingers, probe liners and sample recovery glassware. Source sampling contractors should select reagents and purge gas to minimize potential contamination and should evaluate the quality of these materials prior to field use. The recovery of the samples should be accomplished in a location where potential contaminants are minimized. It should be recognized that low sample weights may introduce the appearance of excessive imprecision that is the natural result of measurements near the limit of detection.

Do I have to use Method 202 to measure emissions of condensable particulate?

There may be some sources where the use of EPA Method 202 would not be required in order to measure the particulate matter that the method is intended to measure. While not stated within the method, the particulate matter measured by this method is intended to represent that material that would become solid or liquid at ambient conditions but passes through the filters maintained at elevated temperatures. Therefore, a process with an exhaust gas temperature that is at ambient conditions could use EPA Method 17 to represent total particulate matter or EPA Method 201A to represent particulate matter that is smaller than 10 uM in aerodynamic diameter. Depending on the exhaust gas moisture content, there may be some sources with elevated exhaust gas temperatures where modification and operation of the sampling train may allow the sampling gas to be cooled to essentially ambient temperatures and satisfy the intent of EPA Method 202. Although ambient temperatures can vary considerably, a temperature of 20 °C (68 °F) is a reasonable value for ambient temperature since that is the standard temperature to which source test methods are corrected. In addition, this temperature is consistent with the range of temperatures that would be considered to be "room temperature" and allowed by Method 202 for final evaporation of the inorganic and organic particulate matter portions. As with other source sampling methods, it is reasonable to include a range of allowable filtration temperature variations to accommodate difficulties in maintaining constant temperatures and preventing condensation of water vapors on the filter and internal surfaces of the probe.

What is EPA doing to assess and reduce artifact formation in Method 202?

EPA has performed at least two studies to assess artifact formation, is continuing some limited assessments, and is exploring improvements to Method 202. The paper, "Laboratory and Field Evaluation of the EPA Method 5 Impinger Catch for Measuring Condensible Matter from Stationary Sources" (Method 5 Paper) is a summary report of the results of this early study and was presented at an AWMA specialty conference. The second study was performed in 2005 by Battelle. The report, "Laboratory Evaluation of Method 202 to Determine Fate of SO2 in Impinger Water" (Battelle Paper) replicates some of the earlier work and addresses some additional areas. EPA was encouraged by a proposed minor modification to the glassware and beginning conditions of Method 202 that were presented in the proceedings of a November 2005 AWMA specialty conference. The paper, "Optimized Method 202 Sampling Train to Minimize the Biases Associated with Method 202 Measurement of Condensible Particulate Matter Emissions" (Minimizing Bias Paper) by Richards, Holder and Goshaw presents some background and results that were obtained using this minor modification. In July 2006 EPA obtained resources to investigate in more detail artifact formation in Method 202 and to explore improvements that may further reduce the artifacts. EPA engaged several industrial and State agency stakeholders to comment on EPA's laboratory test plan and to expand on the laboratory evaluations to address gas matrix conditions that were overlooked or other conditions that they believe should be addressed. On August 1, 2006, EPA held a workshop in Research Triangle Park, North Carolina, to present to the stakeholders the Agency plan for evaluating Method 202 and potential modifications that would reduce artifact formation. At the workshop, stakeholders made suggestions for improving and expanding the plan. In addition, several stakeholders volunteered to use the final protocols to conduct laboratory evaluations that replicated some of the Agency evaluations, as well as extending the evaluations to address other gas matrices that were of interest to them. The Agency will combine the data from its own evaluations and the stakeholders' laboratory experiments to evaluate the artifact formation associated with Method 202 and the modified methods. The EPA is also making the invitation request and the minutes of the workshop (Invitation and Minutes) available to keep interested parties informed of the ongoing activities to improve Method 202. The Agency is also soliciting additional stakeholders that would like to join the effort by following the protocol, replicating evaluations, expanding the matrices being evaluated, and sharing results with all stakeholders. If you are an interested stakeholder, contact Ron Myers at myers.ron@epa.gov .

On September 27, 2006, Ron Myers e-mailed all of the stakeholders update information on the progress of the project. Included in this email were the results of EPA's laboratory results of the comparative sulfate analyses of the EPA Method 202 and the Dry Impinger Method. Also included in the e-mail were preliminary results provided by Jorge Marson of Environment Canada. Jorge provided data on dry impinger laboratory experiments and some additional issues related to obtaining consistent weighing results.

On November 9, 2006, Ron Myers e-mailed all of the stakeholders the approved Quality Assurance Project Plan (QAPP) for the laboratory assessment of the proposed method for quantifying condensable particulate matter. The e-mail transmitting the QAPP to the stakeholders requested comments on the plan and requested that stakeholders who were interested in supplementing the EPA assessment submit their plans using a template that was included in EPA's QAPP document. The QAPP that was attached to the e-mail is available through this link.

On January 18, 2007, a meeting of several experienced stack testing individuals and two local equipment vendors was held to discuss hardware issues associated with modifications of the sampling equipment and the glassware for the proposed condensable particulate matter test method. Minutes of the meeting are provided here.

On January 5, 2007, Ron Myers e-mailed all of the stakeholders an announcement of a February 9, 2007 workshop to discuss our progress, the results of our laboratory study, and commitments to extend the investigation by stakeholders external to EPA. On February 8, 2007, all of the stakeholders were e-mailed a list of individuals that had indicated that they would attend the workshop or participate by phone. Attached to the e-mail was the preliminary agenda and presentations by EPA and several stakeholders. Minutes of the workshop were drafted and circulated to individuals that made presentations or made comments during the workshop. The revised minutes and the final presentation materials used at the workshop are available here.

EPA has made an earlier draft version of the dry impinger test method available to stakeholders with the understanding that all parties (the owner of the source, the source test contractor and the regulatory authority) understood that it was a work in progress and agreed to its use. These stakeholders have provided feedback to EPA on the performance of the method, and EPA has assisted the stakeholders in resolving unexpected results. EPA has compiled stakeholder comments and recommendations, submitted up to April 17, 2007, on procedures that the stakeholders believe would improve the precision of condensable particulate matter source testing. In response to the comments and recommendations, EPA analyzed and recorded both the comments and evaluations in this document.

In addition, the Alliance of Automotive Manufacturers (Alliance), a stakeholder in the study to improve the condensable particulate matter test method, conducted field testing to compare EPA Method 202 to the improved dry impinger test method. The stationary source chosen by the Alliance for comparison evaluation was a wet machining operation associated with an oil mist collector control device that serves an automotive machining process for transmission components. The source's flue gas temperature was less than or equal to 85F. The study, conducted on March 29th and 30th, 2007, consisted of simultaneous testing of condensable particulates with Method 202 and with the dry impinger method evaluated by EPA in laboratory studies. One of the Alliance's conclusions is that there is no significant statistical difference between the improved method and traditional Method 202. The report submitted to EPA on 7-26-2007 is available here.

Concurrent with these stakeholder efforts, EPA has revised the dry impinger test method to improve and, where needed, to clarify the required procedures. The revised dry impinger test method is available here for continued use by stakeholders as long as all parties understand that this method is a work in progress and agree to its use. EPA is making this version available to the entire stakeholder community for review and comment prior to posting this method to the "Other Test Methods" web page. We would appreciate any recommendations that stakeholders believe would make the method more precise and more consistent with quantifying primary particulate matter emissions (that is, those emissions formed near the stack exit as a result of condensation or chemical reaction with stack gases following cooling to ambient temperature and pressure). EPA will consider all comments received prior to October 26, 2007 for incorporation in the initial posting of the method to this web site. Comments, recommendations, and justifications should be submitted to Ron Myers at myers.ron@epa.gov .

Since October 26, 2007, additional stakeholder sponsored laboratory studies were performed providing information justifying several minor modifications in the procedures of the draft dry impinger test method that was posted to this site. In addition, several stakeholders have provided recommendations for editorial and substantive changes in the posted method. We are now posting the dry impinger method to the "Other Test Methods" site as OTM 28. We have made every effort to insure that the method provides an accurate and precise measurement of condensable particulate matter emissions. As with the previous draft dry impinger test method, we are soliciting comments on the method as posted and will consider all comments received prior to June 27, 2008. Comments, recommendations, and justifications should be submitted to Ron Myers at myers.ron@epa.gov

Concurrent with the posting of the dry impinger test method to the Other Test Methods web page, we are posting an updated filterable PM10 and PM2.5 test method OTM 27. OTM 27 is a reformatted and edited version of Conditional Test Method 40. As with OTM-28, we are soliciting comments on this method and will consider comments received by June 27, 2008.

Update (August 19, 2008): Several comments on the conduct of the dry impinger test method for CPM were evaluated. We have revised the dry impinger test method to accommodate those comments. Most are changes in the method to correct typographical errors and to clarify some issues associated with the conduct of the method. In assessing and addressing the comments from stakeholders, we noticed that in Equation 1, the constant used for the correction of the addition of ammonia hydroxide was 18.03 when it should be 17.03. We have reposted OTM 28 to the Other Test Method web page with the revisions.

Several comments were received on the conduct of OTM 27. OTM 27 uses a pair of cyclones to size the filterable material. Several of the comments were associated with the physical size of the combined PM10 and PM2.5 cyclones, and the ability to use these in exhaust systems that are typical for their industry. Some of these same commenters also requested modifications to address the potential for low sample weight collection. They indicated that the current method would require extending the sample time in order to collect a weighable mass for PM 10 and PM2.5. With existing particle sizing technology, reducing the size of the cyclones would require a substantial reduction in the flow rates of the sampler to achieve proper particle sizing. Reducing the flow rate would adversely impact the duration of the sampling campaign needed to collect weighable masses. As with OTM 28, there are corrections to address typographical mistakes. We have also made revisions to clarify the need to maintain the sampling conditions necessary to collect a good sample and address some of the size issues associated with the hardware. Here is the link the updated OTM 27. We have compiled a summary of the comments that we received, our responses to the comments, and copies of the comment letters or e-mails that we received here.

OTM 27 and 28 will provide the template for future proposed revisions to EPA Test Methods 201A and 202. We do not expect that there will be any revisions to OTM 27 and 28 until we propose revisions to Methods 201A and 202. We recognize that several stakeholders are using these two test methods to characterize their emissions and prepare for future requirements. We are interested in information on the performance of the test methods and for suggested changes that would improve the reliability and precision of these methods. We are also interested in obtaining source test data using these methods so that the emission factors for the processes being tested can be evaluated for revision. In order to facilitate the ability to use these test data, we strongly encourage stakeholders to use the Electronic Reporting Tool, ERT, to document the conduct of the emissions test and the operation of the source.

Update (April 14, 2009): A draft comprehensive method development support document was prepared to provide detailed information on the laboratory studies and assessments that have been performed by US EPA, Environment Canada, and EPRI that provide technical support for the proposed revisions to EPA Method 202 (and OTM-28). The document, "Draft Project Report - Evaluation and Improvement of Condensable Particulate Measurement," was posted to the docket of the proposal to revise Method 201A and 202, and is now being made available on this web site through this link. We welcome recommendations that would make this draft document more readable and understandable. Also, if you are requesting additional information within this draft report, please provide supporting rationale for the inclusion of this information.

Following the August 2008 posting of OTM-28 to the EMC web site, we have received several comments on the selection and availability of filter media used between the first two impingers and the second two impingers (immersed in the ice bath). One of the comments concerned the availability of Teflon membrane filters. We performed a limited internet search for suppliers of filter media which may meet the specifications and determined that there is more than one supplier. This file lists the web sites of two suppliers of these filter media. Our citing of these suppliers is not an indication that these are the only suppliers of these filters, nor is this an endorsement by EPA of these suppliers. The other comment that we have received concerned the type of filter media which is required to pass the specification for filtration performance. The specification that the filter must have an efficiency of at least 99.95 percent on 0.3 micron particles does not imply that the filter media pore size be this diameter. Some individuals have interpreted this requirement as requiring filter media with pore size comparable to the challenge particulate size. As indicated in at least one supplier's literature, filters having pore sizes significantly larger than 0.3 micrometers have demonstrated collection efficiencies of more than 99.95 percent.

During the March 8 – 13, 2009 Stationary Source Sampling and Analysis for Air Pollutants Conference XXXIII, two presentations were made concerning the pending Federal Register proposal of revised source test methods for particle sizing of the filterable and the condensable components of PM emissions. We are posting these presentations on this web site for wider dissemination of the information. This presentation concerned the potential issues associated with transitioning from a variety of test methods used for emissions inventories and regulatory compliance purposes to test methods that incorporate particle sizing and the inclusion of the condensable fraction. This presentation provided a technical overview of the differences in application of Method 202 as promulgated in 1990 versus the dry impinger method (OTM 28) for quantifying condensable particulate matter.

On March 25, 2009, the proposed revisions to EPA Methods 201A and 202 were published in the Federal Register. The preamble and methods are also available on the EMC web site at this link. The official comment period for these proposed methods and the material presented in the preamble extends to May 26, 2009. This file provides a listing and summary of material that has been placed in the docket as background and support for these two methods. Many of the materials for the revised Method 202 are already available as links in the running commentary on this web page, while the remaining documents are available by accessing the docket, then searching for Docket ID No. EPA-HQ-OAR-2008-0348. Comments on these methods should be submitted in one of the five ways described in the Addresses section of the preamble. To be most helpful, comments should be accompanied by supporting information and any suggested changes that you believe would resolve the issue.

Subsequent to sending the proposal package for executive review and the date of publication in the Federal Register, we received several comments from stakeholders. For those comments that were received after July 9, 2008, we have developed responses that are consistent with the basis of the intent of the proposed methods. Some of these comments address issues that relate peripherally to the proposed test methods, some of the comments deal with issues that were identified prior to receiving the comments and may be resolved in the proposed methods that were published, and the rest of the comments deal with issues that the commentors may feel we have not addressed to their satisfaction. We have posted the summaries, responses, and full e-mail responses to these commentors here. We are also informing these commentors that they may wish to review the preamble and methods that were proposed in the Federal Register and revise and resubmit their comments should they wish.

Update (April 15, 2009): Both OTM 27, (Determination of PM10 AND PM2.5 Emissions From Stationary Sources (Constant Sampling Rate Procedure)), and OTM 28, (Dry Impinger Method for Determining Condensable Particulate Emissions From Stationary Sources), were revised to be consistent with the proposed Method 201A and 202. Some editorial errors that were in the file provided to the Federal Register Office for publication have been corrected in these versions of OTM 27 and 28.

Still have questions on this method? Contact the EMC expert Ron Myers at myers.ron@epa.gov .

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September 30, 2005

Ms. Vickie Presnell
Project Officer
Office of Air Quality Planning and Standards
Emissions, Monitoring, and Analysis Division (C304-02)
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

Dear Ms. Presnell:

EPA Contract No. 68-D-02-061, Work Assignment 3-14

Please find enclosed one copy of a draft technical report entitled "Laboratory Evaluation of Method 202 to Determine Fate of SO_2 in Impinger Water." This draft report serves as a deliverable under Task 2 of the subject Work Assignment.

If you have any questions, please call me at 614/424-6538 or Jan Satola at 614/424-4251.

Sincerely,

Basil W. Coutant, Ph.D.
Principal Research Scientist
Measurement and Data Analysis Sciences

BWC:llj
Enclosure
cc: Otelia Newsome (EPA CO) *(ltr only)*
Thomas J. Logan (EPA WAM 3-14)

September 30, 2005

Draft Technical Report

on

LABORATORY EVALUATION OF METHOD 202 TO DETERMINE FATE OF SO_2 IN IMPINGER WATER

Contract No. 68-D-02-061
Work Assignment 3-14

for

Vickie Presnell
Project Officer

Thomas J. Logan
Work Assignment Manager

Emissions, Monitoring, and Analysis Division
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U.S. ENVIRONMENTAL PROTECTION AGENCY
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ABBREVIATIONS AND SYMBOLS USED

APM	artifact particulate matter
cc	cubic centimeter
CO_2	carbon dioxide
CPM	Condensible Particulate Matter
DI	de-ionized (water)
Dil-corr	Dilution-corrected
IC	Ion chromatographic
L	liter
μL	microliter
LPM	liters per minute
MFC	mass flow controller
mg	milligram
min	minute
N_2	nitrogen
O_2	oxygen
pk-ht	peak height
PM	particulate matter
ppm	parts per million
SCR	selective catalytic reaction
SNCR	selective non-catalytic reaction
SO_2	sulfur dioxide
SO_3^{-2}	sulfite anion
SO_4	sulfate
SO_4^{-2}	sulfate anion
Unk 1	unknown compound #1
Unk 2	unknown compound #2
UPH	ultra high purity

Draft Technical Report
on
Laboratory Evaluation of Method 202 to Determine Fate of SO_2 in Impinger Water

Work Assignment 3-14

BACKGROUND

The U.S. Environmental Protection Agency (EPA) introduced Method 202 in 1991 as a method to quantify condensible particulate matter (CPM) in flue gas streams of elevated temperature. CPM is defined as the mass of solid residue remaining after the impinger contents are analyzed. The CPM measurement relies on gravimetric determination of the captured CPM after the impinger deionized water has been evaporated away. The method quantifies the condensibles using the impinger catch from a Method 5 type sampling train. The analysis includes dividing the catch into an organic and an inorganic portion. An important addition to Method 202 that was not in previous sampling is the nitrogen purge procedure. Due to concern of sulfur dioxide (SO_2) oxidizing to sulfates in the impingers after sampling, and then being incorrectly counted as particulate matter, the impingers are purged with nitrogen for one hour. The purge is intended to remove the sulfur dioxide, thereby preventing artifact sulfate formation. By purging the SO_2, quantifying SO_2 pseudo-particulate should not occur.

Under EPA Contract No. 68-D-02-061, Work Assignment 3-14, a literature search on CPM issues was conducted and is summarized in Appendix A. One of the literature search papers [1] succinctly summarized the sulfur dioxide chemistry taking place in the impingers during sampling observing that sulfur dioxide (SO_2) and molecular oxygen (O_2) both are soluble in water. The dissolved SO_2 can form hydrated SO_2 ($SO_2 \bullet H_2O$) and sulfite (SO_3^{-2}) and bisulfite (HSO_3^{-}) ions in aqueous solution. At the pH range of interest (pH 2 through 7), HSO_3^{-} is the preferred state. The individual dissociations are very fast, so aqueous-phase equilibria are established instantaneously. The dissociation of the dissolved species enhances its aqueous solubility so that the total amount of dissolved sulfate always exceeds that predicted by Henry's Law for SO_2 alone. There are several pathways for sulfate formation by reaction of these ions with dissolved O_2, ozone, and hydrogen peroxide (the latter two are of no importance in flue gas sampling), which can be catalyzed by many substances such as iron and manganese. Free NH_3 in the samples can increase the amount of dissolved SO_2 and, thereby, increase artifact sulfate formation, since it instantly reacts in aqueous solution forming ammonium sulfite/bisulfite ions and additional SO_2 must dissolve to maintain equilibrium.

The general consensus of the literature search regarding CPM measurement from iced impingers, as in Method 202, is that the CPM is dominated by the inorganic fraction (regardless of the type of fuel burned [2]), which turns out to be predominantly sulfate-related. It appears that a standard one hour post-sampling nitrogen purge of lower concentration impinger samples satisfactorily removes this false CPM, while higher concentrations suffer from artifact particulate that is not present in the original gas stream.

There are two main mechanisms for impinger sulfate formation:

- Gaseous SO_2 dissolves in the impinger water to form $H_2SO_3^-$, which may then oxidize by means of molecular O_2 or other compounds dissolved in the water to form H_2SO_4.
- Compared to the actual exhaust plume that cools with atmospheric dilution, condensation of vapors in the impingers is excessive, since the impingers cool the gas stream without dilution.

For example, because of the artifact particulate matter (APM), Method 202 CPM measurements from gas-fired sources may depend more on the natural gas sulfur content than on the process operating conditions, and so may not reflect the actual CPM existing in the exhaust plume. [3] Regarding the second mechanism (cooling without dilution as the source of APM), comparison of impinger sampling to dilution tunnel sampling showed that the mass of $PM_{2.5}$ measured by EPA source test methods that included the impinger fraction, was 80 to 100 times greater than that measured by a dilution sampler. Analysis of material collected in the impingers showed a dominant sulfate; much more sulfate than was collected in the dilution sampling system. This was attributable to the dissolution and oxidation of SO_2 from the stack gas in the impingers. [1, 4]

Method 202 was originally designed for use over short sampling times (i.e., one hour) at relatively high SO_2 concentrations. As SO_2 reduction measures have been applied to many sources, Method 202 has been used over much longer sampling times (e.g., up to six hours), increasing the potential for APM formation. Longer Method 202 test runs and longer sample storage after sampling allow more time for the conversion of SO_2 to solid residues, thus increasing the APM measured. This means that APM artifacts can easily dominate CPM results when the true CPM concentrations are low. A previous study [1] of SO_2 impinger concentrations, considerably lower than those for this set of tests, was performed for one-hour and six-hour sampling runs with mixtures containing 0, 1, and 10 ppm SO_2. One pair of trains was purged with nitrogen for one hour immediately following the tests, while the other was not. The samples were stored at 4 C for approximately two weeks prior to analysis. Significant amounts of SO_4^{-2}, approximately proportional to the SO_2 concentration in the gas, were present in impingers regardless of the post-test purge. While the post-test purge clearly reduced SO_4^{-2} concentration in the impingers, significant SO_4^{-2} still remained. Purging was less efficient at reducing SO_4^{-2} for the 6-hour runs than for the 1-hour runs, indicating that much of the SO_2 oxidation occurs within this period. The current study undertaken for this report not only stored samples at 4 C for approximately two weeks prior to analysis, but also it analyzed the impinger samples taken after sampling but before the nitrogen purge, as well as samples taken (but not stored) after the nitrogen purge.

Studies of oil-fired and gas-fired combustion systems [1] involving higher concentrations of approximately 2,000 ppm SO_2 report APM in spite of post-test purging, accounting for up to 42 percent of the measured CPM. Test results from a gas-fired refinery boiler using unpurged sample trains showed that approximately 50 to 100 percent of the SO_4^{-2} found in the field samples, comprising more than 80 percent of the total CPM, was attributed to the SO_2 APM artifact.

The literature search also provided some interesting information regarding impinger pH. The removal of SO_2 from the impinger through N_2 purging, according to at least one author [5], is related directly to the pH of the solution. The SO_2 is more easily removed at a pH of 2 than at pHs above 4.

This report describes a series of experiments designed to evaluate the impact of SO_2 concentration, sampling duration, and other factors on APM formation in Method 202 samples. Subsequent sections of this report summarize the experimental procedures, results, and implications of this study.

EXPERIMENTAL DESIGN

Sampling Train Setup

Two identical Method 202 sampling trains were set up to run nearly simultaneously in order to compress the total testing and sample analysis times. Figure 1 shows one of the two trains, set up such that it could be supplied by cylinders of SO_2, N_2 (nitrogen), and an O_2/CO_2 (oxygen/carbon dioxide) mixture.

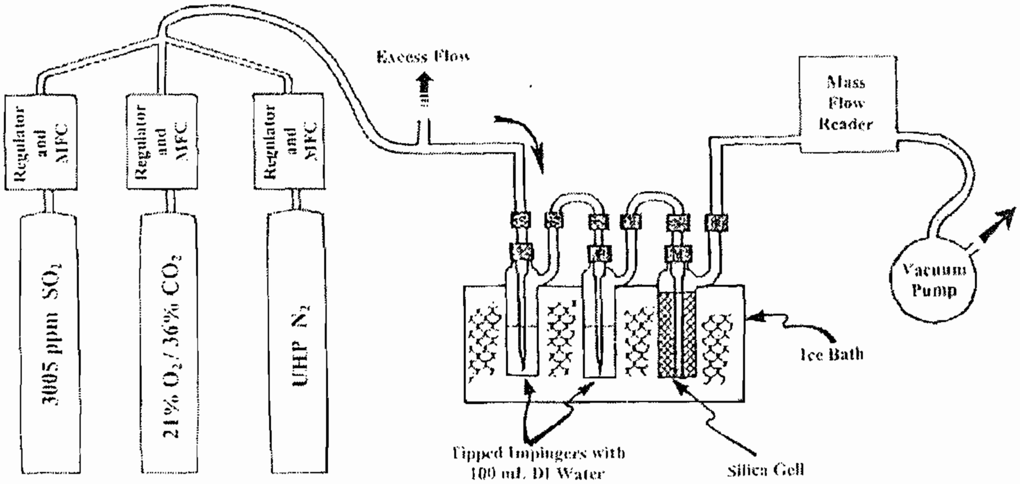

Figure 1. **Sampling Train Setup Schematic.**

Each cylinder was equipped with a regulator and its own mass flow controller to supply the target gas flows. The O_2/CO_2 cylinder mixture of 21 percent/36 percent was diluted with nitrogen for all runs by a factor of 3 to simulate actual stack concentrations of 7 percent oxygen and 12 percent carbon dioxide. The second sampling train was simultaneously supplied from these same three cylinders by inserting a “T” connector and a second mass flow controller at each cylinder regulator. A vacuum pump was connected to the train exhausts and the exit flows were monitored to determine total system flows (approximately 20 liters per minute, LPM) through each train. During the test runs, an excess flow (<1 LPM) was maintained through the “Excess Flow” line leading off the manifold just before the gases entered into the impingers, as shown in Figure 1. The constant flow through this excess line insured that outside air was not pulled into the system by the vacuum pump and, thus, the exit flow measured by the mass flow reader consisted entirely of the input gases. The gas flow from each of the three cylinders passing through each sampling train was set before each run and monitored during the runs. In addition, the total flow from each train exhaust was monitored throughout the runs. Table 1 shows the originally intended test matrix with gas flows totaling 20 LPM; however, this matrix was modified during the actual testing.

Table 1. Planned Concentration/Sampling Time Test Matrix.

SO_2 Concentration, ppm	Impinger Flow Time, Hours	3005 ppm SO_2, cc/min.	O_2/CO_2 Mix 21% / 36%, Liters/min.	Nitrogen Diluting Flow, Liters/min.	Total Sample Flow, Liters/min.
300	1	1997	6.67	11.33	20.00
100	3	666	6.67	12.66	20.00
50	6	333	6.67	13.00	20.00

Sample Collection

The twin sampling trains (**a** and **b**) were run with an offset of about an hour in order to minimize the time required to collect impinger samples, measure impinger pHs, and begin the nitrogen purge. The pH measurements were taken on the contents of each impinger prior to each test, before beginning an immediate post-sampling nitrogen purge, and after the nitrogen purge. To measure the pH of the front and back impingers, pH paper as opposed to a pH meter was selected because of the paper’s speed and small sample requirement.

A pipet was employed to collect four impinger samples of 2 mL each for each test. For each sample, 1 mL was collected from the front impinger and added to 1 mL from the back impinger of each train. For each test, the first pair of samples was collected after the test run but immediately before the nitrogen purge, and the second pair was collected immediately after the nitrogen purge. Samples were placed in 2 mL IC vials and capped for later analysis. The entire process of collecting the impinger samples, measuring the impinger pHs, and starting the nitrogen purge was accomplished in 5 minutes or less for each run. With almost 200 mL of impinger solution for each sample run, the samples removed before the purge negligibly decreased the total impinger volume.

Quality of Cylinder Gases Used

The cylinders of SO_2 (3005 ppm) and O_2/CO_2 mix (21 percent/36 percent) were Master Class grade gases obtained from Scott Specialty Gases (Troy, Michigan) with a tolerance of ±2 percent. The dilution nitrogen was ultra high purity grade.

Sulfate and Sulfite Detection

A Shimadzu Ion Chromatographic (IC) system with a CDD-6A conductivity detector was chosen to analyze samples simultaneously for both sulfate and sulfite anions. A sulfate calibration curve was set up for this instrument using a NIST sulfate standard (using the convention that 1 ppm SO_4^{-2} = [1 mg SO_4^{-2}]/L); however, the rapid oxidation of any sulfite standard into sulfate made the use of a sulfite calibration curve impractical. To overcome this difficulty, some samples were divided in two portions: the first portion underwent regular analysis, while 20 or 50 μL of 30 percent H_2O_2 was added to the second portion, rapidly oxidizing all of the sulfite to sulfate. By comparing these oxidized samples with their original sulfite/sulfate counterparts, a linear sulfite calibration curve (Appendix B) was generated by subtraction, and this curve was then used with the sulfite peak heights to calculate the sulfite content of all the samples.

Sample Designation

The 49 samples analyzed in this study were each given a sample ID starting with A, B, C … AU, plus YA and YB. Following the sample ID, there is a 5-slot code in brackets that tells how the sample was created and handled, including the matrix run time, sample source (Train **a**, Train **b**, or other source), nitrogen purged/non-purged status, hydrogen peroxide addition/ non-addition status, the hold time before analysis, and, finally, the sample dilution factor. This sample coding system is shown more clearly in Figure 2 below:

▶Matrix run-time in hours (1, 1.3, 3, or 6)
| ▶Sampling Train (**a** or **b**), or special sample type (S_i, i = 1, 2, or 3)
| | ▶Sample N_2 purged (N for 1 hour and N/2 for 0.6 hours) or non-purged, 0
| | | ▶H_2O_2 added to sample, H; or not added, 0
| | | | ▶Holding time in hours before analysis
| | | | |
R [3 b N H (4.7)] 10.02
| |
| ▶Dilution Factor if different from 1.00
▶Sample ID: the 49 sample IDs run from A to AU, plus YA and YB

Figure 2. Sample Identification Code.

The code in Figure 2 indicates this particular sample is "Sample R," which came from a 3-hour run using Train **b**, and was purged with nitrogen for 1 hour. This sample was diluted by a factor of 10 (100 µL sample + 900 µL DI water), and then 20 µL of hydrogen peroxide was added for a total dilution factor of 10.02. The time between the end of the 3-hour sampling run and analysis by IC was 4.7 hours. The chromatograms for all the test runs (Appendix B) are also labeled according to this coding system. Some samples were run more than once, with the different holding times indicated by the sample code.

RESULTS AND DISCUSSION

Six experiments were performed with the available cylinder gas resources in order to determine the formation of sulfate APM as a function of SO_2 concentration and duration of the sampling. Initially, it was expected from the literature that the impinger concentrations generated would be a fraction of the concentration of SO_2 bubbled through the sample train, and so the calibration curve was set up to span from 0 to 100 ppm. However, when the first sample of the first run (one hour at 300 ppm SO_2) was analyzed, it yielded a total sulfate concentration of over 400 ppm. At this point, the IC operator's recommendation was to keep the initial 0 - 100 ppm calibration curve to maintain sensitivity to lower sample concentrations, and at the same time simply dilute the higher concentration samples to fit within this same curve. Although the first high value of 400 ppm was outside of the calibration curve, subsequent 1:10 dilutions (samples G and H) of this test run demonstrated the accuracy of the original high value.

Actual Test Matrix

The actual tests performed are designated by the sampling duration (1, 1.3, 3, or 6 hours) followed by the impinger train (**a** or **b**), and the SO_2 concentration in ppm in parenthesis; the test designations are listed in the first column of Table 2. The actual test matrix differs from the planned pre-test Table 1 matrix in three ways. First, the amount of cylinder gas resources did not allow an anticipated repeat of the 1a test (although Test 1.3a was run with a 38-minute nitrogen purge). Secondly, test flows were not always 20 LPM, but, in fact, varied between about 17.7 - 18.8 LPM, as shown in the fourth column of Table 2; and nitrogen purge flows (Table 2, fifth column) were between 0.1 and 0.5 L higher than the corresponding test flows. Lastly, the SO_2 flow was not changed between the first (1a) and second tests (3a and 3b), resulting in an SO_2 concentration of 300 ppm for both the 1 hour and 3-hour tests; that is, the 3-hour tests originally planned as 100 ppm runs are actually 3-hour extensions of Test 1a. In spite of the higher concentrations for the 3-hour tests, interesting insights into APM formation were nevertheless gathered.

Table 2. Actual Test Matrix and Test Conditions.

Test	SO_2 Flow, LPM	Purge Time, hours	Total Average Gas Flow, LPM	Total Average Purge Flow, LPM	SO_2 Concen., ppm	Total SO_2 Impinger Exposure, ppm-hour	Relative Humidity, %	Temp., F	Barometric Pressure, Inches Hg
1a (300)	1.77	1.0	17.81	18.11	299	299	45	69	29.15
3a (300)	1.76	1.0	17.67	17.90	300	900	51	69	29.18
3b (300)	1.82	1.0	18.20	18.64	301	902	51	69	29.18
6a (50)	0.299	1.0	17.95	18.03	50.0	300	42-43	70-71	29.18-29.21
6b (50)	0.296	1.0	18.75	19.28	47.5	285	42-43	70-71	29.18-29.21
1.3a (50)	0.316	0.63	17.74	0	50.0	65.1	40	70	29.21

Chromatographic Data

The raw chromatographic data are compiled in two tables in this report:

- Table 3a: Raw Test Data, and
- Table 3b: Two Week Post-Test Raw Data.

The raw data in the first two tables were processed and are presented in two additional tables:

- Table 3c: Processed Test Data, and
- Table 3d: Two Week Post-Test Processed Data.

The patterns in the data comprising these four tables are more readily recognized if all the tables are combined into one single table (photocopies pasted together), which, unfortunately, makes too large a table to place in this report.

The chromatograms themselves are available in Appendix C.

Compounds Detected

There were five main compounds of interest detected in the samples analyzed from the impinger trains. Three of these compounds are identified in the three special sample chromatograms; that is, sample IDs A, B, and C in Table 3a.

The **Sample A** chromatogram was a test sulfite preparation in which a small portion of the sulfite had already been oxidized into sulfate. The sulfite eluted at about 3.96 minutes

(Figure 3) while the sulfate peak's elution time was about 4.10 minutes. **Sample B** shows the same sulfite solution, to which 20 μL of 30 percent hydrogen peroxide had been added. Note that the Sample B sulfite was completely oxidized into sulfate; the excess peroxide had a peak at about 3.50 minutes (Figure 3). **Sample C** consisted of hydrogen peroxide in DI water, and the peroxide peak again eluted at about 3.5 minutes. For the samples analyzed, the sulfite peak heights are found in column G of Table 3a and the corresponding concentration in ppm in column M of Table 3b. The corresponding sulfate data are found in columns H and L of the respective tables.

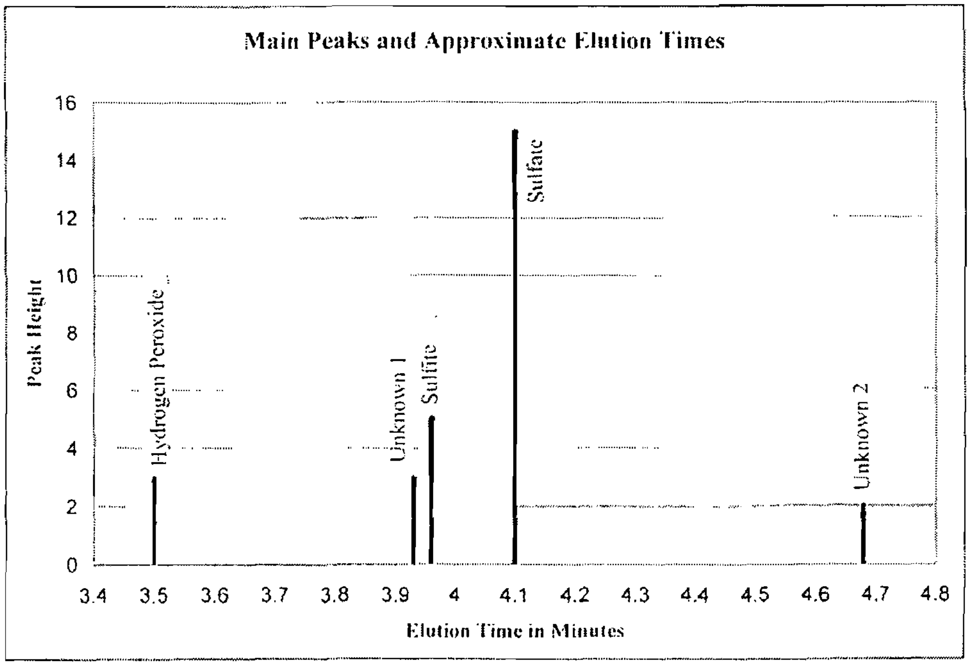

Figure 3. Typical IC Chromatogram Locations of Main Sample Components.

Sample O shows the other two compounds of interest. The sulfate and hydrogen peroxide are readily identifiable in this chromatogram, but there are two additional compounds that show up not only here, but also with most of the other runs. The more prevalent compound can be seen eluting at around 3.93 minutes (referred to as "Unknown 1"), and the second compound elutes at about 4.68 minutes (referred to as "Unknown 2"). The peak heights of these unknown compounds are found in the raw data tables in columns I and J, respectively. The peak height of Unknown 1 is sometimes given as "?", meaning that the peak may be zero; however, it may also be non-zero but still small enough to be masked by a larger nearby peak. Note that the Sulfite and Unknown 1 elute at almost the same time. It should also be noted that elution times can vary slightly from chromatogram to chromatogram, and the closeness of peaks together tends to shift peak elution times slightly, as can be often observed with the three closest peaks: Unknown 1, Sulfite, and Sulfate.

Table 3a. **Raw Test Data.**

A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*
Sample ID	**Sample creation/handling**					**SO_3^{-2} pk-ht**	**SO_4^{-2} pk-ht**	**Unk 1 pk-ht**	**Unk 2 pk-ht**	**Run Date/Time**
	Run Time	**a, b, or S**	**Purge**	**H_2O_2**	**Hold Hours**					
A	0	S_1	0	0	*0.0*	20.3	3	?	0.2	6/21/16:18
B	0	S_2	0	H	*0.0*	0	43	0.1	0.3	6/21/16:23
C	0	S_3	0	H	*0.0*	0	0	0.1	0.6	6/23/15:15
300 ppm										
D	1	a	0	0	*1.4*	98	35	?	0.5	6/21/17:51
E	1	a	0	0	*1.6*	87	47	?	0.5	6/21/18:04
F	1	a	0	H	*1.8*	0	210	5	1	6/21/18:16
G	1	a	0	0	*2.3*	1.5	23	0.5	0.25	6/21/18:47
H	1	a	0	H	*2.5*	0	26	1	0.5	6/21/19:00
I	1	a	N	0	*2.8*	0.1	13	4	0.1	6/21/19:14
J	1	a	N	H	*3.0*	0	14	5	0.5	6/21/19:27
K	1	a	0	0	*16.7*	75	66	?	0.5	6/22/10:11
L	1	a	N	0	*18.2*	0.5	13	4	0.1	6/22/11:39
M	1	a	N	0	*18.4*	0.1	12	4	0.1	6/22/11:52
N	1	a	N	H	*18.7*	0	14	4	0.5	6/22/12:08
O	1	a	N	H	*18.9*	0	13	5	0.5	6/22/12:21
300 ppm										
P	3	b	0	0	*3.3*	0.7	26	0.2	0.1	6/22/14:30
Q	3	b	0	H	*3.5*	0	28	0.2	0.3	6/22/14:42
R	3	b	N	0	*3.8*	0.1	1.5	0.4	0.2	6/22/14:55
S	3	b	N	H	*4.0*	0	1.6	0.4	0.5	6/22/15:08
T	3	b	N	0	*4.5*	0.2	15	4	0.2	6/22/15:41
U	3	b	N	H	*4.7*	0	13	4	0.6	6/22/15:53
V	3	a	0	0	*3.7*	6	33	?	0.2	6/22/16:06
W	3	a	0	H	*3.9*	0	48	0.1	0.3	6/22/16:18
X	3	a	N	0	*4.1*	0.02	1.9	0.3	0.2	6/22/16:31
Y	3	a	N	H	*4.3*	0	2	0.3	0.6	6/22/16:43
50 ppm										
YA	1.3	a	0	0	*0.9*	15	47	15	0.1	6/22/17:48
YB	1.3	a	0	0	*1.1*	18	43	16	0.1	6/22/18:00
Z	6	b	0	0	*0.9*	20	37	?	0.2	6/22/21:07
AA	6	b	0	H	*1.1*	0	75	4	1	6/22/21:20
AB	6	b	0	0	*1.3*	0.37	7	0.4	0.2	6/22/21:32
AC	6	b	0	H	*1.5*	0	8	0.4	0.6	6/22/21:45
AD	6	b	0	0	*1.7*	0.4	7	0.4	0.2	6/22/21:57
AE	6	b	0	0	*1.9*	19.4	39	?	0.2	6/22/22:10
AF	6	b	N/2	0	*15.4*	2.7	35	5	0.2	6/23/11:39
AG	6	b	N/2	H	*15.6*	0	42	5	0.4	6/23/11:52
AH	6	a	0	0	*12.3*	25.1	32	?	0.2	6/23/12:05
AI	6	a	0	H	*12.5*	0	81	0.5	0.5	6/22/21:07
AJ	6	a	N	0	*12.7*	0.5	7	1.5	0.3	6/22/21:20
AK	6	a	N	H	*12.9*	0	8	2	0.5	6/22/21:32

a: Dil-corr means corrected for sample dilution.
b: Total $SO_4^{-2} = SO_3^{-2} + SO_4^{-2}$

Table 3b. Two Week Post-Test Raw Data.

A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*
Sample ID	**Sample creation/handling**					**SO_3^{-2} pk-ht**	**SO_4^{-2} pk-ht**	**Unk 1 pk-ht**	**Unk 2 pk-ht**	**Run Date/Time**
	Run Time	**a, b, or S**	**Purge**	**H_2O_2**	**Hold hours**					
Hold for 2 Weeks										
AL	1	a	0	0	***384***	57	130	?	**0.1**	7/7/17:42
AM	1	a	N	0	***385***	0.1	15	**0.2**	**0.1**	7/7/18:45
AN	3	a	0	0	***366***	75	98	?	**0.2**	7/7/18:32
AO	3	a	N	0	***366***	0.4	10	**1.5**	**0.25**	7/7/18:07
AP	3	b	0	0	***366***	76	108	?	**0.5**	7/7/17:55
AQ	3	b	N	0	***366***	0.1	16	**4**	**0.2**	7/7/18:20
AR	6	a	0	0	***356***	18	46	?	**0.2**	7/7/19:23
AS	6	a	N	0	***356***	1.5	7	**0.7**	**0.2**	7/7/19:35
AT	6	b	0	0	***359***	3	78	**4**	**0.2**	7/7/18:58
AU	6	b	N/2	0	***359***	0.1	44	**5**	**0.2**	7/7/19:10

Sample Normalization

Sample dilutions were corrected by multiplying the diluted concentration by the inverse of the dilution factor (Table 3c, column N) for the sample. In addition, since the sample flows in the test runs varied as much as 5 percent from each other, a final normalization factor was applied to the total sample sulfate (column Q) by adjusting all flows to 19 LPM. These normalized sulfate values are shown in column S of Tables 3c and 3d. This was accomplished by multiplying the column Q sulfate value by the factor of: 19 LPM / (Run Flow). The "Run Flow" is the number of liters per minute for a particular test, and is found in the fourth column of Table 2.

Sample Oxidation

Examination of the chromatograms (Appendix C) yielded three major sources of sample sulfite oxidation, which transformed the sulfite into sulfate:

- The addition of peroxide.
- Dilution/mixing of high concentration samples to fit the calibration curve, which converted most of the sample sulfite into sulfate.
- Sample holding time before analysis; i.e., the longer the holding time, the more sulfite was oxidized into sulfate.

Note that for those samples that received the addition of peroxide, there was no detectable sulfite peak, and there was always the additional peroxide peak indicating an excess of peroxide present. These three points are elaborated upon in the next paragraphs.

Table 3c: Process Test Data.

A	L	M	N	O	P	Q	R	S
Sample ID	SO_4^{-2} IC, ppm	SO_3^{-2} calc, ppm	Dilute Factor	Dil-corr[a] SO_4^{-2}, ppm	Dil-corr[a] SO_3^{-2}, ppm	Dil-corr[a] Total[b] SO_4^{-2}, ppm	SO_3^{-2}/ SO_4^{-2}, P/O	Total SO_4^{-2}, Flow Adj To 19 LPM
A	5.1	72.2	1.00	5.1	72.2	77.3	14.1	
B	73.5	0.0	1.02	75.0	0.0	75.0		
C	0.2	0.0	1.02	0.2	0.0	0.2		
300 ppm								
D	67.8	348.5	1.00	67.8	348.5	416.3	5.14	444.1
E	93.0	309.4	1.00	93.0	309.4	402.4	3.33	429.3
F	409.9	0.0	1.02	418.1	0.0	418.1		446.0
G	40.2	5.3	10.00	402.0	5.3	407.3	0.01	434.6
H	43.8	0.0	10.00	437.5	0.0	437.5		466.8
I	22.1	0.4	1.00	22.1	0.4	22.4	0.02	23.9
J	23.0	0.0	1.02	23.4	0.0	23.4		25.0
K	127.4	266.7	1.00	127.4	266.7	394.1	2.09	420.4
L	21.7	1.8	1.00	21.7	1.8	23.5	0.08	25.1
M	20.9	0.4	1.00	20.9	0.4	21.3	0.02	22.7
N	23.1	0.0	1.02	23.5	0.0	23.5		25.1
O	21.4	0.0	1.02	21.8	0.0	21.8		23.3
300 ppm								
P	44.6	2.5	10.00	445.5	24.9	470.4	0.06	491.1
Q	46.7	0.0	10.02	467.8	0.0	467.8		488.4
R	2.7	0.4	10.00	27.2	3.6	30.8	0.13	32.1
S	2.7	0.0	10.02	27.0	0.0	27.0		28.2
T	24.8	0.7	1.00	24.8	0.7	25.5	0.03	26.6
U	25.6	0.0	1.02	26.1	0.0	26.1		27.2
V	59.0	21.3	5.00	295.1	106.7	401.7	0.36	432.0
W	80.1	0.0	5.02	402.1	0.0	402.1		432.4
X	3.4	0.1	5.00	17.2	0.4	17.6	0.02	18.9
Y	3.3	0.0	5.02	16.5	0.0	16.5		17.7
50 ppm								
YA	87.7	53.7	1.00	87.7	53.7	141.3	0.61	151.3
YB	80.7	64.4	1.00	80.7	64.4	145.1	0.80	155.4
Z	67.5	71.1	1.00	67.5	71.1	138.6	1.05	140.4
AA	132.2	0.0	1.02	134.8	0.0	134.8		136.6
AB	10.9	1.3	11.00	120.4	14.5	134.9	0.12	136.6
AC	12.8	0.0	11.05	141.9	0.0	141.9		143.7
AD	11.8	1.4	11.00	129.5	15.6	145.1	0.12	147.0
AE	70.7	69.0	1.00	70.7	69.0	139.7	0.98	141.5
AF	61.2	9.6	1.00	61.2	9.6	70.8	0.157	71.7
AG	68.8	0.0	1.02	70.2	0.0	70.2		71.1
AH	59.1	89.3	1.00	59.1	89.3	148.4	1.51	157.1
AI	138.8	0.0	1.02	141.6	0.0	141.6		149.9
AJ	10.5	1.8	1.00	10.5	1.8	12.3	0.17	13.0
AK	12.0	0.0	1.02	12.3	0.0	12.3		13.0

a: Dil-corr means corrected for sample dilution.
b: Total $SO_4^{-2} = SO_3^{-2} + SO_4^{-2}$

Table 3d. Two-Week Post-Test Process Data.

A	L	M	N	O	P	Q	R	S
Sample ID	SO_4^{-2} IC, ppm	SO_3^{-2} calc, ppm	Dilute Factor	Dil-corr[a] SO_4^{-2}, ppm	Dil-corr[a] SO_3^{-2}, ppm	Dil-corr Total[b] SO_4^{-2}, ppm	SO_3^{-2}/ SO_4^{-2}, P/O	Flow Adjust of Total SO_4^{-2} To 19 LPM
Hold for 2 Weeks								
AL	247.1	202.7	1.00	247.1	202.7	449.8	0.82	479.9
AM	23.7	0.4	1.00	23.7	0.4	24.0	0.02	25.6
AN	181.8	266.7	1.00	181.8	266.7	448.5	1.47	482.3
AO	15.1	1.4	1.00	15.1	1.4	16.5	0.09	17.8
AP	204.0	270.3	1.00	204.0	270.3	474.2	1.33	495.1
AQ	24.2	0.4	1.00	24.2	0.4	24.2	0.02	26.0
AR	78.9	64.0	1.00	78.9	64.0	142.9	0.81	151.2
AS	11.3	5.3	1.00	11.3	5.3	16.7	0.47	17.6
AT	125.0	10.7	1.00	125.0	10.7	135.7	0.09	137.4
AU	70.9	0.4	1.00	70.5	0.4	70.9	0.01	70.9

a: Dil-corr means corrected for sample dilution.
b: Total $SO_4^{-2} = SO_3^{-2} + SO_4^{-2}$

Time Evolution of Non-Purged Sulfate/Sulfite Sample Concentrations

In this series of tests, as the trains began sampling, the sulfite anions quickly built up in the impingers and more slowly began converting into sulfate anions. Thus, for the same input SO_2 concentration, longer sampling/storage periods will produce more sulfate than shorter periods. This trend of an initially dominant sulfite concentration transforming into sulfate over time can be clearly seen by tracking one of the non-purged samples over time. To quantify this trend, the 1 hour non-purged sample sulfite and sulfate levels are tracked through time in Table 4.

Table 4. Test 1 Sulfate/Sulfite Time Evolution.

Hours Since Test Completion	SO_3^{-2} Concentration, ppm	SO_4^{-2} Concentration, ppm
1.5	329	80.4
16.7	267	127
384	203	247

At 1.5 hours samples D and E averaged, at16.7 hours sample K averaged, and, finally, at 384 hours sample AL averaged. Examination of the table time-concentrations suggests an exponential rise of the sulfate concentration and a corresponding exponential decay of the sulfite. This is indeed the case, as can be seen in a graph of the Table 4 data shown in Figure 4. Each curve was fit with an exponential curve, which is placed next to each curve.

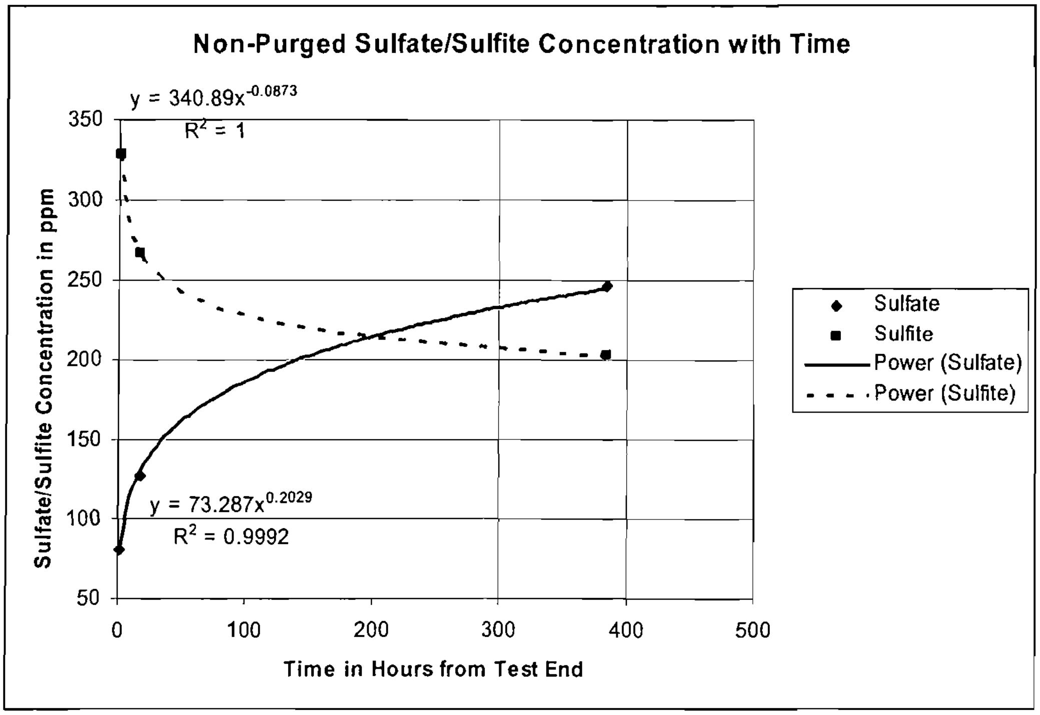

Figure 4. **Transformation of Sulfite to Sulfate Over Time.**

The general trend of conversion of $SO_3^{-2} \rightarrow SO_4^{-2}$ over time for non-purged/non-diluted samples can also be seen in the aging of the Test 1 samples, but cannot be seen in the Test 3 samples since, as previously noted, the process of diluting the Test 3 samples converted most of the sulfite into sulfate almost immediately. For Test 1, the ratio of sulfite/sulfate (samples D and E, Tables 3c and 3d, column R) starts out between about 3 and 5, about 1.5 hours after Test 1 ends. The same sample's (K) ratio reduces to 2.1 after 16.7 hours, reaches a ratio of 1 around 200 hours (Figure 4), and, finally, after 384 hours, the sample's (sample AL) ratio is only 0.82.

For the lower concentration of Test 6, the ratio of sulfite/sulfate (non-purged and non-diluted samples Z and AE) starts out at an average of 1.0, about 1.5 hours after the test ended, while the impinger sample (AH) is still elevated at a ratio of 1.5 12 hours after sampling has ended, showing some unexpected variability in the two sample trains.

After two weeks of storage, mostly at 4 C, the non-purged 6–hour samples (AT and AR) have an average sulfite/sulfate ratio of 0.45; i.e., having less sulfite than sulfate. (All samples were refrigerated at 4 C beginning 1740 hours on 6/24/2005; column K in Tables 3a and 3b shows the sample run times and dates.) Note that sample AT's ratio is about one-tenth that of the corresponding sample AR. This lower ratio was first observed in the short-term comparison of Z and AE to AH, but, after two weeks, the trend has become significantly magnified. This anomalous example shows that samples may be sensitive to small changes in the initial conditions during or shortly after sampling.

Overall, however, the basic trend in sulfite to sulfate ratios in the non-purged/non-diluted samples is clear, as summarized in Table 5. In the short-term, the higher concentration SO_2 gas (300 ppm) bubbled for the shorter time (1 hour, Test 1) results in the much larger ratio of sulfite to sulfate of 4.2, as compared to the lower concentration SO_2 (50 ppm) bubbled for the longer time (6 hours, Test 6).

Table 5. Time-Concentration Trend in Ratio of Sample Sulfite/Sulfate and Total Sulfate.

Test	Pre-Purge Avg. Ratio, (total SO_4^{-2} ppm)	Two-Week Storage Avg. Ratio, (total SO_4^{-2} ppm)	SO_2 Exposure, ppm-hours
1	4.2 (440)	0.8 (480)	300
3	* (461)	1.4 (489)	901
6	1.0 (144)	0.45 (144)	292

* Not available

In this short-term case, the sulfite forms rapidly because of the high SO_2 concentration; however, the transformation of sulfite into sulfate is a slower process than the conversion of SO_2 into sulfite, hence, the large ratio of sulfite to sulfate. The 6-hour test at the lower concentration does not put SO_2 into solution as quickly as the shorter test; however, this test allows more time for the conversion of sulfite into sulfate, hence, the resulting ratio is much closer to unity.

In the long-term, the highest exposure level (900 ppm-hours) generates the most sulfite and, hence, requires the longest time to transform its sulfite into sulfate, as reflected in the long-term by the sulfite to sulfate ratio of 1.4 (compared to 0.8 and 0.45).

Total Sample Sulfate

As Table 5 shows, the amounts of total SO_4^{-2} (Table 3c, column S) for the 3-hour tests are only slightly higher than for the 1-hour test, despite the fact that both 3-hour tests consisted of an exposure level three times higher than the 1-hour test. This comparison points to what appears to be an impinger SO_2 saturation, so that exposures higher than 900 ppm-hours would probably show very little, if any, additional sample sulfate increases in either the purged or non-purged samples under these test conditions.

Without refrigeration, the conversion of sulfite to sulfate should be accelerated and the last data points at 380 hours on each curve of Figure 4 would be further separated than they are. On the other hand, if the samples were refrigerated immediately after generation and in between the analyses, the last points should be closer together.

Test 1.3 (un-purged samples YA and YB in Tables 3a and 3c) was run at 50 ppm SO_2 (see Table 2). In these chromatograms (see Appendix C), nearly equal amounts of Unknown 1 and sulfite can be seen next to the sulfate peak. It is significant that these samples were analyzed only one hour after the test ended (or about two hours earlier than Z and AE were analyzed), at which time the sulfite/sulfate ratio for the two samples from this single Test 1.3 are about 0.7. It seems likely that, in order to have a sulfite/sulfate ratio around 1 (for Z and AE), most of the intermediate Unknown 1 may rapidly convert to sulfite and sulfate in under one and one-half hours.

Two samples from Test 6 (Table 2, 6 hours at 50 ppm SO_2), AF and AG were purged for only 0.63 hours, and then analyzed after about 15.5 hours. These are identical samples except AG was treated with hydrogen peroxide. Comparing the two chromatograms (Appendix C), it is easy to see that the peroxide oxidized the sulfite entirely into sulfate, and also affected the level of Unknown 2. In fact, whenever a sample has had hydrogen peroxide added, the sulfite is always totally transformed, and the Unknown 2 peak increases moderately (for example, the following pairs of samples: E, F; G, H; I, J; L, N; M, O; P, Q; R, S; V, W; X, Y; Z, AA; AB, AC; AF, AG; AH, AI; AJ, AK). Also, as the concentration of the SO_2 increases (as with Test 1, samples D and E) and as the time increases (as with Test 6, sample AH, Unknown 1), peak is overtaken and covered by the sulfite peak.

Sulfite/Sulfate Formation in the Nitrogen-Purged Samples

As indicated by the letter N in column D of Tables 3a and 3b, the nitrogen-purged samples are:

- I, J, L, M, N, O (1 hour, 300 ppm)
- R, S, T, U, X, Y (3 hour, 300 ppm)
- AF (0.63 hours), AG (0.63 hours), AJ, AK (6 hour, 50 ppm)
- AM, AO, AQ, AS, AU (2 Week Hold of 1, 3 and 6 hour samples).

The following is the subset of the nitrogen-purged samples that includes only those that had the full 60-minute purge and without a subsequent addition of hydrogen peroxide:

- I, L, M (1 hour, 300 ppm)
- R, T, X (3 hour, 300 ppm)
- AJ (6 hour, 50 ppm)
- AM, AO, AQ, AS (2 Week Hold of 1, 3 and 6 hour samples).

The dilution-corrected sulfite concentrations from these purged samples are given in column P of Tables 3c and 3d, and that for sulfate in column O. Overall, the sulfite concentrations are very small or nearly zero, and the sulfate concentrations are all small. It is interesting to note that the 1-hour (300 ppb) purged samples (I and J) show almost zero sulfite when analyzed about three hours after sampling, but the next day (L and M, 18 hours after sampling) they show a slight increase in sulfite content with a high value of 1.8 ppm. The 3-hour (300 ppb) purged samples show essentially zero sulfite about four hours after sampling, but it should be noted that all purged 3-hour samples were diluted with water before analysis, which, as noted earlier, oxidizes most of the sulfite. Indeed, all run samples diluted before analysis (nitrogen purged and non-purged) have considerably less sulfite (except V) than their non-diluted counterparts. Still, there is a high value of 3.6 ppm sulfite (column P) for the purged 3-hour samples. The 6-hour samples have a slightly higher short-term sulfite level than the other tests, and five times or more higher level for the long-term samples, in spite of the lower SO_2 concentration of only 50 ppm. These results are summarized in Table 6 below.

Table 6. SO_3^{-2} and SO_4^{-2} Results, 1-Hour Purge with No Peroxide Addition.

Test	SO_3^{-2} Average for Short Hold, ppm	SO_3^{-2} for 2-Week Hold, ppm	SO_4^{-2} Average for Short Hold, ppm	SO_4^{-2} for 2-Week Hold, ppm
1	0.4	0.4	21.6	23.7
3	1.6	0.9	23.2	19.7
6	1.8	5.3	10.5	11.3

Nevertheless, overall, the nitrogen purge was very successful in removing all or almost all of the sample sulfites. Removing the sulfite effectively prevented the formation of APM in the form of sulfate in the samples, as can be seen in Table 7 when comparing the flow-adjusted (Tables 3c and 3d, column S) total sulfate values to their corresponding non-purged samples. Table 7 also shows that, for both the rapidly analyzed samples as well as for the long-term samples stored for two weeks, a 1-hour post-sampling purge reduced sulfate formation by 95 percent for the 1- and 3-hour runs, and by about 90 percent for the 6-hour runs.

Table 7. Purge Efficiency at Reducing Sulfate from Samples.

Test	% SO_4^{-2} Reduction By Purge (2- to 5-Hour Hold)	% SO_4^{-2} Reduction By Purge (2-Week Hold)
1	94.6	94.7
3	94.5	95.5
6	91.0	88.3

Measurements of Impinger pH

Six pH measurements were taken for each run using a few drops of impinger solution for each measurement and pH paper:

- pre-test front and back impingers,
- post-test pre-purge front and back impingers, and
- post purge front and back impingers.

These measurements are given in Table 8.

Table 8. Measurements of Impinger pH at Different Stages.

Test	Pre-Test		Post Test, Pre-purge		Post-Purge	
	Front	Back	Front	Back	Front	Back
1a	5.3	5.3	2.5	2.5	4	4.5
3a	5.3	5.3	1.9	2.5	3.9	4.2
3b	5.3	5.3	2.5	2.5	3.9	3.9
6a	5.3	5.3	2.5	2.5	3.4	3.4
6b*	5.3	5.3	2.5	2.5	2.5	2.5

* purged for only 38 minutes.

All tests showed a decrease in the impinger water pH as well as an increase in sulfate compounds as a result of sampling, indicating the creation of sulfuric acid, as expected. The Post-Test, Pre-Purge impinger pH was nearly the same for all runs, about 2.5. However, the Post-Purge pH was more acidic for the longer runs, indicating that the longer runs allowed more time for the transformation of gaseous SO_2 into H_2SO_4. The Post-Purge pH was generally higher than the Pre-Purge pH, indicating the effectiveness of the nitrogen purge, except for the last test, Test 6b, which was purged for only 63 percent of the stand purge time. Test 6b demonstrates the effectiveness of the last portion of the 60-minute purge in removing the sulfuric acid formed.

SUMMARY

APM Formed

Significant amounts of APM were captured by the impinger trains in these simulated Method 202 stack sampling tests. Nitrogen purging did reduce the APM by 90 to 95 percent; however, it is significant that the 5 to 10 percent APM that remained was never genuine CPM present in the gas stream, since no CPM was ever introduced into the gas stream. In general, higher concentrations and longer sampling times tended to produce higher impinger APM concentrations; however, the APM levels in purged samples (Table 6) were found to be almost gas stream concentration-independent for the exposure levels used in this series of tests.

Purged Samples Relatively Independent of Gas Stream Concentration

The highest levels of APM were, not surprisingly, found in unpurged samples from the highest concentration-time exposure test (see Table 9; note that total SO_4^{-2} is from Table 3c, column S). That is, the 3-hour, 300 ppm tests (900 ppm-hours) had the highest sample sulfate levels.

Table 9. SO_2 Exposure Level and Normalized Sample Concentrations.

Test	Exposure Level, ppm-hours	Unpurged Average Total SO_4^{-2} Concentration, ppm	Samples Averaged for Total SO_4^{-2}	Purged Total SO_4^{-2} Concentration, ppm
1a	299	440	DEFGHK	24.4
3a, 3b	901	461	PQVW	25.1
6a, 6b	292	144	Z,AA,AB,AC, AD,AE,AH,AI	13.0

What is surprising, though, is when comparing Tests 1 and 3, the unpurged sulfate levels in the Test 3 samples are only 5 percent higher than in the Test 1 samples, in spite of the fact that the Test 3 exposure level is three times as high as the Test 1 exposure level. The slight difference in these values may show that the impinger solution was nearly saturated in the 1-hour test at 300 ppm SO_2, and that even tripling the exposure did not significantly raise the solution concentration. This comparison shows that near this saturation level, the impinger catch does not linearly reflect the actual gas SO_2 levels under the test conditions used. Thus, for higher gas stream exposure levels than those investigated in these experiments, the impinger capture might be an even smaller portion of the actual SO_2 level in the gas stream.

This means that with proper sample purging, Method 202 particulate results are not disproportionately affected by APM from high SO_2 gas stream concentrations. That is, SO_4^{-2} levels in properly purged samples are typically below 25 ppm for the exposure levels investigated in these experiments. Purging reduces artifact sulfate formation by about 90 to 95 percent for all conditions tested.

These data indicate that the highest sulfate APM would be expected from high concentration gas streams sampled for long time periods, such as 6 hours. A 6-hour, 900 ppm-hour test would likely produce much higher levels of sulfate in the purged samples than were found in this set of lower exposure tests. It has been reported that studies of systems with SO_2 levels around 2,000 ppm had significant sulfate APM in spite of nitrogen purging, accounting for up to 42 percent of the measured CPM.[1]

Finally, the full 60 minutes of a nitrogen purge insures the maximum reduction of APM for the concentration-times investigated here. This is evidenced by Test 6b, in which the samples were purged for only 38 minutes, resulting in purged samples that contained sulfate levels that were 50 percent of the non-purged samples. It may be the case that additional purging past the 60 minutes may further reduce the APM found in these experiments.

Parameters Affecting APM Formation

The main factors affecting APM formation in these experiments are: nitrogen purging, oxidation, and dilution/mixing. The parameters affecting the APM formation are summarized in Table 10. The mixing and introduction of oxygen that occurs during dilution promoted significant oxidation of samples analyzed in these tests, as is evident in the small sulfite peaks for all the diluted Test 3 samples.

Table 10. Summary of Parameters Affecting Observed Compounds.

Affecting Agent ↓	SO_4^{-2}	SO_3^{-2}
Nitrogen Purging	Decreases 90-95 percent	Greatly Decreases
Hydrogen Peroxide	No Effect	Oxidizes to SO_4^{-2}
Dilution/Mixing	No Effect	Oxidizes to SO_4^{-2}
Holding Time	Promotes Formation	Decreases

As the holding time of a non-purged impinger sample increases, even for refrigerated samples, oxidation of the sulfite to sulfate continues. The ratio of sulfite to sulfate changes from a larger whole number, such as 5 close to the end of the test run, to a value close to unity after several days. If the samples are stored long enough, ultimately all of the sulfite would be expected to become oxidized into sulfate. At least two other compounds, though unidentified, were detected among the sulfite and sulfate compounds. Unknown 1 was prominent during and shortly after sampling was completed, but after only a few hours, Unknown 1 decreased rapidly in concentration.

If samples are properly purged immediately after sampling, about 90 to 95 percent of the APM formation will be prevented. About 20 ppm of APM in the form of SO_4^{-2} remained in all of the purged samples. Samples not purged immediately after sampling would be expected to contain higher levels of sulfate than if had they been purged sooner, since more of the sulfite oxidizes into sulfate. Samples purged later would have proportionately larger sulfate residues than those purged immediately after sampling.

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APPENDIX A:

LITERATURE SEARCH SUMMARY

Appendix A: Literature Search Summary

(1) Chang, M.C., and England, G.C. (2004). "Development of Fine Particulate Emission Factors and Speciation Profiles for Oil-and Gas-Fired Combustion Systems, Other Report: Pilot-Scale Dilution Sampler Design and Validation Tests (Laboratory Study)." GE Energy and Environmental Research Corporation, Irvine, California. Prepared for National Petroleum Technology Office, National Energy Technology Laboratory, and U.S. Department of Energy (DOE Contract No. DE-FC26-00BC15327); Gas Research Institute, California Energy Commission-PIER, and New York State Energy R&D Authority (GRI Contract No. 8362); and American Petroleum Institute (Contract No. 00-0000-4303), July 28.

Previous experiments have demonstrated that the iced impinger test methods can artificially produce inorganic condensable matter. SO_2 and molecular oxygen (O_2) both are soluble in water. The dissolved SO_2 can form hydrated SO_2 ($SO_2 \bullet H_2O$) and sulfite ions (SO_3^-) in aqueous solution. At the potential of hydrogen (pH) range of interest (pH between 2 and 7), HSO_3^- is the preferred state. The individual dissociations are very fast, so aqueous-phase equilibria are established instantaneously. The dissociation of the dissolved SO_2 enhances its aqueous solubility so that the total amount of dissolved sulfate always exceeds that predicted by Henry's Law for SO_2 alone. There are several pathways for sulfate formation by reaction of these ions with dissolved O_2, zone, and hydrogen peroxide, which can be catalyzed by many substances such as iron and manganese. Free NH_3 in the samples can increase the amount of dissolved SO_2, and, thereby, increase artifact sulfate formation since it instantly reacts in aqueous solution forming ammonium sulfite/bisulfite ions and the additional SO_2 must dissolve to maintain equilibrium.

The EPA Methods 202 and 8 implicitly acknowledge the potential for conversion of SO_2 to sulfate ion (SO_4^{-2}) by requiring a post-test purge of the impingers immediately following the test to purge impinger solutions of dissolved SO_2. Studies of systems having SO_2 levels of approximately 2000 ppm showed that the SO_2–to- SO_4^{-2} artifact occurs in spite of post-test purging and that it can account for up to 42 percent of the measured CPM.

Wien et al. (2001) evaluated the SO_2–to-SO_4^{-2} artifact in the laboratory at low SO_2 concentrations typical of gas combustions by passing pure compressed gas mixtures with representative amounts of oxygen, carbon dioxide, nitrogen gas, nitric oxide (NO) and SO_2 through two sets of paired Method 202 impinger trains. No particulate or condensable substances were added. Tests were performed for 1-hour and 6-hour sampling runs with mixtures containing 0, 1, and 10 ppm SO_2. One pair of trains was purged with nitrogen for one hour immediately following the tests, while the other was not. The samples were stored at 4 C for approximately 2 weeks prior to analysis. Significant amounts of SO_4^{-2}, approximately proportional to the SO_2 concentration in the gas, were present in impingers regardless of the post-test purge. While the post-test purge clearly reduced SO_4^{-2} concentration in the impingers, significant SO_4^{-2} still remained. Purging was less efficient at reducing SO_4^{-2} for the 6-hour runs than for the 1-hour runs, indicating that much of the SO_2 oxidation occurs within this period. Wien compared the laboratory data to field result from a gas-fired refinery boiler using unpurged sample trains and concluded that approximately 50 to 100 percent of the SO_4^{-2} in the field samples, which comprised more than 80 percent of the CPM in that field test, could be attributed to the SO_2–to- SO_4^{-2} artifact.

As the flue gases rapidly cool beyond the injection point, moisture in the flue gas reacts with SO_3 and H_2SO_4 forms. The vapor becomes supersaturated, favoring aerosol formation by nucleation followed by condensational growth.

Samples that are analyzed without the optional NaOH titration procedure for preservation of H_2SO_4 in the sample would be expected to contribute significantly to the condensable PM catch for sulfur-bearing fuels. Therefore, the condensable PM catch is uncharacteristically small compared to other test results. This probably accounts for most of the difference between the EPA method and dilution sampler results.

(2) **Corio, L.A., and Sherwell, J. (2000). "In-stack Condensible Particulate Matter Measurements and Issues."** ***Air Waste Management Association*****, February, 50(2): 207-18.**

Methods 202 and 201/201A results for several coal-burning boilers showed that the condensible PM, on average, comprises approximately three-fourths (76 percent) of the total PM10 stack emissions. The results for oil- and natural gas-fired boilers showed that the condensible PM, on average, comprises 50 percent of the total PM10 stack emissions. Results for oil-, natural gas-, and kerosene-fired combustion turbines showed that the condensible PM, on average, comprises 69 percent of the total PM10 emissions. A positive bias in CPM may exist due to the conversion of dissolved sulfur dioxide to sulfate compounds in the sampling procedure. These Method 202 results confirm that CPM, on average, is composed mostly of inorganic matter, regardless of the type of fuel burned.

(3) **England, G.C. (2004). "Development of Fine Particulate Emission Factors and Speciation Profiles for Oil-and Gas-Fired Combustion Systems, Topical Report: Impact of Operating Parameters on Fine Particulate Emissions from Natural Gas-Fired Combined Cycle and Cogeneration Power Plants." GE Energy and Environmental Research Corporation, Irvine, California. Prepared for National Petroleum Technology Office, National Energy Technology Laboratory, and U.S. Department of Energy (DOE Contract No. DE-FC26-00BC15327); Gas Research Institute, California Energy Commission-PIER, and New York State Energy R&D Authority (GRI Contract No. 8362); and American Petroleum Institute (Contract No. 00-0000-4304), November 5.**

In 1997, the EPA promulaged new National Ambient Air Quality Standards (NAAQS) for particulate matter, including for the first time particles smaller than 2.5 microns ($PM_{2.5}$). $PM_{2.5}$ contributes to reduced atmospheric visibility.

Traditional stationary source air emission sampling methods tend to under or overestimate the contributions of the source to ambient aerosols because they do not properly account for primary aerosol formation, which occurs after the gases leave the stack.

CPM is defined as the mass of solid residue remaining after the impinger contents are analyzed.

The EPA Method 202 sample collection and analysis include optional procedures to minimize SO_2 interference (by purging the impingers with N2 for one hour immediately following sample collection), and loss of sulfuric acid (by titrating the inorganic sample fraction with ammonium hydroxide prior to final evaporation and weighing). CPM results are dominated by the inorganic fraction, which chemical analysis shows to be predominantly sulfate related. The net weight of the residues is well above the analytical resolution (5.6 to 9.9 mg sample net weights compared to analytical resolution of 0.1 mg). The standard deviation of the CPM results suggests an in-stack LQL (lower quantitation limits) of approximately 5 mg/dscm (dry standard cubic meters), which is greater than all of the CPM test results. It should be noted that the CPM results are probably biased high due to aqueous phase oxidation of dissolved SO_2 gas to sulfites/sulfates in the impingers during sample collection and storage. Furthermore, condensation of vapors in the impingers is excessive compared to the actual exhaust plume because the sample cools without dilution. Thus, it is likely that CPM measurement results from iced impinger methods applied to gas-fired sources depend more on the natural gas sulfur content than on the process operating conditions and do not represent actual CPM that exists in the exhaust plume.

Based on the iced impinger methods (Methods 202 and 8) with post-test nitrogen purge and optional procedures to minimize H_2SO_4 loss during analysis, the majority of the condensable PM mass is inorganic (sulfate/sulfuric acid), with lesser amounts of other substances. Other tests indicated that most of the sulfate/sulfuric acid in the condensable PM majority of the CMP mass is likely "pseudo-particulate matter" (which is defined in this report as APM) caused by a measurement artifact (aqueous phase oxidation of the dissolved gaseous SO_2 to sulfite/sulfate in the impingers during sampling and sample storage prior to analysis. Thus, the biggest factors determining measured condensable PM emissions from gas-fired sources are believed to be sulfur content of the fuel and the specific methods, procedures, techniques, and reporting protocols used for determining CPM emissions using iced impinger methods. Because these measurement artifacts dominate the results, the biggest factors governing true condensable emissions cannot be determined from results using this method.

Lab results showed that bias in CPM results might increase with longer test runs due to increased aqueous-phase conversion of SO_2 to solid residues.

Post-test impinger purge: The impingers should be purged for one hour immediately following sample collection to reduce uncontrolled bias and variation due to aqueous phase SO_2 oxidation.

This research showed that sulfate-related substances dominate CPM measurements. Previous studies indicated that artifact conversion of gaseous SO_2 to solid residues during sample collection and storage can dominate results at low concentrations. Since conditions affecting this artifact are rarely controlled, it remains a source of considerable random uncertainty in the measurements. If the sulfate-related substances include sulfuric acid, random variation can be introduced when drying the samples since sulfuric acid is relatively volatile and can be lost during analysis unless measures are taken to stabilize it.

(4) Canadian Chemical Producers' Association (CCPA) (2001). Source Characterization Guidelines: Primary Particulate Matter and Particulate Precursor Emission Estimation Methodologies for Chemical Production Facilities. CCPA, 805-350 Sparks Street, Ottawa, Ontario, Canada, March.

"Method 202 … [is] subject to substantial artifacts that do not occur in atmospheric processes, especially when ammonia, sulfates and/or chlorides are present in the exhaust, and, thus, may not provide an accurate measure of primary condensible particles. For example in comparison tests … it was shown that the mass of $PM_{2.5}$ measured by EPA source test methods that included the impinger fraction, was 80-100 times greater than that measured by a dilution sampler. Analysis of material collected in the impingers showed a dominant sulfate; much more sulfate than was collected in the dilution sampling system … attributable to the dissolution and oxidation of SO_2 from the stack gas in the impingers. While the SO_2 artifact is well known for coal- and oil-fired systems, this is the first time it was shown to be significant for very low SO_2 concentrations (0.3 to 3 ppm)".

(5) DeWees, W.G., and Steinsberger, K.C. (1990). "Test Report: Method Development and Evaluation of Draft Protocol for Measurement of Condensible Particulate Emissions." CEM/Engineering Division, Entropy Environmentalists, Inc., Research Triangle Park, North Carolina, May 16.

Method 202 allows the determination of both the filterable PM and CPM simultaneously.

Formation of false CPM: Since gases are bubbled through the impinger water, noncondensable gases may react with other gases or condensables to form CPM that would not have otherwise formed. The most notable case of this is the oxidation of SO_2 to form SO_4^{-2}. The SO_2 dissolves in water to form H_2SO_3, which may oxidize to form H_2SO_4. This SO_4^{-2} would then be counted as CPM. Purging the impinger solution immediately after sampling with air effectively removes the SO_2, but may lead to the possible conversion of SO_2 to SO_3.

If the pH of the sample is less than 4.5, then NH_4OH should be added to the sample to stabilize H_2SO_4 and provide for accurate weighing of the residue.

Remove 4 mL from each impinger, combine, and determine SO_3^- and SO_4^{-2} by IC.

The removal of SO_2 from the impinger through N_2 purging is related directly to the pH of the solution. The SO_2 is more easily removed at a pH of 2 than at above 4 (typical impinger pH was about 2).

After samples were saturated with SO_2, they were purged with air. The results were very much pH dependent. At pHs greater than about 4, SO_2 was not effectively removed. At the low pHs, there was much more scatter than with the nitrogen purge.

If the sample pH is greater than 4.5, indicating low concentrations of H_2SO_4 and SO_2 in the sample, then the ammonia addition is no longer required to stabilize the SO_4^{-2}. Thus, when sources of SO_2 are low, the post-test purge and addition of the ammonium hydroxide can be eliminated; i. e., when the sample pH is greater than 4.5.

(6) Pathak, R.K., Louie, P.K., and Chan, C.K. (2004). "Characteristics of Aerosol Acidity in Hong Kong." ***Atmospheric Environment*****, 38(2004) 2965-2974.**

The acidity characteristics of fine particles are a function mainly of the relative humidity and the ammonium-to-sulfate ratio ($[NH_4^+]/[SO_4^{-2}]$). The ammonium-to-sulfate ratio has been used to describe the acidic nature of atmospheric aerosols. The in-situ free acid concentration, the normalized water content ($[H_2O]AIM2/[SO_4^{-2}]$), and the dissociation of bisulfate to free acid in the aerosols decrease as the ammonium-to-sulfate ratio increases and the relative humidity decreases. It was found that a ratio a ratio of 1.5 is a critical condition to the sampling artifact characteristics of $PM_{2.5}$. AR (ammonia-rich) is defined as the ratio $[NH_4^+]/[SO_4^{-2}] > 1.5$, while AP (ammonia-poor) has a ratio 1.5 or less.

(7) U. S. Environmental Protection Agency (US EPA) (2005). Method 202: Determination of Condensible Particulate Emissions from Stationary Sources. Technical Support Division, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

This method was referenced for the Experimental Design portion of this report.

(8) Pjetraj, J. (1998). "Condensable Particulate Matter: Regulatory History and Proposed Policy." North Carolina Department of Air Quality, Stationary Source Compliance Branch, January 27.

Particulate matter exists in the solid and liquid physical states, and gases or vapors may also condense to form PM. The latter, CPM, is of great concern due to the inherently small size of condensation products; overwhelmingly, CP can be classified as $PM_{2.5}$.

Thus, whenever the effluent is at an elevated temperature, there is the potential for condensation of some particulate matter when the effluent temperature decreases.

Analyses by EPA show that the material collected in the impingers of the sampling train is usually, although not in every case, a consistent fraction of the total particulate loading.

Condensable PM_{10}: CPM can be broadly defined as material that is not particulate matter at stack conditions but which condenses and/or reacts (upon cooling and dilution in the ambient air) to form particulate matter immediately after discharge from the stack. CPM is usually quite fine and, thus, falls primarily within the PM_{10} fraction.

Secondary PM_{10} (PM Precursors): Secondary particulate matter can be broadly defined as particles that form through chemical reactions in the ambient air well after dilution and condensation have occurred (i.e., usually at some distance downwind from the emission point). An example of this phenomenon is the formation of sulfate particles in a plume from the oxidation of sulfur dioxide by one of several atmospheric transformation mechanisms. Generally, SPM can be distinguished from CPM by the time and/or distance downwind from the stack required for formation.

Particulate matter is dependent on the temperature of a given effluent. As the effluent temperature changes, the physical state of the particulate constituents may change as well. Therefore, it is difficult to define particulate matter without a reference temperature. The current Method 5 particulate matter test defines particulate as a material that condenses at or above 248 F.

The EPA has designed Method 202 to prevent the formation of reaction materials from dissolved gases. The EPA believes that any remaining material collected and measured by Method 202 represents the material that would condense in the ambient air.

The method may collect some portion of the SO_2 as condensable. The dissolution of SO_2 in water does not lead immediately to the formation of sulfuric acid, but tends to lower the solution pH, which further inhibits sulfate or sulfuric acid formation. The method includes a purging procedure that effectively removes SO_2 before significant oxidation occurs.

Method 202 and M5'71 are virtually the same with respect to the condensable portion of the sampling train. Ultimately, the methods can be described as functionally equivalent when the nitrogen purge is applied to both methods.

(9) Farber, P.S., and Marmer, D.L. (2005). "Condensible Particulate Matter Emission Sources and Control in Coal-Fired Power Plants." Environmental Consulting Group, Sargent and Lundy LLC, 55 East Monroe Street, Chicago, Illinois 60603. Presented at Electric Power 2005, April 5-7.

Coal-fired power plants produce emissions that must be controlled for compliance with State and Federal regulations.

"... testing has shown that a portion of the SO_2 in the gas stream may convert to a "pseudoparticulate" in the impingers of the sampling train. Furthermore, the ammonia (NH_4) use to control NO_x in SCR and SNCR systems can also react in the impingers to form salts that are falsely measured as condensable particulate matter (CPM) in the impingers".

Organic CPM from coal boilers comes mainly from the incomplete combustion of the organic constituents in the coal. Inorganic CPM from coal fired boilers includes salts, acid mists, and trace metals. As an example, sulfur trioxide (SO_3) in the flue gas can react with water or ammonia to produce CLPM in the following reactions:

(Eq. 1) $SO_3 \text{ (gas)} + H_2O \text{ (gas)} \rightarrow H_2SO_4 \text{ (gas)} \rightarrow H_2SO_4 \text{ (liquid)}$

(Eq. 2) $SO_3 \text{ (gas)} + H_2O \text{ (gas)} \rightarrow 2NH_3 \text{ (gas)} \rightarrow (NH_4)_2SO_4 \text{ (solid)}$

There are a few reactions that take place in the impinger solutions that do not normally occur when the flue gas cools to ambient temperatures as it exits the stack into the atmosphere. Such reactions can form "pseudoparticulates" that are measured as CPM by Method 202 and as sulfuric acid by Method 8, but are not truly reflective of actual emissions. Sulfur dioxide in the flue gas, which would normally exit the stack unaffected, can undergo the following pseudoparticulate reaction in the impinger solutions:

(Eq. 3) SO_2 (gas) + H_2O (liquid) → SO_2 (dissolved gas) + time, O_2 → H_2SO_4 (liquid)

During a flue gas emissions test, a portion of the SO_2 in the flue gas dissolves in the impinger water. Throughout the test run, some of the dissolved SO_2 will oxidize to sulfate ions and sulfuric acid. Unlike the formation of SO_3 into sulfuric acid (equation 1), the formation of SO_2 into H_2SO_4 (equation 3) does not reflect what actually happens at the stack exit as the flue gas stream begins to cool.

Staff from the EPA's Environmental Measurements Branch conducted simultaneous testing of Method 5/202 sampling trains at a coal-fired boiler (1.5 percent sulfur content) in order to determine the adequacy of the nitrogen purge under field conditions. The total CPM measured in the purge impingers averaged 4.7 mg, while the CPM measured in the unpurged impingers averaged 51.4 mg. The 10-fold difference between the two suggests that the 1-hour nitrogen purge is effective in removing a good portion of the dissolved SO_2. Comparison of the purged and unpurged trains also indicates that the nitrogen purge has little effect on organic condensibles, as the two measurements had a 95 percent confidence level. Based on these pair-trained tests, the EPA concluded that the 1-hour nitrogen purge was appropriate for Method 202.

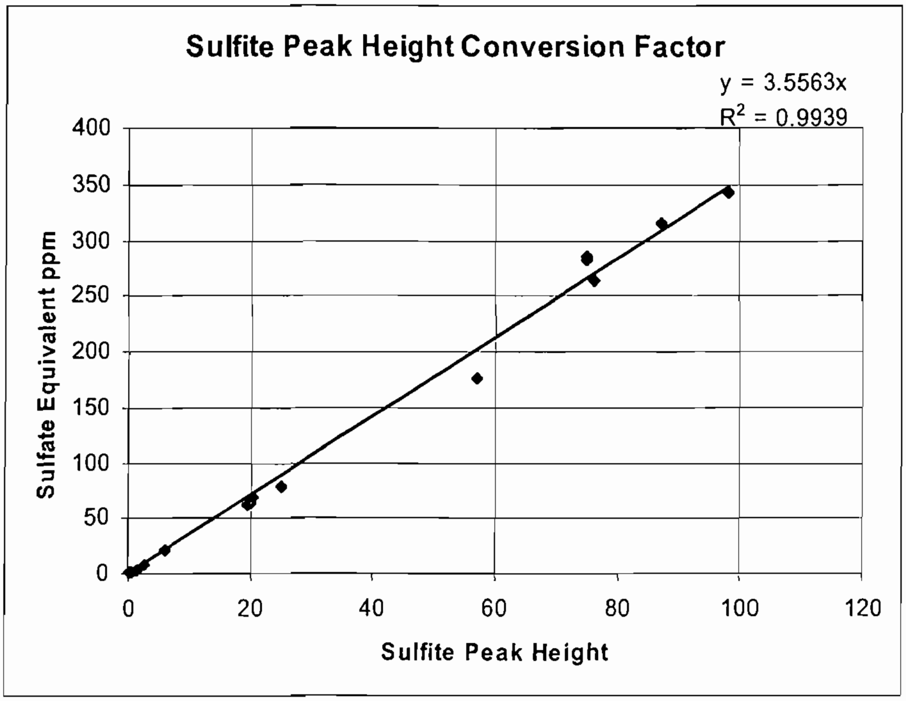
"Another potential pseudoparticulate reaction in the Method 202 impingers occurs when ammonia slip form an SCR or SNCR reacts with SO_2 and SO_3 to form ammonium sulfate and ammonium bisulfate… . Even with the small amounts of ammonia slip sound at modern coal-fired power plants (2 to 10 ppm), the production of ammonia salts can be significant. A nitrogen purge will have no effect in removing the ammonia salts".

"The bulk of the CPM emissions appear to be related to SO_3".

APPENDIX B:

SULFITE PEAK HEIGHT CALIBRATION CURVE

Appendix B: Sulfite Peak Height Calibration Curve



APPENDIX C:

CHROMATOGRAMS OF SULFATE/SULFITE ANALYSES

Appendix C: Chromatograms of Sulfate/Sulfite Analyses

Optimized Method 202 Sampling Train to Minimize the Biases Associated with Method 202 Measurement of Condensable Particulate Matter Emissions

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ABSTRACT

Numerous papers have addressed the significant positive biases associated with the use of EPA Method 202 for the measurement of condensable particulate matter ("CPM") emissions. These biases are due, in part, to the oxidation of soluble gases inadvertently captured in the cold impinger solutions used in Method 202 sampling trains. In some cases, the artifact CPM formed from gases in the impingers can be up to ten times the concentration of filterable particulate matter in the sample gas stream. The CPM emissions measured by Method 202 can significantly over-state the actual emissions of CPM to the atmosphere.

In response to the bias problems, the U.S. Environmental Protection Agency ("U.S. EPA") has been actively developing an air dilution sampling train that can be used to measure CPM without the use of water-filled impingers. This air dilution method is available as EPA Conditional Test Method 039 ("CTM 039"). Unfortunately, this method requires extremely large bulky sampling equipment, is expensive to operate, cannot distinguish between filterable and condensable $PM_{2.5}$ emissions, and is vulnerable to significant wall losses of CPM. The authors are not aware of any uses of CTM 039 outside of limited EPA research test programs.

Until CTM 039 or alterative air dilution techniques are available for practical commercial use, there is a need to minimize the Method 202 biases associated with the measurement of CPM. Air Control Techniques, P.C. has developed an optimized Method 202 sampling train that utilizes off-the-shelf components and operates without the need for water filled impingers. The only water present in the impingers is sample gas stream moisture condensing on the cold surfaces of the dry impingers. The absorption and subsequent aqueous phase reactions of dissolved gases are substantially reduced in this optimized Method 202 sampling train. A filter is used after the dry impingers to achieve high efficiency capture the condensed CPM particles formed in the optimized sampling train. This paper provides data comparing the sulfate artifact levels in a conventional Method 202 sampling train with the optimized Method 202 sampling train. The results of tests indicate that the optimized Method 202 sampling train reduces sulfate artifact levels to 15% of the levels in an un-purged conventional train and to 33% of the levels in a purged conventional train. The results of these laboratory tests are very similar to artifact formation rates calculated based on sulfur dioxide solubility and a 4% per hour oxidation rate in solution.

1. INTRODUCTION

The primary emissions of CPM from stationary sources are of increasing concern because the U.S. EPA believes that these emissions could be significant contributors to ambient $PM_{2.5}$ particulate matter in some geographical areas. U.S. EPA regional offices have been encouraging state and local agencies to request that stationary sources conduct CPM emission tests to compile the data necessary to evaluate future control strategies for the $PM_{2.5}$ National Ambient Air Quality Standards. At the present time, U.S. EPA Method 202 is the only promulgated method available to measure primary CPM emissions. This method is usually conducted with U.S. EPA method 5 for the determination of filterable particulate matter ("FPM") emissions. The combined sampling train is termed Method 5/202.

FPM are defined as particulate matter that exists at a temperature set by the air emission testing procedures which for Method 5 is 248°F ± 25°F. Vapor phase materials (e.g. high molecular weight organic compounds and sulfuric acid) sometimes present in the sample gas streams of combustion sources passes through the sampling train filters and are not collected. EPA has argued that the condensable vapors not collected in a filterable particulate matter test method can form particles once the stack emissions cool in the atmosphere. Accordingly, in 1991 EPA promulgated Method 202 to be used as a stand alone method or in combination with a FPM measurement method such as Method 5. Method 202 involves the analyses of the total organic and total inorganic material trapped in the water filled impingers in the "back half" of the Method 5 sampling train. The impingers capture all vapor phase materials that condense at a temperature below the Method 5 filter temperature and above the impinger exit temperature (<68°F).

2. METHOD 202 MEASUREMENT BIAS

Air emission testing experience since the promulgation of Method 202 in 1991 has demonstrated that it is inappropriate to use water-filled impingers to cool the sample gas stream for CPM combustion sources having SO_2, NO_2[1], and/or soluble organic compound[2] emissions. These gaseous contaminants can partially absorb in the impingers and chemically oxidize to form material counted as CPM in Method 202. These artifact reaction products are not related to the primary emission of CPM from the source.

The potentially significant problems affecting Method 202 accuracy include the following:

1. Dissolution of sulfur dioxide and nitrogen oxides into water with subsequent oxidation to form sulfates and nitrates in the impingers
2. Dissolution of soluble organic compounds into water
3. Penetration of submicrometer sized condensed particles through the impingers of the Method 202 sampling train
4. Gas phase homogeneous reactions between ammonia and hydrogen chloride and/or between ammonia and sulfur dioxide in the cold, water-filled impingers

Of these four sources of bias, the absorption and reaction of sulfur dioxide is most common. Since Method 202 was promulgated, there has been considerable concern that absorption of soluble sulfur dioxide and nitrogen dioxide and subsequent reactions of these dissolved gases occur within the aqueous phase in the impingers (references 1, 2, 3, 4 and 8). These reactions are

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[1] NO_2 is one of the two oxidized nitrogen oxides included as NOx. NO_2 is usually present at levels of 2% to 10% of the total NOx concentration.

[2] Soluble organic compounds include alcohols, aldehydes, ketones, and organic acids.

important because these gases are considerably more soluble in cold liquids than in warm liquids. The 32°F to 68°F temperatures of the liquid in the impingers provide an ideal environment for the collection of soluble inorganic gases.

Atmospheric reactivity studies summarized in the final edition of the Particulate Matter Air Quality Criteria Document (reference 5) indicate that there are a number of reaction mechanisms for converting dissolved sulfur dioxide (sulfite ion) to sulfuric acid. These studies indicate that the conversion rate of sulfur dioxide in water droplets can be "several times" higher than the 1% to 3% per hour conversion rate observed for dry, gas phase reactions. Based on this general relationship, the aqueous phase conversion rates relevant to water filled impingers are estimated to be 2% to 6% per hour.

> "Chemical reactions of SO_2 and NOx within plumes are an important source of H^+, SO_4^{-2}, and NO_3^{-1}. These conversions can occur by gas-phase and aqueous-phase mechanisms. For the conversion of SO_2 to H_2SO_4, the gas-phase rate in such plumes during summer midday conditions in the eastern United Stated typically varies between 1 and 3% per hour, but in the cleaner western United States rarely exceeds 1% hr^{-1}."
>
> U.S. EPA, Particulate Matter Criteria Document (October 2004), Page 3-63.
> (Concerning dry, gas phase reactions)

> "The contribution of aqueous-phase chemistry to particle formation in point-source plumes is highly variable, depending on the availability of the aqueous phase (wetted aerosols, clouds, fog, and light rain)... The in-cloud conversions of SO_2 to SO_4^{-2} can be several times larger than the gas-phase rates give above."
>
> U.S. EPA, Particulate Matter Criteria Document (October 2004), Page 3-63.
> (Concerning aqueous phase reactions similar to those that could occur in Method 202 impingers)

The 2% to 6% per hour secondary particulate (sulfate) formation rates suggested by EPA (reference 5) are very high. Similar SO_2 oxidation rates in the impingers of Method 202 can create significant quantities of sulfate material.

Method 202 includes provisions to address the SO_2 absorption and reaction issue. EPA recommends that the impinger solutions from the Method 202 sampling train be purged with clean nitrogen to strip out the dissolved SO_2 from the solution. Unfortunately, there are two factors that limit the effectiveness of this approach: (1) SO_2 oxidation reactions begin immediately during the test run and prior to the start of the purge step and (2) purging is often not complete.

Obviously, a post test run nitrogen purge has no impact on the quantity of SO_2 that reacts to form sulfates in solution during the one hour Method 202 test run and the one to two hours after the test run that are often needed before purging is started. At a reaction rate of 2% to 6% per hour, there is considerable time prior to purging for the dissolved SO_2 to react to form sulfates that are subsequently falsely counted as "condensable particulate matter" emissions from the source.

It is also apparent that purging is more difficult than anticipated in Method 202. Tests conducted by Corio (reference 3) indicated that, in many cases, the one-hour purge time listed in Method

202 is not adequate to eliminate the gaseous material (e.g. sulfur dioxide) that has absorbed into solution. Similar problems have been observed by McCain and Williamson (references 2, 6, and 7). Purge efficiencies in the mid-80% to low 90%s have been measured in these tests. The remaining 10% to 20% of the dissolved sulfur dioxide (and other dissolved gases) is converted to condensable particulate matter in the samples in the hours to days that pass until the samples are analyzed. This can significantly affect the accuracy the Method 202 test results.

To evaluate the extent of the error in Method 202 caused by SO_2 absorption and reaction, the quantity of SO_2 absorbed in the Method 202 impingers has been calculated based on Henry's Law constants for a pure water - SO_2 solution. The results are summarized in Table 1 for a typical Method 202 sampling run involving the capture of 30 DSCF of sample gas and a 3 hour period after the test run before the initiation of the Method 202 allowed purge step. The results are also based on a SO_2 oxidation rate of 4% per hour.

The hourly and annual artifact CPM "emissions" are based on a total stack gas flow rate of 50,000 DSCFM and 7,500 operating hours per year. The stack gas flow rate is representative of a small-fossil fuel-fired boiler, a moderately sized kiln, or a moderately sized furnace.

Table 1. Calculated Absorption and Oxidation of Sulfur Dioxide in the Impinger Solutions (pure water-sulfur dioxide solution)

SO_2, ppm	N_2 Purge Efficiency, %	Sulfate Artifact @ 4% per hour formation rate, grains/DSCF	Sulfate Artifact, Equivalent @ 50,000 DSCFM, lbs/hour	Sulfate Artifact, Equivalent @ 7,500 hours per year, tons per year
200	No Purge	0.0157	6.7	25.2
	80	0.0055	2.3	8.8
	90	0.0039	1.7	6.2
	100	0.0023	1.0	3.7
500	No Purge	0.0449	19.3	72.2
	80	0.0136	5.8	21.9
	90	0.0097	4.2	15.6
	100	0.0058	2.5	9.3

In laboratory tests conducted by Air Control Techniques, P.C. in 2001 using clean impinger water, condensable particulate matter levels exceeding 0.014 grains/DSCF were found even though the Method 202 laboratory tests were conducted with a sample gas stream blended with Protocol 1 high quality particulate-free gaseous sulfur dioxide, nitrogen oxides, and ammonia (reference 4). There was no condensable particulate matter in the blended gas stream entering the Method 202 sampling train. These measured "CPM" levels observed in these tests confirmed that significant positive biases that can exist with Method 202 techniques when used on stationary sources with sulfur dioxide concentrations in the range of 200 to 500 ppm.

The laboratory tests conducted in 2001 did not include carbon dioxide or water vapor in the sample gas stream. Furthermore, the previous tests did not include any modifications to the conventional Method 202 sampling train to minimize the positive bias related to sulfur dioxide absorption and oxidation. To further evaluate means to minimize the positive bias in Method 202, additional tests were conducted in 2005. The experimental techniques and the characteristics of the optimized Method 202 sampling train are summarized in Section 3. The results of the evaluation program are summarized in Section 4.

3. EVALUATION PROCEDURES

3.1 Conventional Method 202 Sampling Train.

A conventional Method 202 sampling train was set-up in the Air Control Techniques, P.C. laboratory. A sample gas stream was blended from (1) oxygen in nitrogen and carbon dioxide in nitrogen gas cylinders, and (2) a sulfur dioxide in nitrogen gas cylinder. The oxygen and carbon dioxide carrier gases were bubbled through a set of impingers operating at 160°F to 180°F to provide water vapor levels of 1.45% to 3.36% in the blended sample gas stream. This gas stream was then heated to 290°F to 310°F. The concentrations of sulfur dioxide, carbon dioxide, and oxygen were monitored continuously at the outlet of the Method 202 impingers using EPA Methods 3A and 6C. The concentrations were also measured at the inlet to the Method 202 sampling train prior to the test run. The water vapor concentrations were measured using EPA Method 4.

Each Method 202 test run in the lab was conducted for one hour at a sample gas flow rate of approximately 0.62 DSCFM. The oxygen concentrations ranged from 6.4% to 17.0% by volume and the carbon dioxide concentrations ranged from 0% to 16.7%. The sulfur dioxide concentrations at the inlet to the Method 202 sampling train ranged from 130 ppm to 210 ppm. The probe and the filter in the Method 5 "front half" was operated at 250°F to 270°F, within the required Method 5 temperature range. The impinger outlet temperatures ranged from 42°F to 55°F, well within the required Method 202 operating range.

Following each test run, the sampling train was recovered using Method 202 procedures. However, since this test program was limited to the absorption and oxidation of sulfur dioxide, the methylene chloride rinse step was omitted.

3.2 Optimized Method 202 Sampling Train

The optimized Method 202 sampling train shown in Figure 1 has been designed to achieve adequate temperature reduction with minimal contact between the SO_2 containing gas stream and the liquid. A filter located after two "dry" knockout impingers is the primary location for the capture of condensed particulate matter. The optimized Method 202 sampling train is rinsed using water and methylene chloride to collect any condensed material on glassware surfaces.

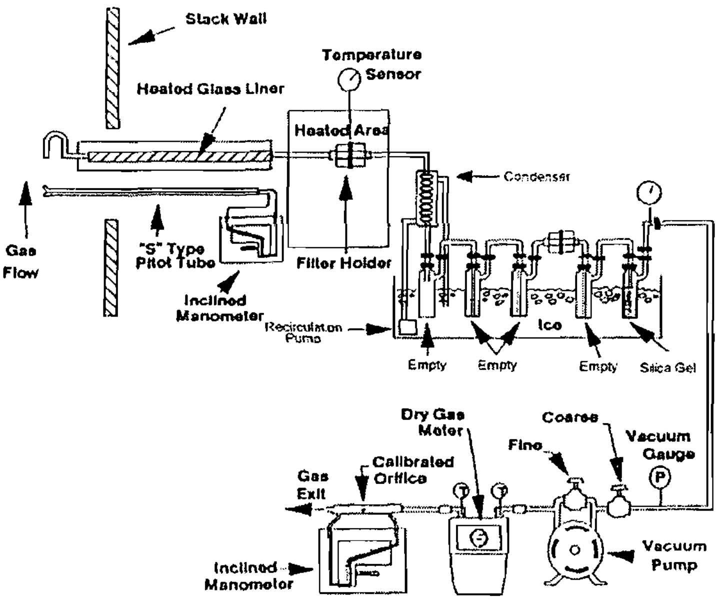

Figure 1. Optimized Method 202 sampling train

The gas stream entering the optimized Method 202 sampling train is first contacted using an indirect condenser that uses cold water recirculated from the impinger case. This decreases the gas temperature to below 68°F. The only contact between gaseous SO_2 and condensed water is with the sample gas stream moisture that condenses on the surfaces of the indirect heater exchanger.

A large knockout impinger is used following the indirect heat exchanger to quickly separate the sample gas stream from the condensed water. The sample gas stream then passes through two empty Greenberg-Smith impingers to ensure complete droplet knockout and CPM formation prior to the filter. A 47mm filter is used to filter out the condensed particulate matter. The filter is combined with the knockout impinger solution and the rinses of the entire sampling train. All of the condensed material is extracted from this combined sample and is analyzed in accordance with standard Method 202 analytical procedures.

The optimized Method 202 sampling train was used with the same simulated stack gas stream used with the conventional Method 202 sampling train. The sulfur dioxide, carbon dioxide, and oxygen concentrations were monitored continuously at the outlet of the last impinger prior to the silica gel. The performance of the optimized Method 202 sampling train was compared with the test results with the conventional Method 202 sampling train.

4. TEST RESULTS

The sulfur dioxide, carbon dioxide, and oxygen concentration trends during the test run with the conventional Method 202 train is illustrated in Figure 2. It is apparent that high efficiency removal of sulfur dioxide occurs in the impinger solutions for the first ten to fifteen minutes of the test run. After saturation of the impinger solutions, the SO_2 concentrations at the outlet of the Method 202 sampling train (prior to the silica gel) reached the inlet concentration level of 180 ppm.

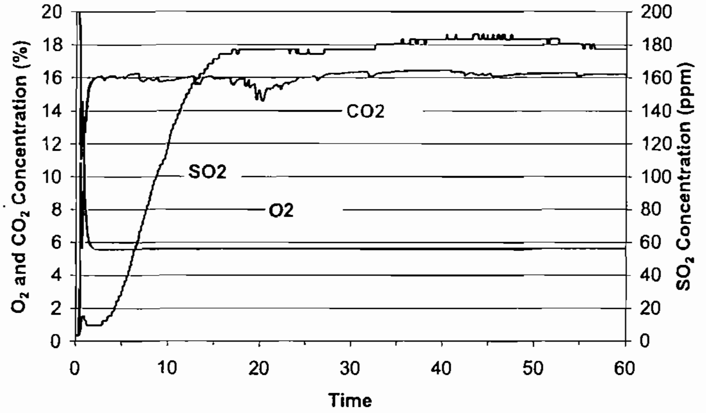

Figure 2. Concentration trends in a conventional Method 202 sampling train

The impact of carbon dioxide on the absorption and reaction of sulfur dioxide in the sampling train was evaluated by eliminating the carbon dioxide source. The concentration trends in Figure 3 for a conventional Method 202 sampling train without the presence of carbon dioxide are very similar to the results with carbon dioxide. In this test run, the inlet sulfur dioxide concentration was 130 ppm.

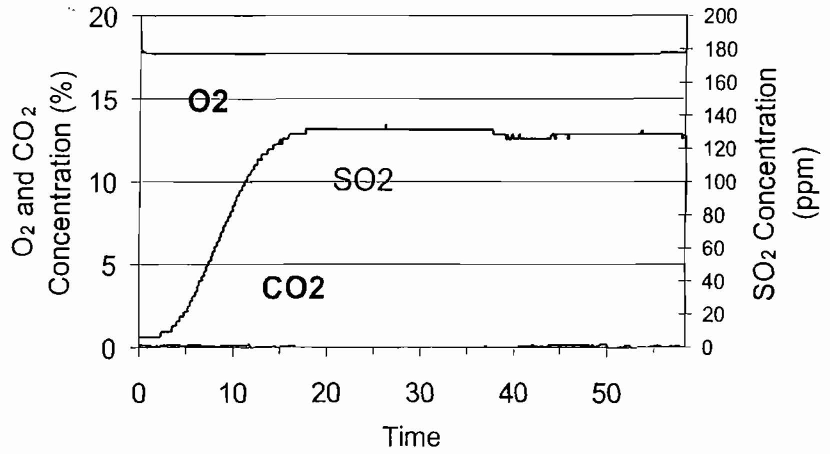

Figure 3. Concentration trends in a conventional Method 202 sampling train without carbon dioxide in the sample gas stream

It is apparent that the elimination of carbon dioxide did not strongly affect the rate at which the sampling train outlet SO_2 concentration ramped back to the inlet concentration level.

The results of the test on the optimized Method 202 sampling train are illustrated in Figure 4. It is apparent that SO_2 absorption is significantly reduced with this optimized arrangement. The SO_2 outlet concentration almost immediately increases to the inlet concentration value of 210 ppm.

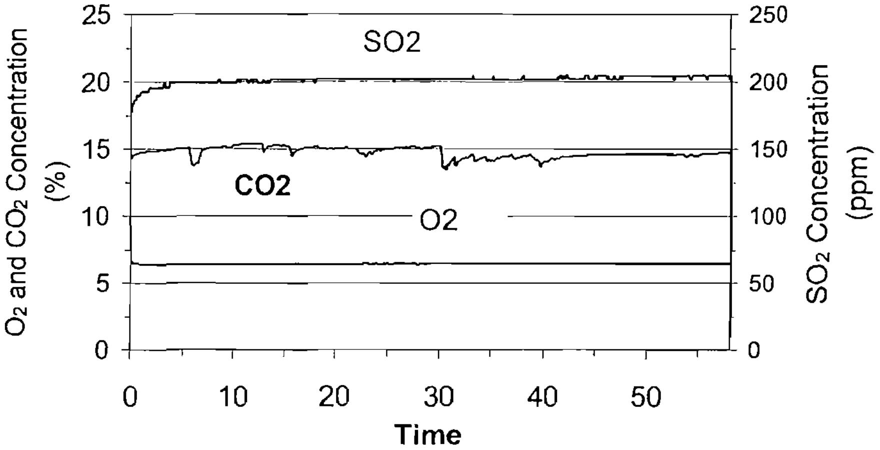

Figure 4. Concentration trends in an optimized Method 202 sampling train

Due to the substantial reduction in the capture of sulfur dioxide, the vulnerability to positive bias related to aqueous phase oxidation reactions is minimized. The differences in the sulfate concentration levels in the Method 202 samples confirm that the positive bias with the optimized train is reduced well below the levels observed in the conventional Method 202 sampling train.

Table 2. Method 202 Test Results

Run	Sampling Train	Test Conditions	Artifact Sulfate, milligrams	Artifact Sulfate, grains/DSCF
1	Conventional	No purge	38.0	0.016
2	Conventional	Purge	15.0	0.006
3	Conventional	Purge, No CO_2	13.8	0.006
4	Optimized	No purge	5.2	0.002

The results with the optimized Method 202 sampling train indicate the artifact levels are 15% of the levels in the conventional Method 202 sampling train with no purge. The optimized Method 202 sampling train had artifact levels that were only 33% of the levels measured in a conventional Method 202 train with a 1-hour nitrogen purge.

5. CONCLUSIONS

Laboratory tests conducted using a conventional Method 202 sampling train on a simulated combustion source gas stream confirmed that this method is subject to a substantial positive bias due to sulfur dioxide absorption and aqueous phase oxidation. This bias can be substantially reduced by modifying the conventional sampling train. Instead of water-filled impingers, Air Control Techniques, P.C. recommends that the sample gas stream first pass through a water-cooled indirect condenser, a "dry" knock-out impinger, and two empty impingers in an ice-bath. This provides sufficient heat exchange to cool the sample gas stream below 68°F and to condense all vapor phase material to form CPM. The condensed particulate matter is captured on a high efficiency filter following the third impinger.

A comparison of the performance of the conventional and optimized Method 202 sampling trains indicates that the optimized unit has artifact formation levels of approximately 15% of an un-purged conventional train and 33% of a purged conventional train. The beneficial impact of the optimized sampling train will be even greater in actual gas streams that have additional gaseous species that can increase sulfur dioxide aqueous phase reaction rates.

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APPENDIX J

REGULATED AIR PERMISSION RATE CALCULATIONS

Summary of Current Permitted Emission Rates
Landfill Gas Powered IC Engine

1-CAT® G3520C IC Engine Specifications

Net Power Output	2,233	bhp
Min. LFG LHV	426.0	Btu/scf
Heat input rate (LHV)	14.89	MMBtu/hr
Fuel consumption	34,953	scf/hr
	583	scfm
	0.839	MMscf/day

		Pollutant Emission Factors			Pollutant Emission Rates 1 CAT G3520 ICE		Pollutant Emission Rates 6 CAT G3520 ICE	
Regulated Pollutant		(g/bhp-hr)	(lb/MMscf)	(lb/MMBtu)	(lb/hr)	(TpY)	(lb/hr)	(TpY)
Carbon Monoxide	CO	3.30	--	--	16.25	71.2	97.47	426.9
Particulate Matter	$PM_{10}/PM_{2.5}$	0.29	--	--	1.44	6.31	8.64	37.8

Per Engine Emission Rates

CO emission rate (lb/hr) = EF_{CO} * bhp/(453.6)

$PM_{10}/PM_{2.5}$ emission rate (lb/hr) = $EF_{PM10/PM2.5}$ * bhp/(453.6)

Annual Emission Rate (TpY) = emission rate (lb/hr) * 8760/2000

For Six (6) Engines

Six Engine emission rate (lb/hr) = 6 * emission rate (lb/hr)

Annual Emission Rate (TpY) = six engine emission rate (lb/hr) * 8760/2000

APPENDIX K

AMBIENT IMPACT ANALYSES

Derenzo and Associates, Inc.
Environmental Consultants

AIR QUALITY MODELING PROTOCOL
FOR
BREVARD ENERGY, L.L.C.
AT THE
CENTRAL DISPOSAL FACILITY LANDFILL

Brevard Energy, LLC
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November 10, 2010

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Derenzo and Associates, Inc.
Environmental Consultants

AIR QUALITY MODELING PROTOCOL
FOR
BREVARD ENERGY, L.L.C.
AT THE
CENTRAL DISPOSAL FACILITY LANDFILL

1.0 INTRODUCTION TO AIR QUALITY IMPACT ANALYSES

Brevard Energy, L.L.C. (Brevard Energy) operates electricity generation processes that results in the beneficial use, after treatment, of landfill gas (LFG) that is collected from the Central Disposal Facility (Landfill) located in Cocoa, Brevard County, Florida. The permit is Title V Permit 0090069-008-AV.

An active gas collection system recovers LFG generated within the landfill. Brevard Energy treats the recovered LFG and uses it as fuel in its landfill gas to energy (LFGTE) facility to produce electricity. Three (3) open utility flares are operated by the Central Disposal Facility to control excess LFG that the LFGTE facility cannot use. This air quality modeling protocol has been prepared for regulatory agency review and approval for the performance of source impact analyses to proposed adjustments to the permitted carbon monoxide and particulate emission rates for the existing six (6) electricity generation internal combustion engines (IC engines) currently in operation.

This protocol presents regulated air pollutant emission rates for the existing electricity generation equipment and a description of the procedures and data used with United States Environmental Protection Agency (USEPA)-approved computer models to predict regional ambient air impacts caused by the proposed emission factor modifications to the existing Brevard Energy emission units and appropriate background sources. Results of the Class II area impact analyses, a visibility analyses and a screen of the particulate Class I area impact analyses are included in this document. The particulate Class I screening analysis was performed based on guidance from the Florida Department of Environmental Protection (Florida DEP) and USEPA. The Federal Land Manager did not require modeling for this site based on distance to Class I areas and relatively small mass emission rates.

2.0 FACILITY INFORMATION AND SITE CHARACTERISTICS

2.1 Facility Description and Permitting

The Central Disposal Facility (Landfill) is owned by Brevard County. The municipal solid waste (MSW) landfill, LFG flares, and existing electricity generation facility are specified in the Title V Air Operation Permit issued to the Central Disposal Facility Landfill (Permit No. 0090069-008-AV). The permit allows for the installation and operation of six (6) reciprocating IC engine generator sets, which are owned and operated by Brevard Energy. A site plan is provided in Appendix K-1.

Brevard County owns approximately 4.40 square kilometers (km^2) of land to the west of US Highway 95, on the western edge of Cocoa about 5 miles from the east coast. The property owned by Brevard County has dimensions of 8,809 feet running north/south and 5,380 feet running east/west. The Central Disposal Facility (portion of the property currently used for waste disposal) occupies an estimated one-fourth of the Brevard County property. The Central Disposal Facility is located in the center of the north half of the property. The existing electricity generation facility is located the south of the landfill area; approximately in the center of the county-owned property.

The LFG fueled IC engines are housed in a single building (with dimensions of 62.7 feet by 108.7 feet) constructed in a leased area (within the landfill property) near the LFG collection system header. A gas transmission line (fuel supply pipe) is connected to the header of the LFG collection system and a dedicated gas blower/compressor is used to draw the fuel from the existing LFG collection system to the gas treatment system and electricity generation facility.

A single meter (flow totalizer) was installed and is operated at the Brevard Energy electricity generation facility to measure the total amount of LFG fuel to be supplied to power the six (6) IC engines (i.e., individual engine fuel use meters have not been installed).

The Central Disposal Facility currently owns and operates three (3) utility flares to control landfill gas emissions. The three (3) open utility flares have maximum capacities of 2,360 cubic feet per minute (scfm), 2,360 scfm, and 2,080 scfm of landfill gas (i.e., total LFG control capacity of 6,800 scfm). Producing electricity from combustion of the LFG in the IC engines is the preferred use for the gas. After the installation of the engine facility the flares have served primarily as back-up control devices and only used when an excess amount of gas exists (e.g., if an engine is taken off-line for maintenance or if the landfill gas production rate exceeds the amount that can be used in the engines). The air impact analyses presented in this document are based on continuous operation of the electricity generation facility and the flares at 100% capacity (worst-case scenario).

2.2 Land Use Classifications

The general land use classification of the land within 3 kilometers (km) surrounding the Central Disposal Facility location is rural.

2.2.1 *Population Density*

The population density of the area within a radius of 3 km from the source was determined using a county population density map from the 2000 U.S. Census Bureau. The density map indicates that the area surrounding the facility (the town of Cocoa, Florida) has a population density of approximately 351.6 persons per square mile. The Census Bureau classifies urban areas as having at least 1000 persons per square mile. Because the area surrounding the Brevard Energy facility has a population density significantly less than 1000 persons per square mile (and no significant development has occurred since the 2000 census), the land use of that area can be considered rural. The Census Bureau lists urban areas as having at least 1000 persons per square mile. The facility location is not in an industrial area that would significantly impact the population density analysis (in heavy industrial areas the non-resident population may be much larger than those indicated by standard population density plots).

2.2.2 *Federal Class I Areas*

The Central Disposal Facility located in Cocoa, Florida is located approximately 175 kilometers from the closest portion of the Chassahowitzka National Wildlife Refuge Wilderness Area (Chassahowitzka NWR). The refuge was established in 1941 and encompasses 31,000 acres on the western portion of Florida that includes swampland, estuaries, and saltwater bays.

Other nearby Class I areas include Okefenokee National Wilderness Area (278 km from Brevard Energy), and Everglades National Park (282 km from Brevard Energy). These Class I areas are further from the facility location compared to the Chassahowitzka NWR and will not be modeled at this time. Impacts within the Chassahowitzka NWR will be modeled since it is the closest to the Brevard Energy facility.

The CO Class II modeling indicated that the CO ambient impacts were insignificant and the distance to the nearest Class I area is over 175 kilometers. Due to the low ambient air impacts and distance, the Class I ambient air impacts will not be performed for CO.

Pursuant to USEPA guidance, a Class I area PSD increment for $PM_{10}/PM_{2.5}$ emissions and visibility analysis must be performed since the facility is a potential major source that will be located within 300 km of a designated Class I area. However, the Florida DEP has determined that the Federal Land Manager has waived the requirements to perform a Class I Ambient Impact Evaluation, and the USEPA has requested that a Class I screening analysis be performed as presented in Section 8 of this report for $PM_{10}/PM_{2.5}$ emissions.

Table 2.1 presents distances from the Brevard Energy facility location to the nearby Class I areas.

Figure 2.1 provides a general location map for the Central Disposal Facility.

2.3 Topography

The topography of the land that surrounds the Central Disposal Facility is relatively flat. The base elevation of the Brevard Energy electricity generation facility is approximately 6.4 meters (21 ft.) above sea level and the minimum stack heights of the IC engine exhaust stacks is 20 feet (as measured from local grade), which results in an exhaust stack release elevation of 41 feet above sea level. Based on review of topography plots of the surrounding area there is no terrain within 3 km that has elevations greater than 41 feet above sea level.

Appendix K-1 provides a site plan of the electricity generation facility building and surrounding topography.

Table 2.1 Class I National Wilderness Areas and their approximate distance to the Brevard Energy Facility

State	Location Description	Representative UTM Coordinate (km) East	Representative UTM Coordinate (km) North	Distance to Brevard Energy (km)
FL	Brevard Energy Facility	3,140	517	-
FL	Chassahowitzka Wilderness Area	3,174	344	175
GA	Okefenokee National Wilderness Area	3,385	383	278
FL	Everglades National Park	2,860	551	282

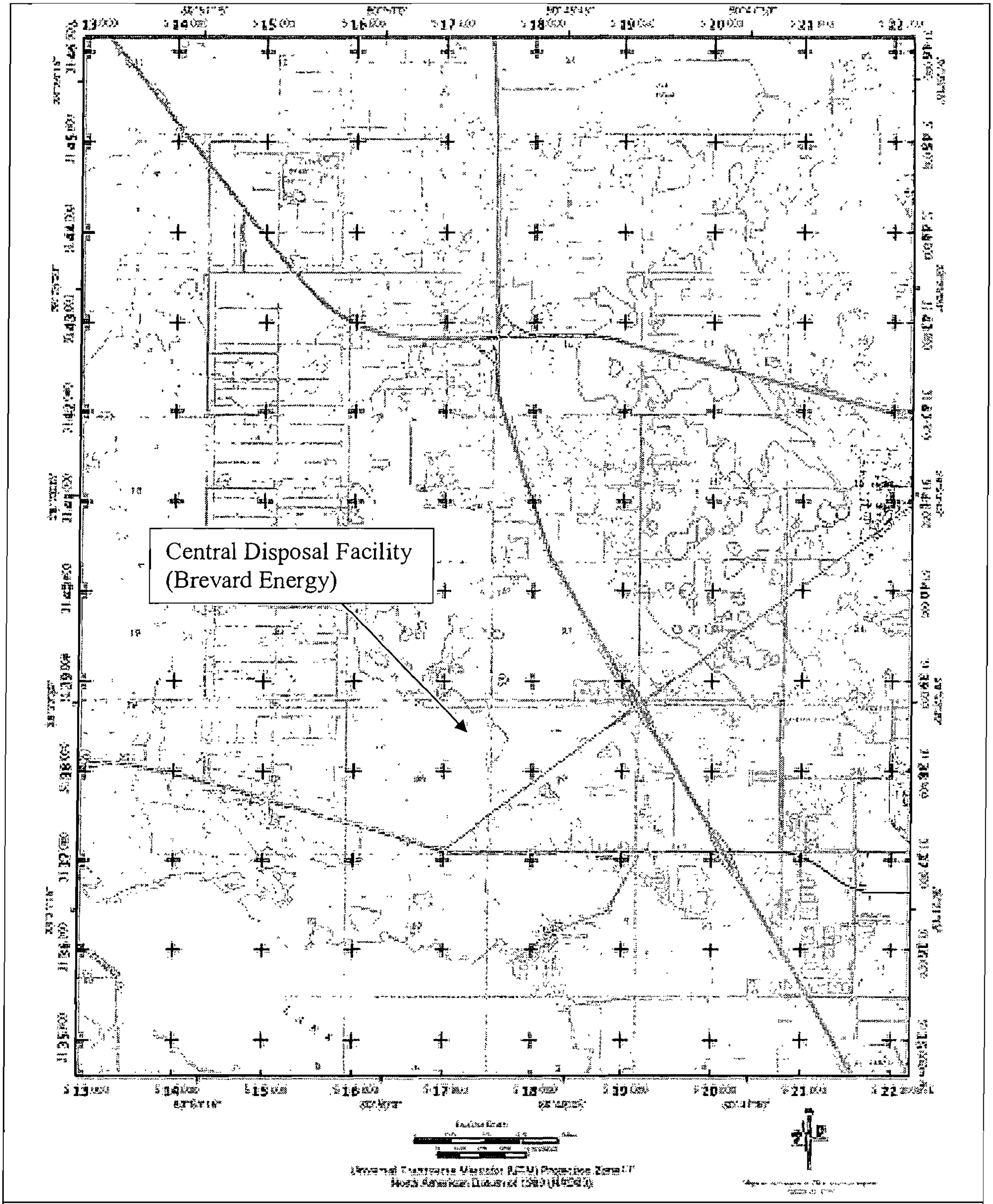

Central Disposal Facility
(Brevard Energy)

Figure 2.1 Central Disposal Facility (Landfill) Site Map

3.0 EMISSION UNIT SPECIFICATIONS

3.1 Gas Collection and Control

The LFG is collected using a system of wells that are connected to a central header (gas collection system). The collected LFG is primarily directed to the electricity generation facility where it is treated and used as fuel for the IC engine generator sets. Excess LFG (gas which is collected and exceeds the electricity generation facility fuel capacity) or LFG collected during IC engine outages (due to planned engine maintenance or engine shutdowns) is directed to the LFG flaring stations operated by the Central Disposal Facility for the destruction of methane and air toxics contained in the gas. However, the preferred use for the collected LFG is the transfer to Brevard Energy for treatment and use as a fuel gas.

3.2 Gas Treatment System

Brevard Energy operates a treatment system that filters (removal of particles down to 0.3 microns), dewaters and compresses the LFG received from the Central Disposal Facility prior to its combustion as fuel in the IC engine generators. This system is designed to treat the gas to support good combustion, prolong the life of the combustion equipment and reduce material buildup (combustion deposits) on the internal components of the engines.

Components of the gas treatment system are not equipped with atmospheric vents. Therefore, all of the LFG received by the treatment system is directed to the IC engine generators for use as a fuel.

3.3 Landfill Gas Collection Rates

A design heat input rate is required to maintain base load operation of the IC engine generators. Therefore, the volumetric fuel use rate is dependent on the fuel quality (BTU value or methane content) of the recovered LFG that is treated and used as fuel. Presently, the LFG collection rate and fuel quality is sufficient to support the existing electricity generation facility operating at base load.

Based on data obtained from Brevard Energy, the existing IC engine generators used approximately 1586 million cubic feet per year (MMcf/year) based on 915 MMCF used from December 2009 to June 2010 with LFG quality averaging 516 British thermal units per cubic foot (Btu/cf) higher heating value (HHV). The excess LFG that is/will be generated by the Central Disposal Facility and collected by the gas collection system will be sent to the flaring system.

3.4 Electricity Generation Facility Specifications

The LFG-fueled IC engines generator sets are housed in a single building constructed within the leased property area. A gas transmission line (fuel supply pipe) is connected to the header of the existing LFG collection system and a dedicated gas blower/compressor is used to draw LFG from the collection system to the gas treatment system and electricity generation facility.

The IC engines generator sets are designed to fire low-pressure, lean fuel mixtures and produce low combustion by-product emissions. The engines are fueled exclusively with treated LFG generated by the Central Disposal Facility (natural gas is not used to fuel the IC engine operations under any conditions) and designed to operate at base load (100% capacity) conditions. Engine exhaust gas is released into the ambient air through individual stacks connected to the engine exhaust manifolds. A muffler (for noise control) is installed on each engine exhaust stack. No add-on equipment is used to further reduce specific air pollutants.

3.4.1 Modified Emission Factors for Brevard Energy

Brevard Energy is proposing to modify the emission factors for CO and $PM_{10}/PM_{2.5}$ for the six (6) existing CAT® G3520C IC engines generator sets. Each CAT® G3520C IC engine has a power generation rating of 2,233 brake horsepower (bhp).

The CAT® G3520C engine is equipped with an air-to-fuel ratio controller that monitors engine performance parameters and automatically adjusts the air-to-fuel ratio and ignition timing to maintain efficient fuel combustion, which minimizes air pollutant emission rates. Each engine is connected to a 1600 kilowatt (kW) electricity generator, resulting in a total electricity generation rate of 9.6 megawatts (MW) for the six (6) existing engine generators. The modifications requested will not change the total electricity generation rate of the plant.

Table 3.1 presents general design specifications and exhaust stack information for the existing Brevard Energy CAT® G3520C LFG-fueled IC engine generator sets.

3.4.2 Exhaust Gas Specifications

At actual operating conditions, the CAT® G3520C engine exhausts combustion effluent gas at a rate of 13,700 actual cubic feet per minute (acfm) at 900°F through an 18-inch diameter stack. These exhaust gas conditions were used in the modeling demonstration for the IC engines generators.

Table 3.2 presents exhaust stack parameters used in the computer model for the existing Brevard Energy CAT® G3520C LFG-fueled electricity generation engines.

Appendix K-2 presents engine exhaust gas calculations.

Table 3.1 *General design specifications and exhaust stack information for the Brevard Energy CAT® G3520C LFG-fueled electricity generation IC engines*

Engine Model	No. Units	Engine Rating (bhp)	Generator Output (MW)	Stack Diameter (inch)	Release Height (ft)	Exhaust Temp. (°F)	Exhaust Flowrate (acfm)
CAT® G3520C	6	2,233	1.60	18.0	20	900	13,700
Total Electricity Generation			**9.6**				

Table 3.2 *Exhaust stack parameters used in the computer model for the six (6) Brevard Energy CAT® G3520C LFG-fueled electricity generation engines*

Source ID	Location (UTM) East (m)	North (m)	Base Elev. (m)	Stack Height (m)	(ft)	Stack Diameter (m)	(ft)	Temp. (°F)	Exit Velocity (m/s)
EU004	516,755	3,140,579	6.40	6.09	20.0	0.457	1.5	900	39.8
EU005	516,760	3,140,579	6.40	6.09	20.0	0.457	1.5	900	39.8
EU006	516,765	3,140,579	6.40	6.09	20.0	0.457	1.5	900	39.8
EU007	516,770	3,140,579	6.40	6.09	20.0	0.457	1.5	900	39.8
EU008	516,775	3,140,579	6.40	6.09	20.0	0.457	1.5	900	39.8
EU009	516,780	3,140,579	6.40	6.09	20.0	0.457	1.5	900	39.8

4.0 CRITERIA POLLUTANT EMISSION RATES

4.1 Existing Electricity Generation Facility Emission Rates

4.1.1 Carbon Monoxide

The amounts of CO that are produced by the specified IC engines are dependent on fuel quality and the operating parameter specifications at which the equipment is set. Based on data that have been provided by the engine manufacturer (Caterpillar, Inc.) and the results of periodic emission monitoring performed for the CAT® G3520C IC engine at other facilities, Brevard Energy has determined that varying levels of CO emissions from the LFG fueled engines are expected to exist from the time the engines are initially placed in operation and between scheduled maintenance periods due to normal engine wear.

The Title V Air Operations Permit (No. 0090069-008-AV) issued to the Brevard County Board of County Commissioners) specifies a CO emission limit of 2.75 g/bhp-hr (13.54 lb/hr) for the six (6) existing CAT® G3520C IC engines at Brevard Energy. As presented in this application, information and data obtained by Brevard Energy indicate that the CO emission rate can be variable throughout the maintenance cycle of the engines due to normal engine wear and variations in fuel quality.

Based on a review of periodic emission monitoring data collected for similar LFG-fueled facilities Brevard Energy has determined that CO emissions will not exceed 364 parts per million by volume, dry basis corrected to 15% oxygen (ppmvd at 15% O_2) over the operating life of the engines. Based on the heat input rate and exhaust gas specifications presented in Section 3.4 of this protocol, this results in a calculated CO emission rate of 16.25 lb/hr, which is equivalent to 3.30 g/bhp-hr. Brevard Energy is proposing to increase the CO emission rate for the six (6) existing CAT® G3520C engines from 2.75 g/bhp-hr to 3.30 g/bhp-hr. This adjustment results in a calculated CO emission rate of 16.25 lb/hr per unit from 13.54 lb/hr.

A comprehensive best available control technology (BACT) analysis is included in the permit application documents to support the proposed CO emission rate for the IC engines.

4.1.2 Particulate Matter

The Title V Air Operations Permit (No. 0090069-008-AV) issued to the Brevard County Board of County Commissioners) specifies a PM_{10} emission limit of 0.24 g/bhp-hr (1.18 lb/hr) for the six (6) existing CAT® G3520C IC engines at Brevard Energy.

Data does not currently exist for expected $PM_{2.5}$ emissions for the CAT® G3520C engines. USEPA AP-42, Volume I, Fifth Edition, Chapter 2.4 Municipal Solid Waste Landfills, states in the footnote to the particulate matter emission rate for IC engines combusting LFG that *...most of the particulate* *matter emitted will be less than 2.5 microns in diameter. Hence this emission rate* (particulate matter) *can be used for PM_{10} or $PM_{2.5}$ emissions.*

Based on a review of emission test data collected for Brevard Energy and similar LFG-fueled facilities, Brevard Energy has determined that PM_{10}/$PM_{2.5}$ emissions will not exceed 0.29 g/bhp-hr (1.44 lb/hr) over the operating life of the engines. Brevard Energy is proposing to increase the PM_{10} emission rate for the six (6) existing CAT® G3520C engines from 0.24 g/bhp-hr to 0.29 g/bhp-hr. This adjustment results in a calculated PM_{10} emission rate of 1.44 lb/hr per unit from 1.18 lb/hr.

The adjustment is also due in part to the PM_{10} emission testing results that are biased high due to EPA Method 202 and higher than anticipated sulfur content of the treated LFG. It is suspected that the artifact formation and the hydrophilic nature of the collected inorganic particulates created during the testing is the reason that the PM_{10} concentrations are higher than anticipated (Permit Application Document).

A comprehensive PM_{10} / $PM_{2.5}$ BACT analysis is included in the permit application documents to support the proposed PM_{10} / $PM_{2.5}$ emission rate for the IC engine generators.

Table 4.1 presents criteria pollutant emission rates that were used in the modeling analysis for the electricity generation facility.

4.2 Alternate Operating Conditions / Startup and Shutdown Emissions

The IC engines are designed to operate continuously with the exception of planned maintenance downtime or automatic engine shutdowns (instantaneous, automatic IC engine shutdowns if monitored operating parameters are outside of preset ranges). The amount of time required for the IC engine start-up is minimal (the IC engines ramp from start to full load within approximately 20 minutes). Since the IC engines are operated at base load conditions and the durations of IC engine shutdown and startup times are minimal, no air emission estimates or air quality impact concentrations analyses will be performed for these specific events. The IC engines will not be operated for any appreciable amount of time at loads other than 100%; therefore, modeling startup/shutdown emission scenarios are not practical to this type of source.

Table 4.1 Criteria pollutant emission rates used in the air quality modeling analysis for the six (6) Brevard Energy CAT® G3520C LFG-fueled IC engines

Pollutant	LFG-fueled IC engine emission factors		Modeled emission rate per engine[1] (lb/hr)	(g/s)	Emission rate for six (6) IC engines (lb/hr)	(ton/yr)
Carbon Monoxide (CO)	3.30	g/bhp-hr	16.25	2.047	97.5	426.9
Particulates (PM_{10})	0.29	g/bhp-hr	1.44	0.180	8.64	37.8
Particulates ($PM_{2.5}$)	0.29	g/bhp-hr	1.44	0.180	8.64	37.8

1. Based on continuous operation at base load (100% capacity); engine output of 2,233 hp.

5.0 MODELING REQUIREMENTS

5.1 PSD Applicability

Brevard Energy is requesting a modification to the existing permit to change the emission factors for CO and $PM_{10}/PM_{2.5}$. The facility is an existing major source of CO emissions. The proposed Brevard Energy facility modifications for the existing IC engines does not exceed the Prevention of Significant Deterioration of Air Quality (PSD) significant increase threshold of 100 tons per year (TpY) relative to 40 CFR §52.21(b) for CO. Due to the emission factor increase, the CO modeling was performed to verify that there are no regulatory obligations with the proposed total amount of annual CO emissions including the current permitted emissions. In addition, PM_{10} and $PM_{2.5}$ emissions for the facility are greater than the corresponding PSD significant emission increase threshold (15 TpY and 10 TpY, respectively).

Table 5.1 presents emission rates for the proposed Brevard Energy facility existing engine emission adjustments compared to the PSD significant emissions increase thresholds.

Pursuant to 40 CFR §52.21(m), Air Quality Analysis, an application for a permit under the PSD program *shall contain an analysis of ambient air quality in the area that the major stationary source or major modification would affect for each of the following pollutants:*

> *(a) For the source, each pollutant that it would have the potential to emit in a significant amount;*
>
> *(b) For the modification, each pollutant for which it would result in a significant net emissions increase*

Additionally, the modeling analysis must demonstrate that emissions will not cause or significantly contribute to a violation of National Ambient Air Quality Standards (NAAQS) or State ambient air quality standard (AAQS) for all pollutants that exceed the significant emission increase value.

Based on the provisions specified in 40 CFR §52.21(m), CO, PM_{10} and $PM_{2.5}$ for the existing Brevard Energy facility are subject to PSD air quality analysis requirements.

A significant impact analysis was performed using the procedures described in this protocol to:

1. Calculate maximum ambient air impacts for the emission units and modified potential emission rates for comparison to the applicable PSD significant impact level (a demonstration that indicates the maximum predicted ambient air pollutant impacts are less than the applicable significant impact levels is equivalent to a demonstration of compliance with federal and State ambient air standards).

2. Determine the radius of significant impact (R of I) for those pollutant emissions that exceed the significant impact concentration. The R of I is used to determine appropriate background emission sources required to be included in the multisource modeling standards demonstration (federal and state AAQS).

5.2 Modeling Scenarios

The significant impact analysis determines maximum ambient air impacts associated with operation of the existing Brevard Energy electricity generation facility (CO and particulate emissions for six existing CAT® G3520C IC engine generators) for comparison to the PSD significant impact concentrations presented in Table 5.1.

For modeled pollutants that have maximum impacts that exceed the corresponding PSD significance concentration, the R of I was determined (the radius of significant impact is the distance from the modeled source to the farthest receptor at the corresponding significance concentration).

5.3 Influencing Structure and GEP Stack Height Analysis

The existing IC engine generators are installed within a 62.7 ft. (width) by 108.7 ft. (length) building that has a roof height of 15 ft. The individual exhaust stacks are located on the roof of the building and set approximately 20 feet from the western edge of the building. The stacks will extend above the roof at least 5 feet (i.e., overall IC engine exhaust release height of 20 ft. as measured from grade of the land that surrounds the building) and exhaust vertically. The existing electricity generation facility will have a maximum projected crosswind width of 125.5 feet (i.e., the diagonal of the rectangular building).

In general, air pollutant dispersion models consider the influence of building structures on exhaust stack plumes (i.e., downwash conditions) when the exhaust stack has a height that is less than its Good Engineering Practice (GEP) stack height. The GEP stack height for the engine exhaust stacks is 37.5 ft. (11.43 meters) determined with the following equation:

$$H_{GEP} = H_b + 1.5L$$

where: H_{GEP} = formula GEP stack height (ft.)
H_b = height of adjacent building (15 ft.)
L = lesser of height or maximum projected width of adjacent building (15 ft)

There are no other structures located near the electricity generation facility that have the potential to increase the calculated GEP stack height (i.e., the dimensions of the existing electricity generation facilities control the GEP stack height determination). The release height of the identical engine exhaust stacks is less than the GEP stack height (based on the dimensions of the structure in which the engines will be installed); therefore, emissions from the existing IC engine generator exhaust stacks have the potential to be influenced by aerodynamic downwash created by the buildings that house the equipment. The influence of stack downwash on emission impacts was included in the dispersion modeling analyses.

Other nearby structures have the potential to influence the plume rise of the engine exhaust stacks if the distance between the stacks and the nearby structure is less than five times the L dimension (lesser of the building height or maximum projected width) of the structure. No other nearby structures are located within the 5L radius.

The UTM coordinate locations and heights of the influencing structures (i.e., the buildings that house the IC engines generators) and exhaust stacks were entered into the USEPA Building Profile Input Program, Plume Rise Enhancement version (BPIP-PRIME). This computer program calculates projected building widths and heights for the influencing structure as a function of wind direction for use in the building downwash algorithms of the dispersion model that is used for the significant impact analysis (which is described in the following section of this document).

Appendix K-3 provides a compact disc that contains the BPIP input files (.PIP and .GPW files) and output building parameter files (.TAB, .SUM and .SO files) that were used in the significant impact analysis.

Table 5.1 Proposed Brevard Energy emission rate compared to PSD Significant Emissions Increase threshold

Pollutant	Brevard Energy Emission Rate[1] (ton/yr)	PSD Significant Emissions Increase (ton/yr)
Carbon Monoxide (CO)	426.9	100
Particulates (PM_{10}/TSP)	37.8	15
Particulates ($PM_{2.5}$)	37.8	10

1. Proposed emission rate for the six (6) LFG-fueled CAT® G3520C IC engines.

6.0 CLASS II AREA SIGNIFICANT IMPACT ANALYSIS

6.1 Computer Modeling

The maximum impact and radius of significant impact (if applicable) was calculated for each criteria pollutant released from the Brevard Energy LFG-fueled IC engine generators. Screening modeling is often performed for an initial determination of maximum impacts and the radius of significant impact. However, the screening model (e.g., SCREEN3) only calculates impacts associated with a single emission source. Therefore, no screening modeling was performed for initial determination of the R of I (i.e., the R of I determination and subsequent multisource modeling was performed using a refined model only).

6.1.1 Model Selection

The AERMOD (American Meteorological Society/Environmental Protection Agency Regulatory Model) air pollutant dispersion model (version No. 07026) was used to calculate ground-level pollutant concentrations resulting from the proposed air pollutant emission rates and emission unit exhaust configurations. AERMOD is the most recent Gaussian steady-state plume dispersion model released by USEPA for use in assessing ambient air impacts associated with air pollutant releases and was adopted by the USEPA as the preferred general purpose dispersion model (Federal Register Notice November 9, 2005). The USEPA *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) specifies that impacts calculated with most steady-state Gaussian plume models are applicable at distances up to 50 km from the origin of the emission source.

The use of the AERMOD model was determined appropriate because it can be used to determine cumulative pollutant concentrations resulting from the operation of multiple sources.

The following sections present input data and processing options that were used for the AERMOD air pollutant dispersion modeling. The AERMOD input files were prepared by entering appropriate data (applicable to the specific emission process) and model operating parameters into a Windows-based graphical user interface (GUI) developed by BEE-Line/ Oris Solutions (BEEST for Windows, current version 9.83. BEEST for Windows uses the unmodified regulatory AERMOD program.

6.1.2 Model Options

Based on information presented in Section 2.2 of this protocol, the land use for the area surrounding the electricity generation facility is predominantly classified as rural. Therefore, no options for urban dispersion were used to calculate air quality impact concentrations produced by the modeled emission sources.

6.1.3 Meteorological Data

Meteorological data files (hourly surface measurements and upper-air soundings) for the most recent available, complete and quality-assured five-year period for a nearby, representative meteorological monitoring station were used to characterize the dispersion of air pollutants.

Upper air and surface meteorological data for calendar years 1999 through 2003 were obtained from the Florida DEP for the meteorological station in the Orlando area. The data for the selected period is complete. Data from 2004 and 2005 would have provided more current data, but hurricanes during those years did not allow for a complete data set for 2004 and 2005. This station was selected based on its proximity to the project site and a completeness check of the recorded data. While this meteorological station is located in a metropolitan area, it is determined to be the most representative of the meteorological conditions for the area surrounding the Brevard Energy facility due to proximity to the project site.

The data were preprocessed using the AERMET meteorological preprocessor program to produce two types of data files for each meteorological year which are used by AERMOD; surface scalar parameters (*filename*.sss) and vertical profiles (*filename*.pfc).

The AERSURFACE program was used to process existing land cover data to determine surface characteristics (surface albedo, Bowen Ratio and surface roughness) within 1 km of the data collection site. These files were processed by Florida DEP for use by the regulated community.

The AERMET data files used for this project are provided on the compact disc in Appendix K-3.

6.1.4 Fenceline and Receptor Network

Ground-level pollutant impact concentrations are required to be calculated for all nearby areas that are considered to be ambient air (i.e., areas in which public access is not precluded or restricted by the stationary source). The fenceline that surrounds the Central Disposal Facility (which includes the existing Brevard Energy facility) was used as the ambient air boundary.

Results from preliminary modeling using AERMOD indicate that maximum impacts occur at or very near the facility fenceline due to the relatively small height of the exhaust stacks. The receptor network (locations at which air pollutant impact concentrations are calculated) used for the significant impact area (SIA) determination was developed by creating a grid of receptors on a Cartesian coordinate system having a spacing of 100 meters to determine off-site impacts up to 3 km from the facility (i.e., receptors placed at the Central Disposal Facility boundary and extended 3 km in all directions from the property boundary fenceline). Receptors were placed on the Central Disposal Facility fenceline with a spacing of 100 meters to determine impacts at the property boundary.

No flagpole receptors were identified in the area surrounding the facility. Therefore, no flagpole receptors were included in the modeling analysis.

Figure 6.1 presents a depiction of the receptor network with UTM coordinates that was used to perform the SIA modeling analysis.

6.1.5 Terrain Data

Spatial Data Transfer Standard (SDTS) data files were obtained containing information for the geographical area surrounding the facility. USGS 30-meter (7.5 minute) ASCII Digital Elevation Models (DEM) files were created from the SDTS data using the sdts2dem data extraction computer program. The DEM data were based on the North American Datum of 1927 (NAD27). USEPA's AERMAP computer program (version 09040) was used to extract data from the DEM files and calculate source base elevations and receptor elevations using the default algorithm (inverse distance squared of the nearest four terrain nodes).

The DEM data files and AERMAP output files that were used and developed by the model are provided on the compact disc in Appendix K-3.

6.1.6 Pollutant Impact Averaging Times

For the SIA modeling analysis, maximum (highest high) ambient air pollutant impact concentrations for each averaging period produced by the existing emission sources for CO and particulate were determined for the specified five-year meteorological period. These results were compared to the significant impact levels, and if applicable, to establish the radius of significant impact (i.e., the geographic areas that surround the proposed emission facility that are determined to have maximum impacts that are greater than the significance values).
The impact concentration(s) calculated for:

- CO are based on the maximum 1-hr and 8-hr average impacts.
- PM_{10} and $PM_{2.5}$ are based on maximum 24-hr and annual impacts.

Highest 2nd high impacts for short-term pollutant averaging periods (or in the case of PM_{10} the sixth-highest five-year concentration) that are used for the PSD increment demonstration were not considered for determinations of the SIA and radius of significant impact (i.e., the SIA determination and radius of impact is based on maximum impacts only).

6.1.7 Class II Significant Impact Levels

PM_{10}, and CO significant impact levels (SILs) listed in the federal register will be compared to the predicted impacts for this evaluation. $PM_{2.5}$ interim SILs were chosen as listed in the Federal Register Volume 72, No. 183 as option 2.

Table 6.1 presents PSD significant impact levels for each pollutant and averaging time.

6.1.7.1 $PM_{2.5}$ Guidance

Based upon USEPA guidance and discussions with Florida DEP, Interim $PM_{2.5}$ SILs will be utilized for the comparison to the predicted impacts. The USEPA guidance is from a Memorandum dated March 23, 2010 titled, *Modeling Procedures for Demonstrating Compliance with* $PM_{2.5}$ *and NAAQS.* On Page 6 of the Guidance:

EPA's 2007 proposed rule to establish PSD increments, SILs, and a Significant Monitoring Concentration (SMC) for $PM_{2.5}$ *included three options for the* $PM_{2.5}$ *SILs for both the 24-hour and annual NAAQS. Until the* $PM_{2.5}$ *SILs are finalized, the proposed SILS may not be presumed to be appropriate de minimis impact levels. However, EPA does not preclude states from adopting interim de minimis impact levels for* $PM_{2.5}$ *to determine whether a cumulative impact analysis will be necessary, provided that states prepare an appropriate record to support the value used. Such de minimis levels do not necessarily have to match any of the SILs that have been proposed for* $PM_{2.5}$*, but the levels proposed by EPA and the record supporting EPA's proposed rule could be considered in the states's determination.*

The Federal Register Volume 72, No. 183 specifies three different options for SIL comparisons for $PM_{2.5}$.

- Option 1: The $PM_{2.5}$SILs are based on the current PM_{10} SILs.
- Option 2: The $PM_{2.5}$ SIL s are based upon the national average of the ratio of $PM_{2.5}$ to PM_{10}.
- Option 3: The ratio of $PM_{2.5}$NAAQS to PM_{10} NAAQS will determine the SIL used.

6.1.7.2 $PM_{2.5}$ Proposed Interim SIL

Brevard Energy proposes to establish the $PM_{2.5}$ SIL based on Option 2 of the Proposed Rule. The particulate emissions for PM_{10} and $PM_{2.5}$ from the IC engines are the same since the data does not currently exist for expected $PM_{2.5}$ emissions for the CAT® G3520C engines. USEPA AP-42, Volume I, Fifth Edition, Chapter 2.4 Municipal Solid Waste Landfills, states in the footnote to the particulate matter emission rate for IC engines combusting LFG that *...most of the particulate matter emitted will be less than 2.5 microns in diameter. Hence this emission rate* (particulate matter) *can be used for* PM_{10} *or* $PM_{2.5}$ *emissions.*

Option 2 will be used as listed in *The Federal Register Volume 72, No. 183* since the emission factors for PM_{10} and $PM_{2.5}$ are the same (the PM_{10} mass emission rate is the same as the $PM_{2.5}$ mass emission rate). This is a conservative calculation for $PM_{2.5}$ and this set of criteria is the most representative of the emissions. The annual SIL for $PM_{2.5}$ from Option 2 of the Federal Register, is 0.8 micrograms per cubic meter ($\mu g/m^3$) and the 24-hour SIL for $PM_{2.5}$ used was 4.0 $\mu g/m^3$.

6.2 Significant Impact Area Results

R of I results, based on the data and procedures described in this section, are presented in this protocol for regulatory agency review.

Table 6.2 presents a summary of maximum predicted impacts and the R of I produced by the operation of the proposed emission factor modifications to the six (6) LFG-fueled IC engines generators for CO and particulate and averaging time.

Appendix K-4 provides the AERMOD output summary and plots depicting the maximum radius of impact for each pollutant and averaging period.

These results indicate that emissions from the operation of the six (6) LFG-fueled IC engines generators result in maximum predicted impact concentrations that do not exceed the PSD SIL for CO (1-hr and 8-hr), annual PM_{10}, and annual $PM_{2.5}$ averaging periods. However, both PM_{10} and $PM_{2.5}$ impacts exceeded the 24-hr average SIL.

The R of I for PM_{10} is 0.7 kilometers for the 24-hour averaging period. The calculated significant impact area was used to determine the source inventory for the multisource modeling PSD increment and standards analysis.

As presented in Section 6.1.7, proposed interim PSD significant impact levels for $PM_{2.5}$ were used for the comparison with the predicted impacts. The R of I for $PM_{2.5}$ is 0.8 kilometers for the 24-hour averaging period.

Table 6.1 PSD Significant Impact Levels ($\mu g/m^3$) for Class II Areas[1]

Pollutant	Annual	24-Hr	8-Hr	3-Hr	1-Hr
Carbon Monoxide (CO)	--	--	500	--	2000
Particulates (PM_{10})	1.0	5.0	--	--	--
Particulates ($PM_{2.5}$)	0.8	4.0	--	--	--

1. USEPA has not established a significant impact level for 24-hour $PM_{2.5}$. The Florida DEP requested the use of an interim $PM_{2.5}$ SIL. The SIL used is Option 2 of the Proposed $PM_{2.5}$ Rule (*Federal Register Volume 72, No. 183* dated September 2007).

Table 6.2 Air pollutant impact results for the Brevard Energy facility compared to PSD Significant Impact Levels

Pollutant	Avg. Time	Proposed Brevard Energy Impact[1] ($\mu g/m^3$)	PSD Significant Impact Level ($\mu g/m^3$)	Radius of Significant Impact (km)
CO	8-hr	102	500	--
	1-hr	182	2000	--
PM_{10}	Annual	0.31	1.0	--
	24-hr	5.2	5.0	0.7
$PM_{2.5}$	Annual	0.31	0.8	--
	24-hr	5.2	4.0	0.8

1. The maximum impact over the 5-year meteorological data set was used to establish the significant impact and radius of impact.

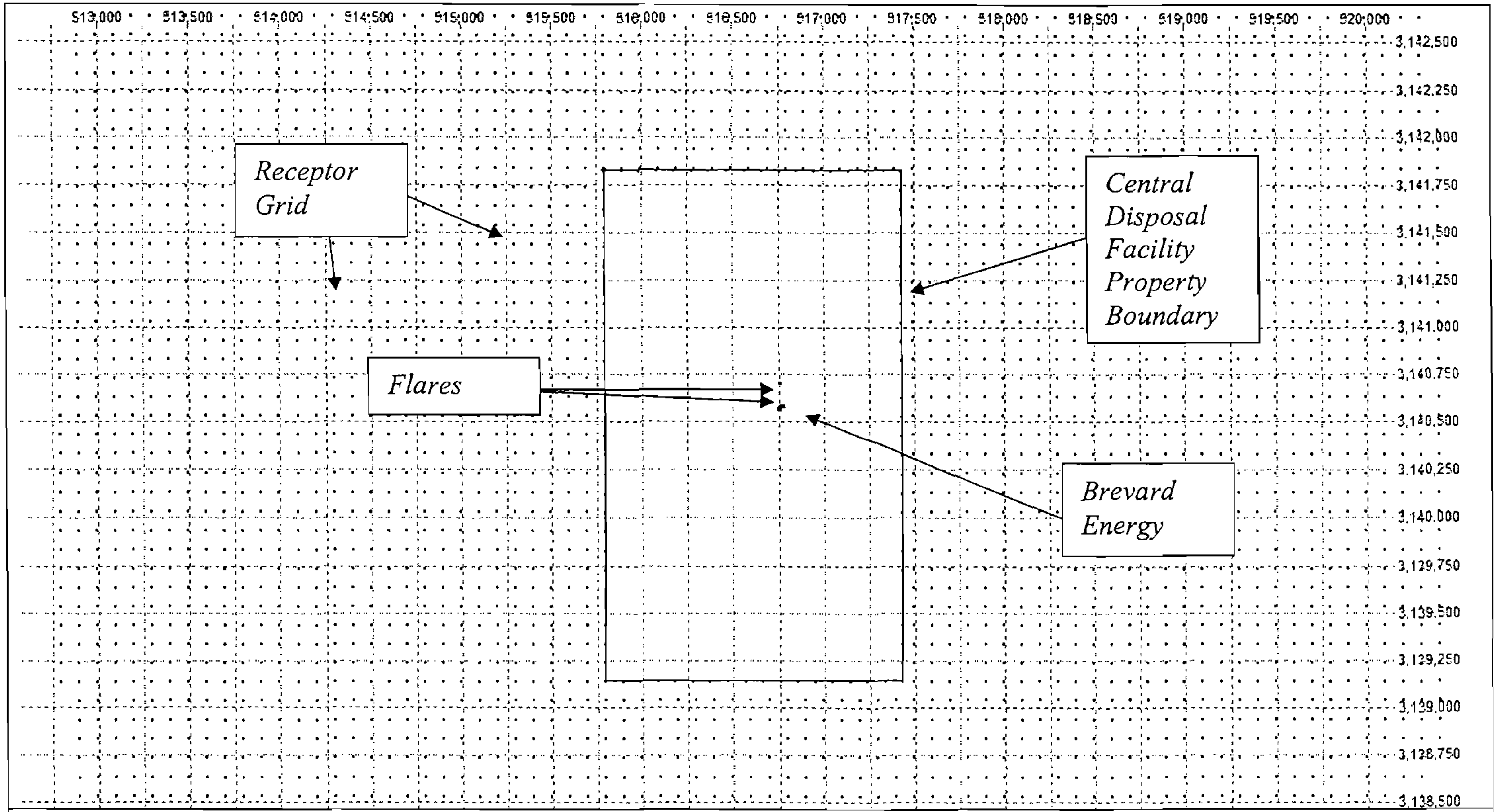


Figure 6.1: Brevard Energy Receptor Network with UTM Coordinates used for SIA modeling analysis

7.0 CLASS II PSD INCREMENT STANDARDS DEMONSTRATION

Air pollutant emissions from proposed major sources that result in predicted ambient air impacts that exceed the significant impact levels are required to perform additional modeling to consider the cumulative impact caused by the proposed facility and:

1. Nearby increment-consuming sources (multisource modeling) for comparison to allowable PSD increment concentrations.

2. Regional air pollutant background concentrations to demonstrate compliance with applicable federal and State ambient air quality standards.

For pollutants subject to PSD modeling, the maximum predicted impacts for the proposed emission factor modifications to the existing Brevard Energy exceeded PSD significance for the 24-hour averaging period for PM_{10} and $PM_{2.5}$. PSD increments have not been established for $PM_{2.5}$. Therefore, multisource modeling will be performed to demonstrate compliance with federal PSD increments for PM_{10} and ambient air quality standards (NAAQS) for PM_{10}, and $PM_{2.5}$.

7.1 Multisource Modeling for PSD Increment Consumption

A multisource modeling analysis to demonstrate compliance with PSD increment consumption is required for all pollutants with a maximum impact that exceeds the significant impact concentration and must consider all major sources that:

1. Are located within the significant impact area (sources located at a distance from the proposed facility that is less than the radius of significant impact); and

2. Have the potential to significantly impact the SIA of the proposed facility (generally considers major sources within 50 km of the SIA).

3. Were installed after the applicable PSD increment baseline date for the specific pollutant.

The PSD increment consumption (multisource modeling) analysis included the existing Brevard Energy facility, existing Central Disposal Facility flares and potential increment-consuming sources within 51 km of the facility.

Sections 7.4 and 7.5 provide information for the existing Brevard Energy facility and the Central Disposal Facility flares that were included in the analysis.

Brevard Energy requested and received from Florida DEP a list of background sources within approximately 51 km of the project site that may be required as part of the multisource modeling demonstration. The list of background sources provided by Florida DEP was first reduced by screening out several facilities using the "20D" rule, which has been used in previous modeling demonstrations submitted to the Florida DEP. Background sources are screened out of the modeling demonstration (i.e., considered insignificant for modeling purposes) if the distance in kilometers from the project site to the background source multiplied by 20 (20D value) is greater than the background source emission rate in tons per year.

After applying the 20D rule for PM_{10} and $PM_{2.5}$ emission sources, all but five (5) off-site background sources were screened out of the modeling demonstration. These five (5) sources include two (2) Florida Power and Light, Inc. sources, and three (3) RRI Energy-Florida, LLC sources.

Table 7.1 presents applicable allowable PSD increment consumption concentrations.

Appendix K-3 includes the background sources provided by Florida DEP and 20D rule results.

7.2 Background Air Quality (Monitoring Data) and AAQS Demonstration

For the AAQS demonstration, representative background pollutant concentrations were added to the predicted air pollutant impacts determined by the multisource modeling analysis.

Table 7.2 presents applicable federal and state ambient air quality standards.

Air quality impact and radius of significant impact results for the proposed emission increases are presented in Table 6.2. Table 7.3 presents a comparison of the maximum predicted air quality impacts for the proposed emission increase versus the preconstruction monitoring de minimis values specified in 40 CFR §52.21(i) *Exemptions*.

Maximum predicted air quality impacts associated with the air pollutant emission increase are less than or equal to the 40 CFR §52.21(i) preconstruction monitoring de minimis value for 24-hr PM_{10}.

The Brevard Energy facility is located in a rural area (less than 1000 persons per square kilometer) and the land cover for the surrounding area consists mainly of pasture, deciduous forest and shrub land. The area surrounding the facility has a relatively low density of regulated facilities (i.e., facilities that have the potential to affect the surrounding environment in an adverse manner). Therefore, Brevard Energy is proposing to use particulate matter ($PM_{10}/PM_{2.5}$) data collected by the network of existing ambient air monitors located in Florida to characterize background air pollutant concentrations. Representative measured air pollutant concentration data for the monitoring stations were obtained by the Florida DEP personnel from the Florida DEP monitoring database.

Brevard Energy requests a waiver from the requirement to perform preconstruction air quality monitoring and requests to use data from the existing air quality monitoring network maintained by Florida DEP to satisfy the 40 CFR §52.21(m) *Air quality analysis* requirements. This request is made on the basis that there are existing ambient air monitors operating within the state that are expected to be representative of the region surrounding the Brevard Energy project site and the predicted pollutant impacts for the source are below the specified de minimis value.

Table 7.4 presents the PM_{10} and $PM_{2.5}$ background concentration data retrieved from the Florida DEP monitoring network.

7.2.1 *Background Concentration Data for PM_{10}*

The nearest PM_{10} monitor (12-009-0007) relative to the Brevard Energy/Central Disposal Facility is located in Brevard County approximately 10 kilometers northeast of the project site.

To determine representative 24-hr background PM_{10} concentrations, the most recent three years of measured maximum concentration data were reviewed for monitor 12-009-0007 (total of three (3) maximum 24-hr. values). The reported maximum 24-hr PM_{10} background concentrations are 74 micrograms per cubic meter ($\mu g/m^3$), 58 $\mu g/m^3$ and 35 $\mu g/m^3$.

7.2.2 *Background Concentration Data for $PM_{2.5}$*

The nearest $PM_{2.5}$ monitor (12-009-0007) relative to the Brevard Energy/Central Disposal Facility is in Brevard County approximately 10 kilometers northeast of the project site.

To determine representative 24-hr background $PM_{2.5}$ concentrations, the most recent three years of measured concentration data were reviewed for monitor 12-009-0007 (total of three (3) maximum annual and 98th percentile values). The reported maximum 98th percentile results used for the 24-hr $PM_{2.5}$ background concentrations are 22.3 $\mu g/m^3$, 16.5 $\mu g/m^3$ and 15 $\mu g/m^3$.

Appendix K-5 presents air monitoring data retrieved from the Florida DEP website for 2007 through 2009 (PM_{10} and $PM_{2.5}$).

7.3 Criteria Pollutant Averaging Periods

The results of the SIA (presented in Table 6.2) for the proposed Brevard Energy modifications are based on the highest calculated impact for each averaging period for any of the five years modeled.

For the PSD increment consumption modeling analysis, the cumulative emission impact concentration was determined by combining the impacts for the existing Brevard Energy emission units and the existing Central Disposal Facility flares. The PSD increment consumption concentration was based on the highest 2nd high PM_{10} impact for the 24-hr averaging period.

For the AAQS modeling analyses, the combined impact of the existing Brevard Energy emission units, existing Central Disposal Facility flares, appropriate background sources and measured background pollutant concentrations will be based on the:

- Sixth highest PM_{10} impact (over the 5-yr. data set) for the 24-hr averaging period.
- Highest eighth-high $PM_{2.5}$ impact (98th percentile) for the 24-hr averaging period.

7.4 Existing Central Disposal Facility Flares

The Central Disposal Facility is permitted to operate three (3) open LFG flares able to control up to 6,800 scfm. Flares 1 and 2 are rated at 2,360 scfm each. Flare 3 is rated at 2,080 scfm. Treatment of the recovered LFG for use as fuel in the existing electricity generation units is the preferred use for the LFG. There will not be sufficient LFG available to fuel all LFG combustion equipment. The flares will be used as back-up units, but are included in the modeling as a worst-case scenario.

7.4.1 Exhaust Stack Parameters

The flares are designed to achieve a 98% destruction of total hydrocarbons when the LFG has a methane content between 40-60%. The LFG at Central Disposal Facility is estimated to have a methane content of 55%. Flares 1 and 2 have actual release heights of 8.53 m; Flare 3 has an actual release height of 8.63 m. An equivalent release height and diameter were calculated for the flares based on the actual release height and design heat release using the following equations from the TSCREEN users manual:

$H_{equiv} = H_{actual} + 0.00128(Q_c^{0.478})$; and
$D_{equiv} = 1.754*10^{-4} * \mathrm{sqrt}(Q_c)$

Where: H_{equiv} = Equivalent stack height
H_{actual} = Actual stack height (8.53m for Flares 1 & 2 and 8.63m for Flare 3)
D_{equiv} = Equivalent stack diameter (m); and
Q_c = Flared gas heat release ($40.75*10^6$ Btu/hr for Flares 1 & 2 and $68.64*10^6$ Btu/hr for Flare 3)

The equations above account for the flared gas plume rise based on an effective buoyancy flux parameter. Using a gas heat release rate equivalent to the combustion of 2,360 scfm of gas for Flares 1 and 2 and 2,080 scfm of gas for Flare 3 at 550 Btu/scf results in equivalent flare heights of 14.09 m for Flares 1 and 2 and 15.76 m for Flare 3. These parameters also result in an equivalent diameter of 1.120 m for Flares 1 and 2 and 1.453 m for Flare 3, respectively.

The flares were entered into the computer dispersion model as two (2) individual point sources (Flares 1 and 2 have the same parameters and emissions and were combined into a single emission point) using the calculated equivalent height, diameter and default values for temperature (1000° Celsius) and velocity (20 meters per second).

Tables 3.1 and 7.8 presents exhaust stack parameters for the six (6) identical IC engines and utility flares that were used in the air quality impact analyses.

Appendix K-1 provides a plot plan of the electricity generation facility building, IC engine exhaust stacks and flares on a UTM coordinate system.

7.4.2 Potential / Permitted Air Pollutant Emission Rates

The USEPA AP-42 default particulate emission rate for open flares, 17 pounds per million dry standard cubic feet of methane (lb/MMdscf), was used to calculate potential $PM_{10}/PM_{2.5}$ emissions generated by the flares. This results in a calculated $PM_{10}/PM_{2.5}$ emission rate of 1.26 lb/hr for Flare 1/2 and 2.12 lb/hr for Flare 3.

Tables 7.8 and 7.9 present design and exhaust parameters for the Central Disposal Facility open flares and calculated $PM_{10}/PM_{2.5}$ emission rates.

Appendix K-2 provides flare maximum emission calculations.

7.5 Background Emission Sources – Florida DEP Inventory

7.5.1 Exhaust Stack Parameters

An inventory of sources within 51 km was obtained from the Florida DEP. The 20D screening test indicated that there were two sources (facilities) with PM_{10}/ $PM_{2.5}$ emissions required to be included in the multisource NAAQS analysis(a total of five point sources).

Table 7.10 presents exhaust stack parameters for the off-site background sources included in the modeling demonstration.

7.5.2 Potential / Permitted Air Pollutant Emission Rates

The Florida DEP inventory provided permitted or potential emission rates for each emission source or exhaust stack. These individual source / stack emissions rates were inputted into the model.

Table 7.11 presents the exhaust stack PM_{10}/ $PM_{2.5}$ emission rates for the background sources that were included in the multisource modeling demonstration.

Appendix K-3 includes the background sources that were reviewed and modeled.

7.6 Modeling Results

Table 7.12 presents results of the modeled PSD increment consumption and the NAAQS analysis.

The highest 2nd high PM_{10} 24-hour ambient air impact produced by the modeled emission sources is 4.75 $\mu g/m^3$, which is less than the allowable PSD increment of 30 $\mu g/m^3$. The 6th high PM_{10} 24-hour impact result is 3.53 $\mu g/m^3$ and results in a cumulative ambient air concentration, including background, of 59.17 $\mu g/m^3$, which is less than the NAAQS of 150 $\mu g/m^3$.

The highest eighth high $PM_{2.5}$ 24-hour ambient air impact produced by the modeled emission sources is 3.51 $\mu g/m^3$ and results in a cumulative ambient air concentration, including background, of 21.45 $\mu g/m^3$, which is less than the NAAQS of 35 $\mu g/m^3$.

These calculated impacts result in cumulative ambient air concentrations, including representative background concentrations, that are less than the respective NAAQS (i.e., there are no calculated ambient air impacts that exceed the standards).

Appendix K-3 provides AERMOD output summary files for the PSD increment and NAAQS refined modeling analyses.

Table 7.1 Allowable PSD Class II Increment Consumption Concentrations ($\mu g/m^3$)

Pollutant	Annual	24-Hr	8-Hr	3-Hr	1-Hr
Particulates (PM_{10})	17	30	--	--	--
Fine Particulates ($PM_{2.5}$)	--	--	--	--	--

Table 7.2 Applicable federal air quality standards ($\mu g/m^3$)

Pollutant	Annual	24-Hr	8-Hr	3-Hr	1-Hr
Particulates (PM_{10})	50	150	--	--	--
Fine Particulates ($PM_{2.5}$)	15	35	--	--	--

Table 7.3 Comparison of the maximum predicted air quality impacts for the proposed emission increase versus the 40 CFR §52.21(i) de minimis values

Pollutant	Averaging Period	De minimis Value[1] (μg/m³)	Predicted Max. Impact for Proposed Emission Increase (μg/m³)
Particulate matter (PM_{10})	24-hr	10	5.2

1. De minimis values specified in 40 CFR §52.21(i) *Exemptions.*

Table 7.4 Representative background pollutant concentrations from the Florida monitoring network

			Maximum Measured Concentration	
Pollutant	Monitoring Site	Year(s)	24-hour[A]	Annual
PM_{10} (μg/m³)	Brevard County	2007	74	15.4
		2008	58	16.0
		2009	35	14.4
$PM_{2.5}$ (μg/m³)	Brevard County	2007	22.3	9.37
		2008	16.5	8.76
		2009	15	8.18

A. 24-hour $PM_{2.5}$ values presented are the 98th percentile value (seventh highest to be conservative)

Table 7.5 Exhaust stack parameters used in the computer model for the existing Central Disposal Facility Landfill Open Flares

Source ID	Location (UTM) East (m)	Location (UTM) North (m)	Base Elev. (m)	Stack Height (m)	Stack Height (ft)	Stack Diameter (m)	Stack Diameter (ft)	Temp. (K)	Exit Velocity (m/s)
FLARE1/2†	516,760	3,140,709	6.40	14.09	46.21	1.120	3.67	1273	20.00
FLARE 3†	516,755	3,140,709	6.40	15.76	51.71	1.453	4.77	1273	20.00

† Data presented for height and diameter are equivalent values calculated for open flares, using equations from the TSCREEN users manual. Exit temperature and velocity are default values for open flares.

Table 7.6 Criteria pollutant emission rates used in the air quality modeling analysis for the existing Central Disposal Facility open flares Flare 1/2 and Flare 3

Pollutant	Emission Factor	Flare 1/2 Modeled Emission Rate lb/hr	Flare 1/2 Modeled Emission Rate g/s	Flare 3 Modeled Emission Rate lb/hr	Flare 3 Modeled Emission Rate g/s
$PM_{2.5}$	17 lb/MMdscf CH_4[1]	1.26	0.16	2.12	0.27
PM_{10}	17 lb/MMdscf CH_4[1]	1.26	0.16	2.12	0.27

1. AP-42, Chapter 2.4 – Table 2.4-1 utilizing methane (CH_4) for the fuel source.

Table 7.7 Exhaust stack parameters used in the computer model for the modeled background sources

Source Stack ID[1]	Location (UTM) East (m)	North (m)	Base Elev. (m)	Stack Height (m)	(ft)	Stack Diameter (m)	(ft)	Temp. (K)	Exit Velocity (m/s)
FPL Unit 1[2]	522900	3148900	5.49	121	397	5.7	18.7	414.8	22.42
FPL Unit 2	522910	3148910	5.35	121	397	5.7	18.7	414.8	22.42
RRI Unit 1[3]	521500	3151700	5.99	91.44	300	4.27	14.0	435.9	26.21
RRI Unit 2	521510	3151710	5.89	91.44	300	4.27	14.0	435.9	26.21
RRI Unit 3	521300	3151700	6.87	91.44	300	4.30	14.1	444.3	32.63

1. Background sources were evaluated over the 20D comparison to emissions and similar stacks were combined per the SCREEN3 guidance.
2. Florida Power and Light, Inc. (FPL) is a utility electricity generating facility.
3. RRI Energy is a utility electricity generating facility.

Table 7.8 PM_{10}/ $PM_{2.5}$ emission rates from background sources used in the air quality modeling analysis

	PM_{10}/ $PM_{2.5}$ Emissions	
Source Stack Identification	(lb/hr)	(g/sec)
FPL Unit 1	293.61	36.99
FPL Unit 2	293.61	36.99
RRI Unit 1	73.84	9.30
RRI Unit 2	178.96	22.55
RRI Unit 3	270.58	34.09

Table 7.9 Modeled Results Compared to PSD Increment and NAAQS Standards

Pollutant[1]	Averaging Period	Multisource Modeling Result	PSD Increment	Modeling Result Added to Background	NAAQS
PM_{10}	24-hr	4.75[2]	30	59.17[4]	150
$PM_{2.5}$	24-hr	3.51[3]	---	21.45	35

1. PM_{10} and $PM_{2.5}$ concentrations are reported as µg/m^3
2. PM_{10} comparison for the NAAQS is based on the second highest 24-hour average PM_{10} modeled result.
3. $PM_{2.5}$ result is based upon the 8th highest high modeled result
4. PM_{10} results for comparison to the NAAQS are based upon the 6th high modeled result.

8.0 CLASS I AREA SIGNIFICANT IMPACT/VISIBILITY ANALYSIS

Based on guidance from the Federal Land Manager and Florida DEP modeling personnel, a Class I area PSD increment and visibility analyses must be performed when a proposed facility is a potential major source that will be located within 300 km of a designated Class I area. In this case, the Brevard Energy facility is located approximately 175 km from the nearest boundary of the Chassahowitzka NWR. The Florida DEP referred to the Federal Land Manager which waived the requirements to perform a Class I Area Significant Impact Analysis due to the distance to the NWR and low-level of emissions from Brevard Energy. Additionally, Florida DEP contacted USEPA which requested that a test of receptors at 50 km in the direction of the Class I area would need to be performed to verify that no particulate Class I Area Significant Impact Analysis would be required.

8.1 Modeling Scenarios

An evaluation using AERMOD was performed to determine if a Class I Area Significant Impact Analysis, using a long-range transport model, was needed. AERMOD is a steady-state dispersion model designed for short-range (up to 50 km) dispersion of air pollutant emissions. Therefore, five (5) receptors were selected in the general direction of the Chassahowitzka NWR at approximately 50 km from the Brevard Energy facility. Emissions from the six (6) existing Brevard Energy CAT G3520C engines were used for the modeling evaluation. If these receptors are below significance for a Class I area, then a full Class I Ambient impact analysis will not be performed

Figure 8.1 presents the receptor network used in the Class I area significant impact evaluation.

8.2 Visibility

The presence of fine particulate matter (sulfates, nitrates and organic carbons) in the atmosphere has the potential to cause visibility impairment by the scattering or adsorbing of light. USEPA has concluded (*Guideline on Air Quality Models*, 40 CFR Part 51, Appendix W, §7.2.1) that the long-range transport of fine particulate matter can significantly impair visibility in areas that are located hundreds of kilometers from the source of these emissions. Therefore, based on the distance between the electricity generation facility and the nearest Class I area (Chassahowitzka NWR), the Florida DEP requires that analyses be performed to evaluate the potential impacts of the emission plume produced by Brevard Energy at the closest Class I area.

A screening analysis to determine the impacts on visibility caused by the Brevard Energy facility at surrounding scenic vistas was performed. The VISCREEN model provided by the USEPA was used to determine the visual effect parameters (color difference parameter and plume contrast against a background) from the Brevard Energy facility exhaust gas plume from a given vantage point. The criterion for VISCREEN is a contrast less than 0.05 and a delta E less than 2.00.

A particulate matter emission rate of 37.8 TpY was entered into the model. The source-observer distance and minimum distance to the Chassahowitzka NWR were both set at 175.0 kilometers and the maximum distance to the Chassahowitzka NWR was set at 200.0 kilometers. A background range of 40.0 kilometers was used for the surrounding area, as presented in Figure 4-3 of the VISCREEN manual. Default particle size, particle density and worst-case meteorological conditions (F stability and wind speed) were selected from the model to provide a worst-case scenario (i.e., Level-1 screening analysis).

Table 8.1 presents visibility analyses criterion for Class I areas.

8.4 Model Results

Appendix K-3 provides on a compact disc input files used and output files generated in the Class I Area analyses.

Meteorological data provided by the Florida DEP used in the AERMOD modeling are included on the compact disc.

8.4.1 Criteria Pollutant Results

Table 8.2 presents maximum air pollutant impacts predicted by the AERMOD model at the 50 km distance.

The predicted impacts for PM_{10} and $PM_{2.5}$ emissions are less than the Class I significant impact values. Impacts within the Class I area, which is at least 125 km beyond the receptors used in this analysis, are expected to be significantly lower. Therefore, no Class I analyses is required to be performed for this evaluation per the Florida DEP, USEPA, and Federal Land Manager guidance.

8.4.2 Visibility Results

Table 8.1 presents the results of the VISCREEN Class I area visibility impairment analysis.

Execution of the VISCREEN model with the inputs specified above resulted in visual impacts at the Chassahowitzka NWR (175 km from the facility) that are not considered objectionable or adverse (i.e., do not exceed screening criteria) inside of the wildlife refuge.

Appendix K-3 presents the VISCREEN model inputs and results.

Table 8.1 presents the results of the VISCREEN visibility impairment analysis in the Class I Area.

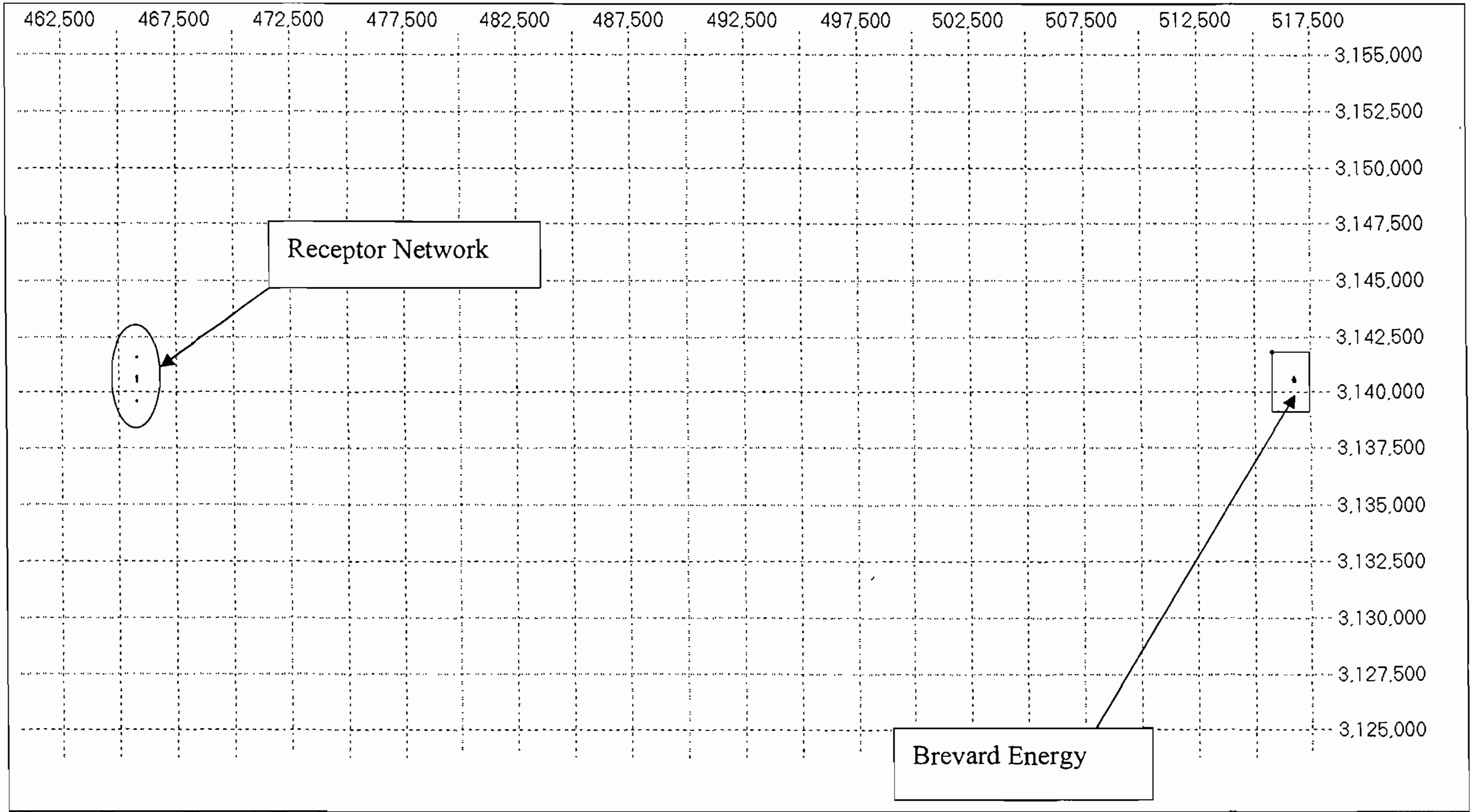


Figure 8.1 Receptor Network for the Brevard Energy AERMOD Class I Screen

Table 8.1 Visibility Impairment Criteria and Results for Class I Areas

Parameter	Result	Criteria
Delta E	0.003	< 2.00
Contrast	0.000	< 0.05

Table 8.2 Air Pollutant Impact Results for the Brevard Energy Facility Compared to Class I Area PSD Significant Impact Levels

Pollutant	Averaging Time	Predicted Impact (μg/m^3)	PSD Class I Area Significant Impact Levels (μg/m^3)
PM_{10}	Annual	0.006	0.16
PM_{10}	24-hr	0.173	0.32
$PM_{2.5}$	Annual	0.006	0.16
$PM_{2.5}$	24-hr	0.173	0.24

9.0 SPECIAL MODELING CONSIDERATIONS

9.1 Particle Deposition

Based on the design and operation of the existing IC engines and the treatment (dewatering, compression and filtration) of LFG received from the landfill prior to its use as a fuel, the amount of particulates emitted from the combustion process are expected to be relatively small. Therefore, compliance with the particulate matter ambient air quality standards will be demonstrated without considering particle deposition (i.e., the removal of particulates from the exhaust plume over the distance of maximum ground-level impacts due to deposition are expected to be minimal).

9.2 Fugitive Emissions

The existing electricity generation equipment will utilize LFG that is supplied by the Central Disposal Facility landfill gas collection and control system. The electricity generation facility will not be a source of any appreciable fugitive emissions.

9.3 Impacts on Vegetation, Soils and Wildlife (including Endangered Species)

Federal and State of Florida PSD regulations require (in addition to appropriate air pollutant emission BACT and air quality impact demonstrations) that new major sources address air quality issues that pertain to visibility degradation, and vegetation, soil and growth impacts.

The effects that air pollutants have on vegetation can be classified into three general categories: acute, chronic and long term. Acute effects are those that result from relatively short exposures (i.e., less than one month) to high concentrations of pollutant emissions. Chronic effects occur when organisms are exposed for months or even years to certain threshold levels of pollutants. Long-term effects include abnormal changes in ecosystems and subtle physiological alterations in organisms. Acute and chronic effects are caused by pollutants acting directly on the organism, whereas, long-term effects can be indirectly caused by secondary agents such as changes in the pH of the soil.

The USEPA Air Quality Planning and Standards, Air Strategies and Standards Division, has developed secondary NAAQS for the protection of *the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air*. The values set for the secondary NAAQS incorporate the protection of ecosystems, which includes vegetation and soil.

The results of Ambient Impact Analyses (Class II) presents maximum CO, PM_{10} and $PM_{2.5}$ pollutant impacts, which are estimated to occur from the proposed electricity generation facility emissions and are below the associated secondary NAAQS. As stated in the permit application and this document, a screening level Class I Ambient Impact Analyses was performed for particulate as requested by the regulators.

The electricity generation facility is a pollution control project (PCP) where control is provided for LFG generated by the Central Disposal Facility through its beneficial utilization. Control of the LFG will result in reductions in the amounts of total VOC and NMOC that are generated by the landfill.

A time dependent amount of LFG is generated at the Central Disposal Facility, which is required to be controlled through its combustion. Both flaring and IC engines create LFG combustion by-product air pollutant emissions. Therefore, the effect on the air quality that surrounds the facilities is similar whether the LFG is flared or burned as IC engine fuel (a specific quantity of LFG will be combusted in either device).

Therefore, based on the preceding information, no significant or adverse impact on vegetation and soil is expected to occur from the electricity generation facility.

9.4 Growth Impacts

The location of the existing electricity generation facility is the result of the generation of LFG at the Central Disposal Facility. Therefore, the availability of existing alternative fuel resources had no influence in the selection of the existing facility site. The continued operation of the Brevard Energy electricity generation facility will not produce significant commercial growth in the Cocoa, Florida area. The existing facility interconnects to the distribution network through a nearby power line. This power will be use to satisfy electricity demands within the general area. This power will supplement or offset power that would otherwise be produced by the utility and does not cause any increase in electricity demand nor significantly increase air pollutant emissions from residential and commercial construction and growth, or any other activities associated with the proposed facility.

Based on the location of the Central Disposal Facility (i.e., a relatively rural area), emission configuration of the electricity generation facility and magnitude of associated air quality impacts, a significant portion of the applicable PSD increments are expected to be available to the Cocoa, Florida area. Therefore, sufficient air resources are expected to be available to support future growth in the Cocoa, Florida area relative to PSD increment consuming pollutants.

9.5 Alternative Sites Analysis

Based on the location of the fuel source for the existing electricity generation facility (i.e., the LFG fuel for the proposed project is generated by the Central Disposal Facility), it is not feasible (or practical) to construct the air pollutant emission and power generation processes at another site that is removed or distant from the fuel source.

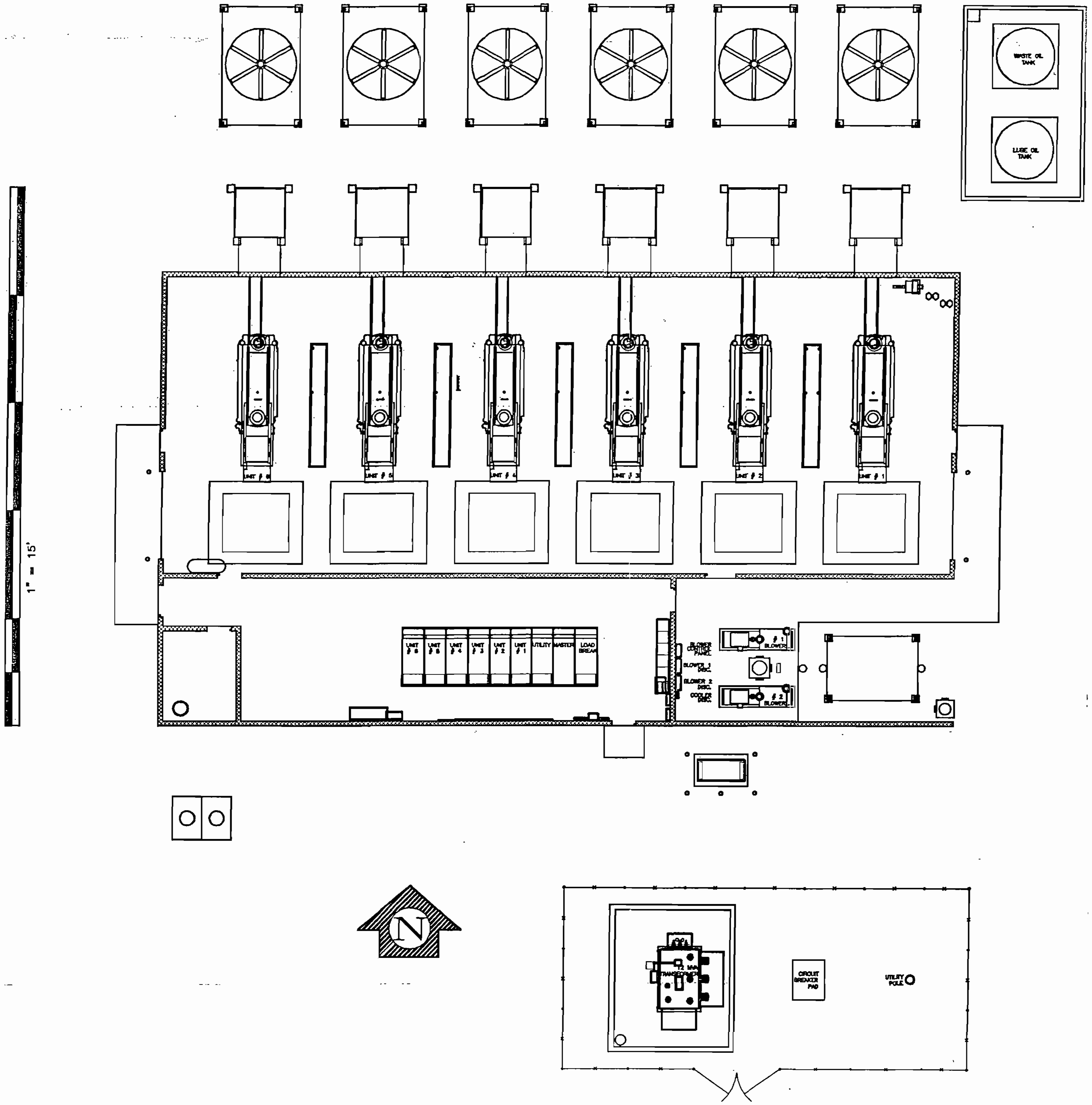
Flaring is being utilized to control any unused LFG from the IC engines due to maintenance, down time, or increase in generation of LFG from the Central Disposal Facility. This flaring of the LFG wastes the energy value of the LFG.

The size of the electricity generation facility is governed by the amount of fuel that can be recovered from the Central Disposal Facility. The number and size of the IC engine generator sets has been selected based on its ability to best utilize the LFG fuel generated by the Central Disposal Facility (i.e., fit the gas generation curve that increases with added waste placement and decreases with the closure of the landfill). Therefore, alternative sizes and production processes for the proposed project result in electricity generation inefficiencies (i.e., inefficiencies in the utilization of available LFG as a fuel).

The existing facility will continue to produce 9.6 MW of electricity and interconnects to the distribution network through a nearby power line. This transfer of electricity may offset an equivalent amount of power that would otherwise be produced using non-renewable fossil fuels. While increases in regulated air pollutant emissions will occur at the electricity generation facility, decreases in these emissions may occur at an offsite power plant.

APPENDIX K-1

FACILITY SITE PLAN AND PLOT OF THE SURROUNDING AREA



BREVARD COUNTY
GAS-TO-ENERGY PROJECT
2250 ADAMSON RD.
COCOA, FL. 32926
PROJECT

SHEET TITLE BUILDING PLAN

DRAWING STATUS CONCEPTUAL

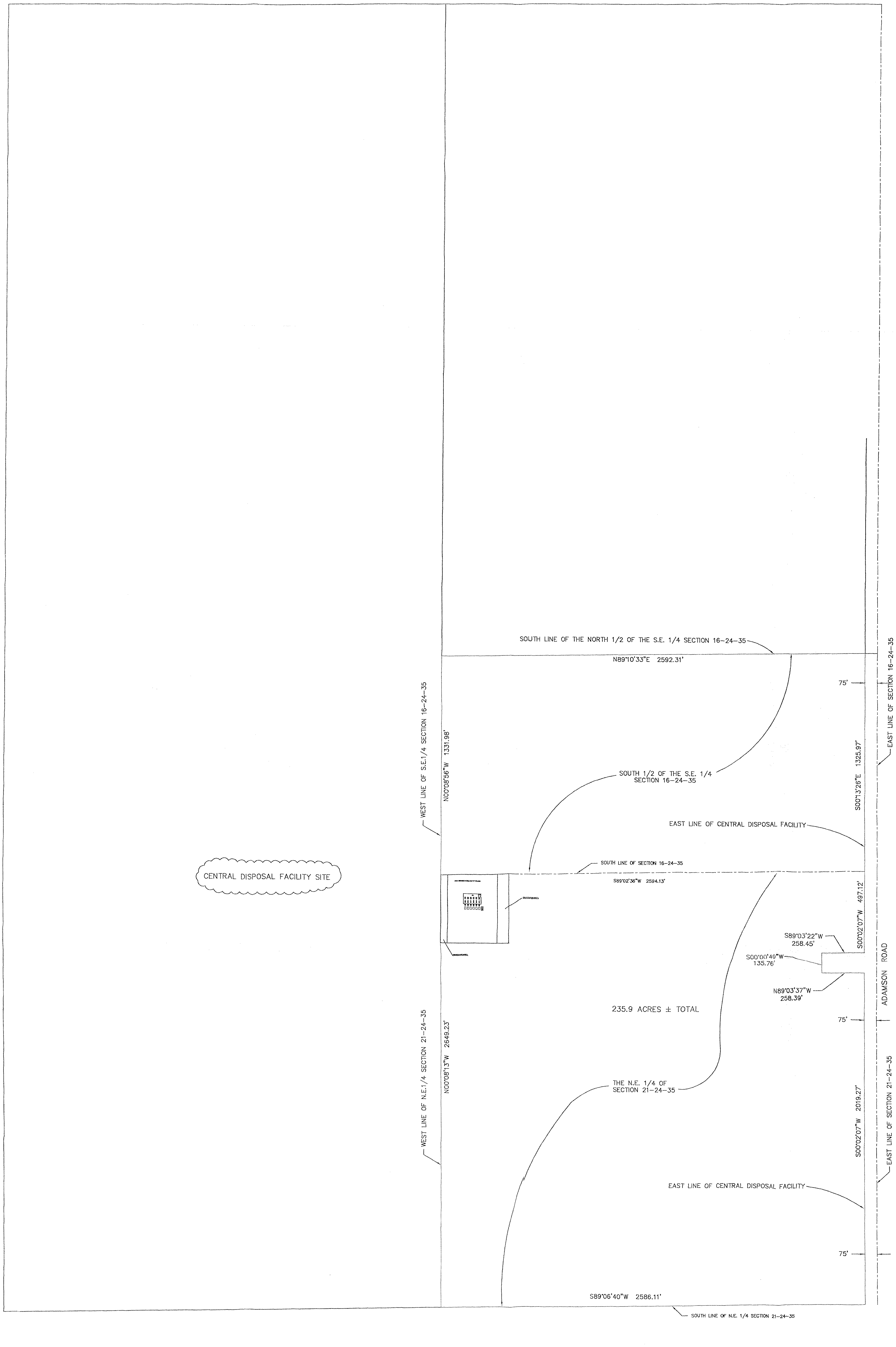
Landfill Energy Systems
29261 WALL ST.
WIXOM, MI. 48393
248 380-3920

SCALE:
TAG #: N/A
DRAWN BY: MKL
CHECKED BY: MKL
DATE ISSUED: 07/13/05

SHEET C-1

REMARKS

REV	DATE	COMMENTS



2005 AERIAL DATE

②

APPENDIX K-2

ENGINE AND FLARE EXHAUST GAS CALCULATIONS

Summary of Current Permitted Emission Rates
Landfill Gas Powered IC Engine

1-CAT® G3520C IC Engine Specifications

Net Power Output	2,233	bhp
Min. LFG LHV	426.0	Btu/scf
Heat input rate (LHV)	14.89	MMBtu/hr
Fuel consumption	34,953	scf/hr
	583	scfm
	0.839	MMscf/day

Regulated Pollutant		Pollutant Emission Factors (g/bhp-hr)	(lb/MMscf)	(lb/MMBtu)	Pollutant Emission Rates 1 CAT G3520 ICE (lb/hr)	(TpY)	Pollutant Emission Rates 6 CAT G3520 ICE (lb/hr)	(TpY)
Carbon Monoxide	CO	3.30	--	--	16.25	71.2	97.47	426.9
Particulate Matter	$PM_{10}/PM_{2.5}$	0.29	--	--	1.44	6.31	8.64	37.8

Per Engine Emission Rates

CO emission rate (lb/hr) = EF_{CO} * bhp/(453.6)

$PM_{10}/PM_{2.5}$ emission rate (lb/hr) = $EF_{PM10/PM2.5}$ * bhp/(453.6)

Annual Emission Rate (TpY) = emission rate (lb/hr) * 8760/2000

For Six (6) Engines

Six Engine emission rate (lb/hr) = 6 * emission rate (lb/hr)

Annual Emission Rate (TpY) = six engine emission rate (lb/hr) * 8760/2000

Summary of Current Permitted Emission Rates

Flare Calculation Sheet

Pollutant	LFG Utility Flare Emission Factors		Flare 1/2 Emission Rate[2]			Flare 3 Emission Rate[3]		
			(lb/hr)	(TpY)	(g/sec)	(lb/hr)	(TpY)	(g/sec)
Carbon Monoxide (CO)[1]	0.2	lb/MMBtu	8.15	35.70	1.03	13.73	60.13	1.73
Particulates	17	lb/MMdscf CH4	1.26	5.52	0.16	2.12	9.29	0.27

1 - Manufacturer guaranteed emission rate

2 - Based upon continuous operation at 1,235 scfm and 40.75 MMBtu/hr (550 Btu/scfm) from previous permit

3 - Based upon continuous operation at2,080 scfm and 68.64 MMBtu/hr (550 Btu/scfm) from previous permit

4 - Default PM emission rate AP-42 section 2.4-5

APPENDIX K-3

COMPACT DISC WITH MODELING FILES AND BACKGROUND SOURCES


STAPLES
CD-RW
CONTENTS
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APPENDIX K-4

SUMMARY AND RADIUS OF IMPACT PLOTS

Brevard Energy
Summary of AERMOD Results - Significance
October 28, 2010
CO Modeled from 1999-2003

Model	File	Pollutant	Average	Group	Rank	Concentration ($\mu g/m^3$)	East(X)	North(Y)	Elevation (m)	Hill (m)	Flag	Met File	Sources	Groups	Receptors
Model:AerMod 09292	BrevardPM102010_1999_CO.SUM	CO	1-HR	BNRG	1ST	181.45461	517433	3140630.7	6.71	6.71	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_CO.SUM	CO	1-HR	BNRG	2ND	169.81130	517433	3140332.3	6.88	6.88	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_CO.SUM	CO	8-HR	BNRG	1ST	84.91176	517433	3140232.9	6.71	6.71	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_CO.SUM	CO	8-HR	BNRG	2ND	72.09749	517433	3140630.7	6.71	6.71	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_CO.SUM	CO	1-HR	BNRG	1ST	182.32380	517433	3140531.2	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_CO.SUM	CO	1-HR	BNRG	2ND	176.64528	517433	3140531.2	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_CO.SUM	CO	8-HR	BNRG	1ST	93.49505	517433	3140431.8	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_CO.SUM	CO	8-HR	BNRG	2ND	90.34630	517433	3140431.8	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_CO.SUM	CO	1-HR	BNRG	1ST	176.73698	517433	3140531.2	6.71	6.71	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_CO.SUM	CO	1-HR	BNRG	2ND	176.33946	517433	3140531.2	6.71	6.71	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_CO.SUM	CO	8-HR	BNRG	1ST	75.78627	517433	3140431.8	6.71	6.71	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_CO.SUM	CO	8-HR	BNRG	2ND	74.98671	517433	3140431.8	6.71	6.71	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_CO.SUM	CO	1-HR	BNRG	1ST	181.34090	517433	3140531.2	6.71	6.71	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_CO.SUM	CO	1-HR	BNRG	2ND	175.50719	517433	3140531.2	6.71	6.71	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_CO.SUM	CO	8-HR	BNRG	1ST	89.86076	517433	3140730.1	6.71	6.71	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_CO.SUM	CO	8-HR	BNRG	2ND	72.95168	517433	3140332.3	6.88	6.88	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_CO.SUM	CO	1-HR	BNRG	1ST	180.47138	517433	3140531.2	6.71	6.71	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_CO.SUM	CO	1-HR	BNRG	2ND	169.04290	517433	3140531.2	6.71	6.71	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_CO.SUM	CO	8-HR	BNRG	1ST	101.82743	517433	3140332.3	6.88	6.88	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_CO.SUM	CO	8-HR	BNRG	2ND	90.20813	517433	3140332.3	6.88	6.88	0	MCOTPA2003.SFC	6	1	5504

CO 8-hr Significance = 500 µg/m3
CO 8-hr Significance = 2000 µg/m3

Brevard Energy
Summary of AERMOD Results - Significance
October 28, 2010
PM10 Modeled from 1999-2003

Model	File	Pollutant	Average	Group	Rank	Concentration (μg/m^3)	East(X)	North(Y)	Elevation (m)	Hill (m)	Flag	Met File	Sources	Groups	Receptors
Model:AerMod 09292	BrevardPM102010_1999_PM10.SUM	PM10	PERIOD	BNRG	1ST	0.30175	516757.7	3139139	6.1	6.1	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_PM10.SUM	PM10	24-HR	BNRG	1ST	4.23199	517433	3140630.7	6.71	6.71	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_PM10.SUM	PM10	24-HR	BNRG	2ND	3.24641	517433	3140332.3	6.88	6.88	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_PM10.SUM	PM10	24-HR	BNRG	6TH	2.2874	517433	3140332.3	6.88	6.88	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_1999_PM10.SUM	PM10	24-HR	BNRG	8TH	2.02086	517433	3140431.8	6.71	6.71	0	MCOTPA1999.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_PM10.SUM	PM10	PERIOD	BNRG	1ST	0.31341	516661.2	3139139	6.1	6.1	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_PM10.SUM	PM10	24-HR	BNRG	1ST	3.69425	517433	3140431.8	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_PM10.SUM	PM10	24-HR	BNRG	2ND	3.08543	517433	3140431.8	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_PM10.SUM	PM10	24-HR	BNRG	6TH	2.72225	517433	3140431.8	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2000_PM10.SUM	PM10	24-HR	BNRG	8TH	2.42815	517433	3140431.8	6.71	6.71	0	MCOTPA2000.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_PM10.SUM	PM10	PERIOD	BNRG	1ST	0.27308	516661.2	3139139	6.1	6.1	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_PM10.SUM	PM10	24-HR	BNRG	1ST	4.8673	517433	3140431.8	6.71	6.71	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_PM10.SUM	PM10	24-HR	BNRG	2ND	4.23473	517433	3140431.8	6.71	6.71	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_PM10.SUM	PM10	24-HR	BNRG	6TH	2.60058	517433	3140332.3	6.88	6.88	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2001_PM10.SUM	PM10	24-HR	BNRG	8TH	2.21162	517433	3140332.3	6.88	6.88	0	MCOTPA2001.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_PM10.SUM	PM10	PERIOD	BNRG	1ST	0.28608	515793	3140232.9	5.79	5.79	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_PM10.SUM	PM10	24-HR	BNRG	1ST	4.07804	517433	3140232.9	6.71	6.71	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_PM10.SUM	PM10	24-HR	BNRG	2ND	3.34869	517433	3140332.3	6.88	6.88	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_PM10.SUM	PM10	24-HR	BNRG	6TH	2.39688	517433	3140332.3	6.88	6.88	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2002_PM10.SUM	PM10	24-HR	BNRG	8TH	2.3092	517433	3140332.3	6.88	6.88	0	MCOTPA2002.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_PM10.SUM	PM10	PERIOD	BNRG	1ST	0.25642	516661.2	3139139	6.1	6.1	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_PM10.SUM	PM10	24-HR	BNRG	1ST	5.1968	517433	3140630.7	6.71	6.71	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_PM10.SUM	PM10	24-HR	BNRG	2ND	3.11708	517433	3140332.3	6.88	6.88	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_PM10.SUM	PM10	24-HR	BNRG	6TH	2.46257	517493	3140339	7.01	7.01	0	MCOTPA2003.SFC	6	1	5504
Model:AerMod 09292	BrevardPM102010_2003_PM10.SUM	PM10	24-HR	BNRG	8TH	2.10231	517433	3140531.2	6.71	6.71	0	MCOTPA2003.SFC	6	1	5504

PM10 Annual (Period) Significance = 1 μg/m3
PM10 24-hr Significance = 5 μg/m3

Brevard Energy
Summary of AERMOD Results - PSD Increment/NAAQS
October 29, 2010
PM10 Modeled from 1999-2003

Model	File	Pollutant	Average	Group	Rank	Concentration (μg/m^3)	East(X)	North(Y)	Elevation (m)	Hill (m)	Flag	Met File	Sources	Groups	Receptors
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM10	PERIOD	ALL	1ST	0.50948	516757.7	3139139	6.1	6.1	0	8760 HRS	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM10	24-HR	ALL	1ST	4.74598	517433	3140630.7	6.71	6.71	0	99101724	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM10	24-HR	ALL	2ND	3.47647	517433	3140332.3	6.88	6.88	0	99031024	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM10	24-HR	ALL	6TH	2.74109	516661.2	3139139	6.1	6.1	0	99121724	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM10	24-HR	ALL	8TH	2.56345	516757.7	3139139	6.1	6.1	0	99011124	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM10	PERIOD	ALL	1ST	0.5327	517433	3140431.8	6.71	6.71	0	8784 HRS	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM10	24-HR	ALL	1ST	4.74598	517433	3140630.7	6.71	6.71	0	99101724	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM10	24-HR	ALL	2ND	3.47647	517433	3140332.3	6.88	6.88	0	99031024	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM10	24-HR	ALL	6TH	3.03506	517433	3140431.8	6.71	6.71	0	99031024	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM10	24-HR	ALL	8TH	2.89058	517433	3140431.8	6.71	6.71	0	42224	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM10	PERIOD	ALL	1ST	0.5327	517433	3140431.8	6.71	6.71	0	8760 HRS	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM10	24-HR	ALL	1ST	5.48302	517433	3140431.8	6.71	6.71	0	1030524	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM10	24-HR	ALL	2ND	4.42319	517433	3140431.8	6.71	6.71	0	1040124	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM10	24-HR	ALL	6TH	3.2903	517433	3140332.3	6.88	6.88	0	123024	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM10	24-HR	ALL	8TH	3.21365	517433	3140332.3	6.88	6.88	0	12524	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM10	PERIOD	ALL	1ST	0.53934	515793	3140232.9	5.79	5.79	0	8760 HRS	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM10	24-HR	ALL	1ST	5.48302	517433	3140431.8	6.71	6.71	0	1030524	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM10	24-HR	ALL	2ND	4.42319	517433	3140431.8	6.71	6.71	0	1040124	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM10	24-HR	ALL	6TH	3.52049	517433	3140332.3	6.88	6.88	0	2010724	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM10	24-HR	ALL	8TH	3.47647	517433	3140332.3	6.88	6.88	0	99031024	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM10	PERIOD	ALL	1ST	0.52996	515793	3140232.9	5.79	5.79	0	MCOTPA2003.SFC	13	1	5504
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM10	24-HR	ALL	1ST	5.55262	517433	3140630.7	6.71	6.71	0	MCOTPA2003.SFC	13	1	5504
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM10	24-HR	ALL	2ND	4.74576	517433	3140630.7	6.71	6.71	0	MCOTPA2003.SFC	13	1	5504
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM10	24-HR	ALL	6TH	3.53358	517433	3140332.3	6.88	6.88	0	MCOTPA2003.SFC	13	1	5504
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM10	24-HR	ALL	8TH	3.50352	517433	3140332.3	6.88	6.88	0	MCOTPA2003.SFC	13	1	5504

Pollutant	Modeled Results Including Background Sources	PSD Increment	Background Concentrations	Modeled Results Including Background Sources and Background Concentrations	NAAQS
PM10 - 24hr	4.75	30	55.67	NA	NA
PM10 - 24hr	3.53	NA	55.67	59.17	150

All Units are μg/m^3

Brevard Energy
Summary of AERMOD Results - PSD Increment/NAAQS
October 29, 2010
PM2.5 Modeled from 1999-2003

Model	File	Pollutant	Average	Group	Rank	Concentration (µg/m³)	East(X)	North(Y)	Elevation (m)	Hill (m)	Flag	Met File	Sources	Groups	Receptors
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM2.5	PERIOD	ALL	1ST	0.50948	516757.7	3139139	6.1	6.1	0	8760 HRS	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM2.5	24-HR	ALL	1ST	4.74598	517433	3140630.7	6.71	6.71	0	99101724	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM2.5	24-HR	ALL	2ND	3.47647	517433	3140332.3	6.88	6.88	0	99031024	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM2.5	24-HR	ALL	6TH	2.74109	516661.2	3139139	6.1	6.1	0	99121724	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_1999_PM10.SUM	PM2.5	24-HR	ALL	8TH	2.56345	516757.7	3139139	6.1	6.1	0	99011124	MCOTPA1999.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM2.5	PERIOD	ALL	1ST	0.5327	517433	3140431.8	6.71	6.71	0	8784 HRS	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM2.5	24-HR	ALL	1ST	4.74598	517433	3140630.7	6.71	6.71	0	99101724	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM2.5	24-HR	ALL	2ND	3.47647	517433	3140332.3	6.88	6.88	0	99031024	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM2.5	24-HR	ALL	6TH	3.03506	517433	3140431.8	6.71	6.71	0	99031024	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2000_PM10.SUM	PM2.5	24-HR	ALL	8TH	2.89058	517433	3140431.8	6.71	6.71	0	42224	MCOTPA2000.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM2.5	PERIOD	ALL	1ST	0.5327	517433	3140431.8	6.71	6.71	0	8760 HRS	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM2.5	24-HR	ALL	1ST	5.48302	517433	3140431.8	6.71	6.71	0	1030524	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM2.5	24-HR	ALL	2ND	4.42319	517433	3140431.8	6.71	6.71	0	1040124	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM2.5	24-HR	ALL	6TH	3.2903	517433	3140332.3	6.88	6.88	0	123024	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2001_PM10.SUM	PM2.5	24-HR	ALL	8TH	3.21365	517433	3140332.3	6.88	6.88	0	12524	MCOTPA2001.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM2.5	PERIOD	ALL	1ST	0.53934	515793	3140232.9	5.79	5.79	0	8760 HRS	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM2.5	24-HR	ALL	1ST	5.48302	517433	3140431.8	6.71	6.71	0	1030524	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM2.5	24-HR	ALL	2ND	4.42319	517433	3140431.8	6.71	6.71	0	1040124	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM2.5	24-HR	ALL	6TH	3.52049	517433	3140332.3	6.88	6.88	0	2010724	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2002_PM10.SUM	PM2.5	24-HR	ALL	8TH	3.47647	517433	3140332.3	6.88	6.88	0	99031024	MCOTPA2002.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM2.5	PERIOD	ALL	1ST	0.53934	515793	3140232.9	5.79	5.79	0	8760 HRS	MCOTPA2003.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM2.5	24-HR	ALL	1ST	5.55277	517433	3140630.7	6.71	6.71	0	3041024	MCOTPA2003.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM2.5	24-HR	ALL	2ND	4.74598	517433	3140630.7	6.71	6.71	0	99101724	MCOTPA2003.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM2.5	24-HR	ALL	6TH	3.53552	517433	3140332.3	6.88	6.88	0	2042224	MCOTPA2003.SFC	13	1
Model:AerMod 09292	BrevardPM10BGS2010_2003_PM10.SUM	PM2.5	24-HR	ALL	8TH	3.51327	517433	3140332.3	6.88	6.88	0	1041724	MCOTPA2003.SFC	13	1

Pollutant	Modeled Results Including Background Sources	PSD Increment	Background Concentrations	Modeled Results Including Background Sources and Background Concentrations	NAAQS
PM2.5 - 24hr	3.51	---	17.93	21.45	35

All Units are µg/m³

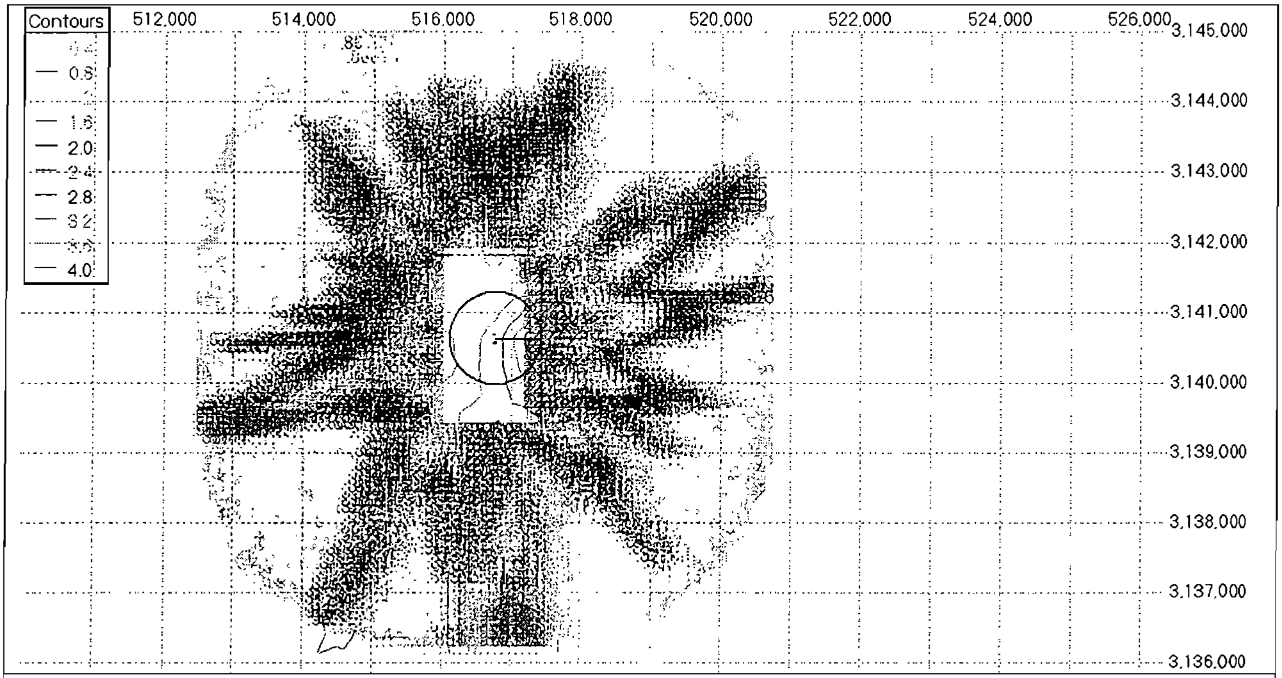

Figure 1: Radius of Influence of 0.7 kilometers – 1999, 24-hour, $PM_{2.5}$.

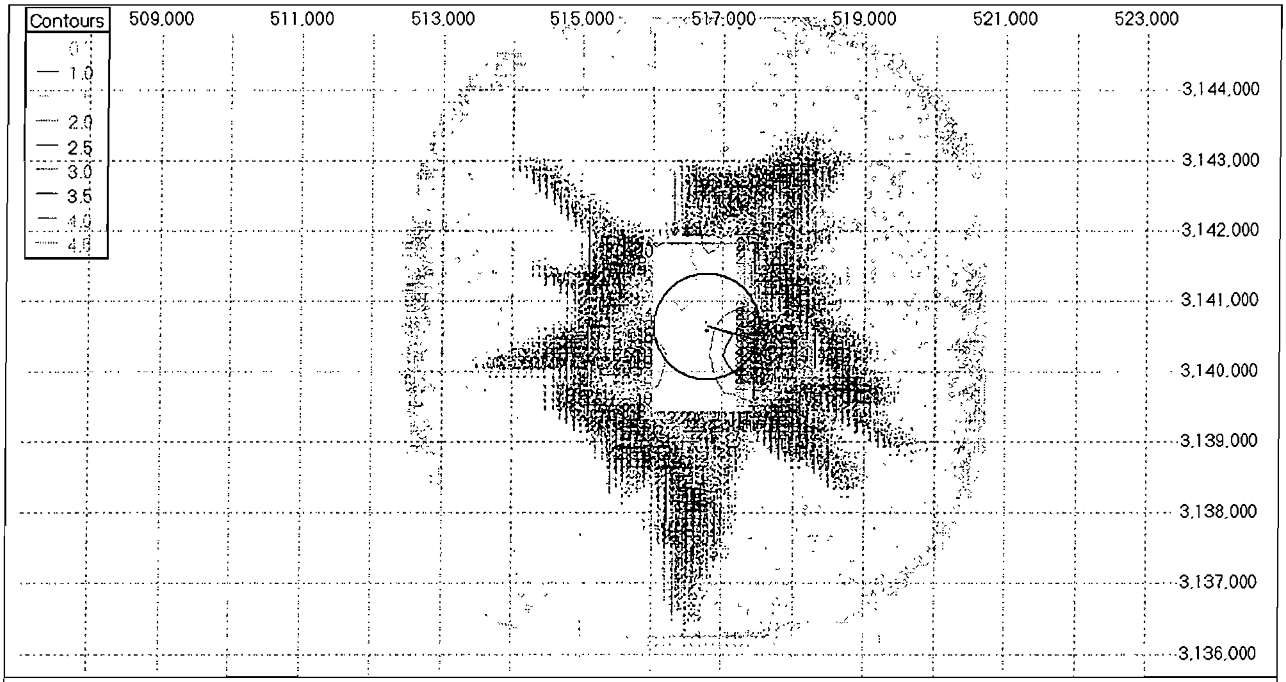

Figure 2: Radius of Influence of 0.8 kilometers – 2001, 24-hour, $PM_{2.5}$.

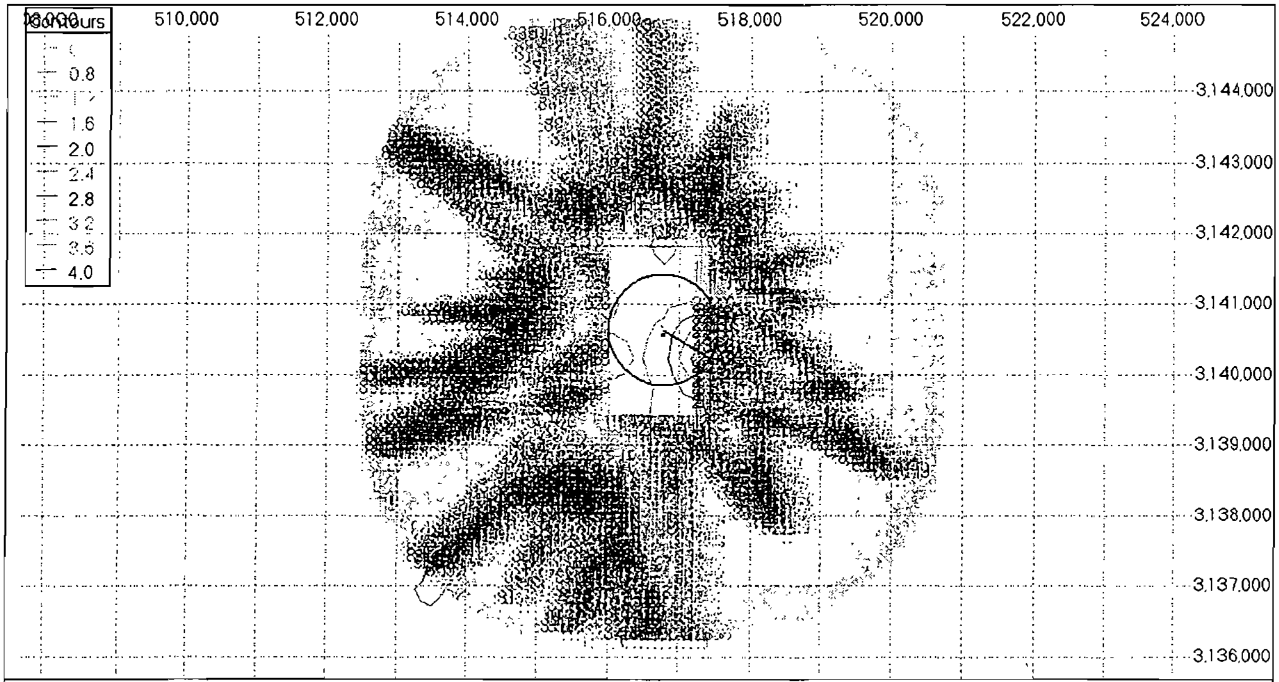

Figure 3: Radius of Influence of 0.8 kilometers – 2002, 24-hour, $PM_{2.5}$.

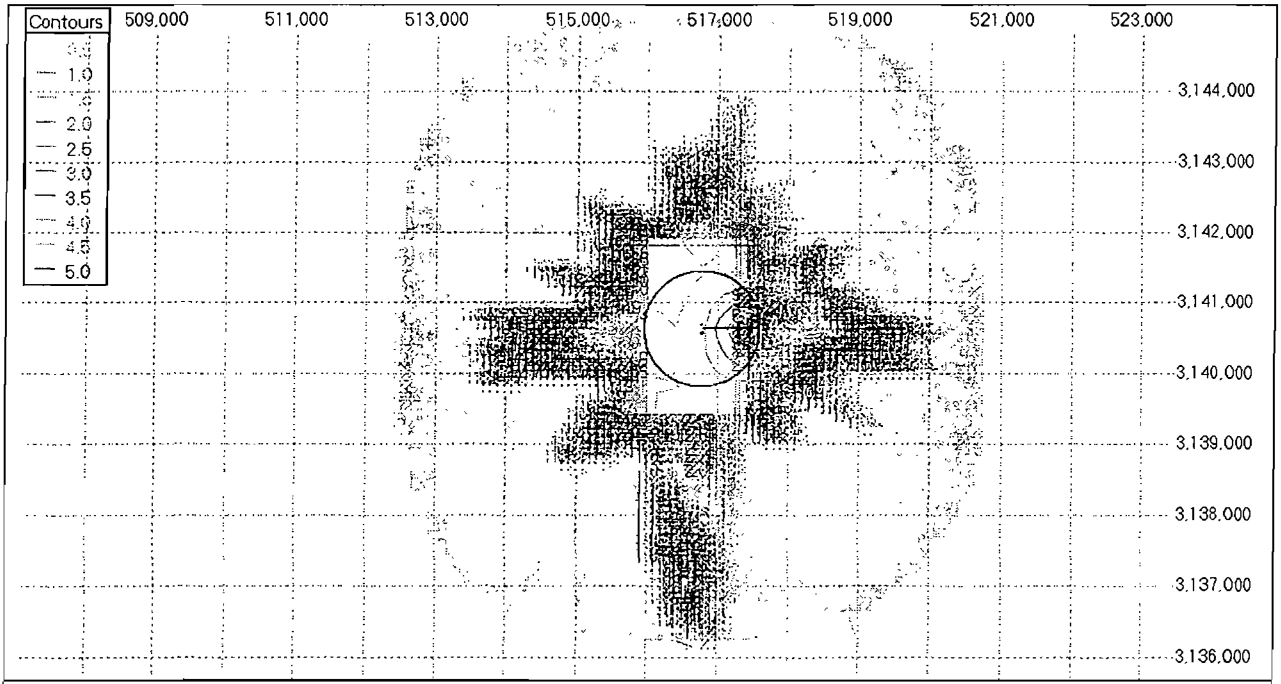

Figure 4: Radius of Influence of 0.8 kilometers– 2003, 24-hour, $PM_{2.5}$.

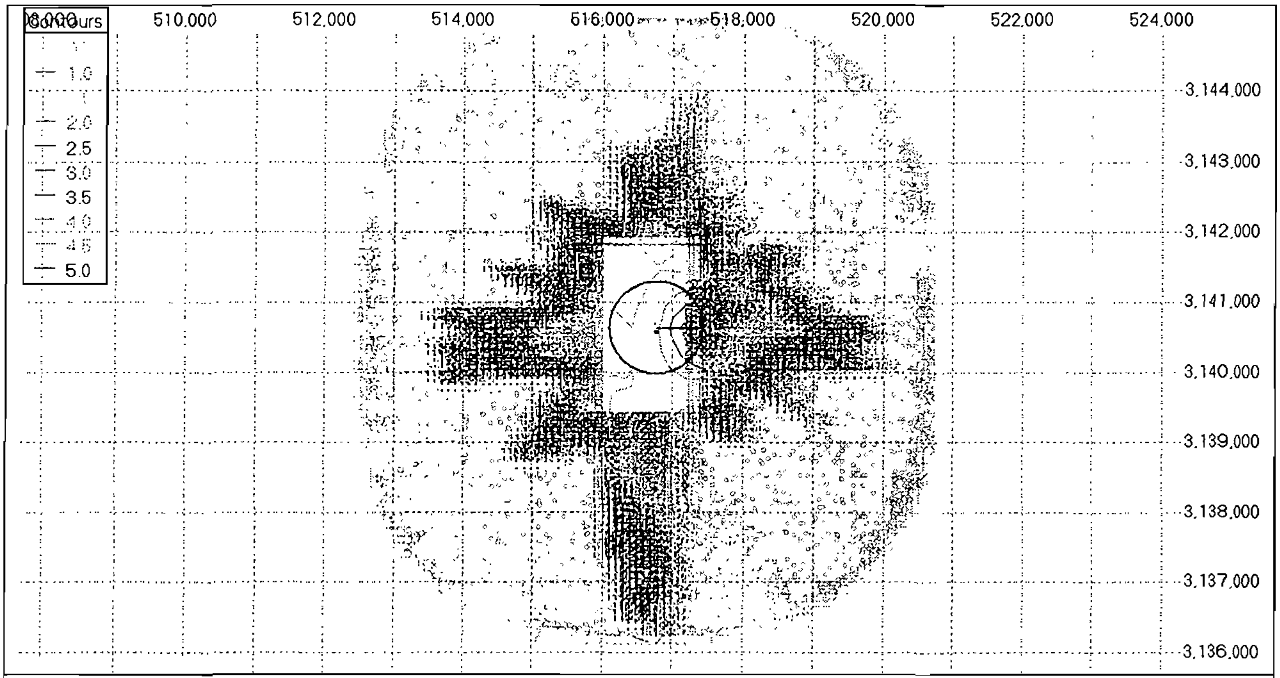

Figure 5: Radius of Influence of 0.7 kilometers – 2003, 24-hour, PM_{10}.

APPENDIX K-5

BACKGROUND MONITORING DATA

Violation of Standards Report
2007 to 2009

Criteria

Site	Parameter	Interval
C0090007	PM25C_3	001h
	PM25M	001d

Report Created:09/02/2010 16:47

$PM_{2.5}$ (88101,88500,88501,88502,88503) Units: µg/m^3

Site:C0090007 - Melbourne County:Brevard AQS Monitor ID:12-009-0007-88101-1

	Quarterly Averages (#Valid 24-hour Observations)				Ranked 24hr Averages						
Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st	2nd	3rd	98th Percentile	Weighted Annual Average	3-Year 98th Percentile Average	3-Year Annual Average
2007	6.64 [29]	9.86 [29]	6.99 [31]	5.67 [28]	23.5 (05/09)	21.9 (08/07)	19.9 (05/30)	19.9	7.29		
2008‡	7.35 [32]	9.34 [30]	7.39 [29]	5.60 [29]	21.3 (08/13)	19.9 (06/15)	17.7 (06/16)	17.7	7.42		
2009	6.42 [29]	8.05 [24]	5.77 [29]	5.65 [24]	22.0 (06/21)	15.4 (06/12)	15.3 (06/15)	15.3	6.47	17.6	7.06

‡ Exceptional events occurred in this year and are included in the report.

The national ambient air quality standards for PM 2.5 are: (1) 35 micrograms per cubic meter for a 24-hour average concentration and (2) 15 micrograms per cubic meter for an annual mean concentration. The 24-hour standard is attained when the 3-year average of the annual 98th percentile values is less than or equal to the 24-hour standard. The annual standard is attained when the 3-year of the annual means is less than or equal to the annual standard.

$PM_{2.5}$ (88101,88500,88501,88502,88503) Units: µg/m^3

Site:C0090007 - Melbourne County:Brevard AQS Monitor ID:12-009-0007-88502-3

	Quarterly Averages (#Valid 24-hour Observations)				Ranked 24hr Averages						
Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st	2nd	3rd	98th Percentile	Weighted Annual Average	3-Year 98th Percentile Average	3-Year Annual Average
2007	0.00* [0]	0.00* [0]	0.00* [0]	8.07* [67]	22.7 (11/04)	15.8 (11/10)	14.2 (11/06)	15.8	8.07*		
2008	8.16 [91]	9.33 [91]	8.81 [92]	6.79 [92]	26.0 (08/13)	20.4 (06/15)	19.1 (07/09)	16.5	8.27		
2009	7.91 [90]	8.87 [91]	7.93 [92]	7.00 [92]	21.4 (06/21)	19.2 (06/22)	18.3 (06/12)	16.3	7.92	16.2*	8.09*

* There was insufficient data to produce a valid average.

The national ambient air quality standards for PM 2.5 are: (1) 35 micrograms per cubic meter for a 24-hour average concentration and (2) 15 micrograms per cubic meter for an annual mean concentration. The 24-hour standard is attained when the 3-year average of the annual 98th percentile values is less than or equal to the 24-hour standard. The annual standard is attained when the 3-year of the annual means is less than or equal to the annual standard.

Elapsed time = 1 seconds

Violation of Standards Report

2007 to 2009

Criteria

Site	Parameter	Interval
C0090011	PM10C	001h
	PM25C_3	001h

Report Created:09/02/2010 16:45

PM10 (81102) Units: µg/m^3

Site:C0090011 - Fay Park County:Brevard AQS Monitor ID:12-009-0011-81102-1

	Quarterly Averages (%Valid Observations)				Ranked 24hr Averages					
Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st	2nd	3rd	Weighted Annual Average	Estimated # of Exceedances	Expected # of Exceedances
2007	14.0 (99%)	18.2 (100%)	15.5 (100%)	14.2 (100%)	74 (05/09)	34 (08/04)	32 (08/08)	15.4	0.0	
2008	14.4 (89%)	18.4 (91%)	17.6 (100%)	13.9 (82%)	58 (08/13)	45 (05/11)	45 (07/09)	16.0	0.0	
2009	14.7 (100%)	15.9 (99%)	15.0 (100%)	12.3 (99%)	35 (07/31)	35 (08/27)	32 (08/07)	14.4	0.0	0.0

The national ambient air quality standard for PM 10 is: 150 micrograms per cubic meter for a 24-hour average concentration. The 24-hour standard is attained when the expected number of exceedances is less than or equal to 1. The expected exceedances are the averages of the estimated exceedances from the most-recent 3 years.

PM$_{2.5}$ (88101,88500,88501,88502,88503) Units: µg/m^3

Site:C0090011 - Fay Park County:Brevard AQS Monitor ID:12-009-0011-88502-3

	Quarterly Averages (#Valid 24-hour Observations)				Ranked 24hr Averages						
Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st	2nd	3rd	98th Percentile	Weighted Annual Average	3-Year 98th Percentile Average	3-Year Annual Average
2007	8.54 [89]	11.54 [91]	9.20 [91]	8.23 [92]	66.0 (05/09)	28.1 (05/10)	26.3 (08/08)	22.3	9.37		
2008	8.51 [90]	9.93 [81]	8.98 [92]	7.63 [91]	23.7 (08/13)	18.5 (05/11)	18.2 (05/16)	16.5	8.76		
2009	8.58 [90]	8.81 [91]	7.80 [92]	7.53 [92]	20.5 (06/21)	18.1 (06/22)	17.2 (06/12)	15.0	8.18	17.9	8.77

The national ambient air quality standards for PM 2.5 are: (1) 35 micrograms per cubic meter for a 24-hour average concentration and (2) 15 micrograms per cubic meter for an annual mean concentration. The 24-hour standard is attained when the 3-year average of the annual 98th percentile values is less than or equal to the 24-hour standard. The annual standard is attained when the 3-year of the annual means is less than or equal to the annual standard.

Elapsed time = 2 seconds

FAMAS Network Description
2010

Report Date:7/2/2010 10:44:44 AM

FDEP District - Florida Dept of Environmental Protection, Central District (0396)

Site	Type	Pollutant	POC	Collection Frequency	Sampler	Type of Sampling	Spatial Scale	Comments
Brevard County								
12-009-0011	Fay Park (+28.469316,-80.800099)							Site Opened 11/1/2006
	SPECIAL PURPOSE	SO_2	1		TECO 43C	SOURCE ORIENTED	URBAN SCALE	SU 11/1/07
	SPECIAL PURPOSE	SO_2	1	Continuous	TECO 43C	SOURCE ORIENTED	URBAN SCALE	SU 11/1/07
	SLAMS	PM_{10}	1	Continuous	TEOM	SOURCE ORIENTED	URBAN SCALE	SU 11/1/06
	SPECIAL PURPOSE	$PM_{2.5}$	3	Continuous	TEOM	SOURCE ORIENTED	URBAN SCALE	SU 11/1/06
Lake County								
12-069-0003	OCALA NF (+29.012500,-81.641389)							Site Opened 4/28/2004
	SPECIAL PURPOSE	$PM_{2.5}$	3	Continuous	TEOM	HIGHEST CONCENTRATION	NEIGHBORHOOD	SU 4/28/04; Forestry Service Monitor
MSA - Daytona Beach, Fl								
12-127-2001	Port Orange (+29.109722,-80.993611)							Site Opened 11/7/1991
	SLAMS	Ozone	1	Continuous	TECO 49C	POPULATION EXPOSURE/ HIGHEST CONCENTRATION	URBAN SCALE	SU 1/1/92
12-127-5002	Daytona - Blind Services (+29.206667,-81.052500)							Site Opened 4/27/1992
	SLAMS	Ozone	1	Continuous	TECO 49C	HIGHEST CONCENTRATION	URBAN SCALE	SU 1/1/92
	SLAMS	PM_{10}	2	Continuous	TEOM	POPULATION EXPOSURE	NEIGHBORHOOD	SU 6/26/98
	SLAMS	$PM_{2.5}$	1	Every 3rd Day	R&P 2025	POPULATION EXPOSURE	NEIGHBORHOOD	SU 1/4/1999; SD 12/31/2007; SU 4/1/2009
	SLAMS	$PM_{2.5}$	3	Continuous	TEOM	POPULATION EXPOSURE	NEIGHBORHOOD	SU 12/20/07
MSA - Melbourne-Palm Bay, Fl								
12-009-0007	Melbourne (+28.053611,-80.628611)							Site Opened 3/1/2000
	SLAMS	Ozone	1	Continuous	TECO 49C	POPULATION EXPOSURE	NEIGHBORHOOD	SU 3/1/00
	SLAMS	$PM_{2.5}$	1	Every 3rd Day	R&P 2025	POPULATION EXPOSURE/ UPWIND BACKGROUND	NEIGHBORHOOD	SU 3/1/00
	SLAMS	$PM_{2.5}$	3	Continuous	TEOM	POPULATION EXPOSURE	NEIGHBORHOOD	SU 10/25/07
12-009-4001	Freedom 7 Elementary School (+28.311117,-80.614133)							On-site MET Site Opened 9/15/1988

	SLAMS	Ozone	1	Continuous	TECO 49C	HIGHEST CONCENTRATION	NEIGHBORHOOD	SU 9/18/88
MSA - Ocala, Fl								
12-083-0003	Ocala - YMCA (+29.171389,-82.094722)							On-site MET Site Opened 5/27/1998; 70 meters ESE of SE 17th St and 30th Ave
	SLAMS	Ozone	1	Continuous	TECO 49C	HIGHEST CONCENTRATION/ UPWIND BACKGROUND	NEIGHBORHOOD	SU 5/27/1998
	SPECIAL PURPOSE	PM2.5	3	Continuous	TEOM	POPULATION EXPOSURE	NEIGHBORHOOD	SU 11/27/2007
12-083-0004	County Sheriff Impound (29.192778,-82.173056)							Site Opened 11/9/2000
	SLAMS	Ozone	1	Continuous	TECO 49C	POPULATION EXPOSURE	NEIGHBORHOOD	SU 11/8/00
MSA - Orlando, Fl								
12-069-0002	Clermont - Lost Lake Elementary School (+28.523611,-81.723611)							Site Opened 10/1/2000
	SLAMS	Ozone	1	Continuous	TECO 49C	POPULATION EXPOSURE	NEIGHBORHOOD	SU 6/1/00
12-097-2002	Osceola Co. Fire Station - Four Corners (+28.345555,-81.636667)							On-site MET Site Opened 9/1/1993
	SLAMS	Ozone	1	Continuous	TECO 49C	HIGHEST CONCENTRATION	URBAN SCALE	SU 9/1/93
12-117-1002	Seminole Community College (+28.746111,-81.310556)							Site Opened 1/1/1980
	SLAMS	Ozone	1	Continuous	TECO 49C	HIGHEST CONCENTRATION	URBAN SCALE	SU 1/1/80
	SLAMS	PM10	3	Continuous	TEOM	POPULATION EXPOSURE	NEIGHBORHOOD	SU 12/22/00
	SLAMS	PM2.5	1	Every 3rd Day	R&P 2025	POPULATION EXPOSURE	NEIGHBORHOOD	SU 1/7/1999; Collocated
	SLAMS	PM2.5	2	Every 12th Day	R&P 2025	POPULATION EXPOSURE	URBAN SCALE	SU 1/7/1999

Summary of Sites/Monitors for Florida Dept of Environmental Protection, Central District

Total Number of Sites	11

Number of Monitors by Network Type

SLAMS	18
SPECIAL PURPOSE	5

Number of Criteria Pollutant Monitors

Ozone	9
PM2.5	9
PM10	3
SO2	2
CO	0
NO2	0
Lead	0
Lead 14129	0

PM2.5 Breakout

Daily FRMs	0
Every 3rd Day FRMs	3
Every 6th Day FRMs	0
Every 12th Day FRMs	1
Continuous	5
Collocated (POC 2)	1

Total 23

APPENDIX L

MSW LANDFILL NSPS USEPA CENTRAL SISPOSAL FACILITY

LFG DETERMINATIONS

David

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

4APT-ATMB

OCT 1 9 2006

Joseph Kahn, Acting Director
Division of Air Resource Management
FL Department of Environmental Protection
Mail Station 5500
2600 Blair Stone Road
Tallahassee, FL 32399-2400

Dear Mr. Kahn:

The purpose for this letter is to provide you with a determination regarding emission limit applicability and monitoring requirements for landfill gas that will be combusted in internal combustion engines to produce electricity at the following landfills located in Florida:

Trail Ridge Landfill (Baldwin, Florida)

Brevard County Landfill (Cocoa, Florida)

Seminole County Landfill (Geneva, Florida)

These landfills are subject to 40 CFR Part 60, Subpart WWW (Standards of Performance for Municipal Solid Waste Landfills), and a consultant (Derenzo and Associates, Inc.) representing the owners of all three sites submitted applicability determination requests to the U.S. Environmental Protection Agency (EPA) Region 4 and to your agency. The primary question posed in these requests is whether the landfill gas processing operations at these sites constitute "treatment" as this term is defined under Subpart WWW. Based upon our review of the information provided with the applicability determination request, we concluded that the gas processing conducted at the three landfills in question does constitute treatment under Subpart WWW. Therefore, the gas leaving the treatment systems at these landfills is no longer subject to the control and monitoring requirements in Subpart WWW. Details regarding the gas processing systems at these sites and the basis for our determination are provided in the remainder of this letter.

Derenzo and Associates requested a determination regarding whether the gas processing at the three landfills in Florida constitutes treatment because gas that has been treated is no longer subject to the control requirements in Subpart WWW. Under provisions in 40 CFR §60.752(b)(2)(iii), gas collected from landfills subject to Subpart WWW must be routed to either a flare, a control system that reduces nonmethane organic compound (NMOC) emissions by 98 weight-percent, an enclosed combustor, or a treatment system that processes the gas for subsequent sale or use. If an enclosed combustor is used, NMOC emissions must be reduced by either 98 weight-percent or to a concentration of less than 20 parts per million as hexane, corrected to three percent oxygen. Although landfill gas is no longer subject to the control requirements in Subpart WWW after it has been processed for subsequent sale or use, emissions from any atmospheric vents in the treatment system must be sent to a control system (flare, enclosed combustor, etc.) that complies with the removal efficiency standards in the rule.

According to the process description that Derenzo and Associates provided with its applicability determination requests, gas collected at the three landfills in question is filtered to remove particles larger than one micron, dewatered, and compressed. According to several previous U.S. Environmental Protection Agency (EPA) determinations, a landfill gas processing operation that includes filtration to ten microns or less, dewatering, and compression constitutes treatment in accordance with provisions in 40 CFR §60.752(b)(2)(iii)(C). Since the gas processing operations at the three landfills in question include all of the steps cited in EPA's previous determinations, they constitute treatment systems for Subpart WWW purposes, and the treated gas leaving these systems will no longer be subject to control or monitoring requirements under the rule.

If you have any questions about the determination provided in this letter, please contact Mr. David McNeal of the EPA Region 4 staff at (404) 562-9102.

Sincerely,

Beverly H. Banister
Director
Air, Pesticides and Toxics
Management Division

cc: Syed Arif
Division of Air Resource Management
FL Department of Environmental Protection
Mail Station 5500
2600 Blair Stone Road
Tallahassee, FL 32399-2400

APPENDIX M

LFG ENGINE EMISSIONS AND USEPA RBLC DATA

Summary of USEPA RBLC Query October 18, 2010

Facility Information Name	RBLC Identification	Process Code	State	Engine Size (MMBtu/hr)	Engine Size (kW)	Engine Size (hp)	NOx (g/bhp-hr)	NOx (lb/hr)	CO (g/bhp-hr)	CO (lb/hr)	PM/PM$_{10}$ (g/bhp-hr)	PM/PM$_{10}$ (lb/hr)
>4000 bhp engines												
Minnesota Methane, Tajiuas	CA-0843	17.150	CA	43.68		4,314	0.59				(0.34)	(3.19)
County of Sacremento, Kiefer	CA-0960	17.150	CA		3,000	4,230	0.55 *		2.70			
2000-4000 bhp engines												
PPL Renewable Energy, LLC	VT-0029	17.140	VT		1,600	2,233			2.75	13.5		
Reliant Energy, Harris	TX-0349	17.150	TX		1,664	2,343	0.60 *	3.10	3.00	15.5	(0.15)	0.77
Reliant Energy, Galveston	TX-0385	17.140	TX			2,343	0.60	3.10	3.00	15.5	(0.09)	0.49
Reliant Energy, Montgomery	TX-0404	17.140	TX		1,664	2,343	0.60		3.00		(0.04)	(0.19)
Trailridge Energy-LES	FL-0289	17.140	FL		1,600	2,233	0.60	2.95	2.75	13.54	0.24	1.18
Seminole Energy-LES	FL-0290	17.140	FL		1,600	2,233	0.60	2.95	2.75	13.54	0.24	1.18
Brevard Energy-LES	FL-0291	17.140	FL		1,600	2,233	0.60	2.95	2.75	13.54	0.24	1.18
Manchester Renewable Power-OEC Expansion	NJ-0068	17.140	NJ	16.38	1,600	2,233	0.50 *		2.75		0.20	0.98
Ridgewood Power Mgt, LLC	RI-0022	17.140	RI			2,229	0.50 *	2.46	2.75	13.51	0.10	0.49
New England Waste Services	VT-0019	17.140	VT		1,600	2,221	0.50	2.45	2.75	13.5		
Bio-Energy, EDI Covel Gardens	TX-0495	17.140	TX		1,565	2,172	(0.60)	2.87	(2.80)	13.41	(0.15)	0.71
Burlington County Resource Rec.	NJ-0067	17.140	NJ	12.5	1,500	2,160	0.60 *	2.66	2.50	11`.95	(0.16)	0.75
University of New Hampshire expansion	NH-0014	17.140	NH	14.3	1,600	N/A	0.50 *		2.75		0.10	
1000-2000 bhp engines												
Bio-Energy, EDI Carbon[1]	OH-0260	17.140	OH	14.0	1,400	1,877	(1.19)	4.90	(2.27)	9.40	(0.10)	0.40
MM San Bernardino Energy	CA-1092	17.140	CA	14.7		1,850	0.60		2.50		(0.05)	0.20
Bio-Energy, EDI Loraine[2]	OH-0273	17.150	OH	14.0		1,830	(1.50)	5.88	(2.50)	9.76	(0.09)	0.37
New England Waste Services ME expansion	ME-0036	17.140	ME	10.8		1,468		1.94	2.75			0.49
Monmouth County Reclamation	NJ-0069	17.140	NJ	9.81	1,000	1,468	0.53 *		2.53		(0.18)	0.58
Northwest Reg. Landfill	AZ-0042	17.150	AZ			1,410	0.60		2.50			
MM Hackensack Energy[3]	NJ-0021	17.150	NJ	9.96	950	1,340	1.00		(2.00)	6.05	(0.19)	0.55
Monterey Regional Waste Management	CA-0789		CA			1,274	1.20					
Manchester Renewable Power	NJ-0068	17.150	NJ	8.6	800	1,138	0.50	2.46	2.70	13.54	2	0.98
Sumpter Energy, Carleton Farms expansion	MI-0371	17.140	MI	8.6	817	1,138	(1.80)	4.52	(2.90)	7.28		
Sumpter Energy, Carleton Farms	MI-0314	17.150	MI	8.6		1,138	2.00	5.02	2.90	7.28		
Sumpter Energy, City Sand	MI-0317	17.150	MI	8.6		1,138	2.00		2.90			
Sumpter Energy, Pine Tree	MI-0299	17.150	MI	8.6	800	1,138	2.00		2.90			
Northern Tier Solid Waste Authority	PA-0173	17.150	PA		815	N/A	2.00		3.00			
Not Applicable or <1000 bhp												
Industrial Power Generating Corp	VA-0288	17.140	VA		350	550	5.05		7.70			
Bio Energy, EDI Azusa[4]	CA-0961	17.150	CA	NA	NA	N/A						
Chino Basin Desalter Authority	CA-1022	17.140	CA	10.75			0.6		2.5			0.2

* Specified as LAER

(Parantheses indicate calculated value based on information presented in USEPA RBLC Database)

Notes

1. Emission factors (g/bhp-hr) for CO and NOx presented in RBLC database were revised based on modified permit issued in 2003.
2. Data presented in the USEPA RBLC is for one 1830 hp engine, not a 5500 hp engine. NOx and CO emissions are adjusted accordingly.
3. Data presented in the USEPA RBLC indicates a CO emission rate of 0.607 lb/MMBtu, which converts to 2.0 g/bhp-hr.
4. Project Cancelled.

APPENDIX N

BAAQMD BACT DETERMINATION

BAY AREA AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guideline

Source Category

Source:	**IC Engine – Landfill Gas Fired**	**Revision:**	**4**
		Document #:	**96.2.2**
Class:	**> 250 Hp Output**	**Date:**	**03/05/2009**

Determination

	Pollutant	**BACT 1. Technologically Feasible/ Cost Effective 2. Archived in Practice**	**TYPICAL TECHNOLOGY**
	POC	1. n/s 2. 120 ppm @ 3% O_2 [b] (0.16 g/bhp-hr)	1. Lean Burn Technology + LFG Trtmt: filtration + refrigeration + carbon adsorption [h] 2. Lean Burn Technology [a]
Low-Nox Engine Bias	**NO_x** [Low-NO_x Engine Bias]	1. n/s 2. 0.5 g/bhp-hr [c, g]	1. n/d 2. Lean Burn Technology [c]
	CO [Low-NO_x Engine Bias]	1. n/s 2. a) Initial Standard: 2.5 g/bhp-hr [g, h] b) Not to Exceed Standard: 3.9 g/bhp-hr [c, h] c) CO emissions based overhaul schedule [c, e, f]	1. Lean Burn Technology + LFG Trtmt: filtration + refrigeration + carbon adsorption [h] 2. Lean Burn Technology [c, h]
Low-CO Engine Bias	**NO_x** [Low-CO Engine Bias]	1. n/s 2. 0.6 g/bhp-hr [d, g, h]	1. n/d 2. Lean Burn Technology [d, h]
	CO [Low-CO Engine Bias]	1. n/s 2. a) Initial Standard: 2.1 g/bhp-hr [c, d, g] b) Not to Exceed Standard: 3.6 g/bhp-hr [e, h] c) CO emissions based overhaul schedule [c, e, f]	1. Lean Burn Technology + LFG Trtmt: filtration + refrigeration + carbon adsorption [h] 2. Lean Burn Technology [c, d, h]
	SO_2	1. n/s 2. n/s	1. LFG Treatment with >80% H_2S Removal [a] 2. n/d
	PM_{10}	1. n/d 2. n/s	1. n/d 2. LFG Filtration [a]
	NPOC	1. n/a 2. n/a	1. n/a 2. n/a

References and notes for LFG IC Engine BACT Determination

a. BAAQMD Published Waste Gas IC Engine BACT Determination, 6-2-1995, Revision 3.

b. BAAQMD Regulation 8-34-301.4. 120 ppm as methane at 3% O_2 (equivalent to 40 ppm @ 15% O_2. Equivalent to 98% NMOC destruction. Compliance with CO NTE limit may be used as a surrogate for NMOC destruction for the purpose of showing compliance on a monthly basis.

c. LFGTE Coalition LFG BACT Proposal, 7-3-2007

d. AN 12649 (Ameresco-Half Moon Bay), AN 14265 (Ameresco-Keller Canyon).

e. 3.9 g/bhp-hr equivalent CO Limit = 420 ppm CO at 15% O_2. 3.6 g/bhp-hr equivalent CO Limit = 385 ppm CO @ 15% O_2. Ongoing compliance demonstrated by monthly monitoring with handheld analyzer for NO_x and CO. Exceeding 420 ppm CO (or 385 ppm CO, if appropriate) triggers either 1) compliance source test to determine g/bhp-hr NO_x and CO emissions or 2) operator must shutdown engine within 30 days for maintenance. If 80% of NTE limit is exceeded, engine must be shutdown for maintenance within 12 months of date of the CO excursion. NOTE: The ppm CO to g/bhp-hr CO conversions are based on LFG methane content of 50% and engine mechanical efficiency of 30% (gross heat input to shaft horsepower). The owner or operator may request a revised ppm equivalent level based on site specific engine and landfill gas characteristics.

f. Engine maintenance may be deferred until 26,000 hours or 36 calendar months of operation, whichever comes first, if all standards are met (with CO $\leq$ 80% of NTE).

g. Source test required within 60 days of engine startup after top-end or major maintenance event.

h. White Paper, "Revisiting BACT for Lean Burn Landfill Gas Fired Internal Combustion Engines", BAAQMD, 2-26-2009.