PREVENTION OF SIGNIFICANT DETERIORATION AIR CONSTRUCTION PERMIT APPLICATION FOR A LANDFILL GAS–FUELED RECIPROCATING INTERNAL COMBUSTION ENGINE ELECTRICITY GENERATION FACILITY AT THE BREVARD COUNTY SOLID WASTE MANAGEMENT CENTRAL DISPOSAL FACILITY

Brevard Energy, LLC
29261 Wall Street
Wixom, Michigan 48393

May 25, 2006

DAI Project No. 0603003

Derenzo and Associates, Inc.
Environmental Consultants

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1.0 INTRODUCTION

Brevard Energy, LLC (Brevard Energy) plans to construct and operate an electricity generation facility that will result in the beneficial use of landfill gas (LFG) generated by the Brevard County Solid Waste Management Central Disposal Facility (Central Disposal Facility). The proposed facility will:

1. Be located at the Central Disposal Facility in Cocoa, Brevard County, Florida;

2. Use methane-rich gas to fuel reciprocating internal combustion (IC) engine operations;

3. Consist of LFG treatment equipment, six (6) identical lean-burn IC engines and generators sets;

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

5. Interconnect to the Florida Power & Light distribution network through a nearby power line.

The electricity generated by the proposed facility will be sold under the provisions of a Power Purchase Agreement with Florida Power & Light.

Landfill gas that is currently being generated at the Central Disposal Facility as a result of the degradation of the solid wastes placed in the facility and is not being utilized for its energy value is directed by an active LFG collection system (LGCS) to three (3) open candlestick flares for control (i.e., destruction of methane and other hydrocarbons contained in the gas).

The combustion of LFG in the proposed IC engines has the potential to emit into the ambient environment nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOC), sulfur oxides (SO_X), fine particulates (PM_{10}, particulates with diameters less than 10 microns) and other compounds (nonmethane organic compounds, hazardous air pollutants) that are defined as regulated air pollutants by the State of Florida and U.S. Environmental Protection Agency (USEPA).

New facilities located in the State of Florida that have the potential to emit significant amounts of regulated air pollutants are required to submit permit application documents to the Florida Department of Environmental Protection Division of Air Resource Management (FDEP-DARM) for its review and approval (through the issuance of 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.

Brevard Energy is requesting the issuance of an Air Construction Permit for the proposed LFG fueled IC engine electricity generation facility with the submittal of this permit application and its approval by the FDEP-DARM. An operating permit will be applied for under the regulatory provisions of *Chapter 62-213 Operation Permits For Major Sources of Air Pollutants*, F.A.C., after the proposed LFG fueled IC engine electricity generation facility has commenced operation.

Construction for the proposed project is expected to be complete by July 2007.

This technical support document contains data and information required by the regulatory agency to support the issuance of an Air Construction Permit for the proposed 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 Air Construction Permit Application documents for the proposed LFG fueled IC engine electricity generation facility.

Mr. Bill Owen, Executive Vice President of Landfill Energy Systems (parent company of Brevard Energy), authorized the preparation of the Air Construction 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 LFG fueled IC engine electricity generation facility.

Appendix B provides a detailed approximate schedule for construction of the facility.

2.0 PROPOSED ELECTRICITY GENERATION FACILITY

The electricity generation facility proposed by Brevard Energy will consist of:

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

2. Six (6) lean-burn IC engines that will be connected to individual electricity generators; and

3. Ancillary equipment that supports the electricity generation operations (e.g., engine oil storage tanks and LFG temperature and moisture conditioning equipment).

The LFG fueled IC engines will be housed in a single building constructed (with dimensions of 62.67 feet by 108.67 feet) in a leased area (at the landfill facility) near the existing LFG collection system header and control system flare. A gas transmission (fuel supply) line (pipe) will be connected to the header of the existing LFG collection system and a dedicated gas blower/compressor will be used to draw methane-rich gas (fuel) from the existing LFG collection system to the proposed electricity generation facility.

A single meter (flow totalizer) will be installed and operated at the Brevard Energy electricity generation facility to measure the total amount of LFG fuel that is supplied to power the six (6) IC engines (i.e., individual engine fuel use meters will not be installed).

The proposed electricity generation facility will be located within the boundaries of the Central Disposal Facility.

The general classification of the land use surrounding the landfill is rural based on information and procedures utilized for Ambient Impact Analyses, which are provided in Appendix I and will be submitted to the FDEP-DRAM as a separate document.

Appendix C provides general location and site drawings that illustrate the location of the Central Disposal Facility in Brevard County and proposed electricity generation facility at the landfill.

Appendix D provides a process flow diagram and engineering specifications for the proposed electricity generation facility.

2.1 Landfill Gas Fuel

2.1.1 Physical Properties

Landfill gas 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 Central Disposal Facility has performed net heating value and fixed gas (main gas components) composition analyses on samples of gas delivered to the LFG flaring system by the LFG collection system.

Table 1 presents results of measurements performed in July 2005 that indicate the net and lower heating value (LHV) of the LFG generated at the Central Disposal Facility is approximately 397.4 British thermal units per standard cubic foot of gas (Btu/scf). The heating value of LFG is primarily dependent on its methane content.

The LHV of the LFG (i.e., net heating value obtained by subtracting the latent heat of vaporization of water from the gross heating value) extracted from the Central Disposal Facility at the time full fuel demand is required for normal engine operations by the proposed electricity generation facility is expected to be approximately 450 Btu/scf.

Appendix E provides the results of the July 2005 net heating value and fixed gas analyses that were performed on samples of LFG generated by the Central Disposal Facility.

2.1.2 Heating Value Requirement

A fuel having a minimum LHV of approximately 420 Btu/scf is required to properly support the operation of the proposed electricity generation IC engines. The analyses performed on samples of gas generated by the Central Disposal Facility (which are presented in Table 1) indicate that the specified minimum heating value is currently being achieved.

Based on considerations for variables in gas generation and composition, the LHV of the LFG generated at the Central Disposal Facility is expected to range from 450 to 550 Btu/scf over the operating life of the proposed electricity generation facility (the corresponding HHV of the gas is expected to range from 500 to 612 Btu/scf).

2.1.3 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 proposed IC engines) will 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 10-microns and larger).

2. A gas compressor/blower.

3. Air-to-gas coolers (chillers), which will be used to reduce the elevated temperatures of LFG received from compressor to approximately 10°F above ambient temperatures.

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 3-microns and larger).

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

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

2.2 Engine / Generator Specifications

Table 2 presents equipment design, performance and operating specifications for the Caterpillar, Inc. (CAT®) Model G3520C gas IC engine and electricity generators.

Appendix F provides technical data (Caterpillar, Inc. equipment operating specifications) for the CAT® Model G3520C gas engine and power generation rating.

2.2.1 CAT® G3520C Gas IC Engine

Six (6) identical lean-burn IC engines, CAT® Model G3520C gas IC engines, will be used to power electricity generators. This engine:

1. Is designed to fire low-pressure, lean fuel mixtures and produce low combustion

by-product emissions. The 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 emissions.

2. Will be fueled exclusively with LFG generated by and received from the Central Disposal Facility (natural gas will not be used to fuel the IC engine operations under any conditions).

The CAT® G3520C gas IC engine has a power generation rating of 2,233 brake horsepower (bhp). The Caterpillar, Inc. technical data sheet specifies that the maximum LHV fuel operating requirement for the CAT® G3520C gas IC engine is approximately 14.11 million Btu per hour (MMBtu/hr), which is derived from the 235,181 Btu/min specification and equivalent to a HHV fuel operating requirement of 15.69 MMBtu/hr. However, the footnote presented in this data sheet indicates that the LHV rate specification has a tolerance (i.e., actual operating condition values may vary from those specified by the manufacturer).

Information obtained by Landfill Energy Systems during the startup of CAT® G3520C gas engine operations at New England Waste Services of Vermont (a new landfill gas to electricity facility) in October 2005 indicate that the heat input rate value specified in the Caterpillar Gas Engine Technical Data is low (i.e., lower than the heat input rate measured during actual engine operations). Records maintained by the plant operator verify that the actual heat input requirement of the CAT® G3520C gas engine is greater than the value presented in the manufacturer technical data specifications. Therefore, Landfill Energy Systems requested results of tests performed on a CAT® G3520C gas IC engine that was placed in operation at Atlantic County Landfill Energy (New Jersey ID 700611, PCP040001). The Atlantic County Landfill Energy CAT® G3520C gas engine test data indicate that the:

1. HHV of the engine LFG fuel measured during the air pollutant emission compliance demonstration was 499 BTU/scf; and

2. Average fuel flow rate to the engine was 543 scfm (average of 547, 542 and 540 scfm fuel consumption rates measured during the three, one-hour average engine emission tests).

Therefore, the actual HHV input rate of the CAT® G3520C gas IC engine tested at Atlantic County Landfill Energy is 16.28 MMBtu/hr (which is representative of the actual heat input rate required to operate the CAT® G3520C gas IC engine under base load conditions at other landfills).

The lowest LFG fuel LHV that can be utilized by the CAT® G3520C IC engine is 420 Btu/scf (467 Btu/scf HHV), which is the minimum fuel quality required to support proper engine operations based on 20 years of experience obtained by Landfill Energy Systems with the operation of Caterpillar IC engines on LFG fuel.

At the tested HHV input rate of 16.28 MMBtu/hr and minimum fuel heating value requirement of 467 BTU/scf HHV, the CAT® G3520C gas engines proposed for installation and operation by Brevard Energy will each use a maximum of 580 scfm and 34,800 standard cubic feet per hour (scfh).

Appendix G provides the specified Atlantic County Landfill Energy CAT® G3520C gas IC engine test data.

2.2.2 *Electricity Generators*

Each CAT® G3520C gas IC engine will be connected to a 1,600 kW electricity generator.

The proposed facility (six CAT® G3520C gas IC engines) will have a total electricity generation capacity of 9,600 kW (9.6 MW).

2.2.3 *IC Engine Exhaust Configuration*

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

The fuel combustion system exhausts and noise mufflers will be located on the roof of the single building that house the engines.

Table 2 presents exhaust design and operating parameters for the CAT® Model G3520C gas IC engine.

2.3 LFG Fuel Requirement / Availability

The operation of the six (6) CAT® G3520C gas IC engines under based load conditions (100% of capacity) and with fuel that has a minimum LHV of 420 Btu/scf (HHV of 467 Btu/scf) will result in maximum LFG fuel utilization rates of approximately 3,480 scfm and 5.01 million standard cubic feet per day (MMscf/day).

Approximately 2,200 scfm of LFG is currently being controlled by the Central Disposal Facility flaring system, which has a LHV of approximately 397 Btu/scf that is expected to be at least 450 Btu/scf at the time full fuel demand is required by the proposed engines. This gas extraction (control) rate is adequate to fuel (58.3 MMBtu/hr HHV) and power three (3) of the IC engine generators (48.8 MMBtu/hr HHV) proposed for installation at Brevard Energy. New gas extraction wells are being installed and increased fuel quality is expected to be exist at the Central Disposal Facility al levels that will support the operation of all six (6) IC engine generators at the time the Brevard Energy electricity generation processes are commenced.

Supplying methane-rich gas to generate electricity will be the primary means of controlling and utilizing the LFG being generated at the Central Disposal Facility, which would otherwise be flared. Therefore, it is anticipated that the extent of future LFG flaring operations will be minimized as a result of the proposed IC engine operations and its fuel use requirement.

The existing LFG flaring system will be periodically operated during periods of equipment downtime and maintenance, and continually operated when future LFG collection and extraction rates (from new waste placement) exceed the fuel supply requirement of the installed and operated engines.

2.4 Ancillary Equipment

Each of the proposed IC engines will be equipped with a stand-alone fan-cooled radiator.

Engine coolant for the radiators will be stored on-site in drum quantities.

Engine lube oil (new and used) will be stored in separate above ground holding tanks positioned on the premises of the proposed LFG fueled IC engine electricity generation facility. The new lube oil storage tank will have a capacity of approximately 2,000-gallons. The waste oil storage tank will have a capacity of approximately 1,000-gallons.

3.0 <u>LANDFILL FACILITY</u>

The Central Disposal Facility is:

1. Owned by Brevard County;

2. Operated by Brevard County; and

3. Located at 2250 Adamson Road in Cocoa, Brevard County.

3.1 Gas Collection / Control System

Methane-rich LFG produced from the decomposition of disposed waste materials at both active and capped cells is being collected by a reliable 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. Landfill gas that is not currently being used for its energy value is directed to three (3) open candlestick flares where methane, NMOC and HAPs contained in the gas are destroyed at high temperatures. Approximately 3.2 MMscf/day (2,200 scfm) of LFG is currently being directed to the flaring system for control.

3.2 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. Therefore, in order to reduce the existing LFG control operations performed by its flare, which waste this renewable energy resource, all available LFG from the Central Disposal Facility will be supplied to Brevard Energy for use as fuel to power the proposed IC engine electricity generation facility.

3.3 Title V Air Operation Permit

The FDEP-DARM Central District issued the Brevard County Solid Waste Management (Board of County Commissioners) Central Disposal Facility (Facility ID No.: 0090069) Title V Air Operation Permit Renewal, Final Permit No.: 0090069-002-AV.

The FDEP-DARM issued a revised Title V Operating Permit (Final Permit No.: 0090069-003-AV) to Brevard County on December 9, 2004 that allows for the operation of an additional candlestick flare and blower to provide redundancy for the LFG control system that has been expanded.

Final Permit No.: 0090069-003-AV has an expiration date of September 30, 2007.

4.0 AIR POLLUTANT EMISSIONS

The proposed IC engine electricity generation facility will be 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.

Table 3 presents a summary of the CAT® G3520C gas IC engine potential criteria air pollutant emissions (NO_X, CO, SO_2, VOC, PM_{10}) and HAP emissions [as specified in 62-210.200 Definitions (129) "Hazardous Air Pollutants (HAP)", F.A.C.].

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

4.1 Criteria Air Pollutants

The amounts of NO_X, CO and total VOC that are emitted by the CAT® G3520C gas IC engine are dependent on fuel quality 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 6.0 (Emission Control Analyses) of this document, the CAT® G3520C gas IC engine will have the following maximum NO_X, CO, VOC and PM_{10} emission rates:

- 2.75 grams of CO per brake-horsepower hour (g/bhp-hr);
- 0.60 g/bhp-hr NO_X;
- 0.28 g/bhp-hr of total VOC; and
- 0.24 g/bhp-hr for PM_{10}.

The 2.75 g/bhp-hr CO value specified for the CAT® G3520C gas IC engine emissions is based on the results of Best Available Control Technology (BACT) analyses (Section 6.8.1 CO BACT of this document).

The 0.60 g/bhp-hr NO_X value specified for the CAT® G3520C gas IC engine emissions is based on the results of BACT analyses (Section 6.8.2 NO_X BACT of this document).

The 0.28 g/bhp-hr total VOC value specified for the CAT® G3520C gas IC engine emissions is based on a voluntary limitation that is 90% of the 40 ton per year (TpY) significant emission threshold presented in *62-212.400 Prevention of Significant Deterioration (PSD).*, F.A.C. The CAT® G3520C gas IC engine is designed to produce low NO_X emissions. These lower emissions are produced in part based on the high carbon dioxide content of LFG fuels that results in cooler combustion temperatures, which influence VOC destruction and control efficiencies. Experience with compliance demonstrations performed on low emission LFG fueled IC engines by Landfill Energy

Systems indicates that the 0.28 g/bhp-hr total VOC emission rate is readily achievable and that flexibility in establishing an allowable limit is required to ensure ongoing compliance over all engine fuel quality and mechanical operating conditions.

The 0.24 g/bhp-hr PM_{10} value specified for the CAT® G3520C gas IC engine emissions is based on the results of BACT analyses (Section 6.9 PM_{10} BACT of this document).

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:

- 13.54 pounds per hour (lb/hr) and 59.30 TpY of CO (one engine);
  81.24 lb/hr and 355.8 TpY of CO (six engines);

- 2.95 lb/hr and 12.94 TpY of NO_X (one engine);
  17.72 lb/hr and 77.6 TpY of NO_X (six engines);

- 1.37 lb/hr and 5.99 TpY of total VOC (one engine);
  8.22 lb/hr and 36.0 TpY of total VOC (six engines);

- 1.18 lb/hr and 5.17 TpY of PM_{10} (one engine); and
  7.08 lb/hr and 31.0 TpY of PM_{10} (six engines).

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).

Site-specific sulfur content analyses have not been performed on the LFG generated by the Central Disposal Facility. Therefore, data developed by USEPA (which are presented in *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, AP-42, Section 2.4, Municipal Solid Waste Landfills) were use to estimate the total potential sulfur content of the LFG to be used as IC engine fuel. The AP-42 data specify a hydrogen sulfide (H_2S) default LFG concentration of 35.5 parts per million by volume (ppmv). However, the experience of Derenzo and Associates obtained from a review of tests performed on LFG samples collected from numerous landfills indicates that H_2S is typically observed at concentrations greater than 35.5 ppmv but less than 150 ppmv. Therefore, the AP-42 H_2S default LFG concentration of 35.5 ppmv was replaced with the 150 ppmv value. The results of this analysis indicate that the total sulfur content of the LFG to be used as IC engine fuel is estimated to be less than 164.2 ppmv as H_2S.

The LFG sulfur content of 164.2 ppmv as H_2S is equivalent to a SO_X (as SO_2) emission rate of 27.5 pounds per million cubic feet (lb/MMscf) of fuel based on the complete oxidation of the fuel-bound sulfur compounds during the combustion process.

Appendix H-1 provides calculations for the CAT® G3520C gas IC engine potential SO_2 emissions.

The operation of CAT® G3520C gas IC engines at the specified SO_2 pollutant emission rate under base load conditions (100% design capacity) will result in maximum potential emissions of:

- 0.96 lb/hr and 4.22 TpY of SO_2 (one engine); and
  5.76 lb/hr and 25.32 TpY of SO_2 (six engines).

4.2 Hazardous Air Pollutants

Hazardous Air Pollutants [as specified in 62-210.200 Definitions (129) "Hazardous Air Pollutants (HAP)", F.A.C.] have the potential to be produced during the combustion of LFG to be used as fuel by the IC engines since:

1. HAP compounds are present in the gas generated by the Central Disposal Facility and the fuel combustion process is not 100% complete (i.e., a small portion of the HAPs pass through the fuel combustion system).

2. Chlorinated compounds that are present in LFG have the potential to form hydrogen chloride (HCl, a regulated HAP) when they are combusted.

Site-specific HAP content analyses have not been performed on the LFG generated by the Central Disposal Facility. Therefore, data developed by USEPA (which are presented in *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, AP-42, Section 2.4, Municipal Solid Waste Landfills) were use to estimate the total potential HAP content of the LFG to be used as IC engine fuel.

Table 2.4-3 of AP-42 provides *Control Efficiencies for LFG Constituents* that specifies IC engines typically reduce (control) halogenated species by 93 percent and non-halogenated species by 86.1 percent. These LFG constituent control efficiencies were considered in the HAP potential emission determinations that were performed for the IC engine operations.

The contribution of HCl to the HAP potential emissions of the IC engines was estimated based on a conversion of the individual chlorinated compound measurements presented in the AP-42 default list of LFG constituents to HCl as a result of the high temperature combustion environment and exhaust processes. The results of this analysis indicate that the HCl exhaust rate of the proposed IC engines (as function of LFG fuel utilization) is 11.95 lb/MMscf, which is equivalent to an annual potential emission of 10.9 TpY under base load conditions (100% design capacity). It is the perspective of Brevard Energy (based on emission testing performed by Landfill Energy Systems on similar LFG fueled engines) that the AP-42 default LFG constituent concentrations overestimate the potential HCl content of the gas generated at the Central Disposal Facility. Therefore, Brevard Energy will restrict the allowed HCl emissions from the proposed engine operations to less than 10 TpY through appropriate permit limits.

The HAP exhaust rate of the proposed IC engines (as function of LFG fuel utilization) is 13.81 lb/MMscf. The operation of six (6) CAT® G3520C gas IC engines under base load conditions (100% design capacity) will result in maximum potential HAP emissions that are less than 12.6 TpY.

Appendix H-2 provides calculations for the CAT® G3520C gas IC engine potential HCl and HAPs emissions.

5.0 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 proposed by Brevard Energy.

5.1 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 proposed 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 Air Construction Permit.

(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.

Landfill Energy Systems check no. 16828 for $7,500 (made payable to the Florida Department of Environmental Protection) has been attached to the original set of permit application forms provided in Appendix A.

5.2 Facility

62-204.200 Definitions., F.A.C., specifies that:

(16) "Facility" means ... *All of the emission units which are located on one ore 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 will be located on leased land at the Central Disposal Facility, the electricity generation equipment and processes will be owned and operated by Brevard Energy and not under the control of Brevard County, which owns and operates the landfill (i.e., the Brevard Energy electricity generation facility and Central Disposal Facility will be separate).

Brevard Energy will be fueled exclusively with methane-rich gas generated by the Central Disposal Facility (i.e., no natural gas capabilities). Since all of the fuel utilized by Brevard Energy will be supplied by the Central Disposal Facility, the landfill has an implied control over the electricity generation operations of the proposed 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 Central Disposal Facility stationary source and its approved Air Construction Permit is required to be incorporated into the landfill Title V Operating Permit.

5.3 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).
(a) All of the state except those areas designated as nonattainment under paragraph 62-204.340(2)(a), F.A.C., is designated as attainment for the air pollutant ozone.

62-204.340(2)(a), F.A.C, does not list any ozone nonattainment 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.

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

62-204.340(2)(c), F.A.C, does not list any sulfur dioxide 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.

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

62-204.340(2)(e), F.A.C, does not list any nitrogen dioxide nonattainment areas.

(3) Designation of Areas Which Cannot Be Classified as Attainment or Nonattainment (Unclassified Areas).
(a) All of the state except those areas designated as nonattainment under paragraph 62-204.340(2)(b), F.A.C., is designated as unclassifiable for the air pollutant PM_{10}.
(b) The following areas are designated as unclassifiable for the air pollutant sulfur dioxide.

Brevard County is not designated as unclassifiable for the air pollutant sulfur dioxide.

(4) Designation of Air Quality Maintenance Areas.
(a) Each of the following areas is designated as an air quality maintenance area for the air pollutant ozone: ...

> Brevard County is not designated as an air quality maintenance area for the air pollutant ozone.

5.4 Prevention of Significant Deterioration Area Designations

62-204.360 Designation of Prevention of Significant Deterioration Area., F.A.C, specifies that:
(1) The following areas are designated as PSD areas for the air pollutant particulate matter:
(a) All of the state ...

(2) The following areas are designated as PSD areas for the air pollutant sulfur dioxide:
(a) All of the state ...

(3) The following areas are designated as PSD areas for the air pollutant nitrogen dioxide:
(a) All of the state ...

(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.

5.5 Adopted Federal Regulations

62-204.800 Federal Regulations Adopted by Reference., F.A.C., lists the following federal regulations that are applicable to the proposed project through its use of 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 ...

Section 7.1 (MSW Landfill NSPS) of this document provides details that indicate the proposed LFG fueled IC engine electricity generation facility will operate in compliance with 40 CFR 60, Subpart WWW requirements.

(11) ... National Emission Standards for Hazardous Air Pollutants ...
(b) ...58. 40 CFR 63, Subpart AAAA, Municipal Solid Waste Landfills ...

Section 7.2.2 (MSW Landfill NESHAP) of this document provides information that indicates the proposed LFG fueled IC engine electricity generation facility will operate in compliance with 40 CFR 63, Subpart AAAA requirements.

80. 40 CFR 63, Subpart ZZZZ, Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

Section 7.2.1 (RICE NESHAP) of this document provides information that indicates the proposed LFG fueled IC engine electricity generation facility will operate in compliance with 40 CFR 63, Subpart ZZZZ requirements.

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

Section 7.3 (Federal Acid Rain Program) of this document provides information that indicates the proposed LFG fueled IC engine electricity generation facility will operate in compliance with 40 CFR 72, Subpart A - I requirements.

5.6 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.

5.7 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 ...

Section 4.1 (Criteria Air Pollutants) of this document and Table 3 present information that indicate the proposed LFG fueled IC engine electricity generation facility is a major source of CO under state and federal PSD regulations. Therefore, results of a public comment period are required to be considered in the permit approval process.

5.8 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 will be housed in a single building with dimensions of 62.67 feet wide by 108.67 feet long by 15 feet high (information from Section 2.0 Proposed Electricity Generation Facility and Table 2 of this document). Therefore, good engineering practice stack height for the proposed emission units is 37.5 feet (i.e., the building height plus 1.5 times the lesser dimension of building height or width). The above ground height of the proposed IC engine exhaust stacks is designed for 20 feet (information from Table 2), which is 17.5 feet less than the specified good engineering practice stack height.

5.9 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 Brevard Energy LFG fueled IC engine electricity generation facility.

5.10 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 4.1 (Criteria Air Pollutants) of this document and Table 3 present information that indicate the proposed LFG fueled IC engine electricity generation facility is subject to federal PSD permitting requirements (its potential CO emissions are equal to or greater than 250 tons per year).

(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:

> 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.

> Section 4.1 (Criteria Air Pollutants) of this document and Table 3 present information that indicates the NO_X and PM_{10} emission rates from the proposed LFG fueled IC engine electricity generation facility are significant (i.e., its potential NO_X emissions are equal to or greater than 40 tons per year and PM_{10} emissions are equal to or greater than 15 tons per year).

(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)

Section 8.1 (Visibility Degradation) of this document presents information that indicates that no Class I areas are located within 100 kilometers of the site of the proposed LFG fueled IC engine electricity generation facility.

(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 5.10 (Prevention of Significant Deterioration) of this document provides information that indicates the proposed LFG fueled IC engine electricity generation facility is required to apply CO, NO_X and PM_{10} BACT (i.e., the proposed project is a major PSD source for CO and has NO_X and PM_{10} significant emission rates).

Section 6.0 (Emission Control Analyses) of this document provides CO, NO_X and PM_{10} BACT analyses.

(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 I provides Ambient Impact Analyses for the proposed LFG fueled IC engine electricity generation facility. These analyses will be submittal to the FDEP-

DARM as a separate document.

(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 ...

Section 8.0 (Additional Impact Analyses) of this document provides additional impact analyses (impairment to soils, vegetation; and air quality impact projected for the area) for the proposed LFG fueled IC engine electricity generation facility.

Cocoa, Florida is located over 100 kilometers from the:

1. Everglades National Park.
2. Chassahowitzka Wilderness Area.
3. St. Marks National Wilderness Area.
4. Bradwell Bay National Wilderness Area.
5. Okefenokee National Wilderness Area.
6. Wolf Island National Wilderness Area.

Therefore, Federal Class I visibility impact analyses are not required to be performed for the proposed LFG fueled IC engine electricity generation facility.

(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 8.0 (Additional Impact Analyses) of this document provides the Permit Application Information Required for the proposed LFG fueled IC engine electricity generation facility.

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

(a) BACT Determination ...

Section 6.0 (Emission Control Analyses) of this document provides CO, NO_X 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.

5.11 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.

Based on the:

1. Small magnitudes of the IC engine exhaust chemical concentrations compared to published odor thresholds (i.e., LFG combustion is an approved procedure for the control of landfill gas);

2. Additional dilution of the relatively small emitted chemical concentrations prior to ground-level ambient air impacts;

3. Relatively large distances between the proposed emission equipment and impact receptors; and

4. Experience of Brevard Energy with the operation of numerous LFG fueled IC

engine electricity generation facilities (i.e., no adverse odor impact have ever been recorded as a results of these engine operations);

impacts of odorous emissions from the combustion of LFG fuel in the proposed CAT® G3520C gas IC engines will be insignificant (i.e., no odor impacts).

(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).

Experience obtained by manufacturers and operators of LFG fueled IC engines indicates that visible emissions from the CAT® G3520C gas IC engines will be insignificant (emissions are not expected to be visible during normal engine operations).

(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.

Brevard Energy will take appropriate precautions to prevent unconfined emissions of particulate emissions during the construction and operating activities of the proposed LFG fueled electricity generation facility.

5.12 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 will:

1. Install sampling ports on each engine exhaust stack that have a minimum inside diameter of three (3) inches and can be sealed when they are not in use.

2. Install sampling ports in each engine exhaust stack that are two (2) stack diameters (36 inches) downstream and at least 0.5 stack diameters (9 inches) upstream from any flow disturbance.

3. Install two sampling ports in each engine exhaust stack (each port 90 degrees apart).

4. Utilize the roof as the work platform for the engine exhaust stack compliance tests. The engine exhausts are located on the roof of the building approximately 10 to 15 feet from its eastern edge. A ladder will be used to access the sampling ports, which will be located approximately six feet above the roof work platform.

5. Provide access to the building roof with a ladder that will be stored at the facility.

6. Provide four (4) 120-volt AC, 20 amp outlets to supply power to the sampling equipment. An adequate number of extension cords, which are required to transfer electricity from the supply outlets to the sampling, will be stored at the facility.

(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...

Section 4.1 (Criteria Air Pollutants) of this document and Table 3 present information that indicate the annual CO emission compliance test are required to be performed on the LFG fueled IC engines.

5.13 Operation and Maintenance Plan

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

Appendix J provides the Operation and Maintenance Plant developed for the CAT® G3520C gas IC engine.

6.0 EMISSION CONTROL ANALYSES

The following text provides analyses of process design, operating practices and best available emission control devices (applicable Best Available Control Technology, BACT) that were considered in determining the appropriate pollution control strategies for the proposed LFG fueled IC engine electricity generation facility.

6.1 LFG Treatment

Standards of Performance for MSW Landfills (MSW Landfill NSPS, 40 CFR Part 60 Subpart WWW) regulate NMOC 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 ...

The equipment and processes proposed for use by Brevard Energy to treat (dewater, filter and compress) LFG received from the Central Disposal Facility (prior to its combustion as fuel in the proposed IC engines) meets the control system criteria of the MSW landfill NSPS.

Appendix K provides *Clarifications of Landfill Gas Treatment NSPS Exemption for Dixon/Lee Energy Partners* ... and other determinations that have been issued by USEPA (Regions 1, 3, 5 and 9) on the treatment of LFG. These documents specify that *U.S. EPA has made several determinations and has stated in the Federal Register Proposed Rule Amendments dated May 23, 2002, that compression, de-watering, and filtering the landfill* *gas down to at least 10 microns is considered treatment for the purposes of 60.752 (b) (2) (iii) (C).*

Therefore, BACT for the LFG used to fuel the proposed IC engine electricity generation facility is treatment with the equipment and processes presented in Section 2.1.3 (Treatment) of this document.

6.2 Engine Selection

The size (operating capacity) of the equipment and processes selected for the proposed electricity generation facility are dependent on the gas generation and recovery potential of the landfill (i.e., size of the landfill, amount of in-place and future wastes, fuel quality of the recovered gas and estimates of LFG generation over time).

Approximately 2,200 scfm of LFG is currently being controlled in the Central Disposal Facility flares. Additional LFG is expected to be available at the commencement of operations to fuel and power the six (6) IC engine generators proposed for installation by Brevard Energy. Therefore, with the issuance of a permit by the FDEP-DARM activities will commence to place all six (6) of the IC engine generators in operation (i.e., it is expected that adequate amounts of LFG fuel will be available to support the operation of all of the proposed engine generators and the project will not require the staged installed of equipment). While additional future amounts of LFG may be generated by the Central Disposal Facility after the proposed electricity generation processes are made operational, there are currently no plans by Brevard Energy for the subsequent installation of additional IC engine-generator sets.

The methane rich gas generated at the landfill is most efficiently utilized when the power generation equipment selected for the project best fits the gas generation curve. Therefore, since the quantity of available gas from the landfill may be rising (or falling) depending on its gas generation potential (i.e., the amount of in-place wastes and planned future waste placement activities), the gas is best utilized as a fuel by multiple individual power generation units that fit the gas generation curve (i.e., smaller engines that provide operating flexibility in response to gas collection rate changes and maintenance downtime). The operation of large engines does not allow for the best utilization of available fuel since:

1. A larger quantity of LFG is wasted during individual unit maintenance downtimes;

2. Periods of reduced LFG generation (e.g., associated with wellfield maintenance and construction) may have the potential to render a significant portion of the electricity generation facility inoperable; and

3. The increased fuel requirements of a larger engine provide a less appropriate fit to the gas generation curve under base load operations.

Gas turbine engines have been successfully operated on LFG. Commercially available gas turbine engines require LFG flow rates that are at least 1,800 scfm. However, similar to larger IC engines, they do not best utilize available LFG and fit the gas generation curve of the Central Disposal Facility.

Microturbines (that have electricity generation ratings between 30 and 150 kW) have been fired with LFG fuel and require extensive gas treatment to remove fuel impurities. Microturbines are primarily used for backup or emergency power in applications that have relatively low electricity demands or to power auxiliary equipment (e.g., to power a compressor that is part of a larger facility). Based on microturbine specifications (i.e., the relatively low fuel flow capacity) that are currently available from manufacturers, the use of this equipment to utilized up to 3,480 scfm of LFG and generate 9.6 MW of electricity is not feasible.

Equipment manufacturers have developed high-pressure reciprocating IC engines that produce ultra low CO and NO_X emission rates, which have been achieved with the use of a precombustion chamber that mixes and preheats the LFG fuel and combustion air. However, as a result of the expense and complexities that are associated with the fabrication of these engines and their replacement components, manufacturers only offer this technology on larger engines. The CAT® Model G3616 high-pressure gas IC engine, for example, is equipped with a precombustion chamber and produces CO and NO_X emissions that are below 2.7 and 0.55 g/bhp-hr, respectively. However, the CAT® G3616 gas IC engine has a 4,230 bhp rating and heat input capacity of 32.8 MMBtu/hr that corresponds to a fuel use rate of approximately 1,300 scfm, which based on the preceding information does not best utilize the available LFG and fit the gas generation curve of the landfill.

Based on the preceding information, six (6) CAT® G3520C gas IC engines have been selected to power electricity generators for the proposed project. The combined operation of these engines has a fuel demand that closely fits the existing LFG generation curve of the landfill (i.e., the installation and operation of 6 engines results in a maximum LFG utilization rate of approximately 3,480 scfm, which is based on a LHV fuel of 420 Btu/scf, which is expected to compare well with LFG fuel availability at the commencement of the proposed electricity generation operations).

The CAT® G3520C gas IC engine is a relatively new engine that is capable of achieving low NO_X emissions in applications where LFG flowrates and/or fuel heat values are not large enough to support ultra-low NO_X engines (those equipped with a precombustion chamber).

6.3 Add-on Emission Controls (General)

The California Air Resource Board (CARB) has developed and published *Guidance for the Permitting of Electrical Generation Technologies*, July 2002 to assist companies and organizations in the permitting of electrical generation equipment. This CARB guidance document:

- Recognizes the benefits of generating electricity from waste gases (landfill and digester gas) and provides BACT determinations for reciprocating IC engines fueled with these materials.

- Indicates that waste gases "contain impurities that, if combusted will likely poison catalyst-based post combustion control systems."

- Determines that additional fuel treatment and post combustion controls have limited success and/or have not been proven to be cost effective in reducing air pollutant emissions from waste gas combustion applications.

Other state regulatory agencies have made similar determinations with the issuance of permits that specify BACT for LFG fueled IC engines that do not include the use of add-on emission controls.

6.4 Add-on Emission Controls (Caterpillar, Inc. Recommendation)

Appendix L provides a 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. The *Catalyst Operation With Landfill Gas or Digester Gas* section of this document specifies that:

Several attempts have been made to control exhaust emissions of reciprocating engines operating on landfill gas or digester gas with an exhaust gas catalyst. Landfill gas 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.

6.5 Documented BACT / LAER Determinations

Independent research was performed for the proposed LFG fueled IC engine electricity generation facility and 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 rely on catalyst-based systems that are subject to fouling when used to control emissions from LFG combustion applications.

The USEPA Office of Air Quality Planning and Standards RACT / BACT / LAER Clearinghouse (RBLC) emission and control technology determination data indicate that no add-on emission controls have been established as BACT or LAER for LFG fueled IC engines.

Appendix M provides USEPA RBLC CO, NO_X and particulate BACT/LAER data and supporting information for LFG fueled IC engine operations. The specified data search, which reviewed information in the USEPA RBLC through May 24, 2006, has identified 21 associated determinations.

The State of Texas issued PSD permit (PSD-TX-1034) to Bio Energy Texas, LLC on July 23, 2004 for the installation of eight (8) LFG fueled IC engines. However, the PSD BACT determinations for this source have not been incorporated into USEPA RBLC. Appendix M-1 provides the maximum allowable emissions that were permitted for this source (i.e., 2.8 g/bhp-hr for CO, 0.6 g/bhp-hr for NO_X, 0.148 g/bhp-hr PM_{10}).

The State of New Jersey has completed its review of an ozone (NO_X) nonattainment area new source review (NSR) and CO PSD permit (Permit Activity No. PCP050001; Facility ID No. 79083), which will be issued to Ocean Energy Corp., Inc. (a Landfill Energy Systems company) for the installation of six (6) LFG fueled IC engines. Appendix M-2 provides the maximum allowable emissions contained in a draft permit released by the NJDEP on January 20, 2006 for this source (i.e., 2.75 g/bhp-hr for CO, 0.6 g/bhp-hr for NO_X, 0.24 g/bhp-hr PM_{10}).

Table M-1 of Appendix M provides a summary of the USEPA RBLC CO, NO_X and particulate matter (as PM_{10}) BACT/LAER data for LFG fueled IC engine operations. The Bio Energy Texas PSD BACT and Ocean Energy Corp. BACT/LAER determinations are also listed in the Table M-1 summary.

CAT® G3520C gas IC engines (the same engines as those proposed for use by Brevard Energy):

1. Have been installed and are operating at Ridgewood Power Management (final

permit issued in approximately early 2005);

2. Have been installed and are operating at New England Waste Services (final air permit issued in approximately late 2004);

3. Have been installed and are operating at Bio Energy Texas (final air permit issued in July 2004); and

4. Are planned for installed at Ocean Energy Corp with final permit issuance estimated in the second half of 2006.

6.6 Emission Control System Contacts

Mr. Ed Wheless of the Sanitation Districts of Los Angeles County (SDLAC) was contacted in January 2006 to obtain information on the successful implementation of emission controls on equipment that utilize LFG fuel. Mr. Wheless informed Derenzo and Associates, Inc. that:

1. The paper on *Siloxanes in Landfill and Digester Gas* (published by Ed Wheless and Dan Gary in 2002) provides a summary of attempts that have been made to control emissions from the combustion of LFG (through 2002). At the time this paper was published, Mr. Wheless was not aware of results from the installation of Applied Filter Technology (AFT) systems at the Bergen County Utilities to treat (clean) digester gas prior to its use as IC engine fuel and the subsequent effects on oxidation catalysts that are operated on the equipment. Mr. Wheless noted the Bergen County Utilities Authority improvements in his paper, however, the authority had not completed the work in 2002.

   The Bergen County Utilities Authority (Bergen County, New Jersey) operates a sewerage sludge treatment system where methane-rich gas generated by anaerobic digesters ($\geq$60% methane) is used as fuel to power two CAT® 3608 gas IC engines. The engines were permitted with oxidation catalysts to control the amount of CO emitted from the equipment. Representatives of the authority (Mr. Eric Abrahamsen, 208-807-8665) were contacted in March 2005 to obtain details on the equipment and its operations, which is summarized in the following text:

   a) The IC engines, oxidation catalyst emission controls and gas treatment equipment were placed in operation in 1996.

   b) Within a relatively short period of time (approximately 2 months) of the initial start of operations, the engine exhaust oxidation catalysts failed.

c) Subsequent oxidation catalyst replacements malfunctioned on less than 500 engine-operating hours.

d) The engine operations were stopped for a one-year period while the problem was evaluated and to address conflicts between equipment suppliers and the authority over warrantee issues and performance guarantees.

e) The results of the equipment operation evaluation indicated that siloxane compounds in the digester gas fuel poisoned/fouled the oxidation catalysts.

f) Upon the restarted of the engine operations with improvements to the system, problems with the proper and continued operation of the oxidation catalysts continued.

g) In approximately 2002, the authority installed an AFT gas treatment system.

h) While the AFT gas treatment system has improved the quality of the digester gas used to fuel the IC engines (i.e., lessen engine maintenance requirements and reduced the influence of siloxane impacts), the oxidation catalyst controls continue to be poisoned and malfunction (i.e., approximately four catalyst replacements on each engine have been required in the 2.5 year period since the AFT gas treatment system was made operational).

   The authority pays approximately $9,000 for each replacement oxidation catalyst (i.e., the installation of the equipment is performed by the authority).

   While the Bergen County Utilities Authority does not use the identical equipment or type of fuel as that proposed by Brevard Energy, the similarities in the processes and its operations are useful in evaluating the technical feasibility of using oxidation catalyst emission controls with fuels that contain impurities (i.e., contaminants that are known to influence catalyst operations).

2. While companies (AFT, Jenbacher, Dominic Hunter) are attempting to develop systems to remove LFG impurities prior to its combustion as fuel and pilot studies have been completed or are in progress, he is not aware of any projects (i.e., the treatment of LFG prior to use and/or emission reductions on LFG combustion devices) that have successfully demonstrated cost effective emission controls for the utilization of LFG fuel.

3. Measurements performed by the SDLAC indicate that the concentration of siloxanes in LFG (within the facilities operated by the SDLAC) have increased by a factor of 10

within the last three - four year period. Similar increases have been reported by LFG end users in Europe. The higher LFG siloxane contents appear to be from increased use of silicon based materials in recent years, which get disposed in landfill, and reductions in (and bans on) detergent phosphates contents.

6.6.1 Siloxanes

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 increase wear on moving parts and poison catalyst-based post combustion control systems. Therefore, vendors and suppliers are not willing to guarantee the performance of the specified types of add-on equipment when it is used in applications to control emissions for LFG combustion projects.

Measurements performed by Derenzo and Associates, Inc. (for numerous measurement events at three separate facilities) indicate that the average total siloxane concentration in LFG is approximately 12 ppm (as elemental Si).

Since there is no industry standard, the accuracy of the measurements and how well the reported siloxane concentrations represent actual LFG conditions is based on the procedures that are utilized to collect the sample (whole gas by Tedlar bag or metal canister, methanol solution, charcoal) and the laboratory analysis used to measure the compounds (i.e., GC/MS, GC/AED and whether the whole air samples are heated prior to analysis).

6.6.2 LFG Treatment

AFT has developed a Segmented Filter Technology that uses a form of polymorphous graphite sieving to remove siloxanes and other compounds that are present in LFG.

Jenbacher has developed a system that uses carbon to remove siloxanes and other compounds that are present in LFG.

Dominic Hunter has developed a system that uses alumina silicate to remove siloxanes and other compounds that are present in LFG.

These systems and technologies:

1. Can require that the LFG be pressurized then chilled to remove moisture;

2. Have been used to clean sewerage digester gasses; and

3. Have been used to clean LFG fuel for use in microturbine operations.

However, no data have been reported that indicate the systems and technologies have been successfully implemented to clean LFG fuel for use in IC engine operations to a level where add on controls are not rendered inoperative by the residual siloxane and other material compounds that remain after treatment.

In addition, site-specific analyses can indicate that other chemical components within the LFG have the potential to interfere with the removal of some siloxane species by the media being used.

While the specified LFG treatment systems and technologies are expected to improve gas quality (remove components of the LFG that have negative impacts on IC engine operations), the equipment will not improve gas quality to a level that would ensure the proper continued operation of add-on oxidation catalyst emission controls (i.e., siloxanes and other materials will still be present in the LFG used to fuel the IC engines at levels that influence/poison/foul the oxidation catalyst).

Oxidation catalyst operations are also influenced by the presence of compounds that contain chlorides, fluorides, sulfur and other materials, which are present in LFG and not specifically addressed in LFG treatment systems.

6.7 Add-on Emission Controls

Non-Selective Catalytic Reduction (NSCR) uses a three-way catalyst to remove NO_X and CO from IC engine exhausts.

Selective Catalytic Reduction (SCR) uses the injection of a solution (urea or ammonia) into the engine exhaust to react with its NO_X content. The combustion exhaust gases produced by the engine are subsequently passed through a catalyst in order to achieve NO_X reductions.

Oxidation Catalysts use energy in the presence of an appropriately selected metal catalyst to transform CO into carbon dioxide (i.e., the combustion exhaust gases produced by the engine are passed through a catalyst in order to complete the oxidation of CO to carbon dioxide).

Catch and burn technologies typically use structured catalysts (a monolithic catalyst with bored chambers) that oxidate unburned hydrocarbons and aerosols (condensable particulates) as the exhaust gas diffuses through the wall of the catalyst chambers.

All of the previously specified technologies require the use of a fuel that does not have the potential to affect the operation of the catalyst (i.e., one that does not have siloxanes and significant amounts of other chemical impurities).

6.8 CO / NO_X BACT

In general, NO_X and CO emissions that result from fuel combustion are inversely related. Increased excess air supply and combustion cylinder temperatures typically result in a more complete fuel combustion process that limits the formation of CO. However, the presence of excess oxygen in high-temperature environments results in the formation of increased amounts of thermally derived NO_X. Therefore, as a result of this relationship:

1. NO_X and CO emission reductions from combustion technology adjustments cannot be performed independently on each pollutant; and

2. The control of NO_X and CO emissions from the IC engine operations have been collectively considered in the required BACT analysis.

6.8.1 <u>CO BACT</u>

Data in the USEPA RBLC (and that specified for Bio Energy Texas and Ocean Energy Corp.) were reviewed to identify control technology determinations issued by regulatory agencies for the operation of IC engines on LFG fuel. The results of this review indicate that BACT for CO emissions from IC engines with power ratings greater than 2,000 and less than 4,000 bhp range from 2.75 to 3.0 g/bhp-hr (the CAT® G3520C gas IC engine has a power rating of 2,233 hp). The corresponding NO_X LAER values range from approximately 0.5 to 0.6 g/bhp-hr. The USEPA RBLC database presents CO BACT determinations for LFG fueled IC engines that are as low as 2.3 g/bhp-hr. However, these CO BACT determinations generally correspond to NO_X emission rates that exceed 1.0 g/bhp-hr. The specified USEPA RBLC NO_X LAER and CO BACT determinations are applicable to the operation of lean burn engines with air to fuel ratio control or simply specified as 'clean burn engine'.

Appendix M provides USEPA RBLC CO BACT, and other appropriate BACT/LAER determination data and supporting information for LFG fueled IC engine operations.

Due to the presence of siloxanes (and other chemicals) in the LFG fuel (as presented in Section 6.7 Add-on Emission Controls of this document), the utilization of NSCR and oxidation catalysts to control CO in the exhaust of LFG fueled IC engines is not feasible.

Technical data issued by Caterpillar, Inc. for the CAT® G3520C IC engine specifies that

CO emissions for the first 100 hours of operations will be equal to or less than 2.5 g/bhp-hr and maximum CO emissions will not exceed 4.2 g/bhp-hr. (Appendix F engine performance specifications). Research performed by Caterpillar, Inc. and operational experience obtained by users of the equipment indicates that CO emissions for LFG fueled IC engines tend to increase with time (between manufacturer scheduled major engine maintenance activities). Increasing CO emissions occur as a result of the combustion of siloxanes that exist in the LFG used to fuel the engines. The combustion of LFG siloxanes produces particulate silica that acts as an abrasive material and increases normal wear on the moving components of the engine. With increasing engine operating hours, increasing amounts of silica deposits are typically found:

1. On the fixed and moving parts in the engine combustion cylinder; and

2. In the lubricating oil reservoir (crankcase).

The specified increased engine wear affects the combustion process resulting in a gradual increase in CO emissions over the number of operating hours. Engine operation and maintenance practices have been developed to minimize the effect of fuel quality influences on air pollutant emission rates. However, varying levels of CO emissions from the LFG fueled CAT® G3520C IC engines are expected to exist from the time they are initially placed in operation and between scheduled maintenance periods (i.e., lower CO emissions will exist at the initial startup of the engine operations and after major scheduled maintenance events).

Based on the preceding information, BACT for the proposed IC engines is the use of air to fuel ratio control technology (which has equipment specific and site specific fuel quality influences) that minimizes the amount of NO_X emissions (which influences the associated CO levels) produced during the LFG combustion process and results in maximum emissions of 2.75 g/bhp-hr. CO.

Based on the low NO_X emission technology that is used by the equipment and potentials for increased engine wear that result from fuel quality influences, CO emission limits that are higher than the first 100 hour limit of 2.5 g/bhp-hr limit guaranteed by the Caterpillar, Inc. are required to maintain ongoing compliance.

6.8.2 NOx BACT

Data in the USEPA RBLC (and that specified for Bio Energy Texas and Ocean Energy Corp.) were reviewed to identify control technology determinations issued by regulatory agencies for the operation of IC engines on LFG fuel. The results of this review indicate that LAER for NO_X emissions from IC engines with power ratings greater than 2,000 and less than 4,000 bhp range from 0.5 to 0.6 g/bhp-hr (the CAT® G3520C gas IC engine has a power rating of 2,233 hp). The specified USEPA RBLC (and Bio Energy Texas and Ocean Energy Corp.) NO_X LAER determinations are applicable to the operation of lean burn engines with air to fuel ratio control or simply specified as 'clean burn engine'.

Appendix M provides USEPA RBLC NO_X LAER/BACT and other appropriate BACT/LAER determination data and supporting information for LFG fueled IC engine operations.

Due to the presence of siloxanes (and other chemicals) in the LFG fuel (as presented in Section 6.7 Add-on Emission Controls of this document), the utilization of NSCR and SCR equipment to control NO_X in the exhausts of LFG fueled IC engines is not feasible.

NO_X emissions from the LFG fueled CAT® G3520C engines are expected to be relatively constant with respect to number of operating hours and can be maintained at the proposed levels throughout the operating life of the equipment.

Based on the preceding information, BACT for the proposed IC engines is the use of air to fuel ratio control technology (which has equipment specific and site specific fuel quality influences) that minimizes the amount of NO_X emissions produced during the LFG combustion process and results in maximum emissions of 0.6 g/bhp-hr.

The LFG fueled CAT® G3520C gas IC engine has a maximum NO_X emission rate of 0.6 g/bhp-hr, which is a value at the lower range of the data presented in Table K-1 and based on the manufacturer's (Caterpillar, Inc.) 0.5 g/bhp-hr guarantee value $\pm$ 18% (i.e., tolerance specified in the footnote of the engine technical data sheet provided in Appendix F).

6.9 PM10 BACT

Operational experience obtained by Caterpillar, Inc. and users of its LFG fueled IC engines indicates that PM10 emissions for LFG fueled IC engines are dependent on engine operating hours. While PM10 emissions from the operation of new LFG fueled IC engines have been initially tested to be very low (i.e., <0.1 g/bhp-hr) subsequent measurements on the same equipment that are representative of increased engine operating hours indicate the presence of higher emission levels. The increased PM10 emissions (from new engine operating conditions) has been attributed to particulate contributions from crankcase lubrication oil aerosols, which is the result of normal wear on piston rings and seals (i.e., not additional particulate contributions from the source of the LFG fuel).

Data presented in the USEPA RBLC for IC engines operated on LFG fuel indicate that:

- Permits issued LFG fueled IC engines have limited their PM10 emissions to rates that range from 0.04 to 0.34 g/bhp-hr.

- LFG (fuel) pretreatment to remove condensate and particulate matter (as presented in Section 2.1.3 Treatment of this document) without the use of add-on control equipment has been specified as BACT.

Landfill Energy Systems is the operator of CAT® 3616 LFG fueled IC engines that generate electricity at the County of Sacramento Kiefer Landfill (which is a facility listed in Table L-1) and has reviewed the results of 2000, 2001 and 2002 PM10 compliance tests that were performed on the equipment. These data indicate that:

1. Engine PM10 emissions are variable and increase with the number of operating hours through the maintenance cycle of the equipment; and

2. The highest PM10 emission measured for the operation of CAT® 3616 engines on LFG fuel over the three-year compliance demonstration period is 0.172 g/bhp-hr (Engine No. 1 February 2002 tests).

Inspections performed by Landfill Energy Systems on the internal components of LFG fueled IC engines with various numbers of hours indicate that the equipment maintenance schedule recommended by Caterpillar, Inc. is adequate to maintain appropriate engine components within acceptable tolerances and specifications that limit the IC engine PM10 emissions.

Due to the presence of siloxanes (and other chemicals) in the LFG fuel (as presented in Section 6.7 Add-on Emission Controls), the utilization of catch and burn equipment to control particulates in the exhaust of LFG fueled IC engines is not feasible.

Based on its review of the Kiefer Landfill CAT® 3616 LFG fueled IC engine test data, the NJDEP specified (in January 2006) that appropriate control for PM10 emissions from the CAT® G3520C LFG fueled IC engine is 0.24 g/bhp-hr. This value is based in the highest value measured for the CAT® 3616 LFG fueled IC engine of 0.172 g/bhp-hr (as previously specified) rounded upward to the nearest tenth plus a 20% uncertainty factor.

Based on the preceding information, BACT for the control of PM10 emissions from the proposed IC engine operations is treatment of the LFG fuel (as specified in Section 2.1.3 Treatment of this document) and proper equipment maintenance that minimizes the amount of particulate emissions produced during the LFG combustion process and results in maximum PM10 emissions of 0.24 g/bhp-hr.

7.0 APPLICABLE FEDERAL REGULATIONS

7.1 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 control compliance demonstration and equipment operating parameter monitoring and recordkeeping requirements of the MSW Landfill NSPS.

USEPA has issued several determinations (Appendix K provides an example) that support the use of gas 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 landfill gas 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.

The LFG compression, dewatering and filtration equipment (as presented in Section 2.1.3 Treatment of this document) that will be installed and operated to support the proposed electricity generation processes satisfies the definition of treatment presented in the specified regulations.

Based on the preceding information, the proposed electricity generation facility will be fueled with treated LFG. Therefore, the proposed LFG control processes (IC engines) will not be subject to the specific emission control compliance demonstration and equipment operating parameter monitoring and recordkeeping requirements of the MSW landfill NSPS since LFG received from the Central Disposal Facility will be routed to a treatment system that processes the collected gas for subsequent sale or reuse.

Brevard Energy plans to request that USEPA Region IV issue a determination that specifies the MSW Landfill NSPS requirements are not applicable to the IC engine operations at the proposed electricity generation facility since the combustion equipment will use treated gas as fuel.

Appendix N provides draft documents for submittal to USEPA Region IV to request a treated gas determination.

7.2 National Emission Standard for Hazardous Air Pollutants

The proposed LFG fueled IC engine electricity generation facility has the potential to emit:

1. HAPs from the incomplete combustion of these compounds, which are present in the LFG.

2. Inorganic HAP compounds (primarily HCl) from the combustion of chlorinated compounds, which are present in LFG.

7.2.1 Reciprocating Internal Combustion Engine NESHAP

The reciprocating IC engine National Emission Standard for Hazardous Air Pollutants (RICE NESHAP, 40 CFR Part 63 Subpart ZZZZ) applies to major sources of HAPs that operate RICE rated for 500 bhp or greater. Major is defined as a facility that has the potential to emit in excess of 25 TpY of any combination of HAP compounds or 10 TpY of any single HAP.

The proposed electricity generation facility individual RICE will have power ratings that exceed 500 bph. However, based on the information presented in Section 4.2 (Hazardous Air Pollutants) of this document, the maximum HAP emissions from the proposed LFG fueled IC engine electricity generation facility are expected to be less than the major facility thresholds. Therefore, the proposed facility is not subject to the requirements of the RICE NESHAP.

The RICE NESHAP specifies that IC engines at affected facilities that combust landfill or digester gas equivalent to 10 percent or more of the gross heat input on an annual basis are only subject to initial notification, reporting and recordkeeping requirements, and not required to meet the emission limitations and operating limitations of the subpart.

7.2.2 Municipal Solid Waste Landfill NESHAP

The Central Disposal Facility is subject to the MSW landfill NSPS. Therefore, provisions (i.e., development and implement a start-up, shutdown and malfunction plan, submittal of periodic deviation reports and compliance with recordkeeping, notification and reporting requirements) of the MSW landfill NESHAP (40 CFR Part 63 Subpart AAAA) are applicable to processes that utilize LFG generated by the facility. However, Section 2.1.3 (Treatment) and Appendix K of this document provide information and data that indicate the proposed IC engine electricity generation facility will be fueled with treated gas and compliance with the control requirements of the MSW Landfill NSPS will be achieved by routing the collected gas to a treatment system that processes the gas for subsequent sale or reuse.

Therefore, with the issuance of an approved MSW landfill NSPS treated gas determination by USEPA Region IV, the proposed LFG fueled IC engine electricity generation facility will be exempt from the MSW Landfill NESHAP requirements and a start-up, shutdown and malfunction (SSM) plan will only be required for the specified gas treatment equipment and processes.

Appendix O provides a draft SSM plan for the LFG treatment equipment and processes.

7.3 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. New unit exemption provisions of §72.7 specify that utility units:

1. Having a total nameplate capacity of 25 MW or less;

2. Not burning coal or coal-derived fuel; and

3. Burning gaseous fuel with an annual average sulfur content of 0.05% by weight or less,

are exempt from the Acid Rain Program, except for its notification and recordkeeping requirements (§§72.2 through 72.7 and §§72.10 through 72.13).

Utility unit is defined for the purposes of Part 72 as *any person that sells electricity.*

Therefore, the proposed electricity generation facility:

1. Is an utility that has a total nameplate capacity of 9.6 MW,

2. Does not burn coal or any coal-derived fuel, and

   Only burns gaseous fuel (LFG) with an annual average sulfur content of less than 0.05% by weight (Appendix H, Table H-3 data indicate that the Central Disposal Facility LFG sulfur content is 0.018% by weight).

Based on the preceding information, the proposed LFG fueled IC engine electricity generation facility is only subject to the notification and recordkeeping requirements of the federal Acid Rain Program.

8.0 ADDITIONAL 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.

8.1 Visibility Degradation

New major sources that have the potential to impair visibility in any Federal Class I area are required to perform analyses to demonstrate the acceptability of the proposed emissions. An adverse impact is considered visibility impairment that interferes with the management, protection, preservation, or enjoyment of the visual experience of a visitor to the Class I area. The nearest Class I area to the electricity generation facility proposed by Brevard Energy (Geneva, Florida) is the Chassahowitzka Wilderness Area, which is located over 160 kilometers (100 miles) west of Cocoa.

The Everglades National Park (Florida), (Florida), St. Marks National Wilderness Area (Florida), Bradwell Bay 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 100 kilometers from the site of the proposed electricity generation facility.

Based on the general experience of USEPA and state regulatory agencies with visibility analyses performed for similar emission sources and the distance from the site proposed by Brevard Energy to the Chassahowitzka Wilderness Area, it is expected that the plume from the proposed electricity generation engines will not have an adverse impact on visibility in the Chassahowitzka Wilderness Area. The Class I area visibility criteria established by USEPA and specified in *62-204.260 Prevention of Significant Deterioration.*, F.A.C., are expected to be maintained under general and worst-case emission and transport scenarios.

8.2 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 I to be provided as a separate document) will present maximum CO, NO_X, SO_2, PM_{10} and other applicable pollutant impacts, which are estimated to occur from the proposed electricity generation facility emissions and expected to be below the associated secondary NAAQS.

The proposed electricity generation facility will be 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 methane-rich gas 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 proposed electricity generation facility.

8.3 Growth Impacts

The proposed electricity generating facility will employ up to two people. This work force will be obtained from existing residences in the general Cocoa, Florida area.

The location of the proposed 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 proposed facility site. The construction and operation of the Brevard Energy electricity generation facility will not produce commercial growth in the Cocoa, Florida area at levels greater than normal rates, which are dependent on general economical conditions. The proposed facility will interconnect to the Florida Power & Light distribution network through a nearby power line. This power will be use to satisfy electricity demands within the general area. Therefore, insignificant amounts of air pollutant emissions from residential and commercial construction and growth, and other activities associated with the proposed facility will occur.

Based on the location of the Central Disposal Facility (i.e., a relatively rural area), emission configuration of the proposed 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.

8.4 Alternative Sites Analysis

Based on the location of the fuel source for the proposed electricity generation facility (i.e., the LFG fuel for the proposed project is generated by the Central Disposal Facility), it is not feasible (or practicable) to construct the air pollutant emission and power generation processes at another site that is removed or distant from the fuel source.

Approximately 2,200 scfm of unused LFG is currently being generated by the Central Disposal Facility. Flaring is being utilized to control this unused LFG that wastes the energy value of the methane-rich gas.

The size of the proposed 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 engine generator sets (power generation mechanism) 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 proposed facility will produce 9.6 MW of electricity and will interconnect to the Florida Power & Light 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 CO and NO_X emissions will occur at the proposed electricity generation facility, decreases in these emissions may occur at an offsite power plant.

The USEPA has acknowledged the benefits of using LFG as a fuel by creating the Landfill Methane Outreach Program (LMOP), which promotes the use of LFG as a renewable green energy source.

The promulgation of the American Jobs Creation Act of 2004 (Act) also encouraged the development of electricity generation projects that utilize LFG fuel. Section 710 of the Act designates landfill gas-to-energy facilities that are placed in operation prior to January 1, 2006 as 'qualifying facilities' relative to tax credits that are reserved for electricity produced from renewable energy sources. The date of operation to satisfy the 'qualifying facilities' criteria has been extended to December 31, 2007.

Application Prepared By:	Reviewed By:
David R. Derenzo	Robert Harvey
Services Director	Engineering Services Manager

Table 1. Measured and expected gas composition and fuel properties for LFG recovered from the Central Disposal Facility

Component	Sample Date[1] July 22, 2005	Expected[2] For IC Engine Fuel
Methane (% vol.)	43.7	>45
Carbon Dioxide (% vol.)	33.3	<40
Nitrogen (% vol.)	12.7	<10
Oxygen (% vol.)	3.2	<5
Fuel LHV (Btu/scf)	397.4[A]	>420

Notes
1. Appendix E provides LFG analysis data.
2. Based on engine operator analysis.
A. Calculated based on presented methane concentration

Table 2. Design and operating specifications for the proposed 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]	14.11	-
Heat input rate (LHV MMBtu/hr) Test Data[2]	14.64	87.84
Fuel consumption[3] (scfm)	580	3,480
Exhaust gas temperature (°F)	900	-
Average exhaust flowrate (acfm)	12,050	-
Average exhaust flowrate[4] (dscfm)	4,150	-
Average exhaust oxygen content (% dry)	8.5	-
Average exhaust exist velocity (fps)	110	-
Exhaust stack diameter (inches)	18	-
Exhaust stack release height (feet)	20	-
Building height (feet)	15	-

Notes
1. See Appendix F (235,181 Btu/min LHV)
2. See Appendix G (16.28 MMBtu/hr HHV, 14.64 MMBtu/hr LHV)
3. Based on minimum fuel LHV of 420 Btu/scf and maximum engine LHV input rate of 14.64 MMBtu/hr.
4. Corrected to dry standards conditions (70°F).

Table 3. Criteria air pollutant and HAP potential emission rates for the proposed CAT® G3520C gas IC engine electricity generation facility

	Single CAT® G3520C[A]		Total Facility[1,A]	
Air Pollutant	(lb/hr)	(TpY)	(lb/hr)	(TpY)
Criteria Air Pollutants				
NO_X	2.95	12.94	17.72	77.6
CO	13.54	59.30	81.24	355.8
SO_2	0.96	4.22	5.76	25.3
Total VOC	1.37	5.99	8.22	36.0
PM_{10}	1.18	5.17	7.08	31.0
HAPs				
HCl	0.42	<1.67	2.52	<10.0
Total HAPs	0.48	2.12	2.88	12.7

Notes

1. Based on continuous operation of six (6) CAT® G3520C at maximum capacity.

A. Air pollutant emission rate calculations are provided in Appendix H.

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

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 Energy, L.L.C.	
2. Site Name: Brevard Energy	
3. Facility Identification Number: 0090069 (ID for Central Disposal Facility)	
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 (landfill – yes)

Application Contact

1. Application Contact Name: David Derenzo
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: dderenzo@derenzo.com

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	6-5-06
2. Project Number(s):	0090069-004-AC
3. PSD Number (if applicable):	PSD-FL-378
4. Siting Number (if applicable):	

APPLICATION INFORMATION

Purpose of Application

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

Air Construction Permit

[X] 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

New major facility under State rules and federal Prevention of Significant Deterioration Permitting (PSD) program that is required to apply for an Air Construction Permit.

An Air Operation Permit (modification of the Central Disposal Facility Title V Permit) will be pursued after the issuance of the Air Construction Permit as a separate permitting activity (as recommended by Mr. Jeff Koerner of the FDEP-DARM).

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
EU1	Landfill gas fueled IC engine electricity generation facility (6 identical engine-generator sets)	AC1A	$7,500

Application Processing Fee

Check one: [X] Attached - Amount: $ 7,500 [ ] Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name : David R. Derenzo
2. Owner/Authorized Representative Mailing Address... Organization/Firm: Derenzo and Associates, Inc. Street Address: 39395 Schoolcraft Road City: Livonia State: Michigan Zip Code: 48150
3. Owner/Authorized Representative Telephone Numbers... Telephone: (734) 464 – 3880 ext. Fax: (734) 464 – 4368
4. Owner/Authorized Representative Email Address: dderenzo@derenzo.com
5. Owner/Authorized Representative Statement: *I, the undersigned, am the owner or authorized representative of the facility 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 requirements identified in this application to which the facility 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.*   David R. Derenzo (signature) — Signature   May 25, 2006 — Date

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)

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.

   [X] 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, L.L.C.
   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.

   Scott Salisbury — Signature   March 13, 2006 — Date

APPLICATION INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: Jeff Pope, P.E.
   Registration Number: 53815

2. Professional Engineer Mailing Address...
   Organization/Firm: Clayton Group Services, Inc. - Bureau Veritas
   Street Address: 3140 Finley Road
   City: Downers Grove State: IL Zip Code: 60515

3. Professional Engineer Telephone Numbers...
   Telephone: (630) 795 - 3200 ext. Fax: (630) 795 - 1130

4. Professional Engineer Email Address: jeff.pope@us.bureauveritas.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   May 31, 2006
                                             Date

(seal)

JEFFERY LYNN POPE
LICENSE
No. 53815
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

* Attach any exception to certification statement.

DEP Form No. 62-210.900(1) - Form
Effective: 06/16/03

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 : Proposed electricity generation facility will be located on leased land at the Central Disposal Facility (east of landfill).			

Facility Contact

1. Facility Contact Name: Bill Owen
2. Facility Contact Mailing Address... Organization/Firm: Landfill Energy Systems Street Address: 22801 Deer Run Court City: Murrieta State: CA Zip Code: 92562
3. Facility Contact Telephone Numbers: Telephone: (951) 696 – 9196 ext. Fax: (951) 696 – 8128
4. Facility Contact Email Address: bill.owen@verizon.net

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: Scott Salisbury
2. Facility Primary Responsible Official Mailing Address... Organization/Firm: Brevard Energy, L.L.C. Street Address: 29261 Wall Street City: Wixom State: MI Zip Code: 48393
3. Facility Primary Responsible Official Telephone Numbers... Telephone: (248) 380 – 3920 ext. Fax: (248) 380 – 2038
4. Facility Primary Responsible Official Email Address: Scott.Salisbury@landfillenergy.com

FACILITY INFORMATION

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	[X] Unknown
2. [ ] Synthetic Non-Title V Source	
3. [X] Title V Source	
4. [X] 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. [X] Synthetic Minor Source of HAPs	
8. [X] 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. [X] 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 proposed electricity generation facility will:

1. Be a PSD major source for CO
2. Voluntarily limit HCl (HAP) emissions to < 10 tons per year.
3. Operate devices that provide control for gas (NMOC) generated by the 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
VOC	Y			36	ESCPSD
H106	Y			10	ESCMACT

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

The 36 ton per year (TpY) gas engine total VOC emission is based on a voluntary limitation that is 90% of the 40 TpY significant emission threshold. The CAT® G3520C engine is designed to produce low NO_X emissions. These lower emissions are produced in part based on the high carbon dioxide content of LFG fuels that results in cooler combustion temperatures, which influence VOC destruction and control efficiencies. Therefore, flexibility in establishing an allowable limit is required to ensure ongoing compliance over all engine fuel quality and mechanical operating conditions.

Brevard Energy experience (based on emission testing performed by Landfill Energy Systems on similar LFG fueled engines) indicates that the AP-42 default LFG constituent concentrations overestimate the potential HCl content of the gas generated at the Central Disposal Facility. Therefore, Brevard Energy will restrict the allowed HCl emissions from the proposed engine operations to less than 10 TpY through appropriate permit limits.

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) [X] 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) [X] 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) [X] Attached, Document ID: Section 5.11 [ ] Previously Submitted, Date:________

Additional Requirements for Air Construction Permit Applications

1. Area Map Showing Facility Location: [X] Attached, Document ID: Appendix C [ ] Not Applicable (existing permitted facility)
2. Description of Proposed Construction or Modification: [X] Attached, Document ID: Section 2
3. Rule Applicability Analysis: [X] Attached, Document ID: Sections 5 - 7
4. List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): [X] Attached, Document ID: Section 5.6 [ ] Not Applicable (no exempt units at facility)
5. Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.): [ ] Attached, Document ID:__________ [X] Not Applicable
6. Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.): [ ] Attached, Document ID:__________ [ ] Not Applicable Appendix I – to be provided
7. Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.): [ ] Attached, Document ID:__________ [ ] Not Applicable Appendix I – to be provided
8. Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.): [ ] Attached, Document ID:__________ [ ] Not Applicable Appendix I – to be provided
9. Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.): [X] Attached, Document ID: Section 8 [ ] Not Applicable
10. Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): [ ] Attached, Document ID:__________ [X] 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:________ ☐ 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:__________ ☐ Not Applicable

Additional Requirements Comment

An Air Operation Permit (modification of the Central Disposal Facility Title V Permit) will be pursued after the issuance of the Air Construction Permit as a separate permitting activity (as recommended by Mr. Jeff Koerner of the FDEP-DARM).

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).

   [X] 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:

4. Emissions Unit Status Code:	5. Commence Construction Date:	6. Initial Startup Date:	7. Emissions Unit Major Group SIC Code:	8. Acid Rain Unit?
C			49	☐ Yes [X] 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:

ICE1 – stack1 (1.6 MW)	ICE4 – stack4 (1.6 MW)
ICE2 – stack2 (1.6 MW)	ICE5 – stack5 (1.6 MW)
ICE3 – stack3 (1.6 MW)	ICE6 – stack6 (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 proposed electricity generation facility IC engines. The CAT® G3520C gas IC engine 2.75 g/bhp-hr CO emission rate is based on the results of Best Available Control Technology (BACT) analyses (Section 6.8.1 CO BACT of the permit application documents). The CAT® G3520C gas IC engine 0.60 g/bhp-hr NO_X emission rate is based on the results of BACT analyses (Section 6.8.2 NO_X BACT of the permit application documents). The CAT® G3520C gas IC engine 0.24 g/bhp-hr PM_{10} emission rate is based on the results of BACT analyses (Section 6.9 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: 20,880 scf/hr (LFG fuel)		
2. Maximum Production Rate: 9.6 MW		
3. Maximum Heat Input Rate: 87.84 million Btu/hr (LHV)		
4. Maximum Incineration Rate: pounds/hr tons/day		
5. Requested Maximum Operating Schedule:	hours/day 24 weeks/year 52	days/week 7 hours/year 8,760
6. Operating Capacity/Schedule Comment: 14.64 MMBtu (LHV)/hr/engine maximum heat input 1.6 MW/hr/engine maximum electricity generation 34,800 scf/hr/engine maximum LFG fuel use Base load (100% design capacity) engine –generator operations. The proposed 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: ICE1 – ICE6	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:

EU1 (ICE1-stack1, ICE2-stack2, ICE3-stack3, ICE4-stack4, ICE5-stack5, ICE6-stack6)

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 12,050	10. Water Vapor: %

11. Maximum Dry Standard Flow Rate: dscfm 4,150	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:

Stack1-ICE1
Stack2-ICE2
Stack3-ICE3
Stack4-ICE4
Stack5-ICE5
Stack6-ICE6

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: 0.2088	5. Maximum Annual Rate: 1829.1	6. Estimated Annual Activity Factor:
7. Maximum % Sulfur: 0.017	8. Maximum % Ash: 0	9. Million Btu per SCC Unit: 420 (LHV)
10. Segment Comment: Hourly and annual maximum fuel use rates for the operation of 6 IC engines based on fuel heating value of 420 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: 81.24 lb/hour 355.8 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 2.75 g/bhp-hr Reference: BACT	7. Emissions Method Code: 5
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 13.54 lb/hour/engine, 59.3 tons/year/engine (refer to Section 4.0 and Appendix H 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: NOX	2. Total Percent Efficiency of Control:
3. Potential Emissions: 17.72 lb/hour 77.6 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 0.60 g/bhp-hr Reference: BACT	7. Emissions Method Code: 5
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 2.95 lb/hour/engine, 12.9 tons/year/engine (refer to Section 4.0 and Appendix H 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: VOC	2. Total Percent Efficiency of Control:
3. Potential Emissions: 8.22 lb/hour 36.0 tons/year	4. Synthetically Limited? [X] Yes [ ] No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: Reference: 90% of 40 ton/year significance threshold	7. Emissions Method Code: 0
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 1.37 lb/hour/engine, 6.0 tons/year/engine (refer to Section 4.0 and Appendix H 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: 7.08 lb/hour 31.0 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 0.24 g/bhp-hr Reference: BACT	7. Emissions Method Code: 5
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 13.54 lb/hour/engine, 59.3 tons/year/engine (refer to Section 4.0 and Appendix H 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: SO2	2. Total Percent Efficiency of Control:
3. Potential Emissions: 5.76 lb/hour 25.3 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 27.5 lb/MMscf Reference: fuel sulfur content (AP-42, 150 ppm H2S)	7. Emissions Method Code: 2
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 0.96 lb/hour/engine, 4.2 tons/year/engine (refer to Section 4.0 and Appendix H of the permit application documents)	

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

(Optional for unregulated emissions units.)

<u>Potential/Estimated Fugitive Emissions</u>

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: HAPS	2. Total Percent Efficiency of Control:
3. Potential Emissions: 2.12 lb/hour 12.78 tons/year	4. Synthetically Limited? ☐ Yes ☒ No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 13.8 lb/MMscf Reference: fuel HAPs content (AP-42)	7. Emissions Method Code: 3
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: 0.35 lb/hour/engine, 2.13 tons/year/engine (refer to Section 4.0 and Appendix H 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: H106	2. Total Percent Efficiency of Control:
3. Potential Emissions: lb/hour <10.0 tons/year	4. Synthetically Limited? [X] Yes [ ] No
5. Range of Estimated Fugitive Emissions (as applicable): to tons/year	
6. Emission Factor: 11.9 lb/MMscf Reference: fuel HAPs content (AP-42)	7. Emissions Method Code: 2
8. Calculation of Emissions: Refer to Appendix H of permit application documents	
9. Pollutant Potential/Estimated Fugitive Emissions Comment: <10.0 tons/year/engine (refer to Section 4.0 and Appendix H 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 2.75 g/bhp-hr	4. Equivalent Allowable Emissions: 81.24 lb/hour 355.8 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: RULE	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: NOX 0.60 g/bhp-hr	4. Equivalent Allowable Emissions: 17.72 lb/hour 77.6 tons/year
5. Method of Compliance: Engine exhaust stack emissions testing (once every five years)	
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: VOC 35.5 ppmvd as hexane 3% O2	4. Equivalent Allowable Emissions: 8.22 lb/hour 36.0 tons/year
5. Method of Compliance: Engine exhaust stack emissions testing	
6. Allowable Emissions Comment (Description of Operating Method): Rule 62-212.400	

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: PM10 0.24 g/bhp-hr	4. Equivalent Allowable Emissions: 7.08 lb/hour 31.0 tons/year
5. Method of Compliance: Engine exhaust stack emissions testing (once every five years)	
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: SO2 27.5 lb/MMscf	4. Equivalent Allowable Emissions: 5.76 lb/hour 25.3 tons/year
5. Method of Compliance: Engine fuel sulfur content analysis (once every five years)	
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: ESCMACT	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: HAPS 27.3 lb/MMscf	4. Equivalent Allowable Emissions: lb/hour <25.0 tons/year
5. Method of Compliance: Engine fuel HAPs content analysis (once every five years)	
6. Allowable Emissions Comment (Description of Operating Method): Rule 62-204.800	

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: ESCMACT	2. Future Effective Date of Allowable Emissions:
3. Allowable Emissions and Units: H106 <10.9 lb/MMscf	4. Equivalent Allowable Emissions: lb/hour <10.0 tons/year
5. Method of Compliance: Engine fuel chlorinated compound content analysis (once every five years)	
6. Allowable Emissions Comment (Description of Operating Method): Rule 62-204.800	

G. VISIBLE EMISSIONS INFORMATION

Complete if this emissions unit is or would be subject to a unit-specific visible emissions limitation.

Visible Emissions Limitation: Visible Emissions Limitation 1 of 1

1. Visible Emissions Subtype: VE20	2. Basis for Allowable Opacity: [X] Rule [ ] Other
3. Allowable Opacity: Normal Conditions: 20 % Exceptional Conditions: % Maximum Period of Excess Opacity Allowed: min/hour	
4. Method of Compliance: Engine exhaust stack emissions testing (once every five years)	
5. Visible Emissions Comment: Rule 62-296.320 Experience obtained by manufacturers and operators of LFG fueled IC engines indicates that visible emissions from LFG fueled IC engines will be insignificant (emissions are not expected to be visible during normal engine operations).	

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) [X] 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) [X] 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) [X] Attached, Document ID: Section 6 [ ] 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 _________ [X] 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) [X] Attached, Document ID: Appendix J [ ] Previously Submitted, Date _________ [ ] 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: _________ [X] 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 [X] Attached, Document ID: Sections 1 - 8 [ ] 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)) [X] Attached, Document ID: Section 6.0 [ ] 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.) [X] Attached, Document ID: Section 5.8 [ ] Not Applicable
3. Description of Stack Sampling Facilities (Required for proposed new stack sampling facilities only) [X] Attached, Document ID: Section 5.12 [ ] Not Applicable

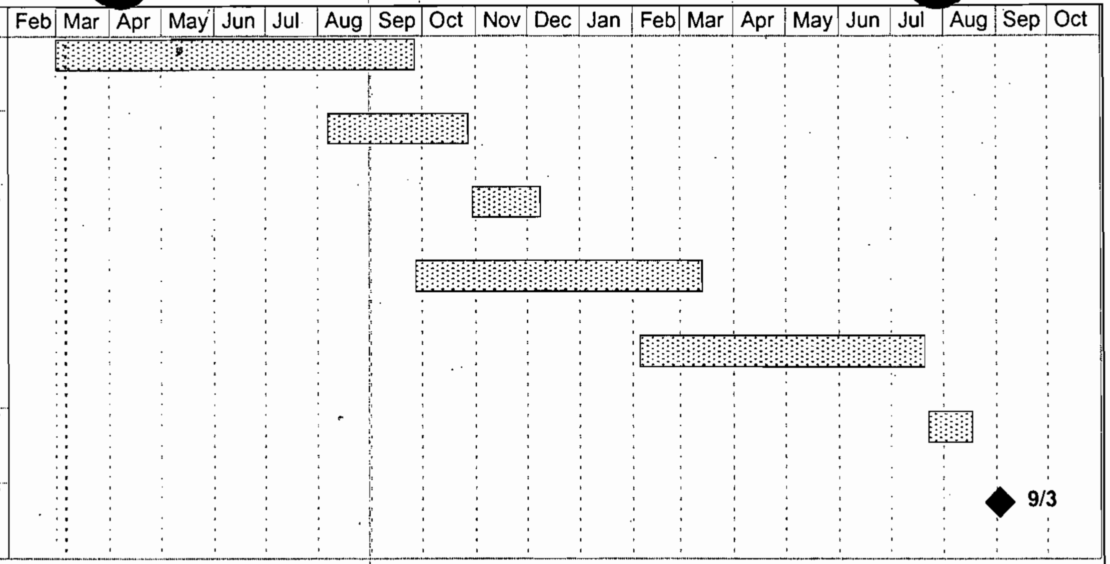
Additional Requirements for Title V Air Operation Permit Applications

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

Brevard Energy, LLC
Construction Schedule

ID	Task Name	Duration	Start	Finish
1	Air Permit	30 wks	Wed 3/1/06	Tue 9/26/06
2	Design	12 wks	Mon 8/7/06	Fri 10/27/06
3	Building Permit	6 wks	Mon 10/30/06	Fri 12/8/06
4	Equipment Procurement	24 wks	Wed 9/27/06	Tue 3/13/07
5	Construction	6 mons	Mon 2/5/07	Fri 7/20/07
6	Start-up	4 wks	Mon 7/23/07	Fri 8/17/07
7	Commercial Operation	0 days	Mon 9/3/07	Mon 9/3/07

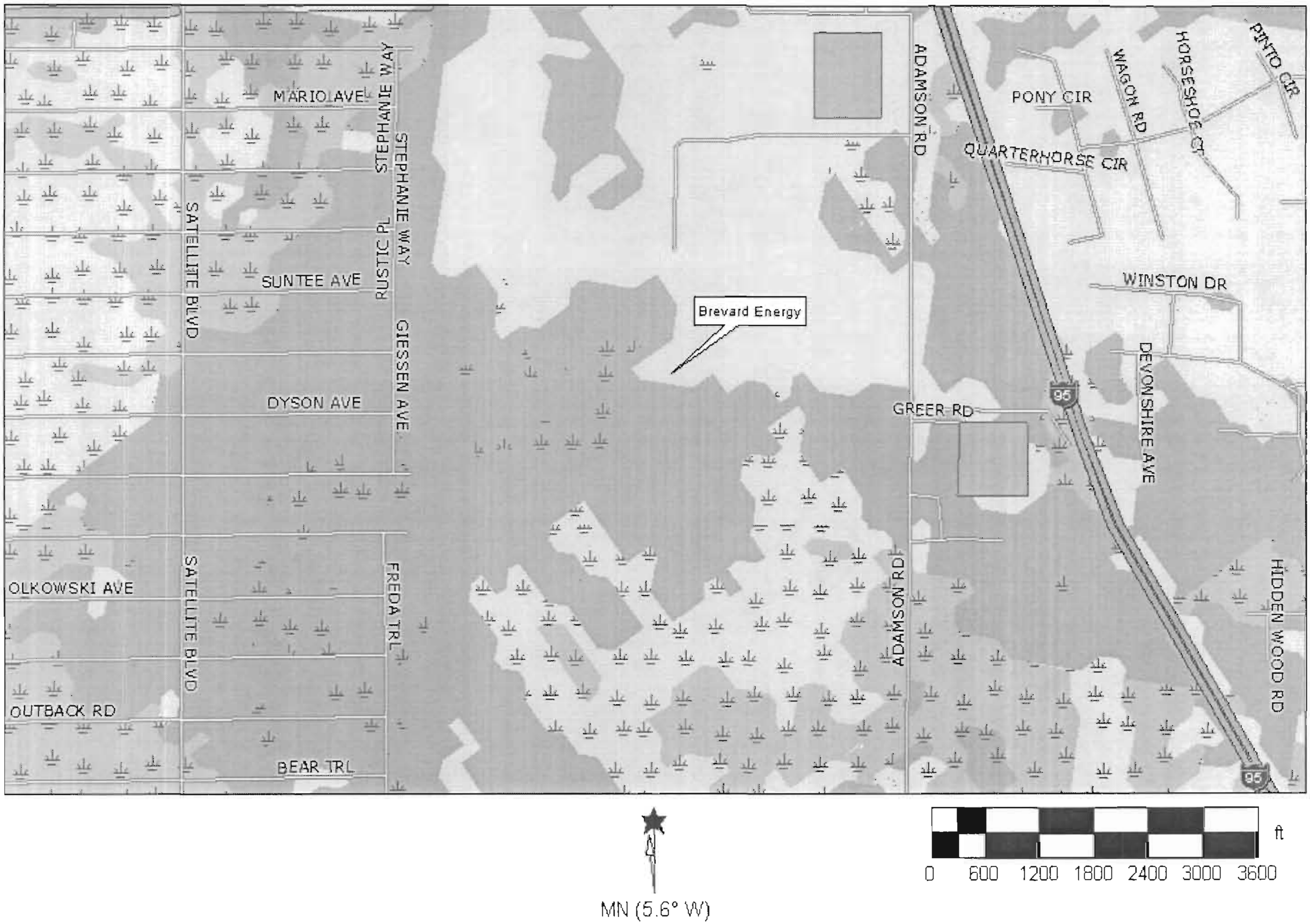


Project: Brevard Project Schedule
Date: Mon 3/6/06

Task | Progress | Milestone | Summary

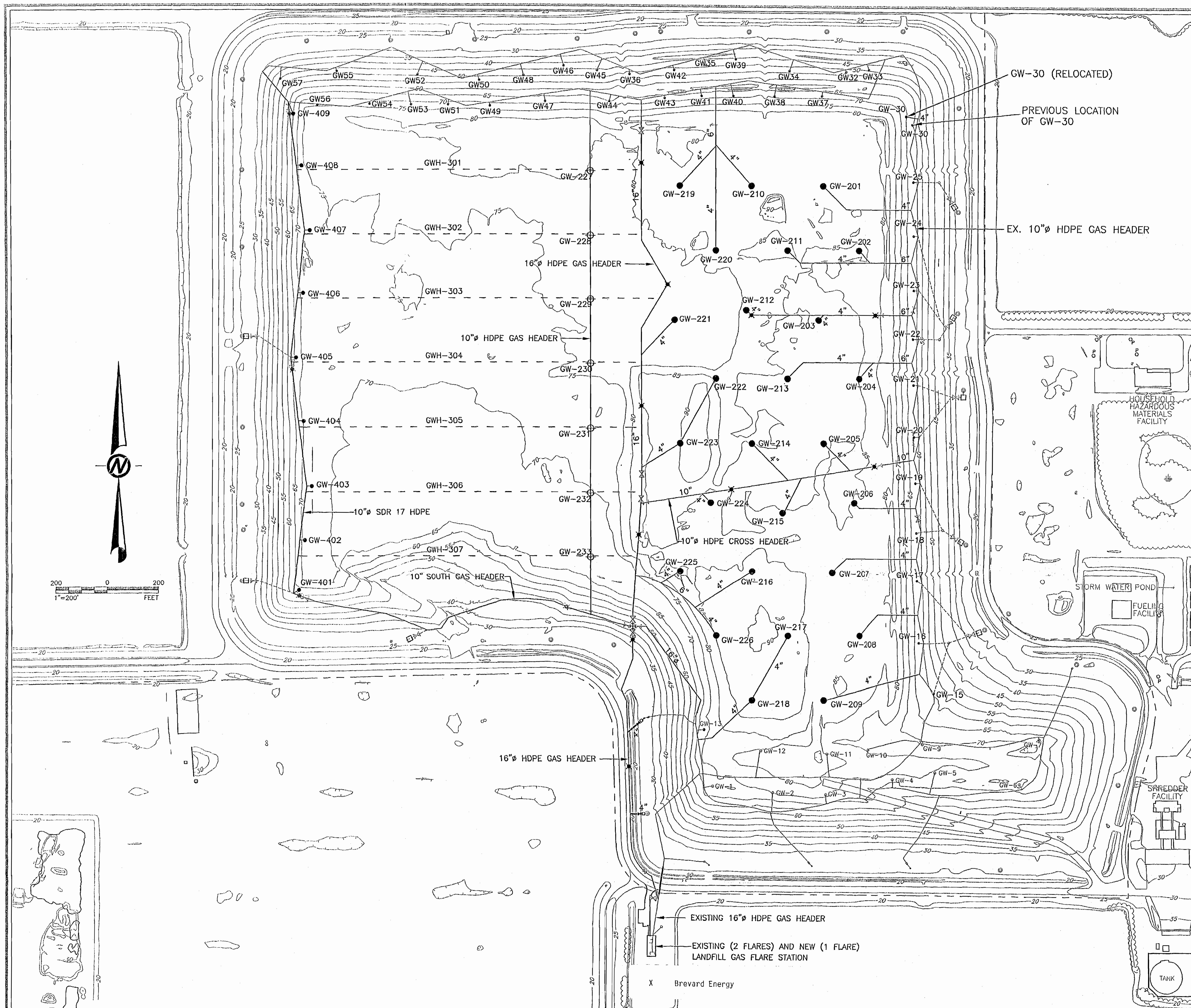
APPENDIX C

Brevard Energy, LLC
Area Location
And
Site Drawings



MARIO AVE
STEPHANIE WAY
SATELLITE BLVD
RUSTIC PL
SUNTEE AVE
GIESSEN AVE
DYSON AVE
OLKOWSKI AVE
FREDA TRL
OUTBACK RD
BEAR TRL
ADAMSON RD
Brevard Energy
GREER RD
PONY CIR
WAGON RD
HORSESHOE CT
PINTO CIR
QUARTERHORSE CIR
WINSTON DR
DEVONSHIRE AVE
HIDDEN WOOD RD
95
MN (5.6° W)
0 600 1200 1800 2400 3000 3600
ft

0090069-004 (1)



LEGEND

——50'——	EXISTING 5' CONTOUR (AS OF 1-23-03)
◎	EXISTING MANHOLE
● GW-16	EXISTING GAS EXTRACTION WELLS
——10"——	EXISTING GAS HEADER
-----GWH-302-----	NEW 8" HORIZONTAL GAS EXTRACTION WELLS
⊕ GW-227	NEW LFG WELL POINTS (MANIFOLD SYSTEM)
● GW-210/GW-407	NEW VERTICAL EXTRACTION WELLS
——16"——	NEW 16" HDPE LANDFILL GAS HEADER
——10"——	NEW 10" HDPE LANDFILL GAS HEADER
—— 4" ——	NEW 4" LATERAL OR CONDENSATE DRAIN

NOTE: FEATURES IDENTIFIED AS "EXISTING" ARE LFG COLLECTION AND CONTROL SYSTEM FEATURES THAT WERE IN PLACE PRIOR TO THE EXPANSION REQUIRED BY TITLE V OPERATION PERMIT 0090069-002-AV, APPENDIX CP-1. THE CONSTRUCTION OF FEATURES IDENTIFIED AS "NEW" HAS BEEN PERMITTED BY THE DEPARTMENT'S SOLID & HAZARDOUS WASTE SECTION.

William J. Edwards, P.E.
Florida Registration # 60876
Signature / Date

REV. No.	DATE	DRAWN BY	CHKD BY	REMARKS
0	R. 5/11/04	PV	WJE	ORIGINAL RELEASE

SEAL OF BREVARD COUNTY FLORIDA

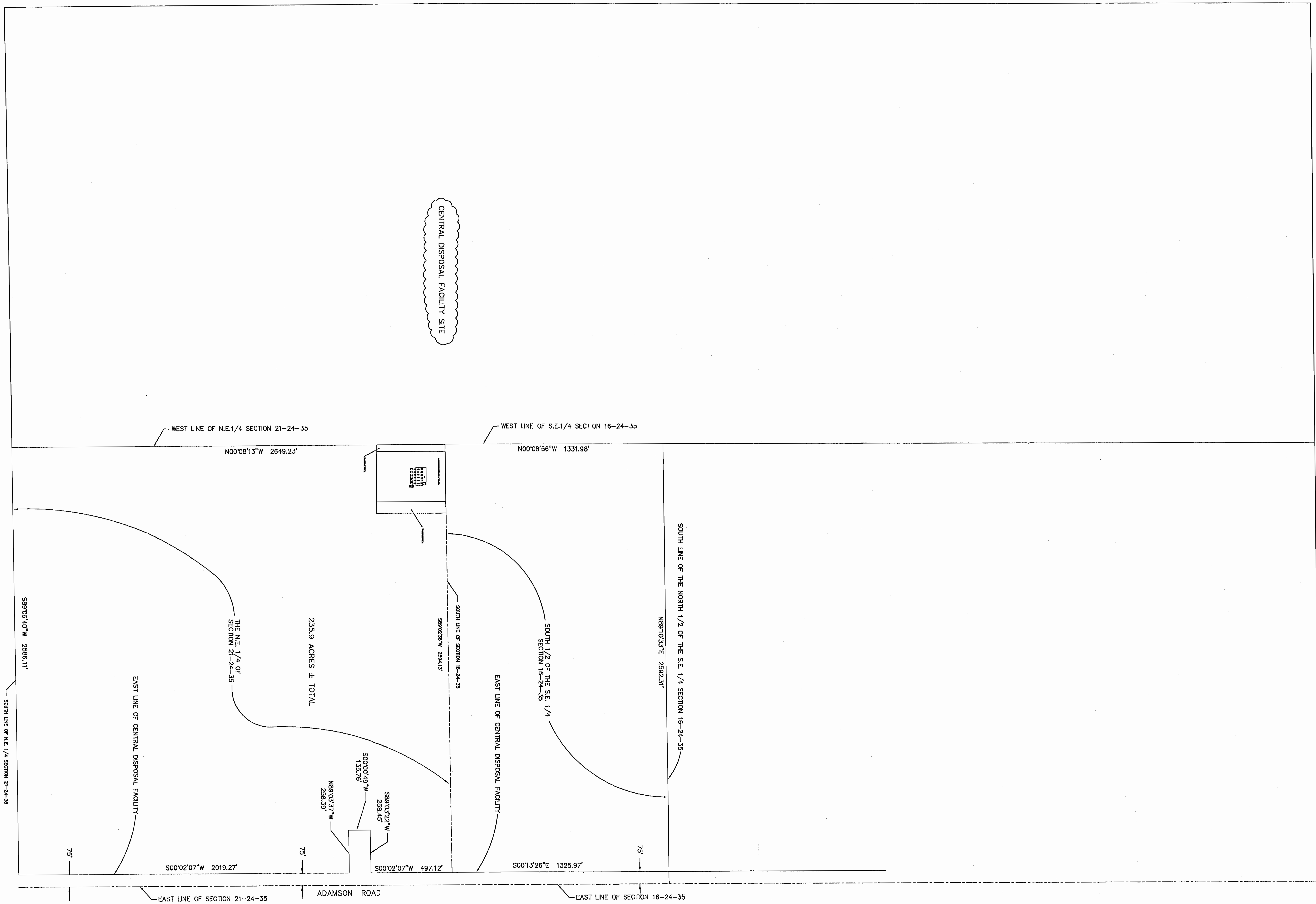
FACILITY PLOT PLAN
LFG SYSTEM EXPANSION
CENTRAL DISPOSAL FACILITY - BREVARD COUNTY

S2Li
529 Versailles Drive, Suite 103
Maitland, Florida 32751
(407) 475-9163 FAX 475-9169
Certification of Authorization # 7831

DRAWING NUMBER
1 of 2

SITE PLAN 05/11/04 03-157

0090069-004 ②



2005 AERIAL DATE

BEST AVAILABLE COPY

LEGEND

——50'——	EXISTING 5' CONTOUR (AS OF 1-23-03)
◎	EXISTING MANHOLE
GW-16	EXISTING GAS EXTRACTION WELLS
——10"——	EXISTING GAS HEADER
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Signature: [signature] Date: 5/26/04

William J. Edwards, P.E.
Florida Registration # 60876

REV. No.	DATE	DRAWN BY	CHKD BY	REMARKS
O.R.	5/11/04	PV	WJE	ORIGINAL RELEASE

* These maps copied in pieces because the originals were approx. 3' by 2' - too big to be reduced.

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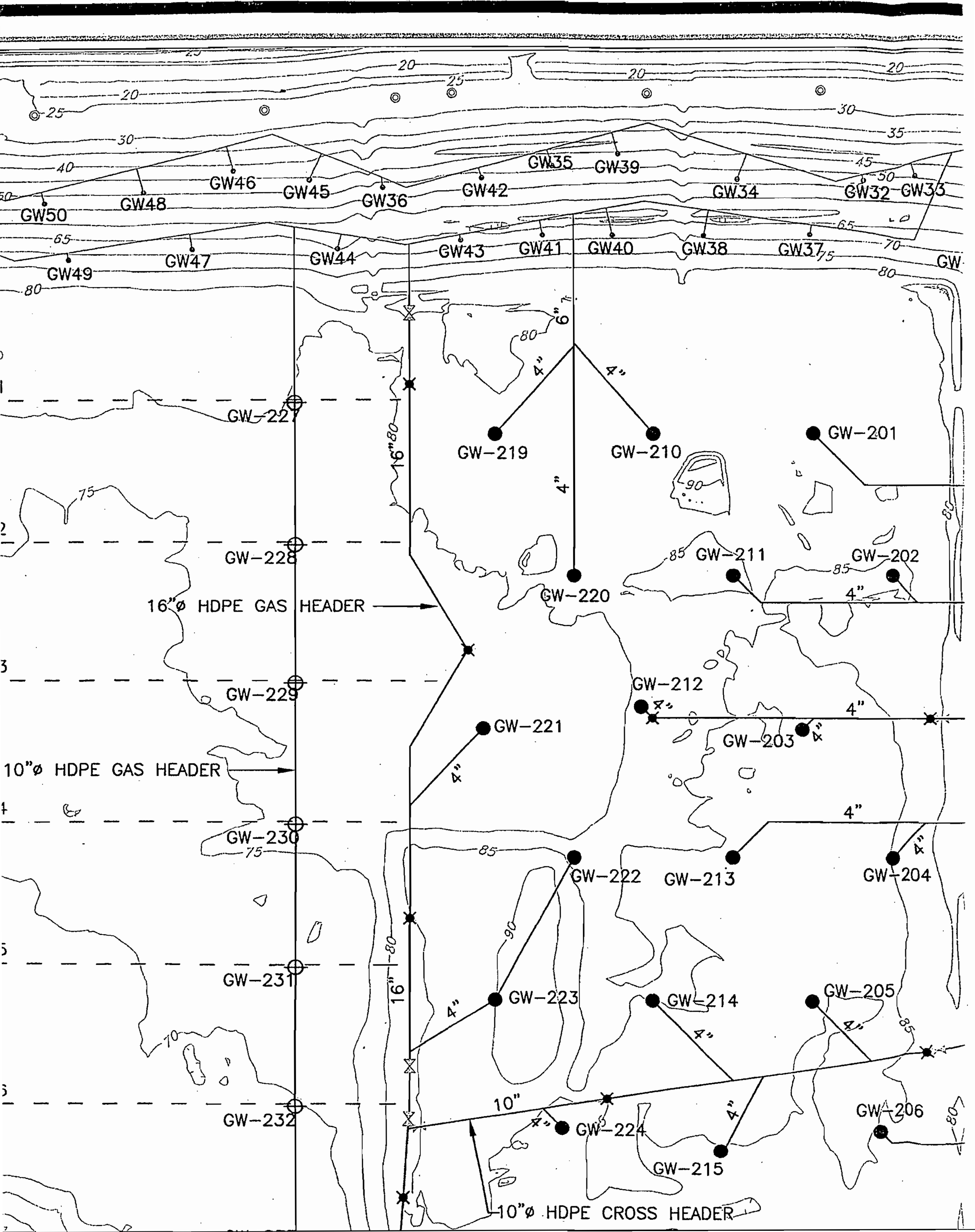
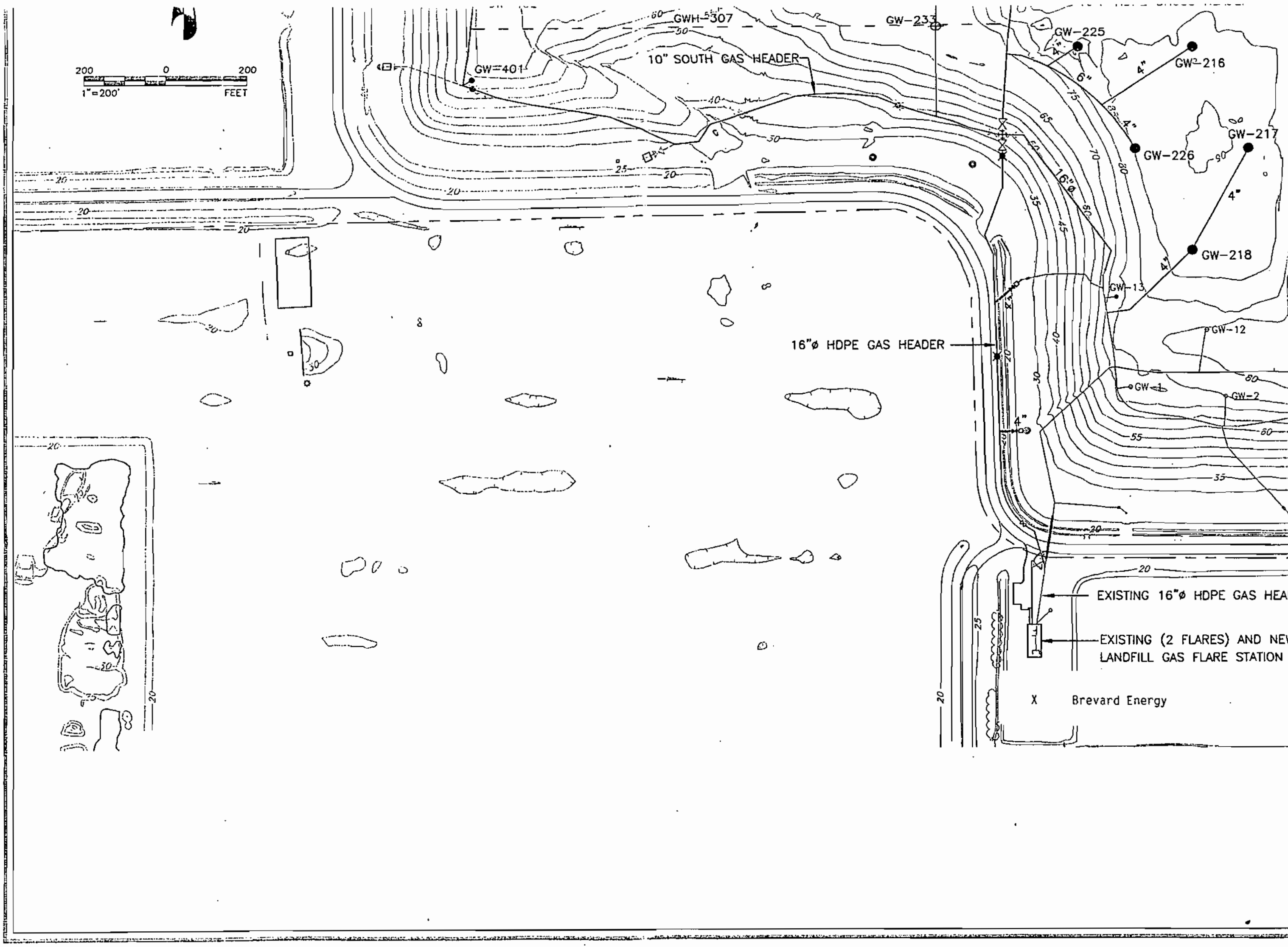
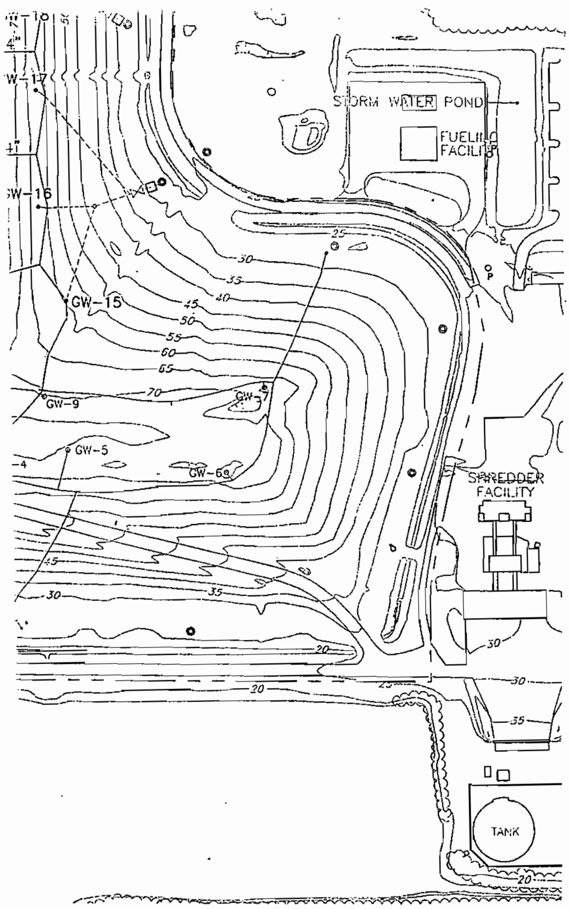




SITE PLAN 05/11/04 03-157



FACILITY PLOT PLAN
LFG SYSTEM EXPANSION
CENTRAL DISPOSAL FACILITY - BREVARD COUNTY

S2Li
529 Versailles Drive, Suite 103
Maitland, Florida 32751
(407) 475-9163 FAX 475-9169
Certification of Authorization # 7831

DRAWING NUMBER
1 of 2

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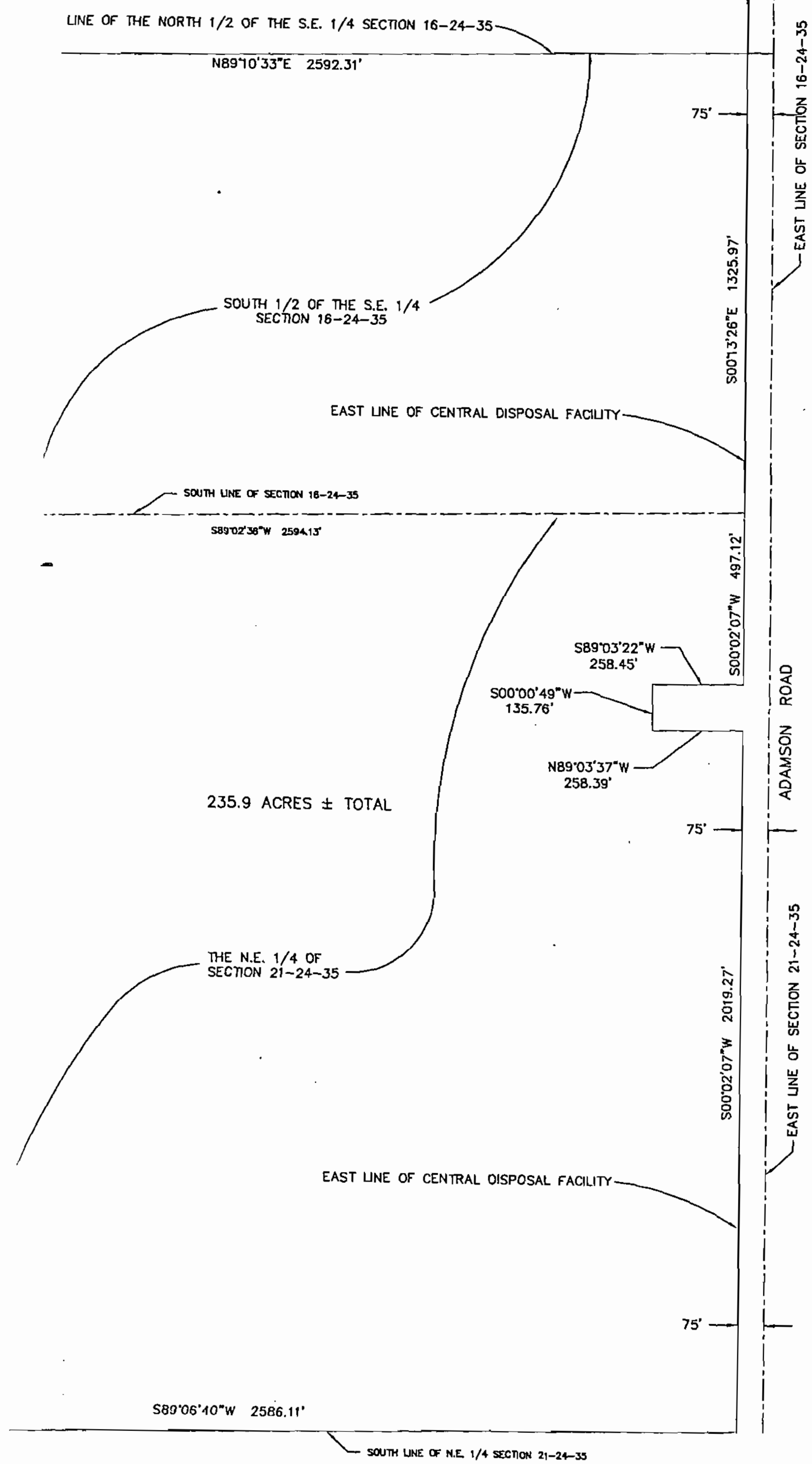
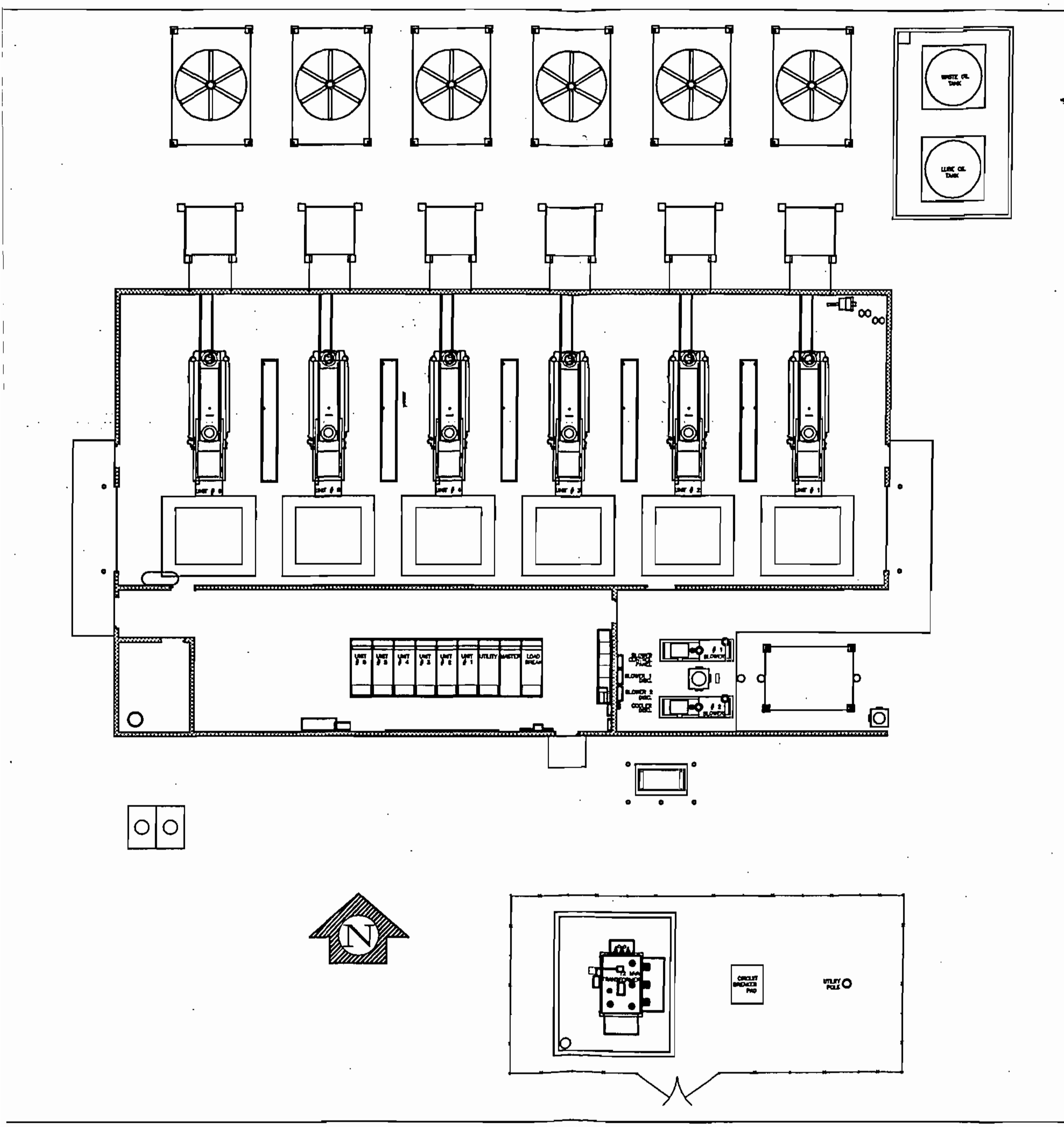
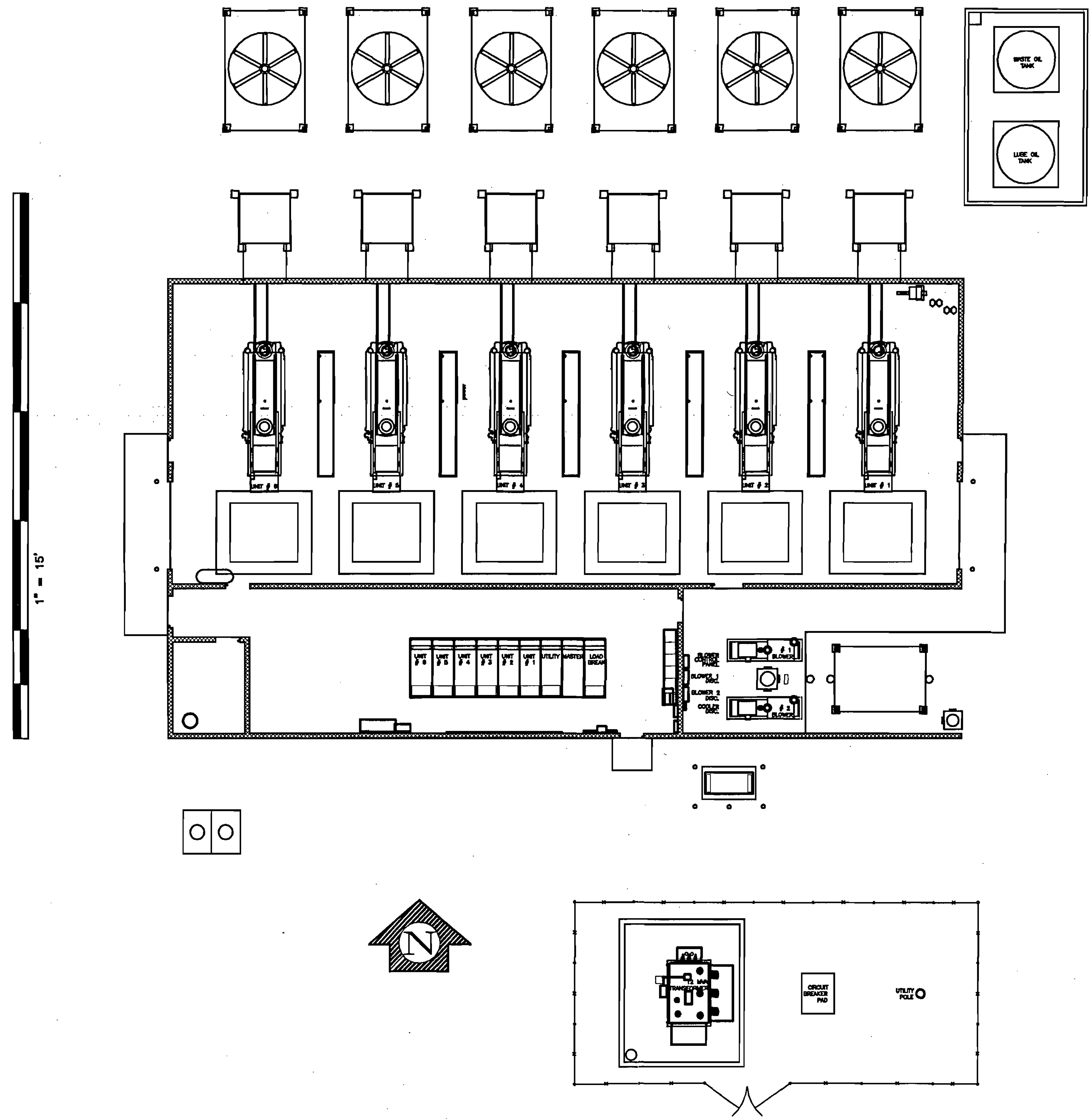


2005 AERIAL DATE

BEST AVAILABLE COPY



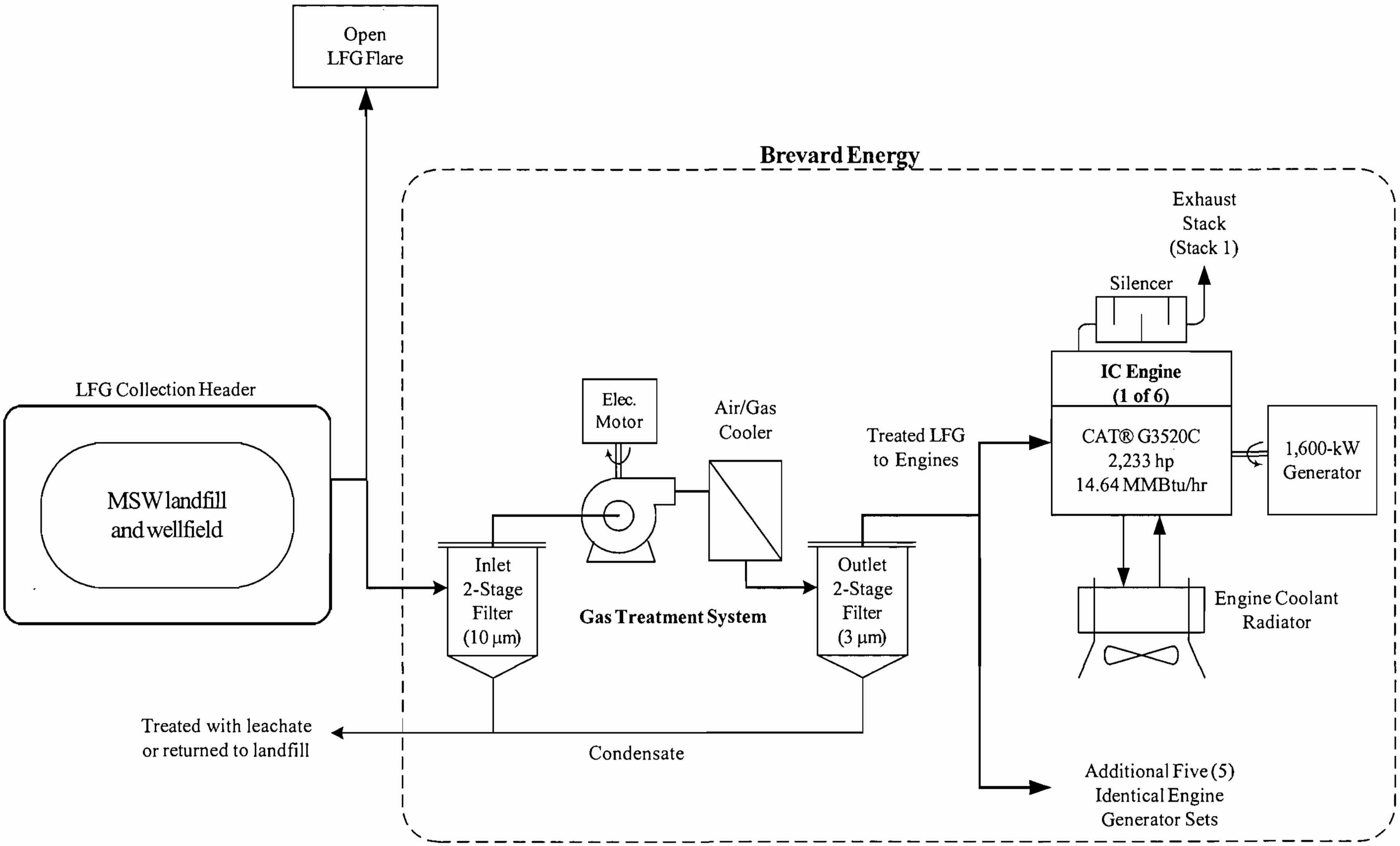
BREVARD COUNTY GAS-TO-ENERGY PROJECT 2250 ADAMSON RD. COCOA, FL. 32926 PROJECT	REMARKS REV | DATE | COMMENT
SHEET TITLE: BUILDING PLAN	
DRAWING STATUS: CONCEPTUAL	
Landfill Energy Systems 29261 WALL ST. WIXOM, MI. 48393 248 380-3920	SCALE: TAG #: N/A DRAWN BY: MKL CHECKED BY: MKL DATE ISSUED: 07/13/05
SHEET	C-1



BREVARD COUNTY GAS-TO-ENERGY PROJECT 2250 ADAMSON RD. COCOA, FL. 32926 PROJECT		REMARKS REV DATE COMMENTS
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

APPENDIX D

Brevard Energy, LLC
Process Flow Diagram
And
Engineering Specifications



05/17/06	**Brevard Energy, L.L.C. LFG Electricity Generation Facility**		
	Scale None	Sheet 1 of 1	Derenzo and Associates Project No. 0603003

APPENDIX E

Central Disposal Facility
LFG Heating Value
And
Fixed Gas Analyses

Golder Associates Inc.

3730 Chamblee Tucker Road
Atlanta, GA USA 30341
Telephone (770) 496-1893
Fax (770) 934-9476

Golder Associates

September 5, 2005

043-3881.002

S2L, Inc.
8029 Ridge Valley
Woodstock, GA 30189-7047

Attn: Mr. Omar Smith, P.E., Regional Manager

RE: INITIAL FLARE PERFORMANCE TEST
BREVARD COUNTY CENTRAL DISPOSAL FACILITY
BREVARD COUNTY, FLORIDA
AIR PERMIT NUMBER 0090069-003-AV

Dear Mr. Smith:

In order to optimize the Brevard County Central Disposal Facility (CDF) Landfill Gas Collection and Control System (GCCS) a third candlestick flare has been installed at the site.

To maintain compliance with the GCCS, a performance test of this open flare was required. Presented herein are the results of the Flare Performance Test completed on July 22, 2005.

REGULATORY REQUIREMENTS

To maintain compliance with the CDF GCCS design plan and as required by 40 CFR Part 60 Subpart WWW, Standards of Performance for Municipal Solid Waste Landfills, the performance test of the Site's open flare was completed on July 22, 2005. The test was conducted in conformance with the Standards for Air Emissions from Municipal Solid Waste Landfills, 40 CFR §60.752(b)(2)(iii)(A).

The flare at the Site was constructed and is operated in accordance with 40 CFR §60.18, General Control Device Requirements. Such requirements, as applied to the CDF flare and to the July 22, 2005 performance testing are addressed in subsequent sections of this report. The following items briefly summarize the application of each pertinent Subpart WWW rule to the CDF landfill gas flare.

Subpart WWW §60.18(c)(1). Visible Emissions
The CDF flare is designed and operated with no visible emissions as determined by methods specified in §60.18(f) except for periods not to exceed a total of five minutes during any two consecutive hours.

Subpart WWW §60.18(c)(2). Flame Presence and Response to Flameout
The flare is operated with a flame present at all times. The presence of the flare pilot flame is monitored by thermocouple or equivalent means. If the sensor does not register that a flame is present, the flare is automatically shut down. All pilot flame outages are recorded and the flare is shut down until such time as the pilot flame operation is restored.

Sample ID	Methane (%)	Carbon Dioxide (%)	Oxygen (%)	Nitrogen (%)
Flare #1	48	37	1.3	6.9
Flare #1 (DUP)	48	37	1.3	6.8
Flare #2	49	37	1.1	6.2
Flare #3	34	26	7.2	25

Methane concentrations ranging from 34 percent to 49 percent were measured at the flare. To determine the net heating value of the gas, Golder used use an average methane concentration of 43.7 percent.

A published value was utilized for the net heat of combustion of methane. According to Chemistry: The Central Science 2nd Edition, by Theodore L. Brown and H. Eugene LeMay, Jr., it has been found experimentally that 802 kJ of heat is produced when 1 mole of methane is burned in a constant pressure system.

It follows that:

$$(802\frac{kJ}{mole})*(\frac{1000J}{1kJ}) = 802{,}000\frac{J}{mole}$$

Since, 1 cal = 4.184 J:

$$(802{,}000\frac{J}{mole})*(\frac{1cal}{4.184J}) = 191{,}682\frac{cal}{mole} = 191.682\frac{kcal}{mole}$$

$$(191.682\frac{kcal}{mole})*(\frac{mole}{16.04g}) = 11.950\frac{kcal}{g}$$

$$H_t = 1.74*10^{-7}(\frac{1}{ppm})(\frac{mole}{scm})(\frac{MJ}{kcal})(437{,}000ppm)(11.950\frac{kcal}{g})(16.04\frac{g}{mole})$$

H_t = 14.57 MJ/scm

The minimum allowable net heating value of the gas being combusted at the non-assisted flare at the CDF Landfill is 7.45 MJ/scm. The actual net heating value of the sample collected at the CDF Landfill is 14.57 MJ/scm as determined using methods and procedures specified in paragraph (f) of 40 CFR Section 60.18.

EXIT VELOCITY OF THE COMBUSTED GAS

The exit velocity was calculated per 40 CFR§60.18(f)(4) using Method 2D, Measurement of Gas Volumetric Flow Rates in Small Pipes and Ducts, to determine the volumetric flow rate through the flare stack. Method 2D applies to measurements made before the emission control device; i.e., in the horizontal piping wherein an appropriate flow rate meter is installed between the blower outlet and the flare flame arrestor.

The flow rate of LFG through this horizontal pipe was determined using a flow meter that has been calibrated for the type of gas being measured (density, moisture content, etc.). Absolute temperature and absolute pressure were measured and used to calculate volumetric flow and standard conditions.

The flow meter permits measurement of the stack flow rate to within five percent of its true value and has a capacity range sufficient to accommodate the minimum and maximum flow rates of the current blower and flare assembly.

Per 40 CFR §60.18(f)(3), the net heating value of the gas conveyed to the flare and monitored by the thermal dispersion flow meter was calculated using the concentration of the principal combustible component (methane being the far greatest percentage) as calculated by Method 3C, Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources.

Although the regulations indicate that Method 18, Measurement of Gaseous Organic Compound Emissions by Gas Chromatography, is required, in a letter dated July 11, 2005 (Attachment B), the United States Environmental Protection Agency (EPA) granted the CDF facility permission to use Method 3C as an alternative to Method 18 to determine the compliance of the utility flare combusting landfill gas. The EPA stated that the alternative method is acceptable because the major components of landfill gas are known to be methane and carbon dioxide. The concentrations of organic compounds other than methane are minimal and their contributions to the heating value or molecular weight calculation can be considered negligible.

The EPA went on further to state that the requirement in §60.18(a)(3) to test for hydrogen with ASTM D1946 was waived in this case due to the low levels of hydrogen in landfill gas. Oxygen and nitrogen can be present in landfill gas in substantial quantities, and the Method 3C analysis must include these for the molecular weight determination. Method 3C was also granted for use in place of Method 3A to determine the landfill gas molecular weight for calculating flare gas exit velocity under §60.18(c)(4).

Using the approach outlined in 40 CFE§60.18(f)(4), the exit velocity of the flare was determined by dividing the volumetric flow rate, 1801 scfm, by the free cross-sectional area of the flare tip, 113.1 in^2 (0.785 ft^2).

$$\frac{1801 ft^3}{\min} * \frac{1}{113.1 in^2} * \frac{144 in^2}{1 ft^2} = 2293.0 ft/\min$$

$$\frac{2293.0 ft}{\min} * \frac{1 \min}{60 \sec} = 38.22 ft/\sec$$

The calculated exit velocity for the CDF flare is 38.22 ft/sec, which complies with the 40 CFR §60.18(f)(4)(i) design velocity of less than 60 feet per second.

Furthermore, according to 40 CFR Section 60.18(f)(5) the maximum permitted velocity, Vmax, shall be determined by the following equation:

$$\log_{10}(V_{max}) = (H_t + 28.8)/31.7$$
$$V_{max} = 24.10 \text{ m/sec} = 79.07 \text{ ft/sec}$$

The exit velocity of the CDF flare was 11.64 m/sec or 38.22 feet/sec, which is less than both V_{max} as specified in 40 CFR Section 60.18(f)(4) and 122m/sec (400 ft/sec) as specified in 40 CFR Section 60.18(c)(4)(iii).

SUMMARY

The flare performance test was completed on July 22, 2005, after observing the maximum anticipated flow rate at which the blower/flare assembly in its current GCCS configuration is operated.

We appreciate the opportunity to provide our continuing services to S2L, Inc. at the Central Disposal Facility in Brevard County, Florida. If you have any questions or require additional information, please do not hesitate to call.

Very truly yours,

GOLDER ASSOCIATES INC.

Dana Beth Mehlman

Dana B. Mehlman
Staff Geotechnical Engineer

Kevin S. Brown, P.E
Senior Project Manager and Associate

DBM/KSB/ksb

X:\Clients\S2Li\043-3881.002 - Flare Performance\200_DraftReports\Flare Perf Test.doc

Field Collection Data
Brevard County Flare Performance Test
22-Jul-05

Time	Flow Rate Reading (scfm)	Static Pressure mm Hg	Static Pressure in Hg	Temperature °F	Temperature °C
10:00	1791			1255	679.4
10:15	1792			1263	683.9
10:30	1799			1257	680.6
10:35	1806			1265	685.0
10:45	1796			1260	682.2
11:00	1803			1262	683.3
11:10	1818			1261	682.8
11:15	1799			1264	684.4
11:25	1806			1253	678.3
11:45	1798			1260	682.2
12:00	1807			1258	681.1
AVE	**1801**	**#DIV/0!**		**1260**	**682**

ATTACHMENT A
LABORATORY RESULTS

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 #: 0507518

Work Order Summary

CLIENT:	Ms. Dana Mehlman Golder Associates, Inc. 3730 Chamblee Tucker Road Atlanta, GA 30341	**BILL TO:**	Ms. Dana Mehlman Golder Associates, Inc. 3730 Chamblee Tucker Road Atlanta, GA 30341
PHONE:	770-496-1893	**P.O. #**	
FAX:	770-934-9476	**PROJECT #**	
DATE RECEIVED:	07/25/2005	**CONTACT:**	DeDe Dodge
DATE COMPLETED:	08/05/2005		

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.
01A	Flare #1	Modified Method 3C	8.0 "Hg
01AA	Flare #1 Duplicate	Modified Method 3C	8.0 "Hg
02A	Flare #2	Modified Method 3C	7.0 "Hg
03A	Flare #3	Modified Method 3C	6.0 "Hg
04A	Lab Blank	Modified Method 3C	NA
05A	LCS	Modified Method 3C	NA

CERTIFIED BY: Linda L. Freeman

Laboratory Director

DATE: 08/05/05

LABORATORY NARRATIVE
Modified Method 3C
Golder Associates, Inc.
Workorder# 0507518

Three 1 Liter Silonite Canister samples were received on July 25, 2005. The laboratory performed analysis via Modified EPA Method 3C for Oxygen, Nitrogen, Carbon Dioxide and Methane using GC/TCD. The method involves direct injection of 1.0 mL of gas sample. The analytical system consists of a multidimensional gas chromatograph equipped with a variety of gas switching valves and columns. See the data sheet for the reporting limits.

Requirement	*Method 3C*	*ATL Modifications*
Daily Calibration Check	Single point standard concentration within 20 % of the sample concentration	A Continuing Calibration standard, %D ± 15 %
Sample Analysis	Analyze samples in duplicate, the peak area for two consecutive runs agree within 5 % of their average, analyze samples until consistent area obtained	Report duplicate analysis at a frequency of 10 % of the samples with %RPD </= 30 % for hits > 5 X's the RL.
Reporting Limit/Unit	10 ppmv	0.1 % (1000 ppmv)
Final Result Correction	Correct for temperature & moisture	No corrections

Receiving Notes

There were no receiving discrepancies.

Analytical Notes

There were no analytical discrepancies.

Definition of Data Qualifying Flags

Seven qualifiers may have been used on the data analysis sheets and indicate as follows:
B - Compound present in laboratory blank greater than reporting limit.
J - Estimated value.
E - Exceeds instrument calibration range.
S - Saturated peak.
Q - Exceeds quality control limits.
U - Compound analyzed for but not detected above the detection limit.
M - Reported value may be biased due to apparent matrix interferences.

File extensions may have been used on the data analysis sheets and indicates as follows:
a-File was requantified
b-File was quantified by a second column and detector

r1-File was requantified for the purpose of reissue

AIR TOXICS LTD.

Summary of Detected Compounds
MODIFIED EPA METHOD 3C GC/TCD

Client Sample ID: Flare #1

Lab ID#: 0507518-01A

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.28	1.3
Nitrogen	0.28	6.9
Methane	0.28	48
Carbon Dioxide	0.28	37

Client Sample ID: Flare #1 Duplicate

Lab ID#: 0507518-01AA

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.28	1.3
Nitrogen	0.28	6.8
Methane	0.28	48
Carbon Dioxide	0.28	37

Client Sample ID: Flare #2

Lab ID#: 0507518-02A

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.26	1.1
Nitrogen	0.26	6.2
Methane	0.26	49
Carbon Dioxide	0.26	37

Client Sample ID: Flare #3

Lab ID#: 0507518-03A

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.25	7.2
Nitrogen	0.25	25
Methane	0.25	34
Carbon Dioxide	0.25	26

AIR TOXICS LTD.

Client Sample ID: Flare #1

Lab ID#: 0507518-01A

MODIFIED EPA METHOD 3C GC/TCD

File Name:	m072922	Date of Collection: 7/22/05	
Dil. Factor:	2.76	Date of Analysis: 7/29/05 07:00 PM	

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.28	1.3
Nitrogen	0.28	6.9
Methane	0.28	48
Carbon Dioxide	0.28	37

Container Type: 1 Liter Silonite Canister

AIR TOXICS LTD.

Client Sample ID: Flare #1 Duplicate

Lab ID#: 0507518-01AA

MODIFIED EPA METHOD 3C GC/TCD

File Name:	m072923	Date of Collection: 7/22/05	
Dil. Factor:	2.76	Date of Analysis: 7/29/05 07:22 PM	

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.28	1.3
Nitrogen	0.28	6.8
Methane	0.28	48
Carbon Dioxide	0.28	37

Container Type: 1 Liter Silonite Canister

AIR TOXICS LTD.

Client Sample ID: Flare #2

Lab ID#: 0507518-02A

MODIFIED EPA METHOD 3C GC/TCD

File Name:	m072924	Date of Collection:	7/22/05
Dil. Factor:	2.64	Date of Analysis:	7/29/05 07:52 PM

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.26	1.1
Nitrogen	0.26	6.2
Methane	0.26	49
Carbon Dioxide	0.26	37

Container Type: 1 Liter Silonite Canister

AIR TOXICS LTD.

Client Sample ID: Flare #3

Lab ID#: 0507518-03A

MODIFIED EPA METHOD 3C GC/TCD

File Name:	m072925	Date of Collection:	7/22/05
Dil. Factor:	2.53	Date of Analysis:	7/29/05 08:13 PM

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.25	7.2
Nitrogen	0.25	25
Methane	0.25	34
Carbon Dioxide	0.25	26

Container Type: 1 Liter Silonite Canister

AIR TOXICS LTD.

Client Sample ID: Lab Blank

Lab ID#: 0507518-04A

MODIFIED EPA METHOD 3C GC/TCD

File Name:	m072905	Date of Collection: NA	
Dil. Factor:	1.00	Date of Analysis: 7/29/05 10:54 AM	

Compound	Rpt. Limit (%)	Amount (%)
Oxygen	0.10	Not Detected
Nitrogen	0.10	Not Detected
Methane	0.10	Not Detected
Carbon Dioxide	0.10	Not Detected

Container Type: NA - Not Applicable

AIR TOXICS LTD.

Client Sample ID: LCS

Lab ID#: 0507518-05A

MODIFIED EPA METHOD 3C GC/TCD

File Name:	m072904	Date of Collection: NA	
Dil. Factor:	1.00	Date of Analysis: 7/29/05 10:32 AM	

Compound	%Recovery
Oxygen	109
Nitrogen	97
Methane	99
Carbon Dioxide	105

Container Type: NA - Not Applicable

ATTACHMENT B
EPA LETTER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

JUL 2005

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Dana B. Mehlman
Golder Associates, Inc.
3730 Chamblee Tucker Road
Atlanta, Georgia 30341

Dear Ms. Mehlman:

In your June 28, 2005 letter, you asked permission to use Method 3C as an alternative to Method 18 and ASTM D1946 to determine the compliance of a flare combusting landfill gas at the Brevard County Central Disposal Facility with 40 CFR Part 60, Subpart WWW, Standards of Performance for Municipal Solid Waste Landfills. Subpart WWW requires open flares to comply with the general flare provisions under § 60.18. This request has been approved several times before for use at facilities similar to yours. Specifically, you desire to use Method 3C in place of Methods 18 and ASTM D1946 to determine landfill gas components for calculating net heating value under § 60.18 (c)(3).

Your requested alternative method is acceptable because the major components of landfill gas are known to be methane and carbon dioxide. The concentrations of organic compounds other than methane are minimal and their contributions to the heating value or molecular weight calculation are normally negligible. Therefore, Method 3C is more appropriate for this application than Method 18. The requirement in § 60.18(a)(3) to test for hydrogen with ASTM D1946 is waived in this case due to the low levels of hydrogen in landfill gas. Oxygen and nitrogen, on the other hand, can be present in landfill gas in substantial quantities. The analysis must include these if Method 3C is used in place of Method 3A to determine the landfill gas molecular weight for calculating flare gas exit velocity under § 60.18(c)(4).

We therefore grant you permission to use Method 3C to determine flare gas heating value, molecular weight, and moisture content under Subpart WWW. A minimum of three 30-minute Method 3C samples must be taken and analyzed for compliance determination. This is a site-specific method approval and applies only to the testing of the utility flare at the Brevard County Central Disposal Facility in Cocoa, Florida.

If you have questions or would like to discuss the matter further, please call Foston Curtis at (919) 541-1063, or you may e-mail him at curtis.foston@epa.gov.

Sincerely,

Conniesue B. Oldham

Conniesue B. Oldham, Ph.D., Group Leader
Air Measurements and Quality Group

APPENDIX F

Caterpillar, Inc.
Model G3520C 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
EXHAUST MANIFOLD:	DRY	NOx EMISSION LEVEL:	0.5 g/bhp-hr
COMBUSTION:	LOW EMISSION	FUEL LHV (BTU/SCF):	456
		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)	%	**41.3**	**39.7**	**37.2**
ENGINE EFFICIENCY	(NOMINAL)	(3)	%	40.3	38.7	36.3
THERMAL EFFICIENCY	(NOMINAL)	(4)	%	39.9	40.0	39.6
TOTAL EFFICIENCY	(NOMINAL)	(5)	%	80.2	78.7	75.9

ENGINE DATA						
FUEL CONSUMPTION	**(ISO 3046/1)**	(6)	**BTU/bhp-hr**	**6170**	**6411**	**6843**
FUEL CONSUMPTION	(NOMINAL)	(6)	BTU/bhp-hr	6320	6568	7010
AIR FLOW (77 °F, 14.7 psi)		(7)	SCFM	4360	3309	2294
AIR FLOW		(7)	lb/hr	19331	14670	10171
COMPRESSOR OUT PRESSURE			in. HG (abs)	100.2	75.2	52.7
COMPRESSOR OUT TEMPERATURE			°F	361	289	208
AFTERCOOLER AIR OUT TEMPERATURE			°F	141	138	137
INLET MAN. PRESSURE		(8)	in. HG (abs)	91.6	69.6	48.3
INLET MAN. TEMPERATURE	(MEASURED IN PLENUM)	(9)	°F	141	138	137
TIMING		(10)	°BTDC	28	28	28
EXHAUST STACK TEMPERATURE		(11)	°F	896	942	964
EXHAUST GAS FLOW (@ stack temp.)		(12)	CFM	12045	9469	6682
EXHAUST MASS FLOW		(12)	lb/hr	21569	16415	11412

EMISSIONS DATA					
NOx (as NO2)	(13)	g/bhp-hr	0.5	0.5	0.5
NTE CO	(14)	g/bhp-hr	4.2	4.28	4.37
NOMINAL CO	(15)	g/bhp-hr	2.5	2.5	2.5
THC (molecular weight of 15.84)	(14)	g/bhp-hr	5.34	6.04	7.31
NMHC (molecular weight of 15.84)	(14)	g/bhp-hr	0.81	0.91	1.1
EXHAUST O2	(16)	% DRY	8.5	8.3	8.1
LAMBDA	(16)		1.70	1.65	1.61

HEAT BALANCE DATA					
LHV INPUT	(17)	BTU/min	235181	183288	130422
HEAT REJECTION TO JACKET	(18)	BTU/min	25082	22244	18780
HEAT REJECTION TO ATMOSPHERE	(19)	BTU/min	7210	6034	4857
HEAT REJECTION TO LUBE OIL	(20)	BTU/min	9888	9338	8840
HEAT REJECTION TO EXHAUST (LHV to 77°F)	(21)	BTU/min	73582	60917	44770
HEAT REJECTION TO EXHAUST (LHV to 350°F)	(21)	BTU/min	55468	46004	33318
HEAT REJECTION TO A/C - STAGE 1	(22)	BTU/min	13345	5012	-474
HEAT REJECTION TO A/C - STAGE 2	(23)	BTU/min	9410	6751	4326

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 DEPENDANT 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	0.92	0.89	0.86	0.82	0.79	0.76	0.73	0.71	0.68	0.65	0.63	0.60
120	0.97	0.94	0.90	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	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.65	0.62
100	1.00	0.97	0.94	0.90	0.87	0.84	0.80	0.77	0.74	0.71	0.69	0.66	0.63
90	1.00	0.99	0.95	0.92	0.88	0.85	0.82	0.79	0.76	0.73	0.70	0.67	0.64
80	1.00	1.00	0.97	0.94	0.90	0.87	0.83	0.80	0.77	0.74	0.71	0.68	0.66
70	1.00	1.00	0.99	0.95	0.92	0.88	0.85	0.82	0.79	0.75	0.72	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	0.95	0.92	0.88	0.85	0.82	0.78	0.75	0.72	0.69

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	1.34	1.39	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41
120	1.27	1.32	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34	1.34
110	1.20	1.25	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27	1.27
100	1.14	1.18	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
90	1.07	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)							
			Overal SPL	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 khz
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

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 039 feet to the site altitude for each additional inch of H2O of exhaust stack pressure greater than spec sheet conditions. Add 070 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 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 (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 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

Atlantic County Landfill Energy
CAT G3520C Gas IC Engine Test Data

Post-it® Fax Note 7671	Date 10/6	# of pages ▶ 3
To David Darenzo	From M. Klein	
Co./Dept.	Co. NJDEP	
Phone #	Phone # 609-530-4041	
Fax # 734-464-4368	Fax # -4504	

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ATLANTIC ANALYTICAL LABORATORY

Landfill Gas Analysis Report

ACLE c/o DCO Energy
17 Gordon's Alley Suite 100
Atlantic City, NJ 08401
609-345-8455 (Fax: 609-345-8452)
Attn: Ron Howley E-mail: rhowley@dcoenergy.com

AAL Number: 4117
Received On: 04/18/05
Report Date: 04/27/05
PO Number:

Sample ID. 1 Landfill Gas Sample
Sample ID. ACLE 1.6MW Eng/Gen – Fuel Supply ACUA Landfill Gas
Sample ID. 500 cc ss Cyl AAL #233 and 2 – 5L Tedlar Bags

Sampled On: 4/14/05
Sample Point: na

Composition (Normalized, % v/v)

Non-Hydrocarbon Gases	Result	D.L.
Nitrogen:	12.16	0.001
Oxygen:	0.087	0.005
Carbon Dioxide:	38.33	0.001
Carbon Monoxide:	nd	0.001
Hydrogen:	nd	0.05
Helium:	–	0.005
Water Vapor:	1.01	0.001

Hydrocarbons	Result	D.L.
Methane:	49.43	0.001
Ethylene:	nd	0.001
Ethane:	nd	0.001
Propylene:	nd	0.001
Propane:	nd	0.001
Isobutane:	nd	0.001
n-Butane:	nd	0.001
Butenes:	nd	0.001
Isopentane:	nd	0.001
n-Pentane:	nd	0.001
Pentenes:	nd	0.001
Hexanes +:	nd	0.001

	ppm v/v	D.L.	ppm w/w	D.L.	Grains/100ft^3	D.L.
Total Sulfur (as H_2S):	360	3	720	.6	24	0.2

Comments:

ATLANTIC ANALYTICAL LABORATORY
P.O. BOX 220 • SALEM INDUSTRIAL PARK • BUILDING #4 • WHITEHOUSE, N. J. 08888
PHONE 908-534-5600 • FAX 908-534-2017

BEST AVAILABLE COPY

Sample ID: DCO Energy

AAL Number: 4117

0119

Elemental Composition (Normalized, % w/w)

Element	Result
Carbon Content (% C, w/w):	37.3
Hydrogen Content (% H, w/w):	7.0
Oxygen Content (% O, w/w):	43.57
Nitrogen Content (% N, w/w):	12.06

Heat of Combustion & Physical Properties (by ASTM D 3588-91)

I. @ ASTM Base Conditions; 14.696 psia, 60°F, dry gas format.	Result
Net Heat of Combustion (Lower Heating Value, Btu/ft.^{3}):	449
Gross Heat of Combustion (Higher Heating Value, Btu/ft.^{3}):	499
Gross Heat of Combustion (Water Saturated Gas Format, Btu/ft.^{3}):	490
Net Heat of Combustion (Lower Heating Value, Btu/lb.):	6038
Gross Heat of Combustion (Higher Heating Value, Btu/lb.):	6706
Density (lb./ft.^{3}):	0.0744
Specific Gravity (vs. dry/normal air):	0.975
Compressibility Factor (z):	0.997

II. @ ASME Base Conditions; 14.73 psia, 60°F, dry gas format.	Result
Net Heat of Combustion (Lower Heating Value, Btu/ft.^{3}):	451
Gross Heat of Combustion (Higher Heating Value, Btu/ft.^{3}):	500
Gross Heat of Combustion (Water Saturated Gas Format, Btu/ft.^{3}):	492
Net Heat of Combustion (Lower Heating Value, Btu/lb.):	6038
Gross Heat of Combustion (Higher Heating Value, Btu/lb.):	6706

D.L. = instrumental detection limit for the reported analyte. nd = indicates the concentration is less than the accompanying report detection limit. -- = test not performed. % = parts per hundred (percent). ppm = parts per million. w/w = weight analyte/weight sample format. v/v = volume analyte/volume sample format (equivalent to mole fraction for normalized, ideal gas mixtures). Conversions: 0.0001% = 1 ppm.

ATLANTIC ANALYTICAL LABORATORY, INC.
P.O. BOX 220 • SALEM INDUSTRIAL PARK • BUILDING #4 • WHITEHOUSE, N.J. 08888
PHONE 908-534-5600 • FAX 908-534-2017

ATLANTIC ANALYTICAL LABORATORY

David Derenzo

From: "Michael Klein" <Michael.Klein@dep.state.nj.us>
To: <dderenzo@derenzo.com>
Sent: Friday, August 26, 2005 8:19 AM
Subject: Re: OPRA Request #28014, ACLE

The LFG flow rate was 547, 542 & 540 scfm for the three test runs, respectively. As I had predicted, we rejected the VOC tests and required retests.

Michael A. Klein
NJDEP - BTS
michael.klein@dep.state.nj.us

>>> David Derenzo <dderenzo@derenzo.com> 08/25/05 01:42PM >>>
Mike

Was fuel flow to the CAT 3520 engine measured during the compliance test,
and if so how can I get the data.

Thanks

David Derenzo

----- Original Message -----
From: "Michael Klein" <Michael.Klein@dep.state.nj.us>
To: <dderenzo@derenzo.com>
Sent: Wednesday, June 22, 2005 8:18 AM
Subject: Re: OPRA Request #28014, ACLE

> Report was received on 6/16. I've faxed you the information you
> requested along with the tester's technical discussion. My quick
glance
> at this information tells me we will likely be requiring retests for
VOC
> DRE using Method 25 on the inlet and outlet. Can't say for sure
until
> we actually review the report.
>
> Michael A. Klein
> NJDEP - BTS
> michael.klein@dep.state.nj.us
>
>>>> David Derenzo <dderenzo@derenzo.com> 06/21/05 04:28PM >>>
> Mike
>
> Our client recently (today) inquired about the status of the data.
I

APPENDIX H

Brevard Energy, LLC.
Regulated Air Pollutant Emission Rate Calculations

APPENDIX H-1

Brevard Energy, LLC
Criteria Air Pollutant Emission Rate Calculations

Summary of Criteria Air Pollutant (and total HAP) Emission Rates
Internal Combustion Engine

1-CAT® G3520C IC Engine Specifications			6 -CAT® G3520C IC Engines	
Engine output	2233	hp	-	
Min. LFG LHV	420.0	Btu/scf	-	
Heat input rate (LHV)	14.64	MMBtu/hr	87.84	MMBtu/hr
Fuel consumption	34,857	scf/hr	209142.86	scf/hr
	581.0	scfm	3485.71	scfm
	0.837	MMscf/day	5.02	MMscf/day

		Pollutant Emission Factors			Pollutant Emission Rates	
Regulated Pollutant		(g/bhp-hr)	(lb/MMscf)	(lb/MMBtu)	(lb/hr)	(TpY)
Nitrogen Oxides	NO_X	0.60	--	--	2.95	12.94
Carbon Monoxide	CO	2.75	--	--	13.54	59.30
Sulfur Dioxide	SO_2	--	27.5	0.065	0.96	4.20
VOC	VOC	0.28	--	--	1.37	5.99
Particulate Matter	PM_{10}	0.24	--	--	1.18	5.17
Hazardous Air Pollutants	HAPs	--	13.8	0.033	0.48	2.11
Hydrogen Chloride	HCl	--	12.0	0.028	0.42	1.82

Notes

Section 4.0 of this document provides engine emission data for NOx, CO, VOC/NMOC, PM_{10} and HAPs

Table H-2 provides lb./MMscf emission data for SO_2

Table H-6 provides lb./MMscf emission data for total HAPs

Sulfur Dioxide Emission Factor for LFG Combustion

LFG Influent Sulfur Compound	EPA AP-42 Concentrations (ppmv)	Utilized Concentrations (ppmv)	Molecular Formula	No. Sulfur Atoms	Sulfur Content as H_2S (ppmv)	Resulting SO_2 Emission Rate (lb./MMcf)
Hydrogen sulfide	35.50	150.0 [A]	H_2S	1	150.0 [C]	24.94 [D]
Carbon disulfide	0.58	0.58 [B]	CS_2	2	1.2	0.39
Carbonyl sulfide	0.49	0.49 [B]	CSO	1	0.5	0.08
Dimethyl sulfide	7.82	7.82 [B]	C_2H_6S	1	7.8	1.30
Ethyl mercaptan	2.28	2.28 [B]	C_2H_6S	1	2.3	0.38
Methyl mercaptan	2.49	2.49 [B]	CH_4S	1	2.5	0.41
Total					**164.2**	**27.50** [E]

Notes

A. Conservative concentration from the review of LFG sample measurements from numerous landfills by Derenzo and Associates, Inc.

B. Default concentration for LFG constituents from USEPA Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume I: Stationary Point and Area Sources (AP-42), Table 2.4-1, which is provided at the end of this Appendix

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

D. Sample calculation: SO_2 generation from hydrogen sulfide (H_2S):

(150.0 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 24.94 lb SO_2/MMcf LFG

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

(164.2 scf H_2S/MMcf LFG) (1 scf SO_2/scf H_2S) (64.06 lb.SO_2/mol) / (385.3 ft^3/mol)
= 27.5 lb SO_2/MMcf LFG

Fuel Sulfur Content Calculation (% Weight)

Expected fixed gas concentrations[A]:	CH_4	45.0% vol.
	CO_2	40.0% vol.
	O_2	5.0% vol.
	Balance N_2	10.0% vol.

Calculated LFG molecular weight:
(16) (%CH_4) + (44) (% CO_2) + (32) (%O_2) + (28) (%N_2) = 29.2 g/mol

LFG sulfur content: **164.2 ppm H_2S**

LFG sulfur content
(164.2 mol H_2S) / (10^6 mol LFG) (32 g S/mol H_2S) / (29.2 g LFG/mol) = 0.018% wt.

A. Expected at LHV of 450 Btu/scf based on Landfill Energy Systems analyses (see Table 1 of main document)

APPENDIX H-2

Brevard Energy, LLC
HAP Emission Rate Calculations

LFG Constituent Combustion Potential Air Contaminant Emissions
Internal Combustion Engine

LFG Constituent	Landfill Gas Concentration[1] (ppm)	(mg/m³)	Molecular Weight (g/mol)	Destruction Effeciency[2] (%)	Emission (lb./hr)	Emission (TpY)
1,1,1-trichloroethane*	0.480	2.66	133.42	93.0%	0.000404	0.00177 [A]
1,1,2,2-tetrachloroethane*	1.110	7.75	167.85	93.0%	0.001175	0.00515
1,1-dichloroethane*	2.350	9.67	98.97	93.0%	0.001466	0.00642
1,1-dichloroethene*	0.200	0.81	96.94	93.0%	0.000122	0.00054
1,2-dichloroethane*	0.410	1.69	98.96	93.0%	0.000256	0.00112
1,2-dichloropropane*	0.180	0.85	112.98	93.0%	0.000128	0.00056
2-propanol (isopropyl alcohol)	50.100	125.22	60.11	86.1%	0.037703	0.16514
Acetone	7.010	16.93	58.09	86.1%	0.005098	0.02233
Acrylonitrile*	6.330	13.97	53.06	86.1%	0.004205	0.01842
Bromodichloromethane	3.130	21.32	163.83	93.0%	0.003233	0.01416
Butane	5.030	12.16	58.14	86.1%	0.003661	0.01604
Carbon disulfide*	0.580	1.84	76.13	86.1%	0.000553	0.00242
Carbon monoxide	141.000	164.22	28.01	86.1%	0.049446	0.21657
Carbon tetrachloride*	0.004	0.03	153.84	93.0%	0.000004	0.00002
Carbonyl sulfide*	0.490	1.22	60.07	86.1%	0.000369	0.00161
Chlorobenzene*	0.250	1.17	112.56	93.0%	0.000177	0.00078
Chlorodifluoromethane (Freon 22)	1.300	4.67	86.47	93.0%	0.000709	0.00310
Chloroethane*	1.250	3.35	64.52	93.0%	0.000508	0.00223
Chloroform*	0.030	0.15	119.39	93.0%	0.000023	0.00010
Chloromethane (methyl chloride)*	1.210	2.54	50.49	93.0%	0.000385	0.00169
Dichlorobenzene	0.210	1.28	147.00	93.0%	0.000195	0.00085
Dichlorodifluoromethane	15.700	78.93	120.91	93.0%	0.011969	0.05242
Dichlorofluoromethane	2.620	11.21	102.92	93.0%	0.001700	0.00745
Dichloromethane (methylene chloride)*	14.300	50.50	84.94	93.0%	0.007658	0.03354
Dimethyl sulfide (methyl sulfide)	7.820	20.20	62.13	93.0%	0.003063	0.01342
Ethane	889.000	1,111.90	30.08	86.1%	0.334792	1.46639
Ethanol	27.200	52.12	46.08	86.1%	0.015692	0.06873
Ethyl mercaptan (ethanethiol)[B]	2.280	5.89	62.13	99.0%	0.000128	0.00056
Ethylbenzene*	4.610	20.35	106.16	99.0%	0.000441	0.00193
Ethylene dibromide*	0.001	0.01	187.88	86.1%	0.000002	0.00001
Fluorotrichloromethane (Freon 11)	0.760	4.34	137.36	93.0%	0.000658	0.00288
Hexane*	6.570	23.54	86.17	86.1%	0.007088	0.03104
Hydrogen chloride*[C]	NA	NA	36.46	0.0%	0.416655	1.82495
Hydrogen sulfide*[D]	124.000	175.71	34.08	99.0%	0.003806	0.01667
Mercury (total)*	0.0003	0.00	200.61	0.0%	0.000005	0.00002

Notes
* 1990 CAA Amendments HAPs

1. Default concentration for LFG constituents from USEPA Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume I: Stationary Point and Area Sources (AP-42), Table 2.4-1, which is provided at the end of this Appendix

2. AP-42 default control efficiency values for IC engines, Table 2.4-3, which are provided at the end of this Appendix.

A. Sample calculation, 1,1,1 trichloroethane (TCE) emissions
(0.48 ft^3 TCE/MMcf LFG) (133.42 lb. TCE/mol) (1-0.93) / (387 ft^3 TCE/mol) (0.034857 MMscf/hr) = 0.000404 lb./hr. TCE

(0.000404 lb./hr. TCE) (8,760 hr./yr.) (1.0 ton/2,000 lb) = 0.00177 TpY

B. Ethyl mercaptan has an autoignition temperature of 570 F, therefore a 99% DE was used.

C. Based on the Hydrogen chloride emission factor presented in Table H-6.

D. Hydrogen sulfide has an autoignition temperature of 500 F, therefore a 99% DE was used.

LFG Constituent Combustion Potential Air Contaminant Emissions
Internal Combustion Engine

LFG Constituent	Landfill Gas Concentration[1] (ppm)	Landfill Gas Concentration[1] (mg/m^3)	Molecular Weight (g/mol)	Destruction Effeciency[2] (%)	Emission (lb./hr)	Emission (TpY)
Methyl ethyl ketone*	7.090	21.26	72.10	86.1%	0.006400	0.02803
Methyl isobutyl ketone*	1.870	7.79	100.16	86.1%	0.002345	0.01027
Methyl mercaptan	2.490	4.98	48.11	86.1%	0.001500	0.00657
Pentane	3.290	9.87	72.17	86.1%	0.002973	0.01302
Perchloroethylene*	3.730	25.72	165.83	93.0%	0.003900	0.01708
Propane	11.100	20.36	44.11	86.1%	0.006130	0.02685
t-1,2-dichloroethene	2.840	11.45	96.94	93.0%	0.001736	0.00760
Trichloroethylene (trichloroethane)*	2.820	15.41	131.40	93.0%	0.002336	0.01023
Vinyl chloride*	7.340	19.07	62.50	93.0%	0.002892	0.01267
Xylene*	12.100	53.41	106.16	86.1%	0.016082	0.07044

Notes
* 1990 CAA Amendments HAPs

1. AP-42 default concentrations for LFG constitiuents, which are provided at the end of this Appendix.

2. AP-42 default control efficiency values for IC engines, which are provided at the end of this Appendix.

LFG Combustion Hydrogen Chloride Emission Factor

Influent Chlorine Compounds	Landfill Gas Concentration[1] (ppm)	Molecular Formula	No. Chlorine Atoms	HCl Emission Factor (lb./MMcf)
1,1,1-trichloroethane	0.48	$C_2H_3Cl_3$	3	0.14 [a,b]
1,1,2,2-tetra chloroethane	1.11	$C_2H_2Cl_4$	4	0.42 [b]
1,1-dichloroethane	2.35	$C_2H_4Cl_2$.	2	0.44 [b]
1,1-dichloroethene	0.2	$C_2H_2Cl_2$	2	0.04 [b]
1,2-dichloroethane	0.41	$C_2H_4Cl_2$	2	0.08 [b]
1,2-dichloropropane	0.18	$C_3H_6Cl_2$	2	0.03 [b]
Bromodichloromethane	3.13	$CBrCl_2$	2	0.59 [b]
Carbon tetrachloride	0.004	CCl_4	4	0.00 [b]
Chlorobenzene	0.25	C_6H_5Cl	1	0.02 [b]
Chlorodifluoromethane	1.3	$CHFCl$	1	0.12 [b]
Chloroethane	1.25	C_2H_5Cl	1	0.12 [b]
Chloroform	0.03	$CHCl_3$	3	0.01 [b]
Chloromethane	1.21	CH_3Cl	1	0.11 [b]
Dichlorobenzene	0.21	$C_6H_4Cl_2$	2	0.04 [b]
Dichlorodifluoromethane	15.7	CF_2Cl_2	2	2.96 [b]
Dichlorofluoromethane	2.62	$CHFCl_2$	2	0.49 [b]
Dichloromethane	14.3	CH_2Cl_2	2	2.69 [b]
Fluorotrichloromethane	0.76	$CFCl_3$	3	0.21 [b]
Perchloroethylene	3.73	C_2Cl_4	4	1.41 [b]
Trichloroethylene	2.82	C_2HCl_3	3	0.80 [b]
t-1,2-dichloroethane	2.84	$C_2H_2Cl_2$	2	0.54 [b]
Vinyl chloride	7.34	C_2HCl	1	0.69 [b]
Total hydrogen chloride emission factor (lb./MMcf)				**11.95**

Notes
1. From AP-42 default concentrations as presented in Table H-4.

a. Assumes complete conversion of chloride to HCl, calculation for 1,1,1-trichloroethane (TCE):
(0.48 ft^3 TCE/MMcf LFG) (3 mol HCl/mol TCE) (36.46 lb. HCl/mol) / (387 ft^3/mol)
= 0.14 lb. HCl/MMcf LFG

b. Based on AP-42 default concentrations, which are provided at the end of this Appendix.

LFG Combustion Hazardous Air Pollutant Emission Factor
Internal Combustion Engine

HAPs[1]	Landfill Gas Concentration[2] (ppm)	Landfill Gas Concentration[2] (mg/m^3)	Molecular Weight (g/mol)	Destruction Effeciency[3] (%)	HAP Emission Factor (lb./MMcf)
1,1,1-trichloroethane	0.48	2.66	133.42	93.0%	0.012 [A]
1,1,2,2-tetrachloroethane	1.11	7.75	167.85	93.0%	0.034
1,1-dichloroethane	2.35	9.67	98.95	93.0%	0.042
1,1-dichloroethene	0.2	0.81	96.94	93.0%	0.004
1,2-dichloroethane	0.41	1.69	98.96	93.0%	0.007
1,2-dichloropropane	0.18	0.85	112.98	93.0%	0.004
Acrylonitrile	6.33	13.97	53.06	86.1%	0.121
Carbon disulfide	0.58	1.84	76.13	86.1%	0.016
Carbon tetrachloride	0.004	0.03	153.84	93.0%	0.000
Carbonyl sulfide	0.49	1.22	60.07	86.1%	0.011
Chlorobenzene	0.25	1.17	112.56	93.0%	0.005
Chloroethane	1.25	3.35	64.52	93.0%	0.015
Chloroform	0.03	0.15	119.39	93.0%	0.001
Chloromethane	1.21	2.54	50.49	93.0%	0.011
Dichloromethane	14.3	50.50	84.94	93.0%	0.220
Ethyl Benzene	4.61	20.35	106.16	86.1%	0.176
Ethylene dibromide	0.001	0.01	187.88	86.1%	0.000
Hexane	6.57	23.54	86.17	86.1%	0.203
Hydrogen chloride	NA	NA	36.46	0.0%	11.953 [B]
Mercury (total)	2.92E-04	0.00	200.61	0.0%	0.000
Methyl ethyl ketone	7.09	21.26	72.10	86.1%	0.184
Methyl isobutyl ketone	1.87	7.79	100.16	86.1%	0.067
Perchloroethylene	3.73	25.72	165.83	93.0%	0.112
Trichloroethylene	2.82	15.41	131.40	93.0%	0.067
Vinyl chloride	7.34	19.07	62.50	93.0%	0.083
Xylene	12.1	53.41	106.16	86.1%	0.461
Total HAP emission factor (lb./MMcf)					**13.81**

Notes

1. 1990 CAA Amendments Section 112(b) HAP
2. From AP-42 default concentrations as presented in Table H-4.
3. AP-42 default control efficiency values for IC engines, Table 2.4-3, which are provided at the end of this

A. Sample calculation, 1,1,1 trichloroethane (TCE) emissions
(0.48 ft^3 TCE/MMcf LFG) (133.42 lb. TCE/mol) (1-0.93) / (387 ft^3 TCE/mol)
=0.012 lb. TCE/MMcf LFG

B. Hydrogen chloride emission factor from Table H-5.

APPENDIX I

Brevard Energy, LLC
Ambient Impact Analyses
(Document will be submitted under separate cover upon its completion)

APPENDIX J

Caterpillar, Inc.
Model G3520C Engine Operation
And
Maintenance Manual

CATERPILLAR®

SEBU7681-06
February 2005

Operation and Maintenance Manual

G3500C and G3500E Generator Sets

B9P1-Up (Generator Set)
CWW1-Up (Generator Set)
CWY1-Up (Generator Set)
GAS1-Up (Generator Set)
GNX1-Up (Generator Set)
GSB1-Up (Generator Set)
GTX1-Up (Generator Set)
GZG1-Up (Generator Set)
GZH1-Up (Generator Set)
GZJ1-Up (Generator Set)
GZK1-Up (Generator Set)
GZL1-Up (Generator Set)
GZM1-Up (Generator Set)
GZN1-Up (Generator Set)
GZZ1-Up (Generator Set)
HAL1-Up (Generator Set)
HAT1-Up (Generator Set)
MAD1-Up (Generator Set)
SLY1-Up (Generator Set)
SSR1-Up (Generator Set)
SXY1-Up (Generator Set)
TJB1-Up (Generator Set)
TJC1-Up (Generator Set)
TJD1-Up (Generator Set)

Table of Contents

Operation Section

Lifting and Storage

i02138880

Product Lifting

SMCS Code: 7000; 7002

Engine Only

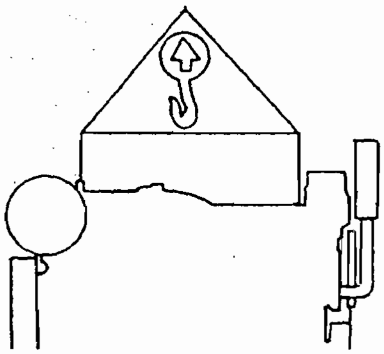

Illustration 23 g00103219

NOTICE
Never bend the eyebolts and the brackets. Only load the eyebolts and the brackets under tension. Remember that the capacity of an eyebolt is less as the angle between the supporting members and the object becomes less than 90 degrees.

When it is necessary to remove a component at an angle, only use a link bracket that is properly rated for the weight.

Use a hoist to remove heavy components. Use an adjustable lifting beam to lift the engine. All supporting members (chains and cables) should be parallel to each other. The chains and cables should be perpendicular to the top of the object that is being lifted.

Some removals require lifting fixtures in order to obtain proper balance and safety.

To remove the engine ONLY, use the lifting eyes that are on the engine.

Note: The lifting eyes must be removed before the engine is operated.

Lifting eyes are designed and installed for the specific engine arrangement. Alterations to the lifting eyes and/or the engine make the lifting eyes and the lifting fixtures obsolete. If alterations are made, ensure that proper lifting devices are provided. Consult your Caterpillar dealer for information regarding fixtures for proper engine lifting.

Generator Set

NOTICE
Do not use the engine lifting eyes to remove the engine and generator together.

A lifting plate is provided with the package generator set. Instructions for lifting the package generator set are stamped on the lifting plate.

Consult your Caterpillar dealer for information regarding proper fixtures and lifting devices.

Generator sets will not be level if you lift the unit from a single lifting point. A counterweight can be added between the package frame rails whenever the application requires frequent relocation of the unit. For complete information about adding the counterweight, consult your Caterpillar dealer.

The single point lifting eye is secured from the factory before being shipped. The correct orientation of the single point lifting eye will allow you to look through the eye when you stand at the side of the enclosure. The lifting eye may stretch when the package is lifted. This may cause the locking nuts to loosen. This could cause the lifting eye to swivel. Ensure that the lifting eye is correctly oriented on the packaged generator set. Ensure that the lifting eye is tightened to the correct torque before you lift the packaged generator set.

i02138884

Product Storage

SMCS Code: 7002

If the engine will not be started for several weeks, the lubricating oil will drain from the cylinder walls and from the piston rings. Rust can form on the cylinder liner surface, which will increase engine wear which can reduce engine service life.

To help prevent excessive engine wear, use the following guidelines:

- Complete all of the lubrication recommendations that are listed in this Operation and Maintenance Manual, "Maintenance Interval Schedule" (Maintenance Section).

- If freezing temperatures are expected, check the cooling system for adequate protection against freezing. Refer to this Operation and Maintenance Manual, "Refill Capacities and Recommendations" (Maintenance Section).

If an engine is out of operation and if use of the engine is not planned, special precautions should be made. If the engine will be stored for more than one month, a complete protection procedure is recommended.

Your Caterpillar dealer will have instructions for preparing the engine for extended storage periods.

For more detailed information on engine storage, refer to Special Instruction, SEHS9031, "Storage Procedure for Caterpillar Products".

Generator Storage

For information on generator storage, refer to this Operation and Maintenance Manual, "Generator Set Installation" (Operation Section).

BEST AVAILABLE COPY

Installation

i01856938

Generator Set Installation

SMCS Code: 7002

Receiving Inspection

If the generator is received during cold weather, allow the unit to reach room temperature before you remove the protective packing material. Warming the generator to room temperature will prevent the following problems:

- Water condensation on cold surfaces
- Early failures due to wet windings
- Early failures due to wet insulating materials

Unpacking and Storage

Moving the Generator

WARNING

Improper lift rigging can allow unit to tumble causing injury and damage.

NOTICE
Do not use the engine lifting eyes to remove the engine and generator together.

Unpack the equipment with care in order to avoid scratching painted surfaces. Move the unit to the mounting location. The unit can be moved by either of the following methods:

- Attach an overhead crane to the lifting eyes that are installed on the generator package.
- Use a lift truck in order to lift the generator.

The hoist and the hoist cables should have a rating that is greater than the weight of the generator. When the unit is moved, ensure that the generator is completely supported by the lift truck's fork tines. Also ensure that the generator is balanced on the lift truck's fork tines. Slide the fork tines beneath the attached skid in order to lift the generator.

Storage

Short Time Storage

If the generator is not installed immediately, store the generator in a clean area. This area should also have the following conditions: low humidity, stable humidity, and stable temperature. Space heaters must be energized in order to keep condensation from the windings. All accessory equipment that is supplied with the unit should be stored with the generator. The combined unit should be covered with a durable cover in order to protect against the following contaminants:

- Dust
- Dirt
- Moisture

Long Time Storage

A storage period in excess of six months should be preceded by the following preparation:

1. Install desiccant bags inside the exciter's cover and install desiccant bags inside the screen of the fan.
2. Seal the unit in a covering of plastic or other material that has been designed for that purpose.
3. Adequately tag the generator. This will ensure that preservative greases and desiccant bags are removed before the unit is placed in operation.

Bearing Inspection

Ball bearing generators use grease. This grease is subject to deterioration. If the generator is stored longer than one year, new ball bearings should be installed. These bearings should be greased to the proper level prior to being put into operation. If inspection indicates that bearings are free of rust or corrosion, and no noise or excessive vibration appear on start-up, replacement is not necessary.

Location

The location of the generator must comply with all local regulations. The location of the generator must also comply with all special industrial regulations. Locate the generator in an area that meets the following requirements:

- Clean
- Dry

- Well ventilated
- Easily accessible for inspection and maintenance

Do not obstruct air inlet openings. Do not obstruct discharge openings. Coolant flow must reach these openings. If the generator is exposed to harsh environmental conditions, the generator can be modified in the field in order to add filters and space heaters. In addition, a more rigid periodic maintenance schedule should be established.

Electrical Measurements

Measure the insulation resistance of each winding if the generator was exposed to the following conditions:

- Rapid changes in temperature
- Freezing
- Wet climate during shipment
- Wet climate during storage

Note: These tests should be conducted prior to any power connections that are being made. These tests should be conducted prior to any control connections that are being made.

Refer to the Generator Maintenance section of this manual in order to measure the following items:

- Exciter field (stator)
- Exciter armature (rotor)
- Generator field (rotor)
- Generator armature (stator)

Alignment

After the generator set has been placed in the final position, the generator must be aligned. Refer to these publications:

- Special Instruction, SEHS7654, "Alignment - General Instructions"
- Special Instruction, SEHS7259, "Alignment of Single-Bearing Generators"
- Special Instruction, REHS0177, "Alignment of the Close Coupled Two-Bearing Generators"

Protective Devices

The output to the load of the generator should always be protected with an overload protection device such as a circuit breaker or fuses. Fuses should be sized by using the lowest possible current rating. However, this rating must be above the current rating for full load. A common recommendation is 115 percent of rated current. Determine the size of fuses or determine the size of circuit breakers in accordance with NEMA, IEC, and Local Electrical Codes.

Features and Controls

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Performance Parameters

SMCS Code: 1000

Air/Fuel Ratio

The correct air/fuel ratio is very important for the following considerations:

- Detonation Margin
- Control of emissions
- Achieving optimum service life for the engine
- Environmental Regulations

If the air/fuel ratio is not appropriate for the fuel and the operating conditions, a failure of the engine may occur. The service life of the turbocharger, the valves, and other components may be reduced.

Any changes to the air/fuel ratio will affect the exhaust emissions. After adjustment, use an emissions analyzer to measure the exhaust emissions. Ensure that the engine is in compliance with local regulations for emissions.

Installation Before the Fuel Control Valve

The fuel flows from the main gas supply through the fuel filter. Usually, the fuel filter is a component of the design at the particular site. The customer is responsible for supplying clean, dry fuel to the engine. The fuel filter may be supplied by Caterpillar or by the customer. To prevent particles from entering the engine, a one micron filter is required. The filter must be properly sized for the required gas pressure.

For installation of the fuel filter, the recommended location is close to the engine before the engine's gas pressure regulator. Pressure gauges in the gas lines on each side of the fuel filter are recommended in order to monitor the filter's differential pressure. A manual shutoff valve in the gas line before the fuel filter will facilitate servicing of the filter.

The filtered fuel flows to the Gas Shutoff Valve (GSOV). For landfill applications, the GSOV must be supplied by the customer. For other applications, the GSOV may be supplied by Caterpillar or by the customer. The solenoid for the GSOV may be connected to engine's wiring harness or to a harness that is supplied by the customer. In either case, the customer may install a switch that can interrupt the circuit.

The control system is configured for a GSOV that i energize-to-run. This means that the GSOV must b energized in order for the engine to run. To enable the fuel flow, the ECM provides +Battery voltage to the solenoid for the GSOV. The valve opens and th fuel flows to the engine. When the control system shuts down the engine, the voltage is removed fron the solenoid. The valve closes and the fuel is shut o

The fuel flows through the GSOV to the gas pressure regulator. The regulator may be supplied b Caterpillar or by the customer. A regulated pressure of 7 to 35 kPa (1 to 5 psi) is recommended. Less pressure may result in reduced power. More pressu may result in instability.

Fuel Temperature

The system is designed for fuel temperatures less than 60 °C (140 °F). For optimum performance, the maximum recommended differential temperature fo the fuel and air is 2.8 °C (5 °F).

Temperature of the Air Supply

To avoid hot air from a generator, use ducting. For more information, refer to Application and Installatio Guide, LEKQ7250, "Air Intake". Consult your Caterpillar dealer for assistance.

Oil Consumption

The rate of oil consumption is called Brake Specific Oil Consumption (BSOC). The unit of measure is grams per brake kilowatt hour or pounds per brake horsepower hour. The BSOC depends on the engine model, the aspiration, the operating load, and the oil that is used. For information on calculating the BSOC, refer to Engine Data Sheet 96.2, LEKQ4028, "Oil Consumption Data".

Table 4 lists the normal mid-life BSOC for G3500 Engines under the following conditions:

- Load factor of 100 percent
- Maintenance is performed according to this Operation and Maintenance Manual, "Maintenance Interval Schedule".
- Caterpillar NGEO is used.

Table 4

BSOC for G3500 Engines	
Turbocharged Aftercooled Engine	0.426 g/bkw h (.0007 lb/bhp h)

i02292582

Sensors and Electrical Components

SMCS Code: 1900; 7400

Note: This section contains some general information about the engine electronic system and sensors. For more information, refer to Systems Operation/Testing and Adjusting.

Electronic System

The Caterpillar Electronic System is a complete electronic control system for gas engines. The following benefits are the most significant advantages of the electronic system:

- Air/Fuel ratio control
- Extensive system diagnostics
- Precise control of engine operation
- Protection from detonation
- Timing control of individual cylinders

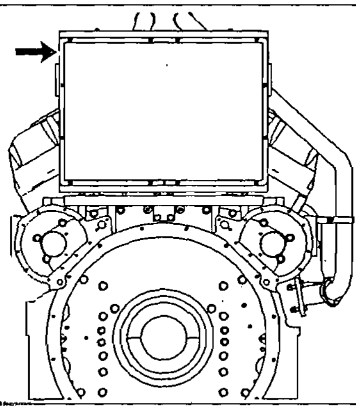

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Illustration 24
Junction box

Most of the functions of the electronic system are provided by the Engine Control Module (ECM). The ECM is a sealed unit that is located inside a junction box at the rear of the engine.

Five primary functions are supported by the ECM:

- Governing of the engine rpm
- Control of ignition
- Control of the air/fuel ratio
- Start/stop control
- Monitoring of engine operation

Governing of the Engine RPM

The ECM receives a signal from the speed/timing sensor. The ECM maintains the desired engine rpm through electrical control of the Proact actuator. The actuator regulates the throttle plate.

Control of Ignition

Each cylinder has an ignition transformer that is located on top of the valve cover. To initiate combustion in each cylinder, the ECM sends a pulse to the primary coil of the ignition transformer. The transformer increases the voltage which creates a spark across the spark plug electrode.

The transformers are grounded through the valve cover. Use caution when a valve cover is removed.

Always disconnect the ignition harness from the transformer when a valve cover is removed.

An ignition harness connects each transformer to the ECM.

Control of Air and Fuel

The ECM determines the desired volume for the flow rates of the air and fuel. The determination is based on the components: actual engine speed, actual load, MAP, MAT, and internal maps. Next, the ECM sends information on the desired fuel flow to the fuel metering valve via the CAN data link. The ECM adjusts the signal to the fuel metering valve in order to maintain emissions. The process is repeated continuously during engine operation.

Start/Stop Control

The ECM contains the logic and the inputs for controlling the starting and stopping of the engine. The logic for starting and stopping can be programmed by the customer. The ECM supplies positive "+" battery voltage to the starting motor relay and the gas shutoff valve.

The engine uses an energize-to-run system. The gas shutoff valve must remain energized in order to supply fuel to the engine. If power is removed from the gas shutoff valve, the fuel is shut off. The gas shutoff valve may be controlled by the customer.

Monitoring Engine Operation

Sensors are used in order to monitor engine operation. Wiring harnesses connect the sensors to the ECM. The ECM uses the information from the sensors in order to monitor the engine. The ECM also uses the information from the sensors in order to control the engine. The information is also used to generate event codes, and diagnostic codes. The codes can be read with a Caterpillar Electronic Technician (ET).

Event – An event is a result of abnormal engine operation. If abnormal engine operation is detected, the ECM generates an event code. The ECM can generate an alarm or a shutdown for abnormal engine operation. These conditions are some examples of events: high inlet air temperature, low oil pressure, and engine overspeed.

Diagnostic – A diagnostic code is a result of a problem with the operating system or with the monitoring system. The ECM uses sensors and internal circuitry to monitor the system components. If a problem develops in a component or a wiring harness, the control system will sense the problem. The control system will notify the operator by creating a diagnostic code. Some examples of conditions that activate diagnostics are a short in a circuit for a sensor, an open circuit, or a noisy signal.

Note: For detailed information on event codes and diagnostic codes, refer to Troubleshooting.

Sensors

Sensors provide information to the ECM. The information enables the ECM to control the engine as efficiently as possible over a wide range of operating conditions. The information is used for monitoring engine operation and for protecting the engine.

Illustration 25 shows the locations of the sensors.

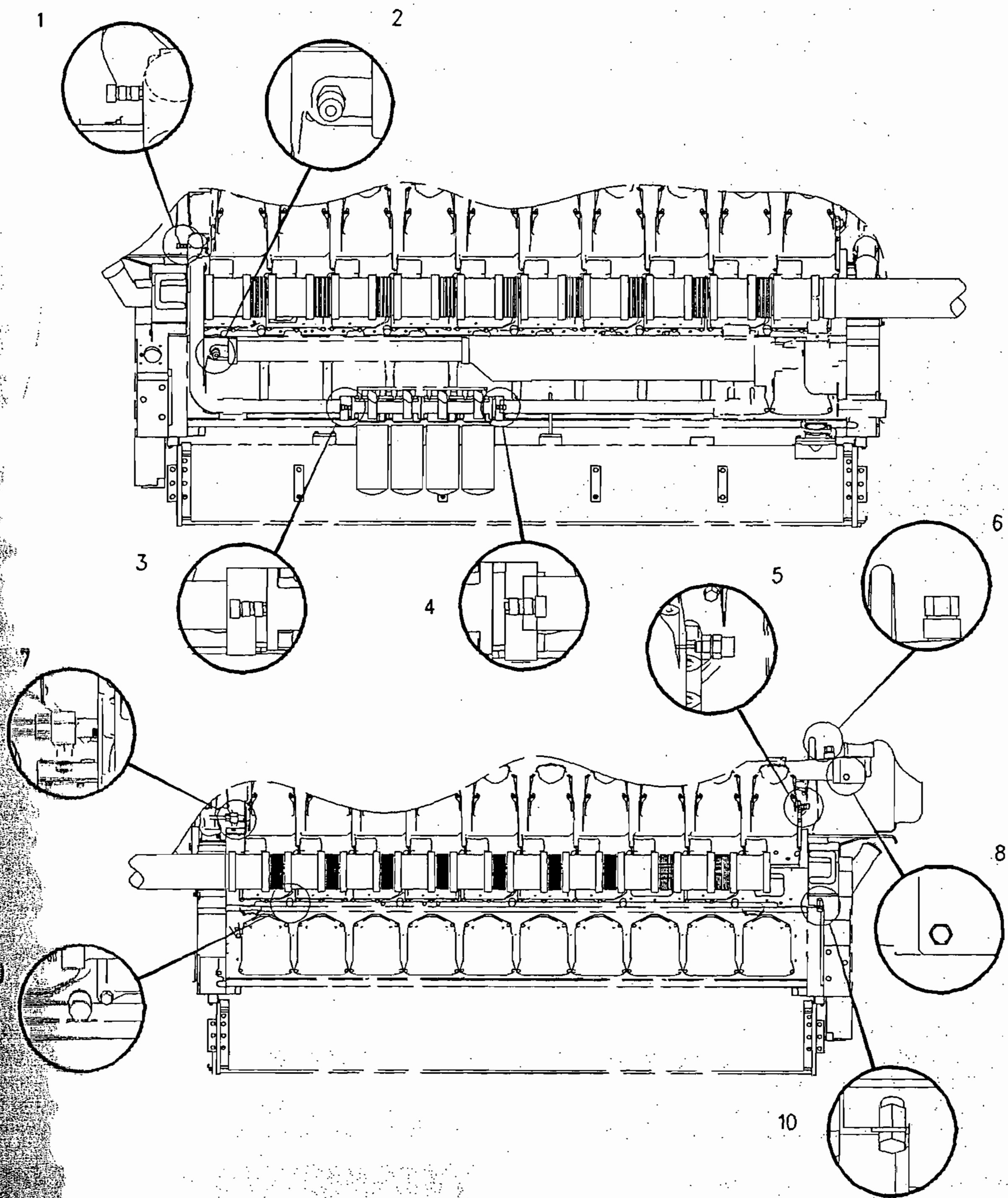

Illustration 26

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(1) Engine oil temperature sensor
(2) Jacket water pressure switch (inlet)
(3) Pressure sensor for unfiltered oil
(4) Pressure sensor for filtered oil
(5) Manifold air temperature sensor
(6) Jacket water pressure sensor (outlet)
(7) Manifold air pressure sensor
(8) Jacket water coolant temperature sensor
(9) Detonation sensor
(10) Speed/timing sensor

The functions of the sensors are described below.

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Engine oil temperature sensor (1) – An oil temperature sensor monitors the engine oil temperature. A high oil temperature will activate an alarm or a shutdown. The ECM compares the oil temperature to the engine coolant temperature. A high difference between the two temperatures will activate an alarm or a shutdown.

Jacket water pressure switch (2) – A pressure switch is located at the outlet of the oil cooler. The jacket water pressure switch is a limit switch for the coolant that is entering the block.

Oil pressure sensors (3) and (4) – The engine oil pressure is measured before the oil filters and after the oil filters. An alarm or a shutdown can be activated by any of the following occurrences: low filtered oil pressure, low oil filter differential pressure, and high oil filter differential pressure.

Manifold air temperature sensor (5) – A sensor for monitoring the air inlet temperature is located in the elbow after the number twenty cylinder head. Excessive inlet air temperature can activate an alarm or a shutdown.

Jacket water pressure sensor (6) – A pressure sensor is located at the outlet for the engine jacket water. If the outlet pressure is too low, the ECM will activate a shutdown.

Manifold air pressure sensor (7) – A sensor for monitoring the air inlet pressure is located in the front end of the manifold. Excessive inlet air temperature can activate an alarm or a shutdown.

Engine coolant temperature sensor (8) – The temperature sensor is located in the water temperature regulator housing. To monitor the coolant temperature, the element must be in contact with the coolant. If overheating occurs due to low coolant level, the sensor will not function properly. A high coolant temperature will activate an alarm or a shutdown. A low coolant temperature will only activate an alarm. The setpoints for the activation can be programmed with the Cat ET. The engine can be restarted after a shutdown due to high engine coolant temperature. However, another shutdown will occur after one minute if the temperature remains high.

Detonation sensors (9) – The detonation sensors monitor the engine for detonation in each cylinder. To eliminate detonation, the ECM retards the timing of the cylinder. If excessive detonation continues, the ECM will shut down the engine.

Speed/timing sensor (10) – The engine speed/timing sensor is located on the rear end of the left camshaft. The engine speed/timing sensor provides accurate information to the ECM about the position of the crankshaft and the engine rpm. The ECM uses the position of the crankshaft in order to determine ignition timing.

Integrated Temperature Sensing Module (ITSM)

The ITSM monitors thermocouples that are located at the exhaust port of each cylinder. Thermocouples are also mounted at the inlets and outlets to the turbochargers. The temperatures are broadcast over the Caterpillar data link for use with other modules.

The ITSM calculates the average temperature for each bank. Event codes are generated if the following conditions occur:

- The temperature is higher than the limit that is programmed.
- The temperature of a cylinder deviates significantly from the average temperature for all of the cylinders.

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Alarms and Shutdowns

SMCS Code: 7400

This section contains some general information about the function of typical engine protective devices.

The alarms and shutdowns are set at critical operating temperatures, pressures, or speeds in order to protect the engine from damage.

An alarm warns the operator when an abnormal operating condition occurs. The shutdowns stop the engine if a more critical operating condition occurs. The shutdowns help to prevent damage to the engine.

Shutdowns may cause unburned gas to remain in the air inlet and in the exhaust manifold.

⚠ WARNING

Unburned gas in the air inlet and exhaust system may ignite when the engine is started. Personal injury and/or property damage may result.

Before starting an engine that may contain unburned gas, purge the unburned gas from the air inlet and exhaust system. Refer to the topic on purging unburned gas in the "Starting the Engine" section.

If an engine protective device shuts down the engine, always determine the cause of the shutdown. Always make the necessary repairs before attempting to start the engine. Refer to Troubleshooting.

Become familiar with the following information:

- Types of the alarms and shutdowns
- Locations of the alarm and shutdown controls
- Conditions which cause each control to function
- Resetting procedure that is required before starting the engine

Testing Alarms and Shutdowns

Alarms must function properly in order to provide timely warning to the operator. Shutdowns help to prevent damage to the engine. It is impossible to determine if the engine protective devices are in good working order during normal operation. Malfunctions must be simulated in order to test the engine protective devices.

NOTICE

During testing, abnormal operating conditions must be simulated.

The tests must be performed correctly in order to prevent possible damage to the engine.

Periodic testing of engine protective devices for proper operation is recommended maintenance. To prevent damage to the engine, only authorized service personnel or your Caterpillar dealer should perform the tests.

Prevention of Start-up

The engine will not start if any of the conditions that cause a shutoff are present. The following conditions will also prevent starting of the engine:

- No input from the driven equipment prevents starting.
- An overcrank occurs.
- Emergency stop is pressed.

If any of these situations occur, the following conditions must be met before the engine can be started:

- The condition that prevented starting is not present.
- The engine control switch is turned to the "OFF/RESET" position.

Setpoints for Alarms and Shutoffs

Some of the setpoints for the alarms and shutoffs can be programmed with a Caterpillar Electronic Technician (ET). Some of the parameters cannot be programmed.

The setpoints are programmed at the factory. The status for most of the parameters is ON. Refer to the Troubleshooting Guide for the default setpoints of the warnings and shutoffs for the engine.

For information on programming of parameters, refer to the Systems Operation/Testing and Adjusting manual.

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Electronic Modular Control Panel II+ (EMCP II+)

SMCS Code: 4490

Note: Your machine may not be equipped with all of the following controls.

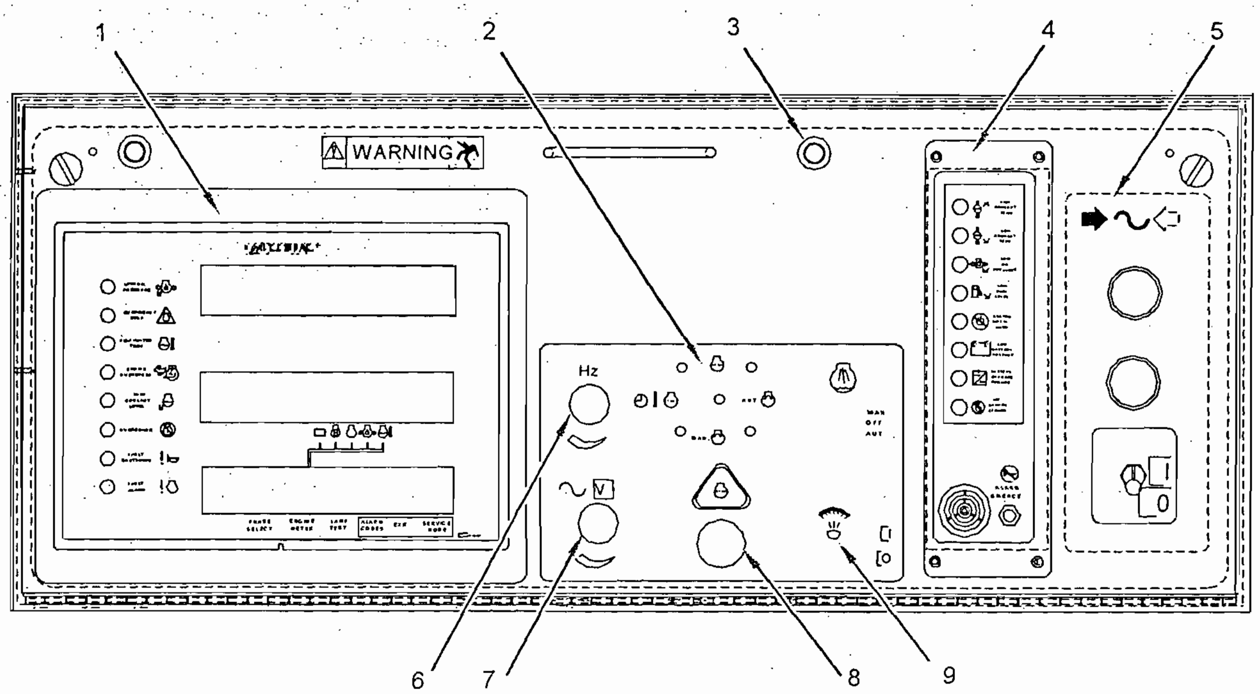

Illustration 26 g011476

Electronic Modular Control Panel II+ (EMCP II+)

(1) Generator set control + (GSC+)
(2) Engine control switch (ECS)
(3) Panel lights (PL)
(4) Alarm module (ALM)
(5) Synchronizing lights module or Custom alarm module (CAM)
(6) Speed potentiometer (SP) or Governor switch
(7) Voltage adjust rheostat (VAR)
(8) Emergency stop push button (ESPB)
(9) Panel light switch (PLS)

The Electronic Modular Control Panel II+ (EMCP II+) is located above the generator distribution housing. The control panel consists of the following components: a main panel with indicators, meters, and control switches. This control panel may be equipped with optional modules in order to match the customers' needs and requirements.

The left side of the control panel contains the Generator Set Control + (GSC+). This is the main component of the system. The GSC+ displays the following information: generator output, fault conditions, and key engine parameters. The center section of the control panel contains switches and an optional alarm module. The right side of the control panel may be blank, or the right side of the control panel may contain the Synchronizing Lights Module or the Custom Alarm Module.

Some components are optional. The optional components may not be required for your particular application.

Generator Set Control + (1) – The generator set control + (GSC+) is the main component of the EMCP II+. See the topic "Generator Set Control + (GSC+)" in this section.

Engine Control Switch (2) – The engine control switch (ECS) determines the status of the control panel. In the AUTOMATIC position, the engine will start automatically when a remote initiated contact is closed. The engine will be shutdown after the contact opens. The engine will be shutdown after a cooldown period that is programmable has elapsed. The cooldown period can be programmed to give a 0 to 30 minute cooldown period before the engine shuts down.

In the MANUAL START position, the engine will start. In the MANUAL START position, the engine will run when ECS remains in the MANUAL START position.

In the STOP position, the engine is shutdown by the fuel solenoid after a programmable cool down time period has elapsed.

In the OFF/RESET position (12 o'clock), the fault lights are reset and the engine shuts down immediately.

NOTICE

The engine must be cranking before using the start aid switch. Damage to the engine is possible if ether is released to the engine but not exhausted or burned by the engine when cranking.

Panel Lights (3) – Panel lights (PL) are controlled by panel lights switch (9). The panel lights switch is an ON/OFF switch.

Alarm Module (4) – The alarm module (ALM) is optional. The ALM provides a visual warning. The ALM provides an audible warning of engine conditions before these conditions become severe. Engine conditions that are severe may cause the engine to shutdown. Engine conditions that are severe may cause the engine not to start.

Synchronizing Lights Module (5) or Custom Alarm Module (5) – The synchronizing lights module uses synchronizing lights for paralleling the generator sets. The synchronizing lights module is optional. The custom alarm module (CAM) may be installed in the same opening on the control panel. The CAM annunciates faults, alarms or other conditions from customer supplied inputs.

Speed Potentiometer (6) – The speed potentiometer (SP) is optional. The SP can be used with the generator set that has an electronic governor. When the governor is equipped with a speed adjusting motor, the governor switch (GS) can be mounted instead of the SP. The GS is used in order to raise the engine speed and the frequency. The GS is used in order to lower the engine speed and the frequency. The GS is also an option.

Voltage Adjust Rheostat (7) – The voltage adjust rheostat (VAR) is used to adjust the generator output voltage to the desired level.

Emergency Stop Push Button (8) – The emergency stop push button (ESPB) is used to shut down the engine during an emergency situation. If equipped, the ESPB shuts off the fuel and the ESPB activates the optional air shutoff.

Panel Light Switch (9) – The panel lights switch turns on or the panel lights switch turns off the panel lights.

Below, you can find the descriptions of the following main modules of the EMCP II+:

- Generator Set Control + (GSC+)
- Alarm Module (ALM)
- Custom Alarm Module (CAM)
- Synchronizing Lights Module

Generator Set Control + (GSC+)

Functions and features of the GSC+

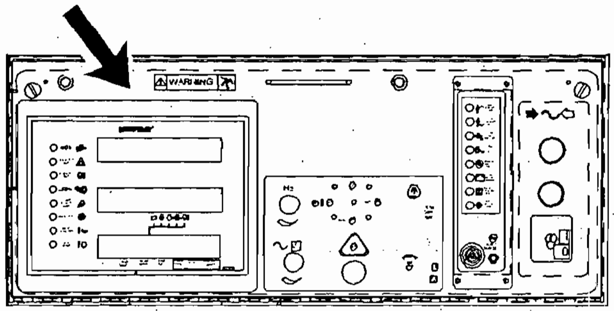

Illustration 27 g00781917

The location of the GSC+ on the control panel for the EMCP II+

The left side of the control panel contains the generator set control + (GSC+). The GSC+ is the main component of the system. The GSC+ displays the following information: generator output, generator set functions, fault conditions, and key engine parameters. The GSC+ accepts information from the following sources: operator, speed sensor, engine oil pressure sensor, water temperature sensor, and optional remote sources. This information is used to determine the following parameters: the "on/off" state of the air for the engine , the "on/off" state of the diesel fuel, and the "on/off" state of the starter.

In the very basic operating conditions, the GSC+ receives a signal in order to run the generator set. The GSC+ turns on the engine's fuel. The GSC+ turns on the engine's starter. When the engine speed reaches the crank termination speed, the starter is disengaged. When the GSC+ receives a signal to stop the engine, the GSC+ shuts off the fuel and the GSC+ shuts off the ignition.

The functions of the GSC+ are listed below:

- The GSC+ controls the normal starting and stopping of the engine.
- The GSC+ shows engine conditions and generator output information on two displays. The displays also show the fault codes and the programming information for the GSC+.
- The GSC+ monitors the system for faults. If a fault occurs, the GSC+ performs a controlled fault shutdown or the GSC+ provides a fault alarm annunciation. The GSC+ uses indicators and displays in order to describe the fault.

- The GSC+ contains programmable features for certain applications or requirements for the customer.

The features of the GSC+ are listed below:

- **Cycle Crank**: The GSC+ can be programmed to crank for adjustable time periods.
- **Governor Control**: When the engine oil pressure increases past the low oil pressure setpoint, the GSC+ indicates that the governor should increase the engine speed from idle rpm to rated RPM.
- **Cooldown**: When the GSC+ receives a signal to perform a shutdown, there is a time delay before the engine will stop running.
- **Automatic Operation**: When the GSC+ is in automatic mode, the GSC+ can be started by a remote initiate signal (contact closure). Upon loss of the signal (contact opening), the GSC+ will perform a normal shutdown.
- **Alarm Module Communication**: The GSC+ can transmit fault conditions and alarm conditions to an alarm module (AM). The GSC+ can also transmit the fault conditions and the alarm conditions to a Customer Communication Module (CCM).
- **Powerdown**: The EMCP II+ system is designed to remove power from the GSC+ when the engine control switch (ECS) is in the OFF/RESET mode and when the proper jumper wire is removed. The GSC+ allows powerdown when the crank termination relay is off for 70 seconds and the fuel control relay is off for 70 seconds. If the wire is not removed, the GSC+ will remain powered. Refer to Technical Information Bulletin, TIBU3508 for additional information on powerdown.
- **Fuel Solenoid Type**: The GSC+ can be programmed in order to work with a fuel system that is energized to run. The GSC+ can also be programmed in order to work with a fuel system that is energized to shutdown.

Fault indicators

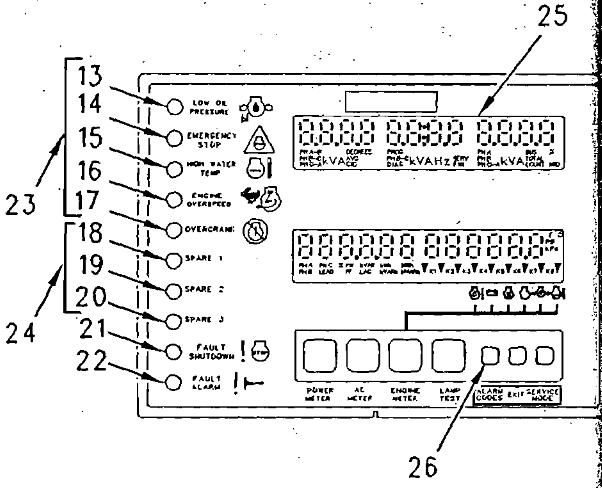

Illustration 28 g00786

Display area of the GSC+

(13) Low oil pressure indicator
(14) Emergency stop indicator
(15) High water temperature indicator
(16) Engine overspeed indicator
(17) Overcrank indicator
(18) Spare 1 indicator
(19) Spare 2 indicator
(20) Spare 3 indicator
(21) Fault shutdown indicator
(22) Fault alarm indicator
(23) Dedicated shutdown indicators
(24) Spare fault indicators
(25) Upper display
(26) The key for the alarm codes

The fault indicators are used in order to show a fau that is present. The fault indicators are used in orde to describe a fault that is present. The fault indicato are divided into four groups. The four groups are listed below:

- Fault alarm indicator (22)
- Fault shutdown indicator (21)
- Spare fault indicators (24)
- Dedicated shutdown indicators (23)

The yellow fault alarm indicator (22) FLASHES whe the GSC+ detects an alarm fault. The alarm fault doe not cause the engine status to change. The engine can be started. The engine will continue operating only if the engine is running at the time of the alarm fault. Fault alarm indicator (22) is accompanied by a alarm fault code that is shown on the upper display (25) when the key for the alarm codes (26) is presse

The red fault shutdown indicator (21) FLASHES when the GSC+ detects a shutdown fault. The engine will be shut down if the engine is running. The engine will not be allowed to start. Fault shutdown indicator (21) is accompanied by a fault code that is immediately shown on the upper display (25).

The yellow spare fault indicators (24) FLASH when the conditions that are associated with that spare fault are active. The three spare faults can be programmed to show coolant loss, engine oil temperature, spare fault condition or no assignment. The spare fault condition may be a customer generated switch input. The yellow fault alarm indicator (22) or the red fault shutdown indicator (21) will accompany the spare fault indicators (24). The spare fault indicators will tell whether the spare fault input is programmed to be an alarm condition or a shutdown condition.

The red dedicated shutdown indicators (23) represent the following shutdown faults: low engine oil pressure, emergency stop, high water temperature, engine overspeed, and engine overcrank. When the GSC+ detects a fault in one of these areas, the dedicated shutdown indicator flashes. The engine is shutdown if the engine is running, and the engine is not allowed to start. No fault codes are associated with the dedicated shutdown indicators because each indicator has a descriptive label.

Many of the dedicated shutdown faults depend on certain setpoints in the GSC+.

The conditions that are required to activate the dedicated fault shutdowns and the results of each dedicated fault are in the following list.

Low Oil Pressure – The engine oil pressure drops below the setpoints for low oil pressure shutdown that are programmed into the GSC+. There are two low oil pressure setpoints. One setpoint is used when the engine is at idle speed. The other setpoint is used when the engine is at rated speed. When a low oil pressure fault occurs, the low oil pressure indicator FLASHES, and the engine is shut down. The engine is not allowed to start until the fault is corrected.

Emergency Stop – The operator presses the emergency stop push button (ESPB) on the front panel. When an emergency stop condition occurs, the emergency stop indicator FLASHES and the engine is shut down. The engine is not allowed to start until the condition is corrected.

High Water Temperature – The engine coolant temperature rises above the setpoint for high water temperature shutdown that is programmed into the GSC+. When the high water temperature fault occurs, the high water temperature indicator FLASHES. The engine is shutdown and the engine is not allowed to start until the fault is corrected.

Engine Overspeed – The engine speed exceeds the setpoint for engine overspeed that is programmed into the GSC+. When the fault for engine overspeed occurs, the engine overspeed indicator flashes. The engine is shutdown and the engine is not allowed to start until the fault is corrected.

Overcrank – The engine does not start within the setpoint for total cycle crank time that is programmed into the GSC+. When the overcrank fault occurs, the overcrank indicator FLASHES. The engine is not allowed to start until the fault is corrected.

Note: The GSC+ can be programmed to override the shutdown for low oil pressure and high water temperature faults. When the operator overrides the shutdown faults, the GSC+ responds to the faults as though the faults are alarm faults. The dedicated shutdown indicator is on continuously, and the indicator will not be flashing. The engine continues to run and the engine can be restarted. When the dedicated shutdown indicator is ON continuously, the setpoint for shutdown has been exceeded, but the GSC+ is programmed to override the shutdown fault. The GSC+ does not treat the shutdown fault as a shutdown fault. The GSC+ treats the shutdown fault as an alarm fault. At the factory, the GSC+ is programmed to treat a low oil pressure fault and a high water temperature fault as shutdown faults. The operator or the service technician must decide to override these shutdown faults. The operator or the service technician must program the GSC+ to treat the shutdown faults as alarm faults.

Display

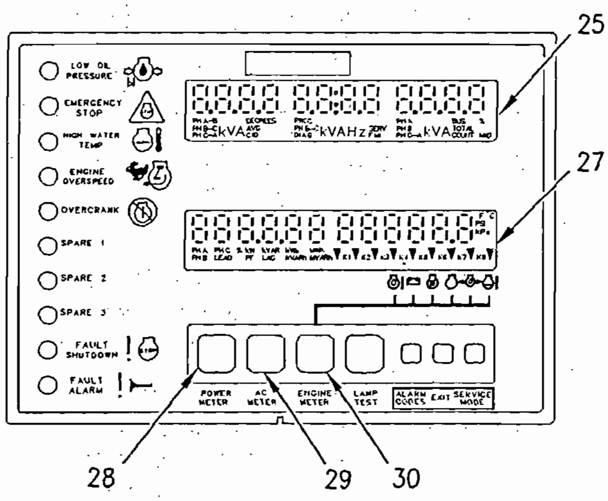

Illustration 29 g00786776

Display area of the GSC+

(25) Upper display
(27) Lower display
(28) The power meter key
(29) The AC meter key
(30) The engine meter key

The display consists of the upper display and the lower display. Both displays are used for programming functions when the display is in the service mode.

Upper display

The upper display (25) shows: AC voltage, current, and frequency. Several options are available on the upper display for AC metering. These options can be viewed one at a time by pressing the AC meter key (29) on the keypad. The options are listed below:

- Average voltage, generator frequency, and total current
- Line to line voltage, generator frequency, and line current for any one phase
- Line to line voltage for all three phases
- Line current for all three phases

Note: When total current increases above "9999A", the GSC+ will show current in "kA" units.

- Line to neutral voltage for all three phases

Upper display (25) is also used to show the various fault codes for system faults.

Note: Line to neutral voltages are not shown whe[n] the setpoint P032 is set to 1 for delta generator se[ts]

Lower display

The lower display (27) shows values for power metering, engine parameters and the relay status.

The left side of the lower display (27) serves as a power meter for the generator set. The following functions will scroll automatically:

- Total real power (kW)
- Total reactive power (KVAR)
- Percentage of rated power (%kW)
- Power factor (average)
- Total energy output (kW/h)

The display will stop scrolling when the operator presses the power meter key for less than five seconds. The display will show a particular paramet[er] continuously. Additional power meter functions will scroll, if the power meter key (28) is held for more than five seconds and then released. The additiona[l] functions are shown below:

- Total real power (kW)
- Real power phase A (kW)
- Real power phase B (kW)
- Real power phase C (kW)
- Total apparent power (kVA)
- Total reactive power (KVAR)
- Percentage of rated power (%kW)
- Power factor (average)
- Power factor phase A
- Power factor phase B
- Power factor phase C
- Total energy output (kW/h)
- Total reactive energy output (kVAR/Hr)

Note: All real power values are signed with a "+" or "–". A negative value indicates reverse power.

Note: The Real power phase and the power factor phase are not shown when setpoint P032 is set to 1 for delta generator sets.

Note: Total energy output that is greater than 999,999 kW/h will be shown as MW/h in two steps in order to maintain a resolution of 1 kW/h. The first step will show MW/h as a whole number up to six places. The second step will show MW/h as a decimal to three places.

The right side of lower display (27) shows the value of certain engine parameters. The parameters are listed below:

- Engine oil temperature (if equipped)
- System battery voltage
- Engine hours
- Engine speed
- Engine oil pressure
- Engine coolant temperature

The value for one of these conditions is shown on display (27) for two seconds. The display then scrolls to the value for the next condition. A small pointer identifies the engine condition that corresponds to the value that is showing. When the engine meter key (30) is pressed, the lower display (27) stops scrolling. The lower display continuously shows one particular value. The pointer flashes above the value that is showing on the display. When the engine meter key (30) is pressed for the second time, the lower display will return to scrolling.

The relay status indicators are on the bottom of the lower display (27). When a relay for the GSC+ is activated, the corresponding indicator is shown on the lower display (27). When a relay is not activated, the corresponding indicator is not shown.

Keypad

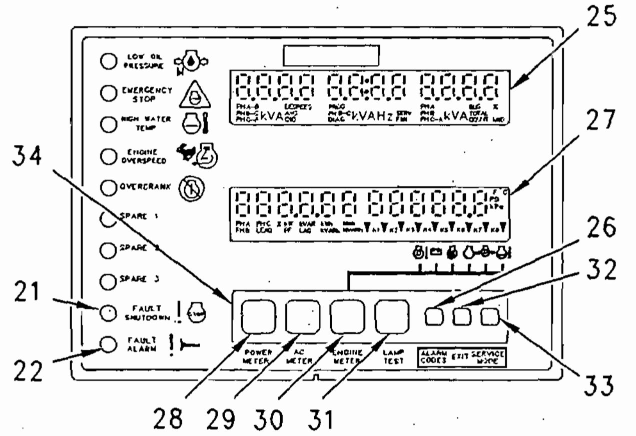

Illustration 30 g00786777

Keypad area of the GSC+

(21) Fault shutdown indicator
(22) Fault alarm indicator
(25) Upper display
(26) Key for the alarm codes
(27) Lower display
(28) Power meter key
(29) AC meter key
(30) Engine meter key
(31) Lamp test key
(32) Exit key
(33) Service mode key
(34) Keypad

Keypad (34) is used to control the information that is shown on the upper display (25) and lower display (27). The seven keys have two sets of functions: normal functions and service functions. The normal functions of the keys are described in the following paragraphs.

Power Meter Key (28) – This key controls the viewing of power meter information. This information is shown on the lower display. Pressing the key for at least five seconds causes all the power meter data to scroll once. The default power meter data then resumes scrolling. If the key is pressed for less than five seconds, the display stops scrolling.

AC Meter Key (29) – The AC meter key controls the viewing of the AC parameters on the upper display. Pressing the key causes the display to show a different set of parameters.

Engine Meter Key (30) – This key controls the viewing of engine parameters on the lower display. Pressing the key stops the scrolling of engine conditions. The value for one particular engine condition will show continuously. The pointer flashes indicating that the scrolling is stopped. The scrolling of the engine conditions will resume when the engine meter key is pressed again.

Lamp Test Key (31) – Pressing this key performs a lamp test on the GSC+ and the optional alarm module. On the GSC+, the ten fault indicators are ON CONTINUOUSLY. Every segment of upper display (5) and lower display (6) is ON. On the optional alarm module, all of the indicators are ON and the horn sounds. The function for the lamp test automatically turns off if the operator presses the key and the operator holds the key for ten seconds.

The Alarm Codes Key (26) – If fault alarm indicator (22) is FLASHING, pressing this key causes the upper display (25) to show the corresponding alarm fault code. If this key is pressed again, the generator AC output information will be shown on the upper display (25). If fault alarm indicator (22) is OFF, this key has no function.

Exit Key (32) – This key only functions when the GSC+ is in Service Mode.

Service Mode Key (33) – Pressing this key causes the GSC+ to enter Service Mode.

Alarm Module

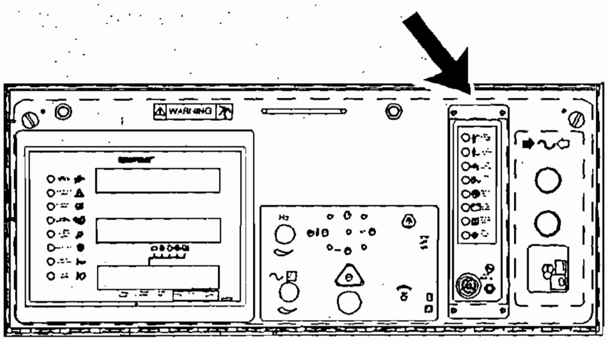

Illustration 31 g00781923

The location of the Alarm Module (ALM) on the control panel for the EMCP II+

The alarm module (ALM) is optional. The alarm module provides a visual warning and the alarm module provides an audible warning of engine conditions before the conditions become severe.

One basic alarm module is used to satisfy the requirements for the following modules: standby NFPA 99 alarm module, standby NFPA 110 alarm module, NFPA 99 remote annunciator panel, and prime power alarm.

The front of the alarm module consists of the following indicators:

- Four amber indicators, which can indicate High Coolant Temperature, Low Coolant Temperature, Low Coolant Level, Low Oil Pressure, Generator On Load, Charger Malfunction, Low Engine Oil Level and Low Fuel Level
- Four red indicators, which can indicate a Low D Voltage, Air Damper Closed, Low Oil Pressure Shutdown, Overcrank Shutdown, High Coolant Temperature Shutdown, and Overspeed Shutdo
- An audible alarm and Acknowledge/Silence swi

Custom Alarm Module

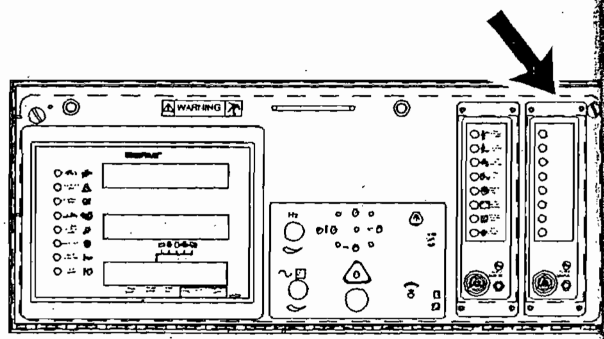

Illustration 32 g007819

The location of the Custom Alarm Module (CAM) on the control panel for the EMCP II+

The custom alarm module (CAM) is optional. The custom alarm module provides a visual warning and the custom alarm module provides an audible warning of the conditions of the customer supplied inputs before these conditions become severe. The CAM is equipped with the following items for the customer: horn, alarm silence switch, lamp test switch, and eight switched inputs

The front of the alarm module consists of the following indicators:

- Four amber indicators, which are used to display alarm conditions
- Four red indicators, which are used to display shutdown conditions

Synchronizing Lights Module

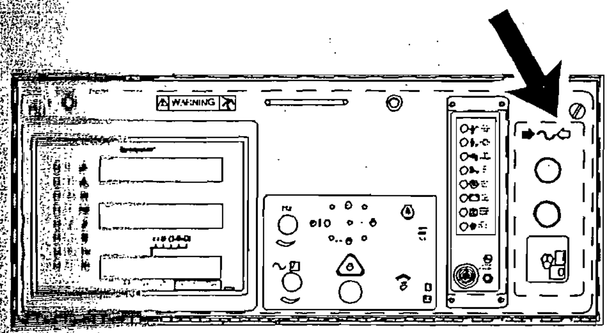

Illustration 33 g00781939

The location of the Synchronizing Lights Module on the control panel for the EMCP II+

(35) Synchronizing lamps
(36) Synchronizing switch

The optional synchronizing lights module is mounted on the right side of the control panel. This module is not used when the control panel is equipped with the 2301A governor.

The synchronizing lights module contains the synchronizing lights (35) and the synchronizing switch (36).

Synchronizing Lights (35) – The synchronizing lights (35) are used as an aid in paralleling units at no load and under load. Each light is connected to the side with the load of the generator output circuit breaker. The lights are used to indicate when the voltages are in-phase. Close the circuit breaker in order to connect the generator with the load.

Synchronizing Switch (36) – The synchronizing switch has two positions, ON and OFF. When the switch is in the ON position, the synchronizing lights are enabled. The generator circuit breaker can be closed manually when the synchronizing switch is on and the lights are synchronized.

Note: Refer to Operation Section, "Parallel Operation" for Information regarding the paralleling of two generators.

When a reverse power relay is added to the synchronizing lights module, the original synchronizing lights module will change in the following ways:

- The reverse power relay is mounted on the control panel interior.
- A reverse power fault is indicated by the Fault Shutdown Indicator on the front of the GSC+.

The reverse power relay is a single phase protective relay. This relay is energized by power in only one direction. In a reverse power fault, the relay contacts close and the engine shuts down. This will take the generator off the line. The reverse power relay is equipped with a test switch and adjustments.

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Engine Starting

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Before Starting Engine

SMCS Code: 1000; 1400; 1450

Note: Certain procedures are required before an engine is started for the first time. See Special Instruction, REHS1438, "Installation and Initial Start-Up Procedure for G3500C and G3500E Engines".

Perform the required daily maintenance and other periodic maintenance before starting the engine. This can prevent major repairs at a later date. See this Operation and Maintenance Manual, "Maintenance Interval Schedule".

Walk-Around Inspection

NOTICE
For any type of leak, clean up the fluid. If leaking is observed, find the source and correct the leak. If leaking is suspected, check the fluid levels more often than recommended until the leak is found or fixed, or until the suspicion of a leak is proved to be unwarranted.

To obtain maximum service life for your engine, make a thorough inspection before starting the engine. Make a walk-around inspection of the installation. Look for items such as oil or coolant leaks, loose bolts and trash buildup. Remove any trash. Make repairs, if necessary.

- The guards must be in the proper place. Repair damaged guards or replace missing guards.
- Ensure that the areas around the rotating parts are clear.

Air Inlet System

⚠ WARNING

Unburned gas in the air inlet and exhaust system may ignite when the engine is started. Personal injury and/or property damage may result.

Before starting an engine that may contain unburned gas, purge the unburned gas from the air inlet and exhaust system. Refer to the topic on purging unburned gas in the "Starting the Engine" section.

- Ensure that the air inlet piping and the air filter are in place and clean.
- Ensure that all clamps and connections are sec
- Inspect the air cleaner service indicator (if equipped). Service the air cleaner filter elemen when the yellow diaphragm enters the red zone the red piston locks in the visible position.

Cooling System

- Inspect the cooling system for leaks or loose connections. Inspect the condition of all the hos and pipes for the cooling system. Ensure that th connections are properly clamped.
- Inspect the water pumps for evidence of leaks.
- Check the coolant level. Add coolant, if necessa For information on the proper coolant to use, se this Operation and Maintenance Manual, "Refill Capacities and Recommendations" (Maintenanc Section).

Driven Equipment

- If necessary, check the oil levels of the driven equipment. Perform any maintenance that is required for the driven equipment. Refer to the literature that is provided by the OEM of the driv equipment.
- If the engine is equipped with a clutch, ensure th the clutch is disengaged.
- For generator set engines, ensure that the main circuit breaker is open.

Electrical System

Inspect the wiring for the following conditions:

- Loose connections
- Wiring that is worn or frayed

Inspect the gauge panel and the control panel for good condition. Reset any shutoff or alarm components.

Fuel System

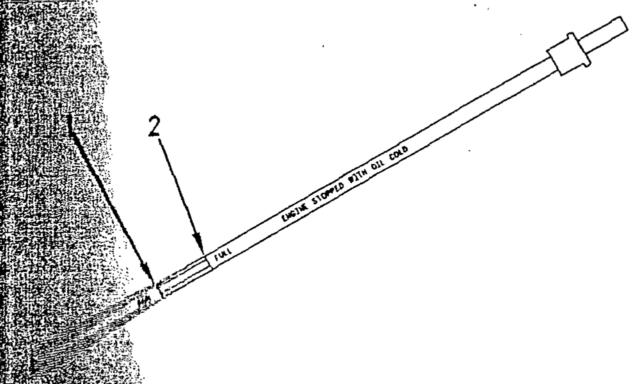
⚠ WARNING

NEVER use a flame to check for gas leaks. Use a gas detector.

An open flame can ignite mixtures of air and fuel. This will cause explosion and/or fire which could result in severe personal injury or death.

- Check the fuel lines for leaks with a gas detector.
- Inspect the fuel lines for loose fittings and leaks. Ensure that the fuel lines are properly clamped.
- Ensure that the fuel is supplied to the engine at the correct pressure for the engine.

Lubrication System



g00760044

Illustration 84
(1) Oil level gauge (dipstick)
(2) "ADD" mark
(3) "FULL" mark

NOTICE
Excessive engine oil will increase oil consumption and result in excessive deposits in the combustion chamber. Do not overfill the engine with oil.

- Check the engine crankcase oil level. Maintain the oil level between the "ADD" and "FULL" marks on the "ENGINE STOPPED WITH OIL COLD" side of the oil level gauge. For information on the proper oil to use, see this Operation and Maintenance Manual, "Refill Capacities and Recommendations" (Maintenance Section).
- Check for leaks at the following components: crankshaft seals, crankcase, oil filters, oil gallery plugs, sensors, and valve covers.
- Inspect the tubes, tee pieces, and clamps on the crankcase breathers.

Starting System

Note: If the engine is equipped with a system for external support, prepare the system before starting the engine. Ensure that all of the systems for engine support are enabled. Perform all prestart checks for the control system.

Air Starting Motor

- Drain moisture and sediment from the air tank and from any other air piping.
- Check the oil level in the lubricator. Keep the lubricator at least half full. Add oil, if necessary.
- Check the air pressure for starting. The air starting motor requires a minimum of 690 kPa (100 psi). The maximum allowable air pressure is 1030 kPa (150 psi). Open the air supply valve.

Electric Starting Motor

- Disconnect any battery chargers that are not protected against the high current drain that is created when the electric starting motor engages.

Inspect the wiring, the electrical cables, and the battery for the following conditions:

- Loose connections
- Wires that are worn or frayed
- Corrosion

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Cold Weather Starting

SMCS Code: 1000; 1250; 1450; 1453; 1456; 1900

NOTICE
Oil pan immersion heaters are not recommended for heating the lube oil. To ensure the compatibility of the components, only use equipment that is recommended by Caterpillar.

A jacket water heater is required to maintain a minimum starting temperature of 45 °C (113 °F). The engine may be difficult to start if the jacket water coolant temperature is below 43 °C (110 °F). The spark plugs may become fouled with moisture condensation if the engine is cranked and the jacket water coolant temperature is below 43 °C (110 °F).

For air starting motors, a larger volume of starting air and/or a higher air pressure may be necessary in order to start the engine at colder temperatures.

For electric starting, extra battery capacity may be necessary.

Consult your Caterpillar dealer for more information on the starting aids that are available for cold weather starting.

i02141963

Starting the Engine

SMCS Code: 1000; 1450

⚠ WARNING

Engine exhaust contains products of combustion which may be harmful to your health. Always start and operate the engine in a well ventilated area and, if in an enclosed area, vent the exhaust to the outside.

NOTICE
For initial start-up of a new or rebuilt engine, and for start-up of an engine that has been serviced, make provision to shut the engine off should an overspeed occur. This may be accomplished by shutting off the fuel supply and/or the ignition to the engine.

⚠ WARNING

Unburned gas in the air inlet and exhaust syst may ignite when the engine is started. Perso injury and/or property damage may result.

Before starting an engine that may contain u burned gas, purge the unburned gas from the inlet and exhaust system. Refer to the topic purging unburned gas in the "Starting the Engi section.

Note: Using the "EMERGENCY STOP" button will shut off both the fuel and the ignition.

Do not start the engine or move any of the control if there is a "DO NOT OPERATE" warning tag or similar warning tag attached to the start switch or the controls.

Ensure that no one will be endangered before the engine is started and when the engine is started.

Perform the procedures that are described in this Operation and Maintenance Manual, "Before Starti Engine".

Purging Unburned Gas

The following events cause unburned gas to remai in the air inlet and in the exhaust manifold:

- Emergency stop
- Engine overspeed
- The engine control is set to the STOP mode and the gas shutoff valve does not close.
- Unsuccessful successive attempts to start the engine

Unburned gas may remain in the air inlet and exhau system after several unsuccessful attempts to start the engine. The unburned gas may increase to a concentration that may ignite during a successive attempt to start the engine.

Perform the following procedure in order to purge the unburned gas:

1. If the Caterpillar Electronic Technician (ET) is not connected to the engine, connect Cat ET to the engine.
2. Verify that the value of the "Engine Purge Cycle" parameter is equal to ten seconds less than the value of the "Crank Cycle" parameter.

3. Set the engine control to the START mode. The engine will crank for the "Engine Purge Cycle" time. Then, the gas shutoff valve will be energized and the ignition will be enabled. The engine will start.

4. Continue with your previous procedure.

Automatic Starting

WARNING

When the engine is in the AUTOMATIC mode, the engine can start at any moment. To avoid personal injury, always remain clear of the the engine when the engine is in the AUTOMATIC mode.

If the engine control switch is in the "AUTO" position, the engine will automatically start when the remote start/stop initiate contact closes.

Parameters for the Start/Stop Control

Driven Equipment

Start-up is delayed until the switch for the driven equipment indicates that the driven equipment is ready.

Purge Cycle

Note: The engine uses an energize-to-run system. The gas shutoff valve must remain energized in order to supply fuel to the engine.

The purge cycle allows any unburned fuel to exit through the exhaust before the ignition system is activated.

The purge cycle occurs under these conditions:

- The gas shutoff valve is de-energized.
- The ignition is off.
- The engine is cranked.

The purge cycle occurs before the crank cycle. The amount of time for the purge cycle is programmable.

Cycle Crank Time

The maximum amount of time for activation of the starting motor and the gas shutoff valve for starting is the cycle crank time. The amount of time is programmable.

Rest Cycle

If the engine does not start within the cycle crank time, starting is suspended for a rest cycle. The amount of time for the rest cycle is equal to the cycle crank time.

Overcrank Time

The overcrank time includes the total purge cycle, the total cycle crank time, and the total rest cycle. These functions are repeated until termination of the overcrank time.

If the engine does not start within the overcrank time, the engine control module generates an event code.

Manual Starting

1. Ensure that fuel is supplied to the engine.

2. Ensure that the driven equipment is ready. For generator set engines, ensure that the main circuit breaker is open.

NOTICE

Do not engage the starting motor when flywheel is turning. Do not start the engine under load.

If the engine fails to start within 30 seconds, release the starter switch or button and wait two minutes to allow the starting motor to cool before attempting to start the engine again.

3. Start the engine.

   The crank terminate speed is programmable. When the engine rpm exceeds the crank terminate speed, the engine control module disengages the starting motor.

4. Allow the engine speed to stabilize at low idle rpm. Check all of the pressure gauges. Inspect the engine for leaks and listen for unusual noises. When all systems are normal, the rpm may be increased.

Table 5

Rated RPM And Low Idle RPM		
Rated rpm	1500	1800
Low idle rpm	1000	1200

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Starting with Jump Start Cables

SMCS Code: 1000; 1401; 1402; 1900

⚠ WARNING

Improper jump start cable connections can cause an explosion resulting in personal injury.

Prevent sparks near the batteries. Sparks could cause vapors to explode. Do not allow jump start cable ends to contact each other or the engine.

If the installation is not equipped with a backup battery system, it may be necessary to start the engine from an external electrical source.

NOTICE

Using a battery source with the same voltage as the electric starting motor. Use ONLY equal voltage for jump starting. The use of higher voltage will damage the electrical system.

Do not reverse the battery cables. The alternator can be damaged. Attach ground cable last and remove first.

When using an external electrical source to start the engine, turn the engine control switch to the "OFF" position. Turn all electrical accessories OFF before attaching the jump start cables.

Ensure that the main power switch is in the OFF position before attaching the jump start cables to the engine being started.

1. Turn the start switch to the OFF position. Turn off all accessories.

2. Connect one positive end of the jump start cable to the positive cable terminal of the discharged battery. Connect the other positive end of the jump start cable to the positive cable terminal of the electrical source.

3. Connect one negative end of the jump start cable to the negative cable terminal of the electrical source. Connect the other negative end of the jump start cable to the engine block or to the chassis ground. This procedure helps to prevent potential sparks from igniting combustible gases that are produced by some batteries.

4. Start the engine.

5. Immediately after the stalled engine is started, disconnect the jump start cables in reverse ord

Note: If there is a problem with the alternator or t battery charger, the engine will not continue to ru after starting, unless the power to the engine con module is supplied by a separate source.

i0224

After Starting Engine

SMCS Code: 1000

For new installations and engines that are recentl rebuilt, carefully monitor the engine in order to det any unusual engine performance.

After all systems are stabilized and normal, the engine rpm can be increased from low idle rpm to rated rpm.

It may be necessary to apply some load in order t attain normal operating temperatures.

Engaging the Driven Equipment

1. Increase the engine speed to rated rpm.

2. Ensure that the operating parameters are in the normal ranges for the engine load.

3. Close the main circuit breaker in order to apply the load.

4. Refer to Special Instruction, REHS1438, "Installation and Initial Start-Up Procedure for G3500C and G3500E Engines" in order to properly load the engine.

Engine Operation

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Engine Operation

SMCS Code: 1000

Proper operation and maintenance are key factors in attaining the maximum service life and economy for the engine. Follow the instructions in this Operation and Maintenance Manual in order to minimize operating costs and maximize the service life of the engine.

Observe the gauges or the Caterpillar Electronic Technician (ET) frequently while the engine is operating. Record the data from the gauges or the Cat ET in a log. It is best to record all Cat ET data from the status screens. Record the time and the date for each event or each diagnostic. Include the parameters that are listed in Table 6. Average the data that is recorded during operation and record the average values for each day. Compare the data to the specifications for normal engine operation. Comparing the data over time will help to detect trends in engine performance.

Table 6

Engine Performance	
Operator	Date
Engine serial number	Hour meter
Load	RPM
Coolant temperature	Oil pressure
Oil filter differential pressure	Air filter differential pressure
Inlet manifold pressure	Inlet manifold temperature
Exhaust temperatures	Exhaust pressure
Secondary transformer voltages	Exhaust emissions
Throttle position	Fuel valve position

Investigate any significant change in the gauge or in the Cat ET readings. Monitor the engine operation and take action when discrepancies are found.

Operating the Engine and the Driven Equipment

Check the gauges and the driven equipment frequently while the engine is operating under a load. The engine can be operated continuously at full load.

Partial Load Operation

Extended operation at low idle or at a reduced load will cause increased oil consumption and carbon buildup in the cylinders. Carbon buildup results in the following effects:

- Narrow margin for detonation
- Power loss
- Poor performance
- Accelerated wear of components

Caterpillar Engines can be operated at very light loads for limited times with no harmful effects. Table 7 lists the limits for hours of operation at various loads.

After the time limit for reduced load operation has expired, operate the engine for a minimum of two hours at a load that is more than 70 percent of the rated load.

For example, an engine is operating at 20 percent of the rated load. The engine may be operated at this load factor for a maximum of one-half hour. After the one-half hour, operate this engine for at least two hours at a load factor of more than 70 percent.

To help keep engine maintenance at a minimum, follow the guidelines that are listed in Table 7.

Table 7

Time Limits For Low Load Operation	
Engine Load	**Time Limit**
0 to 30 percent	1/2 hour
31 to 50 percent	2 hours
51 to 100 percent	Continuous (1)

(1) For continuous operation, the manifold air pressure must be greater than the atmospheric pressure.

Engine Stopping

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Emergency Stopping

SMCS Code: 1000; 7418

NOTICE
Emergency shutoff controls are for EMERGENCY use ONLY. DO NOT use emergency shutoff devices or controls for normal stopping procedure.

Pressing the Emergency Stop Button may cause unburned gas to remain in the air inlet and in the exhaust manifold.

WARNING

Unburned gas in the air inlet and exhaust system may ignite when the engine is started. Personal injury and/or property damage may result.

Before starting an engine that may contain unburned gas, purge the unburned gas from the air inlet and exhaust system. Refer to the topic on purging unburned gas in the "Starting the Engine" section.

Emergency Stop Button

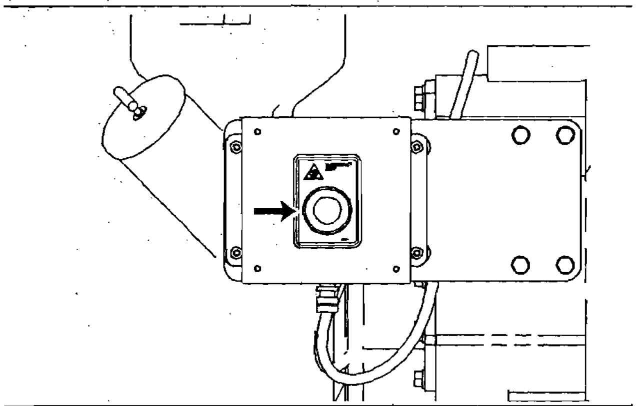

Illustration 35 g00882855

The emergency stop button is in the OUT position for normal engine operation. For an emergency stop, press the emergency stop button. This shuts off both the fuel and the ignition.

Ensure that any system that provides external support to the engine is secured after the engine is stopped.

NOTICE
Do not start the engine until the problem necessita the emergency stop has been located and correc

The engine will not restart when the button is lock To reset the button, pull the button or turn the bu clockwise. The spring-loaded button will return to OUT position.

The control system must also be reset before the engine will start. Turn the engine control switch to the "OFF/RESET" position.

The customer may also provide a remote connec for emergency stopping. For instructions on connecting a remote emergency stop, see Specia Instruction, REHS1438, "Installation and Initial Start-up Procedure for G3500C and G3500E Engines".

Unplanned Shutdowns

Abnormal operating conditions may cause an eng shutdown. The fuel will be shut off, but the ignitio may not be shut off.

An indication of the cause will be generated by the engine control module. The event code or the diagnostic code can be obtained with a Caterpillar Electronic Technician (ET). For more information on event codes and diagnostic codes, refer to Troubleshooting.

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Manual Stop Procedure

SMCS Code: 1000; 7418

NOTICE
Stopping the engine immediately after the engine has been operating under a load can result in overheating and accelerated wear of the engine components.

Allow the engine to gradually cool before stopping the engine.

There may be several different methods of stopping the engine. Be sure that the engine stopping procedure is understood. Follow the instructions that are provided by the OEM of the control panel.

1. Reduce the load to zero.

Note: Remove the load at a rate that will avoid detonation. Reduce the load from 100 percent to zero percent within three minutes but not less than two minutes.

2. For generator set applications, open the main circuit breaker.

Note: Extended idling can cause excessive oil consumption and related problems. Refer to Operation and Maintenance Manual, "Engine Operation".

3. Stop the engine according to the instructions that are provided by the OEM of the control panel.

a. If the cooldown feature is utilized, the engine will continue to run for a programmed period of time before the engine stops. This allows the turbochargers to slow down. After the cooldown, the engine will shut off.

b. If the cooldown feature is not utilized, operate the engine at high idle rpm for a cooldown period before stopping the engine. If the engine has been operated at a high load, operate the engine at high idle until the engine systems stabilize. For example, wait until the speed of the turbochargers is reduced. Under normal operating conditions, the cooldown period should be less one minute.

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After Stopping Engine

SMCS Code: 1000

- Check the engine crankcase oil level. Maintain the oil level between the "ADD" and "FULL" marks on the "ENGINE STOPPED" side of the oil level gauge.
- If necessary, perform minor adjustments. Repair any leaks and tighten loose bolts.
- Note the service hour meter reading. Perform the maintenance that is scheduled in this Operation and Maintenance Manual, "Maintenance Interval Schedule" (Maintenance Section).

NOTICE
Only use antifreeze/coolant mixtures recommended in the Refill Capacities and Recommendations section of this manual. Failure to do so can cause engine damage.

- Allow the engine to cool. Check the coolant level.
- If freezing temperatures are expected, check the coolant for protection against freezing. The cooling system must be protected against freezing to the lowest expected outside temperature. Add the proper coolant/water mixture, if necessary.
- Perform all required periodic maintenance on all driven equipment. Refer to the instructions that are provided by the OEM of the driven equipment.

Generator Operation

i01934941

Generator Operation

SMCS Code: 4450

Loading of the Generator

When a generator is installed or reconnected, be sure that the total current in one phase does not exceed the nameplate rating. Each phase should carry the same load. This allows the engine to work at the rated capacity. An electrical unbalance can result in an electrical overload and overheating if one phase current exceeds the nameplate amperage.

Allowable combinations of unbalanced loads are shown in Illustration 36. When you operate with significant single-phase loads, the combinations of single-phase load and three-phase load may be used. Such combinations should be located below the line on the graph.

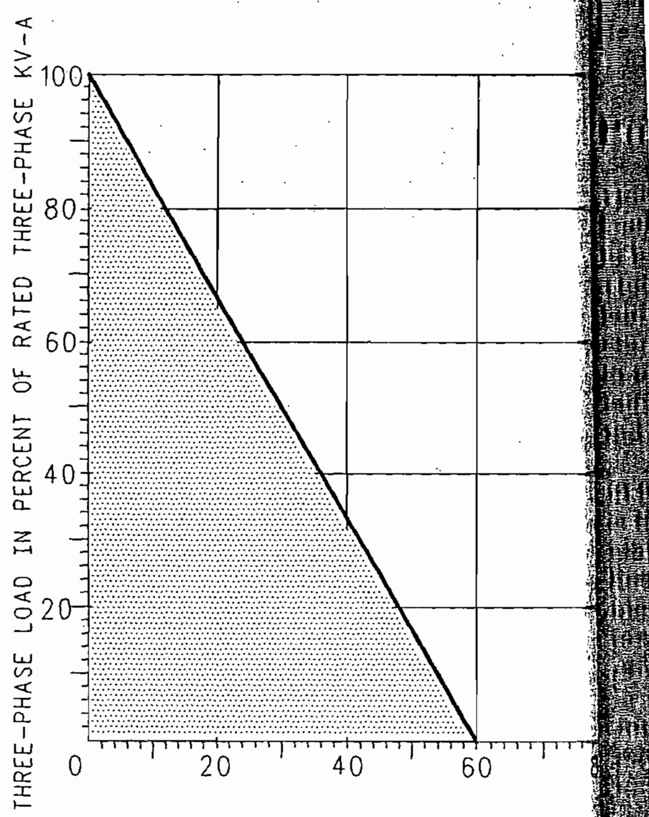

Illustration 36 g00627

Allowable Combinations of Unbalanced Loads

Block Loading and Transient Capability

The block loading capability (transient response) of a generator set that is powered by a gas engine is less than a generator set that is powered by a dies engine. Most of this difference is directly attributed to the inherently different fuel systems of the two engines. When the governor calls for more power, diesel engine reacts by adding fuel directly into the cylinder. This method permits the diesel engine to accept 100% block loads with acceptable voltage dips and frequency changes. When the governor of a gas engine calls for more power the throttle open This causes a larger flow of the air/fuel mixture to move through the aftercooler core and the air intake manifold and into the cylinder. This time dela reduces the gas engine's capability for accepting large block loads.

If a block load derating is required, refer to ISO 8268 Standards or SAE J1349 Standards. Also, reference Engine Data Sheet, LEKX4066, "Loading Transient Response" and Engine Data Sheet, LEKX4067, "Block and Transient Response".

Power Factor

The power factor represents the efficiency of the load. The power factor is the ratio of apparent power to total power. This ratio is expressed as a decimal. The power factor represents the portion of the current which is doing useful work. The portion of current which is not doing useful work is absorbed in maintaining the magnetic field in motors. This current is called the reactive load. Engine power is not required to maintain the reactive load.

In most applications, the power factor of the system is determined by these components: electric motors, controls, and transformers. Induction motors usually have a power factor that is no larger than 0.8. Incandescent lighting is a resistive load of about 1.0 power factor, or unity. Controls can operate at any power factor. Drivers that have variable frequency or variable speed can operate at any power factor. An uninterruptible power supply can operate at any power factor. In this case, the power factor can be between 0.4 and 1.0.

The power factor of a system may be measured with a power factor meter or determined by calculations. Determine the power requirement in kW by multiplying the power factor by the kVA that is supplied to the system. As the power factor increases, the total current that is supplied to a constant power demand will decrease. With equal kW, a lower power factor will draw more current. A high power factor will result in full engine load that is less than the generator's rated amperage. A lower power factor increases the possibility of overloading the generator.

Internationally, Caterpillar generators are designed for a lagging power factor of 0.8. If operation at less than 0.8 lagging power factor is desired, consult your Caterpillar dealer in order to check the rating of the generator.

Excitation Systems

Permanent Magnet Pilot Excited Generators

Permanent Magnet Pilot Excited (PMPE) generators receive power for the voltage regulator from a pilot exciter, rather than the main armature. The pilot exciter consists of a permanent magnet rotor and a stator. The pilot exciter operates independently from the generator output voltage. Constant excitation during a large load application is possible since irregularities in the output voltage are not fed back into the system. Such irregularities can be caused by load conditions. The independent operation also allows the generator to better sustain an overload for a short duration.

Low Idle Adjustment

Typically, the low idle on 3500C generator sets is 1100 rpm. On 60 Hz units, low idle will be approximately 66 percent of the full load speed. On 50 Hz units, low idle will be approximately 80 percent of full load speed.

There is no low idle stop on generator sets with electronic governors. The low idle is set at the factory on generator sets that have mechanical governors. The low idle is also set at the factory on generator sets that run on natural gas. The low idle should only be adjusted by your Caterpillar dealer if adjustment is required.

Note: Operating the electric set at low idle speed for an extended time will cause some voltage regulators to shut off. The electric set must be completely shut down. Then, the electric set must be restarted. This will allow the voltage regulator to again produce an output.

Standby Generator Sets

Most standby units are automatic. Without an operator in attendance, standby units will perform the following functions: start, pick up the load, run, and stop.

Standby units will not change the governor speed control or voltage level settings automatically. The governor speed and voltage level must be preset for the proper operation of that unit. Whenever the generator set is operated manually, ensure that the governor speed and the voltage level settings are set correctly for automatic operation. Check all switches for the proper setting. The Start Selector Switch should be in the AUTOMATIC position. Emergency Stop Switches should be in RUN position.

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Options

Space Heaters

Most of the SR4B generators are provided with space heaters. These space heaters are installed for operation in all climates. The space heaters are especially for use in high humidity conditions. For more information on space heaters, refer to Maintenance Section, "Space Heater - Check".

Embedded Temperature Detectors

SR4B generators are available with embedded temperature detectors. The detectors are installed in the slots of the main armature. The main armature is also called a stator. The detectors are used with the equipment that is provided by the customer. Thus, the temperature of the main armature winding can be measured or monitored. Two types of temperature detectors are available: RTD and thermocouple. Contact your Caterpillar dealer for more information.

Bearing Temperature Detectors

Bearing temperature detectors are available on generators with large frames. Bearing temperature detectors measure the temperature of the main bearing. Thus, the temperature of the bearing can be measured or monitored. Bearing temperature measurements may help to prevent premature bearing failure. Two types of temperature detectors are available. Bearing temperature detectors are used with equipment that is provided by the customer. Contact your Caterpillar dealer for more information.

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Parallel Operation

SMCS Code: 4450

Initial Start-Up

Preparing a generator for parallel operation requires special attention. Before you attempt to parallel units for the first time, check all the units for the following three conditions.

- Same phase rotation
- Same alternating current frequency
- Same voltage adjustment

1. Check the phase rotation.

The phase rotation of the paralleled units mu be equal. There are two methods that are us in order to determine if the phase rotation of t incoming unit is equal to the phase rotation o on-line unit. These methods are listed below.

- Phase rotation meter
- Set of three light bulbs

The procedure for determining the proper pha rotation is described below.

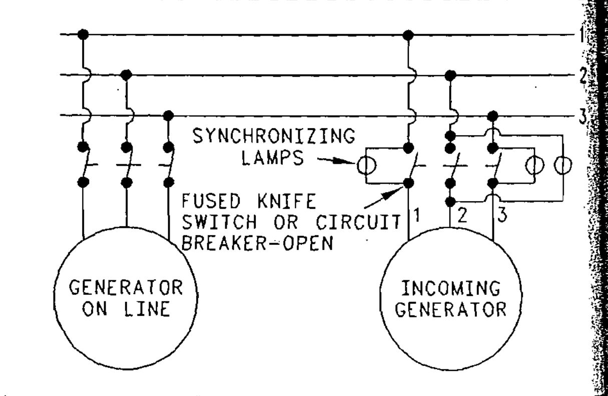

Illustration 37 g0069

⚠ WARNING

When servicing or repairing electric power gen ation equipment:

Make sure the unit is off-line (disconnected fr utility and/or other generators power service), a either locked out or tagged DO NOT OPERAT Remove all fuses.

a. Connect the light bulbs with rated voltage between the generator leads and the corresponding line phase. For example, connect terminal 1 to line 1 across the open circuit breaker.

b. Start the units. Bring the units up to speed. A the units approach the same speed, the light will start to blink.

   - If the lights blink in sequence, one of the units is connected backward. In order to correct the problem, stop the units. Remov generator leads 1 and 3 at the circuit breaker. Exchange these generator leads. This reverses the direction of phase rotatio Terminal 2 should always be connected to line 2. Go to 5.
   - When the lights flash in unison, the phase rotation is equal. The first condition of "Initia Start-Up" has been met.

2. Adjust the frequency.

The speed of the paralleled units must be equal. Speed is proportional to the alternating current frequency.

a. Allow each electric set to run under load for about 30 minutes.

b. Adjust the governor control in order to give rated frequency at full load.

c. Remove the load and check the high idle speed. The high idle speed should be approximately 2 to 5 percent above full load speed for governors that are equipped with droop. If these speeds can not be obtained, contact your Caterpillar dealer.

d. For the most consistent results, repeat 2.b and 2.c until the second condition of "Initial Start-Up" has been met.

3. Adjust the voltage.

There are two basically different methods for reactive power equalization.

- Reactive droop compensation
- Cross current compensation

In the reactive droop compensation, the voltage regulator causes an individual generator output voltage to change in proportion to the reactive current. The reactive current is measured with a current transformer (CT).

The reactive current can be either lagging or leading. As the lagging reactive current increases, the voltage regulator will cause the generator output voltage to droop proportionally. As the leading reactive current increases, the voltage regulator will cause the generator output voltage to rise proportionally.

This method will tend to reduce the reactive current for the better KVAR sharing with other units. The reactive droop compensation is a standard method on the Caterpillar generator sets. The following procedure for voltage adjustment is for the reactive droop compensation.

In the cross current compensation, the voltage regulator is forward biased by the difference in reactive current outputs of the generators in parallel. Cross current compensation is very similar to the reactive droop compensation. In cross current compensation, the secondary circuits of the current transformers are connected in a series string. When one of the generators carries more reactive current than other generators, a net difference voltage signal will offset the generated voltage. This will also reduce the reactive current. Refer to the Engine Data Sheet, LEKX8142, "Caterpillar Zero Droop Voltage for Parallel Operation" for the adjustment procedure.

Note: The adjustment for the voltage level and voltage droop determine the amount of circulating currents between the generators. The circulating currents between the generators will be reduced when the voltage adjustments are carefully matched. Use the same voltmeter to make adjustments on each unit which will be paralleled.

Note: Voltage droop is expressed as the percentage of voltage change from no load to full load. Loads of 0.8 power factor require a voltage droop of about 5 percent. A droop adjustment that causes a 2 percent droop in voltage to a 8 percent droop in voltage is usually required for satisfactory division of ampere loading.

a. Adjust the voltage. Refer to the "Initial Start-Up" in the Operation Section, "Single Unit Operation".

b. While the engine is running at rated speed, turn the voltage droop potentiometer clockwise about 1/2 of full range.

- If the driven load has the unity power factor, set the voltage droop potentiometer on all generators at half of full range. Proceed to 3.g.
- If the driven load is approximately 0.8 power factor, proceed to 3.c.

c. Readjust the voltage level rheostat until the voltage is approximately 5 percent above desired voltage.

d. Apply full load.

e. Readjust the voltage droop rheostat in order to obtain desired voltage with full load at 0.8 power factor. The voltage droop of each generator must be equal in order to divide the reactive load.

f. Repeat 3.c, 3.d and 3.e for each generator until the following two conditions are met.

- The line voltage is equal to the desired level at full load.
- The voltage at no load is approximately 5 percent above the rated voltage.

g. Parallel the generators and apply the driven load. Check the output current of the generator. If the sum of the amperes of the individual generator amperes exceeds the total amperes that are going to the load by 10 percent at full load, adjust voltage droop rheostats. This will lead to proportional current sharing between generators. Some circulating current is permitted at light load. Some circulating current can be expected when generators are cold.

NOTICE
Damage to the generator is possible. Do NOT exceed the rated ampere load on any single generator.

h. Make the final adjustments after the generators that are parallel have been running at full load for one hour. Tighten the locknuts on all controls. Install the access cover. The last condition of "Initial Start-Up" has been met.

Starting Multiple Units

Refer to Operation Section, "Single Unit Operation".

Paralleling Multiple Units

Units may be paralleled at no load or units may be paralleled with units under load. After the initial conditions for start-up are satisfied, verify for the following requirements.

- One of the governors can be an isochronous governor. Electronic load sharing governors are an exception.
- Generators must have voltage droop compensation or cross current compensation.

1. Start the unit which will be paralleled.
2. Turn on the synchronizer lights.
3. After the engine has run a few minutes, bring the engine up to synchronous speed. Synchronous speed means that the frequency of the incoming unit will have the same frequency of the unit that is on-line. The synchronizing lights will begin to blink.

Note: The frequency of the incoming unit should be slightly greater than the line frequency. This will allow the incoming unit to assume part of the load.

4. Adjust the engine speed until the lights blink v slowly.
5. The lights turn off when the voltages of the tw units are in-phase. At this point, very quickly c the breaker while the lights are out.
6. Use governor controls in order to share kW lo between engines.
7. Generator temperature will be stabilized in approximately four hours. After the generator temperature has been stabilized, adjust the voltage droop rheostat of each generator in order to share the reactive load. Adjust the voltage droop rheostat of each generator in order to limit the circulating currents. Less dro increases the reactive current that is carried by generator. Adjusting the voltage droop rheosta in a counterclockwise direction will decrease droop. Adjusting the voltage droop rheostat in clockwise direction will increase droop.

Speed Droop for the Load Divisio (If Equipped)

Once the two units have been paralleled, the sha of the kW load is determined by the governor control setting. If two units of the same capacity a the same governor characteristics have the same governor control settings, the units will share the lo equally. The total load must not exceed the capaci of the one engine.

In order to transfer the load from one engine, follo the following procedure.

1. Increase the governor speed control of one unit order to increase the load.
2. Reduce the governor speed control of the other unit in order to decrease the load on that unit.
3. Raise or lower the governor speed control of bo units in order to change system frequency.

Parallel Operation Of Governors

The different governors that can be used on G3500 generator sets are shown below.

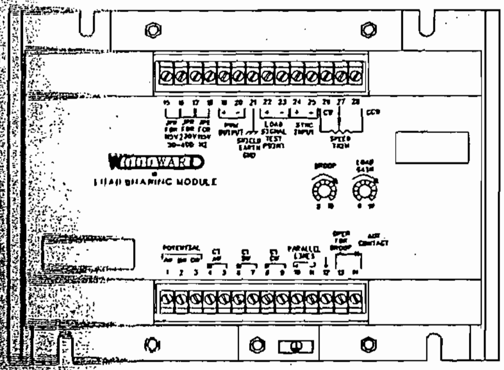

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Illustration 38

Load Sharing Module (typical example)

The generator set load sharing module provides the droop load sharing for generators that are paralleled. The generator set load sharing module provides the isochronous load sharing for generators that are paralleled. The load sharing module has an input for the synchronizing parallel module. The module provides the load sharing that is proportional . More information is available in the System Operation, Testing and Adjusting, SENR6565, "Generator Set Load Sensor and Generator Load Sharing Module".

Function of The Engine Governor

This section describes the function of the engine governor in relation to load division between parallel generator sets. For detailed information on governor operation and adjustments, refer to the Service Manual for additional information.

It is very important to understand two basic facts of load division between generator sets which are operating in parallel.

1. The power which is supplied to the generator is a function of the engine. The engine governor setting and the positions of the governor controls determine the amount of power that is delivered by the engine. Therefore, the engine governor setting and the positions of the governor controls determine the kW load which is carried by the generator. If the governor control setting is advanced, the engine and the generator will assume more kW load. Likewise, decreasing the governor control setting will result in a reduction of load on the unit. Other units on the line will gain load or other units will lose load. These other units will assume that no change in total load or no change in the governor settings of the other units has taken place.

2. The division of power is not determined by generator excitation or terminal voltage. The generator excitation will determine the power factor of the generator during operation when the generator is in parallel with other generators.

Governors that are used with Caterpillar powered electric sets can be of two types: governors with fixed speed droop or governors with adjustable speed droop. The values of speed droop which are commonly used are 3 percent and 0 percent. Governors with adjustable speed droop can be adjusted so that the settings match the settings of the governors with fixed speed droop. If the governor is adjusted for 0 percent speed droop operation, then the same speed from no load to full load can be obtained.

Summary on Governor Operation

The preceding discussion of governor operation can be summarized below.

- The G3520C uses two electronic control modules in order to control engine operation.
- The simplest governor combination for parallel generator sets is a speed droop of 3 percent for each governor. If a constant frequency from no load to full load is required, one governor can be adjusted for isochronous operation. This isochronous unit will be called a "lead unit".
- In order for all paralleled units to accept the full share of the load, the following governor adjustments are required. The governors should have the same full load speed. The governors should have the same high idle speed in the case of governors which are adjusted for speed droop operation. The controls for the governor should be set to the high idle position so that the full range of the governor is available.
- Operation of a governor that is isochronous in parallel with speed droop governors requires special techniques.
- Any number of electric sets can be operated in parallel. However, only one governor of the group can be adjusted for isochronous operation. The exception will be some special cases of electronic governors with an automatic load sharing governor.

Stopping

In order to remove a generator from the line, perform the following procedure.

1. Check the load. The load must be less than the rated capacity of the remaining units.

2. Be sure that the neutral of one of the remaining units is grounded.

3. Remove the load from the outgoing unit. Refer to the Parallel Operation, "Load Division - Speed Droop". The amperage may never go to zero due to circulating currents.

4. Open the circuit breaker.

5. Allow the engine to cool for five minutes.

6. Stop the engine.

Circulating Currents

Understanding the circulating currents becomes very important when you parallel the units. These circulating currents are flowing between generators that are paralleled. The circulating currents are caused by voltage differences between the generators. The amount of the circulating current can be determined by subtracting the amperage which is going to the load from the total generator amperage.

The circulating current may be as high as 25 percent of rated amperes with cold generator sets. Such current may not even be considered harmful. The total generator current should not exceed the amperage rating.

As the generators warm, the circulating currents will decrease. The ammeter readings should decrease slightly, but the voltage meter readings should remain constant.

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Single Unit Operation

SMCS Code: 4450

Initial Start-Up

Before the initial start-up, perform the megohmm test on the main stator winding. Refer to the Spe Instruction, SEHS9124, "Cleaning and Drying of Electric Set Generators" for the procedure.

Starting

1. Make all of the preliminary checks listed in thi Operation and Maintenance Manual, "Before Starting Engine" topic.

2. Be sure that the main circuit breaker or the lin circuit breaker is open.

3. Start the engine according to this Operation a Maintenance Manual, "Starting the Engine" to Allow the engine to warm up.

4. Adjust to the full-load engine speed.

5. Close the main circuit breaker.

6. Apply the load. Do not try to apply the full load Apply the load in increments in order to mainta system frequency at a constant level.

7. Readjust the governor for rated frequency.

Stopping

Refer to this Operation and Maintenance Manual, "Manual Stop Procedure" for the required procedu for stopping the generator set.

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Voltage Regulators

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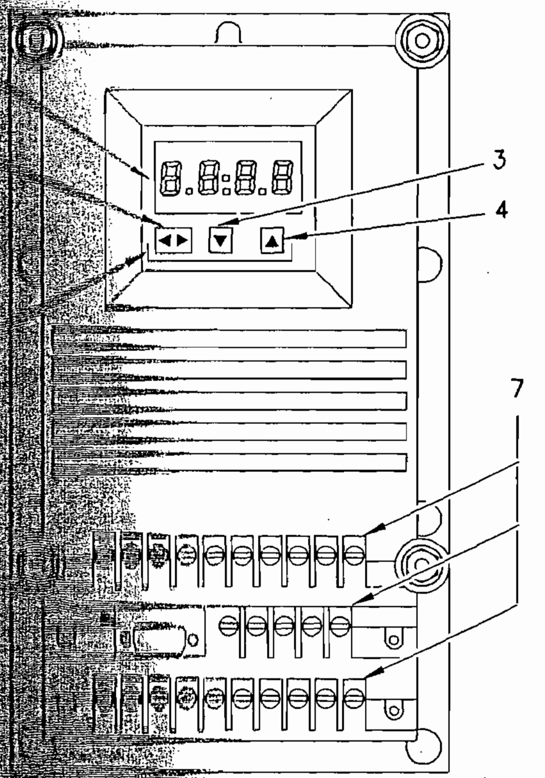
Voltage Regulators

[illegible] Code: 4467

[illegible] voltage regulator controls the generator output [illegible].



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[illegible] Regulator (DVR)

[illegible]

[illegible] regulator (DVR) is a [illegible] based voltage regulator. The [illegible] preset at the factory or the [illegible] be modified in order to meet the [illegible] on the site. Certain system [illegible] be monitored on the display [illegible] keypad (5) is used to change the [illegible] shown on the display. J1 connector [illegible] the DVR to a personal computer. [illegible] (7) are used to join the DVR to the [illegible] various customer options.

Adjustment Procedure for the Voltage Regulators

Refer to the Specifications, Systems Operation, Testing and Adjusting, SENR5833, "Digital Voltage Regulator".

The digital voltage regulator (DVR) can be set up for a specific application by using the configured parameters. Parameters are preset at the factory. Parameters may need to be adjusted in order to meet the specific requirements of a site. The DVR also detects faults. When a fault is detected, the DVR sets the appropriate alarm or caution. Certain system parameters can also be monitored on the display of the DVR.

Display (1) and keypad (5) are used to select parameter values. The display and the keypad are also used to manipulate the parameter values that control the operation of the digital voltage regulator. The display of the digital voltage regulator has four digits. When one of these digits is a colon, the number that is showing is a parameter code. When a colon is not present, the number that is showing is a parameter value. A decimal point in the display is used to indicate the precision of the parameter value.

Keypad (5) has three keys. The keys are listed below.

- Function key (2)
- Scroll down key (3)
- Scroll up key (4)

Display (1) has two modes. These modes are the parameter code mode and the parameter value mode. Function key (2) is used to toggle back and forth between the two modes. Scroll down key (3) and scroll up key (4) are used to change the display's value. The scroll down key will decrease the parameter number or the scroll down key will decrease the value. The scroll up key will increase the parameter number or the scroll up key will increase the value.

Table 8

Parameter Code	Parameter Value
:01	0480
	0481
	0482
	0483
:02	0001
	0002
	0003
	0004
:03	0004
	0003
	0002
:04	0100
	0099
	0100
	0101

The operation of display (1) and keypad (5) is shown in Table 8. Pressing function key (2) toggles the display between the two columns of the table (parameter code and parameter value). The display is in the parameter code mode when a colon is present. If a colon is not present, the display is in parameter value mode.

When you press scroll up key (3), the number that is displayed will increase to the next higher number within the column. When you press scroll down key (4), the number that is displayed will decrease to the next lower number within the column. The scroll keys will not cause the display to change columns.

To configure a parameter code, follow the procedure below:

1. To select the desired parameter code, press scroll key (3) or scroll key (4).
2. Access the parameter value by pressing function key (2).
3. Select the desired parameter value by pressing scroll key (3) or (4).
4. In order to enter the selected value into the digital voltage regulator's memory, press function key (2).

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Voltage Regulator Options

SMCS Code: 4467

Manual Voltage Control

A manual voltage control is available as an optio Caterpillar generator sets. Various specifications certifications require manual voltage control of th generator if the automatic voltage regulator shou fail. The manual voltage control for the permane magnet excited generators is shown below.

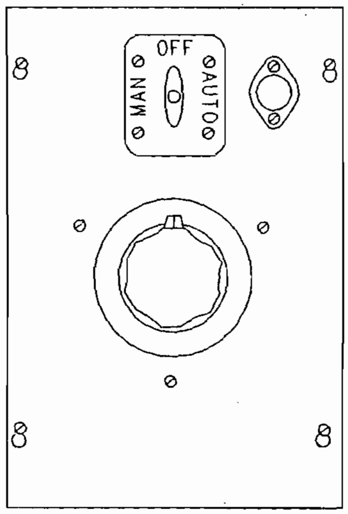

Illustration 40 g0062

Manual voltage control for permanent magnet excited generato

Maintenance Section

Refill Capacities

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Refill Capacities and Recommendations

SMCS Code: 1348; 1395; 7560

Lubrication System

Lubricant Recommendations

Due to significant variations in the quality and in the performance of commercially available oils, Caterpillar makes the following recommendations:

Cat NGEO (Natural Gas Engine Oil)

Cat NGEO EL250 (Natural Gas Engine Oil)

Cat NGEO EL350 (Natural Gas Engine Oil)

The proper SAE viscosity grade of oil is determined by the minimum ambient temperature during cold engine start-up, and the maximum ambient temperature during engine operation. To determine the oil viscosity that is required for starting a cold engine, refer to the minimum temperature in the Table. To select the oil viscosity for operation at the highest anticipated ambient temperature, refer to the maximum temperature in the Table. Use the highest oil viscosity that is available in order to meet the required temperature during start-up.

Table 11

Engine Oil Viscosity		
Cat NGEO Grade of Viscosity	Ambient Temperature	
	Minimum	Maximum
SAE 30	0 °C (32 °F)	40 °C (104 °F)
SAE 40	5 °C (41 °F)	50 °C (122 °F)

Cat NGEO is available in these grades only. Multigrade oils are not recommended for use in Caterpillar Gas Engines. If other grades of viscosity are selected, ensure that the oil meets the requirements for Caterpillar Gas Engines.

For additional information about oils, see Special Publication, SEBU6400, "Caterpillar Gas Engine Lubricant, Fuel, and Coolant Recommendations".

Lubricant Capacities

The capacity of the engine crankcase includes the capacity of the oil filters that are installed at the factory.

Table 10

Lubrication System Approximate Refill Capacities		
Engine	Liters	US Gallons
G3516C G3516E	423	112
G3520C G3520E	541	141

Fuel

Fuel Recommendations

Caterpillar gas engines will operate successfully on a broad range of gaseous fuels. Pipeline natural gas has been used for many years. Commercial fuel gases are mixtures of gases. These fuels consist primarily of hydrocarbons (combinations of hydrogen and carbon) and some inert gases. The compositions of these gas mixtures have extreme variations. Fuels such as wellhead gas, bio-gas, and manufactured gas need to be reviewed for acceptability. Analyze the fuel in order to determine the following characteristics:

- Composition
- Contaminants
- Heat value
- Methane number
- Specific gravity

Field gas can have varying characteristics of combustion. Field gas can contain numerous harmful impurities. The impurities can alter the BTU content. The impurities can also alter the methane number. The impurities include everything from water up to complex hydrocarbons that can lead to detonation and severe engine damage. To minimize these effects, Caterpillar recommends the following guidelines:

1. Evaluate the fuel with the Caterpillar Methane Number Program, LEKQ6378. Methane values below 30 are not recommended for use in a Caterpillar engine. Fuels with a methane number that is below 30 must first be processed in order to remove harmful impurities in the fuel and raising the methane number into the acceptable range.

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2. If necessary, use an engine that is configured for a fuel that has a high energy. Consult the appropriate manual for the engine in order to determine the recommended engine timing.

3. Reduce the oil change interval according to the results of the oil analysis.

For further information on fuels, see Special Publication, SEBU6400, "Caterpillar Gas Engine Lubricant, Fuel, and Coolant Recommendations".

Cooling System

Coolant Recommendations

During shipping and storage, the engine must be protected from damage that can be caused by freezing of the cooling system. If the engine is shipped to a site with freezing temperatures and/or if the engine is stored in a location with freezing temperatures, the cooling system must contain antifreeze that will withstand the lowest ambient temperature. Frequently check the concentration of glycol in the coolant/antifreeze. Make sure that the concentration is adequate in order to prevent freezing. Otherwise, the cooling system must be completely drained.

Coolant/antifreeze is normally composed of three elements: water, glycol, and additives. Each element must meet specific guidelines.

Water

Deionized water or distilled water is recommended for use in engine cooling systems. If distilled water or deionized water is not available, use water with the properties that are listed in Table 11.

Table 11

Caterpillar Minimum Acceptable Water Requirements		
Property	Maximum Limit	ASTM Test
Chloride (Cl)	40 mg/L (2.4 grains per US gal)	"D512", "D4327"
Sulfate (SO_4)	100 mg/L (5.9 grains per US gal)	"D516"
Total Hardness	170 mg/L (10 grains per US gal)	"D1126"
Total Solids	340 mg/L (20 grains per US gal)	"D1888"
Acidity	pH of 5.5 to 9.0	"D1293"

NOTICE

Use of water that does not meet the recommenda for the cooling system will damage the cooling sy

Do not use these types of water in the cooling sy sea water, softened water that has been condi with salt, hard water, and tap water.

Only use water that meets the recommendation the cooling system.

If you are not sure about the properties of your w consult one of the following sources for a water analysis:

- Caterpillar dealer
- Local water utility company
- Agricultural agent
- Independent laboratory

Glycol

NOTICE

Do not use Extended Life Coolant (ELC) w Caterpillar Gas Engines.

ELC was not formulated for use in Caterpillar Gas gines.

Use only the coolant/antifreeze that is recommend

Preferred – Cat NGEC (Natural Gas Engine Coolant)

Alternatively, use Cat DEAC (Diesel Engine Antifreeze/Coolant) or a commercial heavy-duty coolant/antifreeze that meets "ASTM D6210" or "ASTM D4985" specifications.

NOTICE

Do not use a commercial coolant/antifreeze that o meets the ASTM "D3306" specification. This type coolant/antifreeze is made for light duty automot applications.

Use only the coolant/antifreeze that is recommend

Acceptable – In applications that do not require protection from boiling or from freezing, a mixture Cat SCA and water that meets the properties that a listed in Table 11 is acceptable.

Note: The preferred coolant/antifreeze and the acceptable mixture of SCA and water require different concentrations of SCA. Refer to the Special Publication, SEBU6400, "Caterpillar Gas Engine Lubricant, Fuel, and Coolant Recommendations", "Supplemental Coolant Additive (SCA)" topic.

Table 12 is a list of the coolant/antifreeze that is recommended for Caterpillar Gas Engines. The service life of the coolant/antifreeze that is used in Caterpillar Gas Engines is also listed. **To achieve this service life, the coolants must be properly maintained. The maintenance program includes S·O·S coolant analysis.**

Table 12

Recommended Coolant/Antifreeze and Service Life of the Coolant/Antifreeze	
Coolant/Antifreeze	**Service Life (1)**
Cat NGEC	Three Years
Cat DEAC	
Commercial Heavy-Duty Coolant/Antifreeze that meets "ASTM D6210"	Two Years
Commercial Heavy-Duty Coolant/Antifreeze that meets "ASTM D4985"	One Year
Cat SCA and Water	Two Years
Commercial SCA and Water	One Year

(1) The service life of coolant is also limited by use (service hours). Refer to the specific engine's Operation and Maintenance Manual, "Maintenance Interval Schedule".

Additive

Preferred – Caterpillar SCA (Supplemental Coolant Additive)

Acceptable – A commercial SCA that provides 1200 mg/L (70 grains per US gal) or 1200 ppm of nitrites in the final mixture of coolant/antifreeze

Note: A 50/50 concentration of Cat NGEC or of Cat DEAC does not require a treatment with an SCA at the initial fill. Commercial heavy-duty coolant/antifreeze that meets "ASTM D6210" or "TMC RP329" specifications may require a treatment with an SCA at the initial fill. Read the label or the instructions that are provided by the OEM of the product.

To ensure that the correct amount of SCA is in the cooling system, the concentration of SCA must be tested on a scheduled basis. Obtain an S·O·S coolant analysis (Level 1) or use a test kit to check the concentration of the SCA according to this Operation and Maintenance Manual, "Maintenance Interval Schedule".

For further information on coolant, see Special Publication, SEBU6400, "Caterpillar Gas Engine Lubricant, Fuel, and Coolant Recommendations".

Coolant Capacities

To properly maintain the cooling system, the total cooling system capacity must be determined. The total cooling system capacity will vary between individual installations. The total cooling system capacity equals the capacity of the jacket water circuit plus the aftercooler circuit plus the external system capacity. The external system capacity includes the following components: expansion tank, heat exchanger, radiator, and piping. Refer to the specifications that are provided by Caterpillar or by the OEM of the equipment. Record the total cooling system capacity in the following Table:

Table 13

Cooling System Approximate Refill Capacities			
System	**G3516C G3516E**	**G3520C G3520E**	**G3520C Landfill**
Jacket Water Circuit	201 L (53 US gal)	344 L (91 US gal)	371 L (98 US gal)
Aftercooler Circuit	47.5 L (12.5 US gal)	47.5 L (12.5 US gal)	73.7 L (19.5 US gal)
External System			
Total Cooling System			

Maintenance Recommendations

i01135057

General Maintenance Information

SMCS Code: 4450; 7000

Note: Read the warnings and read the instructions that are contained in the Safety Section of this manual. These warnings and instructions must be understood before you perform any operation or any maintenance procedures.

Rotating electric machines are complex structures that are exposed to the following forms of stress:

- mechanical
- electrical
- thermal
- environmental

These stresses may be of varying magnitudes. The insulation systems are very susceptible to damage that is caused by the stresses that are listed above. Exposure to these stresses may shorten the effective life of the insulation system. Therefore, the service life of an electric machine will largely depend on the serviceability of the insulation systems. An inspection program and a testing procedure are recommended. An inspection program and a testing procedure will ensure that the equipment is maintained in satisfactory condition. This will increase field reliability.

A regular maintenance and inspection program can provide an evaluation of the present condition of the equipment. A regular maintenance program and a regular inspection program can also reveal future problems. The frequency of this maintenance program will depend on the following factors:

- application
- environmental conditions
- operator's experience
- operator's philosophy

A regular maintenance program is strongly recommended. This program would involve the following steps:

- periodic disassembly
- knowledgeable visual examination of the equipment
- the application of electrical tests

Never perform a test over the rated potential. Th tests can damage insulation that is contaminate or insulation that is in marginal condition. For mo information, refer to "I.E.E.E. Standard 432-1992 consult a Caterpillar dealer.

Space Heaters

The SR4B generator is capable of operating in h humidity conditions without problems. However, problems can occur when the generator is idle a the surrounding air is warmer than the generator Moisture can form on the windings that will resul poor performance from the windings. Moisture ca also result in damage to the windings. Whenever generator is not active, ensure that the space hea are in operation.

Whenever the generator is operating, ensure tha space heaters are disconnected.

An external source of either 115 VAC or 230 VAC required to operate the space heaters.

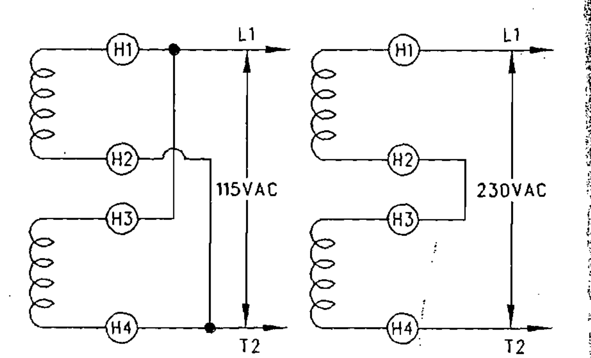

Illustration 41 g00556

Space heater connection to external source (H1), (H2), (H3), a (H4) terminals.

If a 115 VAC source is available, connect both heaters in parallel across the source. If a 230 VAC source is available, connect both heaters in series across the source. Refer to Illustration 41.

i01689052

Generator Start-up Checklist

[illegible] Model [illegible]

GENERATOR START-UP CHECKLIST			
RATING INFORMATION			
Engine Serial Number: ______		Arrangement Number: ______	
Generator Serial Number: ______		Arrangement Number: ______	
GENERATOR NAME PLATE INFORMATION			
Voltage: ______	Package (prime, continuous, standby): ______		
Amperage: ______	Kilowatts: ______		
Storage Location:			
Generator Alignment:			
Main Stator Megohmmeter Reading:	Before Storage:		After Storage:
Generator dried for 24 hours prior to start-up?	(Y/N)		Drying method:

SPACE HEATERS	Yes	No	Comments
Space heaters operating properly?			
Space heater operated 48 hrs. before start-up?			

MEGOHMMETER TEST (SEHS9124)		30 sec. reading	60 sec. reading	30 sec. corrected	60 sec. corrected	Ambient temp.	Comments
[illegible]	Main Stator						
	Main Rotor						
	Exciter Stator						
	Exciter Rotor						
	PMG Stator						
[illegible]	Main Stator						
	Main Rotor						
	Exciter Stator						
	Exciter Rotor						
	PMG Stator						

	Regulator	Voltage	Amps	Comments
[illegible]	F1 to F2	DC		
	20 to 22	AC		
	20 to 24	AC		
	22 to 24	AC		
	20 to 26	AC		
	20 to 30	AC		
	20 to 60	AC		

(continued)

(Table 14, contd)

GENERATOR START-UP CHECKLIST				
Full Load	Generator Excitation Name Plate Information:	DC		Compare with F1 to F2
	F1 to F2	DC		
	20 to 22	AC		
	20 to 24	AC		
	22 to 24	AC		
	26 to 28	AC		
	26 to 30	AC		
	28 to 30	AC		

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[illegible] 18

GENERATOR START-UP CHECKLIST (CONT.)			
ELECTRICAL	**Yes**	**No**	**Comments**
Unit properly grounded			
Check diodes			
Over current protection			
Over voltage protection			
Check for loose wiring			
Adjust voltage			
Adjust frequency			

MECHANICAL	**Data**	**Comments**
Bearing temperature readings at full load	Front ________ Rear ________	
Stator temperature readings at full load	A0 ______ B0 ______ C0 ______	
Air gap on main stator	Top ________ Bottom ________	
Air gap on exciter stator	Top ________ Bottom ________	
Air gap of PMG	Top ________ Bottom ________	
Ambient air to generator at full load	Temperature ________________	
Supplier air opening to generator	Size of Opening ______________	

SWITCHGEAR/PARALLEL OPERATION				
Manufacturer:				
	Setting 1	**Setting 2**	**Setting 3**	**Comments**
Circuit breaker type				
Overload setting				
Reversed power relay				
VAR/PF Controller				
Load share				

INSTALLATION & LOAD INFORMATION	
Neutral grounding system	UPS
Enclosure type	Size
Motor:	Other loads:
Total SKVA	- Lighting
Total HP	- Computers
[illegible]	- Welding
[illegible]	- Non-linear
[illegible]	- Other

LOAD DATA							
[illegible] Amps		kW	KVARS	P.F.			
[illegible]							

i02281361

Maintenance Interval Schedule (Standby)

SMCS Code: 1000; 4450; 7500

S/N: GSB1-Up

S/N: GZG1-Up

S/N: GZH1-Up

S/N: GZL1-Up

S/N: GZM1-Up

S/N: GZN1-Up

S/N: SSR1-Up

S/N: GAS1-Up

S/N: GZZ1-Up

S/N: TJB1-Up; RWA1-Up

S/N: CWY1-Up; GDB1-Up

S/N: GNX1-Up; GHB1-Up

S/N: B9P1-Up; GHC1-Up

S/N: CWW1-Up; GHE1-Up

S/N: GTX1-Up; GHF1-Up

S/N: TJD1-Up; GHG1-Up

S/N: SXY1-Up; GHM1-Up

S/N: SLY1-Up; GHP1-Up

S/N: TJC1-Up; DKR1-Up

S/N: HAL1-Up; GHR1-Up

Before performing any operation or maintenance procedures, ensure that the safety information, warnings, and instructions are read and understood.

Failure to adhere to proper maintenance intervals may result in the degradation of the engine's performance and/or the accelerated wear of the engine's components.

Before each consecutive interval is performed, all of the maintenance requirements from the previous interval must be performed.

When Required

Daily

Every Week

Every 250 Service Hours

Every 1000 Service Hours or 6 Months

Every 1000 Service Hours or 1 Year

Every 2000 Service Hours

Every Year

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i02279681

Maintenance Interval Schedule (Standard)

SMCS Code: 1000; 4450; 7500

S/N: GSB1-Up

S/N: GZG1-Up

S/N: GZH1-Up

S/N: GZL1-Up

S/N: GZM1-Up

S/N: GZN1-Up

S/N: SSR1-Up

S/N: GAS1-Up

S/N: GZZ1-Up

S/N: TJB1-Up; RWA1-Up

S/N: CWY1-Up; GDB1-Up

S/N: GNX1-Up; GHB1-Up

S/N: B9P1-Up; GHC1-Up

S/N: CWW1-Up; GHE1-Up

S/N: GTX1-Up; GHF1-Up

S/N: TJD1-Up; GHG1-Up

S/N: SXY1-Up; GHM1-Up

S/N: SLY1-Up; GHP1-Up

S/N: TJC1-Up; DKR1-Up

S/N: HAL1-Up; GHR1-Up

Before performing any operation or maintenance procedures, ensure that the safety information, warnings, and instructions are read and understood.

Failure to adhere to proper maintenance intervals may result in the degradation of the engine's performance and/or the accelerated wear of the engine's components.

Before each consecutive interval is performed, all of the maintenance requirements from the previous interval must be performed.

When Required

Cooling System Coolant Sample (Level 2) - Obtain 86
Engine Air Cleaner Element - Replace 89
Fuel Metering Valve - Check 98
Generator - Dry ....
Generator Set - Test ....
Insulation - Test ....
Overhaul Considerations ....
Space Heater - Check ....
Stator Winding Temperature - Measure/Record ....
Throttle Control Valve - Check ....
Valve Stem Projection - Measure/Record ....

Daily

Air Starting Motor Lubricator Oil Level - Check ....
Air Tank Moisture and Sediment - Drain ....
Bearing Temperature - Measure/Record ....
Cooling System Coolant Level - Check ....
Engine Air Cleaner Service Indicator - Inspect ....
Engine Oil Level - Check ....
Fuel System Fuel Filter Differential Pressure - Check ....
Fumes Disposal Filter Differential Pressure - Check ....
Generator Load - Check ....
Power Factor - Check ....
Voltage and Frequency - Check ....
Walk-Around Inspection ....

Initial 250 Service Hours

Crankcase Blowby - Measure/Record ....
Cylinder Pressure - Measure/Record ....
Valve Stem Projection - Measure/Record ....

Every 250 Service Hours

Battery Electrolyte Level - Check ....
Cooling System Coolant Sample (Level 1) - Obtain ....
Cooling System Supplemental Coolant Additive (SCA) - Test/Add ....
Engine Oil Sample - Obtain ....
Fumes Disposal Filter - Drain ....

Initial 1000 Service Hours

Engine Speed/Timing Sensor - Clean/Inspect ....

Every 1000 Service Hours

Aftercooler Condensation - Drain ....
Alternator - Inspect ....
Belts - Inspect/Adjust/Replace ....
Crankcase Pressure - Measure ....
Crankshaft Vibration Damper - Inspect ....
Engine Crankcase Breather - Clean ....
Engine Oil - Change ....
Engine Oil Filter - Change ....
Engine Valve Lash and Bridge - Adjust ....
Gas Pressure Regulator Condensation - Drain ....
Hoses and Clamps - Inspect/Replace ....
Ignition System Timing - Check/Adjust ....
Inlet Air System - Inspect ....
Radiator - Clean ....

Every 2000 Service Hours

Every Year

Every 3000 Service Hours

Every 4000 Service Hours

Every 8000 Service Hours

Between 10 000 and 20 000 Service Hours

Every 24 000 Service Hours or 3 Years

Between 30 000 and 60 000 Service Hours

Between 60 000 and 100 000 Service Hours

i02281364

Maintenance Interval Schedule (Landfill)

SMCS Code: 1000; 4450; 7500

S/N: GZJ1-Up

S/N: GZK1-Up

S/N: MAD1-Up; JBX1-Up

S/N: HAT1-Up; JBZ1-Up

Before performing any operation or maintenance procedures, ensure that the safety information, warnings, and instructions are read and understood.

Failure to adhere to proper maintenance intervals may result in the degradation of the engine's performance and/or the accelerated wear of the engine's components.

Before each consecutive interval is performed, all of the maintenance requirements from the previous interval must be performed.

When Required

Daily

Initial 250 Service Hours

Every 250 Service Hours

Initial 1000 Service Hours

Every 1000 Service Hours

Every 2000 Service Hours

Every Year

Every 4000 Service Hours

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Between 7500 and 8000 Service Hours

Overhaul (Top End) 120

Every 8000 Service Hours

[illegible] Disposal Filter Element - Replace 100
[illegible] Rectifier - Check 124
[illegible] - Test 130
Water Temperature Regulator - Replace 132
[illegible] - Test 133

Between 22 500 and 24 000 Service Hours

Overhaul (In-Frame) 117

Every 24 000 Service Hours or 3 Years

Cooling System Coolant (NGEC) - Change 82

Between 37 500 and 40 000 Service Hours

Overhaul (Major) 118

Between 80 000 and 100 000 Service Hours

[illegible] - Inspect 79

APPENDIX K

USEPA Region 1
Use of Treatment System Prior to IC Engine Combustion
Control Number 0300121
August 15, 2003

USEPA Region 3
Waiver of Initial Performance Test
Control Number 0200019
February 12, 2002
Request for Initial Performance Test Waiver
October 3, 2002

USEPA Region 5
Clarification of LFG Treatment NSPS Exemption for Dixon/Lee Energy Partners, L.L.C.
December 9, 2003

USEPA Region 9
Kiefer Landfill
April 22, 2004

Search Applicability Determination Index

Determination Detail

Control Number: 0300121

Category: NSPS
EPA Office: Region 1
Date: 08/15/2003
Title: Use of Treatment System Prior to IC Engine Combustion
Recipient: Douglas McVay
Author: Michael Kenyon
Comments:

Subparts: Part 60, WWW Municipal Solid Waste Landfills

References: 60.752

Abstract:

Q. What constitutes a "treatment system" according to Subpart WWW, and does the treatment system at Ridgewood Power Associates in Johnston, Rhode Island satisfy the requirements of 40 CFR 60.752?

A. The pre-treatment system employed by Ridgewood Power does meet EPA's criteria for a treatment system as defined under 40 CFR 60.752(b)(2)(iii)(C). Treatment of the landfill gas in this manner is a means of compliance with the gas control requirements of the NSPS. Region 1 concurs that the IC engines combusting the treated landfill gas are not subject to the requirements of 40 CFR 60.752(b)(2)(iii)(B).

Letter:

August 15, 2003

Douglas L. McVay
Associate Supervising Engineer
Office of Air Resources
Department of Environmental Management

235 Promenade Street
Providence, RI 02908-5767

Dear Mr. McVay:

Thank you for your June 3, 2003 letter requesting a new NSPS Subpart WWW applicability determination for Ridgewood Providence Power Partners, L.P. RPPP operates a small power plant located at the Central Landfill in Johnston, Rhode Island. The DEM/EPA had previously determined that the RPPP facility, which consists of nine internal combustion engines fired with landfill gas generated by Central Landfill, must comply with the control system requirements found at 40 CFR 60.752(b)(2)(iii)(B).

RPPP is now claiming that they treat the landfill gas prior to combusting the gas in their IC engines. The landfill gas treatment system filters, de-waters and compresses the landfill gas prior to use in the engines, and, according to RPPP, meets the requirements for a "treatment system" in 40 CFR 60.752(b)(2)(iii)(C). Therefore, RPPP maintains that their IC engines combusting the treated gas should not be subject to the control requirements of 40 CFR 60.752(b)(2)(iii)(B).

EPA has reviewed relevant applicability determinations, including two that were presented to the DEM by RPPP, and has also reviewed EPA's proposed definition for "treatment system" contained in a May 23, 2002 Federal Register Notice of proposed rulemaking. [See 67 FR 36480].

As you know, the NSPS does not now contain a definition for the term "treatment system." However, EPA's May 23, 2002 Federal Register Notice contains a proposed definition of the term, which also constitutes EPA's current interpretation of the term as it now appears in the NSPS. The preamble to EPA's May 23, 2002 proposed rulemaking also includes the following statements about the proposed definition of "treatment system":

"At a minimum, the system must filter landfill gas using a dry filter or similar device (e.g., impaction, interception or diffusion device). The filter should reduce particulate matter in the gas stream. This will prolong the life of the combustion device and decrease the buildup of material on combustion device internals, which will support good combustion. Good combustion is essential to ensuring the proper destruction of NMOC. In addition, the system must de-water landfill gas using chillers or other dehydration equipment. The de-watering equipment should reduce moisture content of the gas, which will maintain low water content in the gas and will prevent degradation of combustion efficiencies. Finally, the system must compress landfill gas using gas blowers or similar devices. Compression should further reduce the moisture content of the gas and raise gas pressure to the level required by the end use combustion device."

Thus, if RPPP treats the landfill gas it receives in accordance with EPA's proposed definition of "treatment system" and consistent with the preamble discussion quoted in the preceding paragraph, then Region 1 concurs that the IC engines combusting the treated landfill gas are not subject to the requirements of 40 CFR 60.752(b)(2)(iii)(B). Treatment of the landfill gas in this manner is a means of compliance with the gas control requirements of the NSPS that differs from, and is in the alternative to, the IC engine performance testing and NMOC destruction efficiency compliance method that formed the basis of Region 1's 2001 enforcement action. However, keep in mind that, in accordance with 40 CFR 60.752(b)(2)(iii)(C), any emissions from any atmospheric vent from the gas treatment system, including any compressor, are still subject to the requirements of 40 CFR 60.752(b)(2)(iii)(A) and (B).

Finally, please note that EPA's current interpretation of the term "treatment system," as it now appears in the NSPS, may change based on any changes that might be contained in EPA's final rulemaking.

If you have any questions concerning this applicability determination, please contact John Courcier of my staff at (617) 918-1659, or by email at courcier.john@epa.gov.

Sincerely,

Michael Kenyon, Chief
Air Programs Branch

cc: D. Dart, OES
G. Dain, OES
T. Olivier, OES
J. Courcier, OEP

Search Applicability Determination Index

Determination Detail

Control Number: 0200019

Category: NSPS
EPA Office: Region 3
Date: 02/12/2002
Title: Waiver of Initial Performance Test
Recipient: Steven C. White
Author: Judith Katz
Comments:

Subparts: Part 60, WWW Municipal Solid Waste Landfills

References: 60.752(b)(2)(iii)

Abstract:

Q: Will EPA grant a waiver from the initial performance test required in 40 CFR Part 60, Subpart WWW, for landfill gas used in a large process heater (more than 44 megawatts)? The landfill gas is to be compressed, filtered, and refrigerated before being sent to the process heater.

A: Yes. EPA considers compressing, filtering, and refrigerating landfill gas for use in an energy recovery project to be "treatment" under WWW. Therefore, no initial performance test is required.

Letter:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

February 12, 2002

Steven C. White, P.E.

Enerdyne Power Systems
7421 Carmel Executive Park
Suite 302
Charlotte, North Carolina 28226

Re: Request for Waiver of Requirement for Initial Performance Test

Dear Mr. White:

This letter responds to your October 10, 2001, letter requesting a waiver of the initial performance test requirement in 40 C.F.R. Sec. 60.752(b)(2)(iii)(B) for the Atlantic Waste Disposal, Inc./Honeywell International, Inc. project. Landfill gas is to be piped from the Atlantic Landfill to the Honeywell ammonia plant in Hopewell, Virginia, and burned in a Kellog Primary Reformer, a process heater.

You indicated in conversations and e-mail correspondence with the U.S. Environmental Protection Agency ("EPA") that the landfill gas will be refrigerated, filtered through a 10 micron screen, and compressed before transmission to Honeywell. 40 C.F.R. Sec. 60.752(b)(2)(iii)(C) states that landfill gas may be controlled by routing the collected gas to a treatment system that processes the collected gas for subsequent sale or use. Based on its technical judgement, EPA considers refrigeration, filtering through the 10 micron screen, and compression for combustion in energy recovery devices such as boilers, process heaters (e.g., the Kellog Primary Reformer), turbines, or internal combustion engines to satisfy the definition of treatment at 40 C.F.R. Sec. 60.752(b)(2)(iii)(C). Part 60, Subpart WWW, does not include an initial performance test for the landfill gas treatment control option. Therefore, once this project has met the treatment standards articulated above, an initial performance test will not be required.

However, emissions from any atmospheric vent from the gas treatment system, including any compressor, are subject to the requirements of 40 C.F.R. Sec. 60.752(b)(2)(iii)(A) and (B). This does not include exhaust from an energy recovery device.

EPA's Office of Enforcement and Compliance Assistance and Office of Air Quality and Planning Standards were consulted for this letter. If you have any questions about this issue, call Bowen ("Chip") Hosford at (215) 814-3158.

Sincerely,

Judith M. Katz, Director
Air Protection Division

cc: Edmund J. Skernolis, Waste Management Incorporated Lisa A. Childress, VADEQ, Piedmont Regional Office Gary E. Graham, VADEQ Michelle Laur, EPA, OAQPS Zofia S. Kosim, EPA, OECA

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

OCT 0 3 2002

Amy E. Hardy
Environmental Compliance Coordinator
Southeastern Public Service Authority
Regional Office
723 Woodlake Drive
Chesapeake, Virginia 23320

Re: Request for Initial Performance Test Waiver

Dear Ms. Hardy:

This letter is in response to your October 3, 2002, letter requesting a waiver of the initial performance test requirement in 40 C.F.R. §60.752 (b)(2)(iii)(B) for the Southeastern Public Service Authority ("SPSA") landfill gas to energy plant owned and operated by US Energy Biogas located at the SPSA landfill. Landfill gas is piped from the landfill to US Energy and burned in four Caterpillar internal combustion engines.

You indicated in conversations, and by providing Mr. Jamie Margaritis' October 1, 2002, letter to you, that the landfill gas will be de-watered by passing through three knockouts, filtered through two 10 micron screens, cooled in an air-to-air cooler, and compressed to 8 psig in a 300 horsepower blower before transmission to the energy plant. 40 C.F.R. §60.752(b)(2)(iii)(C) states that landfill gas may be controlled by routing the collected gas to a treatment system that processes the collected gas for subsequent sale or use. Based on its technical judgement, EPA considers de-watering, filtering through the 10 micron screen, and compression for combustion in energy recovery devices such as boilers, process heaters, turbines, or internal combustion engines to satisfy the definition of treatment at 40 C.F.R. §60.752(b)(2)(iii)(C). Part 60, subpart WWW, does not include an initial performance test for the landfill gas treatment control option. Therefore, once this project has met the treatment standards articulated above, an initial performance test will not be required.

However, emissions from any atmospheric vent from the gas treatment system, including any compressor, are subject to the requirements of 40 C.F.R. §60.752(b)(2)(iii)(A) and (B). This does not include exhaust from an energy recovery device.

If you have any questions about this issue, call Bowen Hosford at (215) 814-3158.

Sincerely,

Judith M. Katz, Director
Air Protection Division

cc: Ethan Chatfield, SCS Engineers
Gary E. Graham, VADEQ
Steve Hackney, VADEQ
Martha Smith, EPA, OAQPS
Zofia S. Kosim, EPA, OECA

SOUTHEASTERN PUBLIC SERVICE AUTHORITY

SPSA

Regional Office
723 Woodlake Drive, Chesapeake, VA 23320
phone: (757) 420-4700 fax: (757) 424-4133
www.spsa.com

October 3, 2002

Bowen (Chip) Hosford
Environmental Protection Agency- Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Subject: Request for Waiver from Requirement for Initial Performance Test Southeastern Public Service Authority (SPSA) Regional Landfill

Dear Mr. Hosford:

Per our telephone conversation on October 2, 2002, the Southeastern Public Service Authority (SPSA) Regional Landfill in Suffolk, Virginia is hereby requesting a waiver from the initial performance test requirement in 40 CFR 60.752(b)(2)(iii)(B).

On June 7, 2002, SPSA submitted a Tier 2 test report, as required by the New Source Performance Standards (NSPS), indicating that the facility exceeded the 50 Mg threshold and will therefore be subject to certain provisions of the NSPS requiring installation and operation of the Gas Collection and Control System (GCCS). On August 15, 2002 the Virginia Department of Environmental Quality (VDEQ) issued the subject facility a draft Title V Air Operating Permit. The draft permit requires the landfill gas-to-energy (LFGTE) electrical generation plant, which utilizes landfill gas for fuel, to perform an initial performance test on the 4 Caterpillar internal combustion engines.

In accordance with 40 CFR 60.752(b)(2)(iii)(C), landfill gas collected from a MSW landfill may either be combusted in an appropriate control device or routed to a "treatment system that processes the collected gas for subsequent sale or use". The EPA has recently provided clarification to define the term "landfill gas treatment" in the form of draft NSPS Amendments. This clarification defined landfill gas treatment as "landfill gas processed in a treatment system that filters, de-waters and compresses the gas". Furthermore, the EPA has recently granted other facilities located in Virginia waivers based on similar criteria as outlined above. Specifically, the EPA has granted a waiver from the initial performance test at the Atlantic Waste Disposal, Inc. Landfill in a letter dated February 19, 2002.

The landfill gas treatment process at the SPSA Landfill, prior to the collected gas entering the engines, involves: compression through two Hoffman blowers, de-watering through a minimum of 3 knock-out pots and an air to air cooler, and filtering through a dry 10-micron 4" thick filter. The owner/operator of the LFGTE facility, US Energy Biogas, has outlined this process in correspondence dated September 26, 2002.

P.O. Box 1346
Chesapeake, VA 23320-1346

Since the subject facility routes collected gas from the Landfill to a "treatment system" prior to use in the LFGTE plant, SPSA is requesting a site-specific waiver from the EPA indicating that the SPSA Regional Landfill satisfies the definition of treatment and therefore will be exempt from the initial performance test required by the NSPS and draft Title V permit.

During our discussion on October 2, 2002, background information (correspondence dated September 10, 2002 and September 12, 2002) was forwarded to your office regarding SPSA's response to the draft Title V permit. Although the above request for waiver addresses concerns #3 and 4 of this correspondence, SPSA would also appreciate EPA guidance on concerns #1, 2, 5, 6 and 7.

Per a telephone conversation with Steve Hackney of Tidewater Regional DEQ on October 1, 2002, SPSA requested a delay in the permitting process until a resolution is determined. Mr. Hackney stated the only way the permit could be delayed is by request from the EPA. Therefore, SPSA is asking for guidance from the EPA on this matter in delaying permit finalization. Please contact the undersigned if you have any questions or require additional information.

Sincerely,

Amy E. Hardy

Amy E. Hardy
Environmental Compliance Coordinator

cc: Steve Hackney, DEQ-TRO
Richard Cheliras, SPSA
Ethan Chatfield, SCS Engineers
Bob Dick, SCS Engineers
Jamie Margaritas, US Energy Biogas
Dominic Antignano, US Energy Biogas

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

DEC 0 9 2003

REPLY TO THE ATTENTION OF:

(AE-17J)

Gregory J. Graetz
Project Engineer
Derenzo and Associates, Inc.
39395 Schoolcraft Road
Livonia, Michigan 48150

Re. Clarification of Landfill Gas Treatment NSPS Exemption for Dixon/Lee Energy Partners, L.L.C. in Dixon, Illinois Facility I.D. No. 103020ACJ

Dear Mr. Graetz:

Thank you for your October 20, 2003, letter to the U.S. EPA asking for clarification regarding the gas treatment exemption for Dixon/Lee Energy Partners landfill to energy facility (Dixon) located near Dixon, Illinois. Dixon utilizes landfill gas as fuel to power internal combustion engines (IC) and electricity generators. Dixon acts as the control device for the landfill gas emissions from two neighboring landfills and is subject to the New Source Performance Standards (NSPS) for Municipal Solid Waste Landfills (40 CFR Part 60, Subpart WWW). The landfill gas is the only fuel used at the facility.

Your letter indicates that prior to use as fuel in the IC engines and generators, the landfill gas is first 1) compressed with blowers, 2) chilled with an air-to-air cooler, 3) de-watered with a knock-out pot (tank) and a demister pad, and 4) filtered with a sequence of media that consists of a primary dry 10-micron filter and a secondary dry 1-micron filter. You also indicate that Dixon operates an air-assisted, open candlestick flare that is used to control landfill gas during periods of engine maintenance and repair, and when control is required for excess landfill gas generation.

The regulations at 40 C.F.R. Part 60.752(b)(2)(iii) state that collected landfill gas is required to be routed to a control system that complies with the requirements in either: A) an open flare; B) a control system or enclosed combuster designed to reduce NMOC; or C) a treatment system that processes the collected gas for subsequent sale or use. The landfill gas applicable to Dixon has been treated for sale or use under 60.752(b)(2)(iii)(C). U.S. EPA has made several determinations and has stated in the Federal Register Proposed Rule Amendments dated May 23, 2002, that compression, de-watering, and filtering the landfill gas down to at least 10 microns is considered treatment for the purposes of 60.752(b)(2)(iii)(C).

Your letter also asks for clarification that once the landfill gas is treated pursuant to 60.752(b)(2)(iii)(C), that the gas is no longer subject to the monitoring and recordkeeping requirements found at 60.756(b) and 60.758(b) and (c), respectively. The Federal Register Proposed Rule Amendments clarify that once the landfill gas is treated, the facilities that buy or use the gas have no further obligations related to the NSPS. Therefore, Dixon would not be subject to the monitoring and recordkeeping requirements located at 70.756(b) and 60.758(b) and (c).

However, emissions from any atmospheric vent from the gas treatment system, including any compressor, are subject to the requirements of 40 C.F.R 60.752(b)(2)(iii)(A) and (B). This does not include exhaust from an energy recovery device.

This determination was based on a previous determinations from Region 3 ~~dated February 12, 2002, and October 3, 2002, and was~~ presented to OAQPS and OECA for comment. The Federal Register Proposed Rule Amendments from 2002 are meant to be a clarification of the existing NSPS, not changes in the rule. If you have any questions, feel free to contact Lynne Roberts, of my staff, at (312) 886-0250.

Sincerely yours,

George T. Czerniak, Chief
Air Enforcement and Compliance Assurance Branch

cc: Julie Armitage, Acting Manager
Bureau of Air - Compliance and Enforcement Section
Illinois Environmental Protection Agency

Mary Ann Warner, OAQPS
Research Triangle Park

Zofia Kosim, OECA
USEPA Headquarters

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

APR 2 2 2004

Gregory Gratz
Project Engineer
Derenzo and Associates, Inc.
39395 Schoolcraft Road
Livonia, MI 48150

Re: Kiefer Landfill

Dear Mr. Gratz:

The United States Environmental Protection Agency (EPA) received your letter dated March 2, 2004 regarding New Source Performance Standard ("NSPS") Subpart WWW applicability to internal combustion ("IC") engines and boilers connected to the Kiefer Landfill Gas ("LFG") Treatment system.

EPA has issued several determinations indicating that compression, de-watering, and landfill gas filtered down to at least 10 microns for use in an energy recovery device is considered treatment for the purposes of 60.752(b)(2)(iii)(C). In accordance with those previous determinations, Region 9 concurs with the statement in your letter dated March 2, 2004 that landfill gas treated in this (compression, de-watering, and filtering landfill gas down to at least 10 microns for use in an energy recovery device) manner is not subject to the requirements of Subpart WWW or 40 CFR Part 63 Subpart AAAA- National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Municipal Solid Waste (MSW) Landfills.

Sincerely,

Douglas K. McDaniel
Acting Chief, Air Enforcement

APPENDIX L

Caterpillar, Inc.
G3600-G3300 Low Energy Fuels

CATERPILLAR®

G3600-G3300 Low Energy Fuels

Low Energy Fuels

Introduction

Caterpillar has decades of experience operating spark-ignited engines on medium and low energy fuels. Through 1996, Caterpillar has in excess of 400 megawatts of landfill and digester gas installations. These two fuels are the focus of this manual. Caterpillar offers a complete range of gas engines that can be operated successfully on wide range of landfill gas and other low energy fuels. Our model G3600 and G3500 Low Emission Gas Engines, used in single or multiple installations, seem to best fit the profile of economically feasible landfill power projects. The engines have had specific product development to make them suitable for use with landfill gas. Digester applications are typically smaller in size and have been served well by our G3300 and G3400 size engines, although several projects with digester gas have multiple G3500 or G3600 engines.

All Caterpillar Gas Engines are built on a diesel frame. The block, crankshaft, bearings, connecting rods, in fact most of the basic components are diesel design. As one of the leading engine designers and builders in the world, it makes economic and engineering sense for Caterpillar to use their diesel strength to build a gas engine. This inherent structural strength combined with specific components designed for landfill gas operation, provides excellent performing, very durable gas engines.

Opportunity

In the US alone there are some 5000 landfills in active operation. Worldwide there are many more landfills. All of these landfills have decomposing garbage that in turn produces methane. The methane must be controlled in order to avoid migration of the gas to neighboring areas, adverse effects on plant life, odor, and emission of methane to the atmosphere. Methane released to the atmosphere is a factor in proposed global warming theories. Conversion of methane to carbon dioxide via combustion reduces the warming effect.

Of course the benefits of capturing methane from landfills or digester facilities extends beyond environmental. Methane can be converted to money by generating and selling electricity. Many more landfill gas-to-electricity projects are anticipated in the coming years. Digester facilities' gas-to-energy projects may not typically sell electricity but would reduce the overall amount of electricity the facility is required to purchase.

Significant landfill gas opportunities have developed where there are tax credits, such as in the USA, or subsidized electricity rates, such as in the UK. Worldwide, these incentives combined with aggressive developers have lead to many successful applications of Caterpillar engines using landfill gas. Digester applications have become popular where electricity rates are high and where restrictions exist against placing organic material in landfills.

Low Energy Fuel Engine Features

Caterpillar low energy fuel engines are specifically designed for landfill and digester applications. The following describes specific features of the low energy fuel engines.

G3600 Low Energy Fuel Engines

Fuel System

The G3600 fuel system for Low Energy Fuel applications is modified from the pipeline gas system to allow for the increased flow and to prevent problems due to corrosive contaminants in the fuel. The gas shutoff valve is increased in size to allow for higher flow rates and contaminants. The fuel control valve and gas admission valves are also modified to allow more flow. A different camshaft with increased dwell is installed to increase the gas flow through the gas admission valves. For prechamber enrichment fuel, the standard check valve is installed but the needle valve is larger than the standard needle valve.

The minimum fuel supply pressure requirement is the same as pipeline gas engines, 310 kPa (45 psi) at the fuel control valve, downstream from the gas pressure regulator. In some cases the gas pressure regulator has internal modifications to allow for higher flow requirement.

Cooling System

The cooling system configuration for landfill or other corrosive fuel applications does not change from the standard G3600 arrangement however the jacket water temperature is elevated with thermostats which control to 110°C (230°F). The cooling system consists of two circuits which are described below.

The jacket water circuit temperature is elevated to prevent condensation of acidic compounds inside the engine. The standard G3600 engine driven jacket water pump can be used up to 112°C (235°F).

The separate circuit system includes the aftercooler and oil cooler which are run in parallel. The aftercooler does not change since the fuel is mixed with the air in the intake port, after the aftercooler. Oil temperature is controlled by thermostats which regulate oil flow through the oil cooler. The oil temperature is maintained at 85°C (185°F).

Crankcase Ventilation System

The low energy fuel engines have a non-ingestive positive crankcase ventilation to purge the moisture and corrosive blow-by gases from the crankcase. The crankcase ventilation system is an integral part of the engines and is essential for successful operation. The system requires a customer-supplied blower. Setup of this system is describe later in this manual.

Cylinder Heads

The ignition body which holds the prechamber into the cylinder head has higher corrosion resistance than the standard ignition body. Extensive field testing has shown this component is susceptible to corrosion unless the material is upgraded. The rest of the head components are identical to heads used on pipeline gas applications.

Turbine Cleaning System

An abrasive cleaning system is provided to prevent excessive deposits of silicon and ash from engine oil on the turbine wheel of the turbocharger. The system uses a light, combustible cleaning media such as ground walnut shells to remove the deposits. Compressed air at 6.9 bar (100 psi) is required to inject the cleaning media into the exhaust stream. The maximum interval between cleanings is 50 hours of operation.

G3500 Low Energy Fuel Engines

Fuel System

The fuel system for low energy fuels is sized for the larger volumes of fuel flow. For example, the volume of landfill gas flow through an engine is 81% higher than a similarly powered engine using natural gas. The increased flow on landfill gas (19.7 MJ/Nm^3, 500 Btu/scf) is required in order to supply the engine with same energy flow when compared with natural gas (35.6 MJ/Nm^3, 905 Btu/scf).

The standard fuel system carburetor used in North America is the Impco 600D Vari-Fuel. The Vari-Fuel model has replaceable gas jets that can be changed to operate on various gases. All engines with the Impco Vari-Fuel carburetor are run at the factory on natural gas. The units are shipped with natural gas jets installed to allow a dealer to run the engines in their shop, if required. The jets for other gasses will be shipped with the engines and can be installed on site in about a quarter-hour operation. The jets shipped with landfill engines are sized for 400 to 520 Btu/scf fuel. The gas pressure regulator is a Fisher Controls Model 133L, which has a 2 inch NPT body with a 2 inch diameter internal orifice. The fuel system is supplied in a low pressure gas configuration, requiring a fuel supply pressure of 7 to 35 kPa (1 to 5 psig).

The standard fuel system in Europe uses hardware from Deltec. The Deltec has a mixer body with a removable venturi that is easily changed. Various venturi sizes exist to permit engine operation on a wide range of fuels. The engine is tested in the factory using natural gas then the venturi is removed prior to shipment. COSA dealers procure the proper venturi for their customer's fuel directly from Deltec. The gas pressure regulator is supplied by Dungs. This system is for use with low pressure gas in the range of 11 to 22 MJ/Nm^3 and 50 to 100 mBar.

Cooling System

The cooling system used in landfill, or other corrosive gas applications, is two-circuit with the jacket water temperature elevated above the standard 99°C (210°F). The two circuits are the jacket water circuit and the auxiliary circuit. Each are explained below.

The landfill engine has, as standard equipment, a high temperature jacket water cooling system. The thermostats begin to open at 110°C (230°F) while standard cooling thermostats are fully open at 98°C. The higher jacket water temperature is used to prevent water from condensing on the cylinder liners and in the crankcase. Condensed water will frequently be acidic and cause corrosion to occur. The jacket water circuit in the 2-circuit cooling system separates the oil cooler from the jacket water circuit. The oil cooler becomes a part of the auxiliary cooling circuit.

The standard jacket water pump seal is replaced with a seal designed to operate at the higher jacket water temperatures. However, if the jacket temperature is continually above 112°C (235°F), the seal will not be effective and the Caterpillar pump must be replaced with a customer supplied pump.

Standard cooling systems have the oil cooler in series with the circulation of the jacket water. The two-circuit cooling system has an elevated jacket water temperature which would cause the oil temperature to be above the allowable limit of 99°C. Consequently, the oil cooler is moved from the jacket water circuit to the auxiliary circuit.

The auxiliary water flows from the pump to the aftercooler core, then to the oil cooler core, then to the thermostatic control valve, to the radiator, and finally back to the pump. The thermostat in the auxiliary circuit is set for 54°C (130°F). Lower temperatures are not permitted in order to minimize the amount of potentially corrosive condensation in the intake manifold. The rating with landfill gas and 54°C (130°F) SCAC is higher than the rating for natural gas and 54°C (130°F) SCAC. This is due to the high Methane Number (> 120 MN) of landfill gas which leads to a large detonation margin.

The aftercooler core used in landfill and other corrosive gas applications is made from stainless steel. This core is a standard part of the landfill package and provides the corrosion resistance required to avoid attacks from hydrogen sulfide and acids of chlorine and fluorine.

The oil cooler has a thermostat to regulate oil flow through the cooler. The thermostat begins to open at 93°C (200°F) to control the minimum oil temperature. This prevents the oil from being overcooled, which would cause maintenance problems and shorten engine life.

Crankcase Ventilation System

The low energy fuel engines have a non-ingestive positive crankcase ventilation to purge the moisture and corrosive blow-by gases from the crankcase. The crankcase ventilation system is an integral part of the engines and is essential for successful operation. The system requires a customer-supplied blower. Setup of this system is describe later in this manual.

Cylinder Heads

Cylinder heads for the landfill engine incorporate several modifications in order to provide normal service life. Valve guide clearance is decreased to minimize the amount of corrosive blowby. Valve seats are given a special three angle shape to provide a combination of long life and increased contact forces. The greater contact force combats increased levels of deposits from higher TBN oils and other deposits associated with landfill gas.

G3400 - G3300 Low Energy Fuel Engines

The G3300 and G3400 engines have only some of the special features offered on the G3500. For this reason, these engines are limited in their low energy fuel applications. The G3400 and G3300 TA engines are not offered for landfill or digester applications. The G3400 and G3300 NA engines may be used in digester or landfill applications if the fuel contaminants are below the levels shown for a standard engine in Table 1.

Fuel System

The fuel system offered for stoichiometric product is from Impco. The Impco carburetor allows the internal valve and jet to be changed in order to operate on digester gas.

Cooling System

The G3400 and G3300 engines do not offer high temperature jacket water operation. When using digester gas, the jacket water outlet temperature should be maintained as close as possible to 99°C (210°F).

Crankcase Ventilation System

Caterpillar recommends that a non-ingestive crankcase ventilation system be added to the G3400 and G3300 engines when operating on digester gas. The system aids in the removal of potentially corrosive blowby gases in the crankcase. Setup of this system is described later in the manual.

Low Energy Fuels

Numerous low energy fuels are available for potential application in reciprocating engines; coke gas, blast furnace gas, producer gas, landfill gas, digester gas, wood gas, among others. Currently, only landfill gas, digester gas and coal seam gas have seen widespread commercial viability.

Landfill Gas

Composition

Landfill gas is produced through the natural anaerobic decomposition of organic landfill wastes. As it naturally occurs, the gas has a composition of 55% methane and 45% carbon dioxide. However, the concentration of methane and carbon dioxide varies considerably depending on the landfill management technique. In practice, a typical landfill gas composition has 45-50% methane, 35-45% carbon dioxide, 0-2% oxygen, 1-15% nitrogen, plus a trace amounts of many other compounds. Nearly all landfills that operate with a gas collection system will have a pump pulling the gas from the field. As the gas is pulled from the field, some air intrusion from the top and perimeter of the landfill into the gas is expected but if the level of oxygen in the gas exceeds 2%, problems are to be expected. The presence of oxygen in the landfill will slow down or stop the methogenic bacteria from breaking down the landfill material. When this happens, the methane concentration drops considerably. If the oxygen level is greater than 2%, the landfill operator is not concerned about optimal methane production but may be attempting to control gas migration into areas around the landfill or control excessive odor. With careful landfill gas collection management, a gas of stable methane content within the range of 50-55% methane can be obtained. Maintaining the methane to carbon dioxide ratio from 1.1 to 1.2 provides ideal gas production. For best engine operation results, Caterpillar recommends operation on gases with 45-55% methane.

When sampling the landfill for the gas chemistry, it is important to take multiple samples over a period of weeks. The composition of landfill gas will fluctuate depending on the amount of precipitation, ambient pressure and temperature, and changes in the landfill size.

For landfills where high levels of oxygen are required in order to control odor or migration, engines may operate successfully with lower methane concentration levels but the gas constituency is expected to change erratically with time, leading to carburetion problems. Engine power output will also be reduced. With the increased levels of oxygen, care must be taken to avoid creating a flammable mixture of methane and air in the fuel collection system or in the landfill. Methane has a stoichiometric point by volume of 9.47% in air and can combust if the methane concentration is in the range from 5% to 15% by volume. Also with the increased levels of oxygen, nitrogen will appear according to the oxygen/nitrogen ratio in air. When nitrogen levels exceed the amount expected compared to oxygen, combustion may be occurring in the landfill. Note that gas quality problems often occur only in a zone of the landfill. A properly designed landfill will have many zones, each with its own isolated gas collection system. By properly tuning all areas of the landfill, good quality gas can be expected.

Contaminants

Landfill and digester gases routinely contain corrosive elements and solid particles. These contaminants, depending on their concentration, can be harmful to the engine. Understanding these elements and monitoring them is necessary for acceptable engine performance and life. The corrosive elements are divided into four major categories. They are sulfur compounds, halides, acids, and solids. Table 1 shows the maximum concentration for gas contaminants. Note some limits vary according to fuel heat value and some limits depend on engine configuration.

Sulfur Compounds

Sulfur compounds are formed during the decomposition of organic waste. The primary compound of concern is hydrogen sulfide (H_2S). Hydrogen sulfide is corrosive and can lead to failed aftercooler cores, bearings, and any parts containing copper in the engine.

The maximum level of hydrogen sulfide is listed in mass per fuel heating value. Listing the maximum level of hydrogen sulfide in parts per million (ppm) is unsatisfactory. A fixed ppm level and varying fuel heating value will lead to a change in the total amount of H_2S delivered to the engine. Consider the following example: 1000 ppm of H_2S in field gas (1000 Btu/ft^3) equals 10.67 grams of sulfur per kW. Example 2: 1000 PPMV of H_2S in landfill gas (450 Btu/ft^3) equal 26.2 grams of sulfur per kW. In the above examples, both have 1000 ppm H_2S but the second case results in 2 1/2 times more sulfur per kW in the engine. The maximum level of H_2S allowed in the fuel is shown in Table 1. For hydrogen sulfide testing, Caterpillar recommends Core Laboratories (see page 10 for address).

If the H_2S concentration is greater than the limit, the fuel must be treated to reduce the level of H_2S. The direct H_2S attack cannot be deterred by high TBN oils or controlled by oil analysis. Therefore, it is essential that the H_2S in the fuel gas be reduced to levels below the maximum. There are various devices available to reduce H_2S in the fuel gas, such as

		Standard Engine	Low Energy Fuel Engine
Sulfur Compounds as H_2S See footnote (1,2)*	mg H_2S/MJ ug H_2S/Btu	0.43 0.45	57 60
Halide Compounds as Cl See footnote (1,3)*	mg Cl/MJ ug Cl/Btu	0 0	19 20
Ammonia	mg NH_3 /MJ ug NH_3/Btu	0 0	2.81 2.96
Oil Content	mg/MJ ug/Btu	1.19 1.25	1.19 1.25
Particulates in Fuel See footnote (1,4)*	mg/MJ ug/Btu	0.80 0.84	0.80 0.84
Particulate Size in Fuel:	microns	1	1
Silicon in Fuel See footnote (1,4)*	mg Si/MJ ug Si/Btu	0.1 0.1	0.56 0.60
Maximum Temperature	°C °F	60 140	60 140
Minimum Temperature	°C °F	-10 -50	-10 -50
Fuel Pressure Fluctuation	kPa ± psig ±	1.7 0.25	1.7 0.25
Water Content		Saturated fuel or air is acceptable. Water condensation in the fuel lines or engine is *not* acceptable. It is recommended to limit the relative humidity to 80% at the minimum fuel operating temperature.	

* Footnotes are located on pages 21 and 22.

Table 1. Maximum Contaminants and Conditions. Unless otherwise noted, Contaminant and Condition limits apply to fuel and combustion air. See footnote (1) on pages 21 and 22.

chemically active filters, reactive beds, and solutions. During use, these devices deplete the reactive chemicals and their performance deteriorates. The devices then need servicing or replacing. We recommend that even though a fuel gas is scrubbed to remove H_2S, take precautions when using a high sulfur fuel to protect against these intervals when the chemical scrubbers deteriorate and require servicing. Even brief intervals of operation with high levels of H_2S in the fuel can damage the engine. Consult the section on Lubrication for additional guidelines.

During combustion, hydrogen sulfide and other sulfur compounds break apart, forming sulfuric acid. This is a strong acid that can cause extensive damage to the engine. It is important to closely follow the fuel contaminant limits, application guidelines, and lubrication recommendations.

Halide Compounds

Landfill gas may contain halogenated hydrocarbons. These are commonly referred to as chlorofluorocarbons (CFC's) and have been widely used in the refrigerant industry. Refrigerant 12, the most common refrigerant, has the chemical name dichlorodifluoromethane (CCl_2F_2) and the trade name Freon-12. Refrigerant 11 and 22 are also similarly composed and have been widely used. Paint thinners, degreasers, aerosol cans, refrigerators, and air conditioners are all sources for CFC's and other hydrocarbons. Very few of the halogenated hydrocarbons are formed from the decomposition of plastics and other petroleum-based materials. When the CFC's are burned within the engine, chlorine and fluorine are released during the combustion process, then react with water, and finally form hydrochloric acid (HCl) and hydrofluoric acid (HF). Both these acids are very corrosive to internal engine components. Excessive levels of HCl or HF acid result in accelerated piston ring, cylinder liner, exhaust valve stem, and valve guide wear.

These hydrocarbons are heavier molecules than the methane and CO_2. They tend to remain in the landfill until the landfill gas is collected. Once gas is drawn from the field, the hydrocarbons are evaporated into the moving gas stream until they are depleted. Measurements from producing landfills indicate the volatile hydrocarbons drop to 10-25% from their original levels after one or two years of gas production.

The level of halides is given in mass divided by the fuel energy content, or micrograms of chlorine and fluorine per low heating value of the gas. This is the total amount of chlorine and fluorine present in all the various compounds that may carry halides. See Table 1 for the maximum acceptable level. If this level is exceeded at any time through the lifetime of the project, serious damage may occur to the engine.

Chlorinated hydrocarbon and chlorofluorocarbon gases are in relatively low concentrations within landfill gas, however, their affect can be great. The most widely used test to determine gas concentration is the EPA624 test for volatile hydrocarbons. This is a EPA water standards test which has been adapted for measuring gases. The EPA624 test is acceptable for determining the chlorine level provided the minimum threshold of detectability is 5 ppmv. This test has shown variability from laboratory to laboratory.

Caterpillar has developed a laboratory test for measuring the levels of halogens within a sample of landfill gas. The sample, including the halogenated organic compounds, is oxidized in a CO_2 and O_2 atmosphere. The hydrogen halide by-product of the pyrolysis is measured electrically using microcoulometric titration. The accuracy of this equipment is ±0.002%, not including inaccuracy introduced at the sample withdrawing and depositing. Caterpillar recommends the follow laboratory for halogen and hydrogen sulfide testing:

Core Laboratories- Houston
Attention: Gas Analysis Chemist
6310 Rothway Drive
Houston, TX 77040
(713)690-4444 phone
(713)690-5646 fax

If the chlorine or fluorine level exceeds the maximum shown in Table 1, fuel treatment is required. Chlorine and fluorine are water soluble and are frequently carried into the engine by water vapor. Removing the water vapor by drying the fuel will reduce halogen levels. For more information, see the section on fuel system design in this manual.

Acids

Low energy gases in many cases are saturated with water vapor. Pure water vapor, even in large amounts, does not damage the engine. However, water vapor can combine with the organic compounds to form organic acids and combine with carbon dioxide to form carbonic acid. This water vapor can have a pH from two to six and can be very corrosive to the gas handling equipment as well as the engine. Condensation of water is not permitted in the engine and should be avoided at all points in the fuel delivery system. If condensation is detected in the engine, the fuel dew point must be sufficiently reduced prior to the fuel entering the engine to eliminate condensation in the engine. This can be accomplished through refrigeration. For more information, see the section on fuel system design in this manual.

Silicon

Silicon, the second most abundant element on the earth, is commonly found in sand, quartz, flint, granite, glass, clay, and mica. If ingested into an engine, microscopic pieces of these compounds can cause abrasive wear leading to significant damage. Gaseous compounds containing silicon are man made and can form deposits in the combustion chamber and exhaust system of an engine. Both types of silicon ingestion are discussed below.

Silicon Crystals

Depending upon the landfill cover material, the climate, and the velocity of the gas within the fill, significant levels of microscopic silicon crystals can be carried with the gas. Generally, this silicon is less than one micron in size. The particles are generally too small to cause significant abrasive wear within the engine. However, if the silicon particles are in high enough density, they can coagulate in the combustion process and form larger particles. These larger particles can result in abrasive wear of the exhaust valve face and valve seat. The coagulated silicon particles can also form indentations on the exhaust valve face and seat if they become trapped between those surfaces during valve closure. These indentations or pitting of the valve face and seat may result in eventual leakage or guttering of the valve. Engine oil analysis can indicate levels of silicon in the engine.

Filtration is recommended to control the silicon. Filters with 100% effectiveness of particles 1.0 micron (1 micron equal 10^{-6} meters) and larger are recommended. Even with this filtration equipment, significant amounts of silicon can still enter the engine. The silicon will be detected in the oil analysis results. See Lubrication section of this guide for further information.

Silicon Containing Gases

The more difficult silicon to deal with enters the engine in gaseous compounds containing silicon. The most common class of gaseous silicon compounds known to exist in landfills and in landfill gas are siloxanes.

Siloxanes are organic compounds composed of silicon, oxygen, and methyl groups with structural units of $-(CH_3)_2SiO-$, and molecular weights typically in the range of 150 to 600. Solubility decreases as the molecular weight increases. Siloxanes may be volatile or non-volatile. In the USA, they are not regulated by the EPA as a VOC because siloxanes have been shown not to contribute to the formation of ground level ozone. Siloxanes are common components in products such as shampoos, cosmetics, detergents, pharmaceuticals, ink, lubricants and adhesives. A solid anti-perspirant may contain 50% siloxanes. Siloxanes are found wherever consumer waste and sewage sludge are discharged.

During combustion, the siloxane molecules break down, freeing the silicon and oxygen molecules to an unstable monatomic state. They can then form a deposit by combining with various other elements that may be present in the exhaust gases. X-ray diffraction of deposits shows a mostly amorphous composition of silica (SiO_2) and silicates. The elemental composition of a deposit has a high level of silicon plus elements commonly found in oil additives and wear metals from the engine, such as calcium, sodium, sulfur, zinc, iron, copper, and others. Deposits caused by siloxanes will tend to be white to tan or gray in color, granular or flaky in nature, and can become thick. The deposits are extremely hard and cannot be easily removed by chemical or physical means.

Deposits can appear in the combustion chamber, exhaust manifold, turbine, exhaust stack, and even catalyst equipment. In the combustion chamber, deposits tend to occur on the valve faces. This will lead to excessive valve recession due to the grinding action of the silica on the valve and valve seat. Deposits may also lead to valve guttering. This occurs when a portion of thick deposit on the valve face chips away. This leaves a path for the combustion gases to pass through when the valve is closed, creating a torch effect that literally melts a part of the valve. It has been shown that guttering occurrences on engines with deposits can be decreased by loading the engine slowly over a 20-30 minute period. This allows time for the temperature of the deposits to increase; changing their consistency to plastic from brittle. Deposits on the turbine can cause bearing failure due to imbalance and can cause turbine wheel erosion due to buildup between the wheel and housing. Deposits may also mask catalyst or heat recovery equipment located in the exhaust stream.

The maximum amount of silicon permitted in the gas is shown in Table 1. If the silicon level in the gas exceeds this amount, serious damage to the engine may occur. Silicon levels may vary throughout the lifetime of the landfill project. Testing is recommended at the beginning of the project and subsequently at 6 month intervals until the silicon level is stabilized. After the silicon level stabilizes, testing is recommended if any deposits accumulate in the exhaust or combustion chamber.

Testing for silicon compounds requires specialized equipment. The following section describes the procedure to determine the level of silicon in landfill gas.

Collection of gas samples for trace silicon analysis must be done with great care due to the common presence of silicon in the environment. The sample should be taken immediately before the gas delivery to the engine. Chilled Methanol Adsorption is recommended for gas sampling. In this process, a fixed amount of gas is passed through the adsorption agent, usually methanol (CH_3OH) or a similar hydrocarbon. The exposed methanol should then be analyzed by Gas Chromatography and Mass Spectrometry for the total amount of siloxane compounds. The total content of silicon in the sample should be determined by Liquid Chromatograph with Inductively Coupled Plasma Atomic Emission Spectroscopy.

Caterpillar has developed gas sampling equipment for siloxane and halogen measurements. This kit is available through Bio-Engineering Services (see address below). It may be used to accurately collect and meter gas for the Chilled Methanol Adsorption technique. The kit contains three containers of methanol and a system to pass a fixed amount of gas through the methanol. The exposed methanol is then sent to a laboratory for testing. This kit will also gather gas in a bag for halogen and hydrogen sulfide content tests.

Caterpillar recommends the following laboratories for siloxane testing:

Bio-Engineering Services
36 Virginia Street
Southport, PR8 6RU England
44 (0) 1704 539094 phone
44 (0) 1704 501660 fax

Jet-Care International Inc.
3 Saddle Road
Cedar Knoll, NJ 07927-1902
(201)-292-9597 phone
(201)-292-3030 fax

If the total silicon level in the sample exceeds the limit shown in Table 1, gas treatment is required. Conventional filtering systems will not remove siloxane from the landfill gas. Siloxanes are solvent soluble but are only water soluble to a limited extent. It is for this reason that drying the gas of water will only remove a portion of the siloxane that may be present in a gas stream. However, refrigeration of the gas will reduce the level of siloxanes in the gas. For the most common siloxanes, D_4 and D_5, reduction of the gas temperature from 43.3°C (110°F) to 4.4°C (40°F) should result in an approximate 95% reduction in siloxane level. A limited number of sites have employed refrigeration as a means to control siloxanes and this technique appears to be effective.

Passing the gas through a solvent (methanol, kerosene, toluene, etc.) will cause the siloxane molecules to adsorb to the solvent. A counterflow gas-liquid adsorption bed can be used to significantly reduce the level of siloxane as well as chlorine and fluorine in the gas. However, installation and operation of such a system is usually cost prohibitive. Contact Caterpillar for additional details and supplier recommendations for this type system.

No additional fuel treatment methods exist at this time to reduce siloxane in gaseous fuels.

On G3500 engines, a water wash, or water injection into the engine, has been shown to reduce siloxane caused buildups. Water is sprayed into the intake. The added water vaporizes in the combustion process, cleaning deposits from the combustion chamber. Water injection has been used to clean existing buildups and has been used to control additional buildups. Injection rates vary from 4 to 16 liters (1-4 gallons) of water per hour of engine operation. A spray mist of water is injected downstream of the turbocharger. The water must be the product of reverse osmosis cleaning. Raw water will lead to severe deposits of calcium throughout the engine.

Caution must be used if water injection is used to clean existing buildups. Pieces of a deposit may break loose, guttering valves and damaging the turbochargers. Use low water injection rates until deposits are removed. The factory can provide further guidelines regarding waterwash. The following company designs and sells water injection systems:

Bio-Engineering Services
36 Virginia Street
Southport, PR8 6RU England
44 (0) 1704 539094 phone
44 (0) 1704 501660 fax

Digester Gas

Digester gas, like landfill gas, is produced through the natural anaerobic decomposition of organic wastes. The gas is gathered from a heated digester tank containing liquid effluent from sewage, animal wastes, or other wastes from vegetable and alcohol mills. The tank is maintained at 35 to 37°C or 55 to 57°C depending on the type of digestion desired. The gas is given off at low pressure, typically around 1 kPa. Many large farms will use a lagoon rather than a tank for digestion processes. The lagoon captures animal wastes from the farm and requires little maintenance.

Digester gas is typically composed of 65% methane, 35% carbon dioxide, and trace amounts of several other compounds. The lower heating value of this fuel is about 23.6 MJ/Nm^3 (600 Btu/scf).

Digester gas may contain contaminants that are harmful to the engine. Limits for contaminants are shown in Table 1. Hydrogen sulfide is common in digester gas and must be reduced if the concentration exceeds our guidelines. Silicon compounds may also be present in the gas if the digester is processing wastes involving consumer products. Siloxanes will be in the digester's liquid effluent but typically, only a limited amount will migrate to the gas. If any deposits or buildup are detected in the combustion chamber or exhaust system, a fuel test should be done to check the siloxane level. Additional information about siloxane and silicon are given in the section on landfill gas contaminants.

Coal Seam Gas

Methane gas is released from coal. This gas can be collected and burned to produce electricity or the gas can be cleaned and sold. The percent of methane varies depending on the mining activity of the coal seam. If the coal is actively being mined, air is "pulled" through coal seam to remove the methane gas from the mine. Methane gas can also be extracted by drilling directly into the coal seam. For active mines the percent of methane in the gas will vary considerably. An air fuel ratio control or a method to blend air to stabilize the percent of methane in the gas is necessary.

There are few contaminants in coal seam gas. Some coal contains sulfur, but the sulfur is locked within the coal and is not released to the methane gas in any significant quantity. Water and coal dust must be removed from the gas. See Table 1 for maximum contaminants and conditions.

A small percentage of the coal seam gas will be CO_2. Oxygen content will be dependent on the amount of air that is pulled from the mine with the methane gas. Sometimes the air content is very large and the methane in the gas can drop to a very low value of 30% because coal seam gas with a very low percentage of methane has a low energy value (low btu/cu ft). To properly mix the correct amount of this low energy fuel, special modifications to the fuel system are needed to flow a much higher volume of gas. The fuel system of the standard low energy fuel gas engine is designed to operate on gases with a minimum of 50% methane content.

Landfill Gas Processing Equipment

The following section provides general information about the equipment used to gather and process landfill gas. Caterpillar recommends those involved with landfill design, landfill gas processing, and landfill site evaluations consult with experts in those areas. Caterpillar can provide contacts upon request.

The components of the gas processing system can form a significant portion of the capital cost of a project. The components need to be selected for function, reliability, and resistance to corrosion. A gas recovery project is only as reliable as its weakest link and the components of the gas processing equipment needs to be as reliable as any other component. Figure 1 shows a typical gas processing equipment for a landfill gas recovery project. Some customers will request that the dealer also supply the gas processing equipment. Most customers will work in conjunction with a consulting firm that specializes in landfill gas recovery and prediction of methane production from a landfill.

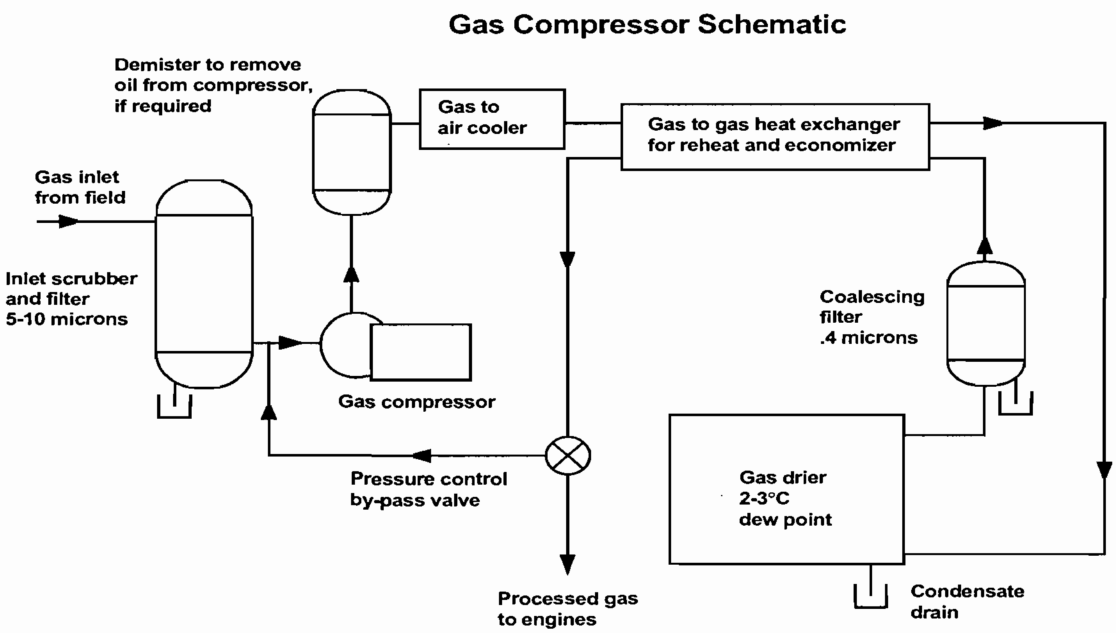

Figure 1.

The gas processing equipment delivers gas from the landfill to the engine. The equipment required will include a compressor and other components, depending on the landfill. The compressor provides a vacuum to draw gas from the field and the positive pressure required to force the gas through the processing equipment to the engine.

The following is a discussion of gas processing equipment found in a typical gas-to-energy project. The equipment listed here is common to many landfills but may not be required for all sites. Consultation with a landfill design expert will determine how best to deliver gas for your gas-to-energy project.

Inlet Scrubber and Filter: This scrubber removes water from the gas and traps solid matter. It is used to protect the compressor from free water and solid matter that may be carried by the gas. Construction is usually carbon steel with the interior epoxy coated to protect from corrosion. Additional filtration will be required before gas can be used in an engine.

Gas Compressor: Many different designs and suppliers of compressors have been applied successfully on landfill gas projects. The following are some general remarks about compressors.

Centrifugal compressors are used for low pressure ratios of up to 35 kPa (5 psi). They are relatively low cost.

Rotary sliding vane compressors are applied successfully on projects up to 200 kPa (30 psi). They offer a wide range of pressures by changing the drive pulley ratios and are moderate in cost. They have good efficiency in converting power to compression.

Lobe or Roots compressor can operate up to 200 kPa3 (30 psi). They are moderate to high cost and have a medium efficiency in converting power to compression. They may create a noise level problem.

Reciprocating Compressors have a wide range of pressure and flow capability and offer the highest efficiency in converting power to compression. They are relatively low maintenance but they are usually the most expensive. A reciprocating compressor is not cost effective unless the pressure required for the project is 300 kPa (45 psi) or greater.

Rotary screw or flooded screw compressors have approximately the same pressure ratios as a reciprocating compressor and have nearly similar costs. The screw is less efficient in converting power to compression.

Demister: This removes oil from the gas stream. It is required if oil is injected into the gas stream to lubricate the compressor. Some customers place a coalescing filter at this position if a gas dryer is also being used. This helps to remove a greater percentage of oil prior to the gas entering the dryer, thus improving the heat transfer efficiency of the dryer.

Gas to Air Cooler: This reduces the gas temperature after it is compressed. If a dryer is being used, the cooler reduces the power required to operate the dryer. This gas to air cooler may also be used as the primary gas cooler. Gas cooling is required to reduce the amount of water in the landfill gas. This avoids potentially corrosive condensation occurring later in the fuel delivery system or in the engine.

Gas to Gas Heat Exchanger: This heat exchanger precools the gas entering the dryer to reduce the dryer power demand. The gas leaving the dryer is reheated by the gas to gas heat exchangers to prevent any water from condensing downstream. Typical material for this heat exchanger is stainless steel.

Dryer: Usually this is a gas to liquid heat exchanger using landfill gas and a refrigerant. The landfill gas is dried by chilling it to a dew point of 2-3°C. Dryers are not required for all landfills but are an excellent method to reduce the level of halogens and hydrogen sulfide in the landfill gas. These contaminants are water soluble and their concentration will be reduced by decreasing the amount of water in the gas. Dryers will also reduce to a lesser extent the level of siloxanes in the gas.

Coalescing Filter: Removes any water or oil droplets that may remain in the gas stream as well as all remaining solid matter down to 0.4 microns.

Pressure Control By-Pass Valve: Required to protect positive displacement compressors from over pressure during low flow periods. The pressure control valve is required on centrifugal compressors to keep the compressor out of the choke or stall operating range.

Condensate Drain: For the water removed from the gas. Typical condensate volumes are approximately 130 L/day for a G3516 Engine. The condensate is usually stored in a holding tank and sampled for hydrocarbons. If found to contain acceptably low levels, it should be disposed of in a sanitary sewer. If the hydrocarbon levels are above limits, the condensate may be filtered through a carbon adsorption filter and then sent to a sanitary sewer. The condensate contains essential nutriments for the methane producing bacteria. Some countries may permit condensate to be returned to the landfill to stimulate methane production.

Engine Emissions

When using landfill or digester gas, the emission levels for NO_x are reduced at a given exhaust oxygen level due to the high concentrations of CO_2 (40-60%). The CO_2 has a high specific heat, cooling the combustion process. The reduced temperature combustion reduces the peak cylinder pressure, thereby reducing the production of NO_x. This is true for rich burn or lean burn engines.

The high level of CO_2 in many low energy gases creates larger flame quench zones near the cylinder walls, piston, and cylinder head. In these zones combustion is incomplete or does not occur at all. In partially complete combustion areas, CO, which wants to become CO_2, is frozen during the combustion process, resulting in CO levels as much as 65% greater than for natural gas. For portions of the air/fuel mixture residing entirely in the quench zone, no combustion occurs and that air/fuel mixture is exhausted as unburned hydrocarbons. The result is a 40% increase in total hydrocarbons (THC) when compared with natural gas THC emissions. The non-methane hydrocarbon (NMHC) emissions however, are very low due to the low content of NMHC's in the fuel.

Catalyst Operation With Landfill Gas or Digester Gas

Several attempts have been made to control exhaust emissions of reciprocating engines operating on landfill gas or digester gas with an exhaust gas catalyst. Landfill gas contains contaminants such as chlorine, fluorine, and silicon that have proven to be detrimental to exhaust catalysts. Digester gas may contain hydrogen sulfide that will poison the catalyst. 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.

Lubrication

Proper lubrication is critical to the success of your engine operation, especially in landfill and digester applications. The following lubrication guidelines are provided when using fuels with corrosive components. Additional information about lubrication is provided in the Lubrication section of the A&I Guide.

Select a proven natural gas engine oil, or select a natural gas engine oil specifically formulated for use with landfill or digester gas. Use the same selection method for this oil as specified for commercial oils mentioned in the Lubrication section of the A&I Guide. Keep in mind that gas contaminant levels may frequently change, making selection of the proper lubricant difficult. Work closely with the oil supplier, landfill operator, and engine servicing group to select the proper oil.

Oils with higher TBN values generally have higher levels of sulfated ash. Ash can cause deposit buildup that leads to valve, combustion chamber, and turbocharger damage and can lead to shortened engine life.

If a suitable landfill oil is not available, then the oil change interval must be shortened to avoid problems with deposits and corrosion.

The Scheduled Oil Sampling (SOS) program must be used to evaluate the engine wear and oil condition. This assures oil change periods are not extended beyond safe limits and that other problems are not overlooked.

As the level of contaminants increase, the oil change interval will decrease.

The level of silicon in the oil may be elevated. The fuel and air filtering systems should be checked to insure that inorganic silicon (silica), which is abrasive, is being captured. Organic silicon (siloxanes) will pass through the fuel filter and a portion will be captured by the engine oil. The organic silicon in the oil is not abrasive and will not damage the engine. However, siloxanes in the oil are a warning that there may be damaging deposits in the combustion chamber. Silicon levels up to 50 parts per million in the oil are not uncommon and can be tolerated provided they are less than one micron in size and do not cause any exhaust valve face wear or guttering. Levels of 100 ppm have been observed that do not cause engine damage. In these cases, the source of silicon is organic.

Additional oil analysis can be used in combination with the SOS program. For high sulfur fuels, oil viscosity by ASTM D445 and TBN by ASTM D2896 are the preferred tests. For engines running on landfill or sewage gas, oil viscosity by ASTM D445 and TAN by D664 are the preferred tests. TAN by D664 may be used by itself or in combination with TBN by D664 to evaluate the corrosiveness of the used oil.

For G3500 and G3600, maintain the coolant outlet temperature at 110°C (230°F). Water and sulfur oxides are formed during combustion and will condense on cylinder walls at low temperature. The higher jacket temperature minimizes the amount of condensation.

For G3400 and G3300 NA engines, maintain the temperature of the oil in the sump high enough to prevent water from condensing in the oil. Normally, maintaining the jacket water outlet temperature at a minimum of 200°F (93°C) will accomplish this.

Where it is possible to start the engine on sweet gas (gas without corrosive components), bring the engine up to operating temperature on sweet gas, then switch to sour gas. Reverse the procedure when shutting the engine down.

Use non-ingestive positive crankcase ventilation (PCV) to reduce the H_2S attack on internal engine components. There is no known oil additive that can protect the internal bright metal engine components from H_2S attack. The PCV system should remove the blowby fumes from the crankcase and allow filtered air to enter the crankcase to dilute the level of H_2S. Guidelines for installing and sizing a system are given in this guide.

Scheduled Oil Sampling

To achieve maximum life from the engine, Caterpillar recommends that regular engine oil analysis be done. Caterpillar dealers offer Scheduled Oil Sampling (SOS) to assist the customer in determining the proper oil change interval based on condemning limits and trend analysis established for the engine. The SOS program will also indicate the presence of oil contaminants. This program will analyze the condition of your engines, indicate shortcomings in engine maintenance, show first signs of excessive wear, and help reduce repair costs. For an optimal program, oil samples must be taken every 250 operating hours.

Cooling System

Radiator

Many engine applications have the radiator engine mounted with a blower fan. The fan flow ventilates the engine enclosure or building . This practice is not recommended for landfill gas applications. Engines with blower fans results in high air velocities across the engine surfaces that cause water condensation in the crankcase and on the engine. This results in severe maintenance problems and short engine life. If an engine driven fan is desired, a box style radiator with horizontal entrance and vertical exit is recommended. This style radiator allows for the simplicity of an engine-driven radiator without the air flow over the engine and the resulting maintenance problems.

Many landfill projects are on active landfills that expect to have gas production for many decades. The project equipment is typically selected for low maintenance, low power demand, and 20 to 30 year life. For the following reasons, the radiator of choice for these applications is a round tube design:

- No solder or gasket joints to fail or leak
- Adequate design margin to withstand the high jacket water temperatures and pressures
- Low fan power and noise
- Low maintenance

The disadvantages are the slightly larger size and higher costs. But these disadvantages can usually be offset by the increased electrical output due to low fan power.

The radiator should also be designed with no metals containing copper. These metals are subject to corrosive attack by landfill gas contaminants. In addition, a sacrificial anode should be used with the radiator as added protection against corrosion.

Expansion Tank

Landfill applications use a jacket water temperature of 110°C (230°F). The high jacket water temperature requires unique cooling system expansion guidelines. A shut down under load will produce considerable after-boil and larger expansion tank volumes than normally are required. Use Table 2 when sizing expansion tanks for G3500 low energy fuel engines.

Model	Jacket Water Expansion Tank Volume	Auxiliary System Expansion Tank Volume
G3516	70 gal (265 L)	20 gal (76 L)
G3512	60 gal (230 L)	20 gal (76 L)
G3508	50 gal (190 L)	15 gal (57 L)

Table 2.

Engine mounted expansion tanks from the price list are not available on low energy fuel engines. The jacket water temperatures of the low energy fuel engines produce system pressures greater than the maximum 48 kPa (7 psi) structural limit of the expansion tank. Heat exchanger cooled units require a customer supplied expansion tank of adequate volume and structural strength to withstand the pressures of the elevated jacket water temperature. The maximum pressure permitted in the cylinder block is shown in the Cooling Systems section of the A&I Guide.

For G3600 expansion tank guidelines, consult the Cooling System Guide.

Heat Recovery Equipment

Low energy fuel engines are equipped with 2-circuit, high temperature cooling system. The elevated jacket water temperature may make these engines ideal for a customer's cogeneration project. On G3500, the landfill 2-circuit cooling system is identical to the standard 2-circuit system except the jacket water pump is included. This pump has high temperature seals and applies for applications with a maximum jacket water temperature of 110°C (230°F). If heat recovery equipment can be applied within the head and flow requirements of the jacket water pump curve, the engines may be applied without modification.

There will likely be some acids in the exhaust gases. Take care to ensure these acids do not condense in the exhaust heat recovery device. To prevent condensation, it is recommended the exhaust gas temperature not be allowed to cool below 204°C (400°F). If frequent starting and stopping of the engine is expected, the heat exchangers must be made corrosion resistant.

Crankcase Ventilation System

As discussed before, crankcase ventilation is a critical factor in a successful landfill or digester gas application. Ventilation of the crankcase reduces corrosive wear and extends oil and engine life. Crankcase fumes are composed primarily of air and fuel mixture that leaks past the piston rings during

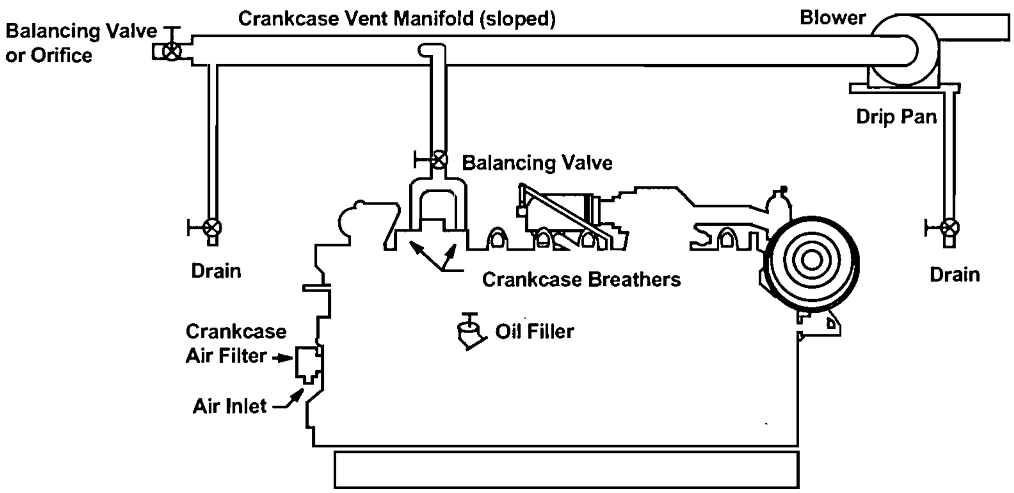

Figure 2.

the compression stroke and early in the power stroke. Some exhaust gases will also be present. Blowby will contribute to lubrication oil contamination. Compounds found in the blow-by gases and the lubricating oil are:

Water: The water from the products of combustion plus water that may be in the fuel gas, if allowed to collect in the crankcase, will provide the aqueous solution required for acid formation and attack of engine components.

Hydrogen Sulfide H_2S: H_2S is commonly found in landfill and digester gas and will therefore be found in the crankcase. The H_2S will dissolve in the lubricating oil and circulate within the engine to attack bright metals in the engine such as oil cooler and various bearings and bushings in the engine.

Halogenated Hydrocarbons: These are commonly referred to as chlorofluorocarbons and have been widely used in the refrigerant industry. They are of themselves not harmful to the engine, but once combusted, chlorine (Cl) and fluorine (Fl) molecules are released to combine with water and form hydrochloride (HCl) and hydrofluoric (HFl) acids in the crankcase and oil.

Sulfuric Acid (H_2SO_4): Hydrogen sulfide burned in the combustion chamber will form H_2SO_4, a strong acid.

The landfill engine arrangement has a positive crankcase ventilation system to purge these various gases and water vapor from the crankcase. There is a filter on the front accessory cover to allow air to enter the crankcase. The air purges the gases from the crankcase and dilutes the remaining gases' concentrations to harmless levels. Removal of the blowby gases reduces corrosive wear and extends oil and engine life.

Design Guidelines For Crankcase Ventilation System

The crankcase ventilation system requires some customer supplied components, refer to Figure 2. The following is a discussion of these components and application guidelines.

Crankcase Blower

The blower is customer supplied and is usually an AC electric sized to provide a flow of 1 scf/hp-hr at a negative pressure on 100 mm (4 in.) of water. Most blowers are not oil-tight and a minimum amount of oil can condense within the blower. It is recommended that the blower be installed in a drip tray to catch any oil that may drip from the blower. The drip tray can then have a drain pipe down to a convenient level for draining and disposal.

Because the engines operate at elevated jacket water temperatures, oil vapors may be formed that can appear to be smoke. The fumes that are blown outside the building by the blower should go into an area where they can be dispersed by the prevailing winds.

Crankcase Ventilation Manifold

The manifold is generally constructed from 152 mm (6 in.) diameter PVC tubing and runs above a multiple engine installation or along one wall of the installation. The manifold should slope away from the crankcase blower and have a drain port on the end farthest from the blower. The end of the manifold has a valve to adjust the overall manifold vacuum. The risers for each engine should enter the manifold at the side or top to prevent any oil condensate in the manifold from running back into the engine.

Engine Risers

Blowby temperature is 110°C (230°F), or greater. The first 474 mm (18 in.) of pipe up from the engine should be made of temperature resistant material. The remaining length of the riser is usually made from PCV tubing. The engine breathers are connected together, after which the minimum riser size is 76 mm (3 in.) diameter. At this point, a butterfly valve is placed between the engine and the crankcase ventilation manifold. The butterfly valve is used to regulate the vacuum on the engine crankcase.

Adjustment Procedures

To set up the system, a Blowby/Air Flow Indicator (Part No. 8T2700) is required. Measure the amount of combustion blowby for a given engine. This is usually done by closing the crankcase ventilation valve on the riser, blocking the crankcase air filter, and then attaching the blow-by indicator to the oil fill spout. The reading on the indicator is the engine's blow-by. All measurements are to be taken with the engine running at rated speed, load, and temperature.

Unplug the crankcase air filter and connect the blow-by indicator to the inlet port of an air filter, with the remaining filters, if any, blocked off. Open the crankcase ventilation butterfly valve on the riser until the blowby indicator reads the flow into the air cleaner equal to the blow-by measured previously at the oil fill spout.

This procedure will cause a volume of air to be drawn into the crankcase that is equal to the blowby gases passing the piston rings. This will sufficiently dilute the blowby fumes, reducing corrosive attacks and increase oil life. Do the above procedure for each engine. Make a final check of the crankcase pressure to insure the vacuum is not too large. Crankcase pressure should not be greater than -25.4 mm H_2O (-1.0 in. H_2O).

Sometimes it is difficult to precisely size the blower for a powered system. If the only blower available is too large, it may draw too much vacuum on the crankcase ventilation butterfly valve and make adjustments difficult. To overcome this problem, an additional valve can be connected on the crankcase vent manifold to draw air into the system and reduce the vacuum to the riser adjusting valves.

Exhaust System

Landfill gas sites typically operate on a continuous basis, 24 hour per day, seven days a week. Under these conditions, exhaust temperatures remain above the dew point for acids that may be in the exhaust gases. No special exhaust system will be required assuming operation is truly continuous. However, some landfills do operate less than continuous, starting and stopping the engine frequently. In this case, acids and water will condense in the exhaust system upon cooldown and therefore, the exhaust system must be made corrosion resistant.

Engine Protection

The G3500 low energy fuel engine arrangements for use in 60 Hz applications, have a shutoff system similar to the natural gas low emission generator engine, with a few exceptions. Check your Autocad CD library for the current engine general dimension drawing and wiring diagram. The differences for the low energy fuel engines are:

The high jacket water temperature shutdown is set at 124°C (255°F).

A high oil temperature shutdown is added and set at 102°C (215°F).

A jacket water pressure shutdown is added to prevent coolant flashing to steam if pressure is lost. This circuit has an arming temperature switch and is only active when the cooling system temperature is above 98°C (208°F). No time delay is required in the switch gear. This signal should shut down the engine if water pressure is lost.

A high inlet manifold air temperature alarm is added and set at 71°C (160°F).

G3500 Landfill arrangements are also available in 50 Hz configurations and are listed in the COSA section of the price list. These arrangements have optional Caterpillar safeties or shutoffs and are for use by European dealers only. European dealers frequently add shutoff groups that meet local codes and must add the shutdown devices and alarms that are discussed above.

Generator Set Transient Response

Low energy fuel engine arrangements are designed to operate parallel to the utility grid. These units are not developed for stand alone operation or to accept large transient loads. If these units are to operate with an auto-parallel device, specify the optional Woodward 701A or Proact governor. These governors provide variable dynamics for starting or off-line operation and for parallel operation. G3600 governors have adjustable gains that can be optimized for use on landfill and digester applications.

Footnotes

(1) Note carefully that the limits given also cover contaminants that may be ingested by the combustion air supply. For example, if chlorine is being ingested to the engine in the fuel and in the air, the total amount may not exceed 20.0 ug Cl/Btu of fuel on a Low Energy Fuel equipped engine. If the fuel is:

50% methane,40% carbon dioxide,
8% nitrogen, and 2% oxygen,

the Lower Heating Value (LHV) is 456 Btu/scf and the stoichiometric air/fuel ratio is 4.76:1, as calculated by the Caterpillar Methane Number Program. Now the maximum amount of chlorine is:

(limit for Cl) (LHV)= amount of Cl in fuel, in this example

(20 ug/Btu) (456 Btu/scf)= 9120 ug Cl/scf of fuel, assuming there is no chlorine in the air.

If chlorine is present in the air, the following example is instructive. Assume that the fuel has 2.2 ug Cl/Btu and that the engine is operating at a lambda of 1.5. What is the maximum allowable chlorine in the air?

For every one standard cubic foot of fuel burned there is:

(stoichiometric air/fuel ratio) (lambda), in this example

(4.76) (1.5)=7.14 scf of air per scf of fuel.

Chlorine present in the fuel is:

(Cl concentration) (LHV)= Cl in fuel, in this example

(2.2 ug/Btu) (456 Btu/scf fuel)=1000 ug Cl/scf fuel

and then maximum allowable chlorine in the air is:

(maximum permitted Cl - Cl in fuel)/(scf of air burned per scf of fuel),

(9120-1000)/(7.14)=1137 ug Cl/scf air.

If there was no chlorine in the fuel, the maximum amount of chlorine allowable in the air would be:

(9120-0)/(7.14)=1277 ug Cl/scf air.

(2) Sulfur compounds are those which contain sulfur. Total sulfur level should account for all sulfur and be expressed as hydrogen sulfide (H_2S). See conversion

below. Consult Lubrication section of the A&I Guide for information on proper lubrication and oil sampling when fuel or air contain sulfur compounds.

(3) Halide compounds are those which contain chlorine, fluorine, iodide, or bromine. Total halide level should account for all halides and be expressed as chlorine. See conversion below. Consult Lubrication section of the A&I Guide for information on proper lubrication and oil sampling when fuel or air contain halide compounds.

(4) Total particulate level must include inorganic silicon. Limit shown for silicon must account for the total organic (siloxanes, etc) and inorganic silicon content.

(5) At low temperatures, hydrocarbon fuels may condense and enter the engine. **Liquids are never permitted in the fuel.** If liquids are present, the customer must remove them by increasing the fuel temperature or by coalescing filter, or by means. Serious engine damage will result if liquids are allowed into the engine.

Useful conversions:

To determine the amount of a particular atom contained in a compound, such as Cl from a particular Cl bearing compound,

% Cl= (MW of Cl) (number Cl atoms in compound) (100)/(MW of compound)

ug Cl/L= (concentration of compound ug/L) (% Cl)/100

and the same procedure can be used for other atoms and compounds.

To show the level of one contaminant as another, such as ug F as ug Cl, (for use with Total Halogen levels),

ug F as Cl = (ug F/L) (MW of Cl)/(MW of F)

To convert ug/Btu to ug/L,

(ug/Btu) (LHV Btu/scf)/(28.3 L/scf)=ug/L

To convert ug/L to ppmv,

ppmv = (ug/L) (23.67)/(MW)

Where,

ppmv = part per million volume

1 mole of gas contains 22.4 liters at 0°C, 101.3 kPa

1 mole of gas contains 23.67 liters at 15.5°C, 101.3 kPa

MW (molecular weight): fluorine-19, chlorine-35.5, bromine-79.9, iodine-126.9, sulfur - 32, hydrogen - 1

1 ft^3 = 28.3 L

1 m^3 = 35.31 ft^3

APPENDIX M

LFG Fueled IC Engine Emissions
And
USEPA RBLC Data

Appendix M

Summary of USEPA RBLC Query (and other sources)

Table M-1

Facility Information (Name, State)		Engine Size			NOx		CO	
	State	(MMBtu/hr)	(kW)	(hp)	(g/bhp-hr)	(ppmv)	(g/bhp-hr)	(ppmv)
Other Known Sources								
Ocean Energy Corp., Inc.	NJ		1600	2233	0.60		2.75	
Bio Energy Texas, LLC	TX			2172	0.60		2.8	
USEPA RBLC Query								
New England Waste Services	VT		1600	2221	0.50		2.75	
Ridgewood Power Mgt, LLC	RI			2229	0.50		2.75	
County of Sacremento, Kiefer	CA			4230	0.55		2.7	
Minnesota Methane, Tajiuas	CA	43.68		4314	0.59			
Northwest Reg. Landfill	AZ			1410	0.60	4.0	2.5	280
Reliant Energy, Harris	TX		1664	2343	0.60		3.0	
Reliant Energy, Galveston	TX			2343	0.60		3.0	
Reliant Energy, Montgomery	TX		1664	2343	0.60		3.0	
MM San Bernardino Energy	CA	14.7		1850	0.60		2.5	
MM Hackensack Energy[1]	NJ	9.96	950	1340	1.0		[2.0]	
Manchester Renewable Power	NJ	8.6	800	1138	1.0		2.3	
Monterey Regional Waste Mgt.	CA			1274	1.2			
Bio-Energy, EDI Loraine[2]	OH	14.0		1833	1.5		2.4	
Bio-Energy, EDI Carbon[3]	OH	14.0	1400	1877	1.5		2.5	
Sumpter Energy, Carleton Farms[4]	MI	8.6	817	1138	1.8		2.9	
Northern Tier Solid Waste	PA		815		2.0		3.0	
Sumpter Energy, Carleton Farms	MI	8.6		1138	2.0		2.9	
Sumpter Energy, City Sand	MI	8.6		1138	2.0		2.9	
Sumpter Energy, Pine Tree	MI	8.6	800	1138	2.0		2.9	
Minnesota Methane, Maricopa[5]	AZ		800					
Bio Energy, EDI Azusa[6]	CA							

[Parentheses indicate calculated value based on information presented in USEPA RBLC Database]

Notes
1. Data presented in the USEPA RBLC indicates a CO emission rate of 0.607 lb/MMBtu, which converts to 2.0 g/bhp-hr.
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. Revised permit has been issued for this facility with limits consistent with Bio-Energy site in Loraine County (1.5 g/bhp-hr NOx, 2.5 g/bhp-hr CO).
4. Permitted emission rate for the six (6) ICE expansion is equal to 1.8 g/bhp-hr NOx, 2.9 g/bhp-hr CO.
5. Emission limits issued for 99 TpY for CO and NOx to avoid major source determination.
6. Project Cancelled.

Appendix M
Table M-1

Summary of USEPA RBLC Query (and other sources)

Facility Information (Name, State)		PM			SOx		VOC/ROC/NMOC		
Name	State	(g/bhp-hr)	(lb/hr)	(lb/MMBtu)	(lb/hr)	(lb/MMBtu)	(g/bhp-hr)	(lb/hr)	(ppmv)
Other Known Sources									
Ocean Energy Corp., Inc.	NJ	0.24	1.18					0.77	20
Bio Energy Texas, LLC	TX	0.148	0.71		0.26			0.76	20
USEPA RBLC Query									
New England Waste Services	VT								
Ridgewood Power Mgt, LLC	RI	0.1	0.49					0.76	20
County of Sacremento, Kiefer	CA								
Minnesota Methane, Tajiuas	CA	[0.34]		0.073					20
Northwest Reg. Landfill	AZ								
Reliant Energy, Harris	TX	[0.15]	0.77		1.27		0.28	0.83	
Reliant Energy, Galveston	TX	[0.09]	0.49		1.20		[0.16]	0.83	
Reliant Energy, Montgomery	TX	[0.15]	0.77				0.28		
MM San Bernardino Energy	CA	[0.04]	0.20		0.10	[0.01]	0.80		
MM Hackensack Energy[1]	NJ	[0.13]	0.55			0.139	[0.25]	0.74	
Manchester Renewable Power	NJ						0.375		
Monterey Regional Waste Mgt.	CA								
Bio-Energy, EDI Loraine[2]	OH	[0.09]	0.37		0.20	[0.01]	[0.17]	0.68	20
Bio-Energy, EDI Carbon[3]	OH	[0.09]	0.4		0.23	[0.02]			20
Sumpter Energy, Carleton Farms[4]	MI								
Northern Tier Solid Waste	PA						1.0		20
Sumpter Energy, Carleton Farms	MI								
Sumpter Energy, City Sand	MI						0.2		20
Sumpter Energy, Pine Tree	MI						0.2	8.8	20
Minnesota Methane, Maricopa[5]	AZ								
Bio Energy, EDI Azusa[6]	CA								

[Parentheses indicate calculated value based on information presented in USEPA RBLC Database]

Notes
1. Data presented in the USEPA RBLC indicates a CO emission rate of 0.607 lb/MMBtu, which converts to 2.0 g/bhp-hr.
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. Revised permit has been issued for this facility with limits consistent with Bio-Energy site in Loraine County (1.5 g/bhp-hr NOx, 2.5 g/bhp-hr CO).
4. Permitted emission rate for the six (6) ICE expansion is equal to 1.8 g/bhp-hr NOx, 2.9 g/bhp-hr CO.
5. Emission limits issued for 99 TpY for CO and NOx to avoid major source determination.
6. Project Cancelled.

COMPREHENSIVE REPORT
Report Date: 05/24/2006

Facility Information

RBLC ID:	RI-0022 (final)	**Date Determination Last Updated:**	06/24/2005
Corporate/Company Name:	RIDGEWOOD POWER MANAGEMENT LLC	**Permit Number:**	RI-PSD-7
Facility Name:	RIDGEWOOD RHODE ISLAND GENERATION LLC	**Permit Date:**	01/05/2005 (actual)
Facility Contact:	JOHN BAHRS 2014479000 JBAHRS@RIDGEWOODPOWER.COM	**FRS Number:**	110000820078
Facility Description:	LANDFILL GAS-FIRED POWER GENERATION	**SIC Code:**	4911
Permit Type:	B: Add new process to existing facility	**NAICS:**	221119
EPA Region:	1		
Faciliy County:	PROVIDENCE		
Facility State:	RI		
Facility ZIP Code:	02919		
Permit Issued By:	RHODE ISLAND DIV OF AIR & HAZ MAT (Agency Name) MR. DOUG MCVAY (Agency Contact) (401)222-2808x7011 DOUG.MCVAY@DEM.RI.GOV		
Other Permitting Information:			

Process/Pollutant Information

PROCESS NAME: 4-CATERPILLAR 3520C LEAN BURN ENGINE-GENERATOR SETS

Process Type: 17.140 (Landfill/Digester/Bio-Gas)

Primary Fuel: LANDFILL GAS

Throughput: 2229 Horsepower

Process Notes: LEAN BURN, SPARK IGNITED, AIR/FUEL RATIO CONTROLLERS, INTERCOOLERS

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 0.50 G/B-HP-H 1-HOUR AVERAGE

Emission Limit 2: 2.46 LB/H 1-HOUR AVERAGE

Standard Emission: 0.05 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: N

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (P) LEAN BURN, AIR/FUEL RATIO CONTROLLERS, INTERCOOLERS

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2.75 G/B-HP-H 1-HOUR AVERAGE

Emission Limit 2: 13.51 LB/H 1-HOUR AVERAGE

Standard Emission: 2.7 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: N

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) GOOD COMBUSTION PRACTICES

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

POLLUTANT NAME: Voltile Organic Compounds (VOC), Non-methane **CAS Number:** VOC

Emission Limit 1: 20 PPMVD@3%O2 1-HOUR AVERAGE

Emission Limit 2: 0.76 LB/H 1-HOUR AVERAGE

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: N

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) GOOD COMBUSTION PRACTICES

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

POLLUTANT NAME: Particulate Matter < 10 μ (PM10) **CAS Number:** PM

Emission Limit 1: 0.10 G/B-HP-H 1-HOUR AVERAGE

Emission Limit 2: 0.49 LB/H 1-HOUR AVERAGE

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: N

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) GOOD COMBUSTION PRACTICES

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	VT-0019 (final)	**Date Determination Last Updated:**	12/21/2005
Corporate/Company Name:	NEW ENGLAND WASTE SERVICES, INC.	**Permit Number:**	AOP-03-044
Facility Name:	NEW ENGLAND WASTE SERVICES OF VERMONT, INC.	**Permit Date:**	12/16/2004 (actual)
Facility Contact:	JOHN GAY 8022237221	**FRS Number:**	110021144279
Facility Description:	THE FACILITY IS A MUNICIPAL SOLID WASTE LANDFILL THAT OPERATES A LANDFILL GAS TO ENERGY (LFGTE) SYSTEM. THE LFGTE SYSTEM WILL CONSIST OF UP TO 4 INTERNAL COMBUSTION ENGINES: CATERPILLAR G3520C LE, EACH RATED TO BURN 507 SCFM OF GAS AND PRODUCE 1600KW. EXCESS GAS IS BURNED TWO BACKUP	**SIC Code:**	4953

FLARES: JOHN ZINK MODEL ZEF1235 EACH RATED AT 2500 SCFM.

Permit Type: A: New/Greenfield Facility **NAICS:** 562212

EPA Region: 1

Faciliy County: ORLEANS

Facility State: VT

Facility ZIP Code: 05825

Permit Issued By: VERMONT AIR POLLUTION CONTROL DIVISION (Agency Name)
MS. JENNIFER BRYAN (Agency Contact) (802)241-3846 jennb@dec.anr.state.vt.us

Other Permitting Information:

Process/Pollutant Information

PROCESS NAME: LANDFILL GAS FLARE

Process Type: 11.320 (Landfill/Digester/Bio-Gas)

Primary Fuel: LANDFILL GAS

Throughput: 5000 SCFM

Process Notes: THERE ARE TWO JOHN ZINK FLARES: MODEL ZEF1235. THEY ARE USED AS A BACKUP COMBUSTION DEVICE IF THE ENGINES ARE NOT AVAILABLE OR WHEN THERE IS EXCESS LANDFILL GAS UNUSED BY THE ENGINEES.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 0.37 LB/MMBTU 1 HOUR

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) LOW EMISSION DESIGN

Est. % Efficiency:

Compliance Verified: N

Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Dioxide (NO2) **CAS Number:** 10102-44-0

Emission Limit 1: 0.0680 LB/MMBTU 1 HOUR
Emission Limit 2:
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) LOW EMISSION DESIGN
Est. % Efficiency:
Compliance Verified: N
Pollutant/Compliance Notes:

Process/Pollutant Information

PROCESS NAME: STATIONARY INTERNAL COMBUSTION ENGINE
Process Type: 17.140 (Landfill/Digester/Bio-Gas)
Primary Fuel: LANDFILL GAS
Throughput: 2028 SCFM
Process Notes: THE PROCESS IS PERMITTED FOR FOUR INTERNAL COMBUSTION ENGINES EACH DRIVING AN ELECTRICAL GENERATOR. EACH SET IS THE SAME: CATERPILLAR G3520C LE RATED AT 2,221 HP / 1600 KW, BURNING 507 SCFM OF LANDFILL GAS.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2.75 G/B-HP-H 1 HOUR
Emission Limit 2: 13.50 LB/H 1 HOUR
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements: OTHER

Control Method: (P) LOW EMISSION ENGINE DESIGN
Est. % Efficiency:
Compliance Verified: N
Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Dioxide (NO2) **CAS Number:** 10102-44-0

Emission Limit 1: 0.50 G/B-HP-H 1 HOUR
Emission Limit 2: 2.45 LB/H 1 HOUR
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements: OTHER
Control Method: (P) LOW EMISSION ENGINE DESIGN
Est. % Efficiency:
Compliance Verified: N
Pollutant/Compliance Notes:

Facility Information

RBLC ID:	MI-0371 (final)	**Date Determination Last Updated:**	08/16/2005
Corporate/Company Name:	SUMPTER ENERGY ASSOCIATES	**Permit Number:**	62-01A
Facility Name:	CARLTON FARMS LANDFILL	**Permit Date:**	12/23/2003 (actual)
Facility Contact:	SCOTT SALISBURY 2483803920	**FRS Number:**	NOT AVAILABLE

Facility Description:	LANDFILL GAS TO ELECTRICITY GENERATION FACILITY	**SIC Code:**	4953
Permit Type:	B: Add new process to existing facility	**NAICS:**	562212
EPA Region:	5		
Faciliy County:	WAYNE		
Facility State:	MI		
Facility ZIP Code:	48164		
Permit Issued By:	MICHIGAN DEPT OF ENVIRONMENTAL QUALITY (Agency Name) MS. DANITA BRANDT (Agency Contact) (517) 373-7034 BRANDTD@MICHIGAN.GOV		
Other Agency Contact Info:	JEFF RATHBUN, PERMIT ENGINEER PO BOX 30260 LANSING, MI 48909 (517) 241-8072		
Other Permitting Information:			

Process/Pollutant Information

PROCESS NAME: SIX INTERNAL COMBUSTION ENGINES

Process Type: 17.140 (Landfill/Digester/Bio-Gas)

Primary Fuel: TREATED LANDFILL GAS

Throughput: 8.6 MMBTU/H

Process Notes: THE ADDITIONAL ENGINES WILL INCREASE CAPACITY AT THE FACILITY BY 4.9 MW FROM THE SIX ENGINES.

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 4.52 LB/H 3-HOUR AVERAGE

Emission Limit 2:

Standard Emission: NOT AVAILABLE

Did factors, other then air pollution technology considerations influence the BACT decisions: N

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements: N/A

Control Method: (N) GOOD COMBUSTION PRACTICE

Est. % Efficiency:

Compliance Verified: YES

Pollutant/Compliance Notes: EMISSION LIMIT IS LB/HR PER ENGINE.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 7.28 LB/H 3-HOUR AVERAGE

Emission Limit 2:

Standard Emission: NOT AVAILABLE

Did factors, other then air pollution technology considerations influence the BACT decisions: N

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements: N/A

Control Method: (N) GOOD COMBUSTION PRACTICE

Est. % Efficiency:

Compliance Verified: YES

Pollutant/Compliance Notes: EMISSION LIMIT IS LB/HR PER ENGINE.

Facility Information

RBLC ID:	VA-0288 (final)	**Date Determination Last Updated:**	06/21/2004
Corporate/Company Name:	IDUSTRIAL POWER GENERATING CORP	**Permit Number:**	61423
Facility Name:	INGENCO	**Permit Date:**	12/17/2003 (actual)
Facility Contact:	ROBERT GREENE (804)521-3557	**FRS Number:**	110008189129
Facility Description:	THIS SOURCE IS A STATE MAJOR, ELECTRIC POWER PLANT	**SIC Code:**	4931

Permit Type:	D: Both B (Add new process to existing facility) &C (Modify process at existing facility)	**NAICS:**	221112
EPA Region:	3		
Faciliy County:	CHESAPEAKE		
Facility State:	VA		
Facility ZIP Code:	23230		
Permit Issued By:	VIRGINIA ENVIRONMENTAL QUALITY AIR DIV. (Agency Name) MR. YOGESH DOSHI (Agency Contact) (804)698-4017 YNDOSHI@DEQ.VIRGINIA.GOV		
Other Agency Contact Info:	MARGARET KEY 7705 TIMBERLAKE ROAD LYNCHBURG, VA 24502 804-582-5120		
Other Permitting Information:	SOURCE HAS REQUESTED A MODIFICATION TO THE EXISTING PERMIT FOR AN INCREASE IN YEARLY EMISSION LIMITS; THERE IS NO CHANGE TO THE EXISTING EQUIPMENT. Original permit (dated 10/16/01) is to construct and operate a dual fuel electric power plant, located at the Virginia Beach Landfill II. In case of a landfill gas treatment system malfunction, untreated landfill gas is diverted to a flare.		

Process/Pollutant Information

PROCESS NAME: IC ENGINES, DUAL FUEL, (36)

Process Type: 17.140 (Landfill/Digester/Bio-Gas)

Primary Fuel: LANDFILL GAS

Throughput: 550 HP

Process Notes: 36 Detroit diesel engines, arranged in 6 groups of 6 engines each. Each engine drives a 350 kW generator. Treated landfill gas input ratio is limited to < 50%, treated landfill gas input to total fuel heat input for each period of continuous dual fuel operations. Compliance with lb/mmBtu limits for PM, PM10, VOC, CO and NOx, determined by stack testing.

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 0.11 LB/MMBTU

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) PROPER ENGINE MAINTENANCE PRACTICES

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: State regulation is basis

POLLUTANT NAME: Sulfur Dioxide (SO2) **CAS Number:** 7446-09-5

Emission Limit 1: 0.2020 LB/MMBTU

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) DISTILLATE OIL FUEL SULFUR LIMITS: FOR NO. 1 OR 2 OIL: 0.2% MAX SULFUR; FOR NO. 4 OIL: 0.5% MAX SULFUR.

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: State regulation is basis

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 2.1 LB/MMBTU

Emission Limit 2:

Standard Emission: 5.05 G/B-HP-H calculated, assumes 48% efficiency

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) AIR-TO-FUEL RATIO CONTROL, TURBOCHARGING, CHARGE- AIR COOLING SYSTEMS, SUPPLEMENTARY INLET CHARGE- AIR WATER-TO-AIR COOLING AND OVERSIZED INLET

CHARGE AND EXHAUST DUCTS.

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: State regulation is basis

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 3.2 LB/MMBTU

Emission Limit 2:

Standard Emission: 7.7 G/B-HP-H calculated, assumes 48% efficiency

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) FUEL LIMIT: TREATED LANDFILL GAS HEAT INPUT RATIO < 50%

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: State regulation is basis

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.22 LB/MMBTU

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) PROPER ENGINE MAINTENANCE

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: state reg is basis

Facility Information

RBLC ID:	OH-0260 (final)	**Date Determination Last Updated:**	07/06/2005
Corporate/Company Name:	BIO-ENERGY, L.L.C.	**Permit Number:**	02-16880
Facility Name:	CARBON LIMESTONE LFG	**Permit Date:**	04/10/2003 (actual)
Facility Contact:	LESLIE M. COOK 7133003310	**FRS Number:**	110017419293
Facility Description:	16 LANDFILL GAS-FIRED (LFG) IC ENGINES, AT EXISTING LANDFILL, FOR POWER GENERATION.	**SIC Code:**	4911
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221112
EPA Region:	5		
Faciliy County:	MAHONING		
Facility State:	OH		
Facility ZIP Code:	77063		
Permit Issued By:	OHIO ENVIRONMENTAL PROTECTION AGENCY (Agency Name) MS. CHERYL SUTTMAN (Agency Contact) (614)644-3617 CHERYL.SUTTMAN@EPA.STATE.OH.US		
Other Agency Contact Info:	CHERYL E. SUTTMAN 122 S. FRONT ST. COLUMBUS, OH 43215 614-644-3617		
Other Permitting Information:	THIS PTI IS A MODIFICATION TO PTI#02-14296 ISSUED 4/5/01. TESTING SHOWED THE ORIGINAL LIMITS FOR NOX AND HCL WERE TOO LOW, AND THE FACILITY WAS OUT OF COMPLIANCE. THIS ADJUSTMENT INCLUDED AN INCREASE OF 170 TONS OF NOX AND 6 TONS OF HCL. PM10, NOX, CO AND OC WERE PSD IN THE INITIAL PERMIT. THE FORMALDEHYDE LIMIT WAS REMOVED IN THIS MODIFICATION AND THE ROLLING 12-MO LIMITS WERE CHANGED TO TPY LIMITS. THE TOTAL FACILITY PM LIMIT IS 61 TONS/YR.		

Process/Pollutant Information

PROCESS NAME: IC ENGINES (16)

Process Type: 17.140 (Landfill/Digester/Bio-Gas)

Primary Fuel: LANDFILL GAS

Throughput: 14 MMBTU/H

Process Notes: SIXTEEN 14 MMBTU/H (1400 KW, 1877 HP) INTERNAL COMBUSTION ENGINES BURNING LANDFILL GAS FOR ELECTRICAL POWER. STACK TESTING WAS CONDUCTED ON ONE OF THE 16 SIMILAR UNITS, FOR NOX, CO, PM, HCL AND OCS. IT WAS FOUND THAT NOX, CO, AND HCL DID NOT MEET THE LIMITS IN THE ORIGINAL PERMIT; IT WAS MODIFIED TO INCREASE THESE LIMITS, AND RE-ISSUED ON 4/10/03. THE WAS AN INCREASE OF 170 TONS OF NOX, 79 TONS CO, AND 6 TONS OF HCL. LANDFILL GAS SHALL BE DIVERTED TO AN EXISTING LANDFILL COMBUSTOR, WHEN NOT BURNED IN THE INTERNAL COMBUSTION ENGINES. THE ALLOWABLE GAS FLOW RATE TO THE INTERNAL COMBUSTION ENGINES SHALL BE EXTABLISHED DURING THE MOST RECENT COMPLIANCE TEST; CURRENTLY THIS IS 415 SCFM.

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 4.9 LB/H

Emission Limit 2: 0.36 LB/MMBTU

Standard Emission: 0.60 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) LEAN BURN TECHNOLOGY.

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes: LIMITS ARE FOR EACH ENGINE. ANNUAL LIMIT: 21.5 T/YR. THESE LIMITS WERE CHANGED IN THE PERMIT MODIFICATION FOLLOWING THE INITIAL STACK TEST. THE ORIGINAL LIMIT COULD NOT BE MET, WAS: 2.48 LB/H AND 10.87 TPY

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 9.4 LB/H

Emission Limit 2: 0.67 LB/MMBTU

Standard Emission: 2 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes: LIMITS ARE FOR EACH ENGINE. ANNUAL LIMIT: 41.2 T/YR.

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.70 LB/H

Emission Limit 2: 3 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes: LIMITS ARE FOR EACH ENGINE.

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 0.40 LB/H

Emission Limit 2: 1.7 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: UNKNOWN
Pollutant/Compliance Notes: LIMITS ARE FOR EACH ENGINE.

POLLUTANT NAME: Sulfur Dioxide (SO2) **CAS Number:** 7446-09-5

Emission Limit 1: 0.23 LB/H
Emission Limit 2: 1 T/YR
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: N/A
Other Applicable Requirements: SIP
Control Method: (N)
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes: LIMITS ARE FOR EACH ENGINE.

POLLUTANT NAME: Hydrochloric Acid **CAS Number:** 7647-01-0

Emission Limit 1: 0.13 LB/H
Emission Limit 2: 0.60 T/YR
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: N/A
Other Applicable Requirements: SIP
Control Method: (N)
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes: LIMITS ARE FOR EACH ENGINE.

POLLUTANT **CAS Number:** 50-00-0

NAME: Formaldehyde

Emission Limit 1: LIMITATION REMOVED SEE NOTE

Emission Limit 2: LIMITATION REMOVED IN MODIFICATION

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: N/A

Other Applicable Requirements: N/A

Control Method: (N)

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes: LIMIT WAS FOR EACH ENGINE. TESTING PROVED THE LIMIT UNNECESSARY AND THIS LIMIT WAS REMOVED FROM THE PERMIT MODIFICATION.

POLLUTANT NAME: Visible Emissions (VE) **CAS Number:** VE

Emission Limit 1: 10 % OPACITY 6 minute average

Emission Limit 2:

Standard Emission: 10 % OPACITY 6 minute average

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: Limit is for each engine.

POLLUTANT NAME: Nonmethane Organic Carbon **CAS Number:** VOC

Emission Limit 1: 20 PPM @ 3% O2 as hexane

Emission Limit 2: 98 % REDUCTION

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	BACT-PSD
Other Applicable Requirements:	
Control Method:	(N)
Est. % Efficiency:	98
Compliance Verified:	Y
Pollutant/Compliance Notes:	Limit is for each engine.

Facility Information

RBLC ID:	CA-1092 (final)	**Date Determination Last Updated:**	01/04/2006
Corporate/Company Name:	MM SAN BERNARDINO ENERGY, LLC	**Permit Number:**	391009
Facility Name:	MM SAN BERNARDINO ENERGY, LLC	**Permit Date:**	05/16/2002 (actual)
Facility Contact:		**FRS Number:**	NEW, NOT FOUND
Facility Description:		**SIC Code:**	4953
Permit Type:	A: New/Greenfield Facility	**NAICS:**	562212
EPA Region:	9		
Faciliy County:	SAN BERNARDINO		
Facility State:	CA		
Facility ZIP Code:	91761		
Permit Issued By:	SOUTH COAST AQMD, CA (Agency Name) MR. MARTIN KAY (Agency Contact) (909)396-3115 mkay@aqmd.gov		
Other Agency Contact Info:	SOUTH COAST AQMD, MARTIN KAY, (909) 396-3115, MKAY@AQMD.GOV		

Other Permitting Information: CARB ID: 795.0, OPERATING PERMIT DATE: , STARTUP DATE: NEW CONSTR MODIFICATION: NEW CONSTRUCTION TECH STATUS: BACT DETERMINATION NO SOURCE TEST AVAILABLE

Process/Pollutant Information

PROCESS NAME: ICE: LANDFILL OR DIGESTED GAS FIRED

Process Type: 17.140 (Landfill/Digester/Bio-Gas)

Primary Fuel: LANDFILL GAS

Throughput: 14.70 MMBTU/H 1850 BHP

Process Notes: EQUIP: , MFR: DUETZ, TYPE: TURBOCHARGED/INTERCOOLED, MODEL: TBG620V16K, FUNC EQUIP: POWER GENERATION, FUEL_TYPE: , SCHEDULE: CONTINUOUS, H/D: 24, D/W: 7, W/Y: 52, NOTES: PPMVD@15%O2: NOX-46, CO-360, HC-79. G/HP-HR: ROG <.02, PM-10 <.05 (BASED ON 34% (HHV) ENGINE EFFICIENCY USED BY THE MANUFACTURE IN HIS CALCULATIONS, THE PPMVD LIMITS CORRESPOND TO THE FOLLOWING G/HP-HR: NOX-0.61, CO-2.9, HC-0.36 (AS METHANE). SOURCE TEST RESULTS:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 0.60 G/B-HP/H

Emission Limit 2:

Standard Emission: 0.60 G/B-HP/H

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements: N/A

Control Method: (A) TURBOCHARGED,INTERCOOLED AIR/FUEL CONTROLLER

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2.5 G/B-HP/H

Emission Limit 2:

Standard Emission: 2.5 G/B-HP/H

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements: N/A

Control Method: (A) TURBOCHARGED,INTERCOOLED AIR/FUEL CONTROLLER

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.80 G/B-HP/H

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements: N/A

Control Method: (A) TURBOCHARGED,INTERCOOLED AIR/FUEL CONTROLLER

Est. % Efficiency:

Compliance Verified: UNKNOWN

Pollutant/Compliance Notes:

POLLUTANT NAME: Particulate Matter (PM) **CAS Number:** PM

Emission Limit 1: 0.20 LB/H

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable N/A

Requirements:
Control Method: (A)
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

POLLUTANT NAME: Sulfur Oxides (SOx)
CAS Number: 7446

Emission Limit 1: 0.10 LB/H
Emission Limit 2:
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: BACT-PSD
Other Applicable Requirements: N/A
Control Method: (N)
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

Facility Information

RBLC ID:	TX-0404 (final)	**Date Determination Last Updated:**	04/13/2005
Corporate/Company Name:	RELIANT ENERGY RENEWABLES SECURITY LP	**Permit Number:**	P791
Facility Name:	RELIANT SECURITY LFGTE	**Permit Date:**	01/31/2002 (actual)

Facility Contact: GREG NEWMAN 7139458334

FRS Number: 110010496917

Facility Description: ELECTRICITY GENERATION FROM LANDFILL GAS

SIC Code: 4911

Permit Type: A: New/Greenfield Facility

NAICS: 221119

EPA Region: 6

Faciliy County: MONTGOMERY

Facility State: TX

Facility ZIP Code: 77210

Permit Issued By: TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) (Agency Name)
MR. JOHNNY VERMILLION (Agency Contact) (512)239-1292 JVERMILL@TCEQ.STATE.TX.US

Other Agency Contact Info: JOHNNY VERMILLION
TX
512-239-1292

Other Permitting Information: ADDITIONAL PERMIT NUMBERS: 44276, PSD-TX-971. THE ISSUED PERMIT WAS FOR THE INSTALLATION OF FOUR 1664 KW GENERATORS FIRED BY LANDFILL GAS.

Process/Pollutant Information

PROCESS NAME: GENERATOR ENGINE, 4

Process Type: 17.140 (Landfill/Digester/Bio-Gas)

Primary Fuel: LANDFILL GAS

Throughput: 1664 KW

Process Notes: THROUGHPUT IS FOR EACH. THE ENGINES ARE JENBACHER MODEL JGS 616. LANDFILL GAS LIMITED TO 11.9 GR/100 DSCF H2S AND 13.2 GR/100 DSCF S.

POLLUTANT NAME: Nitrogen Oxides (NOx)

CAS Number: 10102

Emission Limit 1: 0.60 G/BHP-H

Emission Limit 2: 3.1 T/YR EACH

Standard Emission: 0.60 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: U

Case-by-Case Basis: BACT-PSD

Other Applicable

Requirements:
Control Method: (P) GOOD COMBUSTION PRACTICE
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0
Emission Limit 1: 3 G/BHP-H
Emission Limit 2: 15.50 T/YR EACH
Standard Emission: 3 G/B-HP-H
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: BACT-PSD
Other Applicable Requirements:
Control Method: (P) GOOD COMBUSTION PRACTICE
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC
Emission Limit 1: 0.28 G/BHP-H
Emission Limit 2: 0.83 T/YR EACH
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: BACT-PSD
Other Applicable Requirements:
Control Method: (P) GOOD COMBUSTION PRACTICE
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 0.84 T/YR EACH
Emission Limit 2:
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) GOOD COMBUSTION PRACTICE, LOW SULFUR FUEL
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

POLLUTANT NAME: Sulfur Dioxide (SO2) **CAS Number:** 7446-09-5

Emission Limit 1: 1.24 T/YR EACH
Emission Limit 2:
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: U
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) GOOD COMBUSTION PRACTICE, LOW SULFUR FUEL
Est. % Efficiency:
Compliance Verified: UNKNOWN
Pollutant/Compliance Notes:

POLLUTANT NAME: Visible Emissions (VE) **CAS Number:** VE

Emission Limit 1: 5 % OPACITY

Emission Limit 2:

Standard Emission: 5 % OPACITY

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (P) GOOD COMBUSTION PRACTICE

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	TX-0385 (final)	**Date Determination Last Updated:**	05/05/2005
Corporate/Company Name:	RELIANT ENERGY RENEWABLES COASTAL PLAINS LP	**Permit Number:**	NA031
Facility Name:	RELIANT ENERGY GALVESTON PLANT	**Permit Date:**	01/24/2002 (actual)
Facility Contact:		**FRS Number:**	110002345515
Facility Description:	CO-GENERATION USING LANDFILL GAS AS FUEL	**SIC Code:**	4911
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221112
EPA Region:	6		
Faciliy County:	GALVESTON		
Facility State:	TX		
Facility ZIP Code:			
Permit Issued By:	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) (Agency Name)		

	MR. JOHNNY VERMILLION (Agency Contact) (512)239-1292 JVERMILL@TCEQ.STATE.TX.US
Other Agency Contact Info:	AARON MOON PO BOX 13087 AUSTIN, TX 78711-3087 512-238-1093
Other Permitting Information:	CONSTRUCTION PERMIT FOR THE INSTALLATION AND OPERATION OF SEVEN JENBACHER, 2,343 HP, LANDFILL GAS-FIRED IC ENGINES FOR A TOTAL OF 12 MEGAWATTS OF ELECTRICAL POWER. A SUBSEQUENT PERMIT MODIFICATION REDUCED THE NUMBER OF IC ENGINES TO 6. THE REFERENCE DATE AND AND PERMIT NUMBERS FOR THIS MODIFICATION ARE THE SAME AS THE ORIGINAL. NOT ABLE TO FIND FRS NUMBER

Process/Pollutant Information

PROCESS NAME:	JENBACHER IC ENGINES (7)
Process Type:	17.140 (Landfill/Digester/Bio-Gas)
Primary Fuel:	LANDFILL GAS
Throughput:	12 MW (TOTAL)
Process Notes:	SULFUR COMPOUND LIMITED TO: 13.2 GRAINS H2S/100 DSCF 11.9 GRAINS TOTAL S/100 DSCF

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1:	15.50 LB/H EACH ENGINE
Emission Limit 2:	460.98 T/YR TOTAL FOR ALL
Standard Emission:	3 G/B-HP-H EACH ENGINE

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	Other Case-by-Case
Other Applicable Requirements:	
Control Method:	(N)
Est. % Efficiency:	
Compliance Verified:	Unknown
Pollutant/Compliance Notes:	

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 3.1 LB/H EACH ENGINE

Emission Limit 2: 92.21 T/YR FOR ALL ENGINES

Standard Emission: 0.60 G/B-HP-H EACH ENGINE

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 0.49 LB/H EACH ENGINE

Emission Limit 2: 14.16 T/YR TOTAL

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Sulfur Dioxide (SO2) **CAS Number:** 7446-09-5

Emission Limit 1: 1.27 LB/H EACH ENGINE

Emission Limit 2: 37.75 T/YR TOTAL ALL ENGINES

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) FUEL LIMIT ON SULFUR: 13.2 H2S AND 11.9 TOTAL SULFUR PER 100 DSCF
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Hydrochloric Acid **CAS Number:** 7647-01-0

Emission Limit 1: 0.14 LB/H EACH
Emission Limit 2: 4.14 T/YR TOTAL
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (N)
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.83 LB/H EACH
Emission Limit 2: 24.72 T/YR TOTAL
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (N)
Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

COMPREHENSIVE REPORT
Report Date: 05/24/2006

Facility Information

RBLC ID:	AZ-0042 (final)	**Date Determination Last Updated:**	05/24/2005
Corporate/Company Name:	NORTHWEST REGIONAL LANDFILL	**Permit Number:**	V97016
Facility Name:	NORTHWEST REGIONAL LANDFILL	**Permit Date:**	10/27/2003 (actual)
Facility Contact:	DAVE BEARDEN (602) 708-9815	**FRS Number:**	110001693392
Facility Description:	MUNICIPAL LANDFILL	**SIC Code:**	4953
Permit Type:	D: Both B (Add new process to existing facility) &C (Modify process at existing facility)	**NAICS:**	562212
EPA Region:	9		
Faciliy County:	MARICOPA		
Facility State:	AZ		
Facility ZIP Code:	85374		
Permit Issued By:	MARICOPA CO AIR POLLUTION CONTROL, AZ (Agency Name) MR. AL BROWN (Agency Contact) (602) 506-6616 ABROWN@MAIL.MARICOPA.GOV		
Other Agency Contact Info:	DALE A LIEB AZ (602) 506-6738		
Other Permitting Information:			

Process/Pollutant Information

PROCESS NAME: FLARE, ENCLOSED

Process Type: 19.320 (Digester and Landfill Gas Flares)

Primary Fuel: LANDFILL GAS

Throughput:

Process Notes:

POLLUTANT **CAS Number:** 10102

NAME: Nitrogen Oxides (NOx)

Emission Limit 1:	0.0410 LB/MMBTU
Emission Limit 2:	
Standard Emission:	0.0410 LB/MMBTU

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	Other Case-by-Case
Other Applicable Requirements:	
Control Method:	(N)
Est. % Efficiency:	
Compliance Verified:	Unknown
Pollutant/Compliance Notes:	

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1:	0.13 LB/MMBTU
Emission Limit 2:	
Standard Emission:	0.13 LB/MMBTU

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	Other Case-by-Case
Other Applicable Requirements:	
Control Method:	(N)
Est. % Efficiency:	
Compliance Verified:	Unknown
Pollutant/Compliance Notes:	

Process/Pollutant Information

PROCESS NAME:	INTERNAL COMBUSTION ENGINE
Process Type:	17.150 (Other Gaseous)
Primary Fuel:	LANDFILL GAS

Throughput: 1410 HP

Process Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 0.60 G/B-HP-H

Emission Limit 2: 4500 PPM

Standard Emission: 0.60 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2.5 G/B-HP-H

Emission Limit 2: 280 PPM

Standard Emission: 2.5 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID: OH-0273 (final)

Date Determination Last Updated: 06/23/2003

Corporate/Company Name: Bio-Energy, L.L.C.

Permit Number: 02-17062

Facility Name: LORAINE COUNTY LANDFILL LFG POWER STATION

Permit Date: 04/22/2003 (actual)

Facility Contact: LESLIE M. COOK 713-300-3310

FRS Number: 110009607719

Facility Description: EIGHT 14.0 MMBTU/HR INTERNAL COMBUSTION ENGINES TO BURN LANDFILL GAS TO PRODUCE ELECTRICITY

SIC Code: 4911

Permit Type: A: New/Greenfield Facility

NAICS: 221112

EPA Region: 5

Faciliy County: LORAINE

Facility State: OH

Facility ZIP Code: 77063

Permit Issued By: OHIO ENVIRONMENTAL PROTECTION AGENCY (Agency Name)
MS. CHERYL SUTTMAN (Agency Contact) (614)644-3617 CHERYL.SUTTMAN@EPA.STATE.OH.US

Other Agency Contact Info: CHERYL E. SUTTMAN
122 S. FRONT ST.
COLUMBUS, OH 43215
614-644-3617

Other Permitting Information: Bio-Energy is installing 8 internal combusiton engines for electrical power, using landfill gas from an existing landfill.

Process/Pollutant Information

PROCESS NAME: IC ENGINES, LANDFILL GAS, (8)

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 5500 HP

Process Notes: Eight 14 mmBtu/hr internal combustion engines burning landfill gas for electrical power. Landfill gas shall be diverted to an open flare when not burned in the internal combustion engines. The allowable gas flow rate to the internal combustion engines shall be extablished during the most recent compliance test; this is estimated to be 508 scfm, based on a landfill gas methane content of 49%.

POLLUTANT **CAS Number:** PM

NAME: Particulate Matter < 10 µ (PM10)

Emission Limit 1: 0.37 LB/H

Emission Limit 2: 1.63 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: SIP

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: Limits are for each of 8 engines.

POLLUTANT NAME: Sulfur Dioxide (SO_2) **CAS Number:** 7446-09-5

Emission Limit 1: 0.20 LB/H

Emission Limit 2: 0.90 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: SIP

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: Limits are for each of 8 engines.

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.68 LB/H

Emission Limit 2: 3 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: NSPS

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: Limits are for each of 8 engines. Non-methane organic compound (NMOC) emissions shall be reduced by 98% weight-percent or the outlet NMOC emissions shall be less than 20 ppmvd, as hexane at 3% oxygen.

POLLUTANT NAME: Hydrochloric Acid **CAS Number:** 7647-01-0

Emission Limit 1: 0.28 LB/H

Emission Limit 2: 1.24 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: SIP

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: Limits are for each of 8 engines.

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 5.88 LB/H

Emission Limit 2: 0.42 LB/MMBTU

Standard Emission: 0.50 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) LEAN BURN TECHNOLOGY

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: Limits are for each of 8 engines. Additional limit per engine: 25.8 tons/yr.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 9.76 LB/H

Emission Limit 2: 0.70 LB/MMBTU

Standard Emission: 0.80 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: LImits are for each of 8 engines. Additional limit per engine: 42.75 tons/yr.

POLLUTANT NAME: Particulate Matter (PM) **CAS Number:** PM

Emission Limit 1: 0.87 LB/H

Emission Limit 2: 3.8 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: SIP

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes: LIMITS ARE FOR EACH OF 8 ENGINES.

POLLUTANT NAME: Visible Emissions (VE) **CAS Number:** VE

Emission Limit 1:	10 % OPACITY
Emission Limit 2:	
Standard Emission:	10 % OPACITY

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	N/A
Other Applicable Requirements:	SIP
Control Method:	(N)
Est. % Efficiency:	
Compliance Verified:	Y
Pollutant/Compliance Notes:	LIMITS ARE FOR EACH OF 8 ENGINES

Facility Information

RBLC ID:	PA-0173 (final)	**Date Determination Last Updated:**	04/30/2004
Corporate/Company Name:	NORTHERN TIER SOLID WASTE AUTHORITY	**Permit Number:**	08-322-001D
Facility Name:	NORTHERN TIER LANDFILL	**Permit Date:**	01/29/2002 (actual)
Facility Contact:	DAVID T. TERRILL 570-290-4177 NTSWA@EPIX.NET	**FRS Number:**	110017421645
Facility Description:	PA FOR CONSTRUCTION OF NEW 815 KW CATERPILLAR 3516-LE ENGINE/GENERATOR EQUIPPED CLEAN BURN TECHNOLOGY.	**SIC Code:**	4953
Permit Type:	A: New/Greenfield Facility	**NAICS:**	562212
EPA Region:	3		

Faciliy County: BRADFORD

Facility State: PA

Facility ZIP Code: 18814

Permit Issued By: PENNSYLVANIA DEP, BUR OF AIR QUAL CTRL (Agency Name)
MR. LARRY STRAUSS (Agency Contact) (717)772-3364 lastrauss@state.pa.us

Other Agency Contact Info: RICHARD L. MAXWELL, JR.
PA
(717) 327-3637

Other Permitting Information: Landfill expansion with installation of gas-fired reciprocating generator. Will supply power to landfill and local grid.

Process/Pollutant Information

PROCESS NAME: IC ENGINE

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 815 KW

Process Notes: Stack testing for NOx, CO, NMOC & DE

POLLUTANT NAME: Nitrogen Dioxide (NO2) **CAS Number:** 10102-44-0

Emission Limit 1: 2 G/B-HP-H

Emission Limit 2:

Standard Emission: 2 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: NSPS

Control Method: (P) CLEAN BURN TECHNOLOGY

Est. % Efficiency:

Compliance Verified: Y

Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 3 G/B-HP-H
Emission Limit 2:
Standard Emission: 3 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) CLEAN BURN TECHNOLOGY
Est. % Efficiency:
Compliance Verified: Y
Pollutant/Compliance Notes:

POLLUTANT NAME: Nonmethane Organic Carbon **CAS Number:** VOC

Emission Limit 1: 1 G/B-HP-H
Emission Limit 2: 20 PPMV
Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) USING CLEAN BURN TECHNOLOGY BAT IS 98% DESTRUCTION EFFICIENCY OR 20 PPMV.
Est. % Efficiency: 98
Compliance Verified: Y
Pollutant/Compliance Notes:

Facility Information

RBLC ID:	TX-0349 (final)	**Date Determination Last Updated:**	01/04/2005
Corporate/Company Name:	RELIANT ENERGY RENEWABLES ATASCOCITA LP	**Permit Number:**	PSD-TX-973
Facility Name:	RELIANT ATASCOCITA LFGTE	**Permit Date:**	01/24/2002 (actual)
Facility Contact:	BEN CARMINE	**FRS Number:**	110017419266
Facility Description:	RELIANT ENERGY RENEWABLES ATASCOCITA, L.P. PROPOSES TO CONSTRUCT A LANDFILL- GAS-TO-ENERGY FACILITY (LFGTE). THIS PROJECT WILL ENTAIL THE INSTALLATION OF 7 JENBACHER MODEL JGS 616 GS-LL, 2343 B- HP LANDFILL GAS-FIRED ENGINES. THE PROPOSED LFGTE FACILITY WILL PRODUCE APPROXIMATELY 11.65 MW (1.664 MW EACH) OF ELECTRICITY. THE ENGINES WILL BE THE ONLY AIR POLLUTANT EMITTING EQUIPMENT REQUIRED FOR THE NEW FACILITY. WASTE MANAGEMENT INCORPORATED (WMI) PREVIOUSLY COLLECTED AND ROUTED THE LANDFILL GAS TO A FLARE UNDER THE AUTHORITY OF 30 TAC 106492, REGISTRATION NO 38954. WMI WILL MAINTAIN THIS SEPARATE AUTHORITY TO FLARE ANY GAS THAT IS NOT SOLD TO THE RELIANT ENERGY RENEWABLES LFGTE FACILITY. PREVENTION OF SIGNIFICANT DETERIORATION (PSD) REVIEW FOR CO AND NO2 (AS NOX) AND NONATTAINMENT REVIEW FOR NOX ARE REQUIRED SINCE THE PROJECT INCREASES OF THESE POLLUTANTS ARE SIGNIFICANT UNDER THE CORRESPONDING FEDERAL NSR PROGRAMS. THE COMPANY HAS TWO SIMILAR CONCURRENT PROJECTS IN THE HOUSTON/GALVESTON AREA WHICH ARE ALSO UNDERGOING NON-ATTAINMENT AND PSD REVIEW.	**SIC Code:**	4931
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221119
EPA Region:	6		
Faciliy County:	HARRIS		
Facility State:	TX		
Facility ZIP Code:	772104455		
Permit Issued By:	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ) (Agency Name) MR. JOHNNY VERMILLION (Agency Contact) (512)239-1292 JVERMILL@TCEQ.STATE.TX.US		
Other Agency Contact Info:	AARON MOON PO BOX 13087 AUSTIN, TX 78711-3087 512-238-1093		

Other Permitting Information: LANDFILL GAS TO ENERGY FACILITY

Process/Pollutant Information

PROCESS NAME: (7) LANDFILL GAS-FIRED ENGINES, JGS616GS-LL, E1-7

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 12 MW, TOTAL

Process Notes: EACH ENGINE IS RATED FOR 2343 B-HP OR 1664 KW.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 15.50 LB/H EACH UNIT

Emission Limit 2: 460.98 T/YR TOTAL

Standard Emission: 3 G/B-HP-H EACH UNIT

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N) NONE INDICATED

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 3.1 LB/H EACH UNIT

Emission Limit 2: 92.21 T/YR TOTAL

Standard Emission: 0.60 G/B-HP-H EACH UNIT

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (N) NONE INDICATED

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: PSD POLLUTANT WITH LAER APPLIED.

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.83 LB/H EACH UNIT

Emission Limit 2: 24.72 T/YR TOTAL

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (N) NONE INDICATED

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: VOC ADDITIONAL EMISSION LIMITS: 0.28 G/B-HP-H EACH UNIT

POLLUTANT NAME: Particulate Matter < 10 μ (PM10) **CAS Number:** PM

Emission Limit 1: 0.77 LB/H EACH UNIT

Emission Limit 2: 22.88 T/YR TOTAL

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) LANDFILL GAS PRETREATMENT SYSTEM

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Sulfur Dioxide (SO2) **CAS Number:** 7446-09-5

Emission Limit 1: 1.27 LB/H EACH UNIT
Emission Limit 2: 37.75 T/YR TOTAL
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (P) LANDFILL GAS CONTAINING NO MORE THAN 13.2 GR H2S AND 11.9 GR S/100 DSCF.
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Hydrochloric Acid **CAS Number:** 7647-01-0

Emission Limit 1: 0.14 LB/H EACH UNIT
Emission Limit 2: 4.14 T/YR TOTAL
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (N) NONE INDICATED
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Opacity **CAS Number:** VE

Emission Limit 1: 5 % OPACITY 6 MIN AV, EACH UNIT

Emission Limit 2:

Standard Emission: 5 % OPACITY 6 MIN AV, EACH UNIT

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: SIP

Control Method: (N) NONE INDICATED

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	MI-0314 (final)	**Date Determination Last Updated:**	01/21/2004
Corporate/Company Name:	SUMPTER ENERGY ASSOCIATES	**Permit Number:**	62-01
Facility Name:	SUMPTER ENERGY ASSOCIATES	**Permit Date:**	12/20/2001 (actual)
Facility Contact:	SCOTT SALISBURY 248-380-3920	**FRS Number:**	110017412414
Facility Description:	ELECTRICITY FROM LANDFILL GAS	**SIC Code:**	4911
Permit Type:	D: Both B (Add new process to existing facility) &C (Modify process at existing facility)	**NAICS:**	221112
EPA Region:	5		
Faciliy County:	WAYNE		
Facility State:	MI		
Facility ZIP Code:	48393		

Permit Issued By: MICHIGAN DEPT OF ENVIRONMENTAL QUALITY (Agency Name)
MS. DANITA BRANDT (Agency Contact) (517) 373-7034 BRANDTD@MICHIGAN.GOV

Other Agency Contact Info: TERRY WRIGHT
PO BOX 30260
LANSING, MI 48909
(517) 373-7023

Other Permitting Information: EIGHT INTERNAL COMBUSTION ENGINES, FUELED BY LANDFILL GAS GENERATED AT ADJACENT CARLETON FARMS LANDFILL. ELECTRICITY FED TO LOCAL GRID. LANDFILL DESIGN CAPACITY 57000000 MEGAGRAM OF MUNICIPAL WASTE. LANDFILL SUBJECT TO 40 CFR 60 SUBPART WWW.

Process/Pollutant Information

PROCESS NAME: INTERNAL COMBUSTION ENGINE, 8 EACH

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 1138 HP

Process Notes: EIGHT EACH. CATERPILLAR MODEL NO. 3516. 8.6 MMBTU/H. FUEL USAGE LIMIT 1.51 BILLION CUBIC FEET/YR, TOTAL FOR EIGHT.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 7.28 LB/H

Emission Limit 2:

Standard Emission: 2.9 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: 3-HOUR AVERAGE

POLLUTANT NAME: Hydrochloric **CAS Number:** 7647-01-0

Acid

Emission Limit 1: 5.6 LB/MMCF LB/MMCF GAS

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 5.02 LB/H

Emission Limit 2:

Standard Emission: 2 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: 3-HOUR AVERAGE

Facility Information

RBLC ID:	MI-0317 (final)	**Date Determination Last Updated:**	11/18/2002
Corporate/Company Name:	SUMPTER ENERGY (AT CITY SAND) M4095	**Permit Number:**	56-01
Facility Name:	SUMPTER ENERGY (AT CITY SAND)	**Permit Date:**	12/07/2001 (actual)
Facility Contact:	SCOTT SALISBURY 248-380-3920	**FRS Number:**	110012165815
Facility Description:	LANDFILL GAS WASTE-TO-ENERGY PROJECT.	**SIC Code:**	4911
Permit Type:	D: Both B (Add new process to existing facility) &C (Modify process at existing facility)	**NAICS:**	221111, 221112, 221113, 221119, 221121, 221122
EPA Region:	5		
Faciliy County:	WAYNE		
Facility State:	MI		
Facility ZIP Code:	48111		
Permit Issued By:	MICHIGAN DEPT OF ENVIRONMENTAL QUALITY (Agency Name) MS. DANITA BRANDT (Agency Contact) (517) 373-7034 BRANDTD@MICHIGAN.GOV		
Other Agency Contact Info:	TERRY WRIGHT PO BOX 30260 LANSING, MI 48909 (517) 373-7023		
Other Permitting Information:	MUNICIPAL WASTE LANDFILL PRODUCES GAS, WHICH IS BURNED IN THE INTERNAL COMBUSTION ENGINES TO GENERATE ELECTRICITY. THE ENGINES ARE, IN EFFECT, CONTROL DEVICES FOR THE LANDFILL, ENABLING IT TO MEET NSPS WWW.		

Process/Pollutant Information

PROCESS NAME:	INTERNAL COMBUSTION ENGINES
Process Type:	17.150 (Other Gaseous)
Primary Fuel:	LANDFILL GAS
Throughput:	1138 HP EACH
Process Notes:	EMISSIONS LIMITS ARE FOR THE TOTAL GROUP OF TEN. ENGINES ARE CATERPILLAR MODEL 3516.

POLLUTANT NAME: Hydrochloric Acid **CAS Number:** 7647-01-0

Emission Limit 1: 1 LB/H

Emission Limit 2: 4.4 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N) NO CONTROL ON ENGINES. ENGINES CONTROL THE LANDFILL EMISSIONS OF CHLORINATED ORGANICS.

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Nonmethane Organic Carbon **CAS Number:** VOC

Emission Limit 1: 5 LB/H

Emission Limit 2: 22 T/YR

Standard Emission: NOT AVAILABLE

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: N/A

Other Applicable Requirements: NSPS

Control Method: (N) ENGINES CONTROL THE LANDFILL. BASIS IS 0.2 G/BHP- H. (20 PPMV) AT 3% O2

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 50.40 LB/H

Emission Limit 2: 221 T/YR

Standard Emission: 2 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N) BASED ON 2.0 G/HP-H

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 73 LB/H

Emission Limit 2: 320 T/YR

Standard Emission: 2.9 GR/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (N) BASED ON 2.9 GRAMS/HP-H

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	MI-0299 (final)	**Date Determination Last Updated:**	12/02/2002
Corporate/Company Name:	SUMPTER ENERGY - PINE TREE ACRES	**Permit Number:**	269-97A
Facility Name:	SUMPTER ENERGY - PINE TREE ACRES	**Permit Date:**	07/24/2001 (actual)
Facility Contact:	SCOTT SALISBURY (248) 380-3920	**FRS Number:**	110012611290
Facility Description:	LANDFILL GAS TO ELECTRICITY PROJECT	**SIC Code:**	4911
Permit Type:	D: Both B (Add new process to existing facility) &C (Modify process at existing facility)	**NAICS:**	221111, 221112, 221113, 221119, 221121, 221122

EPA Region: 5

Faciliy County: MACOMB

Facility State: MI

Facility ZIP Code: 48062

Permit Issued By: MICHIGAN DEPT OF ENVIRONMENTAL QUALITY (Agency Name)
MS. DANITA BRANDT (Agency Contact) (517) 373-7034 BRANDTD@MICHIGAN.GOV

Other Agency Contact Info: TERRY WRIGHT
PO BOX 30260
LANSING, MI 48909
(517) 373-7023

Other Permitting Information: SOURCE IS SEVERAL INTERNAL COMBUSTION ENGINES TO GENERATE ELECTRICITY FROM LANDFILL GAS. THE ENGINES REDUCE EMISSIONS FROM THE LANDFILL AND CREATE SOME EMISSIONS OF THEIR OWN. PERMIT 269-97 WAS RECEIVED 04/28/1997. PERMIT 269-97A ALLOWS UP TO SEVEN CATERPILLAR MODEL 3516. UNDER MODIFIED "A" PERMIT, SOME CHANGES IN POLLUTANT EMISSION FACTORS ARE INCORPORATED. AIRS FACILITY NUMBER: MI 094706. PLANT CONTACT MAILING ADDRESS: SCOTT SALISBURY; 29261 WALL ST.; WIXOM, MI 48393. AGENCY CONTACT INFO: TERRY WRIGHT; MICHIGAN DEQ; PO BOX 30260; LANSING, MI 48909; FAX (517) 373-1265; EMAIL WRIGHTTL@MICHIGAN.GOV.

Process/Pollutant Information

PROCESS NAME:	INTERNAL COMBUSTION ENGINES
Process Type:	17.150 (Other Gaseous)
Primary Fuel:	LANDFILL GAS
Throughput:	1138 HP (EACH)

Process Notes: EMISSION LIMITS ARE FOR THE TOTAL GROUP OF SEVEN CATERPILLAR MODEL 3516. EACH ENGINE BURNS 318.5 CFM OF LANDFILL GAS, PRODUCING 800 KW.

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 51.10 LB/H
Emission Limit 2: 223.8 T/YR
Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (N) N/A
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes: MODIFIED PERMIT BASES CO EMISSIONS ON 2.9 G/HP- H. CIRCA 1997 PERMIT ASSUMED 2.3 G/HP-H.

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 35.20 LB/H
Emission Limit 2: 154.2 T/YR
Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case
Other Applicable Requirements:
Control Method: (N) N/A
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes: BASIS IS 2.0 G/HP-H; SAME AS 1997 NSR PERMIT.

POLLUTANT NAME: Nonmethane **CAS Number:** VOC

Organic Carbon

Emission Limit 1: 8.8 LB/H

Emission Limit 2: 38.50 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N) LANDFILL SUBJECT TO WWW. ENGINES CONTROL THE LANDFILL. NO CONTROLS ON ENGINE.

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: BASIS IS 0.2 G/HP-H (20 PPMDV @ 3% O2). CIRCA 1997 PERMIT USED 0.5 G/HP-H.

POLLUTANT NAME: Hydrochloric Acid **CAS Number:** 7647-01-0

Emission Limit 1: 0.70 LB/H

Emission Limit 2: 3 T/YR

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (N) ENGINES CONVERT CHLORINATED SOLVENTS FROM LANDFILL GAS. COMPLIANCE WILL BE CALCULATED FROM 5.1 LB HCL PER MMCF OF GAS BURNED.

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	CA-0961 (final)	**Date Determination Last Updated:**	07/28/2003
Corporate/Company Name:	BIO ENERGY (AZUSA) LLC	**Permit Number:**	352817
Facility Name:	EDI AZUSA LANDFILL	**Permit Date:**	02/22/2000 (actual)
Facility Contact:	LIONEL ORFORD 818-334-0718	**FRS Number:**	110013981860
Facility Description:		**SIC Code:**	4911
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221112
EPA Region:	9		
Faciliy County:	LOS ANGLES		
Facility State:	CA		
Facility ZIP Code:	91702		
Permit Issued By:	SOUTH COAST AQMD, CA (Agency Name) MR. MARTIN KAY (Agency Contact) (909)396-3115 mkay@aqmd.gov		
Other Agency Contact Info:	TED KOWALCZYK CA (818) 572-6186		
Other Permitting Information:	ADDITIONAL PERMIT/FILE NUMBERS: 352818, 352819, 352821, 352822. BACT REVIEW REQUIRED FOR NOX, CO, AND VOC ONLY. NO PERMIT ISSUED, PROJECT CANCELED.		

Process/Pollutant Information

PROCESS NAME:	I.C. ENGINE, LEAN BURN, (5)
Process Type:	17.150 (Other Gaseous)
Primary Fuel:	LANDFILL GAS
Throughput:	1850 HP
Process Notes:	FIVE 1850 BHP DEUTZ TBG620 V16K LEAN BURN ENGINES DRIVING A GENERATOR.

POLLUTANT **CAS Number:** 10102

NAME: Nitrogen Oxides (NOx)

Emission Limit 1: 0.60 G/B-HP-H

Emission Limit 2:

Standard Emission: 0.60 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (P) LEAN BURN

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2 G/B-HP-H

Emission Limit 2:

Standard Emission: 2 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (P) LEAN BURN

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.17 G/B-HP-H

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	LAER
Other Applicable Requirements:	
Control Method:	(P) LEAN BURN
Est. % Efficiency:	
Compliance Verified:	Unknown
Pollutant/Compliance Notes:	

Facility Information

RBLC ID:	CA-0960 (final)	**Date Determination Last Updated:**	07/14/2003
Corporate/Company Name:	COUNTY OF SACRAMENTO - KIEFER LANDFILL	**Permit Number:**	34-AA-0001
Facility Name:	KIEFER LANDFILL	**Permit Date:**	01/18/2000 (actual)
Facility Contact:	916-875-5555	**FRS Number:**	110017420628
Facility Description:	WASTE-TO-ENERGY FACILITY USING LANDFILL GAS TO POWER IC ENGINES	**SIC Code:**	4911
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221112
EPA Region:	9		
Faciliy County:	SACRAMENTO		
Facility State:	CA		
Facility ZIP Code:	95827		
Permit Issued By:	SACRAMENTO METROPOLITAN AQMD, CA (Agency Name) MR. JORGE DEGUZMAN (Agency Contact) (916)874-4860		
Other Agency Contact Info:	JORGE DEGUZMAN CA		

(916)874-4860

Other Permitting Information: BACT REVIEW REQUIRED FOR NOx AND CO ONLY.

Process/Pollutant Information

PROCESS NAME: IC ENGINE, LEAN BURN, (3)

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 4230 BHP

Process Notes: THREE 4230 BHP CATERPILLAR G3616 LEAN BURN IC ENGINES DRIVING A 3 MW GENERATOR

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 0.55 G/B-HP-H

Emission Limit 2:

Standard Emission: 0.55 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (P) LEAN BURN TECHNOLOGY

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes: LIMIT FOR EACH ENGINE

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2.7 G/B-HP-H

Emission Limit 2:

Standard Emission: 2.7 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis:	LAER
Other Applicable Requirements:	
Control Method:	(P) LEAN BURN TECHNOLOGY
Est. % Efficiency:	
Compliance Verified:	Unknown
Pollutant/Compliance Notes:	LIMIT FOR EACH ENGINE

Facility Information

RBLC ID:	NJ-0021 (final)	**Date Determination Last Updated:**	09/06/2002
Corporate/Company Name:	MM HACKENSACK ENERGY, LLC.	**Permit Number:**	LOG# 01-96-2800
Facility Name:	MM HACKENSACK ENERGY, LLC.	**Permit Date:**	04/09/1998 (actual)
Facility Contact:	BEN HEVISER	**FRS Number:**	110012646583
Facility Description:		**SIC Code:**	4931
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221111, 221112, 221113, 221119, 221121, 221122, 22121
EPA Region:	2		
Faciliy County:	BERGEN		
Facility State:	NJ		
Facility ZIP Code:	07032-		
Permit Issued By:	NEW JERSEY DEPT OF ENV PROTECTION (Agency Name) VIORICA PETRIMAN (Agency Contact) (609) 292-1638 VIORICA.PETRIMAN@DEP.STATE.NJ.US		
Other Agency Contact Info:	SUBHASH SHAH NJ		

(609) 633-8224

Other Permitting Information: ADDITIONAL SIC: 4953 NEW COMPANY TO USE LANDFILL GAS TO GENERATE ELECTRICITY AND ALSO DESTRUCT NMOC IN LANDFILL GAS BY 98% AND COMPLY WITH 40 CFR 60 SUBPART CC. 6.8:1 A-F RATIO LEAN BURN C516 FITN. EACH ENGINE SHALL OPERATE AT LEAST 80% OF MAXIMUM LOAD. STACK TEST REQUIRED WITHIN 180 DAYS OF INITIAL OPERATION. ALL EMISSIONS ARE BACT-PSD EXCEPT NOX AND CO, WHICH ARE LAER AND MUST COMPLY WITH STATE EMISSION OFFSET RULES. NO CONTROLS FOR ANY POLLUTANT WERE DESCRIBED-THE FACILITY IS REQUIRED TO REMOVE 98% OF VOCS THROUGH EFFICIENT COMBUSTION, AND MONITOR THE OXYGEN % AND AIR/FUEL RATIO IN THE ENGINES. PLANT CONTACT INFO: BEN HEVISER; 1221 NICOLETTE MALL; SUITE 700; MINNEAPOLIS, MN 55403-2445. APPLICATION REVISED ON 7/7/1997.

Process/Pollutant Information

PROCESS NAME: 6 RECIPROCATING ENGINES

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 9.96 MMBTU/H HHV (EACH)

Process Notes: ENGINE MODEL: CATERPILLAR CAT 3516 SITA. THROUGHPUT: 1340 BHP EACH (950 KW).

POLLUTANT NAME: Sulfur Dioxide (SO_2) **CAS Number:** 7446-09-5

Emission Limit 1: 1.39 LB/H

Emission Limit 2: 0.1390 LB/MMBTU

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (A)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Hydrochloric **CAS Number:** 7647-01-0

Acid

Emission Limit 1: 0.21 LB/H

Emission Limit 2: 0.0210 LB/MMBTU

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (A)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: 1,1,1-Trichloroethane **CAS Number:** 71-55-6

Emission Limit 1: 1.93 E-3 LB/H

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (A)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Perchloroethylene **CAS Number:** 127-18-4

Emission Limit 1: 3.83 E-3 LB/H

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (A)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Acrylonitrile **CAS Number:** 107-13-1

Emission Limit 1: 6.3 E-3 LB/H

Emission Limit 2:

Standard Emission:

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: Other Case-by-Case

Other Applicable Requirements:

Control Method: (A)

Est. % Efficiency:

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 1 G/BHP-H

Emission Limit 2: 0.2960 LB/MMBTU OF HHV 2.95 LB/H

Standard Emission: 1 G/BHP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (P) CONTROL OF AIR/FUEL RATIO AND OXYGEN LEVEL

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes: ADDITIONAL BASIS: STATE EMISSION OFFSET RULE

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.0740 LB/MMBTU OF HHV
Emission Limit 2: 0.74 LB/H
Standard Emission: 0
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: N/A
Other Applicable Requirements: NSPS
Control Method: (P) GOOD COMBUSTION PRACTICE
Est. % Efficiency: 98
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 0.6070 LB/MMBTU OF HHV
Emission Limit 2: 6.05 LB/H
Standard Emission: 0.6070 G/B-HP-H
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: N/A
Other Applicable Requirements: NSPS
Control Method: (P) GOOD COMBUSTION PRACTICE
Est. % Efficiency: 0
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Total Suspended Particulates **CAS Number:** PM

Emission Limit 1: 0.55 LB/H
Emission Limit 2: 0.0550 LB/MMBTU
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: BACT-PSD
Other Applicable Requirements:
Control Method: (A)
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 0.55 LB/H
Emission Limit 2: 0.0550 LB/MMBTU
Standard Emission:
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: BACT-PSD
Other Applicable Requirements:
Control Method: (A)
Est. % Efficiency:
Compliance Verified: Unknown
Pollutant/Compliance Notes:

Facility Information

RBLC ID:	CA-0843 (final)	**Date Determination Last Updated:**	12/18/2001
Corporate/Company Name:	MINNESOTA METHANE TAJIUAS CORPORATION	**Permit Number:**	9788
Facility Name:	MINNESOTA METHANE TAJIUAS CORPORATION	**Permit Date:**	01/09/1998 (actual)
Facility Contact:		**FRS Number:**	110017434917
Facility Description:		**SIC Code:**	4900
Permit Type:		**NAICS:**	
EPA Region:	9		
Faciliy County:	SANTA BARBRARA		
Facility State:	CA		
Facility ZIP Code:			
Permit Issued By:	SANTA BARBARA COUNTY APCD, CA (Agency Name) MR. MIKE GOLDMAN (Agency Contact) (805) 961-8821 GOLDMANM@SBCAPCD.ORG		
Other Agency Contact Info:	STEVE STERNER CA (805) 961-8886		
Other Permitting Information:			

Process/Pollutant Information

PROCESS NAME: FLARE, STANDBY FOR A LANDFILL GAS TO ENERGY PROJEC

Process Type: 19.320 (Digester and Landfill Gas Flares)

Primary Fuel: LANDFILL GAS

Throughput: 2000 SCFM

Process Notes: ARB RECORD # A310-845-98

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 8.4 LB/D

Emission Limit 2: 0.0080 LB/MMBTU

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) LANDFILL GAS FUEL PRETREATMENT SYSTEM TO REMOVE GAS CONDENSATE AND FILTER GAS FROM PARTICULATES PRIOR TO FLARING GAS IN STANDBY FLARE

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Reactive Organic Compounds (ROC) **CAS Number:** VOC

Emission Limit 1: 19 PPMVD

Emission Limit 2: 0

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) STANDBY FLARE EQUIPPED WITH TEMPERATURE CONTROL TO REGULATE ITS AIR COMBUSTION INTAKE

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 0.06 LB/MMBTU

Emission Limit 2: 0

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD
Other Applicable Requirements:
Control Method: (P) INSTRINSIC FLARE BURNER DESIGN
Est. % Efficiency: 0
Compliance Verified: Unknown
Pollutant/Compliance Notes:

Process/Pollutant Information

PROCESS NAME: EQUIPMENT, LANDFILL GAS TO ENERGY PRODUCTION
Process Type: 17.150 (Other Gaseous)
Primary Fuel: LANDFILL GAS
Throughput: 43.68 MMBTU/H
Process Notes: ARB RECORD # A330-846-98; A/C # 9788

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 0.59 G/B-HP-H
Emission Limit 2: 0
Standard Emission: 0
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: BACT-PSD
Other Applicable Requirements:
Control Method: (P) LEAN BURN, EXHAUST ROUTED THROUGH AFTERBURNER TO FURTHER COMBUST ENGINE CO AND UNBURNED HYDROCARBONS
Est. % Efficiency: 0
Compliance Verified: Unknown
Pollutant/Compliance Notes:

POLLUTANT NAME: Reactive Organic **CAS Number:** VOC

Compounds (ROC)

Emission Limit 1: 20 PPMVD @ 3% O2

Emission Limit 2: 53.50 LB/D

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) LEAN BURN, AFTERBURNER IS EQUIPPED TO REGULATE AIR FLOW WITH TEMPERATURE CONTROL

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Particulate Matter < 10 µ (PM10) **CAS Number:** PM

Emission Limit 1: 76.50 LB/D

Emission Limit 2: 0.0730 LB/MMBTU

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) LANDFILL GAS FUEL PRETREATMENT SYSTEM TO REMOVE GAS CONDENSATE AND FILTER GAS FROM PARTICULATES

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	CA-0789 (final)	**Date Determination Last Updated:**	12/18/2001
Corporate/Company Name:	MONTEREY REGIONAL WASTE MANAGEMENT DISTRICT	**Permit Number:**	8521 & 8522
Facility Name:	MONTEREY REGIONAL WASTE MANAGEMENT DISTRICT	**Permit Date:**	11/04/1996 (actual)
Facility Contact:		**FRS Number:**	110017437433
Facility Description:		**SIC Code:**	4953
Permit Type:		**NAICS:**	56292, 562211, 562212, 562213, 562219
EPA Region:	9		
Faciliy County:	MONTEREY		
Facility State:	CA		
Facility ZIP Code:			
Permit Issued By:	MONTEREY BAY UNIFIED APCD, CA (Agency Name) MR. LANCE ERICKSEN (Agency Contact) (831)647-9411		
Other Agency Contact Info:	JERRY STEELE CA (408) 647-9411		
Other Permitting Information:			

Process/Pollutant Information

PROCESS NAME:	JENBACHER LEAN BURN, MODEL JGS 320 GS-LL IC ENGINE
Process Type:	17.150 (Other Gaseous)
Primary Fuel:	LANDFILL GAS
Throughput:	1274 HP
Process Notes:	ARB RECORD # A330-760-97

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 213.45 LB/DAY
Emission Limit 2: 0
Standard Emission: 1.2 G/B-HP-H
Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown
Case-by-Case Basis: LAER
Other Applicable Requirements:
Control Method: (P) LEAN BURN COMBUSTION JENBACHER
Est. % Efficiency: 0
Compliance Verified: Unknown
Pollutant/Compliance Notes:

Facility Information

RBLC ID:	AZ-0027 (final)	**Date Determination Last Updated:**	12/18/2001
Corporate/Company Name:	MINNESOTA METHANE	**Permit Number:**	95-0241
Facility Name:	MINNESOTA METHANE	**Permit Date:**	11/12/1995 (estimated)
Facility Contact:		**FRS Number:**	110017437175
Facility Description:		**SIC Code:**	4959
Permit Type:		**NAICS:**	488119, 56291, 56171, 562998
EPA Region:	9		
Faciliy County:	MARICOPA		

Facility State: AZ

Facility ZIP Code: 85009-

Permit Issued By: MARICOPA CO AIR POLLUTION CONTROL, AZ (Agency Name)
MR. AL BROWN (Agency Contact) (602) 506-6616 ABROWN@MAIL.MARICOPA.GOV

Other Agency Contact Info: LYNN APOSTLE
AZ
(602) 506-6760

Other Permitting Information: COMPANY SELLS ENGINES TO MUNICIPAL LANDFILLS TO DESTROY LANDFILL GAS VIA COGENERATION.

Process/Pollutant Information

PROCESS NAME: ENGINES, COGENERATION (4)

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 800 KW

Process Notes:

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 99 TPY

Emission Limit 2: 0

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) AIR/FUEL CONTROLLER ADJUSTED TO OBTAIN LOW NOX

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT

NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 99.90 TPY

Emission Limit 2: 0

Standard Emission: 0

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: BACT-PSD

Other Applicable Requirements:

Control Method: (P) AIR/FUEL CONTROLLER

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

Facility Information

RBLC ID:	NJ-0022 (final)	**Date Determination Last Updated:**	09/06/2002
Corporate/Company Name:	MANCHESTER RENEWABLE PWR CORP/LANDFILL ENERGY SYST	**Permit Number:**	LOG # 01-94-4469 THRU -4474
Facility Name:	MANCHESTER RENEWABLE PWR CORP/LANDFILL ENERGY SYST	**Permit Date:**	05/10/1995 (actual)
Facility Contact:	MR. SCOTT SALISBURY	**FRS Number:**	110007141878
Facility Description:		**SIC Code:**	4931
Permit Type:	A: New/Greenfield Facility	**NAICS:**	221111, 221112, 221113, 221119, 221121, 221122, 22121
EPA Region:	2		
Faciliy County:	OCEAN		

Facility State: NJ

Facility ZIP Code: 08743-

Permit Issued By: NEW JERSEY DEPT OF ENV PROTECTION (Agency Name)
VIORICA PETRIMAN (Agency Contact) (609) 292-1638 VIORICA.PETRIMAN@DEP.STATE.NJ.US

Other Agency Contact Info: KETAN BHANDUTIA
NJ
(609) 984-6356

Other Permitting Information: 4.5 MW LANDFILL GAS TO ENERGY PROJECT PLANT CONTACT INFO: MR. SCOTT SALISBURY; 29261 WALL STREET; WIXOM, MI 48393

Process/Pollutant Information

PROCESS NAME: I. C. ENGINES

Process Type: 17.150 (Other Gaseous)

Primary Fuel: LANDFILL GAS

Throughput: 8.6 MMBTU/H

Process Notes: 800KW CATERPILLAR 6 ENGINES

POLLUTANT NAME: Nitrogen Oxides (NOx) **CAS Number:** 10102

Emission Limit 1: 1 G/B-HP-H

Emission Limit 2: 0.30 LB/MMBTU

Standard Emission: 1 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT

NAME: Carbon Monoxide **CAS Number:** 630-08-0

Emission Limit 1: 2.3 G/B-HP-H

Emission Limit 2: 0.67 LB/MMBTU

Standard Emission: 2.3 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

POLLUTANT NAME: Volatile Organic Compounds (VOC) **CAS Number:** VOC

Emission Limit 1: 0.3750 G/B-HP-H

Emission Limit 2: 0.11 LB/MMBTU

Standard Emission: 0.3750 G/B-HP-H

Did factors, other then air pollution technology considerations influence the BACT decisions: Unknown

Case-by-Case Basis: LAER

Other Applicable Requirements:

Control Method: (N)

Est. % Efficiency: 0

Compliance Verified: Unknown

Pollutant/Compliance Notes:

APPENDIX M-1

Bio Energy Texas, LLC
CAT G3520 IC Gas Engine
Permit Allowed Emission Rates

Section 1 - Document

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

Permit Numbers 56641 and PSD-TX-1034

This table lists the maximum allowable emission rates and all sources of air contaminants on the applicant's property covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANTS DATA

Emission Source Air Contaminant Emission Rates *

Point No. (1) Name (2) Name (3) lb/hr TPY**

E1 Engine 1 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E2 Engine 2 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E3 Engine 3 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E4 Engine 4 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E5 Engine 5 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E6 Engine 6 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E7 Engine 7 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

E8 Engine 8 NO_x 2.87 12.58

Caterpillar, Model G3520C CO 13.41 58.73

2,172 bHP VOC 0.76 3.34

SO_2 0.26 1.14

PM_{10} 0.71 3.12

Fugitives (4) VOC 0.04 0.18

(1) Emission point identification - either specific equipment designation or emission point number from a plot plan.

(2) Specific point source names. For fugitive sources, use an area name or fugitive source name.

(3) VOC - volatile organic compounds as defined in Title 30 Texas Administrative Code § 101.1

NO_x - total oxides of nitrogen

SO_2 - sulfur dioxide

PM_{10} - particulate matter (PM) equal to or less than 10 microns in diameter. Where PM is not listed, it shall be assumed that no particulate matter greater than 10 microns is emitted.

CO - carbon monoxide

(4) Fugitive emissions are an estimate only and should not be considered as a maximum allowable emission rate.

Fugitive emissions include emissions from the Landfill Gas Treatment System.

* Emission rates are based on and the facilities are limited by the following maximum operating schedule:

24 Hrs/day 7 Days/week 52 Weeks/year or 8,760 Hrs/year

** Compliance with annual emission limits is based on a rolling 12-month period.

Dated July 23, 2004

Headers

Permit Numbers 56641 and PSD-TX-1034

Page 1

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

AIR CONTAMINANTS DATA

Emission Source Air Contaminant Emission Rates *

Point No. (1) Name (2) Name (3) lb/hr TPY**

Published by GroupWise

APPENDIX M-2

Ocean Energy Corp., Inc.
CAT G3520 IC Gas Engine
Permit Allowed Emission Rates

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New Jersey Department of Environmental Protection

Emission Unit: U1 CAT 3520 gas IC engine nos. 1 - 6

Operating Scenario: OS1 Engine 1 base load operations

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
1	Particulate Emissions <= 7.1 lb/hr. [N.J.A.C. 7:27- 4.2(a)]	None.	None.	None.
2	TSP <= 1.48 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	TSP: Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	TSP: Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
3	PM-10 (Total) <= 1.48 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	PM-10 (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	PM-10 (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
4	PM-10 (Total) <= 0.24 grams/brake horsepower-hour. [N.J.A.C. 7:27- 7.13(h)]	PM-10 (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(h)]	PM-10 (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27-22.16(a)]	Submit test results: Within 180 days from the date of the approved permit. [N.J.A.C. 7:27-22.16(a)]
5	PM-2.5 (Total) <= 1.48 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	PM-2.5 (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	PM-2.5 (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
6	VOC (Total) <= 0.77 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	VOC (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	VOC (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
7	VOC (Total) <= 0.16 grams/brake horsepower-hour. [N.J.A.C. 7:27- 8.13(h)]	VOC (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	VOC (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
8	CO <= 14.8 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	CO: Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	CO: Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]

New Jersey Department of Environmental Protection

Ref.#	Applicable Requirement	Monitoring Requirement	Recordkeeping Requirement	Submittal/Action Requirement
9	CO <= 388 ppm @ 15% O2. [N.J.A.C. 7:27- 8.13(h)]	CO: Monitored by periodic emission monitoring each month during operation, based on any 60 minute period (using portable instrument). [N.J.A.C. 7:27- 8.13(d)2]	CO: Recordkeeping by manual logging of parameter each month during operation. [N.J.A.C. 7:27- 8.13(d)3]	Submit a report: Every year beginning on the first of January, three months following the effective date of the approved permit. Submit the report of the monthly readings to the Chief BTS and Chief BPP. [N.J.A.C. 7:27- 8.13(d)2]
10	CO <= 500 ppm @ 15% O2. [N.J.A.C. 7:27-16.10(b)]	None.	None.	None.
11	CO <= 2.75 grams/brake horsepower-hour. [N.J.A.C. 7:27- 8.13(h)]	CO: Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	CO: Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
12	CO <= 2.75 grams/brake horsepower-hour. [N.J.A.C. 7:27- 8.13(h)]	Other: monitored by periodic emission monitoring daily for the first month of operation of engine, once every week for the next five months and then once a month thereafter to determine compliance.[N.J.A.C. 7:27- 8.13(d)1].	CO: Recordkeeping by manual logging of parameter at the approved frequency. The records of all the readings taken by the periodic emission monitor shall be recorded and maintained in a manner acceptable to the Department. [N.J.A.C. 7:27- 8.13(d)3]	Submit a report: Every year beginning on the first of January, three months following the effective date of the approved permit. Submit the yearly report to Chief BTS and to Chief BPP. [N.J.A.C. 7:27- 8.4(f)5]
13	SO2 <= 0.77 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	SO2: Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	SO2: Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
14	NOx (Total) <= 2.95 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	NOx (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	NOx (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to stack testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)5]
15	NOx (Total) <= 2.95 lb/hr. [N.J.A.C. 7:27- 8.13(h)]	NOx (Total): Monitored by periodic emission monitoring each month during operation, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)2]	NOx (Total): Recordkeeping by strip chart, round chart or data acquisition (DAS) system / electronic data storage continuously. [N.J.A.C. 7:27- 8.13(d)3]	Submit a report: Every year beginning on the first of January, three months following the effective date of the approved permit. Submit the report of the monthly readings to the Chief BTS and Chief BPP. [N.J.A.C. 7:27- 8.13(d)2]
16	NOx (Total) <= 0.6 grams/brake horsepower-hour. [N.J.A.C. 7:27- 8.13(h)]	NOx (Total): Monitored by stack emission testing once initially and every 5 years, based on any 60 minute period. [N.J.A.C. 7:27- 8.13(d)1]	NOx (Total): Recordkeeping by stack test results once initially and every 5 years. [N.J.A.C. 7:27- 8.13(d)3]	Stack Test - Submit protocol, conduct test and submit results: As per the approved schedule. Refer to testing requirements specified in this permit. [N.J.A.C. 7:27- 8.4(f)]

APPENDIX N

Brevard Energy, LLC
USEPA Region IV
Draft Treated Gas Determination Request

Attachment A of Request Letter is Appendix K of this document
Attachment B of Request Letter is Appendix D of this document

May 19, 2006

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 4
Air, Pesticides, and Toxics Management Division
Air and EPCRA Enforcement Branch
Air Enforcement Section
61 Forsyth Street
Atlanta, Georgia 30303

Subject: Request for Treated Landfill Gas Exemption Determination (MSW Landfill NSPS)
Brevard Energy, L.L.C.
FDEP-DARM Permit Pending

Dear USEPA Region 4:

Brevard Energy, L.L.C. (Brevard Energy) is submitting this document to the United States Environmental Protection Agency (USEPA) to request that the regulatory agency determine that equipment and processes planned for operation at its landfill gas fueled electricity generation facility satisfy the definition of treatment in accordance with Title 40 of the Code of Federal Regulations (40 CFR) 60.752 (b) (2) (iii) (C). The use of treated landfill gas as engine generator fuel exempts Brevard Energy from the nonmethane organic compound (NMOC) testing and combustion temperature monitoring and recordkeeping requirements of the Municipal Solid Waste (MSW) landfill New Source Performance Standards (NSPS).

A construction and operating permit application for the project has been submitted to the Florida Department of Environmental Protection Division of Air Resource Management (FDEP-DARM), Tallahassee, Florida, for its review and approval.

USEPA TREATED GAS DETERMINATIONS

USEPA has issued several determinations that support the use of gas treatment equipment, which processes the collected gas for subsequent sale or reuse, as an appropriate landfill gas emissions control method. These determinations (USEPA Region 5) 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 landfill gas 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 federal emission standards specified in the MSW Landfill NSPS.

Attachment A provides for reference treated landfill gas determinations that have been issued by USEPA Regions 1, 3, 5, and 9.

BREVARD ENERGY PROCESS DESCRIPTION

The Brevard Energy landfill gas to electricity plant will be located at the Brevard County Solid Waste Management Central Disposal Facility (Central Disposal Facility) in Cocoa, Florida. The proposed facility will utilize landfill gas as fuel to power six Caterpillar, Inc. Model G3520C gas internal combustion (IC) engine and electricity generator sets. Since the IC engines will use landfill gas received from the landfill as fuel, they can be considered either combustion control devices for landfill gas emissions or equipment using treated landfill gas under the regulatory provisions of the MSW landfill NSPS. The treated landfill gas is the fuel that will be used at Brevard Energy.

Prior to its use as fuel at the electricity generation facility, the methane-rich gas collected from the Central Disposal Facility will be directed (in the specified sequence) through a treatment system that is comprised of the following equipment and processes:

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 10-microns and larger).

2. A gas compressor/blower.

3. Air-to-gas coolers (chillers), which will be used to reduce the elevated temperatures of landfill gas received from compressor to approximately 10°F above ambient temperatures.

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 3-microns and larger).

Components of the specified gas treatment system are not equipped with atmospheric vents. Therefore, all of the landfill gas to be directed to the IC engines will be processed by the treatment system for engine generator use as a treated fuel. The treatment system design does not have bypass(es) that would allow for landfill gas emissions.

Attachment B provides a flow diagram and operating details for the Brevard Energy landfill gas treatment system.

APPLICABLE REGULATIONS

Standards for Air Emissions from MSW Landfills

The Central Disposal Facility (the source of the Brevard Energy fuel) is subject to the Standards of Performance for MSW Landfills (MSW Landfill NSPS, 40 CFR Part 60 Subpart

WWW) that regulate NMOC emissions 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 ...

Rule Requirements and Exemption Determinations

Performance Tests

Provisions of the MSW landfill NSPS [40 CFR 60.752 (b) (2) (iii) (B)] require that initial tests be conducted on landfill gas control devices to demonstrate the performance of the equipment relative to its NMOC emissions. The specified performance test is not required pursuant to 40 CFR 60.752 (b) (2) (iii) (C) to demonstrate compliance with 40 CFR 60.752 (b) (2) (iii) if the raw gas is processed by a landfill gas treatment system prior to its subsequent sale or use as fuel.

USEPA Region 3 has specified in documents (Determination Detail Control No. 0200019 and October 3, 2002 correspondence provided in Attachment A) that *Based on its technical judgment, EPA considers refrigeration, filtering through the 10 micron screen, and compression for combustion in energy recovery devices such as boilers, process heaters ..., turbines, or internal combustion engines to satisfy the definition of treatment at 40 CFR Sec. 60.752 (b) (2) (iii) (C).* The approved method of de-watering specified in the October 2002 determination is knock-out pots and an air to air cooler.

Based on the documented landfill gas treatment determinations and associated details that have been recorded by USEPA and the design of the landfill gas de-watering, filtering and compression processes that are proposed for operation at Brevard Energy, the landfill gas used to fuel the electricity generation plant will be received from a treatment system that complies with the provisions of 40 CFR 60.752 (b) (2) (iii). Therefore, the IC engines that will be operated at Brevard Energy are not subject to the NMOC emission performance tests specified in 40 CFR 60.752 (b) (2) (iii) (B).

Combustion Temperature Monitoring and Recordkeeping

Provisions of the MSW landfill NSPS [40 CFR 60.758 (b) (2) (i) and 60.758 (c) (1) (i)] require that combustion temperature monitoring be performed with a device specified in 40 CFR 60.756 (b) (1). The purpose of these measurements is to continuously monitor average combustion temperature for comparison with the value recorded during performance tests required under 40 CFR 60.752 (b) (2) (iii) (B). Therefore, based on the performance test exemption, because the IC engines use treated gas, they are not subject to the testing and combustion temperature monitoring requirements of 40 CFR 60.756 (b).

The December 9, 2003 USEPA, Region 5 determination (provided in Attachment A) specifies that equipment and processes that meet the landfill gas treatment criteria ... *would not be subject to the monitoring and recordkeeping located at 60.756 (b) and 60.758 (b) and (c).*

Brevard Energy, L.L.C. appreciates review of the information presented in this correspondence by USEPA Region 4 and requests that a written notification of the requested determinations be issued.

Please contact us or our consultants (David Derenzo at Derenzo and Associates, Inc. 734-464-3880) if you have any questions or require additional data or information.

Sincerely,

BREVARD ENERGY, L.L.C.

Scott Salisbury
Managing Member

attachments

ATTACHMENT A

USEPA Region 1
Use of Treatment System Prior to IC Engine Combustion
Control Number 0300121
August 15, 2003

USEPA Region 3
Waiver of Initial Performance Test
Control Number 0200019
February 12, 2002
Request for Initial Performance Test Waiver
October 3, 2002

USEPA Region 5
Clarification of LFG Treatment NSPS Exemption for Dixon/Lee Energy Partners, L.L.C.
December 9, 2003

USEPA Region 9
NSPS Subpart WWW Applicability to Internal Combustion Engines
Connected to LFG Treatment System
April 22, 2004

ATTACHMENT B

Brevard Energy, L.L.C.
Landfill Gas Treatment System Process Flow Diagram

APPENDIX O

Brevard Energy, LLC
Gas Treatment System
Draft SSM Plan

Municipal Solid Waste Landfill Gas Collection and Control System

Startup, Shutdown, and Malfunction Plan

Prepared in accordance with the:

National Emission Standards for Hazardous Air Pollutants
40 C.F.R. §63.6(e)(3)

Prepared for:

Facility: Brevard Energy, L.L.C.

Address: Brevarde Energy, L.L.C.
2250 Adamson
Cocoa, Florida 32926

Date: May 19, 2006

This document identifies the procedures for conducting startups, shutdowns or addressing malfunctions of the landfill gas treatment system associated with the Beecher Energy, L.L.C. landfill gas to energy facility subject to this plan in a timely and safe manner.

Revision: 0
Revision Date:
Issuance Date:
Revised By:

1.0 Purpose

The purpose of the Gas Treatment System Monitoring and Startup, Shutdown and Malfunction (SSM) Plan that is presented in this document is to establish appropriate monitoring, operating and malfunction response procedures for the landfill gas treatment system that is operated at the Brevard Energy, L.L.C. (Brevard Energy) landfill gas-to-electricity facility.

This plan has been developed in accordance with provisions of the Municipal Solid Waste (MSW) Landfill New Source Performance Standards (NSPS, Title 40 of the Code of Federal Regulations (40 CFR) Part 60, Subpart WWW) and the MSW Landfill National Emissions Standards for Hazardous Air Pollutants (NESHAP, 40 CFR Part 63, Subpart AAAA).

40 CFR §60.765(d) of the MSW Landfill NSPS specifies that if a device other than an open flare or an enclosed combustor is used as the control system for landfill gas emissions, then information is to be prepared describing the operation of the control device, the operating parameters that indicate proper performance and appropriate monitoring procedures. The MSW Landfill NESHAP requires owners of affected facilities to document standard procedures for equipment startup and shutdown and develop procedures for responding to equipment malfunctions.

A copy of the Gas Treatment System Monitoring and Startup, SSM Plan (original and subsequent revisions/addendums) will be kept on file at Brevard Energy for a period of at least five (5) years.

2.0 Facility and General Process Information

Landfill gas generated at the Brevard County Solid Waste Management Central Disposal Facility (Central Disposal Facility, which is the source of the fuel used by Brevard Energy) is collected using a system of wells, gas headers and blowers, which have been installed and are operated by the landfill owner Brevard County (Facility Identification Number (I.D. No.) 0090069. The Central Disposal Facility has been issued Title V Air Operation Permit Renewal No. 0090069-003-AV by the Florida Department of Environmental Protection, Department of Air Resource Management (FDEP-DARM), which has an expiration date of September 30, 2007. Brevard Energy has a contract with Brevard County (Central Disposal Facility) to purchase the collected landfill gas for use as fuel to power six identical reciprocating internal combustion (IC) engine and electricity generator sets. The electricity that is generated by Brevard Energy is sold to Florida Power & Light under a power purchase agreement for distribution to the local grid.

The landfill gas produced by the Central Disposal Facility is treated prior to being used as fuel in the Brevard Energy electricity generation processes. The United States Environmental Protection Agency (USEPA) has issued regulatory clarifications that define treated landfill gas as "landfill gas processed in a treatment system that filters, de-waters, and compresses the gas."

The gas received from the Central Disposal Facility is initially de-watered in a knockout tank that is located upstream of the Brevard Energy landfill gas treatment system where a majority of the condensate in the landfill gas is removed.

After the initial knockout tank de-watering, the landfill gas is treated in equipment and processes operated by Brevard Energy that consists of:

1. A primary inlet coalescing filter designed to remove particles in the gas stream that are 10 microns (μm) and larger. The bottom chamber of the vessel is designed to knockout any remaining condensate and is equipped with a sight glass device that provides an indication of the presence and amount of water (condensate level) that has accumulated in the chamber.

2. A gas blower for compression of the landfill gas.

3. An air-to-gas cooler to reduce the temperature of the gas (which is heated by the blower during gas compression).

4. A polishing coalescing filter designed to remove particles that are 3 μm and larger. The bottom chamber of the vessel is designed to knockout any remaining condensate and is equipped with a sight glass device that provides an indication of the presence and amount of water (condensate level) that has accumulated in the chamber.

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

3.0 Gas Treatment System Monitoring

Based on the design of the landfill gas treatment system (which is owned and operated by Brevard Energy), the following equipment and process components will be monitored daily and recorded weekly to verify that the system is operating properly:

- <u>Knockout chamber condensate accumulation</u>: The primary and polishing filters typically operate without any noticeable condensate accumulation (no water is typically indicated to be present in the vessels). Noticeable water (condensate) accumulation is an indication that the upstream landfill gas de-watering equipment may have malfunctioned.

If condensate accumulation in the knockout vessels is greater than 50 percent (%) (based on the water level indicated on chamber sight glass), the electricity generation processes will be shutdown to avoid condensate carryover through the subsequent components of the gas treatment system, an investigation of the equipment will be performed and corrective actions implemented.

- Blower discharge pressure: The pressure at the discharge of the blower is measured with an analog pressure gauge. The landfill gas blower should be operated so that minimum pressure observed on the discharge side of the equipment is at least five (2) pounds per square inch gauge (2 psig). Blower discharge pressures less than 2 psig are an indication of problems with the gas compression system.

  If the blower discharge pressure is less than 2 psig, an investigation of the equipment will be performed and corrective actions implemented.

- Coalescing filter differential pressure: The pressure drop across each of the coalescing filters is measured with a pressure differential switch. Large differential pressures (ΔP) indicate that the filters are wet or loaded with particulate matter and should be replaced. The ΔP at the primary filter (vacuum side of blower) should be to equal to or less than 1 pound per square inch differential (psid). The ΔP at the polishing filter (pressure side of blower and downstream of the gas cooler) should be equal to or less than 2 psid.

  If the pressure drop across the coalescing filters is greater than the specified values, the associated filter will be replaced.

  The replacement filters will be of comparable designed for critical air or gas service applications where high-efficiency removal of oil or water droplets and particulate solids is required. Brevard Energy uses LG Liquid and Gas Coalescing Cartridges that are rated for 50 psid and 30 inches in length and 70 millimeters (mm) in diameter. The filters are rated for particulate matter removal to 0.3 (μm) and the nominal filter area is approximately 9.6 square feet (ft^2).

- Air-to-gas cooler outlet temperature: The temperature on the gas (fuel) at the outlet of the air-to-gas cooler is measured with an analog temperature gauge. The air-to-gas cooler is used to reduce the temperature of the fuel (which becomes elevated during the compression process). Outlet gas temperatures greater than 120 degrees Fahrenheit (°F) are an indication of problems with the operation of the air-to-gas cooler.

If the outlet temperature of the air-to-gas cooler is greater than 120°F, an investigation of the equipment will be performed and corrective actions implemented.

4.0 Startup Standard Operating Procedure

"Startup means the setting in operation of an affected source or portion of an affected source for any purpose." (40 CFR §63.2)

The standard operating procedure for the startup of the landfill gas treatment system is to:

1. Ensure that no unsafe conditions are present.

2. Contact prior to startup the Brevard Energy in charge Plant Operator.

3. Ensure that the system is ready to start by one or more of the following:

   a. Valves are positioned in their proper operating locations.
   b. Appropriate gas and fluid levels, pressures and temperatures are within the values of their normal starting range.
   c. Alarms are cleared.
   d. Power is on, and available to the control panel and to energized equipment.
   e. Emergency Stop is de-energized.

4. Initiate the proper equipment, process and system start sequences.

5. Observe that the system achieves normal operating ranges for appropriate gas and fluid levels, pressures and temperatures (see 3.0 Gas Treatment System Monitoring).

6. Appropriate SSM reporting forms and documents will be completed (examples are provided in Appendix A).

7. Refer to Operations and Maintenance Manuals as determined to be necessary.

5.0 Shutdown Standard Operating Procedures

"Shutdown means the cessation of an affected source or portion of an affected source or portion of an affected source for any purpose." (40 CFR §63.2).

The standard operating procedure for shutdown of the landfill gas treatment system is to:

1. Ensure that no unsafe conditions are present.

2. Prior to shutdown, contact the Brevard Energy in-charge Plant Operator and notify appropriate Central Disposal Facility representatives that the landfill gas treatment and electricity generation processes will be shutdown.

   Extended shutdowns of the specified equipment will require startup of the Central Disposal Facility gas flaring processes.

3. Initiate the proper equipment, process and system shutdown sequence by one or more of the following:

   a. Press Emergency Stop as determined to be necessary.
   b. Close On / Off switch(es) or Push On / Off button(s).
   c. Close adjacent valves as determined to be necessary.

4. Observe that system achieves normal shutdown ranges for appropriate gas and fluid levels, pressures and temperatures.

5. Complete the appropriate SSM reporting forms and documents (examples are provided in Attachment A).

6. Refer to Operations and Maintenance Manuals as determined to be necessary.

6.0 Malfunction Standard Operating Procedures

"Malfunction means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes, or has the potential to cause, the emission limitations in an applicable standard to be exceeded. Failures that are caused in part by poor maintenance or careless operation are not malfunctions." (40 CFR §63.2).

1. If landfill gas is determined to be venting from the gas treatment system, the equipment and processes will be immediately isolated from the Central Disposal Facility gas collection system.

   Appropriate Central Disposal Facility representatives will be contacted to inform them that the gas treatment and electricity generation processes are off-line.

2. An investigation of the equipment that caused the malfunction will be performed and corrective actions implemented.

3. After the cause of the malfunction has been identified and corrective actions implemented, the fuel use and electricity generation processes will be restarted using the procedures specified in this document (Section 4.0 Startup Operating Procedures).

4. The appropriate SSM reporting forms and documents will be completed (examples are provided in Attachment A).

   Duration is the time it takes from discovery of the malfunction to Step 3 specified in the preceding text (unless continuous monitoring records indicate the malfunction started earlier).

5. Refer to Operations and Maintenance Manuals as determined to be necessary.

7.0 Recordkeeping

The following information will be maintained to verify proper operation of the Brevard Energy gas treatment system and that proper procedures were implemented in response to equipment startup, shutdown and malfunction requirements:

1. Weekly records of the equipment monitoring parameters that are presented in this document (Section 3.0 Gas Treatment System Monitoring).

2. Equipment maintenance and/or modification records that affect the operation of the gas treatment system.

3. Startup, shutdown and/or malfunction occurrence records with details on the duration of each event (appropriate SSM reporting forms and documents are provided in Attachment A).

4. Startup, shutdown and/or malfunction records that document the actions taken during these events, when such actions are different from those specified in this document (Section 4.0 Startup Operating Procedures, Section 5.0 Shutdown Operating Procedures, Section 6.0 Malfunction Operating Procedures).

A deviation report will be completed when startup, shutdown and/or malfunction actions occur that are different than those specified in this document (an example is provided in Attachment B).

8.0 Plan Revisions

This Gas Treatment System Monitoring and SSM Plan will be:

1. Amended or modified if equipment or processes are added that are not covered under the Plan; or

2. Revised within 45 days of a nonconforming event if the procedures described in the document do not adequately address any startup, shutdown and/or malfunction event that occur at the facility.

Plan revisions will be documented using the revision history log (an example is provided in Attachment C).

9.0 Appendices

The following documents and materials are included as part of the Gas Treatment System Monitoring and SSM Plan:

Attachment A: Startup / Shutdown / Malfunction Report Form

Attachment B: Startup / Shutdown / Malfunction Plan Deviation Report

Attachment C: Gas Treatment System Monitoring and SSM Plan Revision History

ATTACHMENT A

Startup / Shutdown / Malfunction Report Forms and Documents

Brevard Energy, L.L.C.

Startup/Shutdown/Malfunction Report Form

Section 1 - All Events

List all affected piece(s) of equipment: ______________________________

Type of Event	Military Time Date/Time Start	Date/Time End	Duration (hours)	Event Code (see back of form)	SOP* Followed? Yes	No**
☐ Startup						
☐ Shutdown						
☐ Malfunction					Complete Section 2 Below	

* Standard Operating Procedure (SOP) for Flare Startups (Manual & Automatic) and Shutdowns are provided in SSM Plan
If SOP in SSM Plan was not followed, **notify personnel on contact list immediately.

Section 2 - Malfunction Events Only

Step	Corrective Action Procedures for All Malfunctions	☑ *Check one of the following for each step:* Procedure completed	Procedure Not Applicable
1.	Determine if landfill gas is being released to the air (can you smell landfill gas, or measure/detect gas flow?).	☐	
2.	If landfill gas is being released to the air, notify personnel on "Contact List".	☐	☐
3.	Determine if the malfunction is causing an unsafe operating condition (air entering landfill or piping, smoking, vibration, or other problem), which may harm people, the environment or the landfill gas control equipment.	☐	
4.	If unsafe operating condition exists, or landfill gas is being released to the air, **stop** (if possible) **landfill gas flow.**	☐	☐
5.	If Control device or other system component is shutdown due to Step 4, follow Shutdown SOP and Complete Section 1 - "Shutdown".	☐	☐
6.	Detemine if other personnel/resource (qualified technician, electrician, consultant or other) are needed for malfunction diagnosis.	☐	
7.	If additional personnel needed, notify qualified personnel: ? *Record Contact Name:* ? *Record Contact Date:* ? *Record Contact Time:* ? *Contact site representative with information recorded here.*	☐	☐
8.	Start malfunction diagnosis.	☐	
9.	Determine if other resources are needed to fix the malfunction (qualified technician, electrician, contractor, on-site resources, manufacturer's representative, or other).	☐	
10.	If additional resources needed, contact qualified resource: ? *Record Contact Name:* ? *Record Contact Date:* ? *Record Contact Time:* ? *Contact site representative with information recorded here.*	☐	☐
11.	Fix the malfunction.	☐	
12.	Once the malfunction is fixed, re-start the system per SOP if it had been shut down, and record start-up times and dates in Section 1 of this form.	☐	☐
13.	Record date that malfunction occurred, date that malfunction was repaired, and total time that system was out of service in Section 1 of this form.	☐	
14.	Sign this form and place it in the Start-up, Shutdown, Malfunction file.	☐	
15.	If the procedures listed above were not followed, **notify personnel on contact list immediately**.	☐	☐

Date Form Filled Out: ______________________ **Signature:** ______________________

Brevard Energy, L.L.C.

Event Codes

For Start-ups and Shutdowns

Startup: *The setting in operation of an affected source or portion of an affected source for any purpose.* ***Shutdown:*** *The cessation of operation of an affected source or portion of any source for any purpose.*

Code	Event
1	Maintenance
2	Suspected Collection System Malfunction
3	Suspected Control Device Malfunction
4	Suspected Continuous Monitoring System Malfunction (Temperature/Flow/Other)
5	Training
6	Gas System Construction/Expansion
7	Normal Backup Operation
99	Other(Describe) ____________________

For Malfunctions

Malfunction *: Any sudden, infrequent and not reasonably preventable failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual mannter. Failures that are caused in part by poor maintenance or carelss operation are not malfunctions.*

Code	Event
10	Automatic shutdown of control device by designed protective systems
11	Autodialer Callout
12	Shutdown alarms that result in the device not shutting down
13	Unalarmed shutdown
14	Control Device Smoking
15	Inspection identified malfunction
16	Loss of power - utility down
17	Loss of power - unknown
18	Damaged Well, Header or Lateral Piping
19	Leaks at wellheads, valves, flanges, test ports, seals, couplings, etc.
20	Condensate Knock-out Problems
21	Collection Piping Blockages
22	Problems due to Settlement
23	Loss of phase
24	Blower overload condition
25	Blower bearing failure
26	Broken belts (if belt-drive) or broken coupling (if drect-drive) in blower
27	Continuous Monitoring System Malfunction - Thermocouple
28	Continuous Monitoring System Malfunction - UV Scanner
29	Continuous Monitoring System Malfunction - Flow Monitor
30	Continuous Monitoring System Malfuction - Flow Recorder
31	Continuous Monitoring System Malfuction - Temperature Recorder
32	Act of God (i.e., lightening, wind, etc.)
99	Other(Describe) ____________________

ATTACHMENT B

Startup / Shutdown / Malfunction Plan Deviation Report

Startup, Shutdown, and Malfunction Plan
Deviation Report

Facility: ______________________________ Date Form Completed: ___________

Unit ID: ______________________________

Event: ☑ *check the appropriate box.*

☐ Startup ☐ Shutdown ☐ Malfunction

Date: ____________________ Time: ____________________

Duration: _________________

Provide detailed explanation of the circumstance of the startup, shutdown, malfunction:

____

____

Provide description of corrective action:

____

____

Describe the reasons the Startup, Shutdown, Malfunction Plan was not adequate:

____

____

Describe proposed revisions to the Startup, Shutdown, Malfunction Plan:

____

____

Were any excess emissions and/ or parameter monitoring exceedances believed to have occurred during the event?
☑ *check the appropriate box.*

☐ Yes ☐ No

Name: ________________________

Title: ________________________

Signature: ______________________

Sample Semiannual Report Letter
(All SSM Events in Compliance with the SSM Plan)

Date

Air Agency Address

RE: Semiannual Startup, Shutdown, Malfunction (SSM) Plan Report
XXXXX Landfill
Facility Title V Operating Permit No.
Reporting Period: _____ to _______

Dear _______:

The XXXXX Landfill is subject to the National Emissions Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills (Landfill NESHAP – 40 CFR 63 Subpart AAAA). The NESHAP requires that a report be submitted on a semiannual basis, a report be submitted to the Administrator discussing the facility's compliance with the procedures in their SSM Plan, during SSM events (40 CFR 63.10(d)(5)).

The actions taken at the facility during all SSM events, for the reporting period listed above, were consistent with the procedures listed in the SSM Plan at the facility.

During the reporting period listed above, there (were/were not any) revisions made to the SSM Plan at the facility. (If changes were made, state why – revised to reflect new equipment, new contact numbers, etc.).

If you have any questions regarding this Semiannual SSM Plan Report, please contact me at (List Phone Number).

Sincerely,

XXXXXXXXXXXXXX
(NAME OF COMPANY/TITLE HERE)

Sample Semiannual Report Letter

(One or more SSM Events NOT in Compliance with the SSM Plan)

Brevard Energy, L.L.C.

Startup, Shutdown, and Malfunction Plan

Date

Air Agency Address

RE: Semiannual Startup, Shutdown, Malfunction (SSM) Plan Report
XXXXXXXXX Landfill
Facility Title V Operating Permit No.
Reporting Period: _____ to _______

Dear _______:

The Facility Name Landfill is subject to the National Emissions Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills (Landfill NESHAP – 40 CFR 63 Subpart AAAA). The NESHAP requires that a report be submitted on a semiannual basis, a report be submitted to the Administrator discussing the facility's compliance with the procedures in their SSM Plan, during SSM events (40 CFR 63.10(d)(5)).

The actions taken at the facility during one or more SSM events, for the reporting period listed above, <u>were not consistent</u> with the procedures listed in the SSM Plan at the facility. However, the source did not exceed any of the emissions limitations in the Landfill NESHAP during these events. The attached table lists the information that must be submitted in the Semiannual SSM Plan Report in this instance.

During the reporting period listed above, there were ____ revisions made to the SSM Plan at the facility. (If changes were made, state why – revised to reflect new procedures to address non conforming event (mandatory), new equipment, new contact numbers, etc.).

If you have any questions regarding this Semiannual SSM Plan Report, please contact me at (List Phone Number).

Sincerely,

XXXXXXXXX
(NAME OF COMPANY/TITLE HERE)

Attachment: Description of all Malfunction Events

Attachment 1:
Description of all Malfunction Events
For the Reporting Period _______ to _________

Total Number of Malfunctions: _________________

Date of Malfunction	Total Duration (hours)	Equipment Affected*	Description of Malfunction	Were SSM Plan Procedures Followed (Y/N)	Date of SSM Plan Revision to Address Event**

* Control Device, Continuous Monitoring System, or Collection System
**Not Applicable if SSM Plan Procedures were followed during the Malfunction Event

Sample Immediate Notification Letter

(SSM Events NOT in Compliance with the SSM Plan, and Facility Experienced Excess Emissions)

Date

Air Agency Address

RE: XXXXXXXX Landfill
Facility Title V Operating Permit No.
40 CFR 63 Subpart AAAA – Landfill NESHAP
Immediate Notification Report: Non-conforming SSM Event

Dear _______:

The XXXXXX Landfill is subject to the National Emissions Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills (Landfill NESHAP – 40 CFR 63 Subpart AAAA). 40 CFR 63.10(d)(5) of the NESHAP requires that if actions taken at the facility during a startup, shutdown or malfunction (SSM) event are not consistent with the facility's SSM Plan, and the event results in excess emissions, the Agency must be notified verbally within 2 working days after the actions are taken. A letter must be written within 7 days of the event.

Please consider this letter as the required written report for the SSM event that occurred at the facility on (list date). As required by the NESHAP, a verbal notification was made to (give name of agency, person talked to) on (list date).

In accordance with the NESHAP, the following information is required in the letter report for this event:

Record the actions taken for the event: Describe what occurred, what was done, and how it differed from the SSM plan actions.

Describe excess emissions: Discuss the type of emission, and where it came from

Revise the SSM plan within 45 days of the non-conforming event:
Give a date by which the SSM plan will be revised.

If you have any questions regarding this Immediate Notification Report, please contact me at (List Phone Number).

Sincerely,

XXXXXXXX
(NAME OF COMPANY HERE)

ATTACHMENT C

Gas Treatment System Monitoring
And
SSM Plan Revision History

SSM Plan Revision History

This SSM Plan will be amended if equipment or processes are added that are not covered under the plan or will be revised within 45 days of non-conforming events if the procedures described herein do not adequately address any malfunction or start-up/shutdown events that occur at the facility. A copy of the original plan and all revisions/addendums will be kept on file at the facility for at least five (5) years.

Date of Revision	Reason For Revision

Department of
Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Colleen M. Castille
Secretary

June 8, 2006

Mr. Gregg M. Worley, Chief
Air Permits Section
U.S. EPA, Region 4
61 Forsyth Street
Atlanta, Georgia 30303-8960

RE: Brevard Energy, L.L.C.
Central Disposal Facility
0090069-004-AC, PSD-FL-378

Dear Mr. Worley:

Enclosed for your review and comment is a PSD application submitted by Brevard Energy, L.L.C., for a new landfill gas fueled internal combustion engine electricity generation facility in Cocoa, Brevard County, Florida.

Your comments may be forwarded to my attention at the letterhead address or faxed to the Bureau of Air Regulation at 850/921-9533. If you have any questions, please contact Scott Sheplak, Review Engineer, at 850/921-9532.

Sincerely,

Patty Adams

for A. A. Linero, P.E., Administrator
South Permitting Section

AAL/pa

Enclosure

cc: S. Sheplak

FM: Dep Air Resource Mgmt
P. Adams
Director Office Ste 23
111 S Magnolia Dr
Tallahassee, FL 32301
UNITED STATES Phone: 850--92-1-9505

To: U.S. EPA REGION 4
MR. GREGG M. WORLEY
61 FORSYTH STREET
AIR PERMITS SECTION
ATLANTA, GA 30303
UNITED STATES

GND

Pieces: 1/1

ORIGIN: TLH

Sender's ref 37550201000

POSTCODE: **30303**

TEL: 404-562-9141

Day **09FR**

Description: PSD-FL-378 application

Weight: 5 lbs for 1 pcs
Date: 2006-06-08

DHL standard terms and conditions apply.

(2L)US30303

HARB 6V
ATT

WAYBILL: 16505588153

(Non-Negotiable)

▲ PEEL HERE — PEEL HERE ▲

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SENDER'S RECEIPT
Waybill #: 16505588153

To(Company):
U.S. EPA Region 4
Air Permits Section
61 Forsyth Street

Atlanta, GA 30303
UNITED STATES

Attention To: Mr. Gregg M. Worley
Phone#: 404-562-9141

Sent By: P. Adams
Phone#: 850-921-9505

Rate Estimate: 3.07
Protection: Not Required
Description: PSD-FL-378 application

Weight (lbs.): 5
Dimensions: 0 x 0 x 0

Ship Ref: 37550201000
Service Level: Ground (Est. delivery in 1 business day(s))

Special Svc:

Date Printed: 6/8/2006
Bill Shipment To: Sender
Bill To Acct: 778941286

DHL Signature (optional) ____________ Route ______ Date ______ Time ______

For Tracking, please go to www.dhl-usa.com or call 1-800-225-5345
Thank you for shipping with DHL

Create new shipment ▶ ▶ View pending shipments Print waybill ▶

DHL EXPRESS

FM: Dep Air Resource Mgmt
P. Adams
Director Office Ste 23
111 S Magnolia Dr
Tallahassee, FL 32301
UNITED STATES Phone: 850-92-1-9505

GND

Pieces: 1/1

ORIGIN: TLH

Sender's ref:

To: DEP SOUTH DISTRICT
RON BLACKBURN
2295 VICTORIA AVENUE, SUITE 364
AIR RESOURCES
FORT MYERS, FL 33902
UNITED STATES

POSTCODE: 33902

TEL: 239-332-6975

Day 12MO

Description: U.S. Sugar application

Weight: 1 lbs for 1 pcs
Date: 2006-06-09

DHL standard terms and conditions apply.

FMYW 7C
FSC

(2L)US33902

WAYBILL: 16520223053 (Non-Negotiable)

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SENDER'S RECEIPT

Waybill #:	16520223053
To(Company):	DEP South District Air Resources 2295 Victoria Avenue, Suite 364 Fort Myers, FL 33902 UNITED STATES
Attention To:	Ron Blackburn
Phone#:	239-332-6975
Sent By:	P. Adams
Phone#:	850-921-9505

Rate Estimate:	3.07
Protection:	Not Required
Description:	U.S. Sugar application
Weight (lbs.):	1
Dimensions:	0 x 0 x 0
Ship Ref:	
Service Level:	Ground (Est. delivery in 1 business day(s))
Special Svc:	
Date Printed:	6/9/2006
Bill Shipment To:	Sender
Bill To Acct:	778941286

DHL Signature (optional) ______________________ Route ______ Date ______ Time ______

For Tracking, please go to www.dhl-usa.com or call 1-800-225-5345

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Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Colleen M. Castille
Secretary

June 8, 2006

Mr. John Bunyak, Chief
Policy, Planning & Permit Review Branch
NPS – Air Quality Division
P. O. Box 25287
Denver, Colorado 80225

RE: Brevard Energy, L.L.C.
Central Disposal Facility
0090069-004-AC, PSD-FL-378

Dear Mr. Bunyak:

Enclosed for your review and comment is a PSD application submitted by Brevard Energy, L.L.C., for a new landfill gas fueled internal combustion engine electricity generation facility in Cocoa, Brevard County, Florida.

Your comments may be forwarded to my attention at the letterhead address or faxed to the Bureau of Air Regulation at 850/921-9533. If you have any questions, please contact Scott Sheplak, Review Engineer, at 850/921-9532.

Sincerely,

Patty Adams

for A. A. Linero, P.E., Administrator
South Permitting Section

AAL/pa

Enclosure

cc: S. Sheplak

Frm: Dep Air Resource Mgmt
P. Adams
Director Office Ste 23
111 S Magnolia Dr
Tallahassee, FL 32301
UNITED STATES Phone: 850--92-1-9505

EXP

Pieces: 1/1

ORIGIN: TLH

To: NATIONAL PARK SERVICE
MR. JOHN BUNYAK
12795 W. ALAMEDA PARKWAY
AIR DIVISION
LAKEWOOD, CO 80228
UNITED STATES

Sender's ref 37550201000 A7 AP255

POSTCODE: 80228

TEL: 303-966-2818

Description: PSD-FL-378 application

Weight: 5 lbs for 1 pcs
Date: 2006-06-08

DHL standard terms and conditions apply.

EGEH 9E

(2L)US80228

WAYBILL: 16505511956 (Non-Negotiable)

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SENDER'S RECEIPT
Waybill #: 16505511956

To(Company):
National Park Service
Air Division
12795 W. Alameda Parkway

Lakewood, CO 80228
UNITED STATES

Attention To: Mr. John Bunyak
Phone#: 303-966-2818

Sent By: P. Adams
Phone#: 850-921-9505

Rate Estimate: 18.67
Protection: Not Required
Description: PSD-FL-378 application

Weight (lbs.): 5
Dimensions: 0 x 0 x 0

Ship Ref: 37550201000 A7 AP255
Service Level: Next Day 12:00 (Next business day by 12 PM)

Special Svc:

Date Printed: 6/8/2006
Bill Shipment To: Sender
Bill To Acct: 778941286

DHL Signature (optional) ______________ Route _____ Date _____ Time _____

For Tracking, please go to www.dhl-usa.com or call 1-800-225-5345
Thank you for shipping with DHL

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