FINAL

RESPONSES TO FDEP REQUEST FOR ADDITIONAL INFORMATION (RAI) OF JUNE 5, 2014.

SWWRF – Biosolids Improvement Project

B&V PROJECT NO. 179508

PREPARED FOR

City of St. Petersburg

18 AUGUST 2014

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RAI 1

RAI COMMENT 1

<u>Title V Major Source Applicability:</u> In determining if the facility is a Title V major source, the application does not include all of the proposed emission units at the facility as well as the facility-wide hazardous air pollutants (HAP). Please identify each regulated pollutant which the applicant knows or has reason to believe the facility emits or has the potential to emit in a major amount. Major source thresholds are as follows:

a. 100 tons per year for carbon monoxide, nitrogen oxides, particulate matter, sulfur dioxide, and volatile organic compounds;

b. 5 tons per year for lead and lead compounds expressed as lead;

c. 10 tons per year for any hazardous air pollutant;

d. 25 tons per year for total hazardous air pollutants; and

e. 100 tons per year for any other regulated pollutant.

RAI RESPONSE 1

Please note that the design of the Biosolids Improvement Project (BIP) now includes a cooling tower to facilitate requisite cooling of the mesophilic digesters and the raw digester gas prior to entering the Biogas Upgrading System (BUS). Relevant information pertaining to the cooling tower, including the cooling tower's location as depicted in an updated site layout, is provided in Attachment A. This cooling tower was not included in the original air construction permit application; however, its particulate emissions are now accounted for in this submittal. Additionally, the cooling tower qualifies for an exemption from the requirement to obtain an air construction permit under the conditions of Rule 62-212.300(3)(b)(1), F.A.C. In order to be considered exempt, the following conditions of Rule 62-212.300(3)(b)(1), F.A.C. must be met (the demonstration of the satisfaction of these conditions are also provided below);

- Rule 62-212.300(b)(1)(a) – *It would not be subject to any unit-specific limitation or requirement.*
  - The proposed cooling tower is not subject to any unit-specific limitations or requirements.
- Rule 62.212.300(b)(1)(b) – *Its emissions, in combination with the emissions of other units and activities at the facility, would not cause the facility to emit or have the potential to emit any pollutant in such amount as to create a Title V source.*
  - As can be seen below and in Attachment B, the BIP, including the proposed cooling tower, will not have an effect on the SWWRF's status as a non-Title V source.
- Rule 62.212.300(b)(1)(c) – *It would neither emit nor have the potential to emit 500 pounds per year or more of lead and lead compounds expressed as lead, 1,000 pounds per year or more of any hazardous air pollutant, 2,500 pounds per year or more of total hazardous air pollutants, or 5.0 tons per year or more of any other regulated pollutant as defined at Rule 62-210.200, F.A.C.*

  - The proposed cooling tower will not emit lead, lead compounds expressed as lead, and/or HAPs. Additionally, as shown below and in Attachment B, maximum particulate emissions are well below the 5.0 ton threshold required of all other regulated pollutants per the citation.

- Rule 62.212.300(b)(1)(d) – *in the case of a proposed new emissions 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 not result in a modification subject to the review requirements of subparagraph 62-204.800(11)(d)(2), Rule 62-212.400 or Rule 62-212.500, F.A.C.*
  - Rule 62-204.800(11)(d)(2) adopts by reference 40 CFR Part 63, Subpart B, Requirements for Control Technology Determinations for Major Sources in Accordance with Clean Air Sections , §112(g) and 112(j). The SWWRF is currently and will remain an area source of HAPs and, therefore, this review does not apply. Rules 62-212.400 and 62-212.500, F.A.C. set forth the preconstruction review requirements for the NSR/PSD and non-attainment NSR Programs. As discussed in the original air construction permit submittal and in the sections below, neither of these preconstruction review requirements applies to the BIP.
- Rule 62.212.300(b)(1)(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 proposed cooling tower will be installed to support the operation of the mesophilic digesters and the new BUS and will, therefore, not constitute a modification of any existing non-exempt emissions unit.

Additionally, the Title V major source determination in the original BIP application did not include the H_2S emissions of a small existing chemical scrubber that controls odor emissions from the SWWRF headworks. As such, these emissions have now been included in the revised Title V major source determination below and in Attachment B to this document.

Please note emissions calculations found in the original air construction permit application used a 985 Btu/scf heat content for the BUS product gas in the PTE calculations. However, according to design specifications, the minimum heat content of the BUS product gas will be 990 Btu/scf[1]. As such, the calculations included in Attachment B of this document have been revised to reflect this heat content.

Lastly, the heating water system boilers will be capable of combusting BUS product gas. The air construction permit application as originally submitted did not include BUS product gas combustion in the heating water system boilers. However, this does not affect emissions quantities or regulatory applicability of the boilers. To summarize, following the construction of the proposed BIP, the following emissions sources will be operating at the Southwest Water Reclamation Facility;

- Existing Sources;
  - 2,000 kW emergency diesel engine generator;
  - Headworks odor control system;
- Proposed Sources;

[1] BUS design specifications are included in Attachment C.

- Flares 1-4;
- Proposed Odor Control Systems (Scrubbers 1-3);
- 1,100 kW Gas Engine Generators;
- Primary Heating Water System Boilers;
- 1,750 kW emergency diesel engine generator;
- Cooling Tower (new as of this submittal).

Regarding (e) under RAI Comment 1 above, according to the USEPA document, *PSD and Title V Permitting Guidance For Greenhouse Gases*, under Step 2 of the Tailoring Rule existing or newly constructed facilities can be applicable to Title V solely on the basis of their GHG emissions if ***both*** of the following thresholds are met;

- An existing or newly constructed source emits or has the PTE GHGs in amounts that equal or exceed 100 tpy calculated as the sum of the six well-mixed GHGs on a mass basis.
- An existing or newly constructed source emits or has the PTE GHGs in amounts that equal or exceed 100,000 tpy calculated as the sum of the six well-mixed GHGs on a CO_2e basis (GWPs applied).

However, in a June 23, 2014 decision, the United States Supreme Court essentially struck down Step 2 of the Tailoring Rule in determining that sources cannot be required to obtain a PSD or Title V permit based solely on their emissions of GHGs. In a July 24, 2014 memo, USEPA states, "In order to act consistent with its understanding of the Supreme Court's decision pending judicial action to effectuate the final decision, the EPA will no longer require PSD or Title V permits for Step 2 sources." Therefore, according to this ruling, because the SWWRF does not trigger Title V major source requirements for any of the non-GHG pollutants, it could not be subject to the federal Title V program solely via its GHG emissions.

However, in the July 24, 2014 Memo EPA goes on to state, "We do not read the supreme court decision to preclude states from retaining permitting requirements for sources of GHG emissions that apply independently under state law even where those requirements are no longer required under federal law." As such, not knowing FDEP's disposition regarding the Supreme Court's decision regarding the Tailoring Rule and in the interest of being thorough, a Title V applicability analysis of the post-BIP SWWRF based on the aforementioned Step 2 methodology is detailed below.

As shown in Table 1 below and Attachment B, the post-BIP GHG PTE exceeds the 100 tpy threshold on a mass basis, but does not exceed the 100,000 tpy threshold on a CO_2e basis. As such, the post-BIP SWWRF emissions do not equal or exceed Title V major source thresholds for any of the applicable pollutants (including GHGs). Therefore, the SWWRF is not subject to Title V permitting requirements either now or after the BIP project is implemented.

Table 1 BIP Title V Major Source Applicability Determination

POLLUTANT	PTE (TPY)	TITLE V MAJOR SOURCE THRESHOLD (TPY)	EQUALS OR EXCEEDS MAJOR SOURCE THRESHOLD (YES/NO)
NO_X	40.2	100	NO
CO	55.1	100	NO
VOC	16.1	100	NO
SO_2	40.0	100	NO
$PM_{(filterable)}$	1.43	100	NO
$PM_{10\ (filterable+condensable)}$	2.58	100	NO
$PM_{2.5\ (filterable+condensable)}$	2.54	100	NO
Lead	2.74E -05	5	NO
H_2SO_4	0.130	100	NO
H_2S	2.72	100	NO
CO_2	19,359	--	--
CH_4	106	--	--
N_2O	0.121	--	--
GHG – Mass Basis	19,465	100	YES[1]
GHG – CO_2e Basis[2]	22,054	100,000	NO
Maximum Individual HAP - Formaldehyde	4.45	10	NO
Cumulative HAPs	6.18	25	NO

Notes [ ]:

1. **According to USEPA guidance, after July 1, 2011, existing and newly constructed facilities must have GHG PTEs that equal or exceed 100 tpy on a mass basis and 100,000 tpy on a CO_2e basis in order to be considered a Title V Major Source.**
2. **CO_2 equivalents (CO_2e) based on the latest global warming potential for applicable pollutants as listed in Table A-1 to Subpart A of 40 CFR Part 98 – Global Warming Potentials.**

RAI 2

RAI COMMENT 2

Prevention of Significant Deterioration Major Source Applicability: *In determining if the facility is a PSD major source, the application does not include all of the proposed emission units at the facility. Please identify and include in the potential to emit calculations any and all stationary sources associated with this project.*

RAI RESPONSE 2

In a May 16, 2014 phone conversation between Tammy McWade (FDEP), Ajay Kasarabada (Black & Veatch), and Mike Knechtel (Black & Veatch), Ms. McWade expressed concerns that all proposed emissions sources had not been accounted for in the PSD applicability determination submitted in the SWWRF BIP air construction permit application. Specifically, Ms. McWade cited a natural gas dryer which can be seen in drawing M-88-11 included in Appendix C of the air construction permit application. However, the natural gas dryer included in the design employs a desiccant vessel to remove moisture from the BUS product gas prior to being used as fuel in the City's CNG truck fleet. The drying process does not involve combustion nor are there any emissions produced in the process.

However, as noted above, the design of the BIP now includes a cooling tower that was not included in the original air construction permit application. Additionally, as discussed above, the heat content of the BUS product gas has been revised to 990 Btu/scf and the heating water system boilers have the capability to combust BUS product gas in addition to utility natural gas (which has no effect on emissions). As such, the PTE of the proposed sources that make up the BIP has been updated to include the particulate emissions of the cooling tower and the revised heat content of the BUS product gas. The revised PTE of the BIP is included in Table 2 below. As can be seen, the cooling tower particulate emissions and the revised heat content of the BUS product gas do not affect the PSD applicability of the project.

Table 2 PSD Applicability Determination

POLLUTANT	PTE (TPY)[1]	TITLE V MAJOR SOURCE THRESHOLD (TPY)	EQUALS OR EXCEEDS MAJOR SOURCE THRESHOLD (YES/NO)
NO_X	38.6	250	NO
CO	55.0	250	NO
VOC	16.1	250	NO
SO_2	40.0	250	NO
$PM_{(filterable)}$	1.42	250	NO
$PM_{10\ (filterable+condensable)}$	2.57	250	NO
$PM_{2.5\ (filterable+condensable)}$	2.53	250	NO
Lead	2.74E -05	250	NO
H_2SO_4	0.128	250	NO
H_2S	1.53	250	NO
CO_2	19,203	--	--
CH_4	106	--	--
N_2O	0.121	--	--
GHG – Mass Basis	19,310	--	--
GHG – CO_2e Basis	21,899	100,000	NO

Notes [ ] :

1. **See Attachment B for Detailed Emissions Calculations.**

RAI 3

RAI COMMENT 3

Process Flow Diagram: Please provide a basic process diagram identifying the location of all of the equipment associated with this project including all of the emission points (engines, flares, process heaters, carbon scrubbers) in reference to the digester gas cleanup process.

RAI RESPONSE 3

A basic process flow diagram satisfying the requirements of the diagram requested in RAI Comment 3 can be found in Attachment D. Please note that the Gas Engine Generators and Primary Heating Water System Boilers will be capable of ***only*** being fueled by utility natural gas and the BUS product gas cleaned to natural gas standards.

RAI 4

RAI COMMENT 4

<u>Digester Gas Cleanup Process:</u> Based on the application, this project will clean the digester gas to meet natural gas standards. Please provide a detailed description and process flow diagram of the digester gas cleaning process, including:

a. Please describe the contaminates that are expected to be in the digester gas after it is released from the anaerobic digesters and how the processing removes these contaminates, specifically focusing on hydrogen chloride (HCl), formaldehyde, hydrogen sulfide (H2S), metals, and precursor elements such as, chlorine, fluorine, nitrogen, and sulfur.

b. The equipment used in the digester gas cleanup system, the control efficiencies of any equipment used and any other supporting information including vendor guarantees.

c. Please explain the process and identify what the digester gas will be composed of prior to being combusted in the flares and engines.

d. Please provide a comparison of natural gas to the digester gas after processing.

RAI RESPONSE 4

The BUS and final compression facility will continuously upgrade raw digester gas to pipeline quality biomethane at pressures adequate for CNG truck fleet fueling. The CNG fueling system will be designed to fill CNG tube trailers for offsite transport to the City's sanitation refuse hauler fleet CNG fueling station. The BUS product gas can also be used on site for the CHP engines and heating water system boilers.

The BUS and CNG fueling system consists of three main subsystems and their ancillary support systems:

- Pre-cooling, moisture removal and transport;
- The biogas upgrading system (BUS);
- Final compression and fueling.

A process flow diagram depicting the BUS process can be found in Attachment E.

Pre-cooling, Moisture Removal, and Transport

Moisture will be removed prior to the gas being transported through the piping to the BUS. Water accounts for 8.5 percent of the digester gas mass flow at the characteristic temperatures of the digester gas. If moisture is not removed, the gas will cool and water will condense throughout the pipe requiring condensate collection and pumping stations at low points along the length of the pipe. To reduce the need for multiple pumping stations along the pipeline, the gas will be cooled to a temperature of about 40°F (via a process utilizing, in part, cooling water from the cooling tower) and the water will be separated out. Water removal is required for the BUS which requires a maximum dew point of 100°F.

Biogas Upgrading System (BUS)

The BUS will be a pressure swing adsorption (PSA) type manufactured by Guild Associates and designed to process raw digester gas to pipeline or CNG quality. The digester gas will enter the BUS at slight positive pressures and leave at about 90 psig and at a gas quality at or above requirements recommended by the Society of Automotive Engineers standard for compressed natural gas vehicle fuel, SAE J1616 and TECO fuel quality requirements. The product gas will either be sent to the onsite engine-generators or sent to the CNG fueling system for further compression.

The BUS consists of five basic unit operations: feed gas compression, PSA, vacuum pumping, tail gas combustion in a thermal oxidizer (low Btu waste gas burner - Flare 3), and buffer vessels.

- **Feed gas compression skid:** The feed gas compression skid will include an inlet separator, compressor, oil separator, post-compression cooler, condensate separator, and gas re-heat heat exchanger.
- **PSA skid:** The PSA skid will have an inlet separator, three PSA vessels, and pneumatically actuated valves for PSA vessel process cycling. Product gas will leave the skid fully cleaned. The waste gas will be sent through the vacuum pump mounted on the PSA skid.
- **Vacuum pump:** The vacuum pump will draw a vacuum on the process vessels during the regeneration cycle and pressurize the gas sufficiently for Flare 3 to combust the waste gas. The waste gas will contain carbon dioxide, methane, water, hydrogen sulfide, siloxanes, ammonia, nitrogen, and other VOCs present in the digester gas. The methane content will be approximately 15 percent to support combustion in Flare 3.
- **Thermal oxidizer:** Flare 3 will be an assisted combustion device specifically designed for burning low-Btu (i.e. low methane content) waste gas. Flare 3 will have a pilot fueled by utility natural gas and a blower for combustion air.
- **Buffer vessels:** As part of the PSA system, buffer vessels will be installed with pneumatically actuated valves to smooth out pressures and flows during the cyclical process.

Ancillary Devices/Systems

Ancillary device and systems required by the BUS include the following:

- **Gas chromatograph:** The gas chromatograph will measure methane, carbon dioxide, nitrogen and oxygen in the product gas.
- **Odorizer:** The odorizer will inject methyl mercaptan into the product gas to provide an odor similar to pipeline natural gas.
- **Instrument air:** Dual instrument air compressors will provide instrument air for pneumatic valve actuation.
- **Nitrogen purge:** A nitrogen purge station will automatically purge the feed compressor and oil separator on shut down, and provide for manual purging of the remainder of the skids.
- **Condensate collection:** Condensate will be collected from multiple points in the BUS pumped back to the plant collection system.
- **Control and electrical building:** A climate controlled pre-fabricated building will provide a small control kiosk and electrical room for the BUS and CNG fueling systems.

Final Compression and CNG Fueling

The final compression and CNG fueling system will compress the BUS product gas to high pressure for tube-trailer fueling or onsite high pressure storage. The system will be a package from a CNG system vendor modified for variable flow operation. The final compression and CNG fueling station will consist of three main parts:

- **Final compressor:** The final compressor will be capable of compressing BUS product gas while simultaneously fueling from the storage system when storage is full.
- **High pressure storage:** The high-pressure on-site storage will provide for close to 2.5 to 3 hours of storage time at a pressure of 4,000 psig. The on-site storage will consist of six to eight high-pressure storage tubes.
- **CNG fuel dispensing:** fuel dispensing will be the standard CNG dispenser type. By keeping this system standard, the equipment parts and maintenance would be made simpler.

Raw Digester Gas and BUS Product Gas Characteristics

The design specification for the BUS system includes the following characteristics for the raw digester gas at the BUS inlet. The raw digester gas will occasionally be combusted in Flare 1 and Flare 2.

Table 3 Raw Digester Gas Characteristics[2]

DIGESTER GAS CHARACTERISTICS	APPROXIMATE VALUE OR RANGE
Methane, percent by volume (dry)	60-65
Carbon dioxide, percent by volume (dry)	35-40
Nitrogen, percent by volume (dry)	0 to 0.5
Oxygen, ppm_v	0 to 50
Hydrogen Sulfide, ppm_v	100 to 3,000
Total siloxanes, ppm_v	0 to 5
Ammonia, ppm_v	0 to 100
Other volatile organic compounds, ppm_v	0 to 100

Typically, concentrations of HCl, formaldehyde, metals, chlorine, and fluorine, in raw digester gas are either at non-detect levels or nil. Additionally, sulfur compounds, aside from H_2S, are typically insignificant.

The design specification for the BUS system includes the following characteristics for the BUS product gas at the BUS outlet. As stated in the air construction permit application, the BUS product gas will be combusted (along with utility natural gas) in the gas engine generators, the heating water system boilers, and occasionally in the BUS start-up flare (Flare 4). Also, as discussed previously, the original air construction permit application used a heat content of 985 Btu/scf for

[2] See Attachment C.

the BUS product gas in the emissions calculations. As can be seen in the table below, the minimum heat content of the BUS product gas will be 990 Btu/scf. The BUS is designed to remove 99 percent of H_2S and 99+ percent of siloxanes and VOCs relative to the raw digester gas. The BUS product gas characteristics can be found in Table 4.

Table 4 BUS Product Gas Characteristics[2]

DIGESTER GAS CHARACTERISTICS	APPROXIMATE VALUE OR RANGE
Higher heating value, Btu/scf, min	990
Methane, percent by volume (dry)	98
Carbon dioxide, percent by volume (dry)	2
Oxygen percent by volume, max	0.1
Hydrogen Sulfide, ppm_v, max	1
Sum of CO_2, Nitrogen, and Oxygen (percent by volume – max)	2
Total siloxanes, ppb_v, max	Non-detectable
Total ammonia, ppb_v, max	Non-detectable
Other volatile organic compounds, ppb_v, max	Non-detectable

Table 5 contains the natural gas quality standards found in Florida Gas Transmission Company's gas tariff filed with the Federal Energy Regulatory Transmission.

Table 5 Florida Gas Transmission Company Natural Gas Quality Standards[3]

NATURAL GAS CHARACTERISTICS	90-DAY AVERAGE
Higher heating value, Btu/scf, min	1000
Methane, percent by volume (dry)	96
Carbon dioxide, percent by volume (dry)	1
Oxygen percent by volume, max	NA
Hydrogen Sulfide, ppm_v, max[4]	4
Sum of CO_2 and Nitrogen (percent by volume – max)	3
Total siloxanes, ppb_v, max	NA
Total ammonia, ppb_v, max	NA
Other volatile organic compounds, ppb_v, max	NA

As can be seen, the minimum methane requirement in the BUS product gas is 2 percent higher than in the natural gas quality standards. Additionally, the maximum H_2S content is 3 ppmv lower in the BUS product gas specification than in the Florida Gas Transmission Company natural gas quality standard, and the minimum heat content for the BUS product gas is within 1 percent of the quality standard for natural gas. Furthermore, the USEPA definition of "pipeline natural gas" states that "[…] pipeline natural gas must either be composed of at least 70 percent methane by volume or have a gross calorific value between 950 and 1100 Btu per standard cubic foot." As can be seen in Table 4, the BUS product gas meets each of these requirements.

[3] FERC Gas Tariff, Fifth Revised Volume No. 1. Florida Gas Transmission Company, LLC. Part VI, "General Terms and Conditions", Section 2, "Quality".

[4] Converted to ppmv from ¼ grain per 100 scf specification listed in natural gas quality standard. Assumes 120°F gas temperature, which is maximum temperature specified.

RAI 5

RAI COMMENT 5

<u>Emission Factors:</u> When determining the potential to emit emissions for the criteria pollutants and hazardous air pollutants the applicant shows the emission factors used were based on firing only natural gas. New Source Performance Standards (NSPS) Subpart JJJJ of 40 CFR 60 (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines) provides emission factors for the two 1,517 brake-horsepower (bhp) Cummins engines when firing digester gas. Please provide a fuel analysis on the digester gas vs. natural gas and/or test data, if available, to provide reasonable assurance that the contaminates found in digester gas will not degrade the performance of these engines over time and in turn have an impact on projected CO and NO_X emissions in the future. Additionally, the application uses the manufacturer's emission factors for firing natural gas. Please provide the manufacturer's guarantee that these emission factors are sufficient for firing digester gas.

RAI RESPONSE 5

As discussed and shown above, the BUS will clean the raw digester gas to a quality that meets the definition of pipeline natural gas and is on par with the Florida Gas Transmission Company Natural Gas Quality Standards. Furthermore, Table 4 illustrates that the contaminates that would have the greatest potential to degrade the performance of the natural gas engine generators over time, specifically siloxanes, are reduced below detectable levels in the BUS product gas. Therefore, operation of the engine generators on the BUS product gas should not be expected to degrade the performance of the engine generators any more than if the engines were solely operating on utility natural gas.

As has been shown in Tables 4 and 5, the BUS product gas is of natural gas quality and its combustion in the engine generators should not be considered equivalent to the combustion of raw digester gas.

The original air construction permit application uses the manufacturer's emission factors for calculating the engine generators' emissions of NO_X, VOCs (i.e., NMHC), PM, PM_{10}, $PM_{2.5}$ (filterable), CO, and CO_2. Regarding NO_X, VOCs (i.e., NMHC), and CO, the design specification for the gas-fired engine generators includes that the engines will be designed with maximum emissions limits of 1.0 g/hp-h, 0.5 g/hp-h, and 2.0 g/hp-h, respectively[5], which are at or below the standards applicable to the engines per *Subpart JJJJ of 40 CFR 60*. Therefore, the engine vendor is obligated to deliver an engine meeting the specified emissions limits, which are identical to the emission factors used in the air construction permit application.

For particulate matter, according to AP-42, particulate emissions from natural gas fired engine generators include trace amounts of metals, non-combustible inorganic material, and condensable, semi-volatile organics which result from volatized lubricating oil, engine wear, or from products of incomplete combustion[6]. Recalling the discussion in the response to RAI 4, metals in raw digester gas, and thus the BUS product gas, are typically at non detect levels or nil. Furthermore, the methane content (i.e., combustible material) of the BUS product gas is specified at 98 percent, which is two percent higher than the Florida Gas Transmission Company standards, which specify 96 percent methane content. Therefore, a potentially greater volume of non-combustible material

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[5] See Attachment F.

[6] USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.2 "Natural Gas-Fired Reciprocating Engines." April 2000.

could reside in the utility natural gas at this methane content than in the BUS product gas. Lastly, the amount of particulate that is emitted as a result of volatized lubricating oil and engine wear is independent of the type of gaseous fuel combusted and would be equivalent regardless of whether the engine generators are combusting utility natural gas or BUS product gas. For each of these reasons the manufacturer's PM emission factors can be considered appropriate for calculating emissions from the engine generators when firing BUS product gas.

Finally, regarding CO_2, AP-42 states that in the case of natural gas combustion, CO_2 emissions are the result of the conversion of nearly all of the carbon in the fuel gas[7]. Comparing Tables 4 and 5 reveals that any difference in the carbon content of utility natural gas and BUS product gas is insignificant, and therefore, the CO_2 emissions factor provided by the manufacturer for natural gas combustion should also be appropriate for BUS product gas combustion in the gas engine generators.

[7] USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.1 "Stationary Gas Turbines." April 2000.

RAI 6

RAI COMMENT 6

Engine Certification: Based on the application, the two new 1,517 bhp Cummins engines will be firing natural gas and digester fuel. Please provide the manufacturer's guarantee that these engines will not lose their certification when firing digester gas.

RAI RESPONSE 6

Again, it has been demonstrated that the BUS product gas is of natural gas quality and its combustion in the engine generators should not be considered equivalent to the combustion of raw digester gas. Furthermore, the BUS product gas meets the quantitative definition of pipeline-quality natural gas as provided in 40 CFR §60.4248 (i.e., composed of at least 70 percent methane by volume and possessing a gross calorific value between 950 and 1,100 Btu/scf). The engines purchased will be certified on natural gas. Given that the engines purchased will be certified on natural gas and that the BUS product gas *is* equivalent to natural gas per the discussion above, guaranteeing that the engines will not lose their certification when firing the BUS product gas would be redundant and unnecessary.

RAI 7

RAI COMMENT 7

<u>Rule Applicability</u>: Please identify if this project is subject to National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart E of 40 CFR 61 (National Emission Standard for Mercury) and NSPS Subpart MMMM of 40 CFR 60 (Emissions Guidelines and Compliance Timelines for Existing Sewer Sludge Incineration Units).

RAI RESPONSE 7

40 CFR §60.51 states, "The provisions of this subpart are applicable to those stationary sources which […] incinerate or dry wastewater treatment plant sludge". No sludge will be incinerated/combusted at the SWWRF. Furthermore, 40 CFR §61.51(m) defines the term *sludge dryer* as "[…] a device used to reduce the moisture content of sludge by heating to temperatures above 65 °C (ca. 150 °F) directly with combustion gases." No drying will occur at the SWWRF. Rather, sludge at the SWWRF will be dewatered and thickened exclusively via mechanical processes for the purpose of land application. Therefore, NESHAP Subpart E of 40 CFR 61 is not applicable to the proposed BIP.

NSPS Subpart MMMM of 40 CFR 60 establishes emissions standards for existing sewage sludge incinerating (SSI) units, which according to the rule are those units for which construction commenced on or before October 14, 2010. Aside from the relocated 1,750 kW emergency diesel generator, the proposed BIP involves only new sources.

Furthermore, the rule defines a *sewage sludge incineration (SSI) unit* as, "[…] an incineration unit combusting sewage sludge […]" and *sewage sludge* as "solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works." While digester gas, which is generated during the treatment of sewage at the SWWRF, will be combusted by equipment included in the BIP, it is a gaseous compound and therefore, does not meet the definition of sewage sludge.

None of the combustion sources involved in the Project is combusting sewage sludge, and, except for the 1,750 kW diesel-fired emergency generator, all combustion sources are new sources. Therefore, the proposed BIP project, by definition, does not involve any existing SSI units, rendering NSPS Subpart MMMM of 40 CFR 60 not applicable to the proposed BIP.

Attachments

ATTACHMENT A – COOLING TOWER CUT SHEET, PROCESS FLOW, AND REVISED SITE LAYOUT

SPX
COOLING TECHNOLOGIES

Applied Thermal Resources
81 Woodstock Road
Roswell, GA 30075
(770) 674-9100 /
email: blair.anderson@atrga.com

Proposal to:
Brown & Caldwell
Attn. Mr. Dilib Shah

Project:
St. Petersburg Bio-solids Project

Opportunity / Quote No. (Ver): Blair Anderson_131010_155648698 / Blair Anderson_131010_155723699 (1)
Rep Quote No.:

October 28, 2013

Marley MH Fluid Cooler

MODEL	PERFORMANCE CONDITIONS	MECHANICAL DATA PER CELL	DIMENSIONS	WEIGHTS
Quantity of (1) Marley model **MHF7105QAEBN** factory assembled 2-Cell fluid cooler(s)	Process Water Additive: None Per 2-cell cooler: 650.0 gpm 94.5 °F Entering 85.0 °F Leaving 81.0 °F Entering WB 9.00 psi fluid pressure drop	**Fan(s):** 2 **Motor(s): 1 @ 20 HP** 1 speed / 1 wind 3 phase / 60 Hz / **230/460v** 1.15sf / TEFC 1800 RPM Premium Efficiency Inverter duty nameplated **Pump(s): 1 @ 5 HP**	(See drawings)	Per cell: Shipping: 11,198 lb Operating: 18,448 lb Per 2-cell tower: Shipping: 22,396 lb Operating: 36,896 lb

Quantities shown below are per cooler.

Base Construction/Equipment:

Galvanized steel casing and framing.
Stainless steel distribution basins and distribution basin covers.
Stainless steel collection basin.
All stainless steel is series 300.
Marley designed belt drive with 5-year limited warranty (Bearing assemblies and V-belts warranted 18 months)
Standard Low Sound fan
Marley designed and manufactured 12 mil PVC film fill with integral louvers and drift eliminators
Drift rate guaranteed to be no greater than .005% of the recirculating water flow rate
CTI certification per STD-201
HDG steel fan guard(s)

Coil Section:

(2) 4 in (102 mm) Groove and Welding Bevel wet coil inlet connections per cell for process fluid
(2) 4 in (102 mm) Groove and Welding Bevel wet coil outlet connections per cell for process fluid
Galvanized tube bundles consisting of fully welded box headers with 1 in (25.4 mm) O.D. tube serpentine coils
Tube bundles pressure tested to 400 psi; max operating design pressure of 300 psi
Marley designed and manufactured triple-pass 17 mil PVC louvers and drift eliminators

Collection Basin Connections and Accessories:

3 in (76 mm) diameter combination drain and overflow in each cell
(1) 2 in (50 mm) water make-up float valve per cell

Maintenance & Maintenance Access Features:

Convenient access to the collection basin and plenum area is provided via an access door located on each endwall
Plenum walkway in each cell
Internal mechanical equipment platform in each cell

Control Systems:

none

Field Installed Equipment:

The field installed portion of the equipment will require approximately 21.4 man-hours of installation time after the unit arrives at the jobsite (based on USA experienced crew). The price to install these components is NOT included in the total price.

SPX
COOLING TECHNOLOGIES

Applied Thermal Resources
81 Woodstock Road
Roswell, GA 30075
(770) 674-9100 /
email: blair.anderson@atrga.com

Total Sell Price ....(US Dollar) $ 90,000.00
(Freight included. Installation labor not included. Taxes not included.)

Payment Terms: NET 30 days from date of shipment (subject to credit approval)
Freight Terms: F.O.B. SPX plant(s) Olathe, Kansas, USA with freight prepaid
Shipment Lead-Time After Drawing Approval: 55 business days

Notes:

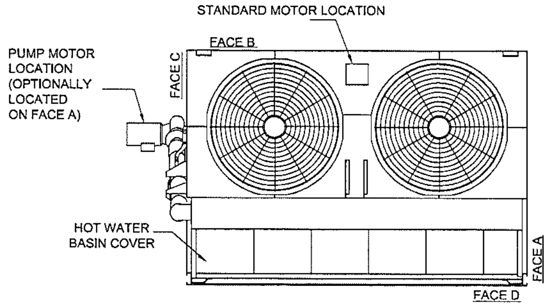
- It is the responsibility of the purchaser to determine the suitability of this equipment for the specific application and all applicable code requirements. Please reference the supporting steel arrangement drawing for the product windload and seismic capacities. The product is designed, analyzed, and tested in accordance with the requirements of the International Building Code and American Society of Civil Engineers (ASCE7-05). Design of the anchorage support system is not included in this quote and shall be administered by others.
- **Any purchase orders should be made out to SPX Cooling Technologies.**
- **This is a proposal and not a contract. When signed by the Purchaser in the space provided below, this form will be considered a purchase order from the Purchaser to SPX Cooling Technologies ("SPX Cooling"). Purchaser's order is not binding on SPX Cooling until the order is accepted by SPX Cooling as indicated by a signature of an officially authorized employee of SPX Cooling in the space provided below. The SPX Cooling Sales Representative providing this proposal has no authority to bind SPX Cooling to any contract, or contract terms or conditions in contradiction to those stated herein.**
- **Offer to purchase is valid for thirty (30) days from the proposal date. Shipment must be made within ninety (90) days of original purchase date. For requested shipments beyond ninety (90) days, pricing must be approved prior to receipt of order.**
- All sales, use or excise taxes payable by SPX Cooling, or to be collected by SPX Cooling from Purchaser, in connection with the sale, installation, or use of the proposed equipment shall be added to the prices quoted above at time of shipment. Any purchase order submitted for a tax exempt project must be accompanied by the Purchaser's valid tax exemption certificate for the state to which the goods are to be delivered. It is the Purchaser's responsibility to provide this documentation. SPX Cooling will not be liable for any failure of Purchaser to pay sales tax without said documentation.
- SPX Cooling's responsibility for delivery is limited to date of shipment. Carrier can be requested to give a maximum of 24 hours notice of delivery. Shipments involving more than one truck may arrive at a job site at different times.
- Purchaser to receive, unload, haul, hoist and set tower(s) in place.
- SPX Cooling hereby warrants the inclusion of labor, when specifically purchased as an option. Labor coverage shall be limited to the specified duration (as indicated by the option purchased) beginning at date of shipment by SPX Cooling to the original installation.
- **This proposal is made expressly conditional upon Purchaser's acceptance of SPX Cooling's Standard Terms and Conditions, and the applicable SPX Cooling Standard Warranty Certificate. These documents are attached. No terms or conditions, including warranty provisions, that are submitted by Purchaser as part of its acceptance shall be valid, and all such terms are hereby expressly objected to and shall have no effect.**

Blair Anderson
770-674-9132

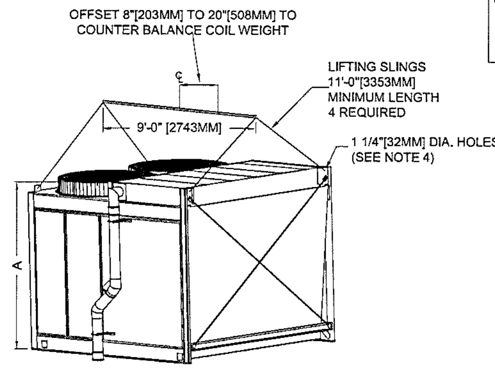
Accepted by (see note above):

Representative	Purchaser	SPX Cooling Technologies
Printed Name	Printed Name	Printed Name
Title	Title	Title
Date	Date	Date

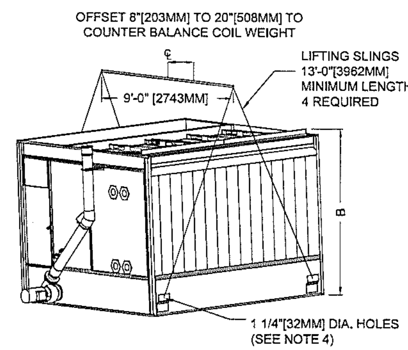
MODEL		A	B	C
MHF7105	##A	7'-9 7/16" [2373MM]	7'-0 7/16" [2145MM]	14'-6 15/16" [4444MM]
	##B	7'-9 7/16" [2373MM]	8'-6 9/16" [2605MM]	16'-0 15/16" [4901MM]
	##D	9'-1 9/16" [2783MM]	7'-0 7/16" [2145MM]	15'-11 1/8" [4854MM]
	##E	9'-1 9/16" [2783MM]	8'-6 9/16" [2605MM]	17'-5 1/8" [5311MM]



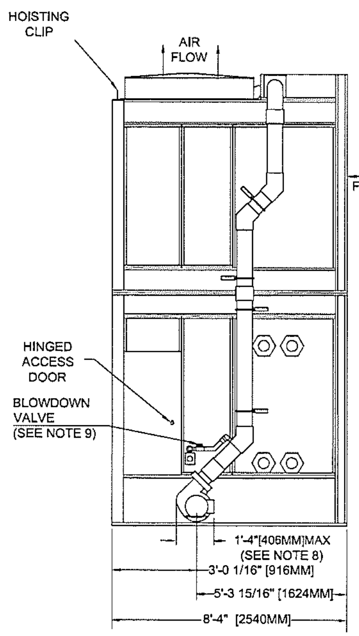
PLAN



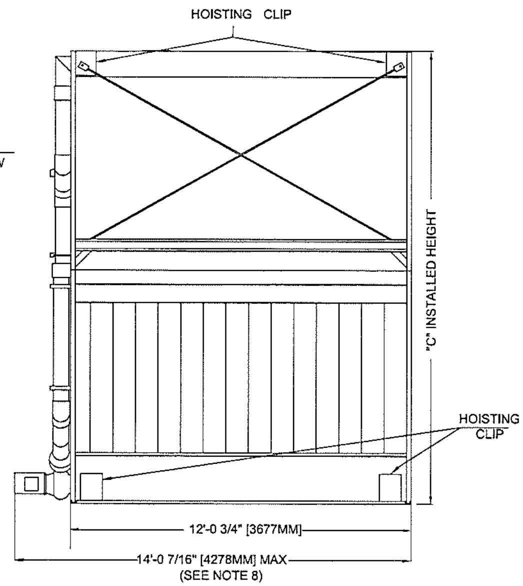
TOP MODULE
HOISTING DETAIL



BOTTOM MODULE
HOISTING DETAIL



SIDE ELEVATION
FACE C



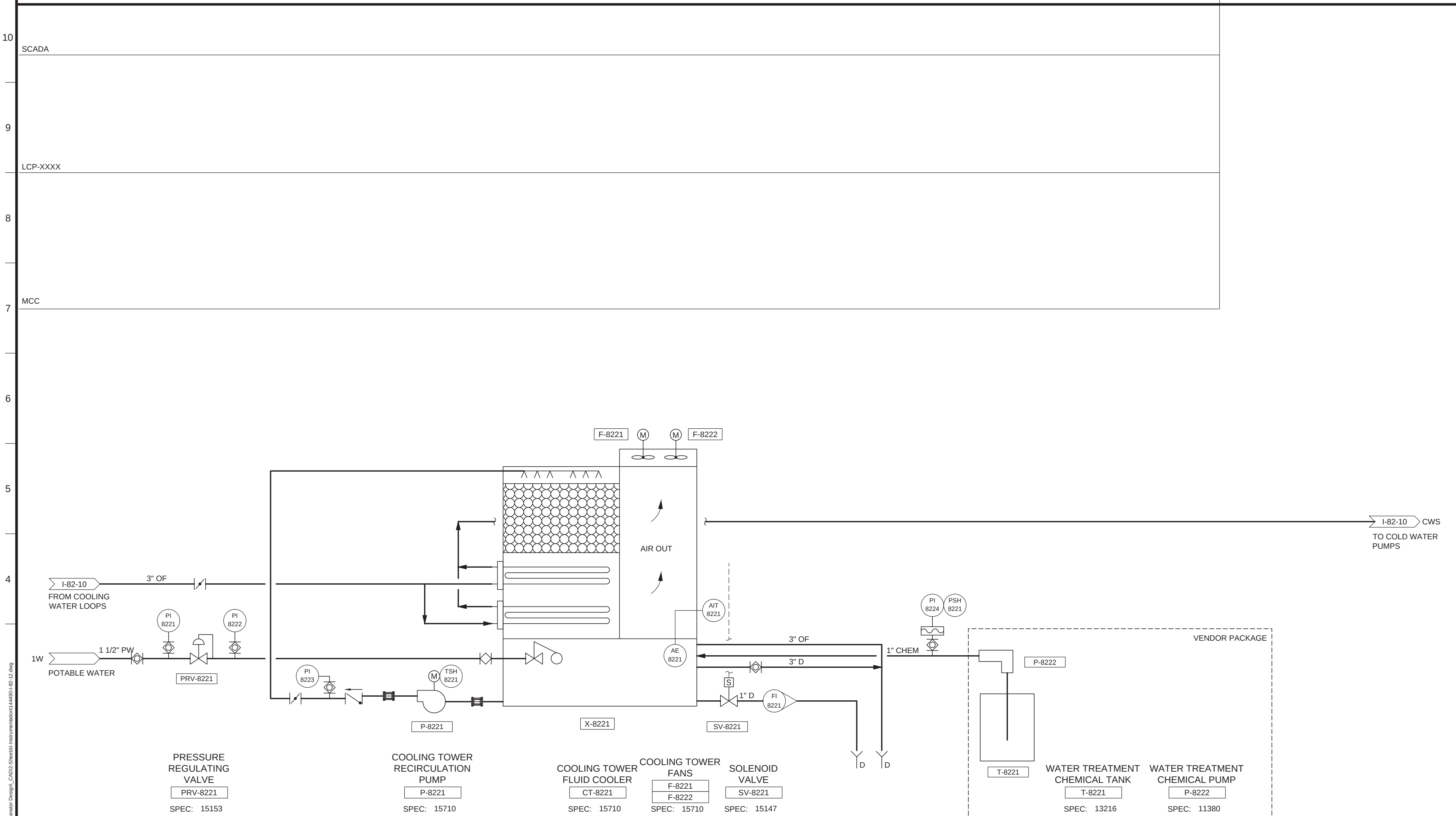
AIR INLET ELEVATION
FACE D

GENERAL NOTES

1. THE EQUIPMENT MUST BE INSTALLED LEVEL TO INSURE MAXIMUM THERMAL PERFORMANCE AND TO AVOID RACKING.
2. AIR INLET FACE MUST HAVE AN ADEQUATE AIR SUPPLY. IF OBSTRUCTIONS EXIST, CONSULT YOUR MARLEY REPRESENTATIVE.
3. ROUTINE MAINTENANCE DOES NOT REQUIRE WORKERS TO USE THE TOP OF THE TOWER AS A WORK PLATFORM. HOT WATER BASIN INSPECTION AND CLEANING CAN BE DONE FROM A PORTABLE LADDER, STAIR, OR SCAFFOLD. MECHANICAL MAINTENANCE CAN BE DONE FROM A PORTABLE LADDER INSIDE THE TOWER. TAKE ADEQUATE SAFETY PRECAUTIONS WHEN USING PORTABLE LADDERS.

   FOR ADDED SAFETY AND CONVENIENCE, MARLEY OFFERS AN OPTIONAL LOUVER FACE PLATFORM OPTION FOR IMPROVED ACCESS FOR HOT WATER BASIN MAINTENANCE. FOR INTERIOR MAINTENANCE, AN OPTIONAL PLENUM WALKWAY AND ELEVATED MECHANICAL EQUIPMENT PLATFORM WITH LADDER ARE ALSO AVAILABLE. DETAIL DRAWINGS FOR THESE AND OTHER TOWER OPTIONS ARE AVAILABLE FROM YOUR MARLEY REPRESENTATIVE.
4. HOISTING CLIPS ARE PROVIDED FOR EASE OF UNLOADING AND POSITIONING. FOR OVERHEAD LIFTS OR WHERE ADDITIONAL SAFETY PRECAUTIONS ARE PRUDENT, ADD SLINGS BENEATH THE MODULES.
5. ASSEMBLY TOLERANCE IS ±1/8"[3MM]. CONSULT SUPPLIERS OF SUPPORTING STRUCTURE FOR CONSTRUCTION TOLERANCES.
6. REFERENCE "SUGGESTED SUPPORTING STEEL ARRANGEMENT" DRAWINGS FOR TOWER SUPPORT REQUIREMENTS WEIGHTS, LOADS AND MULTI-CELL SPACING.
7. COLLECTION BASIN FLOOR SLOPES UNDERNEATH COIL FROM LOUVER FACE TOWARDS MECHANICAL EQUIPMENT END OF TOWER.
8. DIMENSION IS BASED ON A STANDARD SCOT 57 FRAME 60 HZ PUMP ON MODEL MHF7103 AND A SCOT 50 FRAME 60 HZ PUMP ON MODELS MHF7105 & 7107. 50 HZ FRAMES, OR OTHER OPTIONS MAY INCREASE DIMENSION.
9. A BLOWDOWN LINE WITH VALVE CONNECTED TO THE RECIRCULATING PUMP RISER(STANDARD) ALLOWS A PORTION OF THE RECIRCULATING WATER TO BE CONSTANTLY DIVERTED TO THE TOWER OVERFLOW,IF DESIRED.

ECO NUMBER		SCHEMATIC DETAILS MHF 7105				SPX. COOLING TECHNOLOGIES			
17588									
REV. BY	CHECKED								
AMF	AMA								
REV. DATE		DRAWN BY	DATE	CHECKED	APPROVED	ORDER NUMBER	PLOT	DRAWING NUMBER	REV.
7/1/13		AMF	12/19/12	CGW	MAM			2012-27306	B



Brown AND Caldwell

TAMPA, FLORIDA

SUBMITTED: ______ PROJECT MANAGER DATE

APPROVED: ______ BROWN AND CALDWELL DATE

LINE IS 2 INCHES AT FULL SIZE
(IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: B DICKERSON
DRAWN: L DOFFLEMYER
CHECKED: B ELEAZER
CHECKED: B DICKERSON
APPROVED: J DIEDRICH

EXTERNAL REFERENCE FILES
144490-TBK-0000-01.dwg

60% SUBMITTAL

THIS DRAWING IS NOT VALID FOR CONSTRUCTION PURPOSES UNLESS IT BEARS THE SEAL AND SIGNATURE OF A DULY REGISTERED PROFESSIONAL

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

CITY OF St. PETERSBURG
3800 54th AVE. S
St. PETERSBURG, FL. 33711

BIOSOLIDS TO ENERGY

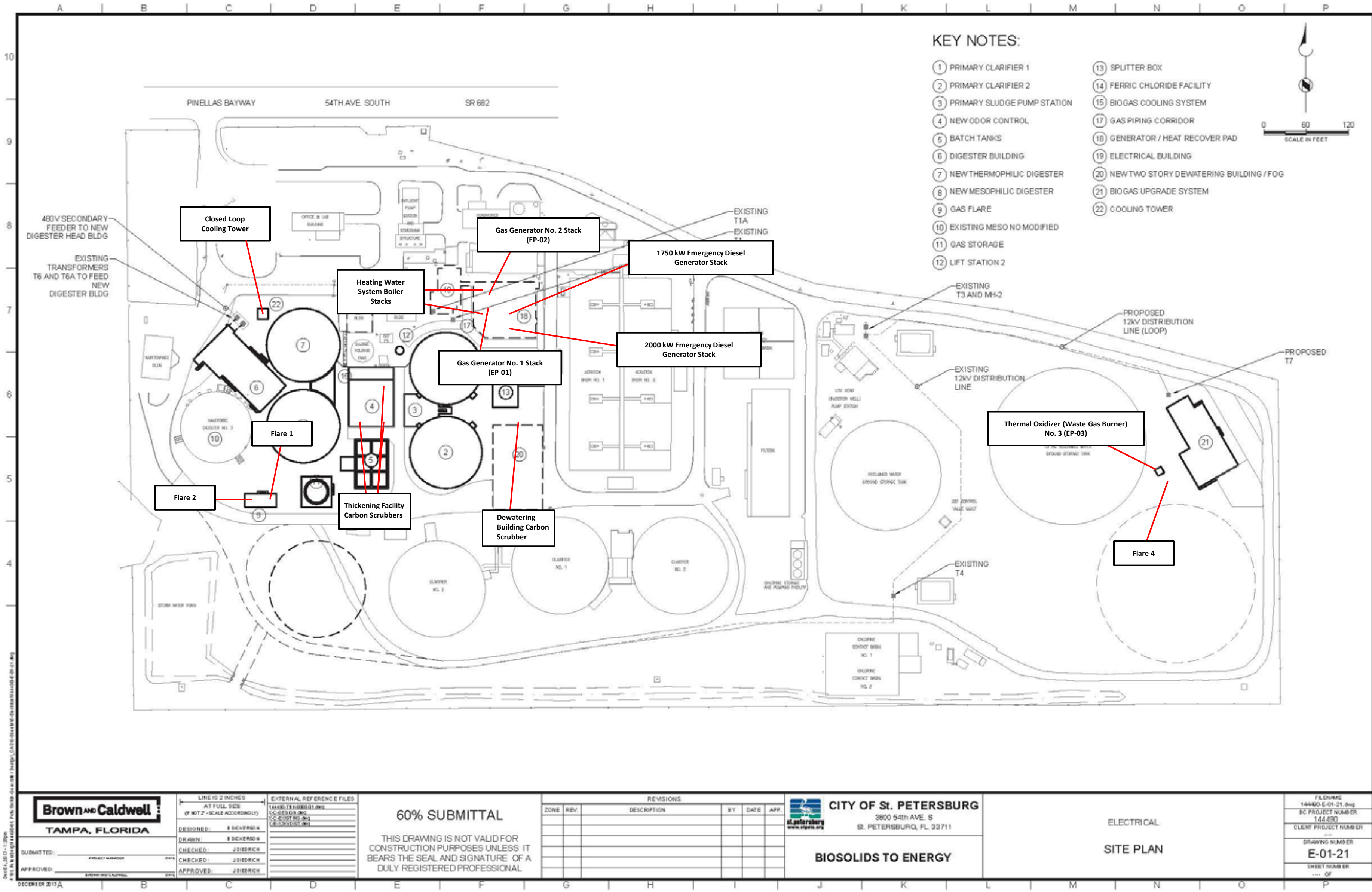
INSTRUMENTATION

CLOSED LOOP COOLING TOWER

FILENAME 144490-I-82-12.dwg
BC PROJECT NUMBER 144490
CLIENT PROJECT NUMBER ----
DRAWING NUMBER I-82-12
SHEET NUMBER ---- OF

DECEMBER 2013

Dec 04, 2013 - 11:07pm
P:\St. Petersburg\144490-St. Pete Solids-Generator Design_CAD\2-Sheets\I-Instrumentation\144490-I-82-12.dwg


KEY NOTES:
1 PRIMARY CLARIFIER 1
2 PRIMARY CLARIFIER 2
3 PRIMARY SLUDGE PUMP STATION
4 NEW ODOR CONTROL
5 BATCH TANKS
6 DIGESTER BUILDING
7 NEW THERMOPHILIC DIGESTER
8 NEW MESOPHILIC DIGESTER
9 GAS FLARE
10 EXISTING MESO NO MODIFIED
11 GAS STORAGE
12 LIFT STATION 2
13 SPLITTER BOX
14 FERRIC CHLORIDE FACILITY
15 BIOGAS COOLING SYSTEM
16 GAS PIPING CORRIDOR
17 GENERATOR / HEAT RECOVER PAD
18 ELECTRICAL BUILDING
19 NEW TWO STORY DEWATERING BUILDING / FOG
20 BIOGAS UPGRADE SYSTEM
22 COOLING TOWER
0 60 120
SCALE IN FEET
PINELLAS BAYWAY
54TH AVE SOUTH
SR 682
480V SECONDARY FEEDER TO NEW DIGESTER HEAD BLDG
EXISTING TRANSFORMERS T6 AND T6A TO FEED NEW DIGESTER BLDG
Closed Loop Cooling Tower
Heating Water System Boiler Stacks
Gas Generator No. 2 Stack (EP-02)
1750 kW Emergency Diesel Generator Stack
2000 kW Emergency Diesel Generator Stack
Gas Generator No. 1 Stack (EP-01)
EXISTING T1A
EXISTING T3 AND MH-2
PROPOSED 12kV DISTRIBUTION LINE (LOOP)
PROPOSED T7
EXISTING 12kV DISTRIBUTION LINE
Thermal Oxidizer (Waste Gas Burner) No. 3 (EP-03)
Flare 1
Flare 2
Thickening Facility Carbon Scrubbers
Dewatering Building Carbon Scrubber
Flare 4
EXISTING T4
Brown AND Caldwell
TAMPA, FLORIDA
60% SUBMITTAL
THIS DRAWING IS NOT VALID FOR CONSTRUCTION PURPOSES UNLESS IT BEARS THE SEAL AND SIGNATURE OF A DULY REGISTERED PROFESSIONAL
REVISIONS
CITY OF St. PETERSBURG
3800 54th AVE. S
St. PETERSBURG, FL 33711
BIOSOLIDS TO ENERGY
ELECTRICAL
SITE PLAN
E-01-21

ATTACHMENT B – REVISED EMISSIONS CALCULATIONS

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Major/Minor Source & 62-210.300, FAC Exemption Applicability Determination

PSD Applicability Determination[3]

Projected Annual Emissions (tpy) of PSD Pollutants from BIP Project			
	BIP PTE	Major Source Threshold (tpy)	Equals/Exceeds Major Source Threshold? (Yes/No)
NO_X	38.6	250	No
CO	55.0	250	No
VOC	16.1	250	No
SO_2	40.0	250	No
$PM_{(filterable)}$ [4]	1.42	250	No
$PM_{10(filterable+condensible)}$	2.57	250	No
$PM_{2.5(filterable+condensible)}$	2.53	250	No
Lead	2.74E-05	250	No
H_2SO4	0.128	250	No
H_2S	1.53	250	No
CO_2	19,203	--	--
CH_4	106	--	--
N_2O	1.21E-01	--	--
GHG - Mass Basis	19,310	--	--
GHG - CO_{2e} Basis	21,899	100,000	No

Title V Applicability Determination

Projected Annual Emissions (tpy) From Entire Facility			
	PTE	Major Source Threshold (tpy)	Equals/Exceeds Major Source Threshold? (Yes/No)
NO_X	40.2	100	No
CO	55.1	100	No
VOC	16.1	100	No
SO_2	40.0	100	No
$PM_{(filterable)}$ [4]	1.43	100	No
$PM_{10(filterable+condensible)}$	2.58	100	No
$PM_{2.5(filterable+condensible)}$	2.54	100	No
Lead	2.74E-05	5	No
H_2SO4	0.130	100	No
H_2S	2.72	100	No
CO_2	19359	--	--
CH_4	106	--	--
N_2O	0.121	--	--
GHG - Mass Basis[5]	19465	100	Yes
GHG - CO_{2e} Basis	22054	100000	No

Projected Annual Emissions (tpy) of Individual HAPs from Entire Project		Major Source Threshold (tpy)	Equals/Exceeds Major Source Threshold? (Yes/No)
	PTE		
1,1,2,2 Tetrachloroethane	3.36E-03	10	No
1,1,2 Trichloroethane	2.67E-03	10	No
1,3 Butadiene	2.25E-02	10	No
1,3 Dichloropropene	2.22E-03	10	No
2,2,4 Trimethylpentane	2.10E-02	10	No
Acetaldehyde	7.03E-01	10	No
Acrolein	4.32E-01	10	No
Benzene	3.85E-02	10	No
Biphenyl	1.78E-02	10	No
Carbon Tetrachloride	3.09E-03	10	No
Chlorobenzene	2.56E-03	10	No
Chloroform	2.40E-03	10	No
Dichlorobenzene	6.58E-05	10	No
Ethylene Dibromide	3.73E-03	10	No
Formaldehyde	4.45E+00	10	No
Methanol	2.10E-01	10	No
Methylene Chloride	1.68E-03	10	No
Napthalene	6.53E-03	10	No
Hexane	1.92E-01	10	No
Phenol	2.02E-03	10	No
Styrene	1.98E-03	10	No
Tetrachloroethylene	2.09E-04	10	No
Toluene	3.50E-02	10	No
Vinyl Chloride	1.25E-03	10	No
Xylene	1.58E-02	10	No
Polycyclic Organic Matter[2]	8.79E-03	10	No
Lead	2.74E-05	10	No
Arsenic	1.89E-05	10	No
Beryllium	5.31E-06	10	No
Cadmium	7.99E-05	10	No
Chromium	1.65E-04	10	No
Cobalt	4.61E-06	10	No
Manganese	4.04E-05	10	No
Mercury	5.15E-05	10	No
Nickel	4.30E-04	10	No
Selenium	1.32E-06	10	No
Total HAPs Project PTE (tpy)	**6.18E+00**	**25**	**No**

62-210.300, FAC Exemption Applicability Determination

Exemption for Natural Gas Boilers (62-210.300(3)(a)(34), FAC)				
Per Unit Threshold for Exemption (mmscf/yr)	Per Unit Projected Fuel Use	Combined Fuel Use Threshold for Exemption (tpy)	Combined Projected Fuel Use from Both Units	Qualifies for Exemption?
150	55	375	110	**Yes**

Exemption for Natural Diesel Generators (62-210.300(3)(a)(35),FAC)		
Combined Fuel Use Threshold for Exemption (gallons/year)	Combined Projected Fuel Use from Both Units	Qualifies for Exemption?
64,000	26,400	**Yes**

Generic Exemption Applicability for Flares, Carbon Scrubbers, & Cooling Tower (62-210.300(3)(b)(1)(c), FAC)					
Threshold	Lead	HAPs		Other[1]	
		Indvidual	Total		Exemption Applies? (Yes/No)
	500 lb/yr	1,000 lb/yr	2,500 lb/yr	5.0 tpy	
Flare 1				2.29	Yes
Flare 2		NA		0.87	Yes
Flare 3				36.79	**No**
Flare 4				4.24E-02	Yes
Scrubbers				1.53	Yes
Cooling Tower				0.11	Yes

Generic Exemption Applicability for Flares, Carbon Scrubbers, & Cooling Tower (62-210.300(3)(b)(1)(b), FAC)			
	Facility PTE	Title V Threshold (tpy)	Equals/Exceeds Threshold? (Yes/No)
NO_X	40.2	100	No
CO	55.1	100	No
VOC	16.1	100	No
SO_2	40.0	100	No
$PM_{(filterable)}$ [4]	1.4	100	No
$PM_{10(filterable+condensible)}$	2.58	100	No
$PM_{2.5(filterable+condensible)}$	2.54	100	No
Lead	2.74E-05	100	No
H_2SO4	0.130	100	No
H_2S	1.53	100	No
CO_2	19,359	--	--
CH_4	106	--	--
N_2O	1.21E-01	--	--
GHG - Mass Basis	19,465	--	--
GHG - CO_{2e} Basis	22,054	100,000	No

Notes [ ]:

1. 62-210.300(3)(b)(1)(c.), FAC specifies that the unit must not have the potential to emit 5.0 tpy of any regulated pollutant (other than HAPs and Lead) as defined by 62-210.200, FAC. For the BIP Project flares and cooling tower, these "other" pollutants include NO_X, VOC, SO_2, PM_{10}, $PM_{2.5}$ and PM, PM_{10} and $PM_{2.5}$, respectively. Only the maximum amount emitted is shown here. Please see "Flares", "Carbon Scrubber Emissions", and "Cooling Tower" for individual pollutant emissions.
2. Polycyclic Organic Matter includes Polycyclic Aromatic Hydrocarbons (PAH) emissions from the relocated diesel generator.
3. The 1,750 kW diesel generator is being relocated from the Albert Whitted facility to the SWWRF. Therefore, it is considered a new emissions source and is included as a component of the BIP Project and its PTE is included in the PSD major source applicability deteremination. The 2,000 kW generator is currently located at the SWWRF. Therefore, the 2,000 kW emissions are not included in the PSD major source applicability determination and it is only shown in this appendix in order to determine Title V Major Source applicability and the applicability of exemptions pursuant to 62-210.300, FAC.
4. USEPA issued a final rule (Reference 2) which removed a requirement in the definition of "regulated NSR pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate matter known as "particulate matter emissions" in the context of the PSD and NSR regulations; therefore, only the filterable portion is regulated with regards to PM emissions.
5. According to USEPA guidance after July 1, 2011 existing and newly constructed facilites must have GHG PTEs that equal or exceed 100 tpy on a mass basis *and* 100,000 tpy on a CO_2e basis.

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Gas - Fired Engine Generators

Cummins Model C1100 N6C	
No. of Engines	2
Engine Output	1517 hp[1]
Heat Input (HHV)	9.60 MBtu/hr[1,6]
Exhaust Gas Flow @100% Load	6650 acfm[1]
Annual Hours of Operation	8760 hrs
Exhaust Gas Temperature	757 °F[1]
SO_2 to SO_3 Conversion Rate (assumed)	100 %
Molecular Weight of SO_2	64 lb/lb-mol
Molecular Weight of H_2SO_4	98 lb/lb-mol
Emission Factors PSD Pollutants	
NO_X	1 g/hp-hr[1,2]
NMHC (VOCs)	0.5 g/hp-hr[1,2]
$PM_{10(filterable)}$	0.03 g/hp-hr[1,2]
$PM_{2.5(filterable)}$	0.03 g/hp-hr[1,2]
$PM_{(filterable)}$	0.03 g/hp-hr[1,2]
$PM_{(condensible)}$	9.91E-03 lb/Mbtu[4]
SO_2	5.88E-04 lb/Mbtu[4]
CO	1.6 g/hp-hr[1]
CO_2	6.4 % (dry)[1,3] 64000 ppmvd
CH_4	1.25 lb/Mbtu[4]
Annual Emissions of PSD Pollutants with Both Engines Operating	
NO_X	29.3 tpy
NMHC (VOCs)	14.6 tpy
$PM_{10(Filterable+Condensible)}$	1.7 tpy[5]
$PM_{2.5(Filterable+Condensible)}$	1.7 tpy[5]
$PM_{(filterable)}$	0.9 tpy[5,7]
SO_2	4.95E-02 tpy
H_2SO_4[9]	7.57E-02 tpy
CO	46.9 tpy
CO_2	11079 tpy
CH_4	105.1 tpy
CO2e[8]	13707 tpy

Hazardous Air Pollutants (HAPS)	Emission Factors (lb/MBtu)[4]	Emission Rate (lb/hr) (per unit)	PTE (tpy) (Both Engines Operating)
1,1,2,2 Tetrachloroethane	4.00E-05	3.84E-04	3.36E-03
1,1,2 Trichloroethane	3.18E-05	3.05E-04	2.67E-03
1,3 Butadiene	2.67E-04	2.56E-03	2.25E-02
1,3 Dichloropropene	2.64E-05	2.53E-04	2.22E-03
2,2,4 Trimethylpentane	2.50E-04	2.40E-03	2.10E-02
Acetaldehyde	8.36E-03	8.03E-02	7.03E-01
Acrolein	5.14E-03	4.94E-02	4.32E-01
Benzene	4.40E-04	4.22E-03	3.70E-02
Biphenyl	2.12E-04	2.04E-03	1.78E-02
Carbon Tetrachloride	3.67E-05	3.52E-04	3.09E-03
Chlorobenzene	3.04E-05	2.92E-04	2.56E-03
Chloroform	2.85E-05	2.74E-04	2.40E-03
Ethylene Dibromide	4.43E-05	4.25E-04	3.73E-03
Formaldehyde	5.28E-02	5.07E-01	4.44E+00
Methanol	2.50E-03	2.40E-02	2.10E-01
Methylene Chloride	2.00E-05	1.92E-04	1.68E-03
Napthalene	7.44E-05	7.14E-04	6.26E-03
Hexane	1.11E-03	1.07E-02	9.34E-02
Phenol	2.40E-05	2.30E-04	2.02E-03
Styrene	2.36E-05	2.27E-04	1.98E-03
Tetrachloroethylene	2.48E-06	2.38E-05	2.09E-04
Toluene	4.08E-04	3.92E-03	3.43E-02
Vinyl Chloride	1.49E-05	1.43E-04	1.25E-03
Xylene	1.84E-04	1.77E-03	1.55E-02
Polycyclic Organic Matter	--	9.59E-04	8.40E-03
2 Methylnaphthalene	3.32E-05	3.19E-04	--
Acenaphthene	1.25E-06	1.20E-05	--
Acenaphthylene	5.53E-06	5.31E-05	--
Benzo(b)fluoranthene	1.66E-07	1.59E-06	--
Benzo(g,h,i)perylene	4.14E-07	3.98E-06	--
Benzo(e)pyrene	4.15E-07	3.98E-06	--
Chrysene	6.93E-07	6.65E-06	--
Ethylbenzene	3.97E-05	3.81E-04	--
Fluoranthene	1.11E-06	1.07E-05	--
Fluorene	5.67E-06	5.44E-05	--
Phenanthrene	1.04E-05	9.99E-05	--
Pyrene	1.36E-06	1.31E-05	--
		Total HAPs	**6.07E+00**

Notes [ ]:

1. Based on preliminary vendor data.
2. Emissions assuming 5% O_2 concentration in exhaust gas.
3. Preliminary vendor data contains CO_2 exaust percentage by volume on a dry basis. The value is conservatively assumed to be on an actual basis in this Appendix.
4. Emission factor obtained from AP-42 (Reference 1a).
5. Assumes all PM is less than 2.5 microns.
6. Based on ratio of average heat content of natural gas at LHV & HHV. HHV=LHV*1.11
7. USEPA issued a final rule (Reference 2) which removed a requirement in the definition of "regulated NSR pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate matter known as "particulate matter emissions" in the context of the PSD and NSR regulations; therefore, only the filterable portion is regulated with regards to PM emissions.
8. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
9. Assumes 100% (by volume) of SO_2 oxidized to form SO_3.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.2 "Natural Gas-Fired Reciprocating Engines". April 2000.
   a. Table 3.2-2 "Uncontrolled Emission Factors For 4-Stroke Lean-Burn Engines."
2. "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$): Amendment to the Definition of "Regulated NSR Pollutant" Concerning Condensable Particulate Matter", 77 Federal Register 207 (25 October 2012), pp. 65107 - 65119.

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Flares

Flare	Maximum Output (scfm)[1]
Flare 1 - Enclosed Flare to Combust Excess Gas from Digesters 1 & 2	760 scfm
Flare 2 - Candlestick Flare to Combust Excess Gas from Digester 3 (16-inch pressure zone)	600 scfm
Flare 3 - Thermal Oxidizer to Combust Waste Gas From BUS	140 scfm
Flare 4 - Candlestick Startup Flare Combusting BUS Product Gas	200 scfm

Emissions Factors	Flare 1 [1]	Flare 3[1]	Flares 2 & 4[2]
NO_X (lb/MBtu)	0.06	0.06	0.068
CO (lb/MBtu)	0.15	0.30	0.37
VOC (lb/MBtu)	0.08	0.08	0.14
PM (lb/mmscf)[3]	60	--	--
PM_{10} (lb/mmscf)[3]	60	--	--
$PM_{2.5}$ (lb/mmscf)[3]	60	--	--
CO_2 (lb/MBtu)[4]	117	117	117
CH_4 (lb/MBtu)[5]	0.08	0.08	0.08
N2O(lb/Mbtu)[4]	2.20E-04	2.20E-04	2.20E-04

Add N2O Emissions Part 98 Table C-1

H_2S Concentration in Digester Gas Upstream of Biogas Upgrade System (BUS)	3,000 ppmv[6]
H_2S Concentration in BUS Product Gas	50 ppmv[1]
Heat Content of Digester Gas Upstream of Biogas Upgrade System (BUS)	645 Btu/scf[6]
Heat Content of BUS Waste Gas	186 Btu/scf[1]
Heat Content of BUS Product Gas	990 Btu/scf[1]
Heat Content of Pilot Fuel Gas	1020 Btu/scf[9]
Temperature of Digester Gas	83 °F[1]
Temperature of BUS Product Gas	100 °F[1]
Moecular Weight of SO_2	64 lb/lb-mol
Flare 1 Gas Throughput	9435039 scf/yr[6]
Flare 1 Pilot Gas Throughput	438000 scf/yr[6]
Flare 2 Gas Throughput	3570459 scf/yr[6]
Flare 2 Pilot Gas Throughput	438000 scf/yr[6]
Flare 3 Gas Throughput	73584000 scf/yr[6]
Flare 3 Pilot Gas Throughput	876000 scf/yr[6]
Flare 4 Gas Throughput	6088 scf/yr[6]
Flare 4 Pilot Gas Throughput	219000 scf/yr[6]

Annual Emissions (tpy) of PSD Pollutants from Flaring of Gas				
	Flare 1	Flare 2	Flare 3	Flare 4
NO_X	0.18	0.08	0.41	2.05E-04
CO	0.46	0.43	2.05	1.12E-03
VOC	0.24	0.16	0.55	4.22E-04
SO_2	2.29	0.87	36.79	2.38E-05
PM[3]	0.28	--	--	--
PM_{10}[3]	0.28	--	--	--
$PM_{2.5}$[3]	0.28	--	--	--
CO_2	356	135	801	3.53E-01
CH_4	0.23	0.089	0.527	2.32E-04
N_2O	6.69E-04	2.53E-04	1.51E-03	6.63E-07
CO_{2e}[8]	362	137	814	3.59E-01

Annual Emissions (tpy) of PSD Pollutants from Flare Pilots[2]				
	Flare 1	Flare 2	Flare 3	Flare 4
NO_X	0.015	0.015	0.030	7.59E-03
CO	0.083	0.083	0.17	4.13E-02
VOC	0.031	0.031	0.063	1.56E-02
SO_2[7]	3.13E-04	3.13E-04	6.26E-04	1.56E-04
CO_2[4]	26.1	26.1	52.3	13.1
CH_4	0.017	0.017	0.034	8.35E-03
N_2O	4.91E-05	4.91E-05	9.83E-05	2.38E-05
CO_{2e}[8]	27	27	53	13.3

Total Annual Emissions (tpy) of PSD Pollutants from Flaring of Gas & Pilot Emissions				
	Flare 1	Flare 2	Flare 3	Flare 4
NO_X	0.20	0.09	0.44	7.80E-03
CO	0.54	0.51	2.22	4.24E-02
VOC	0.27	0.19	0.61	1.61E-02
SO_2[7]	2.29	0.87	36.79	1.80E-04
PM[3]	0.28	--	--	--
PM_{10}[3]	0.28	--	--	--
$PM_{2.5}$[3]	0.28	--	--	--
CO_2[4]	382	161	853	13.4
CH_4	0.25	0.106	0.561	8.58E-03
N_2O	7.19E-04	3.02E-04	1.60E-03	2.45E-05
CO_{2e}[8]	389	164	867	13.6

Notes [ ]:

1. Information obtained from Brown & Caldwell 30% Preliminary Design Report (PDR) and Technical Specifications - Volume No. 2, 60% Submittal.
2. Emission factor obtained from AP-42 (Reference 1a).
3. Assumed to be both filterable and condensible & less than 2.5 microns.
4. CO_2 emission factor obtained from Table C-1 to Subpart C of 40 CFR Part 98. Conservatively used emission factor for natural gas for each flare as the value is greater than the emission factor for combusted biogas.
5. Emission factor obtained from AP-42 (Reference 1b.). Methane emissions are assumed to be 55% of total VOC emissions.
6. Calculated using information obtained from "Air Permit Info.xlsx" sent to Black & Veatch on 12/6/2013 from Christian Aristizabal of Brown & Caldwell.
7. Assumes 1 grain per 100 scf sulfur content in the pilot gas and all sulfur in the fuel is converted to SO_2 during combustion.
8. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
9. Assumed value.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 13 "Miscellaneous Sources", Section 13.5 "Industrial Flares". April 2000.

a. Table 13.5-1 "Emission Factors for Flare Operations".

b. Table 13.5-2 "Hydrocarbon Composition of Flare Emission"

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Backup Heating Boilers for Digesters

Basis:

Number of Units	2	
Fuel	Natural Gas	
Heat Input	6.38	mmBtu/hr [1]
Heating Value of Fuel	990	Btu/scf [2]
Fuel Burn Rate	0.0063	mmscf/hr[1]
SO_2 to SO_3 Conversion Rate	100	% by volume (assumed)

Fuel consumed by each unit operating 8760 hours per year	**55**	mmscf/yr
Combined fuel consumed by both units operating 8760 hours per year	**110**	mmscf/yr

Global Warming Potentials [3]	
CO_2	1
CH_4	25
N_2O	298

Annual Potential Emissions

Pollutant	Mass Emission Rate (Per Unit)			Annual Emissions When Both Units Operating 8760 hrs (tpy)
	(lb/mmscf)	Notes	(lb/hr)	
CO	84	[4]	5.26E-01	4.605
NO_X	100	[4]	6.26E-01	5.48
PM	1.9	[6, 7]	1.19E-02	0.104
PM_{10}	7.6	[6, 8]	4.76E-02	0.417
$PM_{2.5}$	7.6	[6, 8]	4.76E-02	0.417
SO_2	0.60	[9]	3.76E-03	0.0329
VOC	5.5	[6]	3.44E-02	0.302
Lead	0.0005	[6]	3.13E-06	2.74E-05
H_2SO_4	0.92	[10]	5.75E-03	0.0504
CO_2	120,000	[6]	751.06	6,579.28
CH_4	2.3	[6]	1.44E-02	1.26E-01
N_2O	2.2	[6]	1.38E-02	1.21E-01
GHG-CO2e	--	[11]	--	6,618

CAS Number	Pollutant	Mass Emission Rate (per unit)			PTE
		(lb/mmscf)	Notes	(lb/hr)	(tpy)
71-43-2	Benzene	2.10E-03	[12]	1.31E-05	1.15E-04
25321-22-6	Dichlorobenzene	1.20E-03	[12]	7.51E-06	6.58E-05
50-00-0	Formaldehyde	7.50E-02	[12]	4.69E-04	4.11E-03
110-54-3	Hexane	1.80E+00	[12]	1.13E-02	9.87E-02
91-20-3	Naphthalene	6.10E-04	[12]	3.82E-06	3.34E-05
--	Polycyclic Organic Matter	8.82E-05	[12, 4]	5.52E-07	4.84E-06
91-57-6	2-Methylnaphthalene	2.40E-05	[12, 5]	--	--
56-49-5	3-Methylchloranthrene	1.80E-06	[12, 5]	--	--
57-97-6	7,12-Dimethylbenz(a)anthracene	1.60E-05	[12, 5]	--	--
83-32-9	Acenaphthene	1.80E-06	[12, 5]	--	--
203-96-8	Acenaphthylene	1.80E-06	[12, 5]	--	--
120-12-7	Anthracene	2.40E-06	[12, 5]	--	--
56-55-3	Benz(a)anthracene	1.80E-06	[12, 5]	--	--
50-32-8	Benzo(a)pyrene	1.20E-06	[12, 5]	--	--
205-99-2	Benzo(b)fluoranthene	1.80E-06	[12, 5]	--	--
191-24-2	Benzo(g,h,i)perylene	1.20E-06	[12, 5]	--	--
205-82-3	Benzo(k)fluoranthene	1.80E-06	[12, 5]	--	--
218-01-9	Chrysene	1.80E-06	[12, 5]	--	--
53-70-3	Dibenzo(a,h)anthracene	1.20E-06	[12, 5]	--	--
206-44-0	Fluoranthene	3.00E-06	[12, 5]	--	--
86-73-7	Fluorene	2.80E-06	[12, 5]	--	--
193-39-5	Indeno(1,2,3-cd)pyrene	1.80E-06	[12, 5]	--	--
85-01-8	Phenanathrene	1.70E-05	[12, 5]	--	--
129-00-0	Pyrene	5.00E-06	[12, 5]	--	--
108-88-3	Toluene	3.40E-03	[12]	2.13E-05	1.86E-04
[6]	Lead	5.00E-04	[13]	3.13E-06	2.74E-05
[6]	Arsenic	2.00E-04	[13]	1.25E-06	1.10E-05
[6]	Beryllium	1.20E-05	[13]	7.51E-08	6.58E-07
[6]	Cadmium	1.10E-03	[13]	6.88E-06	6.03E-05
[6]	Chromium	1.40E-03	[13]	8.76E-06	7.68E-05
[6]	Cobalt	8.40E-05	[13]	5.26E-07	4.61E-06
[6]	Manganese	3.80E-04	[13]	2.38E-06	2.08E-05
[6]	Mercury	2.60E-04	[13]	1.63E-06	1.43E-05
[6]	Nickel	2.10E-03	[13]	1.31E-05	1.15E-04
[6]	Selenium	2.40E-05	[13]	1.50E-07	1.32E-06
				Total HAPs	1.04E-01

Notes [ ]:

1. Based on preliminary vendor data.
2. Based on design data.
3. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
4. Emission factor obtained from AP-42 (Reference 1a); for a small boiler (<100 mmBtu/hr), uncontrolled.
5. Pollutant is assumed to be a POM.
6. Emission factor obtained from AP-42 (Reference 1b).
7. USEPA issued a final rule (Reference 2) which removed a requirement in the definition of "regulated NSR pollutant" to include condensable PM when measuring one of the emissions-related indicators for particulate matter known as "particulate matter emissions" in the context of the PSD and NSR regulations; therefore, only the filterable portion is regulated with regards to PM emissions.
8. Based on information provided in AP-42 (Reference 1), all particulate matter (filterable and condensable) is assumed to be less than 1.0 micrometer in diameter.
9. Assumed all sulfur in the fuel is converted to SO_2.
10. Assumes 100% (by volume) of SO_2 is oxidized to form SO_3.
11. The GHG emissions is the sum of all applicable GHG pollutants.
12. Emission factor obtained from AP-42 (Reference 1c).
13. Emission factor obtained from AP-42 (Reference 1d).
14. Polycyclic Organic Matter (POM) emissions is the summation of individual POM pollutants.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 1 "External Combustion Sources", Section 1.4 "Natural Gas Combustion". July 1998.
   a. Table 1.4-1 "Emission Factors for Nitrogen Oxides (NO_X) and Carbon Monoxide (CO) from Natural Gas Combustion".
   b. Table 1.4-2 "Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion".
   c. Table 1.4-3 "Emission Factors for Speciated Organic Compounds from Natural Gas Combustion".
   d. Table 1.4-4 "Emission Factors for Metals from Natural Gas Combustion".
2. "Implementation of the New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$): Amendment to the Definition of "Regulated NSR Pollutant" Concerning Condensable Particulate Matter", 77 Federal Register 207 (25 October 2012), pp. 65107 - 65119.

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Proposed Odor Control Systems

H_2S Emissions		
H_2S Concentration in Foul Air (Primary Clarifiers & Gravity Belt Thickener Building)	10	ppmvd[1]
H_2S Concentration in Foul Air (Dewatering Building)	45	ppmvd[3]
AverageTemperature of Foul Air	68	°F[1]
Molecular Weight of H_2S	34	lb/lb-mol
Assumes Continuous Annual Operation	8760	hours
Control Efficiency (per scrubber)[1,2]	95	%
Design Capacity[1]		
Scrubber 1 - Primary Clarifiers & Gravity Belt Thickener Building	12000	scfm
Scrubber 2 - Primary Clarifiers & Gravity Belt Thickener Building	12000	scfm
Scrubber 3 - Dewatering Building[5]	24000	scfm
H_2S PTE (tons per year)[4]		
Scrubber 1 - Primary Clarifiers & Gravity Belt Thickener Building	0.139	tpy
Scrubber 2 - Primary Clarifiers & Gravity Belt Thickener Building	0.139	tpy
Scrubber 3 - Dewatering Building[5]	1.26	tpy
Total	**1.53**	**tpy**

Notes: [ ]:

1. Information obtained from Brown & Caldwell 30% Preliminary Design Report (PDR) and Technical Specifications - Volume No. 3, 60% Submittal. Value is downstream of Biotrickling Filters at inlet of carbon scrubbers.
2. Specifications are for 99% control efficiency. 95% conservatively assumed.
3. Based on engineering estimates. Conservatively assumes maximum H_2S concentration of 45 ppmvd.
4. 3 total scrubbers available to Primary Clarifiers & Gravity Belt Thickener Building, however, only 2 in use at any one time, with one stand-by.
5. Foul air flow through scrubber 3 assumed to be equal to aggregate of scrubbers 1 & 2.

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Existing Headworks Odor Control Systems

H_2S Emissions		
H_2S Concentration in Foul Air (Headworks)	275	ppmvd[1]
AverageTemperature of Foul Air	68	°F[3]
Molecular Weight of H_2S	34	lb/lb-mol
Assumes Continuous Annual Operation	8760	hours
Control Efficiency (per scrubber)[2]	95	%
Design Capacity[1]		
Existing Scrubber - Headworks	3700	scfm
H_2S PTE (tons per year)		
Existing Scrubber - Headworks	1.183	tpy

Notes: [ ]:

1. Maximum measured influent H_2S concentration as monitored by SWWRF odor loggers located in the wet-well and headworks.
Specifications - Volume No. 3, 60% Submittal. Value is downstream of Biotrickling Filters at inlet
of carbon scrubbers.
2. Specifications are for 99% control efficiency. 95% conservatively assumed.
3. Assumed value based on engineering data from proposed odor control systems.

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Relocated 1750 kW Diesel Emergency Generator (New Source)

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,347	HP
Heat Input	17.26	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	126	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]
Sulfur Content of Fuel	0.0015	% [3]

Global Warming Potentials [4]	
CO_2	1
CH_4	25
N_2O	298

Pollutant	Mass Emission Rate			PTE
	g/hp-hr	Notes	(lb/hr)	(tpy)
CO	0.87	[1,10]	4.52	0.23
NO_X	11.84	[1,10]	61.24	3.06
PM	0.20	[1,10]	1.04	0.052
PM_{10}	0.20	[5]	1.04	0.052
$PM_{2.5}$	0.20	[5]	1.04	0.052
SO_2	0.0052	[6]	0.027	0.0013
VOC	0.25	[1,10]	1.28	0.064
Lead	--		--	--
H_2SO_4	0.0079	[7]	0.041	0.0020
Fluorides	--		--	--
TRS (including H_2S)	--		--	--
GHG-Mass	526.196	[9]	2,723	136
CO_2	5.26E+02	[8]	2,722.52	136.13
CH_4	2.88E-02	[8]	0.15	0.01
N_2O	--		--	--
GHG-CO2e	526.887	[9]	2,726	136
CO_2	5.26E+02	[4]	2,722.52	136.13
CH_4	7.20E-01	[4]	3.72	0.19
N_2O	--		--	--

Notes [ ]:

1. Caterpillar Model 3516 1750 kW generator installed at Albert Whitted facility in 2000, to be relocated at SWWRF as part of BIP. Data from this specific engine is unavailable. Therefore, calculations based on 1999 performance data from vendor for Model 3516B 1825 kW diesel generator.
2. Based on diesel fuel characteristics listed in Reference 2.
3. Based on the requirements of 40 CFR Part 63, Subpart ZZZZ and 40 CFR Part 80.510(b).
4. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
5. Conservatively assumed all particulate matter emissions are less than 2.5 micrometers in diameter.
6. Assumed all sulfur in the fuel is converted to SO_2.
7. Assumed 100% conversion of SO_2 to H_2SO_4.
8. Greenhouse gases (CO_2 and CH_4) emission factors obtained from AP-42 (Reference 1a), for a large stationary diesel engine (2-02-004-01).
9. The GHG emissions is the sum of all applicable GHG pollutants.
10. Emission factors enveloped across varying operational conditions to represent worst-case emissions.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
   a. Table 3.4-1 "Gaseous Emission Factors for Large Stationary Diesel and All Stationary Duel-Fuel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

HAP Emissions - Relocated 1750 kW Diesel Emergency Generator (New Source)

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,347	HP
Heat Input	17.26	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	126	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]

Pollutant	Composition [3] (%wt)
Arsenic	8.50E-06
Beryllium	5.00E-06
Cadmium	2.10E-05
Chromium	9.50E-05
Manganese	2.10E-05
Mercury	4.00E-05
Nickel	3.38E-04

Pollutant	Mass Emission Rate			PTE
	(lb/mmBtu)	Notes	(lb/hr)	(tpy)
Benzene	7.76E-04	[4]	1.34E-02	6.70E-04
Toluene	2.81E-04	[4]	4.85E-03	2.43E-04
Xylenes	1.93E-04	[4]	3.33E-03	1.67E-04
Formaldehyde	7.89E-05	[4]	1.36E-03	6.81E-05
Acetaldehyde	2.52E-05	[4]	4.35E-04	2.18E-05
Acrolein	7.88E-06	[4]	1.36E-04	6.80E-06
Naphthalene	1.30E-04	[5]	2.24E-03	1.12E-04
PAH	2.12E-04	[5]	3.66E-03	1.83E-04
Arsenic	4.37E-06	[6, 7]	7.55E-05	3.78E-06
Beryllium	2.57E-06	[6, 7]	4.44E-05	2.22E-06
Cadmium	1.08E-05	[6, 7]	1.87E-04	9.33E-06
Chromium	4.89E-05	[6, 7]	8.44E-04	4.22E-05
Manganese	1.08E-05	[6, 7]	1.87E-04	9.33E-06
Mercury	2.06E-05	[6, 7]	3.55E-04	1.78E-05
Nickel	1.74E-04	[6, 7]	3.00E-03	1.50E-04
			Total HAPs	1.71E-03

Notes [ ]:

1. Caterpillar Model 3516 1750 kW generator installed at Albert Whitted facility in 2000, to be relocated at SWWRF as part of BIP. Data from this specific engine is unavailable. Therefore, calculations based on 1999 performance data from vendor for Model 3516B 1825 kW diesel generator.
2. Based on diesel fuel characteristics listed in Reference 2.
3. Based on data provided by USEPA (Reference 3a) for No. 2 fuel oil/diesel fuel.
4. Emission factor obtained from AP-42 (Reference 1a).
5. Emission factor obtained from AP-42 (Reference 1b).
6. Conservatively assumed all metal in the fuel oil is emitted into the atmosphere.
7. Emission factor based on the metal composition in the fuel. See Table C47 of this Appendix for details.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
   a. Table 3.4-3 "Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines".
   b. Table 3.4-4 "PAH Emission Factors for Large Uncontrolled Stationary Diesel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.
3. USEPA, EPCRA Section 313: Industry Guidance: Electricity Generating Facilities. EPA-745-B-00-004. February 2000.
   a. Table 3-4 "Estimated Concentration Values of EPCRA Section 313 Constituents in Crude Oil and Petroleum Products (Weight Percent)".

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - 2000 kW Diesel Emergency Generator

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,682	HP
Heat Input	18.91	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	138	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]
Sulfur Content of Fuel	0.0015	% [3]

Global Warming Potentials [4]	
CO_2	1
CH_4	25
N_2O	298

Pollutant	Mass Emission Rate			PTE
	g/hp-hr	Notes	(lb/hr)	(tpy)
CO	0.30	[1,10]	1.77	0.09
NO_X	5.45	[1,10]	32.22	1.61
PM	0.03	[1,10]	0.15	0.007
PM_{10}	0.03	[5]	0.15	0.007
$PM_{2.5}$	0.03	[5]	0.15	0.007
SO_2	0.0049	[6]	0.029	0.0015
VOC	0.11	[1,10]	0.65	0.033
Lead	--		--	--
H_2SO_4	0.0076	[7]	0.045	0.0022
Fluorides	--		--	--
TRS (including H_2S)	--		--	--
GHG-Mass	526.196	[9]	3,111	156
CO_2	5.26E+02	[8]	3,111.12	155.56
CH_4	2.88E-02	[8]	0.17	0.01
N_2O	--		--	--
GHG-CO2e	526.887	[9]	3,115	156
CO_2	5.26E+02	[4]	3,111.12	155.56
CH_4	7.20E-01	[4]	4.25	0.21
N_2O	--		--	--

Notes [ ]:

1. Based on performance data for Caterpillar model 3516C 2000 eKW Diesel Generator Set.
2. Based on diesel fuel characteristics listed in Reference 2.
3. Based on the requirements of 40 CFR Part 63, Subpart ZZZZ and 40 CFR Part 80.510(b).
4. CO_2 equivalents (CO_2e) based on the global warming potential for applicable pollutant as listed in Table A-1 to Subpart A of 40 CFR Part 98 - Global Warming Potentials.
5. Conservatively assumed all particulate matter emissions are less than 2.5 micrometers in diameter.
6. Assumed all sulfur in the fuel is converted to SO_2.
7. Assumed 100% conversion of SO_2 to H_2SO_4.
8. Greenhouse gases (CO_2 and CH_4) emission factors obtained from AP-42 (Reference 1a), for a large stationary diesel engine (2-02-004-01).
9. The GHG emissions is the sum of all applicable GHG pollutants.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
    a. Table 3.4-1 "Gaseous Emission Factors for Large Stationary Diesel and All Stationary Duel-Fuel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.

St. Petersburg - SW WRF
Biosolids Improvement Project (BIP)

HAP Emissions - 2,000 kW Diesel Emergency Generator

Basis:

Number of Units	1	
Fuel	Diesel Fuel Oil	
Power Rating	2,682	HP
Heat Input	18.91	mmBtu/hr
Heating Value of Fuel	137,000	Btu/gal [2]
Fuel Burn Rate	138	gal/hr [1]
Hours of Operation	100	hours per year
Density of Fuel	7.05	lb/gal [2]

Pollutant	Composition [3] (%wt)
Arsenic	8.50E-06
Beryllium	5.00E-06
Cadmium	2.10E-05
Chromium	9.50E-05
Manganese	2.10E-05
Mercury	4.00E-05
Nickel	3.38E-04

Pollutant	Mass Emission Rate			PTE
	(lb/mmBtu)	Notes	(lb/hr)	(tpy)
Benzene	7.76E-04	[4]	1.47E-02	7.34E-04
Toluene	2.81E-04	[4]	5.31E-03	2.66E-04
Xylenes	1.93E-04	[4]	3.65E-03	1.82E-04
Formaldehyde	7.89E-05	[4]	1.49E-03	7.46E-05
Acetaldehyde	2.52E-05	[4]	4.76E-04	2.38E-05
Acrolein	7.88E-06	[4]	1.49E-04	7.45E-06
Naphthalene	1.30E-04	[5]	2.46E-03	1.23E-04
PAH	2.12E-04	[5]	4.01E-03	2.00E-04
Arsenic	4.37E-06	[6, 7]	8.27E-05	4.13E-06
Beryllium	2.57E-06	[6, 7]	4.86E-05	2.43E-06
Cadmium	1.08E-05	[6, 7]	2.04E-04	1.02E-05
Chromium	4.89E-05	[6, 7]	9.24E-04	4.62E-05
Manganese	1.08E-05	[6, 7]	2.04E-04	1.02E-05
Mercury	2.06E-05	[6, 7]	3.89E-04	1.95E-05
Nickel	1.74E-04	[6, 7]	3.29E-03	1.64E-04
			Total HAPs	1.87E-03

Notes [ ]:
1. Based on performance data for Caterpillar model 3516C 2000 eKW Diesel Generator Set.
2. Based on distillate oil characteristics listed in Reference 2.
3. Based on data provided by USEPA (Reference 3a) for No. 2 fuel oil/diesel fuel.
4. Emission factor obtained from AP-42 (Reference 1a).
5. Emission factor obtained from AP-42 (Reference 1b).
6. Conservatively assumed all metal in the fuel oil is emitted into the atmosphere.
7. Emission factor based on the metal composition in the fuel. See Table C47 of this Appendix for details.

References:

1. USEPA, AP-42, Fifth Edition, Vol. I. Chapter 3 "Stationary Internal Combustion Sources", Section 3.4 "Large Stationary Diesel and All Stationary Duel-Fuel Engines". October 1996.
    a. Table 3.4-3 "Speciated Organic Compound Emission Factors for Large Uncontrolled Stationary Diesel Engines".
    b. Table 3.4-4 "PAH Emission Factors for Large Uncontrolled Stationary Diesel Engines".
2. USEPA, AP-42, Fifth Edition, Vol. I. Appendix A "Miscellaneous Data & Conversion Factors". September 1985.
3. USEPA, EPCRA Section 313: Industry Guidance: Electricity Generating Facilities. EPA-745-B-00-004. February 2000.
    a. Table 3-4 "Estimated Concentration Values of EPCRA Section 313 Constituents in Crude Oil and Petroleum Products (Weight Percent)".

St. Petersburg SW WRF

Biosolids Improvement Project (BIP)

Potential to Emit - Proposed Cooling Tower

Emissions Equation

PM

$$E = CWF \times DR \times \rho_{H2O} \times TDS \times Hours\ of\ Op. \times \frac{60\ min}{1\ hr} \times \frac{1\ ton}{2{,}000\ lbs}$$

where,

E =	emissions, tons	see Table below	
CWF =	circulating water flow, gpm	650	gpm [1]
DR =	drift rate, %	0.005	% [1]
ρ_{H2O} =	density of water, lb/gal	8.3454	lb/gal
TDS =	cycled water TDS, ppmw	1,494	ppmw [2]
Hours of Op. =	hours of operation, hrs/yr	8,760	hrs/yr

PM_{10}

$$E = E_{PM} \times F_{PM10/PM}$$

where,

E =	emissions, tons	
E_{PM} =	PM emissions	
$F_{PM10/PM}$ =	PM_{10} fraction, dimensionless	1 [3]

$PM_{2.5}$

$$E = E_{PM10} \times F_{PM2.5/PM10}$$

where,

E =	emissions, tons	
E_{PM10} =	PM_{10} emissions	
$F_{PM10/PM}$ =	$PM_{2.5}$ fraction, dimensionless	0.6 [4]

Cooling Tower Emissions

Activity	Potential Emissions (ton/yr)		
	PM	PM_{10}	$PM_{2.5}$
Mechanical Draft Cooling Tower	0.11	0.11	0.06

Notes [ ]:

1. Based on vendor data.
2. Site-specific water data was unavailable. Conservative preliminary engineering estimate based on Florida experience and 3 cycles of concentration.
3. Conservatively assumed all particulate matter emissions are less than 10 micrometers in diameter.
4. Fraction of PM_{10} that is $PM_{2.5}$ was obtained from SCAQMD (Reference 1a).

References:

1. South Coast AQMD, Air Guidance Book "Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds". Final. October 2006.
   a. Appendix A - Table A "Updated CEIDARS Table with $PM_{2.5}$ Fractions".

ATTACHMENT C – BUS DESIGN SPECIFICATION

1. The BUS shall be capable of upgrading raw gas produced by anaerobic digesters with characteristics listed in the table below to product gas characteristics as defined in this section. Prior to entering the BUS, the digester gas will normally be dehydrated through a chilling and liquid separation step.

Digester Gas Characteristics	Approximate Value or Range
1. Continuous volumetric flow requirements, scfm:	
a. minimum (require turndown)	120
b. maximum (required max flow)	333
2. Inlet gas pressure, inches W.C.	0 to 10
3. Gas temperature, degrees F	40 to 100
4. Methane, percent by volume (dry)	60 to 65
5. Carbon dioxide, percent by volume (dry)	35 to 40
6. Nitrogen, percent by volume (dry)	0 to 0.5
7. Oxygen, ppm_v	0 to 50
8. Water Dew Point, degrees F	40 to 90
9. Hydrogen sulfide, ppm_v	100 to 3,000
10. Total siloxanes, ppm_v	0 to 5
11. Ammonia, ppm_v	0 to 100
12. Other volatile organic compounds, ppm_v [a]	0 to 100

a. Refer to gas analysis from 4/22/13

2. The BUS shall treat the digester gas sufficiently to meet the following requirements at the discharge of the system. Methane recovery shall be measured by the mass flow of methane leaving the BUS in the product gas divided by the mass flow of methane entering the bus in the digester gas.

Product Gas Characteristics	Exact Value or Range
1. Product pressure, psig	90
2. Gas temperature, degrees F, max	120
3. Methane, percent by volume, min	98
4. Carbon dioxide, percent by volume, max	2
5. Oxygen, percent by volume, max	0.1
6. Sum of carbon dioxide, nitrogen, oxygen percent by volume, max	2

Product Gas Characteristics	Exact Value or Range
7. Higher heating value, Btu / scf, min	990
8. Water, lb / million scf, max	0.5
9. Hydrogen sulfide, ppm_v, max	1
10. Total siloxanes, ppb_v, max	Non-detectable
11. Total ammonia, ppb_v, max	Non-detectable
11. Other volatile organic compounds, ppb_v, max	Non-detectable
12. Minimum methane recovery, %	87

The product gas shall be free of objectionable liquids and solids and be commercially free from dust, gums, gum-forming constituents or other liquid or solid matter which might become separated from the product gas in the course of transportation through pipeline or tube trailer. Product gas shall meet all requirements of SAE J1616.

3. The BUS shall produce a waste gas that is combustible by the thermal oxidizer without the need for a supporting fuel flow other than for pilot fuel.

4. The BUS shall be capable of changing capacity at a minimum rate of 10% per adsorption cycle.

C. DESIGN REQUIREMENTS:

1. Motors shall meet requirements of Section 11060.

2. Hazardous electrical classification shall be Class I, Division 1, Group D within a 10 foot envelope of gas equipment, valves and appurtenances and Class I, Division 2 Group D within a 5 foot envelope on all sides of the Division 1 envelope as defined by NFPA 70 NEC.

3. The BUS shall have a maximum sound limits as follows:

   a. 82 dBA at all points on a 10 foot boundary from the compressor skid

   b. 82 dBA at all points on a 10 foot boundary from the vacuum pump / PSA skid

   c. 82 dBA at all points on a 10 foot boundary from the vacuum pump / PSA skid

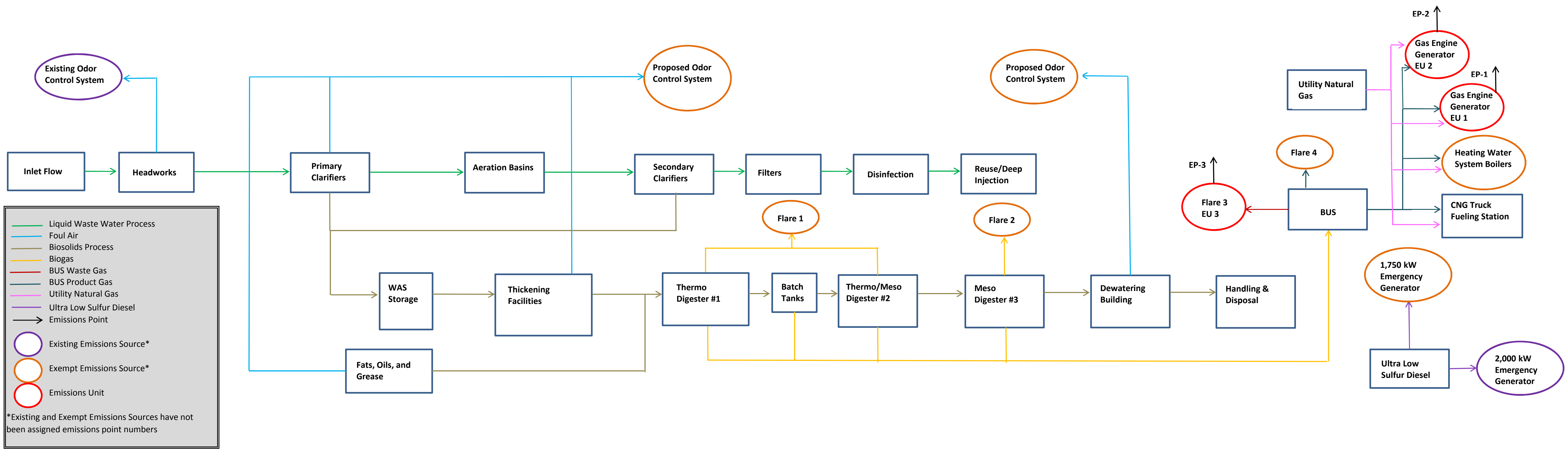
   d. 87 dBA at all points on a 10 foot boundary from the buffer vessels and vacuum pump / PSA skid during pressure equalization step

ATTACHMENT D – COMPREHENSIVE PROCESS FLOW DIAGRAM

St. Petersburg - SW WRF

Biosolids Improvement Project (BIP)

Comprehensive Process Flow Diagram

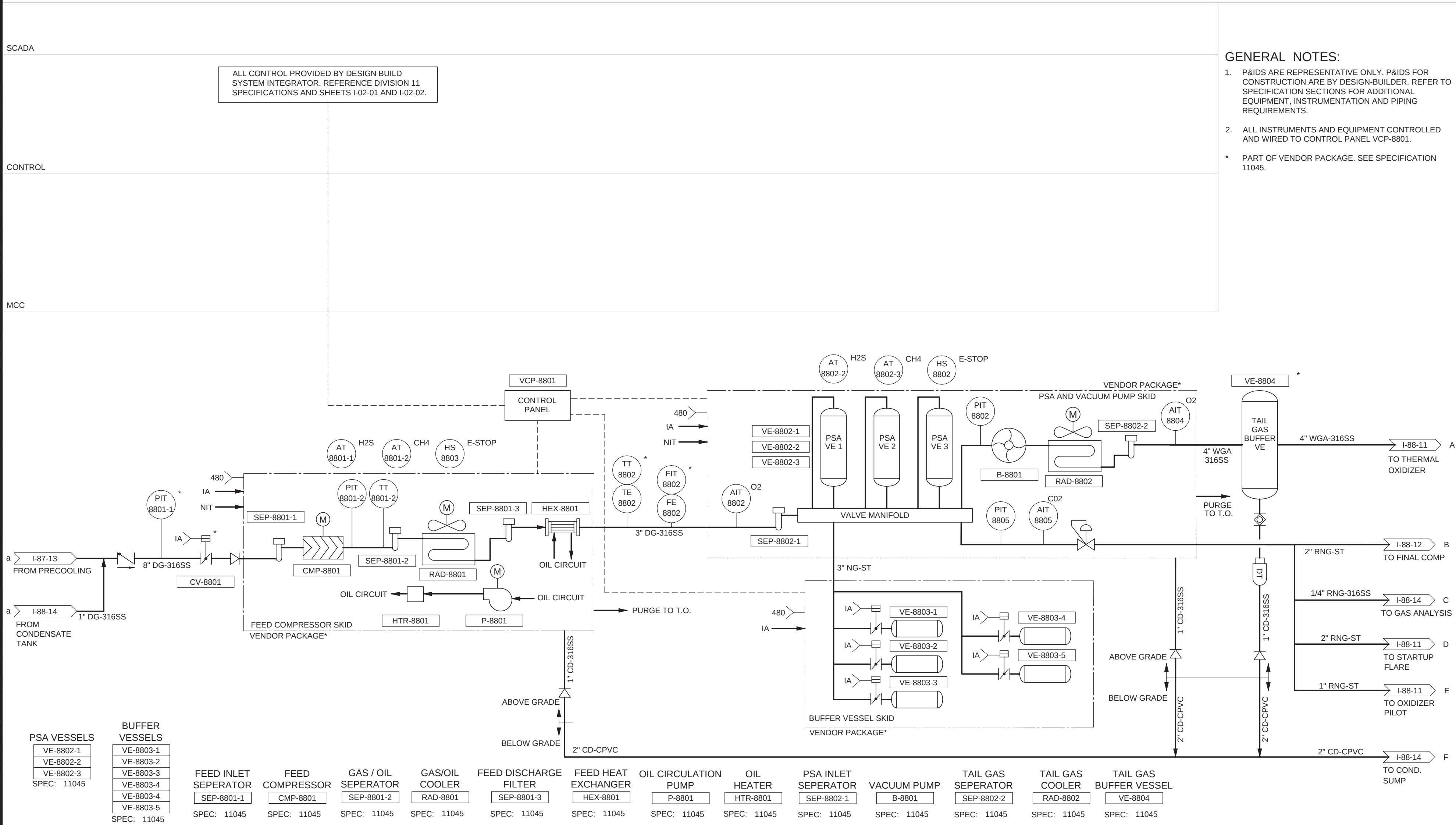


ATTACHMENT E – BUS PROCESS FLOW DIAGRAM

GENERAL NOTES:

1. P&IDS ARE REPRESENTATIVE ONLY. P&IDS FOR CONSTRUCTION ARE BY DESIGN-BUILDER. REFER TO SPECIFICATION SECTIONS FOR ADDITIONAL EQUIPMENT, INSTRUMENTATION AND PIPING REQUIREMENTS.
2. ALL INSTRUMENTS AND EQUIPMENT CONTROLLED AND WIRED TO CONTROL PANEL VCP-8801.

* PART OF VENDOR PACKAGE. SEE SPECIFICATION 11045.



Brown AND Caldwell
TAMPA, FLORIDA

SUBMITTED: PROJECT MANAGER DATE
APPROVED: BROWN AND CALDWELL DATE

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)

DESIGNED: B DICKERSON
DRAWN: L DOFFLEMYER
CHECKED: B ELEAZER
CHECKED: B DICKERSON
APPROVED: J DIEDRICH

EXTERNAL REFERENCE FILES
144490-TBK-0000-01.dwg

60% SUBMITTAL

THIS DRAWING IS NOT VALID FOR CONSTRUCTION PURPOSES UNLESS IT BEARS THE SEAL AND SIGNATURE OF A DULY REGISTERED PROFESSIONAL

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

CITY OF St. PETERSBURG
3800 54th AVE. S
St. PETERSBURG, FL. 33711

BIOSOLIDS TO ENERGY

INSTRUMENTATION

BIOGAS UPGRADE SYSTEM

FILENAME 144490-I-88-10.dwg
BC PROJECT NUMBER 144490
CLIENT PROJECT NUMBER ----
DRAWING NUMBER I-88-10
SHEET NUMBER ---- OF

DECEMBER 2013

Dec 04, 2013 - 11:09am
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ATTACHMENT F - GAS ENGINE GENERATOR DESIGN SPECIFICATION

Code in conjunction with ASCE 7. The facility is located in a wind-borne region. The enclosure shall meet the following conditions:

Wind velocity, mph	160	mph
Exposure Coefficient	Exposure C	
Structure Importance Factor	1.15	

2-2.02. Performance Requirements. The engine-generator unit shall at a minimum be capable of utilizing natural gas at the design conditions as specified herein.

Generator minimum nominal power rating capacity without accessories and operating on natural gas at standard conditions at 1.0 power factor (PF)	1,100	kW
Frequency	60	Hz
Power factor	0.8	
Terminal voltage	3 phase, 4 wire, 12,470	volts
Maximum engine speed	1,800	rpm
Duration of run, other than routine maintenance.	24 hours per day 7 days per week 8,760 hours per year	
Noise limit at 10 meters.	65	dBA

Maximum engine emission limits

Nitrogen Oxides (NOx)	1.0	g/bhp-hr
Carbon monoxide (CO)	2.0	g/bhp-hr
NMHC or VOC	0.5	g/bhp-hr

Engine cooling requirements:

Engine jacket water loop

Medium	Glycol/Water	
Flow	275	gpm
Inlet temperature to engine	185	F
Maximum outlet temperature from engine	200	F