APENDICE C

Estudio de Impacto a la Calidad del Aire Ambiental

Noviembre 2010

Declaración de Impacto Ambiental – Preliminar

Planta de Generación de Energía Renovable y Recuperación de Recursos

BARRIO CAMBALACHE DE ARECIBO

EnergyAnswers Arecibo

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Renewable Power Generation
and Resource Recovery Plant

Arecibo, Puerto Rico

Air Quality Analysis Technical Report

PRELIMINARY EIS

OCTOBER 2010

Air Quality Analysis Technical Report

Preliminary Environmental Impact Statement

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Executive Summary

Energy Answers is proposing to construct an electric generating facility capable of producing approximately 80 megawatts (MW) of renewable power. The facility will be fueled primarily by Processed Refuse Fuel (PRF), and will have the capability to supplement PRF with Automotive Shredder Residue (ASR), shredded urban wood waste, and tire chips. The proposed facility will be located in Arecibo, Puerto Rico.

Existing air quality in Arecibo is monitored by USEPA and the Puerto Rico Environmental Quality Board (EQB). Based on actual air quality monitoring data and designations by USEPA, this region is attaining the National Ambient Air Quality Standards (NAAQS).

Air quality impacts are assessed for this proposed project qualitatively for construction activities, and quantitatively for the potential emissions when the facility is in operation. Quantitative impacts are assessed by (1) developing air emission rates of regulated air pollutants and (2) executing an atmospheric dispersion model to estimate impact to criteria pollutant concentrations and potential plume visibility from the proposed project. The USEPA's AERMOD modeling system was used for this evaluation.

The construction phase activities would likely impact near-field air quality in an insignificant fashion. Emissions of particulate matter from both the earthmoving activities and construction equipment exhaust are expected to occur intermittently and within the immediate vicinity of the project site. Impacts from PM are expected to be minimal, to be in the immediate vicinity of construction operations, and are expected to dissipate quickly from the area. Impacts would also we very limited in duration, occurring just during construction of the facility.

During the operational phase, emissions from the facility would be expected year round from the sources except during routine shutdown and maintenance activities. The emission sources proposed for construction and operation include: bottom ash processing, fly ash processing, oil-fired boilers, cooling towers, and an emergency generator and fire water pump. Potential maximum emissions were modeled and compared with the Prevention of Significant Deterioration (PSD) Significant Impact Level (SIL) thresholds. Maximum ambient air impacts were found to be below the PSD SIL for all modeled regulated air pollutants except for nitrogen dioxide (NO2) and sulfur dioxide (SO2) impacts averaged on a 1-hour basis. Impacts below the SIL can be considered de minimis. For the 1-hour NO2 and SO2, a limited cumulative air modeling analysis was completed, including other permitted emission sources in the

area that could contribute to potential impacts from the proposed Energy Answers facility. Results for the limited cumulative impact analysis indicate that the potential maximum air impacts are below the National Ambient Air Quality Standards (NAAQS) for NO2 and SO2, averaged on a 1-hour basis.

Visibility impacts were simulated and assessed for the stack plume in the immediate area around the project site and at several distances from the plant site. The visibility impacts are predicted to be insignificant.

1. Introduction

1.1 Purpose of this Technical Report

This document is a technical appendix to the Preliminary Draft EIS (PDEIS) and assesses, in detail, the impacts of the proposed project on air quality. Impacts to air quality have potential consequences of increasing concentrations of regulated air pollutants, degrading visibility, increasing deposition of acid gases to soils and plants, and stressing ecosystems adversely. Moreover, poor air quality can introduce additional stresses on the lung functions and respiratory systems in humans, especially in small children, the elderly, asthmatics, or those with other respiratory ailments. This report also summarizes the key air regulations that will apply to the project due to the potential emissions and processes proposed for installation.

1.2 Project Description

Energy Answers Arecibo, LLC (Energy Answers) is an award-winning[1], international designer, developer, owner and operator of environmentally sound resource recovery systems. Energy Answers is proposing to construct electric generating facility capable of producing approximately 80 MW of renewable power. The plant will be fueled primarily with Processed Refuse Fuel (PRF) and have the capability to be supplemented with Automotive Shredder Residue (ASR), shredded urban wood waste, and tire chips. The facility will be located in Barrio Cambalache, Arecibo Puerto Rico, at the site of the former Global Fibers paper mill. Figures 1-1 and 1-2 illustrate the location of the proposed project site. This project represents a move toward decreasing landfill of waste, reducing the use of fossil fuel and increasing the renewable energy supply on the grid in Puerto Rico.

The facility will have the following air emission sources:

- Two (2) spreader-stoker boilers rated at 500 MMBtu/hr each, equipped with three (3) 167 MMBtu/hr fuel oil-fired burners each;
- Ash handling conveyors
- Three storage silos
- One cooling tower with 4 cells (air-cooled condenser type);

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[1] In 1996, SEMASS was awarded the Ecological Society of America's Corporate Award for Resource Recycling, recognizing its "record of remarkable reduction of waste flow combined with environmental concern, done profitably and on a large regional scale."

- One (1) diesel-fired emergency generator set; and
- One (1) diesel-fired emergency fire water pump

The site layout is depicted in Figure 1-3. In addition to power production, the facility will pre-process municipal solid waste (MSW) into PRF and will process bottom ash and fly ash on site. PRF processing technology developed by Energy Answers maximizes the recovery of energy and marketable materials from MSW and other non-hazardous commercial and light industrial waste streams. This technology has been implemented at the SEMASS Resource Recovery Facility located in Rochester, Massachusetts. SEMASS has been in commercial operation since January 1989.

The supplementary fuels (ASR, urban wood waste and TDF) to be used in conjunction with the PRF will be pre-processed off site by the suppliers.

The proposed facility will include a system for processing bottom ash. This system is designed to recover ferrous and non-ferrous metals and will produce a granular material known as Boiler Aggregate™ (BA™). Boiler Aggregate can be used as filler for roadway asphalt and in the manufacture of concrete blocks, among many other applications. Energy Answers also proposes to process the fly ash using a separate and independent system that will condition it for reuse as a marketable material.

For the purposes of this study, operations at the facility are assumed to occur continuously, 24 hours per day, 365 days per year although, in actuality, there will be scheduled shutdowns for maintenance.

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2. Existing Conditions

2.1 Regional Climate

Puerto Rico is generally affected by easterly trade winds, with a daily land/sea breeze that is found within the wind circulation pattern. Sea breezes tend to blow in an east-southeast direction across the land during the day. At night, the wind pattern changes to blow off-shore (land breezes). Precipitation generally falls in the afternoons as small showers or thunderstorms. Puerto Rico is within the tropical hurricane region of the Caribbean Sea. Consequently, the island is subject to infrequent tropical storms and hurricanes from approximately June through November. Due to its tropical location near the equator, the temperature does not change more than approximately 6°F between winter and summer months, ranging between 76 °F to 79 °F through the course of the year.

2.2 Ambient Air Quality

The Clean Air Act, which was last amended in 1990, regulates air quality by requiring the United States Environmental Protection Agency (EPA) to establish the National Ambient Air Quality Standards (NAAQS) for airborne compounds that have been shown to cause degradation to the quality of ambient air. These compounds are commonly referred to as the “criteria” air pollutants. . The NAAQS are set for various averaging times at levels which are protective of public health and welfare with an adequate margin of safety. The primary standards are intended to protect human health; and the secondary standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of air pollutants, such as damage to soils, vegetation and wildlife. The criteria air pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter with a diameter of 10 microns or less (PM_{10}), particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$), ozone (O_3), sulfur dioxide (SO_2), and lead (Pb). In January, 2010 and June, 2010, the EPA established one-hour average standards for NO_2 and SO_2, respectively. . The current NAAQS are presented in Table 2-1.

Table 2-1 National Ambient Air Quality Standards (NAAQS)

Pollutant	Type of Standard	Averaging Time	Concentration ($\mu g/m^3$)	Concentration (ppm)
Carbon Monoxide (CO)	Primary	8-hour (1)	10,000	9
	Primary	1-hour (1)	40,000	35
Nitrogen Dioxide (NO_2)	Primary and Secondary	Annual Arithmetic Mean	100	0.053
	Primary	1-hour (2)	188	0.1
Ozone (O_3)	Primary and Secondary	1-hour (3)	235	0.12
		8-hour (1997 std) (4)	156	0.08
		8-hour (2008 std) (4)	147	0.075
Particulate Matter (PM_{10})	Primary and Secondary	24-hour (5)	150	-
Particulate Matter ($PM_{2.5}$)	Primary and Secondary	Annual (Arithmetic Mean)	15.0	-
	Primary and Secondary	24 hour	35	-
Sulfur Dioxide (SO_2)	Primary	Annual Arithmetic Mean	80	0.03
	Primary	24-hour(1)	365	0.14
	Primary	1-hour(6)	195	0.075
	Secondary	3-hour	1,300	0.5
Lead (Pb)	Primary and Secondary	Quarterly Average	1.5	-
	Primary and Secondary	Rolling 3-Month Average	0.15	

$\mu g/m^3$ micrograms per cubic meter

ppm parts per million

(1) Not to be exceeded more than once per year

(2) 3-year average of the 98th percentile of the daily maximum 1-hour average

(3) Applies only in Early Action Compact Areas

(4) 3-year average of the fourth-highest daily maximum 8-hour average

(5) Not to be exceeded more than once per year on average over 3 years

(6) 3-year average of the 99th percentile of the daily maximum 1-hour average

The origination and potential effects of each of the criteria pollutants are briefly described below.

Carbon monoxide (CO) is a colorless gas that can interfere with the body's ability to carry and transfer oxygen through the blood to vital organs. CO is predominately emitted to the atmosphere from combustion sources such as motorized vehicles, industrial boilers and power plants that are fueled by fossil fuels. Exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, and put stress on the heart. Typically, the highest concentrations of CO can be observed near congested intersections, in parking garages, along high-volume roadways, and in urban areas where buildings and other features can inhibit natural dispersion.

Nitrogen dioxide (NO2) is a brownish gas that, like CO, is predominately emitted as a product of combustion. Nitrogen in combustion air and fuel is oxidized to nitrogen dioxide and other oxides of nitrogen (NOx) that subsequently convert to NO2 in the atmosphere. NOx formation has been found to be largely a function of the combustion temperatures where the greater the temperature, the more NOx emitted. Atmospheric NO2 has been found to be a major contributor to the formation of ozone. It can also be a significant source of nitrogen deposited in streams, ponds, lakes and soils where it can affect acidity, plant growth and dissolved oxygen levels in water.

Particulate matter (PM) emissions, classified as PM10 and PM2.5, originate from many types of industrial processes and from fossil fuel combustion, including diesel powered motor vehicles. Roadway construction activities also produce PM10 and PM2.5 emissions, although PM2.5 emissions are primarily formed from diesel engines rather than in dust generated from earthwork cut-and-fill activity. PM2.5 can also form from secondary atmospheric reactions of organic and inorganic compounds. Generally, particulate matter is a category made up of a combination of solid particles, aerosols and condensable compounds. Examples include dust, soot, smoke, metal fume, acid fume, ammonium sulfate and other carbonaceous matter. When inhaled, these materials can stress the respiratory system and heart. Particulate matter suspended in the atmosphere can also have a light-scattering effect that reduces visibility and can cause a visible haze.

Ozone (O3) is a secondary pollutant formed by atmospheric reactions involving volatile organic compounds (VOC) and NOx. Its formation is a complex process that depends on the intensity and spectral distribution of sunlight, atmospheric mixing and other atmospheric processes as well as the concentrations of NOx and VOC in ambient air. Ozone is highly reactive gas that can irritate and damage lung tissue, oxidize plant tissue, stunt plant growth and reduce agricultural crop yield. Since ozone formation occurs as a function of secondary reactions in the atmosphere, ozone is understood to be a pollutant that is monitored and controlled on a regional scale. Given the multitude of sources of NOx and VOC emissions throughout the project study area and throughout the region, and the inherent variability of sunlight and meteorological factors that contribute to ozone formation, it is beyond the scope of this evaluation to attempt to quantify the potential effects that this project could have on ozone concentrations in the study area.

Sulfur dioxide (SO2) emissions originate primarily from fossil fuel combustion at electrical utilities, industrial plants and, to a smaller extent, in diesel powered motor vehicles including locomotives. At combustion sources, SO2 emissions occur as a direct function of the sulfur present in the fuel, where sulfur is oxidized in the combustion process to SO2. When vented to the atmosphere, SO2 emissions can react with water to form sulfuric acid and sulfate that eventually gets deposited to soils and waterways as particles or droplets. Similar to nitrogen deposition, sulfur deposition can increase the acidity of soils and water which has the effects of depleting nutrients and reducing viability. In addition, SO2 concentrations in ambient air have been found to cause acute respiratory symptoms and diminished ventilator function, especially in children.

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from motor vehicles dramatically declined in the last two decades. Today, the highest levels of lead in air are usually found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

In humans, Pb gets distributed throughout the body in the blood and accumulates in the bones. Depending on the level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system (e.g., high blood pressure and heart disease). Lead exposure also affects the oxygen carrying capacity of the blood. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioral problems, learning deficits and lowered IQ.

2.3 Methodology for Assessing Existing Conditions

Existing air quality conditions were evaluated primarily on the basis of actual monitoring data collected for criteria air pollutants. Depending on whether monitoring data indicate that the ambient concentrations of the criteria pollutants meet the NAAQS, EPA designates geographical areas as "attainment," "non-attainment," or "unclassifiable" for each criteria pollutant. An attainment designation indicates that the area or region has ambient concentrations that are below the NAAQS, whereas a designation of "non-attainment" is given for areas that violate or have contributed to violations of the NAAQS. "Unclassifiable" areas are those where a positive designation cannot be made due to insufficient monitoring data.

2.3.1 NAAQS Attainment Status for the Project Site

The USEPA has classified the Municipality of Arecibo and the surrounding area as being in compliance with the NAAQS (attainment) for each criteria pollutant. The USEPA and Puerto Rico Environmental Quality Board maintain air quality monitoring stations that measure actual ambient air concentrations of the criteria pollutants. Based on the recorded data collected at the ambient air monitors for Puerto Rico, the following table lists the actual recent monitored values recorded for the area as reported by the USEPA AirData database.

Table 2-2 Actual Ambient Air Quality Measurements

Monitor ID	Year	Municipality	Pollutant	Averaging Period	Concentration (µg/m^3)	NAAQS (µg/m^3)
721270003	2008	San Juan	PM10	24-hour	78	150
720010002	2008	Adjuntas	PM2.5	24-hour Annual	10.5 5.21	35 15
720170003	2005	Barceloneta	SO_2	1-hour 3-hour 24-hour Annual	86.5(1) 39.3 15.7 7.86	195 1300 365 80
720330008	2006	Catano	NO_2	1-hour Annual	72(2) 18.9	188 100
721270003	2008	San Juan	CO	1-hour 8-hour	4255 2645	40,000 10,000
721270003	2008	San Juan	Pb	3-month average	0.05	0.15

(1) Value represents the maximum recorded concentration in 2005, however, the NAAQS is the 3-year average of the annual 99th percentile of daily maximum 1-hour measurements. The 1 hour SO2 standard was recently finalized by USEPA in 2010. Official ambient monitoring values for the 1 hour SO2 standard have not yet been published.

(2) Value represents the maximum recorded concentration in 2006, however, the NAAQS is the 3-year average of the annual 98th percentile of daily maximum 1-hour measurements. The 1-hour NO2 standard was recently finalized by USEPA in 2010. Official ambient monitoring values for the 1-hour NO2 standard have not yet been published.

2.3.2 Hazardous Air Pollutants

In addition to the criteria air pollutants, the Clean Air Act identified 188 chemical compounds or groups of compounds as being toxic to human health or the environment referred to as hazardous air pollutants (HAP). Several of these compounds are predicted to be present in the exhaust from the proposed facility; however, there are no ambient air quality standards for these compounds except for lead. EPA has taken a technology-based approach for regulating HAPs. Standards for HAP are issued under the National Emissions Standards for Hazardous Air Pollutants (NESHAPs) under which Maximum Achievable Control Technology (MACT) standards are imposed on qualifying specific emission source categories that emit HAP. Energy Answers proposes to install an air quality control system that will meet or exceed the applicable MACT standards for HAP compounds.

2.3.3 Regional Haze and Visibility

Regional haze is a reduction in visibility caused by the combined effect of particles and gases in the atmosphere that scatter and absorb light over a wide geographic area. The reduction in visual clarity that results (haziness) is technically referred to as “light extinction.” Evaluations of both particles and gases indicate that the presence of fine particles (PM2.5) in the atmosphere is the primary cause of regional haze. These particles consist of ammonium sulfate, organic carbon, elemental carbon, ammonium nitrate, and soil and can be present as a result of natural processes or human activity.

Under the Clean Air Act Regional Haze Program, visual air quality in 156 Class I areas across the country is being monitored. The states with Federal Class I areas are required to establish a baseline visibility value 2000-2004 from which future improvements will be gauged. Since visibility conditions are not constant, but rather vary with changing natural processes that can lead to high short-term impacts, the rate of improvement in visual quality is measured over a long-term averaging period (5 years). Specifically, visual quality is measured in terms of the 20 percent clearest (best) days and the 20 percent haziest (worst) days over a 5-year period. The ultimate goal of the Regional Haze Program is to restore visual clarity to the level defined as the “natural visibility conditions” for the 20 percent haziest days and prevent the 20 percent best days from getting worse. Natural visibility conditions represent the long-term degree of visibility that is estimated to exist in the absence of human-caused effects.

Visibility conditions, progress goals, and changes in natural visibility conditions are expressed in terms of deciview (dv) units, per 40 CFR 51.308(d)(1). The deciview is a unit of measurement of haze that indicates changes in perception of haziness (derived from light extinction). The approved methodology for calculating visibility in Federal Class I areas was established by the Interagency Monitoring of Protected Visual Environments (IMPROVE). Concentrations of particulate matter species are summed in conjunction with the relative humidity averages for a given area.

States are required to establish baseline values using visibility data collected from 2000-2004 to develop strategies for improving visibility in the Federal Class I areas, and to implement these strategies in a State Implementation Plan (SIP) for Regional Haze. The SIP submittals were due no later than 2008. Because regional haze is due to a wide number of influencing human activities and air currents that do not recognize state boundaries, many states are working together in regional partnerships to establish policies and goals for regional haze improvements (e.g., VISTAS).

The closest designated PSD Class I area is Virgin Islands National Park, located on the island of St. John, approximately 170 km east of the proposed site. Given the relatively large distance, visibility modeling would not yield reliable or meaningful results. Therefore, no further analysis for potential Regional Haze impacts was completed.

3. Air Quality Impacts

3.1 Air Impact Criteria

Impacts to air quality from construction or operation would require mitigation if one of the following occurred:

- Emissions from the proposed project are predicted to result in a violation of federal or Puerto Rico Environmental Quality Board air quality standards
- Emissions from the proposed project qualifying as a major source of air pollution
- Emissions from the proposed project predicted to contribute to a violation or worsen an existing violation of the NAAQS
- Emissions from the proposed project predicted to cause incremental increases of air quality pollutants exceeding the allowable limit under the Prevention of Significant Deterioration (PSD) regulations for Class I and II areas

An air quality analysis, including completion of an inventory of potential emissions and conducting dispersion modeling, serves as the basis for evaluating the potential air quality impacts from the proposed facility.

3.2 Applicable Air Regulations and Limitations

The proposed project will be subject to both federal and Puerto Rico air quality control regulations and emission limits. Emissions from the proposed facility will be limited to comply with regulations under the following programs:

- Federal New Source Review PSD regulations for major new sources including:
  - Site-specific Best Available Control Technology (BACT) emission limits
  - Air Dispersion Modeling Impact Analysis to quantify the potential change in ambient air quality from the proposed facility
- Federal New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)

- Puerto Rico preconstruction approvals
- Puerto Rico emission standards

A description of these applicable requirements is given below.

3.2.1 Federal PSD Permitting

Based on the size of the facility, and in accordance with Puerto Rico and federal regulations, Energy Answers must obtain a Prevention of Significant Deterioration (PSD) air permit prior to beginning construction, in accordance with permitting procedures per 40 CFR Part 52.21 and PR Rule 203. This permit application will be submitted to the United States Environmental Protection Agency Region 2 for approval to construct and operate the proposed facility. The proposed project area location is currently designated as in attainment of National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. The attainment status for the area is an important factor in determining the necessary review procedures for the proposed project.

The USEPA adopted PSD regulations (40 CFR 51) pursuant to the CAA Amendments of 1977 that outlined a detailed PSD program. The objectives of the PSD permit program regulations are (1) to ensure that economic growth will occur in harmony with the preservation of existing clean air resources; (2) to protect ambient air quality from degrading as a result of increased emissions from new major stationary sources or from expanding existing emission sources; and (3) to preserve air quality in special areas such as national parks and wilderness areas. The primary provisions of the PSD regulations require new major stationary sources and major modifications to be examined prior to construction to ensure compliance with the NAAQS and applicable PSD air quality allowable “increments”. The PSD program also requires new major projects to install the best available control technology (BACT) to reduce its emissions.

A new source of air pollution is subject to the PSD regulations if it is proposed to be located in an attainment area and it qualifies as a major stationary source. A major stationary source is any source included on a list of 28 specified categories which has the potential to emit 100 tons per year (tpy) or more of any pollutant regulated under the CAA and any unlisted sources with emissions of a regulated pollutant of greater than 250 tons per year (tpy). The proposed Energy Answers facility falls within a PSD Source Category and is subject to the 100 tons per year major source threshold. Based on the proposed facility’s potential to emit, it will be a PSD major source subject to the PSD preconstruction review and permitting procedures for several criteria pollutants and other regulated air pollutants. Table 3-1 summarizes the PSD applicability by emission rate.

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Table 3-1 PSD Applicability

Pollutant	PSD Major Source [1] (tons/year)	Potential Emission Rate[2] (tons/year)	PSD Review Required
Carbon Monoxide	100	702	Yes
Nitrogen Oxides	100	347	Yes
Sulfur Dioxide	100	256	Yes
Particulate Matter (PM)	100	46.1	No
Particulate Matter < 10 microns (PM10)	100	45.1	No
Particulate Matter < 2.5 microns (PM2.5)	100	24	No
Volatile Organic Compounds	100	63	No
Lead	0.6	0.25	No
Asbestos	0.007	N/A	No
Beryllium	0.0004	0.003	Yes
Fluorides (as HF)	3	13	Yes
Mercury	0.1	0.06	No
Sulfuric Acid Mist	7	55	Yes
Hydrogen sulfide (H2S)	10	N/A	No
Total Reduced Sulfur Compounds	10	N/A	No
Vinyl chloride	1	N/A	No
Municipal Waste Combustor Organics (measured as total tetra-thru octa-chlorinated dibenzo-p-dioxins and dibenzofurans)	3.5E-6	4.5E-5	Yes

(1) Source: 40 CFR 52.21
(2) Estimated maximum annual emission rates assume both boilers operate at a heat input rate of 500 MMBTU/hr for 8760 hours

The EPA Region 2 office is responsible for issuing the PSD permit for Energy Answers and other major sources in Puerto Rico. As part of the PSD permitting program, Energy Answers must evaluate air pollution control technologies that are available for each pollutant that will potentially be emitted in "significant" quantities. A "top-down" evaluation must be completed to determine which emissions control technology is the Best Available Control Technology (BACT) for each pollutant. In addition to the BACT analysis, Energy Answers is required to complete an air quality impacts analysis and secondary impacts analysis as part of the PSD application process. The analyses require that the applicant use USEPA-approved air dispersion modeling methods to predict the maximum ambient air impacts of the regulated air pollutants.

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3.2.2 New Source Performance Standard (NSPS) Requirements

The New Source Performance Standards (NSPS), codified under 40 CFR Part 60, specify the minimal performance requirements for certain new or modified air emission sources. The proposed Energy Answers facility will be subject to the following NSPS under 40 CFR Part 60:

- Subpart A – General Provisions
- Subpart Da – Electric Utility Steam Generating Units
- Subpart Eb – Large Municipal Waste Combustors
- Subpart IIII – Stationary Compression Ignition Internal Combustion Engines

A summary of the requirements of each of these rules to the proposed facility is given below:

3.2.2.1 Subpart A – General Provisions

Certain provisions of 40 CFR Part 60 Subpart A (General Provisions) apply to the owner or operator of any stationary source subject to a NSPS. Based on the proposed plant design and equipment specifications, the facility will be subject to NSPS Subparts Da, Eb and IIII. The specific requirements of each of these rules are described in further detail in the subsections below. In addition to the emission limits and operating requirements provided within each individual NSPS, Energy Answers is required to comply with General Provisions of Subpart A. The applicable General Provisions include *§60.7 (Initial notification and recordkeeping); §60.8 (Performance Tests); §60.11 (Compliance with standards and maintenance requirements); §60.13 (Monitoring requirements); and, §60.19 (General notification and reporting requirements)*.

3.2.2.2 Subpart Da – Standards of Performance for Electric Utility Steam Generating Units

Subpart Da regulations apply to (fossil-fuel fired) electric utility steam generating units for which construction, modification, or reconstruction commenced after September 18, 1978, and which have a heat input capacity of greater than 250 MMBtu/hour. Since the fuel oil burners will collectively have a heat input greater than 250 MMBtu/hr (each is rated at 167 MMBtu/hr) and meet the “steam generating unit” definition, they will be subject to NSPS Subpart Da. Subpart Da specifies emission limitations, monitoring, recordkeeping and reporting requirements for PM, NO_x, SO_2, and opacity.

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Table 3-2 NSPS Subpart Da Emission Limits

Parameter	Subpart Da Limit	Operating Scenario	Averaging Period
Particulate Emissions	0.14 lb/MWh or 0.015 lb/MMBtu	Any Fuel	Continuous
	<u>or</u> 0.03 lb/MMBtu and 99.9% reduction		
	<u>or</u> 99.8% reduction		
Opacity	20 %	Any Fuel	6-minute average
	CEMS for PM		
SO2	1.2 lb/MMBtu	Solid Fuel	30 day rolling average
	0.54 lb/MMBtu	Liquid or gaseous Fuel	
NOx	1.0 lb/MWh	Any Fuel	30 day rolling average

3.2.2.3 Subpart Eb – Standards of Performance for Large Municipal Waste Combustors

NSPS Subpart Eb applies to individual Municipal Waste Combustor (MWC) units with capacities greater than 225 mega grams per day (approximately 250 tons/day). Under 40 CFR 60.51b, municipal solid waste is defined to include "refuse-derived fuel." Since the proposed facility will use an average of 2,100 tons per day (1,050 tons per day per boiler) of processed refuse fuel, the provisions of Subpart Eb will apply. Emission standards are given for metals, opacity, acid gases, dioxins and furans, NOx, and fugitive emissions from ash handling. Each of the emission limits are listed in Table 3-3. Subpart Eb also provides requirements that the owner or operator implement Good Combustion Practices for minimizing emissions of CO, dioxins and furans, and particulate matter. Additionally, Subpart Eb specifies requirements for siting the facility, implementing management planning, preparing a materials separation plan, and conducting operator training.

Table 3-3 NSPS Subpart Eb Limits

Parameter	Subpart Eb Limit	Units	Averaging Period
Particulate Matter	20	mg/dscm	
NOx	150	Ppmvd	daily 24-hour arithmetic average
CO	150	Ppmvd	
SO2	30	Ppmvd	daily 24-hour geometric mean
	80	% reduction	
Cadmium	10	ug/dscm	
HCl	25	Ppmvd	
	95	% reduction	
Lead	140	ug/dscm	
Mercury	28	ug/dscm	
Total Dioxons / Furans	13	ng/dscm	
Opacity	10	Percent	6-minute average
Fugitive Emissions from Ash Handling	5	Percent	3 hour observation period
Load Level	110	percent of maximum load during dioxin/furan test	4-hour block average
PM Control Device Inlet Temperature	17	degrees Centigrade above maximum temp during dioxin/furan test	4-hour block average

3.2.2.4 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Subpart IIII applies to stationary compression ignition (CI) internal combustion engines (ICE) that commence construction after July 11, 2005, where the CI ICE are manufactured after April 1, 2006 (for engines which are not fire pumps) or after July 1, 2006 (for NFPA fire pumps). This subpart will be applicable to the facility's emergency generator and fire water pump.

3.2.3 National Emission Standards for Hazardous Air Pollutants

The proposed Facility will have the potential to emit greater than 10 tons per year of any single HAP. Therefore, the facility will be a major source under Section 112 of the CAA. Section 112 provides technology-based standards that reduce emissions of HAP nationally. The NESHAPs are codified in 40 CFR Part 63. The proposed Renewable Energy Plant includes an air quality control system that will achieve a level of control on HAP that can be considered "new source MACT" level of control. Specifically, the Turbosorp®, in combination with the fabric filters, is designed to reduce emissions of HCl, HF, and particulate HAP. Similarly, the activated carbon injection system, in combination with the fabric filters, is expected to reduce potential mercury and dioxins/furans to levels of control that can be considered to be MACT. Finally, organic HAPs, which generally can be emitted as a result of incomplete combustion, will be minimized by maintaining high (combustion) temps and monitoring CO levels via a CEMS.

Additionally, Energy Answers will comply with 40 CFR 60, Subpart Eb which includes emission standards for HAP compounds, and generally was developed based on a procedure similar to MACT.

The Reciprocating Internal Combustion Engine (RICE MACT) applies to the diesel engines in the future as re-proposed by the USEPA on March 5, 2009. This rule is codified in 40 CFR 63, Subpart ZZZZ. Generally, Energy Answers will be installing new units which will be manufactured to comply with this rule.

3.2.4 Puerto Rico Preconstruction Approvals

Puerto Rico Rules 201, 202 and 203 describe the application content and Environmental Quality Board (EQB) review procedures for facilities proposing to construct a new major stationary emission source. Rule 201 specifically describes the Location Approval requirement in which a facility must prepare a demonstration that shows the proposed facility would not cause or contribute to a violation of the NAAQS. The proposed operations and air quality control equipment must be described and the emissions modeled in accordance with the provisions of Rule 202, unless otherwise exempt. Emission offsets are allowed, if necessary, for a source to demonstrate that impact will remain below the NAAQS. A public hearing must be offered as part of the location approval process. EQB makes a final determination of location approval within one year of receiving a complete application.

Per the exemptions allowed under paragraph (I) of Rule 201, the proposed Energy Answers facility is not required to include a modeling analysis as part of its Location Approval application since it will utilize more that 50 percent refuse derived fuel. Nevertheless, Energy Answers is completing an air quality impact modeling analysis under the requirements to obtain a preconstruction PSD air permit from the EPA and will also file an application to obtain a permit to construct from the EQB per Rule 203.

3.2.5 Puerto Rico Emission Standards

Rules 401 through 417 provide emission standards that apply to permitted facilities. Specific limitations are set on visible emission in Rule 403 where opacity is limited to 20 percent on a 6-minute average. Rule 406 specifies a limit on particulate emissions from fuel burning equipment of 0.30 pounds per million BTU. Rule 407 specifies an allowable emission rate of particulate matter from non-fuel burning equipment (e.g. storage silos and conveyors) based on the process weight rate through the equipment or emission source. The emission standards under these rules are overlapped by the emission limits that will be enforceable under the PSD permitting procedure. The PSD limit is expected to be equally stringent or more stringent than what is allowed by the Puerto Rico Air Quality Rules including Rules 403, 406, and 407. Therefore, when Energy Answers operates in compliance with the terms and conditions of its PSD permit, it will also operate in compliance with the Puerto Rico air quality Rules.

3.3 Air Quality Impacts Evaluation

3.3.1 Construction Impacts

Emissions of regulated air pollutants will occur at the site during the construction activities. Specifically, construction equipment will produce emissions from the diesel and gasoline fired engines, and the earth-moving activities will generate fugitive emissions of particulate matter. These emissions are temporary and at ground level, which results in potential impacts that are localized and insignificant. Energy Answers proposes to minimize the potential emissions during construction by implementing best management practices, such as using a water suppressant, for controlling fugitive dust generated from the earthwork activities and construction equipment movements. In addition, the construction equipment used will need to conform to USDOT and EPA non-road diesel emission standards, which minimize emissions of diesel particulate matter and other pollutants from the engine exhaust.

3.3.2 Operating Impacts

The majority of emissions will occur during typical operation once sources have been constructed. Pollutants expected to be emitted under operating conditions were quantified for evaluation in an air modeling analysis to predict impacts to air quality.

Facilities that require review under the PSD regulations must conduct an air quality impact analysis, using air dispersion modeling methods, for each pollutant emitted in major (significant) quantities. The purpose of the analysis is to demonstrate whether the proposed installation will meet applicable NAAQS and PSD allowable increments. In the event that predicted ambient air impacts are below Significant Impact Levels (SIL) defined in the regulations, no further analysis is necessary. SILs are a screening tool used to determine whether a proposed source’s emissions will have a “significant” impact on air quality in the area. If an individual facility is expected to result in an increase in air quality impacts less than the corresponding SIL, its impact is said to be *de minimis* and the applicant is not required to perform a more comprehensive, cumulative modeling analysis. A cumulative analysis involves measuring the impact of the new facility in addition to impacts from other existing sources in the area. This modeling analysis included a comparison of predicted impacts to the SILs. A limited cumulative modeling analysis was completed for emissions that exceeded the SILs.

The modeling results are also important when determining whether ambient air monitoring will be required for the project. The PSD regulations also require an applicant to conduct actual ambient air monitoring before construction can be approved. Similar to the SIL, the PSD regulations include Significant Monitoring Concentrations (SMC), which are the levels above which the permitting authority requires one year of pre-construction ambient air monitoring. If the dispersion model predicts ambient concentrations below the SMC, the source’s impact may be considered *de minimis* and the reviewing authority can exempt the application from preconstruction ambient monitoring.

The NAAQS, PSD allowable increment, SIL and SMC values are defined in 40 CFR Part 50 and are listed in Table 3-4.

Table 3-4 Ambient Air Quality Standards, PSD Increments, Significant Impact Levels, and Significant Monitoring Concentrations

Pollutant	Averaging Period	Ambient Air Quality Standards NAAQS(μg/m³)	PSD Increment Class II (μg/m³)	SIL (μg/m³)	SMC (μg/m³)
SO_2	1-hour	[1]195	none	8	none
	3-hour	1,300	512	25	none
	24-hour	365	91	5	13
	Annual	80	20	1	none
PM_{10}	24-hour	150	30	5	10
	Annual	Revoked	17	1	none
$PM_{2.5}$	24-hour	35	9	1.3[2]	4.0
	Annual	15	4	0.3[2]	none
CO	1-hour	40,000	none	2,000	none
	8-hour	10,000	none	500	575
NO_2	1-hour	188[3]	none	8	none
	Annual	100	25	1	14
Pb	3-month	1.5	none	none	0.1
Fluorides	24-hour	None	none	none	0.25

1. EPA issued the new 1-hour SO_2 NAAQS in June 2010. At the same time, EPA revoked the 24-hour and annual SO_2 NAAQS, although they will remain in effect temporarily until further rulemaking is finalized.

2. PM2.5 SIL, increments, and SMC were finalized on September 29, 2010. The effective date of the final rule is pending publication in the Federal Register, which has not occurred as of this writing.

3. EPA issued the new 1-hour NO_2 NAAQS in February 2010.

3.3.3 Air Modeling Methodology

In accordance with the procedures outlined in 40 CFR Part 51 Appendix W Guideline on Air Quality Models and PR Rules 201 and 202 an air dispersion modeling analysis was performed to evaluate the likely effects that the proposed plant emissions may have on ambient air quality. An air dispersion model incorporates the source-specific parameters such as stack height, exit temperature, flow rate, and spatial location with meteorological conditions and building geometry to approximate the dispersion characteristics of an exhaust plume across a study area. Dispersion modeling is used primarily to estimate the ambient concentration of the regulated air constituents within the surrounding air. The technical approach used to analyze the potential ambient air quality impacts from the proposed facility was developed in accordance with accepted practices and USEPA guidance.

3.3.4 Model Selection

For the purposes of this air dispersion modeling study, the EPA Regulatory Model AERMOD was used to predict the maximum ambient air quality concentrations of the regulated emissions. AERMOD (version 09292) was selected to predict ambient concentrations in simple, complex and intermediate terrain surrounding the proposed facility. The AERMOD Modeling System includes preprocessor programs (AERMET (version 06341), AERSURFACE (updated January 2008), and AERMAP (version 09040)) to create the required input files for meteorology and receptor terrain elevations. AERMOD is the recommended model in USEPA's *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) (USEPA 2005).

The land use data available through the United States Geological Survey (USGS) for Puerto Rico are not considered representative of the current conditions. Therefore, per USEPA direction, the AERSURFACE utility was not proposed to be used for this project. Rather, surface roughness numbers were calculated per the *ADEC Guidance for AERMET Geometric Means*, which was developed by the State of Alaska. This guidance provides the equations needed to calculate the surface roughness numbers for inclusion in AERMET. This guidance essentially replicates the procedure followed by AERSURFACE utility program, but with the land use data determined through satellite images and photographs. Further details regarding the surface parameters are given in section 3.3.14.

3.3.5 Model Options

The AERMOD "regulatory default" option was selected for this analysis. This model option directs AERMOD to use the following techniques:

- The elevated terrain algorithms requiring input of terrain height data for receptors and emission sources;
- Stack tip downwash (building downwash automatically overrides);
- The calms processing routines;
- Buoyancy-induced dispersion; and
- The meteorological processing routines that account for missing data.

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3.3.6 Emission Source Description

The proposed Energy Answers plant will install and operate the following air emission sources:

- Two (2) spreader-stoker boilers with a heat input rating of 500 MMBTU/hr each, equipped with three (3) 167 MMBTU/hr No 2 Fuel Oil-fired burners each;
- MSW receiving, processing and PRF storage operations;
- Fly and bottom ash transfer, processing and storage operations;
- Storage Silos (lime, pulverized activated carbon, flyash);
- One (1) cooling tower, with 4-cells (air-cooled condenser type);
- One (1) diesel fuel-fired emergency generator set; and
- One (1) diesel fuel-fired emergency firewater pump

3.3.7 Emission Control Systems

Energy Answers is committed to installing advanced air quality control systems on its power plant that qualifies as the Best Available Control Technology (BACT) for its operations. Independently operating air quality control systems will be proposed for each boiler, potentially consisting of the following technologies:

- An activated carbon injection system to remove heavy metals, including mercury and dioxins/furans;
- A Turbosorp Dry Circulating Fluid Bed Scrubber system to remove acid gases using lime injection
- A fabric filter (baghouse) to control particulate emissions (including metals); and,
- A regenerative selective catalytic reduction (RSCR) system for reducing emissions of nitrogen oxides (NO_x).

The boilers are expected to operate near the design heat input rating of 500 MMBTU/hr each. For the purposes of this air quality impact analysis, this is defined as the 100 percent load scenario. In addition to the 100 percent load, Energy Answers evaluated the 110 percent load (550 MMBTU/hr each) as representing the short-term maximum operating conditions.

3.3.8 Emission Source Stack Parameters

The air dispersion model requires the input of certain site-specific data to produce results that are representative of the actual site conditions. These data include stack coordinates, height, diameter, emission rates exit temperature and exit flow rate. Table 3-5 provides a list of these data estimated for the maximum short term (110% firing rate) and average sustainable (100% firing rate) operating scenarios.

Table 3-5 Source Stack Parameters and Emission Data

Source ID	Vent #	Boiler Load	Stack Height (m)	Stack Diam (m)	Exit Velocity (m/s)	Temp (K)	Emission Rate (g/sec)			
							CO	NOx	SOx	PM10
Boiler1	P-5	110%	95.52	2.13	32.81	431	11.09	5.46	4.06	0.634
		100%			28.82	431	10.08	4.97	3.69	0.577
Boiler2	P-6	110%	95.52	2.13	32.81	431	11.09	5.46	4.06	0.634
		100%			28.82	431	10.08	4.97	3.69	0.577
Cool1	P-11	N/A	10.7	9.14	7.62	311	N/A	N/A	N/A	0.0054
Cool2	P-12	N/A	10.7	9.14	7.62	311	N/A	N/A	N/A	0.0054
Cool3	P-13	N/A	10.7	9.14	7.62	311	N/A	N/A	N/A	0.0054
Cool4	P-14	N/A	10.7	9.14	7.62	311	N/A	N/A	N/A	0.0054
MSW1	P-1A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MSW2	P-1B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PRF	P-2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ash	P-15	N/A	20+/-	1.52	15.52	311	N/A	N/A	N/A	0.0322
Trans1	P-3	N/A	16.5	0.83	17.47	311	N/A	N/A	N/A	0.0216
Trans2	P-4	N/A	16.5	0.83	17.47	311	N/A	N/A	N/A	0.0216
Silo 1	P-9	N/A	13.1	0.18	18.59	311	N/A	N/A	N/A	0.00108
Silo 2	P7	N/A	30.5	0.18	18.59	311	N/A	N/A	N/A	0.00108
Silo 3	P-8	N/A	38.1	0.18	18.59	311	N/A	N/A	N/A	0.00108
Gen	P-16	N/A	10.0	0.152	49.2	779	1.097	2.70	0.00113	0.028
FWP	P-17	N/A	10.0	0.152	49.2	708	0.278	0.32	0.00021	0.014

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3.3.9 Emission Rate Calculations

Emission rate calculation were developed using equipment specifications, published emission factors, and the approximate design parameters for the proposed facility. Where appropriate, the emission calculations were based upon the proposed BACT performance levels that are guaranteed by the manufacturers of the equipment and control devices, and, therefore, represent conservative estimates of actual emissions.

3.3.9.1 Processed Refuse Fuel (PRF) Boilers

The boilers will emit NOx, SOx, PM, and CO. The technical approach for calculating the maximum potential to emit from the two PRF-fired boilers was to use the proposed BACT emission limits and control equipment vendor guaranteed outlet concentrations with the design outlet air flow specifications. Emissions representing a short-term maximum (110%) firing rate and a typical sustained (100%) firing rate were calculated and are provided in Attachment 1. Maximum hourly and annual emission rates are detailed in the table. For annual potential-to-emit (PTE) calculations, the two boilers were assumed to operate continuously for 8,760 hours per year at 100% design capacity.

3.3.9.2 Cooling Tower

The cooling tower is a potential source of particulate matter emissions. The maximum emission rates for PM, PM_{10}, and $PM_{2.5}$ were calculated based upon the equations and methods in AP-42 Chapter 13.4, design flow specifications, and actual water quality test data obtained for the potential cooling water supply source (Cano Triburones). These emission rates are further refined via a method developed by Reisman and Frisbie that is specific to cooling towers. The cooling towers are assumed to operate continuously for 8,760 hours per year at 100% design capacity for PTE calculations. The emission calculations for the cooling tower are provided in Attachment 1.

3.3.9.3 Lime and Ash Handling

Loading, unloading, and conveying activities associated with receiving, storing, and handling lime for the Turbosorp and ash from the boilers (both fly ash and bottom ash) can potentially result in emissions of particulate matter. Energy Answers proposes to control the potential emissions of particulate matter from its lime storage and ash handling operations by using fabric filters (baghouses). Emission rates of particulate matter are, therefore, developed based on the performance specifications given for the fabric filters and the maximum design exhaust air flow rates through the baghouses. Attachment 1 provides the calculations of particulate from the lime and ash handling activities.

3.3.9.4 Emergency Generator

The proposed emergency diesel generator will be approximately 670 horsepower. This unit will be new and, therefore, subject to the emission limits provided in NSPS Subpart IIII and NESHAP Subpart ZZZZ. These emission standards were conservatively used in conjunction with the emergency generator operating limit of 500 hours per year that EPA recommends using for emergency equipment in order to estimate the maximum potential to emit. Emissions of individual hazardous air pollutants are also estimated using conservative emission factors given in AP-42. Attachment 1 provides the emission rate calculations for the emergency generator.

3.3.9.5 Fire Water Pump

Energy Answers proposes to install one fire water pump with an approximate rating of 350 horsepower. Similar to the emergency generator, this unit will be new and, therefore, subject to the emission limits provided in NSPS Subpart IIII and NESHAP Subpart ZZZZ. These emission standards were used in conjunction with the operating limit of 500 hours per year to estimate the maximum potential to emit since it will be manufactured to meet these limits. Additional emissions are estimated using conservative emission factors given in AP-42. Attachment 1 provides the emission rate calculations for the emergency generator.

3.3.10 Startup and Shutdown Emissions

Each boiler will be equipped with three fuel oil burners rated at 167 MMBTU/hr each. Startup and shutdown procedures will require No. 2 fuel oil to be burned for approximately 12 hours. Emission rates during this period are summarized in Attachment 1. Emissions during startup and shutdown episodes will be vented through the control equipment which will actively minimize emissions.

3.3.11 Facility Potential To Emit Summary

Table 3-6 summarizes the potential annual emissions from the proposed facility as derived using the methods described above.

Table 3-6
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ARECIBO PUERTO RICO

Annual Emissions Summary - TPY

Pollutant	Boiler 1	Boiler 2	Ash Handling	Silos	EDG	FWP	Cooling Tower	Total	PSD Major Source TPY
PM	20.0	20.0	3.74	0.113	0.055	0.0277	2.03	46.1	**100**
PM10	20.0	20.0	3.74	0.113	0.055	0.0277	1.07	45.1	**100**
PM2.5	20.0	20.0	3.74	0.113	0.055	0.0277	0.0044	44.0	**100**
NOx	173	173	---	---	1.11	0.55	---	347	**100**
SO2	128	128	---	---	0.0007	0.00037	---	256	**100**
CO	350	350	---	---	0.96	0.48	---	702	**100**
VOC	35.0	35.0	---	---	0.055	0.0277	---	70.2	**100**
HCl	76.1	76.1	---	---	---	---	---	152	---
Mercury	0.0341	0.0341	---	---	7.75E-09	---	---	0.0682	**0.1**
Nickel	0.0121	0.0121	---	---	4.65E-08	---	---	0.024	---
Arsenic	0.00099	0.00099	---	---	1.09E-08	---	---	0.0020	**> 0**
Cadmium	0.0200	0.0200	---	---	2.84E-08	---	---	0.040	---
Chromium	0.00780	0.00780	---	---	1.49E-07	---	---	0.016	---
Lead	0.150	0.150	---	---	2.30E-08	---	---	0.30	**0.6**
TCDD-2378	2.61E-05	2.61E-05	---	---	---	---	---	5.21E-05	**3.50E-06**
Beryllium	0.0016	0.0016	---	---	6.46E-09	---	---	0.0032	**0.0004**
Fluorides (as HF)	7.01	7.01	---	---	---	1.87E-06	---	14.0	**3**
Sulfuric acid (as H2SO4)	30.7	30.7	---	---	---	---	---	61.3	**7**
Ammonia	28.4	28.4	---	---	---	---	---	56.7	---

3.3.12 Good Engineering Practice Stack Height

Prior to modeling, each emission point stack height must be evaluated relative to what is considered Good Engineering Practice (GEP) stack height, identified in federal regulation 40 CFR 51. GEP stack height is a measure for evaluating whether nearby buildings and outlying topography significantly affect the air dispersion patterns from the modeled source, resulting in conditions of aerodynamic downwash, including building cavity and wake effects. The building cavity is a region of turbulent, re-circulating airflow which extends downwind a distance of approximately three building heights from the structure. The building wake is a turbulent zone that extends from the cavity zone to a downwind distance of approximately ten (10) building heights from the structure. If a pollutant plume is entrained within these regions, nearby impact concentrations can be higher than in the absence of such effects. GEP also represents the maximum stack height allowable for a given source (beyond which additional dispersion credit is not acceptable) when conducting an air quality impact modeling analysis.

As a part of this dispersion modeling analysis, the USEPA-approved Building Profile Input Program -Prime (BPIPPRM Version 04274) was used for comparing the actual stack height for each source with its GEP stack height. In the instance where the actual stack height occurs below the GEP height, the BPIP program also calculates the appropriate direction-specific building dimensions for each wind direction (10-degree increments). This information is used by the AERMOD dispersion model to calculate the effects of the site-specific building downwash (cavity and wake effects) on ambient concentrations and the overall dispersion of the plume.

3.3.13 Meteorological Data

Careful consideration was given to selecting a location from which to obtain meteorological data to ensure the data is representative of conditions at the proposed project site. Complete meteorological data, collected at the San Juan International Airport station for the last five consecutive years (2005 to 2009) was obtained. Both the surface and upper air levels were available for this location. Additionally, one year of historical data (August 1992 to August 1993) was available from the Puerto Rico Energy Power Authority (PREPA) in Cambalache which has a meteorological station within one mile of the subject site in Arecibo. PREPA data were used in conjunction with the San Juan data from the 1992-1993 timeframe for completion of this modeling analysis. The San Juan meteorological data were determined to be reasonably representative of the proposed site. This was important in order to format and compile the 1992-1993 PREPA Cambalache meteorological data for use in the AERMOD modeling. The PREPA Cambalache data included wind direction, wind speed, temperature, and solar radiation. To complete the PREPA Cambalache meteorological data set so that it could be used in AERMOD, it was necessary to add data representing cloud cover, ceiling height, pressure, and relative humidity. Data were extracted from the 1992-1993 meteorological data set collected in San Juan for this purpose.

Surface and upper air input files for AERMOD were prepared using the AERMET processor programs. The inputs to AERMET for surface characteristics (surface roughness, Albedo and Bowen ratio) were determined based on land use in the area surrounding the anemometer site.

3.3.14 Land Use and Dispersion Coefficients

Electronic land use data that are available through the USGS for Puerto Rico are not considered representative of the current conditions. Therefore, per USEPA direction, the AERSURFACE utility was not be used for this project. Rather, surface roughness numbers were calculated per the ADEC *Guidance for AERMET Geometric Means*, which was developed by the State of Alaska. This guidance provides the equations needed to calculate the surface roughness numbers for inclusion in AERMET. This guidance essentially replicates the procedure followed by AERSURFACE utility program, but with the land use data determined through satellite images and photographs. The surface roughness calculated is representative of the sites where the meteorological data were collected: Cambalache, Arecibo, Puerto Rico (Latitude: 18.471553°; Longitude: -66.701673°) and Luis Munoz Marin International (SJU) Airport, San Juan, Puerto Rico (Latitude: 18.437484°; Longitude: -66.002791°). Twelve equal sectors were evaluated for two six-month periods; summer conditions (wet season) and winter conditions (dry season).

Based on climatological patterns for Puerto Rico, the region experiences two seasons: (1) a wet season from May through October, and (2) a dry season from November through April. During the wet season, the vegetation is lush and trees contain full foliage. For this reason, the Bowen ratio, albedo, and surface roughness values from the AERSURFACE guidance Mid Summer category were selected. During the dry season, scrubland vegetation and most trees maintain their foliage. However, most crop areas have been harvested and deciduous trees lose some foliage due to lack of water. Therefore, the Late Spring Category values from the AERSURFACE guidance were selected for the surface characteristics for the dry season.

In determining surface roughness coefficients, land use conditions out to a distance of one kilometer were assessed. The Bowen ratio and albedo were determined based on land use conditions out to a distance of 10 kilometers. The resulting surface characteristics are presented in Table 3-7 below.

Table 3-7 Surface Characteristics for the Cambalache Site for Summer and Winter Seasons

Sector (degrees)	Bowen Ratio	Albedo	Surface Roughness
0-30	0.107 (0.107)	0.102 (0.102)	0.155 (0.154)
30-60	0.127 (0.127)	0.107 (0.107)	0.201 (0.201)
60-90	0.405 (0.368)	0.157 (0.157)	0.192 (0.154)
90-120	0.311 (0.229)	0.160 (0.160)	0.176 (0.125)
120-150	0.847 (0.636)	0.172 (0.172)	0.285 (0.216)
150-180	0.693 (0.432)	0.173 (0.173)	0.172 (0.125)
180-210	0.655 (0.434)	0.172 (0.172)	0.117 (0.066)
210-240	0.646 (0.428)	0.172 (0.172)	0.111 (0.059)
240-270	1.263 (1.192)	0.178 (0.178)	0.167 (0.139)
270-300	0.156 (0.155)	0.110 (0.110)	0.032 (0.030)
300-330	0.100 (0.100)	0.100 (0.100)	0.009 (0.009)
330-360	0.100 (0.100)	0.100 (0.100)	0.007 (0.007)

Selection of the appropriate dispersion coefficients for air quality modeling is determined using the USEPA-preferred land use classification technique in 40 CFR 51, Appendix W (also known as the "Auer" technique). This classification technique involves assessing land use for Auer's categories within a three (3) kilometer radius of the site (Auer 1978). USEPA recommends using urban dispersion coefficients and mixing heights if greater than 50 percent of the area is urban; otherwise, rural coefficients and mixing heights apply. Based on an evaluation of land use in the vicinity of the site, approximately 20 percent of the area within three (3) kilometers is urban while rural land use constitutes approximately 80 percent. See Figure 3-1 for an aerial view of the study area with the surrounding land use identified. Based on the land use observed, the "rural" dispersion parameter is selected for this analysis.

3.3.15 Receptor Arrays

Coarse and dense grid receptor arrays were used to evaluate potential impacts. The dense grid is a Cartesian system that covers of 8 km by 8 km in area centered at the proposed project location. Receptors are located at the project boundary and extend outward in all directions. Receptor spacing from the project boundary is as follows:

- Inner grid = 25 m spacing out to a distance of 200 m;
- Second grid = 50 m spacing out to a distance of 400 m;
- Third grid = 100 m spacing to 0.5 km;
- Fourth grid = 500 m spacing out to a distance of 4 km;
- Outer grid = 1,000 m spacing out to a distance of 8 km.

The coarse grid also includes a polar coordinate grid extending out to 24 km from the center of the project location. Grid radials will be spaced every ten degrees and rings will be placed at 1-km intervals beginning 2 km from the project location center.

Receptor elevations were assigned using the USEPA's AERMAP software tool (version09040; USEPA 2009), which is designed to extract elevations from USGS National Elevation Dataset (NED) data at 1 degree (approximately 30 m) resolution in GeoTIFF format (USGS 2002). While 7.5-minute DEM data would be preferable as the 7.5-minute data provide better resolution, these data are not available for Puerto Rico. The one degree datum is acceptable internationally and adequately captures changes in elevation such as the mountain southwest of the subject site. AERMAP, the terrain preprocessor for AERMOD, uses interpolation procedures to assign elevations to a receptor. As a quality check procedure, a topographic map of the model region was generated from AERMAP elevations; this map was compared with the most recent available topographic maps to ensure accurate representation of terrain features were captured during the processing of AERMAP.

3.3.16 Air Quality Modeling Results

Table 3-8 lists the maximum modeled ambient air concentration for CO, PM10, PM2.5, NO2, and SO2 for all proposed emission sources in comparison with the PSD Class II Significant Impact Level (SIL). Two operating scenarios were modeled based on100% normal operating level and 110% peak operating level.

Table 3-8 Significant Impact Levels Evaluation

Parameter	Averaging Period		Maximum Concentration ($\mu g/m^3$)	Class II SIL ($\mu g/m^3$)	UTM Northing (meters)	UTM Easting (meters)
CO	1	High	136	2000	746602	2036551
	8	High	35	500	742658	2042988
PM10	24	High	4.3	5	742527	2042426
	Annual	High	0.85	1	742527	2042426
PM2.5	24	High	0.54	1.3	741561	2036624
	Annual	High	0.10	0.3	741663	2042191
SO2	1	High	49.8	8	742602	2035551
	3	High	16.6	25	742602	2035551
	24	High	3.45	5	741561	2036624
	Annual	High	0.64	1	741663	2042191
NO2 [1]	1	High	68	8	742739	2042949
	Annual	High	0.89	1	742637	2042975

1. NO_2 concentration estimated as 75% of the NOx predicted by modeling based on EPA Guidance for the Tier II NO2 calculation method (EPA, 2010).

Modeled concentrations below the SIL indicate that potential emissions will not cause or contribute to a violation of the NAAQS or PSD increment. Values shown for CO, PM10 and PM2.5 were found to be below their respective SIL, and no further analysis is required. Maximum modeled concentrations were found to exceed the one-hour SIL for SO2 and NO2. Concentrations of NO2 and SO2 were below the SIL for all other averaging times. Consequently, this evaluation includes a limited cumulative analysis in order to evaluate whether the NAAQS could potentially be exceeded for the1 hour NO2 and SO2 averaging period.

The limited cumulative impact analysis required that emissions from additional nearby major sources of SO2 and NO2 be included in the analysis. Energy Answers, with the assistance of PR EQB, collected emissions data from nearby emission sources and found that the nearest emission source that would likely influence the cumulative one-hour air quality impacts is the Puerto Rico Electric Power Authority (PREPA) Cambalache facility. The maximum permitted emission rates at the PREPA Cambalache plant were modeled using actual stack parameters and coordinates obtained from EQB. When modeling cumulative impacts, AERMOD was used with the same input specifications as described above. However, where the maximum impact is used for comparison to the SIL, the impacts representing the 98th and 99th percentile were used for the 1-hour NO2 and SO2 for comparison to the NAAQS. Results of this analysis are tabulated below.

Table 3-9 Model Results – Cumulative Impact Levels

Parameter	Averaging Period		Maximum Concentration ($\mu g/m^3$)	Background Ambient Concentration ($\mu g/m^3$)	Total Ambient Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
SO2	1	High	41.3	86.5	128	195
NO2	1	High	101[1]	72	173	188

1. NO_2 concentration estimated as 75% of the NOx predicted by modeling based on EPA Guidance for the Tier II NO2 calculation method (EPA, 2010). 1 hour NO2 Concentration reported is the 8th highest, representing the 98th percentile of the annual daily maximum 1 hour concentrations to show compliance with the NAAQS.

Based on these results, emissions from the proposed facility are expected to result in ambient concentrations that are below the NAAQS for NO2 and SO2. To date, there are no PSD increments for the one-hour NO2 and SO2 averaging periods. Emissions of PM10, PM2.5 and CO are estimated to result in ambient concentrations that are below the Significant Impact Level (SIL).

3.4 Summary of Air Quality Impacts

The results of this analysis indicate that the impacts during the construction phase of the project for the partial-build and build alternatives would be minor for during construction. The potential impacts from construction are temporary, short-term, localized increases in ambient concentrations that are prevalent in the active construction area. Long-range transport of pollutants during construction is not likely to occur to any quantifiable degree because the emissions are generated near ground level, whether they originate from the internal combustion engines of the construction equipment or from the dust-generating actions associated with clearing, excavation, grading or paving.

Potential air quality impacts during the facility operating phase are predicted to be below the PSD SIL thresholds for all but NO2 and SO2 on a 1-hour average. Therefore, these potential impacts can be considered insignificant and no further analysis is required. For the 1-hour NO2 and SO2, a limited cumulative impact analysis was completed, including the PREPA Cambalache facility located near the project site. Results of the cumulative impact analysis indicate that the 1-hour NAAQS for NO2 and SO2 will not be exceeded. Therefore, the potential impacts to air quality from the proposed facility are not considered significant.

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Figures

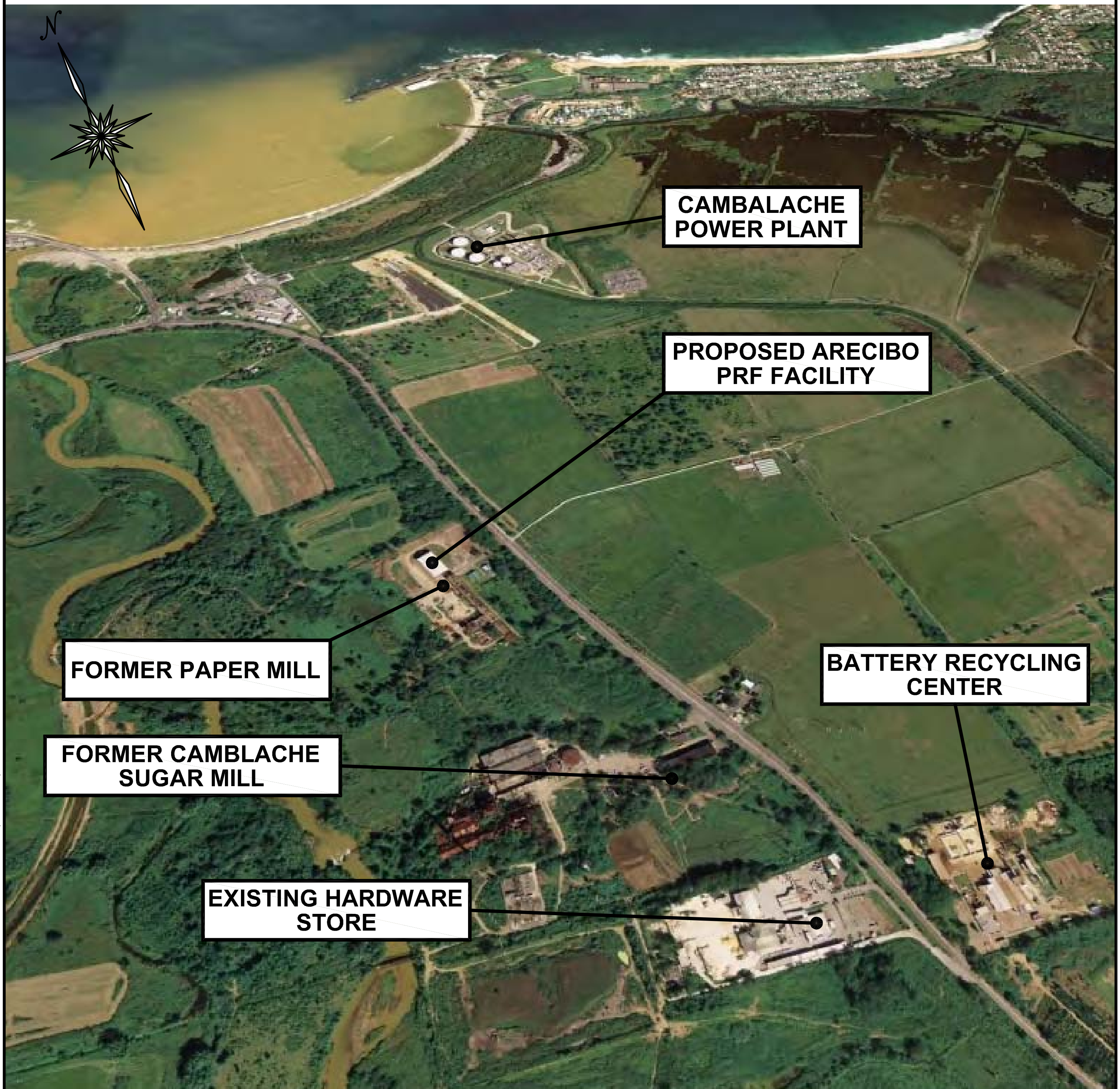
ENERGY ANSWERS
ARECIBO, PUERTO RICO

PROJECT LOCATION MAP

ARCADIS

FIGURE
1

CITY:NOVI DIV/GROUP:ENV DB: PIC: PM: TM: TR: PROJECT NUMBER:
G:\GIS\Project Files\EnergyAnswers\Arecibo\Documents\ProjectLocationMap.mxd



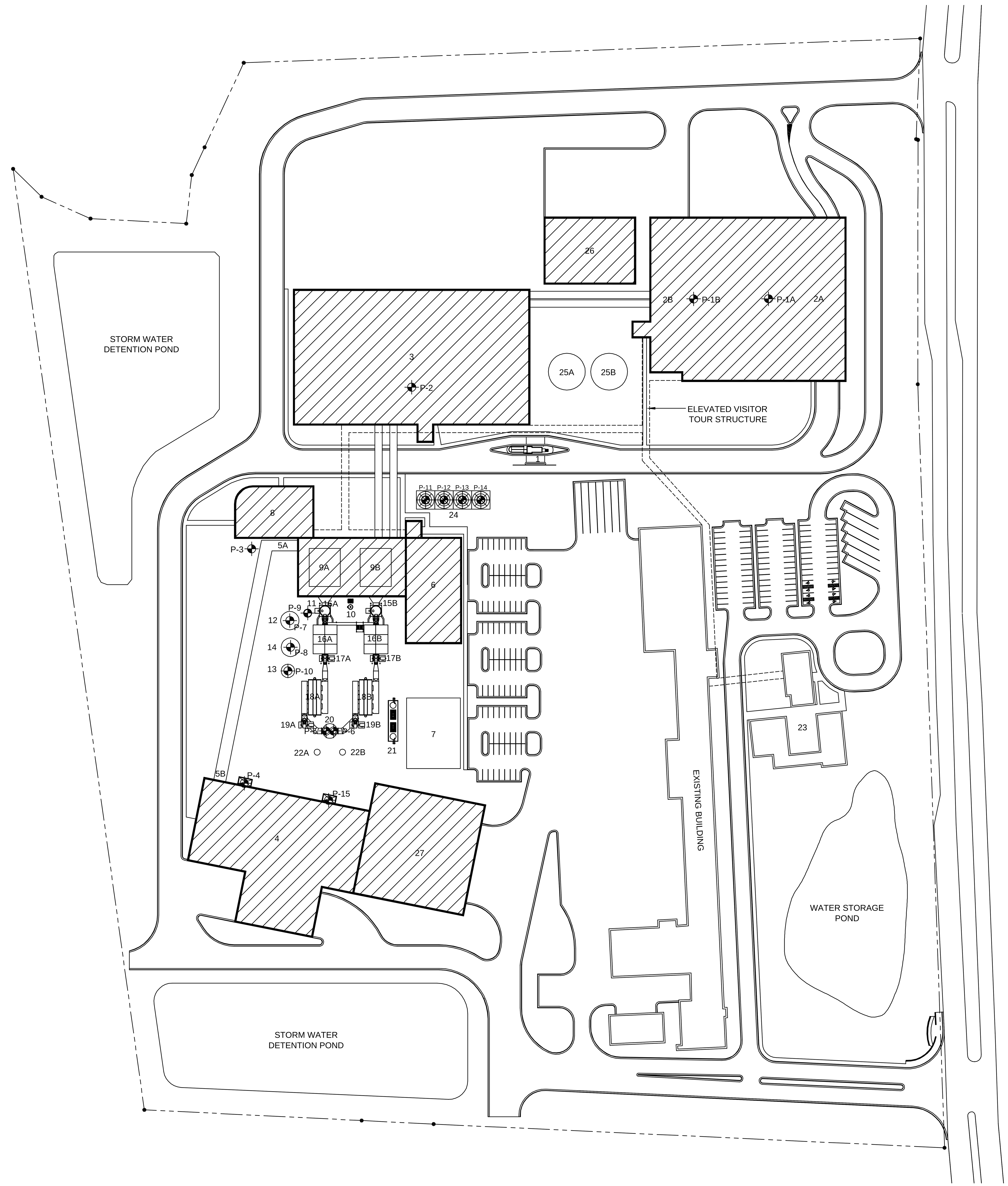
ENERGY ANSWERS INTERNATIONAL, INC.
PUERTO RICO

ARECIBO AREA AERIAL MAP
AND LOCATION OF FACILITY

ARCADIS

FIGURE 1-2

CITY: Augusta, GA DIV/GROUP: ENV DB: A. Warren LD: PIC: PM: TM:) LYR:
G:\LNR\NCENRGY1.0003\ENV\FIGURES\CAD\GPP-1-2 test 2.dwg LAYOUT: 1-2 SAVED: 4/9/2010 3:08 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ARCADIS STANDARD.STB PLOTTED: 5/11/2010 2:23 PM BY: LYNCH, ADAM



NO.	LEGEND AND LOCATION SCHEDULE	VENT LOCATION SCHEDULE			
	STRUCTURE	VENT NO.	COORDINATES		ELEVATION (METERS)
			METERS*	DEGREES*	
1	WEIGH STATION				
2A	MSW RECEIVING AREA	P-1A	130.9116	71.72	15.2
2B	MSW PROCESSING AREA	P-1B	116.9924	87.74	12.2
3	PRF STORAGE AREA	P-2	132.3847	159.52	30.5
4	ASH PROCESSING AREA	P-15	204.6976	232.72	18.2
5A	BOTTOM ASH TRANSFER AREA	P-3	192.2018	194.47	10.7
5B	BOTTOM ASH TRANSFER AREA	P-4	233.0714	224.33	18.2
6	POWER BLOCK BUILDING				
7	SWITCHYARD				
8	CAFETERIA, TRAINING & LOCKER ROOMS				
9A	BOILER 1				
9B	BOILER 2				
10	WATER TANK				
11	PAC SILO	P-9	169.4434	205.84	13.1
12	LIME SILO	P-7	178.9684	206.28	30.5
13	FLYASH STABILIZATION SILO	P-10	187.833	213.59	14.6
14	FLYASH SILO	P-8	182.5244	210.32	38.1
15A	SDA 1				
15B	SDA 2				
16A	BAGHOUSE 1				
16B	BAGHOUSE 2				
17A	ID FAN 1				
17B	ID FAN 2				
18A	RSCR 1				
18B	RSCR 2				
19A	BOOSTER FAN 1				
19B	BOOSTER FAN 2				
20A	STACK FLUE - BOILER 1	P-5	184.8358	224.44	106.7
20B	STACK FLUE - BOILER 2	P-6	181.7878	225.07	106.7
21	AMMONIA SKID				
22A	RAW WATER STORAGE TANK 1				
22B	RAW WATER STORAGE TANK 2				
23	ADMINISTRATION BUILDING				
24	COOLING TOWER (4 CELLS)	P-11	106.4514	183.88	10.7
24	COOLING TOWER (4 CELLS)	P-12	97.409	183.17	10.7
24	COOLING TOWER (4 CELLS)	P-13	88.3666	182.33	10.7
24	COOLING TOWER (4 CELLS)	P-14	79.3496	181.29	10.7
25A	WATER STORAGE TANK				
25B	WATER STORAGE TANK				
26	STORAGE / WAREHOUSE				
27	CONCRETE PRODUCTS BUILDING				

FOR DISPERSION MODEL PURPOSES COORDINATES ARE GIVEN IN TERMS OF METERS FROM THE NW CORNER OF THE EXISTING PAPERMILL AND DEGREES COUNTERCLOCKWISE FROM TRUE EAST. *

0 100 200
SCALE IN FEET

ENERGY ANSWERS
ARECIBO, PUERTO RICO

SITE LAYOUT

ARCADIS

1-3

PROJECT NUMBER:
CITY:NOVI DIV/GROUP:ENV DB: PIC: PM: TM: TR:
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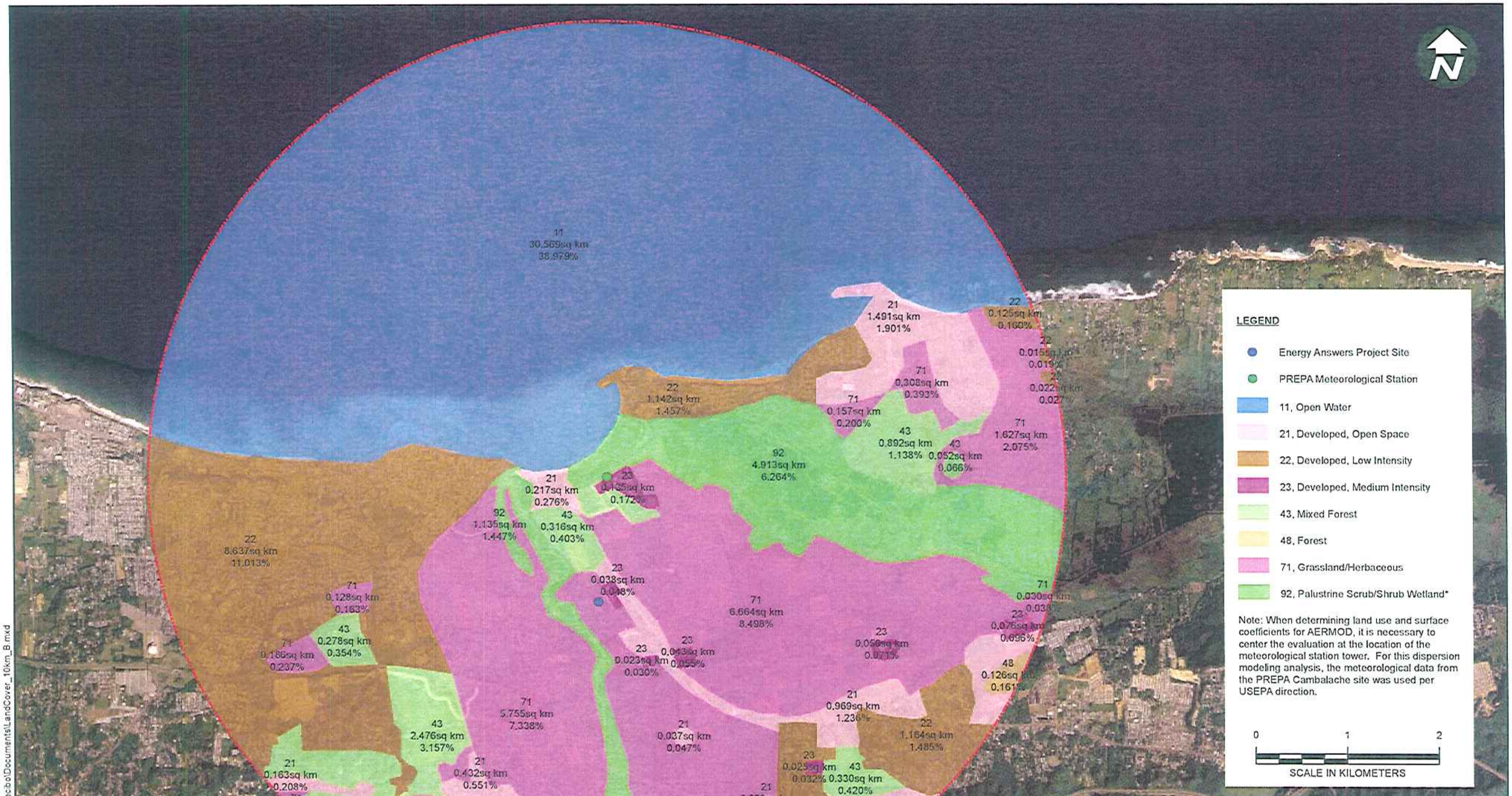

ENERGY ANSWERS
ARECIBO, PUERTO RICO

LAND USE 10KM DIAMETER

ARCADIS

FIGURE
3-1

Attachment 1
Emission Calculations

PRELIMINARY DRAFT

Attachment 1

ENERGY ANSWERS ARECIBO

BOILER POTENTIAL EMISSIONS AND STACK PARAMETERS

ARECIBO PUERTO RICO

Parameter	**Units**	**MAX**	**TYPICAL**
Fuel Firing Rate	TPD	1155	1050
Heat Input	MMBTU/hr	550	500
% Load Capacity	%	110	100

Estimated Flue Gas Conditions			
Stack Gas Temperature	F	317	316
Flue Gas Flow (wet)	lb/hr	630267	572970
Flue Gas Flow (dry)	lb/hr	635728	577935
Flue Gas Flow (wet)	acfm	248540	225945
Flue Gas Flow (dry)	dscfm	134415	122196
Flue Gas Flow (dry)	dscmm	3806	3460
Stack Inner Diameter	ft	7	7
Velocity	fps	107.64	97.85

Pollutant	BACT Limit / Emission Factor	Units	MODEL EMISSION RATE MAX g/s	AVG g/s	MAX lb/hr	AVG lb/hr	TPY (1)
PM	10	mg/DSCM @ 7% O2	0.634	0.577	5.03	4.58	20.0
PM10	10	mg/DSCM @ 7% O2	0.634	0.577	5.03	4.58	**20.0**
PM2.5	10	mg/DSCM @ 7% O2	0.634	0.577	5.03	4.58	**20.0**
NOx	45	ppmvd @ 7% O2	5.46	4.97	43.36	39.42	**172.7**
SO2	24	ppmvd @ 7% O2	4.06	3.69	32.20	29.27	**128.2**
CO	150	ppmvd @ 7% O2	11.09	10.08	87.98	79.98	**350.3**
VOC	0.016	lbs/MMBtu	1.11	1.01	8.80	8.00	35.0
HCl	25	ppmvd @ 7% O2	2.41	2.19	19.11	17.38	76.1
Mercury	17	ug/DSCM @ 7% O2	1.08E-03	9.80E-04	0.0086	0.0078	0.034
Nickel	0.000063	lbs/ton PRF	3.82E-04	3.47E-04	0.0030	0.0028	0.012
Arsenic	0.00000517	lbs/ton PRF	3.13E-05	2.85E-05	0.00025	0.00023	0.000991
Cadmium	10	ug/DSCM @ 7% O2	6.34E-04	5.77E-04	0.0050	0.0046	0.0200
Chromium	0.0000407	lbs/ton PRF	2.47E-04	2.24E-04	0.0020	0.0018	0.0078
Lead	75	ug/DSCM @ 7% O2	0.0048	0.0043	0.038	0.034	0.150
TCDD-2378	13	ng/DSCM @ 7% O2	8.25E-07	7.50E-07	6.54E-06	5.95E-06	2.61E-05
Beryllium	0.00000073	lbs/MMBtu	0.000051	0.000046	4.02E-04	3.65E-04	0.00160
Fluorides (as HF)	0.0032	lbs/MMBtu	0.222	0.202	1.76	1.60	**7.01**
Sulfuric acid (as H2SO4)	0.014	lbs/MMBtu	0.970	0.882	7.70	7.00	**30.7**
Ammonia	20	ppmvd @ 7% O2	0.90	0.82	7.12	6.47	28.4

Example Calculations:

PM10 : 10 mg/DSCM x 3460 DSCMM x 1 g/1000 mg x 1 min / 60 sec = 0.577 g/s

SO2 : 24 ppmvd x 122196 ft / min x 1 ppm / 1,000,000 x 1 lb-mol / 385 ft3 x 64.04 lb SO2/lb-mol x 453.6 g/lb x 1 min /

Sulfuric acid : 0.014 lb/MMBtu x 500 MMBtu/hr x 453.6 g/lb x 1 hr / 3600 sec = 0.882 g/s

Nickel : 0.000063 lb/ton PRF x 1050 ton/day x 1 day/24 hr x 1 hr/3600 sec x 453.6 g/lb = 3.74 E-4 g/s

Notes:

(1) Annual Emissions are based on the average operating condition (100% load) occurring continously for 8,760 hours per year.

Attachment 1
ENERGY ANSWERS ARECIBO
POTENTIAL EMISSIONS AND STACK PARAMETERS
ARECIBO PUERTO RICO
COOLING TOWER

One cooling tower with four cells will be used as follows:

Number of Cooling Towers	1	(with 4 cells per unit)
Recirculation Rate	65150	gpm
Make-up Water	1016	gpm
Cycles of Concentration of Cooling Water	5.00	
TDS in Make-Up	3000.00	ppmw
Drift Eliminator Efficiency	0.0005	%
TDS in Cooling Water	3000	ppmw
Predominant dissolved solids in cooling water	NaCl	
Density of Primary DS	2.165	g/cm^3

Per AP-42, Chapter 13.4 the following equation is used for estimating PM emissions from the cooling tower.

Total PM = Circulating flow x Drift Rate x TDS in cooling water

This equation combined with the values listed above provide the following PM emission values:

Total PM emissions =	0.0154	g/s	Per Cell in the CT
Total PM emissions =	0.122	lbs/hr	Per Cell in the CT
Total PM emissions =	0.54	tons/year	Per Cell in the CT

The fraction of total particulate matter which is equal to or less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) are estimated based on a methodology developed by Reisman and Frisbie. This methodology was developed for use with cooling towers that use ocean water, so the primary particulate used in their calculations was sodium chloride (salt).

Volume of drift droplet = $\boxed{\frac{4}{3} \cdot \Pi \cdot \left(\frac{D_d}{2}\right)^3}$

Mass of solids in drift droplet = $\boxed{TDS \cdot \rho_w \cdot \frac{4}{3} \cdot \Pi \cdot \left(\frac{D_d}{2}\right)^3}$

Assuming the solids remain and coalesce after the water evaporates, the mass of solids can also be expressed as:

Mass of solids in drift droplet = $\boxed{\rho_{TDS} \cdot \frac{4}{3} \cdot \Pi \cdot \left(\frac{D_d}{2}\right)^3}$

Solving the previous two equations for D_p then gives:

$$D_p = D_d \cdot \sqrt[3]{TDS \cdot \left(\rho_w / \rho_{TDS} \right)}$$

Where:

TDS = concentration of Total Dissolved Solids, in ppmw
D_p = diameter of solid particle (after evaporation), in microns (µm)
D_d = diameter of drift droplet (before evaporation), in microns (µm)
r_w = density of water droplet, 1.0 g/cm^3
r_{TDS} = density of solid particle, in g/cm^3

Recreating Tables 1 and 2 from the Resiman and Frisbie document for the facility's specific TDS concentration gives the following new table:

EPRI Droplet Diameter (µm)	Droplet Volume (µm^3)	Droplet Mass (mg)	Particle Mass Solids (mg)	Solid Particle Volume (µm^3)	Solid Particle Diameter (µm)	EPRI % Mass Smaller than PM_{10} (10 µm)
10	524	5.24E-04	1.57E-06	0.73	1.1	0.000
20	4,189	4.19E-03	1.26E-05	5.8	2.2	0.196
30	14,137	1.41E-02	4.24E-05	20	3.3	0.226
40	33,510	3.35E-02	1.01E-04	46	4.5	0.514
50	65,450	6.54E-02	1.96E-04	91	5.6	1.816
60	113,097	0.1	3.39E-04	157	6.7	5.702
70	179,594	0.2	5.39E-04	249	7.8	21.348
90	381,704	0.4	1.15E-03	529	10.0	49.812
110	696,910	0.7	2.09E-03	966	12.3	70.509
130	1,150,347	1.2	3.45E-03	1,594	14.5	82.023
150	1,767,146	1.8	5.30E-03	2,449	16.7	88.012
180	3,053,628	3.1	9.16E-03	4,231	20.1	91.032
210	4,849,048	4.8	1.45E-02	6,719	23.4	92.468
240	7,238,229	7.2	2.17E-02	10,030	26.8	94.091
270	10,305,995	10.3	3.09E-02	14,281	30.1	94.689
300	14,137,167	14.1	4.24E-02	19,590	33.4	96.288
350	22,449,298	22.4	0.1	31,108	39.0	97.011
400	33,510,322	33.5	0.1	46,435	44.6	98.340
450	47,712,938	47.7	0.1	66,115	50.2	99.071
500	65,449,847	65.4	0.2	90,693	55.7	99.071
600	113,097,336	113.1	0.3	156,717	66.9	100.000

Using the conservative estimate of the calculated PM diameter immediately greater than the PM fraction of interest, the Brentwood Industries study values above show the following breakdown of total PM:

PM_{30} = 94.7%
PM_{10} = 49.8%
$PM_{2.5}$ = 0.20% (estimated using linear interpolation)

Attachment 1
ENERGY ANSWERS ARECIBO
POTENTIAL EMISSIONS AND STACK PARAMETERS
ARECIBO PUERTO RICO
COOLING TOWER

Therefore, only the fractions of total PM calculated for cooling tower emissions corresponding with the values listed above will be used in the facility's emission estimates. Applying these percentages to the total annual emissions calculated above provide the following PTE values for various PM size distributions:

	g/s	lb/hr	TPY	
PM_{30} =	0.015	0.116	0.51	per cell
PM_{10} =	0.00767	0.061	0.27	per cell
$PM_{2.5}$ =	3.13E-05	0.00025	1.1E-03	per cell

Attachment 1
ENERGY ANSWERS ARECIBO
ARECIBO PUERTO RICO
LIME AND ASH HANDLING

Energy Answers will operate ash handling and storage facilities. Each potential source will be controlled using a baghouse.

Filter performance specification taken from USEPA's Environmental Technology Verification for Bahouse Filtration Products of QG061 Filtration Media, manufactured by GE Energy.

PM10

Description	Source ID	Vent ID	Flow Rate m3/s	Flow Rate cfs	Filter spec grains/acf	Material	lb/s	g/s	lb/hr	TPY
Bottom Ash Handling Conveyor	Trans1	P-3	9.45	334	0.001	Nomex / BHA-TEX	4.77E-05	0.0216	0.172	0.75
Bottom Ash Handling Conveyor	Trans2	P-4	9.45	334	0.001	Nomex / BHA-TEX	4.77E-05	0.0216	0.172	0.752
Ash Processing Bldg	Ash	P-15	28.16	995	0.001	Nomex / BHA-TEX	1.42E-04	0.0645	0.512	2.241
Lime Storage Silo	Silo 2	P-7	0.473	16.7	0.001	Nomex / BHA-TEX	2.39E-06	0.00108	0.0086	0.038
Flyash Storage Silo	Silo 4	P-8	0.473	16.7	0.001	Nomex / BHA-TEX	2.39E-06	0.00108	0.0086	0.038
Activated Carbon Storage Silo	Silo 1	P-9	0.473	16.7	0.001	Nomex / BHA-TEX	2.39E-06	0.00108	0.0086	0.038

PM2.5

Description	Source ID	Vent ID	Flow Rate m3/s	Flow Rate cfs	Filter spec g/dscm	Material	lb/s	g/s	lb/hr	TPY
Bottom Ash Handling Conveyor	Trans1	P-3	9.45	334	0.000017	Nomex / BHA-TEX	3.54E-07	1.61E-04	0.001	0.01
Bottom Ash Handling Conveyor	Trans2	P-4	9.45	334	0.000017	Nomex / BHA-TEX	3.54E-07	1.61E-04	0.001	0.006
Ash Processing Bldg	Ash	P-15	28.16	995	0.000017	Nomex / BHA-TEX	1.06E-06	4.79E-04	0.004	0.017
Lime Storage Silo	Silo 2	P-7	0.473	16.7	0.000017	Nomex / BHA-TEX	1.77E-08	8.04E-06	0.0001	0.0003
Flyash Storage Silo	Silo 4	P-8	0.473	16.7	0.000017	Nomex / BHA-TEX	1.77E-08	8.04E-06	0.0001	0.0003
Activated Carbon Storage Silo	Silo 1	P-9	0.473	16.7	0.000017	Nomex / BHA-TEX	1.77E-08	8.04E-06	0.0001	0.0003

Attachment 1

ENERGY ANSWERS ARECIBO

Potential Emissions Calculations

Emergency Diesel Generator (670 hp)

Engine Power Output = 670 hp

Annual Operating Time = 500 hours

Pollutant		Emission Factor g/bhp-hr	Emission Rate lb/hr	Emission Rate g/s	Annual Emissions lb/yr	Annual Emissions TPY
PM	NSPS LIMIT	0.15	0.22	0.028	111	0.0554
PM10	NSPS LIMIT	0.15	0.222	0.028	111	0.0554
PM2.5	NSPS LIMIT	0.15	0.222	0.028	111	0.0554
SO2	NSPS LIMIT	0.002	0.0030	0.00037	1.48	0.000739
NOx	NSPS LIMIT	3.0	4.43	0.56	2,216	1.11
VOC	NSPS LIMIT	0.15	0.22	0.028	111	0.055
CO	NSPS LIMIT	2.61	3.86	0.486	1,928	0.96
HAP						
Acetaldehyde		3.86E-07	5.71E-07	7.19E-08	0.0003	1.43E-07
Acrolein		5.52E-08	8.15E-08	1.03E-08	0.00004	2.04E-08
Arsenic		2.94E-08	4.34E-08	5.47E-09	0.0000	1.09E-08
Benzene		5.43E-06	8.02E-06	1.01E-06	0.00401173	2.01E-06
Benzo(a)pyrene		1.80E-09	2.66E-09	3.35E-10	0.0000013	6.64E-10
Beryllium		1.75E-08	2.58E-08	3.26E-09	0.0000129	6.46E-09
Cadmium		7.70E-08	1.14E-07	1.43E-08	0.00006	2.84E-08
Chromium		4.03E-07	5.95E-07	7.49E-08	0.0003	1.49E-07
Chromium (VI)		0.00E+00	0.00E+00	0.00E+00	0.000000	0.00E+00
Ethylbenzene		2.23E-07	3.30E-07	4.16E-08	0.000165	8.25E-08
Fluoride		1.02E-05	1.50E-05	1.89E-06	0.00750	3.75E-06
Formaldehyd	5	5.52E-07	8.16E-07	1.03E-07	0.00041	2.04E-07
Lead		6.23E-08	9.20E-08	1.16E-08	0.00005	2.30E-08
Manganese		9.80E-08	1.45E-07	1.82E-08	0.00007	3.62E-08
Mercury		2.10E-08	3.10E-08	3.91E-09	0.00002	7.75E-09
Methyl Chloroform		6.44E-08	9.51E-08	1.20E-08	0.00005	2.38E-08
Naphthalene		9.10E-07	1.34E-06	1.69E-07	0.00067	3.36E-07
Nickel		1.26E-07	1.86E-07	2.35E-08	0.00009	4.65E-08
POM		1.48E-06	2.19E-06	2.76E-07	0.00110	5.48E-07
Toluene		1.97E-06	2.91E-06	3.66E-07	0.00145	7.26E-07
Xylenes		1.35E-06	2.00E-06	2.51E-07	0.00100	4.99E-07

Notes:

1) Emission factors taken from AP-42 "Compilation of Air Pollutant Emission Factors", 5th edition, Tables 3.4-3 and 3.4-4, and 40 CFR 89 Subpart B Table 1.
2) Conservatively, 100 percent of TSP is assumed to be PM-2.5.
3) Fuel Sulfur content not to exceed 15 parts per million (per NSPS Subpart IIII and 40 CFR 80.510(b)).
4) NSPS Limit is given in terms of NOx + Nonmethane Hydrocarbon (VOC). VOC is assumed to be 5% by weight.
5) AP-42 Emission Factors for HAP are converted to lb/hp-hr assuming 7,000 Btu/hp-hr as noted in Table 3.3-1.

Attachment 1

ENERGY ANSWERS ARECIBO

Potential Emissions Calculations

Fire Water Pump (335 hp)

Engine Power Output = 335 hp

Annual Operating Time = 500 hours

Pollutant		**Emission Factor g/bhp-hr**	**Emission Rate lb/hr**	**Emission Rate g/s**	**Annual Emissions lb/yr**	**Annual Emissions TPY**
PM	NSPS LIMIT	0.15	0.11	0.014	55.4	0.0277
PM10	NSPS LIMIT	0.15	0.111	0.014	55.4	0.0277
PM2.5	NSPS LIMIT	0.15	0.111	0.014	55.4	0.0277
SO2	NSPS LIMIT	0.002	0.0015	0.00019	0.74	0.000369
NOx	NSPS LIMIT	3.0	2.22	0.28	1,108	0.554
VOC	NSPS LIMIT	0.15	0.11	0.014	55	0.028
CO	NSPS LIMIT	2.61	1.93	0.243	964	0.482
HAP						
Acetaldehyde		5.37E-06	3.97E-06	5.00E-07	0.0020	9.91E-07
Acrolein		6.48E-07	4.78E-07	6.03E-08	0.00024	1.20E-07
Benzene		6.53E-06	4.82E-06	6.08E-07	0.0024	1.21E-06
Benzo(a)pyrene		1.32E-09	9.72E-10	1.22E-10	0.00000049	2.43E-10
1,3-Butadiene		2.74E-07	2.02E-07	2.55E-08	0.0001011	5.05E-08
Ethylbenzene		2.23E-07	1.65E-07	2.08E-08	0.0000825	4.12E-08
Fluoride		1.02E-05	7.50E-06	9.45E-07	0.00375	1.87E-06
Formaldehyde		8.26E-06	6.10E-06	7.69E-07	0.0031	1.53E-06
Methyl Chloroform		6.44E-08	4.76E-08	5.99E-09	0.000024	1.19E-08
Naphthalene		5.94E-07	4.38E-07	5.52E-08	0.000219	1.10E-07
POM		1.18E-06	8.69E-07	1.09E-07	0.00043	2.17E-07
Propylene Ox	5	1.81E-05	1.33E-05	1.68E-06	0.0067	3.33E-06
Toluene		2.86E-06	2.11E-06	2.66E-07	0.00106	5.29E-07
Xylenes		2.00E-06	1.47E-06	1.86E-07	0.000737	3.68E-07

Notes:

1) Emission factors taken from AP-42 "Compilation of Air Pollutant Emission Factors", 5th edition, Table 3.3-2 and 40 CFR 60 Subpart IIII Table 4.
2) Conservatively, 100 percent of TSP is assumed to be PM-2.5.
3) Fuel Sulfur content not to exceed 15 parts per million (per NSPS Subpart IIII and 40 CFR 80.510(b)).
4) NSPS Limit is given in terms of NOx + Nonmethane Hydrocarbon (VOC). VOC is assumed to be 5% by weight.
5) AP-42 Emission Factors for HAP are converted to lb/hp-hr assuming 7,000 Btu/hp-hr as noted in Table 3.3-1.

Attachment 1

ENERGY ANSWERS ARECIBO

Potential Emissions Calculations
500 MMBTU/hr Boilers During Startup
Firing No. 2 Fuel Oil

No. 2 Fuel Oil Heating Value:	**140000**	**BTU/gal**	
Max Fuel Use Rate - 100% load:	**3,571**	**Gal/hour**	(EACH BOILER)
Annual Max Fuel Usage:	**180,000**	**Gal/yr**	

Pollutant	Emission Factor lb/1000 gal	Uncontrolled Emission Rate lb/hr	Control Efficiency %	Controlled Emission Rate lb/hr	Controlled Annual Emissions	
					lb/yr	TPY
PM	3.30	11.79	99	0.118	5.9	0.0030
PM10	1.00	3.571	99	0.036	2	0.0009
PM2.5	0.25	0.893	99	0.00893	0	0.0002
SO2	21.3	76.0714	80	15.2	766.80	0.383400
NOx	24.0	85.71	80	17.1	864	0.43
VOC	0.20	0.71	0	0.714	36	0.018
CO	5.00	17.86	0	17.9	900	0.45
HAP						
Arsenic	5.60E-04	2.00E-03	99	2.00E-05	0.0010	5.04E-07
Benzene	2.75E-03	9.82E-03	0	9.82E-03	0.49500000	2.48E-04
Beryllium	4.20E-04	1.50E-03	99	1.50E-05	0.0007560	3.78E-07
Cadmium	4.20E-04	1.50E-03	99	1.50E-05	0.00076	3.78E-07
Chromium	4.20E-04	1.50E-03	99	1.50E-05	0.0008	3.78E-07
Ethylbenzene	8.17E-04	2.92E-03	0	2.92E-03	0.147112	7.36E-05
Fluoride	3.73E-02	1.33E-01	80	2.66E-02	1.34280	6.71E-04
Formaldehyde	4.80E-02	1.71E-01	0	1.71E-01	8.64000	4.32E-03
Lead 5	1.26E-03	4.50E-03	99	4.50E-05	0.00227	1.13E-06
Manganese	8.40E-04	3.00E-03	99	3.00E-05	0.00151	7.56E-07
Mercury	4.20E-04	1.50E-03	70	4.50E-04	0.02268	1.13E-05
Methyl Chloroform	2.36E-04	8.43E-04	0	8.43E-04	0.04248	2.12E-05
Naphthalene	3.33E-04	1.19E-03	0	1.19E-03	0.05994	3.00E-05
Nickel	4.20E-04	1.50E-03	99	1.50E-05	0.00076	3.78E-07
POM	3.30E-03	1.18E-02	0	1.18E-02	0.59400	2.97E-04
Selenium Compounds	2.10E-03	7.50E-03	99	7.50E-05	0.00378	1.89E-06
Toluene	7.97E-02	2.85E-01	0	2.85E-01	14.34112	7.17E-03
Xylenes	1.40E-03	5.00E-03	0	5.00E-03	0.25213	1.26E-04

Notes:

1) Emission factors taken from AP-42 "Compilation of Air Pollutant Emission Factors", 5th edition, Chapter 1.3.

Attachment 1
ENERGY ANSWERS ARECIBO
ARECIBO PUERTO RICO

Annual Emissions Summary - TPY

Pollutant	Boiler 1	Boiler 2	Ash Handling	Silos	EDG	FWP	Cooling Tower	Total	PSD Major Source TPY
PM	20.0	20.0	3.74	0.113	0.055	0.0277	2.03	46.1	**100**
PM10	20.0	20.0	3.74	0.113	0.055	0.0277	1.07	45.1	**100**
PM2.5	20.0	20.0	3.74	0.113	0.055	0.0277	0.0044	44.0	**100**
NOx	173	173	---	---	1.11	0.55	---	**347**	**100**
SO2	128	128	---	---	0.0007	0.00037	---	**256**	**100**
CO	350	350	---	---	0.96	0.48	---	**702**	**100**
VOC	35.0	35.0	---	---	0.055	0.0277	---	70.2	**100**
HCl	76.1	76.1	---	---	---	---	---	152	**---**
Mercury	0.0341	0.0341	---	---	7.75E-09	---	---	0.0682	**0.1**
Nickel	0.0121	0.0121	---	---	4.65E-08	---	---	0.024	**---**
Arsenic	0.00099	0.00099	---	---	1.09E-08	---	---	**0.0020**	**> 0**
Cadmium	0.0200	0.0200	---	---	2.84E-08	---	---	0.040	**---**
Chromium	0.00780	0.00780	---	---	1.49E-07	---	---	0.016	**---**
Lead	0.150	0.150	---	---	2.30E-08	---	---	0.30	**0.6**
TCDD-2378	2.61E-05	2.61E-05	---	---	---	---	---	**5.21E-05**	**3.50E-06**
Beryllium	0.0016	0.0016	---	---	6.46E-09	---	---	**0.0032**	**0.0004**
Fluorides (as HF)	7.01	7.01	---	---	---	1.87E-06	---	**14.0**	**3**
Sulfuric acid (as H2SO4)	30.7	30.7	---	---	---	---	---	**61.3**	**7**
Ammonia	28.4	28.4	---	---	---	---	---	56.7	**---**

Attachment 2
Air Modeling Files