ATTACHMENT 1

Energy Answers International
Resource Recovery Solutions

Energy Answers International, Inc.

Arecibo Puerto Rico Renewable Energy Project

Prevention of Significant Deterioration (PSD) Air Permit Application

FEBRUARY 2011

1. Introduction

1.1 Project Summary

Energy Answers International, Inc. is an award-winning[1], international designer, developer, owner and operator of environmentally sound resource recovery and renewable energy systems. The company, through its affiliate Energy Answers Arecibo, LLC (Energy Answers) is proposing to construct a 77-megawatt (MW) renewable energy facility to be fired primarily with Processed Refuse Fuel (PRF), having the capability to supplement PRF with automotive shredder residue tire derived fuel, and, shredded urban wood waste. The Project, referred to herein as the Arecibo Renewable Energy Project (AREP), 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 Project site. This Project will decrease the quantity of waste going to landfills, displace fossil fuel used for power generation in Puerto Rico, and increase the renewable energy supply available on the power grid in Puerto Rico.

The proposed facility will have the following air emission sources:

- Two spreader-stoker boilers rated at 500 MMBtu/hr each, equipped with three 167 MMBtu/hr auxiliary fuel oil-fired burners each;
- One cooling tower with four cells (evaporative type);
- One diesel-fired emergency generator set; and
- One diesel-fired emergency fire water pump
- Three storage silos used for lime, activated carbon, and flyash storage. Note that the lime and activated carbon will be used for air quality control.

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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."

2.2.2 Processed Refuse Fuel (PRF) Characterization

Only MSW from residential, non-hazardous light industrial and commercial sources will be accepted at the Project. Based on operating data from the SEMASS facility, approximately 0.9% (by weight) of the wastes received by that facility were non-processible or unacceptable materials removed prior to processing. A smaller percentage of non-processible materials are anticipated for the Project due to advances in shredder technology.

A quality assurance plan will be implemented at the Project to prevent unacceptable waste from entering the PRF supply to the boilers. Unacceptable and non-processible materials will be removed at the MSW receiving area and transported to markets or the appropriate landfill disposal sites. The acceptable and unacceptable materials for production of PRF for the Project are described as follows:

> **Acceptable Materials** means materials that will be processed into PRF and includes that portion of solid waste which has the characteristics of waste collected and disposed of as part of normal household municipal waste collection programs, as well as commercial/retail waste and non-hazardous waste from industrial facilities. Acceptable waste includes, but is not limited to, garbage, trash, rubbish, and refuse. It does not include "Unacceptable Materials."
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> **Unacceptable Materials** means materials that will not be processed into PRF, and includes radioactive material, explosive material, cesspool and other human wastes, industrial sludges, liquids, ashes and other combustion residues, human and animal remains, motor vehicles, trailers, marine vessels, pathological and biological wastes, infectious and chemotherapeutic wastes, foundry sand, offal, agricultural and farm machinery and equipment, lead-acid automobile batteries, cathode ray tubes, button batteries, fluorescent bulbs, mercury-bearing electrical switches and thermostats or any material which may present a substantial endangerment to health or safety or a reasonable possibility of adversely affecting the operations of the Project.

Energy Answers will implement standard operating procedures that will ensure that waste will be inspected thoroughly at the MSW tipping floor to remove readily identifiable unacceptable wastes prior to PRF processing.

The Puerto Rico Solid Waste Management Authority (SWMA) commissioned a waste characterization study in 2003 that sampled waste deliveries at 12 landfills and 2 transfer stations in Puerto Rico. The average MSW composition from the two study sampling periods (June and September) is shown in Table 2-1.

Table 2-1 Post-Recovery MSW Composition

Component	Percentage of Incoming Material (by weight)
Paper and Paperboard	24.58
Glass	3.21
Ferrous Metals	3.86
Non-ferrous Metals	1.21
Plastics	14.06
Organic Wastes	17.21
HHW	0.67
Construction Debris	10.72
Yard Trimmings	14.23
Other	10.25
TOTAL	100.0

Assuming that government mandates requiring an increase in the recycling of yard waste and construction debris result in a 50 percent reduction in the amount of those components requiring disposal, the projected MSW composition for Project planning purposes is shown in Table 2-2. Based on this composition and a 70 percent removal of ferrous metals after shredding, the Project PRF is expected to have the characteristics also shown in Table 2-2.

Table 2-2 Reference Waste Analysis

Components	Percentage (by weight)
Moisture	25.02
Inerts	15.76
N	0.72
H	4.13
O	20.97
S	0.11
C	32.59
Cl	0.70
TOTAL	100.00
Minimum Higher Heating Value (BTU/lb)	4,600
Average Higher Heating Value (BTU/lb)	5,700
Maximum Higher Heating Value (BTU/lb)	7,600

As indicated, the Project will be designed to combust PRF with: an expected energy content, or higher heating value (HHV), of 5,700 British thermal units per pound (Btu/lb), within a range of 4,600 to 7,600 Btu/lb; an average moisture content of about 25 percent; and an ash content of up to 20 percent. •

2.2.3 Supplementary Fuels

In addition to PRF, the Project will have the ability to accept supplementary processed waste derived fuels from which energy and recyclable materials can be recovered. According to the percentages specified below, one or more of these

3. Emissions Summary

This Section describes the methodology for estimating emissions from the proposed Facility. The detailed emission rate calculations are given in Appendix A. Emission calculations were developed for normal operating conditions, including 100 percent, 110 percent, and 80 percent boiler load scenarios. Emissions from fuel oil combustion during startup and shutdown transitional periods are also quantified using a conservative approach and published emission factors. Greenhouse gas (GHG) emissions from the facility are also quantified and contrasted against emission levels that would otherwise occur from landfilling the waste materials.

3.1 Normal Operations

Where appropriate, the emission calculations were based upon the proposed BACT performance levels described in Section 5. The BACT emission levels have been guaranteed by the manufacturers of the equipment and control devices, and, therefore, represent conservative estimates of expected actual emissions.

3.1.1 Processed Refuse Fuel (PRF) Boilers

The technical approach for calculating the maximum potential to emit from the two PRF-fired boilers was to use the proposed BACT emission limits (See Section 5) and control equipment vendor guaranteed outlet concentrations with the design outlet air flow specifications. Emissions representing a short-term maximum (110%) firing rate; a typical sustained (100%) firing rate; and a short-term minimum (80%) firing rate were calculated and are provided in Table 2 of Appendix A. Maximum hourly and annual and emission rates are given. 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. In reality, the Facility is expected to operate at 95 percent availability, or 8,322 hours per year.

3.1.2 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

APPENDIX A - TABLE 2
ENERGY ANSWERS INTERNATIONAL
BOILER POTENTIAL EMISSIONS AND STACK PARAMETERS
ARECIBO PUERTO RICO

Parameter	Units	MAX	TYPICAL	MIN
Fuel Firing Rate	TPD	1158	1053	842
Heat Input	MMBTU/hr	550	500	400
% Load Capacity	%	110	100	80
Estimated Flue Gas Conditions				
Stack Gas Temperature	F	323	314	305
Actual Flue Gas Density at Stack Inlet	lb/ft3	0.0495	0.0498	0.0518
Flue Gas Flow (wet)	lb/hr	724452	658685	525917
Moisture in Flue Gas	lb/hr	83325	74083	56456
Percent Moisture in Flue Gas	%vol	18.02	17.65	16.9
Percent Oxygen in Flue Gas	%vol	7.53	7.56	7.67
Flue Gas Flow (dry)	lb/hr	641127	584602	469461
Flue Gas Flow (wet)	acfm	243717	220380	169351
Flue Gas Flow (dry)	dscfm	136064	124037	99610
Flue Gas Flow (dry)	dscmm	3852	3512	2820
Stack Inner Diameter	ft	7	7	7
Velocity	fps	105.55	95.44	73.34

Pollutant	BACT Limit / Emission Factor	Units	MODEL EMISSION RATE MAX g/s	AVG g/s	MIN g/s	MAX lb/hr	AVG lb/hr	MIN lb/hr	TPY (1)
PM	10	mg/DSCM @ 7% O2	0.642	0.585	0.470	5.10	4.65	3.73	20.3
PM10	10	mg/DSCM @ 7% O2	0.642	0.585	0.470	5.10	4.65	3.73	20.3
PM2.5	10	mg/DSCM @ 7% O2	0.642	0.585	0.470	5.10	4.65	3.73	20.3
NOx	45	ppmvd @ 7% O2	5.53	5.04	4.05	43.89	40.01	32.13	175.3
SO2	24	ppmvd @ 7% O2	4.11	3.74	3.01	32.59	29.71	23.86	130.1
CO	150	ppmvd @ 7% O2	11.22	10.23	8.22	89.06	81.19	65.20	355.6
VOC	0.016	lbs/MMBtu	1.11	1.01	0.806	8.80	8.00	6.40	35.0
HCl	25	ppmvd @ 7% O2	2.44	2.22	1.78	19.35	17.64	14.17	77.3
Mercury	17	ug/DSCM @ 7% O2	1.09E-03	9.95E-04	7.99E-04	0.0087	0.0079	0.0063	0.035
Nickel	0.000063	lbs/ton PRF	3.83E-04	3.48E-04	2.78E-04	0.0030	0.0028	0.0022	0.012
Arsenic	0.00000517	lbs/ton PRF	3.14E-05	2.86E-05	2.29E-05	0.00025	0.00023	0.00018	0.000994
Cadmium	10	ug/DSCM @ 7% O2	6.42E-04	5.85E-04	4.70E-04	0.0051	0.0046	0.0037	0.0203
Chromium	0.0000407	lbs/ton PRF	2.47E-04	2.25E-04	1.80E-04	0.0020	0.0018	0.0014	0.0078
Lead	75	ug/DSCM @ 7% O2	0.0048	0.0044	0.0035	0.038	0.035	0.028	0.153
TCDD-2378	13	ng/DSCM @ 7% O2	8.35E-07	7.61E-07	6.11E-07	6.62E-06	6.04E-06	4.85E-06	2.65E-05
Beryllium	0.00000073	lbs/MMBtu	0.000051	0.000046	0.000037	4.02E-04	3.65E-04	2.92E-04	0.00160
Fluorides (as HF)	0.0032	lbs/MMBtu	0.222	0.202	0.161	1.76	1.60	1.28	7.01
Sulfuric acid (as H2SO4)	0.014	lbs/MMBtu	0.970	0.882	0.706	7.70	7.00	5.60	30.7
Ammonia	20	ppmvd @ 7% O2	0.91	0.83	0.67	7.21	6.57	5.28	28.8

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 / 60 sec = 3.69 g/s

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.