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AIR QUALITY IMPACT ANALYSIS

PLAINFIELD RENEWABLE ENERGY PROJECT
Mill Brook Road
Plainfield, CT

In Support of:
CTDEP Application No. 200602226
For Air Permit to Construct and Operate

Prepared For:
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EXECUTIVE SUMMARY

Ambient air quality impact analyses were performed in support of the air permit application by Plainfield Renewable Energy LLC to construct and operate a biomass-fueled fluidized bed staged gasifier power plant in Plainfield, CT. Based on potential emissions, the Project is subject to Prevention of Significant Deterioration review requirements for PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO and VOC. Therefore, in addition to a demonstration of compliance with Ambient Air Quality Standards and applicable PSD Increments, additional impact analyses were performed to evaluate the impacts of facility emissions on visibility, on soils and vegetation, and to evaluate the potential for impacts due to secondary growth.

All modeling analyses were performed in accordance with procedures specified in the CTDEP Ambient Impact Analysis Guideline or otherwise recommended by CTDEP. The results of the air quality impact analyses demonstrate that ambient impacts resulting from facility potential emissions will comply with all applicable Ambient Air Quality Standards and PSD Increments and will not impair visibility or significantly impact soils and sensitive vegetation. In addition, no significant additional emissions or air quality impacts from secondary growth are anticipated due to construction or operation of the PRE project.

ABBREVIATIONS

AQCR	Air Quality Control Region
AQRV	Air Quality Related Value
AAQS	Ambient Air Quality Standards
AQIA	Air Quality Impact Analysis
CAAQS	CT Ambient Air Quality Standards
CO	Carbon monoxide
CO_2	Carbon dioxide
C&D	Construction and demolition debris
CTDEP	CT Department of Environmental Protection
EPI	Energy Products of Idaho, Inc.
FBG	Fluidized bed gasifier or fluidized bed gasification
GEP	Good Engineering Practice
lb/hr	Pounds per hour
lb/MMBtu	Pounds per million British Thermal Units
MADEP	Massachusetts Department of Environmental Protection
MASC	Maximum Allowable Stack Concentration
NAAQS	National Ambient Air Quality Standards
NNSR	Nonattainment New Source Review
NO_X	Nitrogen oxides
NO	Nitric oxide
NO_2	Nitrogen dioxide
NSR	New Source Review
PM	Particulate matter
PM_{10}	Particulate matter less than 10 microns
$PM_{2.5}$	Fine particulate matter – less than 2.5 microns
ppmv	Parts per million by volume (uncorrected, wet conditions)
PRE	Plainfield Renewable Energy LLC (the "Applicant")
PSD	Prevention of Significant Deterioration
RCSA	Regulations of Connecticut State Agencies
RIDEM	Rhode Island Department of Environmental Management
SIL	Significant Impact Level
SO_2	Sulfur dioxide
SO_X	Sulfur oxides
TPY	Tons per year
VOC	Volatile organic compounds

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1.0 INTRODUCTION

This report summarizes the air quality impact analysis performed on behalf of Plainfield Renewable Energy LLC (PRE) in support of its August 9, 2006 application for a New Source Review Permit to Construct and Operate a biomass-fueled fluidized bed staged gasification (FBG) power plant to be located in Plainfield, CT. Based on estimated potential emissions from the proposed premise, the Project will be a Major Stationary Source subject to Prevention of Significant Deterioration (PSD) review, including requirements to perform an air quality impact analysis to demonstrate compliance with National and CT Ambient Air Quality Standards (NAAQS/CAAQS) and Allowable PSD Increments. This report summarizes the scope, procedures and results of the screening and refined dispersion modeling analyses, which were performed in accordance with the CTDEP's Ambient Impact Analysis Guideline (AIAG)[1] and other guidance provided by CTDEP.

1.1 Project Description

PRE is a joint venture between Decker Energy International, Inc., and NuPower LLC, dedicated to developing Connecticut's first renewable biomass energy project. The PRE project will produce renewable power from biomass fuels, which will result in conservation of limited fossil fuels and lower pollutant emissions than existing fossil fuel fired power plants, among other benefits.

The Connecticut Clean Energy Fund, created by the Connecticut General Assembly, promotes the development of clean energy throughout the state. The Clean Energy Fund has selected PRE to meet their progressive goals for generating clean energy, and has committed significant development funding to insure its success.

The PRE project will be a 37.5 MW (net) biomass energy facility at a site located on Mill Brook Road in Plainfield, CT. The Project will be located on 27 acres of industrial-zoned land in Plainfield, bounded by Mill Brook Road and State Route 12. Previously a Superfund location, this site has been fully cleaned and remediated and will significantly contribute to Plainfield's tax base with development of the Project. A USGS site location topographic map is provided as Figure 1-1. The PRE project will be located in the Eastern Connecticut Air Quality Control Region (AQCR 41).

The proposed PRE power plant will use an advanced fluidized bed staged gasification (FBG) process to produce a gas stream derived from biomass to generate steam to drive a conventional steam turbine generator. Fluidized bed staged gasification of solid fuels will result in inherently lower air pollutant emissions than alternative grate or spreader-stoker type combustion systems. In addition, the PRE facility will employ state-of-the-art air pollution control systems, including selective non-catalytic reduction (SNCR) for control of nitrogen oxides (NO_X); a spray dryer scrubber for control of sulfur oxides (SO_X), acid gases and metals emissions; and a fabric filter (baghouse) for particulate matter (PM) emissions control. A process flow diagram showing the conceptual arrangement of the fluidized bed gasifier, boiler and flue gas controls is provided in Figure 1-2.

Figure 1-1 – USGS Site Location Map

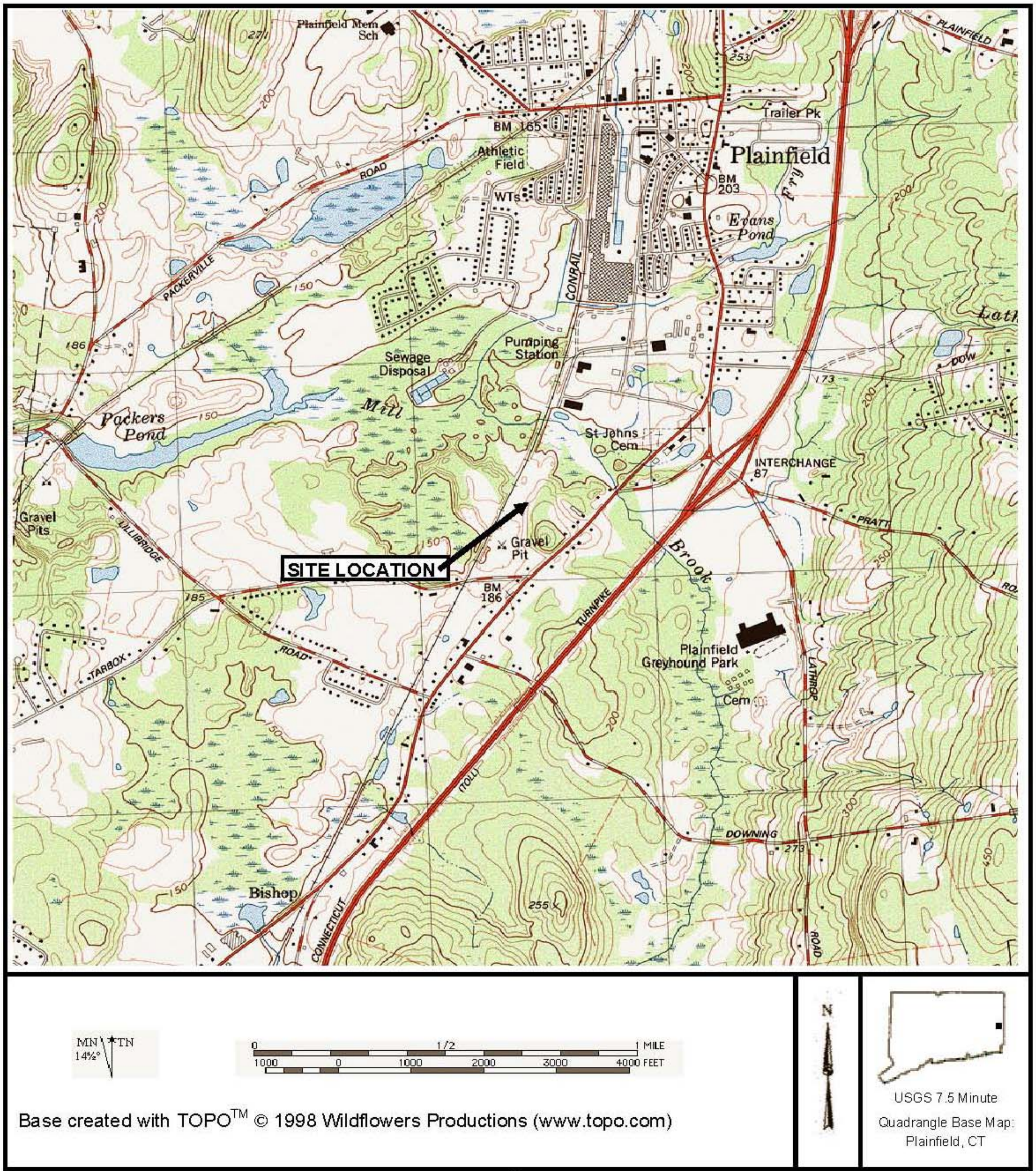
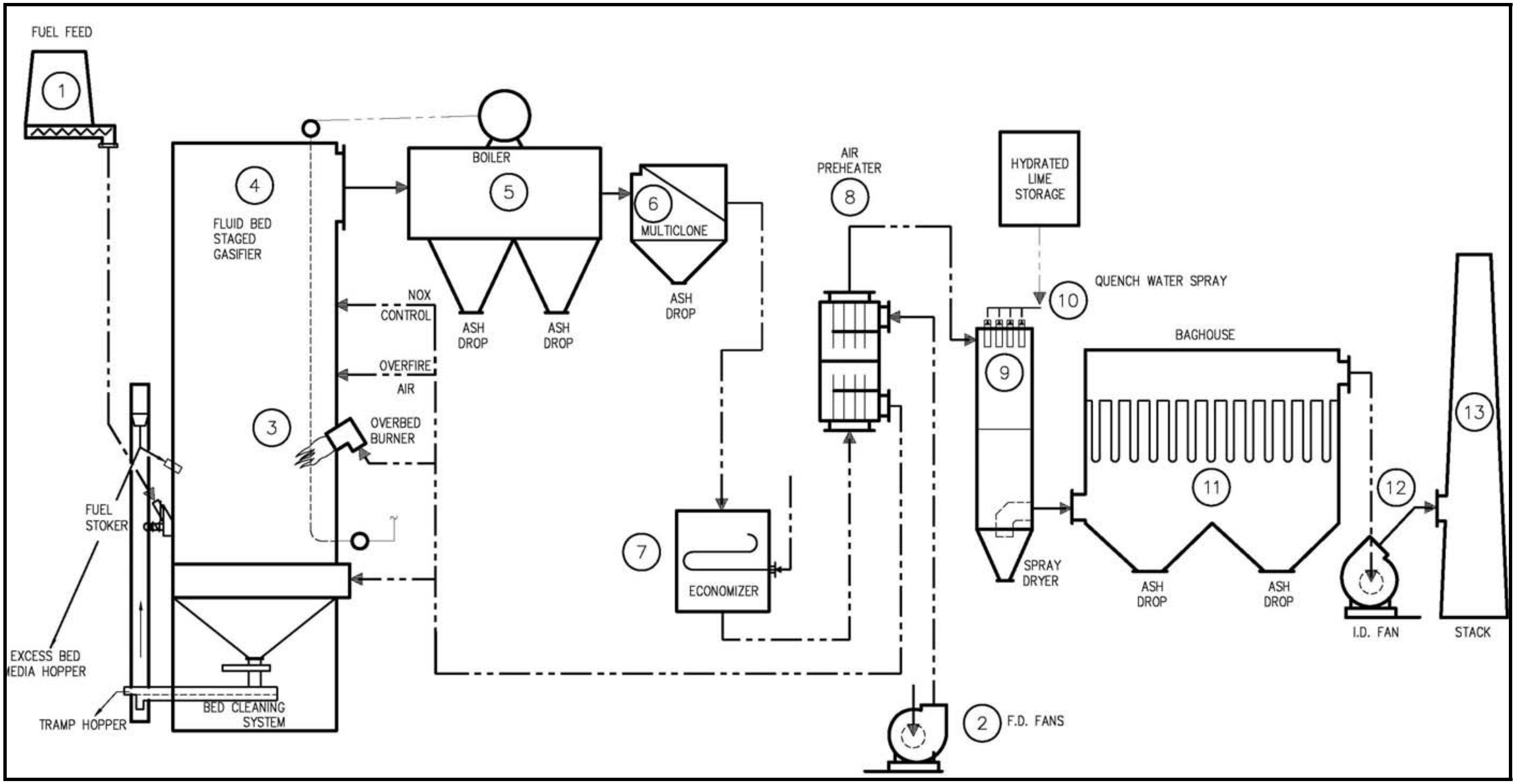


Figure 1-2 – EPI Fluidized Bed Gasifier Process Flow and Conceptual Arrangement Diagram



The facility will accept and gasify biomass fuels from a range of sources, including: forest management residues, landclearing debris and waste wood from municipalities and other industries. In addition, the facility will accept and gasify wood derived from the processing of construction and demolition (C&D) debris obtained from regulated offsite fuel processing facilities adhering to strict specifications (size, quality, etc.).

Other ancillary emissions sources at the PRE biomass energy facility will include a wet cooling tower and a stationary internal combustion engine used to power an emergency generator. The wet cooling tower is estimated to have the potential to emit less than 15 TPY PM_{10} and $PM_{2.5}$ and will, therefore, not trigger CTDEP permit requirements. As currently planned, the emergency generator will be powered by a diesel engine. The emergency engine will be operated in accordance with CTDEP permit exemption criteria pursuant to RCSA § 22a-174-3b(e) and will, therefore, not require an individual air permit.

1.2 Proposed Potential Emissions and Regulatory Requirements

Emission calculations representing the range of expected operating conditions were provided in Attachment E to the Air Permit Application along with the assumptions and bases of the calculations. The proposed controlled potential emissions of regulated pollutants are summarized in Table 1-1.

Table 1-1 – Proposed Potential Emissions

Pollutant[1]	Biomass FBG Controlled Potential Emissions (TPY)	Diesel Engine Emergency Generator (TPY)	Cooling Tower (TPY)	Total Premise Controlled Potential Emissions (TPY)	CTDEP Major Stationary Source Threshold (TPY)	PSD Significant Emission Rate (TPY)
PM/PM_{10}	45.82	0.07	0.65	46.55	100	25/15
$PM_{2.5}$[2]	45.82	0.07	0.65	46.55	100[2]	10[2]
NO_X	171.84	2.41		174.25	50[3]	40
SO_X	81.29	0.0012		81.29	100	40
CO	239.47	0.55		240.02	100	100
VOC	26.59	0.07		26.66	50[3]	25
Pb	0.32	7.0E-06		0.32	10	0.6
H_2SO_4	6.50			6.50	100	7
Hg	0.006			0.006	100	0.1
Dioxins[4]	2.0E-07			2.0E-07	10	3.5E-06

1 Other regulated pollutants potentially subject to PSD review are estimated to be less than applicable Significant Emission Rate (see permit application, Attachment E, submitted August 9, 2006).

2 $PM_{2.5}$ emissions conservatively assumed to be equal to PM_{10} emissions. Major Source threshold and PSD Significant Emission Rate based on EPA "Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards", Federal Register/Vol. 70, No. 210/ November 1, 2005

3 CTDEP Nonattainment New Source Review/Major Stationary Source Thresholds based on location of proposed facility in serious ozone nonattainment area.

4 Dioxins emissions expressed in terms of 2,3,7,8 dibenzo-p-dioxin equivalents, as defined in RCSA § 22a-174-1. PSD Significant Emission Rate expressed in terms of total tetra-through octa-chlorinated dibenzo-p-dioxins and furans.

Based on the attainment status of the Plainfield area (AQCR 41 is currently classified as serious nonattainment for ozone, attainment or unclassified for all other criteria pollutants) and the estimated potential emission levels summarized in Table 1-1, the proposed PRE project will be considered a Major Stationary Source with respect to the PSD regulations and will be subject to PSD review for all criteria pollutants with the exception of lead. The following subsections describe the specific CTDEP and PSD ambient impact analysis requirements applicable to the PRE facility.

PRE will also be subject to Nonattainment New Source Review (NNSR) due to potential emissions of ozone precursor NO_X emissions, which will exceed 50 TPY in a serious ozone nonattainment area. Demonstration of compliance with NNSR requirements, including a Lowest Achievable Emission Rate (LAER) analysis for NO_X, emissions offset requirements and an alternatives analysis, were included in the air permit application submitted to CTDEP on August 9, 2006. Demonstrations of compliance with additional EPA and CTDEP emission standards, permit and other requirements applicable to the project were also included in the permit application.

1.3 Ambient Impact Analysis Requirements

1.3.1 CTDEP Ambient Impact Analysis Requirements

Pursuant to Regulations of Connecticut State Agencies (RCSA) § 22a-174-3a(d), a CTDEP permit to construct and operate a stationary source shall not be issued unless the applicant demonstrates, among other requirements, that the proposed stationary source or modification can be operated without preventing or interfering with the attainment or maintenance of any applicable ambient air quality standards (AAQS) or any PSD Increments. The CTDEP AAQS, which are the same as the National Ambient Air Quality Standards (NAAQS) are summarized in Table 1-2 along with EPA-defined Significant Impact Levels (SILs). PSD Increments are summarized in Table 1-3. In accordance with EPA and CTDEP regulations and guidance, if the maximum ambient impact from a proposed project are less than a SIL, the source is presumed to not cause or significantly contribute to a PSD Increment or NAAQS violation and is not required to perform multiple source cumulative impact assessments.

For minor sources with potential emissions within specified ranges (between 3 and 15 TPY of SO_2 or PM, 5 and 40 TPY of NO_X, an d 5 and 100 TPY of CO), screening calculations conducted in accordance with CTDEP's Stationary Source Stack Height Guideline and Addendum to Stationary Source Stack Height Guideline or other approved screening modeling techniques may be used in lieu of performing refined dispersion modeling. However, for proposed new or modified sources with potential emissions above these ranges and for Major Stationary Sources subject to PSD review, a refined dispersion modeling analysis is performed following CTDEP's Ambient Impact Analysis Guideline (AIAG).

1.3.2 PSD Ambient Impact Analysis Requirements

As discussed in the permit application and in Section 1.2 of this report, PRE will be a Major Stationary Source (> 100 TPY potential emissions) of NO_X and CO emissions. Furthermore, as

Table 1-2 – National and CT Ambient Air Quality Standards and Significant Impact Levels

Pollutant	Averaging Period	CT and National AAQS[a] Primary (µg/m³)	CT and National AAQS[a] Secondary (µg/m³)	Significant Impact Level (µg/m³)
SO_2	3-Hour	---	1300	1300
	24-Hour	365	---	365
	Annual	80	---	80
NO_2	Annual	100	100	100
O_3 (ppm)[b]	1-Hour[b]	0.12	0.12	0.12
	8-Hour	0.08	0.08	0.08
$PM_{2.5}$	24-Hour	65	65	65
	Annual	15	15	15
PM_{10}	24-Hour	150	150	150
	Annual	50	50	50
CO	1-Hour	40,000	40,000	40,000
	8-Hour	10,000	10,000	10,000
Lead[c]	3-Month[c]	1.5	---	1.5

a) All short-term (24 hours or less) values are not to be exceeded more than once per year, except $PM_{2.5}$, for which the 3-year average of the 98th percentile of 24-hour concentrations must not exceed the listed value. All long-term values are not to be exceeded, except for $PM_{2.5}$, for which the 3-year average of the annual arithmetic mean is not to exceed the listed value. To attain the 8-hr ozone standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured over each year must not exceed 0.08 ppm.

b) The 1-hour ambient air quality standard for ozone no longer applies after June 15, 2005, or on such later date as the revocation of the 1-hour standard is effective.

c) Maximum arithmetic mean averaged over a calendar year quarter.

Table 1-3 – Allowable PSD Increments (µg/m³)

Pollutant	Averaging Time	Class I	Class II	Class III
PM_{10}[a]	Annual	4	17	34
	24-Hour	8	30	60
SO_2	Annual	2	20	40
	24-Hour	5	91	182
	3-Hour	25	512	700
NO_2	Annual	2.5	25	50

a) EPA is in the process of developing an approach for preventing significant deterioration of air quality, which may include $PM_{2.5}$ increments. The EPA has placed this action on a separate administrative track due to the additional time necessary to fully develop any potential proposal. In the interim period, States must continue to implement the PM_{10} increments in 40 CFR 51.166, 52.21 and/or their SIPs, as applicable (EPA Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards, Federal Register/Vol. 70, No. 210/ November 1, 2005).

shown in Table 1-1, potential emissions of PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO and VOC will be above PSD Significant Emission Rate thresholds. Therefore, PRE will be subject to PSD review requirements for each of the identified pollutants. In addition to the CTDEP ambient impact analysis requirements applicable to minor sources summarized in Section 1.3.1 (i.e., demonstration of compliance with AAQS and PSD Increments), PSD regulations require additional impact analyses to evaluate the impacts of facility emissions on visibility, on soils and vegetation, and to evaluate the potential for impacts due to secondary growth. In addition, if the source is located within 100 kilometers (62 miles) of a federal Class I area, the impacts must be evaluated at these areas based on the more stringent Class I PSD Increments.

1.4 Summary of Modeling Analysis Objectives

In summary, the air quality modeling analysis was performed to satisfy the following objectives:

1. To demonstrate compliance with applicable AAQS for PM_{10}, $PM_{2.5}$, NO_2, SO_2, CO, Pb and dioxins[a].
2. To demonstrate compliance with applicable PSD Increments for SO_2, NO_2 and PM_{10}.
3. To justify request for waiver from pre-construction ambient monitoring for all pollutants.
4. To demonstrate that the facility will have not have significant impacts on visibility; on soils and vegetation; or due to secondary growth.

[a] Although potential emissions of lead and dioxins (as defined in RCSA § 22a-174-1) will be less than PSD Significant Emission Rates, single-source modeling was also performed for these pollutants for comparison to applicable SILs, Pre-Construction Monitoring De Minimis Levels and/or applicable AAQS.

2.0 MODEL INPUTS AND PRELIMINARY ANALYSES

2.1 PRE Sources, Emissions and Stack Parameters

As discussed in Section 1.1, the primary emission source at the proposed PRE facility will be the FBG stack. Other ancillary sources will be the emergency diesel engine generator and a wet cooling tower. The diesel generator will only be operated during power interruptions to provide emergency power and lighting when the facility's FBG is not operating and typically once or twice per month for less than an hour for testing purposes. It will also be limited under CTDEP's permit exemption in RCSA § 22a-174-3b(e) to less than 300 hours per consecutive 12-months. The facility's wet cooling tower will operate continuously when the FBG is operated; however, potential emissions are estimated at less than 1 TPY $PM_{10}/PM_{2.5}$. Based on the limited operating scenarios and/or insignificant potential emissions from the emergency diesel generator and cooling tower, the screening and single-source modeling analyses were performed only with the FBG stack. However, both the diesel generator and cooling tower were included in the multiple-source cumulative impact analyses. In addition, GEP stack height and cavity zone impact calculations were performed for both ancillary sources.

Table 2-1 summarizes the emissions, stack temperature, diameter and exhaust volume rate data for four (4) different FBG operating scenarios ranging from approximately 75 to 100% of maximum rated capacity on a Btu heat input basis, which encompass the range of expected biomass fuel compositions and plant operating loads during normal operation. The emissions and stack parameters were initially provided in Attachment E to the air permit application and were obtained from Energy Products of Idaho (EPI), the preferred vendor of the proposed FBG power plant. Table 2-2 summarizes the stack parameters for the emergency generator and cooling tower.

In addition to normal base load operations on biomass fuel, the FBG would be operated with B100 (100 percent biodiesel), a non-fossil fuel, during FBG startups and for initial and maintenance refractory curing purposes. The startup burners are rated at a maximum 100 MMBtu/hr in total and the typical startup duration is 6 hours. The facility will normally be operated as a base load facility and will not require frequent startups and shutdowns. In addition, emissions of all pollutants from the FBG while operating in a startup mode with B100 will be lower than when the FBG is normally operating with biomass fuel.

Another possible, although extremely limited operating scenario, would occur when B100 is stored on site beyond its typical 6-month shelf-life. In that event, PRE has requested the ability to combust B100 in the startup burners for disposal purposes while also operating the FBG on biomass fuel. Since the emission factors (lb/MMBtu) from B100 combustion in the startup burners are lower than those for biomass fuel in the FBG for all pollutants, then the blend of B100 and biomass will result in emissions that are no higher than the normal operating case with 100 percent biomass. In addition, it is anticipated that PRE would fire no more than 20,000 gal/yr of B100 in this manner as there would be no economic incentive to burn B100 other than for disposal of B100 stored beyond its recommended shelf-life. Therefore, this scenario was not separately modeled.

Table 2-1 – Screening Modeling Analysis Input Data – FBG Stack

SOURCE INFORMATION:

Company Name:	Plainfield Renewable Energy LLC
Equipment Location Address:	Mill Brook Rd., Plainfield, CT
Equipment Description:	EPI Fluidized Bed Staged Gasifier Energy System

ORIG (UTM, XY), meters (FBG stack)	X =	756,096	meters East	Y=	4,616,897	meters North	(Datum NAD27, Zone 18)
	X =	256,549	meters East	Y=	4,616,457	meters North	(Datum NAD27, Zone 19)
Latitude/Longitude	N	41º39'53"		W	71º55'27"		

Stack base elevation above MSL	184	ft.	56	meters

OPERATING DATA AND STACK PARAMETERS:

Case	1				2				3				4			
Description	100/0 C&D/Wood				25/75 C&D/Wood				65/35 C&D/Wood				25/75 C&D/Wood			
% Load	91%				100%				95%				75%			
Exhaust Gas Flow Rate	3474	ft^3/sec	98.40	m^3/sec	3443	ft^3/sec	97.51	m^3/sec	3578	ft^3/sec	101.32	m^3/sec	2738	ft^3/sec	77.53	m^3/sec
Stack Exhaust Temp.	253	deg. F	395.93	deg. K	253	deg. F	395.93	deg. K	253	deg. F	395.93	deg. K	253	deg. F	395.93	deg. K
Stack Height	155	ft.	47.24	m	155	ft.	47.24	m	155	ft.	47.24	m	155	ft.	47.24	m
Stack Diameter	9.00	ft.	2.74	m	9	ft.	2.74	m	9	ft.	2.74	m	9	ft.	2.74	m
Stack Velocity	54.61	ft/sec	16.65	m/sec	54.12	ft/sec	16.50	m/sec	56.24	ft/sec	17.14	m/sec	43.04	ft/sec	13.12	m/sec
Proposed Controlled Emission Rates (1-hour to 24-hour averages)																
PM_{10}	9.94	lb/hr	1.25	g/sec	10.57	lb/hr	1.33	g/sec	9.94	lb/hr	1.25	g/sec	7.74	lb/hr	0.98	g/sec
NO_2	35.64	lb/hr	4.49	g/sec	38.45	lb/hr	4.84	g/sec	37.03	lb/hr	4.67	g/sec	28.99	lb/hr	3.65	g/sec
SO_2	16.82	lb/hr	2.12	g/sec	18.56	lb/hr	2.34	g/sec	17.03	lb/hr	2.15	g/sec	13.99	lb/hr	1.76	g/sec
CO	49.98	lb/hr	6.30	g/sec	49.38	lb/hr	6.22	g/sec	49.78	lb/hr	6.27	g/sec	37.49	lb/hr	4.72	g/sec
Pb	0.067	lb/hr	0.0084	g/sec	0.073	lb/hr	0.0092	g/sec	0.069	lb/hr	0.0087	g/sec	0.055	lb/hr	0.0070	g/sec

Table 2-2 – Stack Parameters for PRE Emergency Generator and Cooling Tower

Emergency Generator Stack (Stack 2)					Cooling Tower (Stack 3)				
UTM, Zone 18 NAD27	X(m) =	756,040	Y(m) =	4,616,867	UTM, Zone 18 NAD27	X(m) =	756,037	Y(m) =	4,616,892
Exhaust Flow Rate	65	ft^3/sec	1.85	m^3/sec	Exhaust Flow Rate	30509	ft^3/sec	864.02	m^3/sec
Stack Temp.	948	deg. F	782.04	deg. K	Stack Temp.	98	deg. F	309.82	deg. K
Stack Base Elev.	177	ft.	54	m	Stack Base Elev.	174	ft.	53	m
Physical Stack Ht.	10	ft.	3.05	m	Physical Stack Ht.	42.8	ft.	13.06	m
Stack Height MSL	187	ft.	3.05	m	Stack Height MSL	217	ft.	13.06	m
Stack Diameter	0.5	ft.	0.15	m	Stack Diameter	39.6	ft.	12.07	m
Stack Velocity	333	ft/sec	101.61	m/sec	Stack Velocity	24.77	ft/sec	7.55	m/sec
Proposed Emission Rates (1-hour to 24-hour averages)[1]					**Proposed Emission Rates (1-hour to 24-hour averages)[1]**				
$PM_{2.5}$	0.47	lb/hr	0.06	g/sec	$PM_{2.5}$	0.15	lb/hr	0.02	g/sec
NO_2	16.09	lb/hr	2.03	g/sec	NO_2		lb/hr		g/sec
SO_2	0.01	lb/hr	0.001	g/sec	SO_2		lb/hr		g/sec
Proposed Emission Rates (annual averages)					**Proposed Emission Rates (annual averages)**				
$PM_{2.5}$	0.07	TPY	0.002	g/sec	$PM_{2.5}$	0.65	TPY	0.02	g/sec
NO_2	2.41	TPY	0.07	g/sec	NO_2		TPY		g/sec
SO_2	0.001	TPY	0.00003	g/sec	SO_2		TPY		g/sec

2.2 Good Engineering Practice (GEP) Stack Height Analysis

Stack height and building dimensional data for the GEP, cavity and downwash analyses are summarized in Table 2-3. The GEP stack height analysis was conducted in accordance with the methodology described in EPA's Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations (June 1985); the calculations are summarized in Table 2-4 through Table 2-6, for the FBG, emergency generator and cooling tower, respectively. The building dimensional data as well as the layout and orientation of buildings on site are based on the site plan and general arrangement plans presented in Appendix A.

The calculated GEP stack height for the FBG stack, generator stack and cooling tower is 78.49 meters (without accounting for differences in stack base and building ground level elevations), based on the dimensions of the Power House – Tier 4 (Boiler Building), identified as BLD_1 Tier 4. With respect to other significant structures at the PRE premise, the FBG stack is either above the calculated GEP height or located beyond a distance of 5L from the building or structure (i.e., located beyond the distance where those structures are capable of causing downwash on the stacks). The proposed stack heights (47.24 meters for the FBG stack, 3 meters for the generator stack and 13 meters for the cooling tower) are less than the GEP stack height calculated for the controlling structure (BLD_1 Tier 4) and the stacks are also located within the 5L zone of influence from that structure. Therefore, a cavity zone impact analysis was performed based on the dimensions of the controlling structures. Results of the cavity impact analysis are further discussed below and the calculations are summarized in Table 2-7 through Table 2-9.

Downwash effects due to all structures on the proposed site were also evaluated using the EPA Building Profile Input Program (BPIP, dated 04274) using the PRIME algorithm. The direction-specific dimensions produced by the BPIP model were included in the ISCST3 screening and refined modeling analyses. The BPIP model output is included in Appendix B.

2.3 Cavity Zone Impact Analysis

Based on the results of the GEP stack height analysis summarized in Table 2-4, only the Power House Boiler Building (BLD_1 Tier 4) has a calculated GEP stack height greater than the proposed FBG stack height and the stack is located within the 5L zone of influence from the structure. Therefore, there is the potential for air pollutants to be trapped in the cavity region, which is a recirculating eddy of air within the wake region of the structure. The two CTDEP-approved methods of evaluating cavity impacts are: (1) the calculation procedure outlined in Appendix C of the EPA document Regional Workshops on Air Quality Modeling: A Summary Report (Revised October, 1983); and (2) the building cavity algorithm contained in the SCREEN3 screening dispersion model. In the calculation procedure from the Regional Workshops report, the cavity height, $H_C = H_B + 0.5L$, where H_B is the height of the structure and L is the lesser dimension of the height or projected width of the structure. In the SCREEN3 algorithm, $H_C = H_B (1.0 + 1.6 \exp(-1.3L/H_B))$, where L = along wind building dimension. H_C by the SCREEN3 procedure is calculated for two orientations, first with the minimum horizontal dimension along wind and then for the maximum horizontal dimension along wind. With either

Table 2-3 – Dimensional Data For GEP Stack Height and Cavity Impact Analysis

Object	Structure/Equipment Description	Height (meters)	Length (meters)	Width (meters)	Distance to Nearest Property Boundary (meters)	Distance to Stack #1 (meters)	Distance to Stack #2 (meters)	Distance to Stack #3 (meters)
Stack 1	FBG stack	47.2			21.0			
Stack 2	Emergency Generator stack	3.1			33.0			
Stack 3	Cooling Tower	13.1			20.0			
Structure #	**Structure Name**							
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	3.66	60.05	53.64	33.5	54.9	6.0	30.5
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	10.97	60.05	53.64	33.5	54.9	6.0	30.5
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	18.90	60.05	47.55	39.6	54.9	8.5	33.4
BLD_1 Tier 4	Power House - Tier 4 (Boiler Bldg.)	31.39	60.05	32.31	54.9	54.9	23.0	44.5
BLD_2	Baghouse	17.68	15.24	9.14	38.1	14.0	41.5	48.5
BLD_3	Spray Dryer	26.21	7.32	7.32	57.0	32.9	38.6	50.0
BLD_4	Covered Hogged Wood Storage	13.72	91.44	60.96	33.2	219.5	170.6	192.0
BLD_5	Cooling Tower	13.06	29.47	13.01	14.3	45.5	10.0	0.0
BLD_6	Filtered Water Storage Tank	11.58	18.29	18.29	40.4	76.5	65.9	87.6
BLD_7	Lime Storage Silo	6.10	6.10	6.10	57.5	37.0	48.8	61.9
BLD_8	Ash Silo	19.20	7.62	7.62	34.6	17.2	59.8	63.9
BLD_9	Demin Water Storage Tank	3.66	4.57	4.57	58.9	64.3	60.2	79.6
BLD_10	Clarifier	5.18	10.97	10.97	16.4	22.0	82.0	83.1
BLD_11	Thickener	3.35	3.05	3.05	33.1	28.6	77.0	81.3
BLD_12	Filter Press Bldg.	3.05	7.62	7.62	30.3	30.8	83.0	88.8
BLD_13	Diesel Emergency Generator Enclosure	1.80	5.80	1.60	32.5	58.0	0.0	20.1

Table 2-4 – Preliminary GEP Stack Height Analysis – FBG Stack

Fluid Bed Gasifier Stack Height, meters = 47.24

Structure #	Description	Building Height HB (meters)	Building Length BL (meters)	Building Width BW (meters)	Maximum Projected Width[1] (m)	De[2] (meters)	Building Type	Influence Distance (5L) (meters)	Actual Distance To Stack (m)	Within Influence?	GEP[3] Height (meters)	GEP Height (feet)	H_s>GEP?	Perform Cavity Analysis?
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	3.66	60.05	53.64	80.52	80.52	squat	18.29	54.90	NO	9.14	30.00	Yes	No Influence
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	10.97	60.05	53.64	80.52	80.52	squat	54.86	54.86	Yes	27.43	90.00	Yes	No Influence
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	18.90	60.05	47.55	76.59	76.59	squat	94.49	54.86	Yes	47.24	155.00	Yes	No Influence
BLD_1 Tier 4	Power House - Tier 4 (Boiler Bldg.)	31.39	60.05	32.31	68.19	68.19	squat	156.97	54.86	Yes	78.49	257.50	No	**Yes**
BLD_2	Baghouse	17.68	15.24	9.14	17.77	17.77	tall	88.39	14.02	Yes	44.20	145.00	Yes	No Influence
BLD_3	Spray Dryer	26.21	7.32	7.32	10.35	26.21	tall	51.73	32.92	Yes	41.73	136.91	Yes	No Influence
BLD_4	Covered Hogged Wood Storage	13.72	91.44	60.96	109.90	109.90	squat	68.58	219.46	NO	34.29	112.50	Yes	No Influence
BLD_5	Cooling Tower	13.06	29.47	13.01	32.21	32.21	squat	65.29	45.50	Yes	32.64	107.10	Yes	No Influence
BLD_6	Filtered Water Storage Tank	11.58	18.29	18.29	25.86	25.86	squat	57.90	76.50	NO	28.95	94.98	Yes	No Influence
BLD_7	Lime Storage Silo	6.10	6.10	6.10	8.62	8.62	tall	30.50	37.00	NO	15.25	50.03	Yes	No Influence
BLD_8	Ash Silo	19.20	7.62	7.62	10.78	19.20	tall	53.88	17.20	Yes	35.36	116.03	Yes	No Influence
BLD_9	Demin Water Storage Tank	3.66	4.57	4.57	6.47	6.47	squat	18.30	64.30	NO	9.15	30.02	Yes	No Influence
BLD_10	Clarifier	5.18	10.97	10.97	15.51	15.51	squat	25.90	22.00	Yes	12.95	42.49	Yes	No Influence
BLD_11	Thickener	3.35	3.05	3.05	4.31	4.31	tall	16.75	28.60	NO	8.38	27.48	Yes	No Influence
BLD_12	Filter Press Bldg.	3.05	7.62	7.62	10.78	10.78	squat	15.25	30.80	NO	7.63	25.02	Yes	No Influence
BLD_13	Diesel Emergency Generator Enclosure	1.80	5.80	1.60	6.02	6.02	squat	9.00	58.00	NO	4.50	14.76	Yes	No Influence

1 $[BL2 + BW2]^{1/2}$
2 Greater of Max. Projected Width or HB
3 HB + 1.5L, where L = lesser of HB or Projected Width

Table 2-5 – Preliminary GEP Stack Height Analysis – Emergency Generator Stack

Emergency Generator Stack Height, meters = 3.06

Structure #	Description	Building Height HB (meters)	Building Length BL (meters)	Building Width BW (meters)	Maximum Projected Width[1] (m)	De[2] (meters)	Building Type	Influence Distance (5L) (meters)	Actual Distance To Stack (m)	Within Influence?	GEP[3] Height (meters)	GEP Height (feet)	H_s>GEP?	Perform Cavity Analysis?
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	3.66	60.05	53.64	80.52	80.52	squat	18.29	6.0	Yes	9.14	30.00	No	Yes
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	10.97	60.05	53.64	80.52	80.52	squat	54.86	6.0	Yes	27.43	90.00	No	Yes
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	18.90	60.05	47.55	76.59	76.59	squat	94.49	8.5	Yes	47.24	155.00	No	Yes
BLD_1 Tier 4	Power House - Tier 4 (Boiler Bldg.)	31.39	60.05	32.31	68.19	68.19	squat	156.97	23.0	Yes	78.49	257.50	No	Yes
BLD_2	Baghouse	17.68	15.24	9.14	17.77	17.77	tall	88.39	41.5	Yes	44.20	145.00	No	Yes
BLD_3	Spray Dryer	26.21	7.32	7.32	10.35	26.21	tall	51.73	38.6	Yes	41.73	136.91	No	Yes
BLD_4	Covered Hogged Wood Storage	13.72	91.44	60.96	109.90	109.90	squat	68.58	170.6	NO	34.29	112.50	No	No Influence
BLD_5	Cooling Tower	13.06	29.47	13.01	32.21	32.21	squat	65.29	10.0	Yes	32.64	107.10	No	Yes
BLD_6	Filtered Water Storage Tank	11.58	18.29	18.29	25.86	25.86	squat	57.90	65.9	NO	28.95	94.98	No	No Influence
BLD_7	Lime Storage Silo	6.10	6.10	6.10	8.62	8.62	tall	30.50	48.8	NO	15.25	50.03	No	No Influence
BLD_8	Ash Silo	19.20	7.62	7.62	10.78	19.20	tall	53.88	59.8	NO	35.36	116.03	No	No Influence
BLD_9	Demin Water Storage Tank	3.66	4.57	4.57	6.47	6.47	squat	18.30	60.2	NO	9.15	30.02	No	No Influence
BLD_10	Clarifier	5.18	10.97	10.97	15.51	15.51	squat	25.90	82.0	NO	12.95	42.49	No	No Influence
BLD_11	Thickener	3.35	3.05	3.05	4.31	4.31	tall	16.75	77.0	NO	8.38	27.48	No	No Influence
BLD_12	Filter Press Bldg.	3.05	7.62	7.62	10.78	10.78	squat	15.25	83.0	NO	7.63	25.02	No	No Influence
BLD_13	Diesel Emergency Generator Enclosure	1.80	5.80	1.60	6.02	6.02	squat	9.00	0.0	Yes	4.50	14.76	No	Yes

1 $[BL2 + BW2]^{1/2}$
2 Greater of Max. Projected Width or HB
3 HB + 1.5L, where L = lesser of HB or Projected Width

Table 2-6 – Preliminary GEP Stack Height Analysis – Cooling Tower

Cooling Tower Height, meters = 13.06

Structure #	Description	Building Height HB (meters)	Building Length BL (meters)	Building Width BW (meters)	Maximum Projected Width[1] (m)	De[2] (meters)	Building Type	Influence Distance (5L) (meters)	Actual Distance To Stack (m)	Within Influence?	GEP[3] Height (meters)	GEP Height (feet)	H_s>GEP?	Perform Cavity Analysis?
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	3.66	60.05	53.64	80.52	80.52	squat	18.29	30.5	NO	9.14	30.00	Yes	No Influence
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	10.97	60.05	53.64	80.52	80.52	squat	54.86	30.5	Yes	27.43	90.00	No	Yes
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	18.90	60.05	47.55	76.59	76.59	squat	94.49	33.4	Yes	47.24	155.00	No	Yes
BLD_1 Tier 4	Power House - Tier 4 (Boiler Bldg.)	31.39	60.05	32.31	68.19	68.19	squat	156.97	44.5	Yes	78.49	257.50	No	Yes
BLD_2	Baghouse	17.68	15.24	9.14	17.77	17.77	tall	88.39	48.5	Yes	44.20	145.00	No	Yes
BLD_3	Spray Dryer	26.21	7.32	7.32	10.35	26.21	tall	51.73	50.0	Yes	41.73	136.91	No	Yes
BLD_4	Covered Hogged Wood Storage	13.72	91.44	60.96	109.90	109.90	squat	68.58	192.0	NO	34.29	112.50	No	No Influence
BLD_5	Cooling Tower	13.06	29.47	13.01	32.21	32.21	squat	65.29	0.0	Yes	32.64	107.10	No	Yes
BLD_6	Filtered Water Storage Tank	11.58	18.29	18.29	25.86	25.86	squat	57.90	87.6	NO	28.95	94.98	No	No Influence
BLD_7	Lime Storage Silo	6.10	6.10	6.10	8.62	8.62	tall	30.50	61.9	NO	15.25	50.03	No	No Influence
BLD_8	Ash Silo	19.20	7.62	7.62	10.78	19.20	tall	53.88	63.9	NO	35.36	116.03	No	No Influence
BLD_9	Demin Water Storage Tank	3.66	4.57	4.57	6.47	6.47	squat	18.30	79.6	NO	9.15	30.02	Yes	No Influence
BLD_10	Clarifier	5.18	10.97	10.97	15.51	15.51	squat	25.90	83.1	NO	12.95	42.49	Yes	No Influence
BLD_11	Thickener	3.35	3.05	3.05	4.31	4.31	tall	16.75	81.3	NO	8.38	27.48	Yes	No Influence
BLD_12	Filter Press Bldg.	3.05	7.62	7.62	10.78	10.78	squat	15.25	88.8	NO	7.63	25.02	Yes	No Influence
BLD_13	Diesel Emergency Generator Enclosure	1.80	5.80	1.60	6.02	6.02	squat	9.00	20.1	NO	4.50	14.76	Yes	No Influence

[1] $[BL2 + BW2]^{1/2}$
[2] Greater of Max. Projected Width or HB
[3] HB + 1.5L, where L = lesser of HB or Projected Width

Table 2-7 – Cavity Region Analysis – FBG Stack

Constants:

Ta (˚K) =	293.15	d_s (m) =	2.743
Ts (˚F) =	253	u_c (m/sec) =	7.5
Ts (˚K) =	395.93	b =	0.91
V_s (m/sec)[1] =	13.12	H_s (m) =	47.24
d_S (ft) =	9.00		

Structure #	Building Description	Building Height HB (meters)	Building Length BL (meters)	Building Width BW (meters)	Projected Width PW1 (m)	The Lesser of HB & PW L (meters)	Cavity Height[2] Hc (meters)	Cavity Height[3] Hc (meters)	Cavity Height[3] Hc (meters)	Momentum Flux Fm (m^4/s^2)	Plume Rise Hm (meters)
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 4	**Power House - Tier 4 (Boiler Bldg.)**	**31.39**	**60.05**	**32.31**	**68.19**	**31.39**	**47.09**	**44.58**	**35.57**	**239.71**	**9.93**
BLD_2	Baghouse	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_3	Spray Dryer	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_4	Covered Hogged Wood Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_5	Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_6	Filtered Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_7	Lime Storage Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_8	Ash Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_9	Demin Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_10	Clarifier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_11	Thickener	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_12	Filter Press Bldg.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_13	Diesel Emergency Generator Enclosure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Structure #	Building Description	Plume Height Hp (meters)	Cavity Capture?	Influence Distance (3L) (meters)	Bldg Distance to Stack (meters)	Within Building Influence?	Distance to Property Line (meters)	Cavity Length 1 Xr (meters)	Cavity Length 2 Xr (meters)	Stack Within Cavity?[4]	Cavity Entirely On Property?
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 4	**Power House - Tier 4 (Boiler Bldg.)**	**57.18**	**No**	**94.18**	**54.86**	**Yes**	**54.86**	**27.30**	**75.73**	**No**	**No**
BLD_2	Baghouse	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_3	Spray Dryer	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_4	Covered Hogged Wood Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_5	Cooling Tower	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_6	Filtered Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_7	Lime Storage Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_8	Ash Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_9	Demin Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_10	Clarifier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_11	Thickener	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_12	Filter Press Bldg.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_13	Diesel Emergency Generator Enclosure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

1. Minimum stack velocity from all screening modeling operating load cases.
2. HC = HB + 0.5L, based on procedure in Appendix C of 1983 Addendum to EPA "Regional Workshops on Air Quality Modeling: A Summary Report."
3. HC = HB (1.0 +1.6 exp(-1.3L/HB), based on cavity height calculation used by SCREEN3, where L = along wind building dimension. HC by the SCREEN3 procedure is calculated for two orientations, first with the minimum horizontal dimension along wind and then for the maximum horizontal dimension along wind.
4. Stack is considered in the cavity if both the plume height is less than the cavity height and the actual distance between the stack and the building is less than the maximum cavity length.

N/A = Stack is not subject to cavity effects because it is located outside the 5L building zone of influence or the stack height is greater than the calculated GEP height.

Table 2-8 – Cavity Region Analysis – Emergency Generator Stack

Constants:

Ta (˚K) =	293.15	d_s (m) =	0.152
Ts (˚F) =	948	u_c (m/sec) =	7.5
Ts (˚K) =	782.04	b =	0.41
V_s (m/sec)[1] =	101.61	H_s (m) =	3.05
d_S (ft) =	0.50		

Structure #	Building Description	Building Height HB (meters)	Building Length BL (meters)	Building Width BW (meters)	Projected Width PW1 (m)	The Lesser of HB & PW L (meters)	Cavity Height[2] Hc (meters)	Cavity Height[3] Hc (meters)	Cavity Height[3] Hc (meters)	Momentum Flux Fm (m^4/s^2)	Plume Rise Hm (meters)
BLD_1 Tier 1	**Power House - Tier 1 (Admin Bldg.)**	**3.66**	**60.05**	**53.64**	**80.52**	**3.66**	**5.49**	**3.66**	**3.66**	**22.47**	**3.75**
BLD_1 Tier 2	**Power House - Tier 2 (Control Room)**	**10.97**	**60.05**	**53.64**	**80.52**	**10.97**	**16.46**	**11.00**	**10.99**	**22.47**	**5.41**
BLD_1 Tier 3	**Power House - Tier 3 (Turbine Bldg.)**	**18.90**	**60.05**	**47.55**	**76.59**	**18.90**	**28.35**	**20.05**	**19.38**	**22.47**	**6.49**
BLD_1 Tier 4	**Power House - Tier 4 (Boiler Bldg.)**	**31.39**	**60.05**	**32.31**	**68.19**	**31.39**	**47.09**	**44.58**	**35.57**	**22.47**	**7.69**
BLD_2	**Baghouse**	**17.68**	**15.24**	**9.14**	**17.77**	**17.68**	**26.52**	**32.12**	**26.90**	**22.47**	**6.35**
BLD_3	**Spray Dryer**	**26.21**	**7.32**	**7.32**	**10.35**	**10.35**	**31.39**	**55.39**	**55.39**	**22.47**	**7.24**
BLD_4	Covered Hogged Wood Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_5	**Cooling Tower**	**13.06**	**29.47**	**13.01**	**32.21**	**13.06**	**19.59**	**18.78**	**14.17**	**22.47**	**5.74**
BLD_6	Filtered Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_7	Lime Storage Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_8	Ash Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_9	Demin Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_10	Clarifier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_11	Thickener	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_12	Filter Press Bldg.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_13	**Diesel Emergency Generator Enclosure**	**1.80**	**5.80**	**1.60**	**6.02**	**1.80**	**2.70**	**2.71**	**1.84**	**22.47**	**2.96**

Structure #	Building Description	Plume Height Hp (meters)	Cavity Capture?	Influence Distance (3L) (meters)	Bldg Distance to Stack (meters)	Within Building Influence?	Distance to Property Line (meters)	Cavity Length 1 Xr (meters)	Cavity Length 2 Xr (meters)	Stack Within Cavity?[4]	Cavity Entirely On Property?
BLD_1 Tier 1	**Power House - Tier 1 (Admin Bldg.)**	**6.80**	**No**	**10.97**	**6.00**	**Yes**	**33.50**	**20.12**	**20.59**	**No**	**Yes**
BLD_1 Tier 2	**Power House - Tier 2 (Control Room)**	**8.46**	**Yes**	**32.92**	**6.00**	**Yes**	**33.53**	**42.25**	**44.37**	**Yes**	**No**
BLD_1 Tier 3	**Power House - Tier 3 (Turbine Bldg.)**	**9.54**	**Yes**	**56.69**	**8.50**	**Yes**	**39.62**	**51.08**	**58.56**	**Yes**	**No**
BLD_1 Tier 4	**Power House - Tier 4 (Boiler Bldg.)**	**10.74**	**Yes**	**94.18**	**23.00**	**Yes**	**54.86**	**27.30**	**75.73**	**Yes**	**No**
BLD_2	**Baghouse**	**9.40**	**Yes**	**53.04**	**41.50**	**Yes**	**38.10**	**16.49**	**35.31**	**No**	**Yes**
BLD_3	**Spray Dryer**	**10.29**	**Yes**	**31.04**	**38.60**	**No**	**57.00**	**27.33**	**27.33**	**No**	**Yes**
BLD_4	Covered Hogged Wood Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_5	**Cooling Tower**	**8.79**	**Yes**	**39.17**	**10.00**	**Yes**	**14.33**	**18.22**	**36.54**	**Yes**	**No**
BLD_6	Filtered Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_7	Lime Storage Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_8	Ash Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_9	Demin Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_10	Clarifier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_11	Thickener	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_12	Filter Press Bldg.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_13	**Diesel Emergency Generator Enclosure**	**6.01**	**No**	**5.40**		**Yes**	**32.50**	**2.29**	**7.07**	**No**	**Yes**

Table 2-8 (Continued)

Structure #	Building Description	Normalized Cavity Conc. Wind Dir. 1 (µg/m³)	Normalized Cavity Conc. Wind Dir. 2 (µg/m³)	NOx Annual Conc. (µg/m³)	CO 1-Hour Conc. (µg/m³)	CO 8-Hour Conc. (µg/m³)	PM10/2.5 24-Hr Conc. (µg/m³)	PM10/2.5 annual Conc. (µg/m³)	SO2 3-Hour Conc. (µg/m³)	SO2 24-Hour Conc. (µg/m³)	SO2 annual Conc. (µg/m³)
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	0	0	0	0	0	0	0	0	0	0
BLD_1 Tier 2	Power House - Tier 2 (Control Room)	202.37	226.51	0.39	105.25	73.67	5.36	0.01	0.20	0.09	0.0002
BLD_1 Tier 3	Power House - Tier 3 (Turbine Bldg.)	117.50	148.39	0.26	68.95	48.26	3.51	0.01	0.13	0.06	0.0001
BLD_1 Tier 4	Power House - Tier 4 (Boiler Bldg.)	70.73	131.45	0.23	61.08	42.76	3.11	0.01	0.12	0.05	0.0001
BLD_2	Baghouse	0	0	0	0	0	0	0	0	0	0
BLD_3	Spray Dryer	0	0	0	0	0	0	0	0	0	0
BLD_4	Covered Hogged Wood Storage	0	0	0	0	0	0	0	0	0	0
BLD_5	Cooling Tower	346.55	785.12	1.36	364.81	255.36	18.57	0.04	0.70	0.31	0.0007
BLD_6	Filtered Water Storage Tank	0	0	0	0	0	0	0	0	0	0
BLD_7	Lime Storage Silo	0	0	0	0	0	0	0	0	0	0
BLD_8	Ash Silo	0	0	0	0	0	0	0	0	0	0
BLD_9	Demin Water Storage Tank	0	0	0	0	0	0	0	0	0	0
BLD_10	Clarifier	0	0	0	0	0	0	0	0	0	0
BLD_11	Thickener	0	0	0	0	0	0	0	0	0	0
BLD_12	Filter Press Bldg.	0	0	0	0	0	0	0	0	0	0
BLD_13	Diesel Emergency Generator Enclosure	0	0	0	0	0	0	0	0	0	0
	CTDEP Adverse Impact Level:			12.5	5000	1250	18.8/8.1	6.3/1.9	162.5	32.5	7.5
	Significant Impact Level			1	2000	500	5/2	1/0.3	25	5	1
	AAQS			100	40000	10000	150/65	50/15	1300	260	60

1. Minimum stack velocity from all screening modeling operating load cases.
2. HC = HB + 0.5L, based on procedure in Appendix C of 1983 Addendum to EPA "Regional Workshops on Air Quality Modeling: A Summary Report."
3. HC = HB (1.0 +1.6 exp(-1.3L/HB), based on cavity height calculation used by SCREEN3, where L = along wind building dimension. HC by the SCREEN3 procedure is calculated for two orientations, first with the minimum horizontal dimension along wind and then for the maximum horizontal dimension along wind.
4. Stack is considered in the cavity if both the plume height is less than the cavity height and the actual distance between the stack and the building is less than the maximum cavity length.
5. Normalized cavity concentration based on 1 g/sec emission rate, and estimated by the Hosker (1984) approximation used in the SCREEN3 model, C = Q/(1.5 A u), where Q is the emission rate (1 g/sec), A is the cross-sectional area of the building normal to the wind (m2) and u is the wind speed (m/sec), assumed to be 5 m/sec. 1-hr concentrations were converted to 3-hr, 8-hr, 24-hr and annual concentrations using the following conversions, respectively: 0.9, 0.7, 0.4, 0.025.

N/A = Stack is not subject to cavity effects because it is located outside the 5L building zone of influence or the stack height is greater than the calculated GEP height.

Table 2-9 – Cavity Region Analysis – Cooling Tower

Constants:

Ta (˚K) =	293.15	d_s (m) =	12.069
Ts (˚F) =	98	u_c (m/sec) =	7.5
Ts (˚K) =	309.82	b =	1.33
V_s (m/sec)[1] =	7.55	H_s (m) =	13.06
d_S (ft) =	39.60		

Structure #	Building Description	Building Height HB (meters)	Building Length BL (meters)	Building Width BW (meters)	Projected Width PW1 (m)	The Lesser of HB & PW L (meters)	Cavity Height[2] Hc (meters)	Cavity Height[3] Hc (meters)	Cavity Height[3] Hc (meters)	Momentum Flux Fm (m^4/s^2)	Plume Rise Hm (meters)
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 2	**Power House - Tier 2 (Control Room)**	**10.97**	**60.05**	**53.64**	**80.52**	**10.97**	**16.46**	**11.00**	**10.99**	**1965.16**	**10.93**
BLD_1 Tier 3	**Power House - Tier 3 (Turbine Bldg.)**	**18.90**	**60.05**	**47.55**	**76.59**	**18.90**	**28.35**	**20.05**	**19.38**	**1965.16**	**13.11**
BLD_1 Tier 4	**Power House - Tier 4 (Boiler Bldg.)**	**31.39**	**60.05**	**32.31**	**68.19**	**31.39**	**47.09**	**44.58**	**35.57**	**1965.16**	**15.52**
BLD_2	**Baghouse**	**17.68**	**15.24**	**9.14**	**17.77**	**17.68**	**26.52**	**32.12**	**26.90**	**1965.16**	**12.82**
BLD_3	**Spray Dryer**	**26.21**	**7.32**	**7.32**	**10.35**	**10.35**	**31.39**	**55.39**	**55.39**	**1965.16**	**14.62**
BLD_4	Covered Hogged Wood Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_5	**Cooling Tower**	**13.06**	**29.47**	**13.01**	**32.21**	**13.06**	**19.59**	**18.78**	**14.17**	**1965.16**	**11.59**
BLD_6	Filtered Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_7	Lime Storage Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_8	Ash Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_9	Demin Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_10	Clarifier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_11	Thickener	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_12	Filter Press Bldg.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_13	Diesel Emergency Generator Enclosure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Structure #	Building Description	Plume Height Hp (meters)	Cavity Capture?	Influence Distance (3L) (meters)	Bldg Distance to Stack (meters)	Within Building Influence?	Distance to Property Line (meters)	Cavity Length 1 Xr (meters)	Cavity Length 2 Xr (meters)	Stack Within Cavity?[4]	Cavity Entirely On Property?
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_1 Tier 2	**Power House - Tier 2 (Control Room)**	**23.99**	**No**	**32.92**	**30.50**	**Yes**	**33.53**	**42.25**	**44.37**	**No**	**No**
BLD_1 Tier 3	**Power House - Tier 3 (Turbine Bldg.)**	**26.16**	**Yes**	**56.69**	**33.40**	**Yes**	**39.62**	**51.08**	**58.56**	**Yes**	**No**
BLD_1 Tier 4	**Power House - Tier 4 (Boiler Bldg.)**	**28.58**	**Yes**	**94.18**	**44.50**	**Yes**	**54.86**	**27.30**	**75.73**	**Yes**	**No**
BLD_2	**Baghouse**	**25.88**	**Yes**	**53.04**	**48.50**	**Yes**	**38.10**	**16.49**	**35.31**	**No**	**Yes**
BLD_3	**Spray Dryer**	**27.67**	**Yes**	**31.04**	**50.00**	**No**	**57.00**	**27.33**	**27.33**	**No**	**Yes**
BLD_4	Covered Hogged Wood Storage	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_5	**Cooling Tower**	**24.64**	**No**	**39.17**		**Yes**	**14.33**	**18.22**	**36.54**	**No**	**No**
BLD_6	Filtered Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_7	Lime Storage Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_8	Ash Silo	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_9	Demin Water Storage Tank	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_10	Clarifier	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_11	Thickener	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_12	Filter Press Bldg.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BLD_13	Diesel Emergency Generator Enclosure	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2-9 (Continued)

Structure #	Building Description	Normalized Cavity Conc. Wind Dir. 1 (µg/m³)	Normalized Cavity Conc. Wind Dir. 2 (µg/m³)	NOx Annual Conc. (µg/m³)	CO 1-Hour Conc. (µg/m³)	CO 8-Hour Conc. (µg/m³)	PM10/2.5 24-Hr Conc. (µg/m³)	PM10/2.5 annual Conc. (µg/m³)	SO2 3-Hour Conc. (µg/m³)	SO2 24-Hour Conc. (µg/m³)	SO2 annual Conc. (µg/m³)
BLD_1 Tier 1	Power House - Tier 1 (Admin Bldg.)	0	0	0	0	0	0	0	0	0	0
BLD_5	Power House - Tier 2 (Control Room)	0	0	0	0	0	0	0	0	0	0
BLD_6	Power House - Tier 3 (Turbine Bldg.)	117.50	148.39				1.12	0.07			
BLD_7	Power House - Tier 4 (Boiler Bldg.)	70.73	131.45				0.99	0.06			
BLD_8	Baghouse	0	0	0	0	0	0	0	0	0	0
BLD_9	Spray Dryer	0	0	0	0	0	0	0	0	0	0
BLD_10	Covered Hogged Wood Storage	0	0	0	0	0	0	0	0	0	0
BLD_11	Cooling Tower	0	0	0	0	0	0	0	0	0	0
BLD_12	Filtered Water Storage Tank	0	0	0	0	0	0	0	0	0	0
BLD_13	Lime Storage Silo	0	0	0	0	0	0	0	0	0	0
	Ash Silo	0	0	0	0	0	0	0	0	0	0
	Demin Water Storage Tank	0	0	0	0	0	0	0	0	0	0
	Clarifier	0	0	0	0	0	0	0	0	0	0
	Thickener	0	0	0	0	0	0	0	0	0	0
	Filter Press Bldg.	0	0	0	0	0	0	0	0	0	0
	Diesel Emergency Generator Enclosure	0	0	0	0	0	0	0	0	0	0
	CTDEP Adverse Impact Level:			12.5	5000	1250	18.8/8.1	6.3/1.9	162.5	32.5	7.5
	Significant Impact Level			1	2000	500	5/2	1/0.3	25	5	1
	AAQS			100	40000	10000	150/65	50/15	1300	260	60

1. Minimum stack velocity from all screening modeling operating load cases.
2. HC = HB + 0.5L, based on procedure in Appendix C of 1983 Addendum to EPA "Regional Workshops on Air Quality Modeling: A Summary Report."
3. HC = HB (1.0 +1.6 exp(-1.3L/HB), based on cavity height calculation used by SCREEN3, where L = along wind building dimension. HC by the SCREEN3 procedure is calculated for two orientations, first with the minimum horizontal dimension along wind and then for the maximum horizontal dimension along wind.
4. Stack is considered in the cavity if both the plume height is less than the cavity height and the actual distance between the stack and the building is less than the maximum cavity length.
5. Normalized cavity concentration based on 1 g/sec emission rate, and estimated by the Hosker (1984) approximation used in the SCREEN3 model, C = Q/(1.5 A u), where Q is the emission rate (1 g/sec), A is the cross-sectional area of the building normal to the wind (m2) and u is the wind speed (m/sec), assumed to be 5 m/sec. 1-hr concentrations were converted to 3-hr, 8-hr, 24-hr and annual concentrations using the following conversions, respectively: 0.9, 0.7, 0.4, 0.025.

N/A = Stack is not subject to cavity effects because it is located outside the 5L building zone of influence or the stack height is greater than the calculated GEP height.

calculation of cavity height, if the plume height is greater than the cavity height, it is assumed that maximum impacts will be dominated by wake effects rather than cavity effects. If the plume height is less than the cavity height and the distance between the stack and the building is less than the calculated cavity lengths, then concentrations within the cavity zone are further evaluated.

The cavity impact analysis for the FBG stack is summarized in Table 2-7 using both methods of calculating the height of the cavity zone. The analysis demonstrates that the plume height from the proposed stack will be greater than the cavity height calculated according to both procedures. Therefore, maximum impacts will be dominated by wake effects and no further analysis of cavity impacts for the FBG stack is required.

The cavity impact analyses for the emergency generator stack and cooling tower are summarized in Table 2-8 and Table 2-9, respectively. In these cases, the plume heights were less than the cavity heights. Therefore, cavity zone concentrations were estimated and compared to CTDEP adverse impact levels (1/8 the AAQS), SILs and AAQS. Based on these comparisons, cavity zone impacts due to emissions from the emergency generator and cooling tower were determined to be insignificant or acceptable.

It also should be noted that the PRIME downwash algorithm was used in conjunction with the ISCST3 model in the screening and refined modeling analyses. The PRIME algorithm partitions plume mass between the cavity recirculation region and the dispersion enhanced wake region based upon the fraction of plume mass that is calculated to intercept the cavity boundaries. The inclusion of the cavity predictions within ISC-PRIME removes a modeling discontinuity that exists when ISC is used without the PRIME algorithm and obviates the need for additional cavity impact analysis using the SCREEN3 or other calculation procedures.[2] [3] Regardless, the more conservative cavity impact calculation procedures were performed as use of the PRIME algorithm is not specifically referenced in the outdated CTDEP AIAG.

2.4 Urban/Rural Designation

The selection of urban or rural designation for screening and refined modeling input was based on the land use classification procedure referenced in the AIAG. The area circumscribed by a 3 kilometer radius circle centered about the PRE source is depicted on the USGS topographical map in Figure 2-1. In making the urban/rural determinations, areas on the topographic map shaded pink and purple are considered urban and areas shaded green are considered rural. Areas shaded white were classified according to Auer land use categories based on a review of aerial photography shown in Figure 2-2. From inspection of the USGS topographical map and aerial photograph, the areas within the 3 kilometer radius circle considered to be urban land uses (i.e., in Auer land use categories I1, I2, C1, R2 or R3) were estimated to be less than 25 percent. Therefore, the land use classification of the modeling domain is considered rural (i.e., less than 50 percent urban areas) and the modeling was performed using rural dispersion coefficients.

Figure 2-1 – USGS Topographic Map Showing 3 KM Radius Land Use

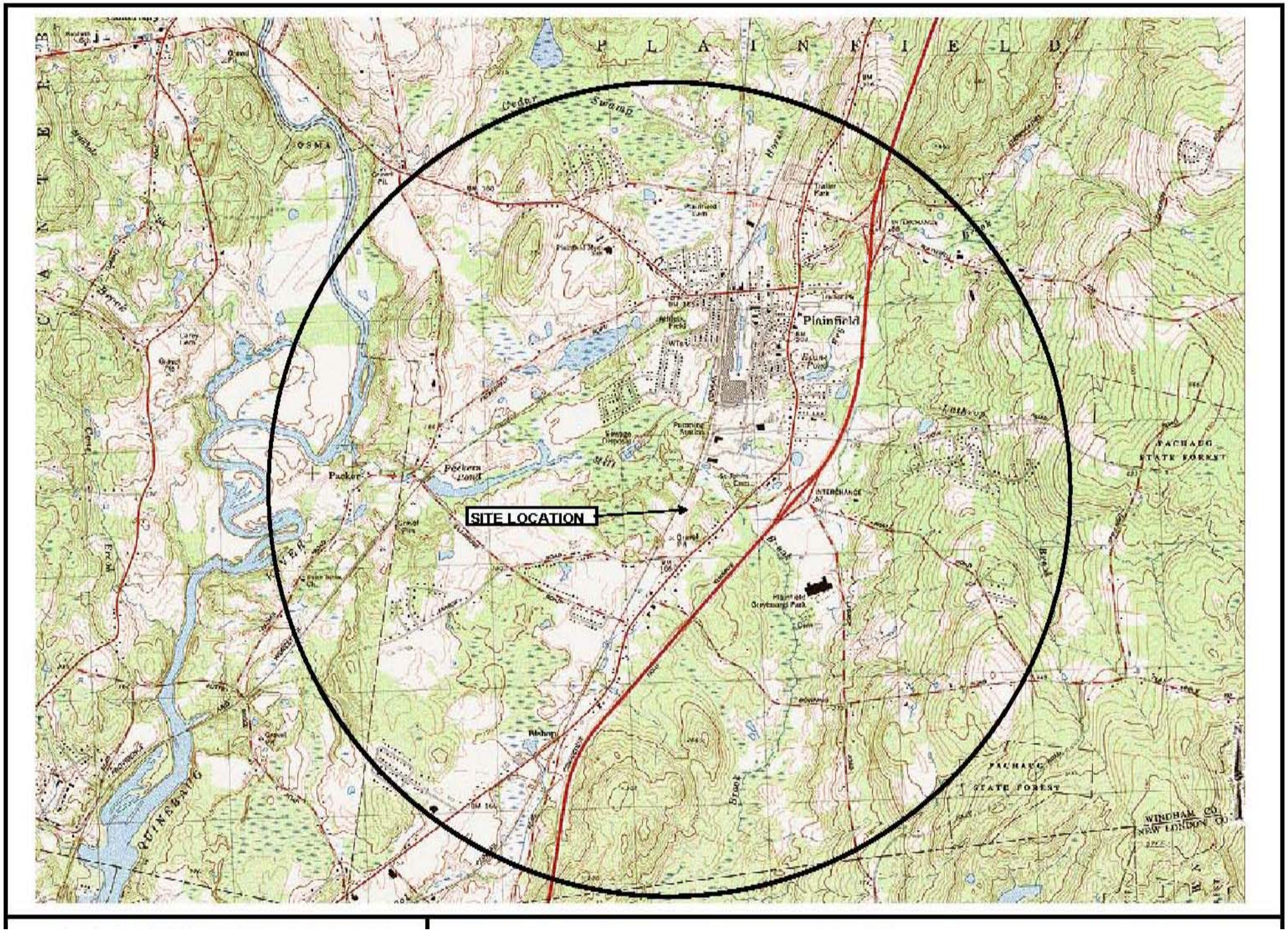
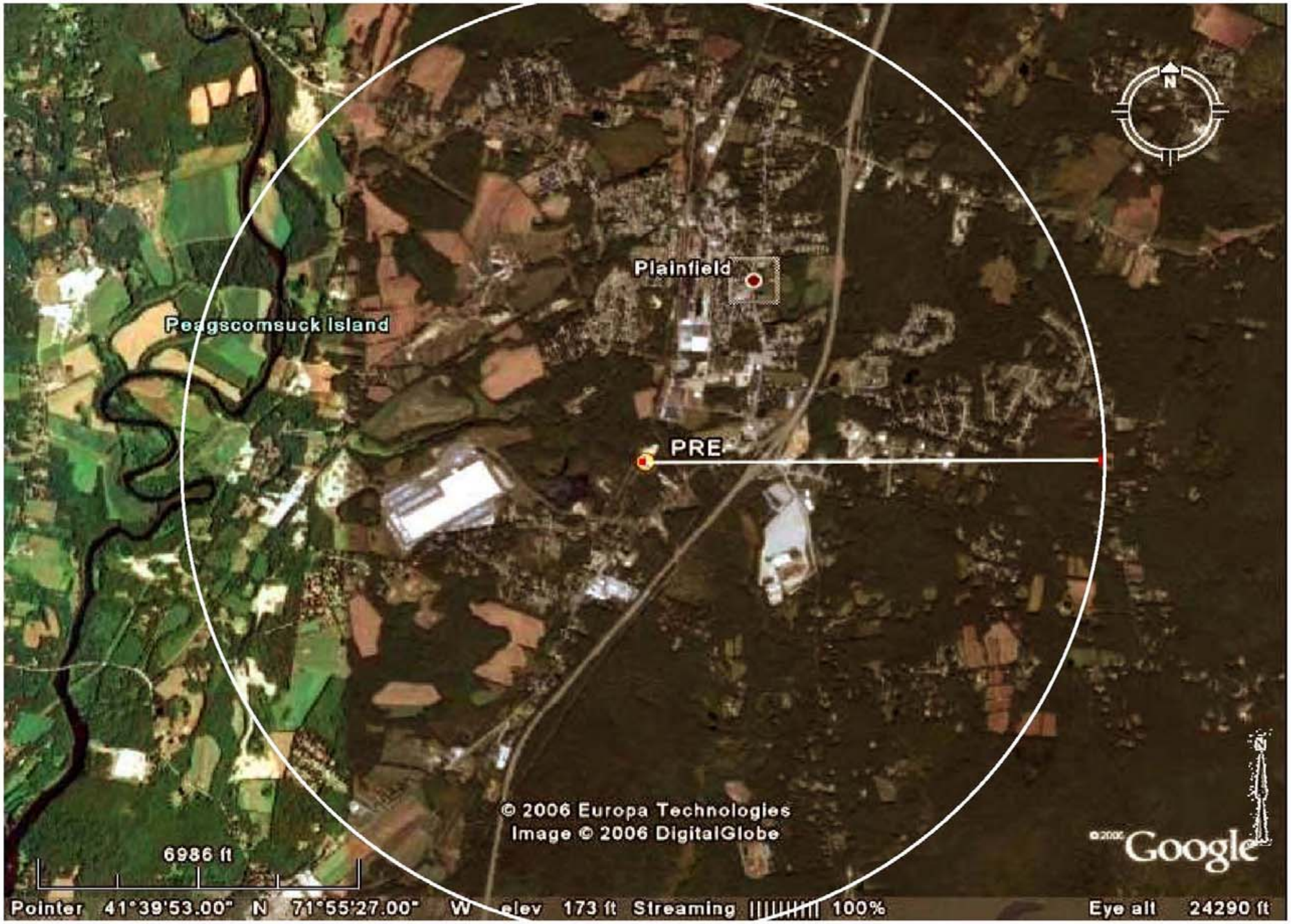


Figure 2-2 – 3 KM Radius Aerial Photograph



3.0 SCREENING MODELING ANALYSIS

Screening modeling was performed with EPA's ISCST3 model (Version 02035 and also with Version 04269 with PRIME algorithm) to determine the worst case operating condition and receptor rings for subsequent refined modeling. The stack parameters corresponding to the four operating load conditions are summarized in Table 2-1. The modeled operating conditions correspond to the expected range of biomass fuel compositions and operating loads for the subject FBG power plant. The modeling was performed using the set of twenty meteorological conditions recommended for screening modeling in the AIAG. Initial runs were performed assuming flat terrain. Receptors were placed along a single wind direction radial at 100-meter intervals out to two kilometers, 500-meter intervals to ten kilometers and 1,000-meter intervals out to 20 kilometers. Because the FBG stack will be susceptible to downwash, an additional receptor was placed at a distance of 3L (94 meters) from the stack.

An additional run of the ISCST model was performed with the maximum terrain representing each receptor ring input to the model. Terrain elevations at each of the receptor points were specified by importing 7.5 minute USGS Digital Elevation Model (DEM) data obtained from www.webgis.com into the Lakes Environmental ISC-AERMOD View model, which was initially set up with a polar receptor grid at the receptor ring distances as specified above. Following the procedure in the AIAG, the method used to select the elevation for each receptor involved importing the highest elevation from within a bounding polygon, where the bounding polygon is defined by half the distance to adjacent receptor grid nodes. Once the terrain elevations were specified for the polar receptor grid, the maximum elevation for each receptor ring was determined and then input to the receptors set up along a single wind direction radial for the screening modeling. Table 3-1 summarizes the screening receptors with terrain data specified in this manner.

A final screening run was performed using the ISCST model with PRIME algorithm (Version 04269) and the receptor terrain data as described above.

The following model options were used for the ISCST3 screening modeling in accordance with the AIAG:

- Rural mode
- Gradual plume rise
- Stack-tip downwash
- Buoyancy-induced dispersion
- Calms processing routine
- No missing data processing routine
- Default wind profile exponents
- Default vertical potential temperature gradients

The ISCST screening model outputs are summarized in Table 3-2. The screening modeling results show that the maximum PM_{10}, NO_2, SO_2 and Pb impacts occur for Case 2 (the 25/75 C&D/Wood @ 100 percent load case) and the maximum CO impact occurs for Case 1 (the 100%

Table 3-1 – Summary of Terrain Data For Screening Modeling

Stack base elevation (m) = 56
Stack Height (m) = 47.24
ORIG (UTM, XY) 756,096 m 4,616,897 m (Datum NAD27, Zone 18)

Receptor Distance (m)	Terrain Height Above MSL (m)	Terrain Height[a] (m)	Complex Terrain[a] (m)
94	59	3	
100	59	3	
200	61	5	
300	66	10	
400	61	5	
500	63	7	
600	66	10	
700	69	13	
800	71	15	
900	72	16	
1000	68	12	
1100	69	13	
1200	73	17	
1300	72	16	
1400	80	24	
1500	87	31	
1600	91	35	
1700	98	42	
1800	102	46	
1900	108	52	52
2000	117	61	61
2500	151	95	95
3000	162	106	106
3500	179	123	123
4000	175	119	119
4500	177	121	121
5000	167	111	111
5500	176	120	120
6000	196	140	140
6500	191	135	135
7000	195	139	139
7500	168	112	112
8000	165	109	109
8500	178	122	122
9000	181	125	125
9500	174	118	118
10000	184	128	128
11000	188	132	132
12000	208	152	152
13000	220	164	164
14000	190	134	134
15000	217	161	161
16000	216	160	160
17000	230	174	174
18000	197	141	141
19000	217	161	161
20000	222	166	166

[a] The terrain height and the stack height are expressed as heights above stack base elevation (56 m above mean sea level).

Table 3-2 – ISCST Screening Modeling Results

(Normalized Impacts for FBG Stack Based on 1 g/sec Emission Rate)
Controlling Building/Tier: BLD_1 Tier 4, Power House (Boiler Bldg.)

Flat Terrain Screening Model Results (ISCST3):

Case	1	2	3	4
Description	100/0 C&D/Wood	25/75 C&D/Wood	65/35 C&D/Wood	25/75 C&D/Wood
Simple Terrain Max. Conc. (1-hr. avg.), (µg/m^3)/(g/sec)	7.461	**7.529**	7.233	9.742
PM_{10} (µg/m^3)	9.34	**10.03**	9.06	9.50
NO_2 (µg/m^3)	33.50	**36.48**	33.75	35.58
SO_2 (µg/m^3)	15.81	**17.61**	15.52	17.17
CO (µg/m^3)	**46.98**	46.84	45.37	46.02
Pb (µg/m^3)	0.063	**0.069**	0.063	0.068

Elevated Terrain Screening Model Results (ISCST3):

Case	1	2	3	4
Description	100/0 C&D/Wood	25/75 C&D/Wood	65/35 C&D/Wood	25/75 C&D/Wood
Max. Conc. (1-hr. avg.), (µg/m^3)/(g/sec)	12.387	**12.468**	12.080	14.913
PM_{10} (µg/m^3)	15.51	**16.60**	15.13	14.54
NO_2 (µg/m^3)	55.62	**60.40**	56.36	54.47
SO_2 (µg/m^3)	26.25	**29.16**	25.92	26.29
CO (µg/m^3)	**78.01**	77.57	75.77	70.44
Pb (µg/m^3)	0.104	**0.115**	0.105	0.104

Elevated Terrain Screening Model Results (ISCST3 w/ PRIME):

Case	1	2	3	4
Description	100/0 C&D/Wood	25/75 C&D/Wood	65/35 C&D/Wood	25/75 C&D/Wood
Max. Conc. (1-hr. avg.), (µg/m^3)/(g/sec)	8.873	**8.921**	8.660	10.580
PM_{10} (µg/m^3)	11.11	**11.88**	10.85	10.32
NO_2 (µg/m^3)	39.84	**43.22**	40.40	38.65
SO_2 (µg/m^3)	18.80	**20.86**	18.58	18.65
CO (µg/m^3)	**55.88**	55.50	54.32	49.98
Pb (µg/m^3)	0.075	**0.082**	0.076	0.074

C&D @ 91 percent load case). Therefore, the refined modeling was performed using these different operating scenarios for the respective pollutants.

4.0 REFINED SINGLE-SOURCE MODELING ANALYSIS

4.1 Models Used

ISCST3 with PRIME algorithm (Version 04269) was used in the refined modeling analyses for both simple and complex terrain. The ISC model was run using the Lakes Environmental's ISC-AERMOD View (version 5.4.0) interface for EPA's ISC and AERMOD models. The PTMTPA-CONN model (modified 3/16/88) was run for all receptors identified in the refined receptor network with complex terrain (higher than stack top).

4.2 Stack Parameters

Table 4-1 summarizes the refined modeling input parameters for the two modeling scenarios. Based on the screening modeling results, all refined modeling for PM_{10}, $PM_{2.5}$, NO_2, SO_2, Pb and Dioxins was performed using stack parameters for Case 2 and all CO modeling was performed using the stack parameters for Case 1.

4.3 Building Downwash – BPIP Model

Building downwash effects were evaluated in the refined modeling analysis using the EPA Building Profile Input Program (BPIP, dated 04274 – contained in Lakes Environmental ISC-AERMOD View interface, version 5.4.0). BPIP determines, in each of the 36 wind directions (10° sectors), which building or structure may produce the greatest downwash effects on a stack. The direction-specific dimensions produced by the BPIP model are imported into the ISCST3 refined modeling input.

The scaled PRE site plan CAD drawing, referenced to the UTM coordinate system (Zone 18, NAD27 datum), was first imported into the ISC-AERMOD View program. Using the geographical interface in ISC-AERMOD View, the stacks and significant buildings and structures previously identified by the GEP stack height analysis were located on the scaled CAD drawing to determine the geographical (UTM - NAD27) coordinates and the structures and tiers were input to the model. Figure 4-1 depicts the BPIP model setup and the BPIP output files are provided in Appendix B. A three-dimensional representation of the significant structures and tiers on site is also provided in Figure 4-2, as generated by the ISC-AERMOD View program. Figure 4-3 is a computer-generated conceptual rendering from a similar viewpoint based on the site plan and general arrangement drawings.

4.4 Receptor Network and Terrain Elevations

The receptor grid used for refined single-source modeling was based on the results of the screening modeling analysis and the procedure described in the AIAG. A non-uniform polar grid receptor network was set up in ISCST3 with the ISC-AERMOD View interface using rings of receptors spaced at 10 degree intervals on 36 radials originating at the stack location. The screening modeling analysis for both operating scenarios resulting in the maximum impacts indicated that 94 meters (3L) was the closest distance to a maximum impact for any stability condition. Therefore, the receptor rings were selected at distances starting at 94 meters and

Table 4-1 – Refined Single-Source Modeling Analysis Input Data

SOURCE INFORMATION:

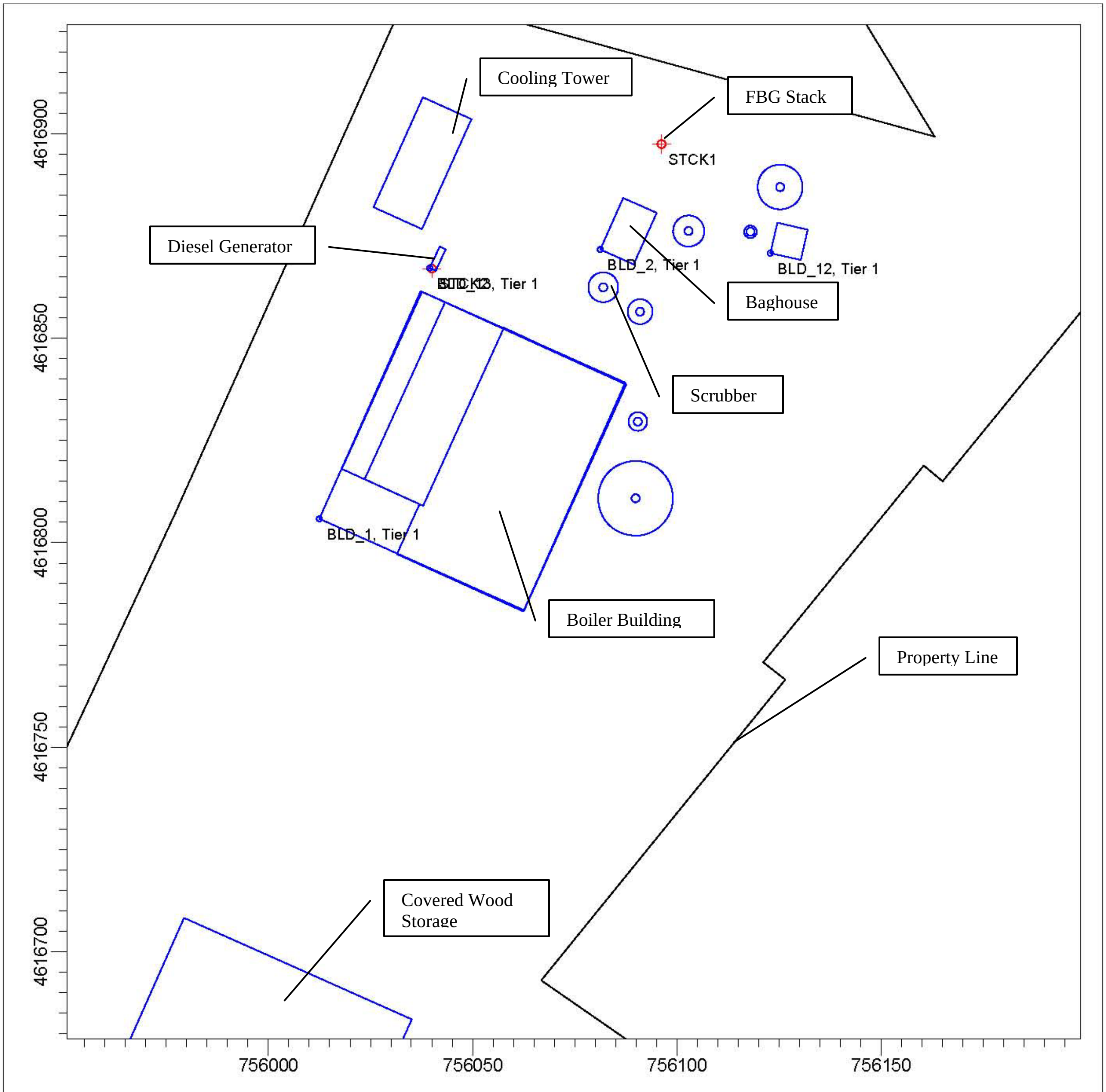
Company Name:		Plainfield Renewable Energy LLC					
Equipment Location Address:		Mill Brook Rd., Plainfield, CT					
Equipment Description:		EPI Fluidized Bed Staged Gasifier Energy System					
ORIG (UTM, XY), meters (FBG stack)	X =	756,096	meters East	Y=	4,616,897	meters North	(Datum NAD27, Zone 18)
	X =	256,549	meters East	Y=	4,616,457	meters North	(Datum NAD27, Zone 19)
Latitude/Longitude	N	41º39'53"		W	71º55'27"		
CT State Plane Coordinates	X =	825,679	feet East	Y=	303,960	feet North	(Datum NAD27)

OPERATING DATA AND STACK PARAMETERS:

Case	2				1			
Description	25/75 C&D/Wood				100/0 C&D/Wood			
% Load	100%				91%			
Exhaust Gas Flow Rate	3443	ft^3/sec	97.51	m^3/sec	3474	ft^3/sec	98.40	m^3/sec
Stack Exhaust Temp.	253	deg. F	395.93	deg. K	253	deg. F	395.93	deg. K
Physical Stack Height	155	ft.	47.24	m	155	ft.	47.24	m
Stack Height above MSL	332	ft.	101.24	m	332	ft.	47.24	m
Stack Diameter	9	ft.	2.74	m	9	ft.	2.74	m
Stack Velocity	54.12	ft/sec	16.50	m/sec	54.61	ft/sec	16.65	m/sec
Proposed Emission Rates (1-hour to 24-hour averages)[1]								
PM_{10}	10.46	lb/hr	1.32	g/sec	10.46	lb/hr	1.32	g/sec
NO_2	39.23	lb/hr	4.94	g/sec	39.23	lb/hr	4.94	g/sec
SO_2	18.56	lb/hr	2.34	g/sec	18.56	lb/hr	2.34	g/sec
CO	54.67	lb/hr	6.89	g/sec	54.67	lb/hr	6.89	g/sec
Pb	0.073	lb/hr	0.0092	g/sec	0.073	lb/hr	0.0092	g/sec
Dioxins	4.6E-08	lb/hr	5.7E-09	g/sec	4.6E-08	lb/hr	5.7E-09	g/sec
Proposed Emission Rates (annual averages)								
PM_{10}	45.82	TPY	1.32	g/sec	45.82	TPY	1.32	g/sec
NO_2	171.84	TPY	4.94	g/sec	171.84	TPY	4.94	g/sec
SO_2	81.29	TPY	2.34	g/sec	81.29	TPY	2.34	g/sec
CO	239.47	TPY	6.89	g/sec	239.47	TPY	6.89	g/sec
Pb	0.321	TPY	0.0092	g/sec	0.321	TPY	0.0092	g/sec
Dioxins	2.0E-07	TPY	5.7E-09	g/sec	2.0E-07	TPY	5.7E-09	g/sec

1. To ensure conservativeness of modeling results, maximum lb/hr emission rates of any operating load scenario were used in the modeling analysis.
2. Stack base elevation automatically obtained in Lakes ISC-AERMOD View from imported USGS DEM data differs slightly from base elevation assumed for screening modeling (i.e., 54 m obtained from DEM data versus 56 m used in screening modeling).

Figure 4-1 – BPIP Model Setup, Building/Structure Identification



COMMENTS:	SOURCES:	COMPANY NAME:	
UTM coordinates referenced to Zone 18, NAD27	7	M.I. Holzman & Associates, LLC	
	RECEPTORS: 742	MODELER: Michael I. Holzman	
		SCALE: 1:1,513 (0 – 0.05 km)	
		DATE: 11/22/2006	PROJECT NO.: 085-001

ISC-AERMOD View - Lakes Environmental Software   C:\MIHA Files\MIHA\Projects\(085)Decker Energy\(001)Plainfield Renewable Energy\Modeling\ISC\PRENOM70.isc

Figure 4-2 – BPIP Model Setup, 3D Building Representation

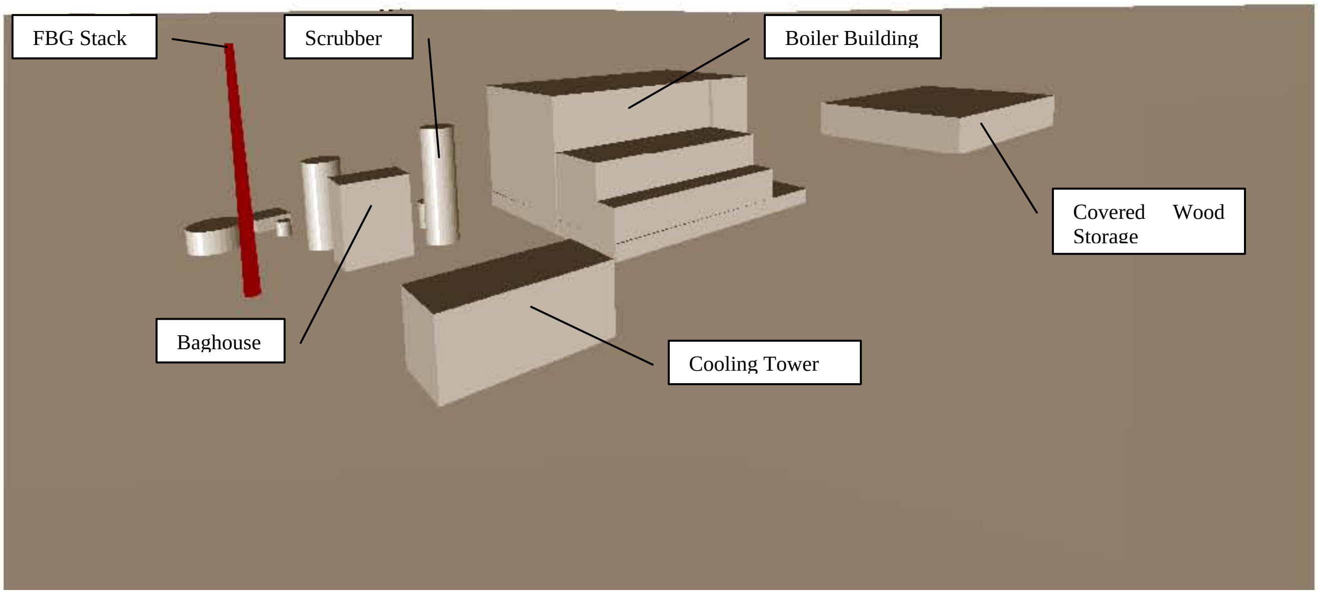


Figure 4-3 – Computer-Generated Conceptual Rendering

progressing geometrically by a factor of 1.33 (with minimum initial ring spacing of 100 meters) until the significant impact area could be defined. For initial refined modeling runs, a total of 19 receptor rings were defined at the following distances in meters from the stack: 94, 194, 260, 340, 450, 600, 800, 1060, 1410, 1880, 2500, 3320, 4410, 5860, 7790, 10360, 13780, 18330, and 24380 meters. In order to import terrain elevations associated with each of the receptors, the polar grid had to be converted into discrete Cartesian receptors.

The proposed site will be fenced and not accessible to the general public. Therefore, a total of 58 discrete receptors were placed along the proposed fenceline, including 23 receptors at each node of the fenceline polygon and 35 receptors at intermediate points between nodes. An additional 40 discrete receptors were defined 50 meters from the plant fenceline at 50 meter spacing. Discrete Cartesian receptors located within the plant boundary were eliminated since the property will not be accessible by the general public. Figure 4-4 depicts the near-field polar receptors, fenceline and plant boundary receptors with those within the plant boundary eliminated. Figure 4-5 depicts the entire receptor network within the modeling domain boundaries.

Terrain elevations at each of the receptor points were specified by importing 7.5 minute USGS Digital Elevation Model (DEM) data into ISC-AERMOD View. The DEM data was obtained from www.webgis.com. The ISC-AERMOD View program was able to import DEM data from different UTM zones by converting the UTM coordinates to a consistent zone and datum reference. UTM Zone 18 (NAD27) was used as the common reference for model setup. Following the procedure in the AIAG, the method used to select the elevation for each receptor involved importing the highest elevation from within a bounding polygon, where the bounding polygon is defined by half the distance to adjacent receptor grid nodes.

The receptor network for the PTMTPA-CONN complex terrain modeling was selected from the ISCST3 polar network based on the elevation of each receptor in relation to the FBG stack top. A total of 151 receptors were determined to have elevations at or above the proposed stack top. The UTM coordinates (referenced to zone 18, NAD27 datum) are summarized in Table 4-2. As required by the AIAG, these high terrain receptors were modeled using both the ISCST3 and PTMTPA-CONN models.

4.5 Meteorological Data

Following the AIAG and discussions with Mr. Jude Catalano of CTDEP's air quality modeling group, surface data from National Weather Service (NWS) Station #14740 (Bradley International Airport) and upper air data from NWS Station # 14735 (Albany County Airport), both for the years 1970 to 1974 were selected for input in the ISCST3 modeling analysis.

The set of 17 meteorological conditions listed in Table 5-3 of the AIAG was used for the PTMTPA-CONN modeling of complex terrain receptors.

4.6 Background Air Quality

Modeled pollutant concentrations are added to background air quality data to evaluate compliance with NAAQS/CAAQS. Background air quality data are conservatively used to account for pollutant concentrations that are otherwise not accounted for in the single-source or

Figure 4-4 – ISCST Model Setup, Showing Buildings, Fenceline, Plant Boundary and Near-Field Receptors

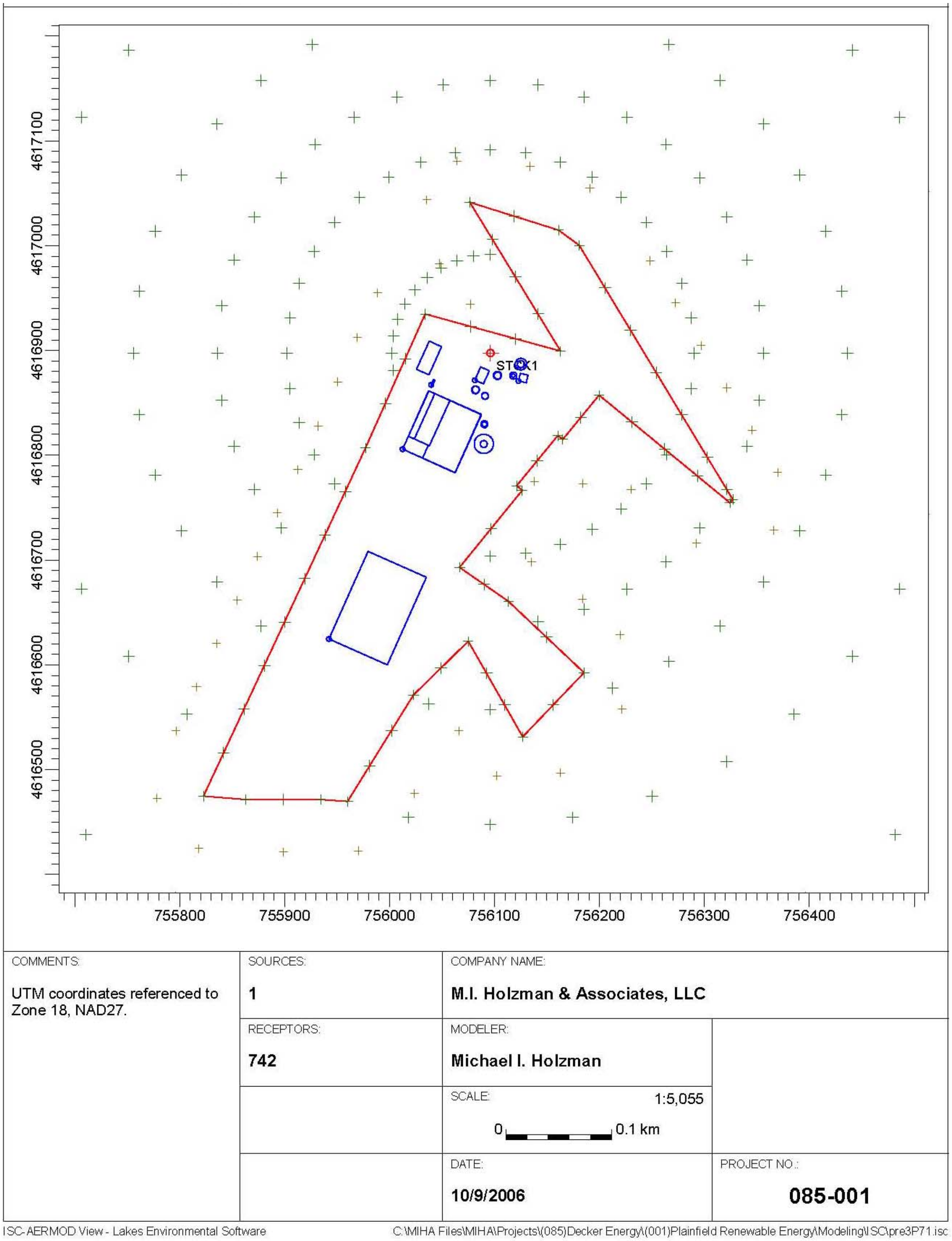


Figure 4-5 – ISCST Model Setup, Polar Receptors and Domain Boundaries

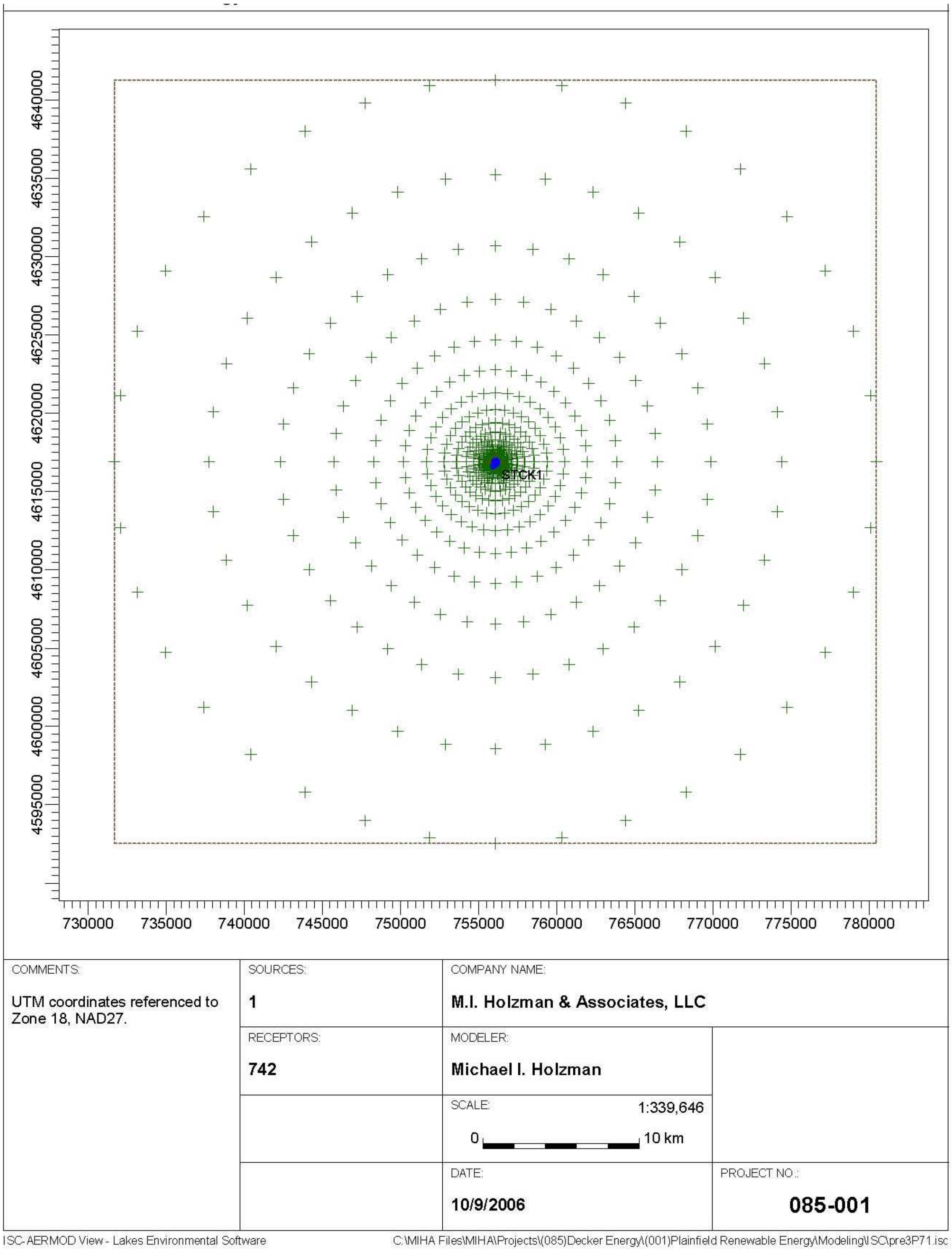


Table 4-2 – PTMTPA Complex Terrain Receptors (Elevation Greater Than Stack Top)

UTM X (KM)	UTM Y (KM)	Z (M)	UTM X (KM)	UTM Y (KM)	Z (M)	UTM X (KM)	UTM Y (KM)	Z (M)
768.28624	4638.01118	216.2	759.41624	4616.89748	151.0	766.29885	4618.69648	121.0
743.90624	4638.01118	205.5	763.41645	4619.56182	150.1	768.03007	4610.00748	121.0
764.95385	4627.45357	204.0	758.2613	4615.64748	149.9	760.32978	4640.90709	120.8
746.93124	4632.77173	196.9	766.65233	4625.75509	149.9	750.91624	4625.8695	120.5
767.87854	4630.93907	195.1	769.87624	4616.89748	149.0	758.55826	4616.46336	120.2
747.75779	4639.80719	191.3	758.23029	4614.35421	147.2	760.80928	4603.94852	118.4
765.26124	4632.77173	191.0	759.3658	4616.32097	146.9	745.89363	4618.69648	116.7
762.98624	4628.83131	187.1	761.60284	4618.90172	146.2	744.16241	4623.78748	116.5
761.95624	4616.89748	185.0	758.97144	4615.23748	146.0	780.10585	4621.13102	115.9
740.22199	4626.06248	179.9	759.4745	4619.73217	145.6	758.59624	4616.89748	115.8
773.32081	4623.16671	177.3	737.42008	4632.56864	145.4	737.42008	4601.22632	115.7
742.05465	4628.67978	176.5	760.24028	4618.40579	145.0	764.03246	4623.55676	115.0
770.13783	4628.67978	176.1	780.10585	4612.66394	144.6	743.14728	4621.61052	114.9
761.86721	4615.8799	175.1	761.27624	4625.8695	144.3	760.80928	4629.84644	114.7
761.60284	4614.89324	175.1	765.06826	4622.07748	144.2	761.17115	4619.82748	114.7
758.93093	4613.51922	175.0	759.21602	4615.76197	144.2	780.47624	4616.89748	114.3
747.12422	4622.07748	175.0	758.30124	4613.07831	144.1	762.36547	4634.12205	114.0
761.86721	4617.91506	174.8	768.03007	4623.78748	143.7	748.77603	4614.23314	113.7
759.4745	4614.06279	174.7	748.16002	4623.55676	142.7	745.89363	4615.09848	113.6
764.43469	4639.80719	172.1	759.91541	4619.10248	142.4	758.44547	4617.75253	113.1
759.3658	4617.47399	172.0	758.97144	4618.55748	141.7	760.58526	4613.13074	113.1
762.06373	4621.9048	171.7	771.7674	4635.57364	141.3	756.09624	4635.22748	111.2
760.43924	4617.66327	171.6	766.45624	4616.89748	141.1	765.06826	4611.71748	111.0
740.42508	4635.57364	171.0	758.01135	4615.29051	137.9	751.08892	4622.86497	111.0
751.8627	4640.90709	170.7	758.44547	4616.04243	136.0	748.42459	4618.2502	110.7
779.00595	4608.55903	170.6	748.77603	4619.56182	133.9	756.09624	4598.56748	110.3
777.20994	4629.08748	169.9	731.71624	4616.89748	133.8	764.03246	4610.2382	110.0
774.42624	4616.89748	169.2	758.55826	4617.3316	132.6	758.2613	4618.14748	109.8
771.97049	4626.06248	168.7	765.26124	4601.02323	132.2	759.63957	4626.6327	109.7
762.75552	4624.8337	167.4	740.22199	4607.73248	132.0	757.60455	4612.75344	109.4
746.36102	4620.44081	167.2	763.76789	4615.54476	131.1	759.27921	4598.84595	109.4
760.50624	4616.89748	165.7	762.06373	4611.89016	131.0	757.23175	4620.01726	108.6
760.24028	4615.38917	165.4	758.10048	4611.39088	130.8	757.75624	4614.02228	108.3
759.91541	4614.69248	162.3	757.75624	4619.77268	130.4	765.83146	4620.44081	108.0
749.20624	4628.83131	161.9	766.29885	4615.09848	130.1	734.98254	4604.70748	107.8
758.63951	4614.76343	161.4	769.66689	4614.50461	130.0	756.09624	4592.51748	107.1
761.17115	4613.96748	159.9	757.70321	4614.98237	129.9	756.09624	4603.11748	106.6
774.14777	4620.08045	159.2	760.58526	4620.66422	129.3	734.98254	4629.08748	106.2
763.76789	4618.2502	158.9	771.97049	4607.73248	129.2	765.83146	4613.35415	106.1
760.43924	4616.13169	158.7	732.08663	4612.66394	129.1	757.86286	4616.25448	105.8
752.91327	4634.94901	158.5	759.86298	4612.40846	127.7	758.76058	4609.57727	105.5
759.02624	4611.82257	158.3	767.87854	4602.85589	126.1	750.32527	4617.91506	105.0
759.21602	4618.03299	157.8	762.36547	4599.67291	125.4	770.13783	4605.11518	105.0
747.23863	4627.45357	157.5	752.20124	4623.64382	125.3	748.30624	4616.89748	104.8
762.84258	4620.79248	156.1	769.66689	4619.29035	124.1	757.94768	4616.57102	104.6
763.88624	4616.89748	154.6	769.0452	4621.61052	123.6	757.97624	4616.89748	104.5
744.31394	4630.93907	154.0	745.73624	4616.89748	123.5	774.7724	4632.56864	104.2
762.84258	4613.00248	153.9	764.95385	4606.34139	123.3	758.63951	4619.03153	104.1
738.04471	4613.71451	153.2	758.30124	4620.71665	122.5	754.29724	4606.69487	103.7
763.41645	4614.23314	152.9	759.99124	4610.15114	121.3	749.3499	4613.00248	103.3
						745.54015	4625.75509	103.3

multiple-source modeling analyses. With exceptions noted as follows, background concentrations were obtained in accordance with the procedure in the AIAG from the average of the most recent available three years of monitoring data (2003-2005) from the three Connecticut monitoring sites nearest to the project site. For $PM_{2.5}$, background concentrations were obtained from the average of 2003-2005 data from the Norwich, CT and East Greenwich, RI monitoring sites as these sites were judged to be most representative of the rural location of the PRE site. Similarly, for PM_{10}, the 24-hour background concentration was obtained from the average of the 2003-2005 values from East Hartford, CT and East Greenwich, RI. The PM_{10} annual background concentration was obtained from the average of the 2003-2005 values from Waterbury, CT and East Greenwich, RI. Table 4-3 summarizes the background ambient data determined to be most representative of the PRE modeling domain.

Table 4-3 – Representative Ambient Background Concentrations

Pollutant	Averaging Period	Background Concentration (μg/m^3)	AAQS (μg/m^3)	Basis
PM10	24-hour	31	150	3
	Annual	17	50	4
PM2.5	24-hour	33	65	2
	Annual	9.8	15	2
NO_2	Annual	33	100	1
SO_2	3-hour	92	1300	1
	24-hour	55	260	1
	Annual	11	60	1
CO	1-hour	20,000	40,000	5
	8-hour	5,000	10,000	5
Pb	3-month		1.5	6
Dioxins	Annual		1.00E-06	6

1. Background concentrations were obtained from the 2003-2005 average values from the 3 CT monitoring sites nearest to the project site (data provided by CTDEP).
2. For PM2.5, background concentrations were obtained from the average of 2003-2005 data from the Norwich, CT and East Greenwich, RI monitoring sites.
3. For PM10, the 24-hour background concentration was obtained from the average of the 2003-2005 values from East Hartford, CT and E. Greenwich, RI.
4. The PM10 annual background concentration was obtained from the average of the 2003-2005 values from Waterbury,CT and E. Greenwich, RI.
5. For CO, the background concentrations were set equal to half the applicable AAQS.
6. No monitoring data available.

4.7 Other Modeling Options

The ISC control options used in the modeling analysis were consistent with the recommendations in the AIAG:

- Rural mode
- Gradual plume rise
- Stack-tip downwash
- Buoyancy-induced dispersion
- Calms processing routine
- No missing data processing routine
- Default wind profile exponents
- Default vertical potential temperature gradients

The PTMPTA-CONN control options used in the modeling analysis were consistent with the recommendations in the AIAG:

- Printing of partial concentrations (KNTRL=1) (*background set to 0)*
- Plane displacement and "STREAMFLOW" (KTOP=1)
- Exponential increase of wind speed with height (KU=1)
- Inputs in metric units (NGLISH=0)
- Buoyancy induced dispersion (IBID=1)
- Rural dispersion coefficients (IRURB=1)

4.8 Modeling Results and Determination of Significant Impact Area

Unit emission rates (1 g/sec) from the FBG stack were modeled using the ISCST3 and PTMTPA models for both operating scenarios predicted by the screening modeling to result in maximum impacts (i.e., Case 2 for PM_{10}, NO_2, SO_2, Pb and Dioxins, and Case 1 for CO). The modeled normalized impacts [(μg/m^3)/(g/sec)] for each applicable averaging period determined with each model and operating scenario are summarized in Table 4-4. The maximum normalized impacts were then multiplied by the respective g/sec emission rates for each pollutant being evaluated to calculate the maximum modeled pollutant impacts. For ISCST model results, highest second high modeled concentrations were used to evaluate all short-term impacts (1-hour to 24-hour) and highest modeled concentrations were used to evaluate annual impacts. For PTMTPA model results, the maximum modeled results from all receptors were used to evaluate impacts for each averaging period.

Table 4-4 – ISCST and PTMTPA Single-Source Normalized (1 g/sec) Impacts

Operating Scenario 2 for PM10, PM2.5, NO2, SO2, Pb and Dioxins Impacts:

	ISCST Normalized Impacts ($\mu g/m^3$)/(g/sec) [1]							UTM Coordinates		Distance from Stack (m)	Azimuth, degrees from N.
	1970	1971	1972	1973	1974	Max.	Max. Year	East (m)	North (m)		
1-hour average	7.47	8.28	7.84	6.91	9.22	9.22	1974	758,261.3	4,618,147.5	2500	60
3-hour average	4.17	4.26	4.13	4.05	4.28	4.28	1974	759,365.8	4,617,474.0	3320	80
8-hour average	2.14	2.36	2.89	2.77	2.10	2.89	1972	758,261.3	4,615,647.5	2500	120
24-hour average	1.24	1.12	1.36	1.30	1.01	1.36	1972	758,261.3	4,615,647.5	2500	120
Annual average	0.21	0.22	0.19	0.20	0.18	0.22	1971	758,261.3	4,615,647.5	2500	120

	PTMTPA Normalized Impacts at Complex Terrain Receptors ($\mu g/m^3$) [1,2]							UTM Coordinates		Distance from Stack (m)	Azimuth, degrees from N.
	Recept. 1 - 30	Recept. 31-60	Recept. 61-90	Recept. 91-120	Recept. 121-150	Recept. 1 51	Max.	East (m)	North (m)		
1-hour average	15.6	21.1	16.7	8.9	4.4	1.1	21.1	758,261.3	4,615,647.5	2500	120
3-hour average	14.0	19.0	15.0	8.0	4.0	1.0	19.0	758,261.3	4,615,647.5	2500	120
8-hour average	10.9	14.8	11.7	6.2	3.1	0.8	14.8	758,261.3	4,615,647.5	2500	120
24-hour average	3.0	3.0	3.0	2.0	2.0	0.0	3.0	758,261.3	4,615,647.5	2500	120
Annual average	0.8	0.8	0.8	0.5	0.5	0.0	0.8	758,261.3	4,615,647.5	2500	120

Alternate receptor locations of maximum 24-hour and annual PTMTPA impacts:	759,216.0	4,618,033.0	3320	70
	758,640.0	4,614,763.0	3321	130

Operating Scenario 1 for CO Impacts:

	ISCST Normalized Impacts ($\mu g/m^3$)/(g/sec) [1]							UTM Coordinates		Distance from Stack (m)	Azimuth, degrees from N.
	1970	1971	1972	1973	1974	Max.	Max. Year	East (m)	North (m)		
1-hour average	7.41	8.23	7.78	6.90	9.16	9.16	1974	758,261.3	4,618,147.5	2500	60
8-hour average	2.13	2.36	2.88	2.76	2.09	2.88	1972	758,261.3	4,615,647.5	2500	120

	PTMTPA Normalized Impacts at Complex Terrain Receptors ($\mu g/m^3$) [1, 2]							UTM Coordinates		Distance from Stack (m)	Azimuth, degrees from N.
	Recept. 1 - 30	Recept. 31-60	Recept. 61-90	Recept. 91-120	Recept. 121-150	Recept. 1 51	Max.	East (m)	North (m)		
1-hour average	15.6	21.1	16.7	8.9	4.4	1.1	21.1	758,261.3	4,615,647.5	2500	120
8-hour average	10.9	14.8	11.7	6.2	3.1	0.8	14.8	758,261.3	4,615,647.5	2500	120

Table 4-4 (Continued)

Notes:

1. For ISCST model results, highest second high modeled concentrations were used to evaluate all short-term impacts (1-hour to 24-hour). Highest modeled concentrations were used to evaluate annual impacts.
2. PTMTPA-CONN provides maximum 3-hour and 24-hour concentrations for each receptor modeled. 1-hour and 8-hour concentrations were calculated by dividing the 3-hour value by 0.9 to calculate a 1-hour average, and then multiplying the 1-hour value by 0.7 to calculate an 8-hour average. Annual average concentrations were estimated by multiplying the maximum 24-hour concentration by 0.25 (the maximum ratio of the annual to 24-hr second high concentrations modeled with ISCST was 0.2 at the maximum PTMTPA impact receptor). Maximum modeled results from all receptors were used to evaluate impacts for each averaging period.

Table 4-5 summarizes the modeling results for each pollutant for comparison to applicable Significant Impact Levels (SILs), Pre-Construction Monitoring De Minimis Levels, Class II Area Allowable PSD Increments[b] and NAAQS/CAAQS. All pollutant impacts predicted by the ISCST model are less than the applicable Pre-Construction Monitoring De Minimis Levels, PSD Increments and AAQS/CAAQS. The ISCST modeling results also show that annual NO_2 impacts are predicted to be above the SIL that triggers multiple-source modeling requirements out to a distance of 2,830 meters from the stack. ISCST-predicted impacts for all other pollutants are less than the applicable SILs.

As summarized in Table 4-5, all pollutant impacts predicted by the PTMTPA model at receptors with terrain elevations above stack top were less than the applicable Pre-Construction Monitoring De Minimis Levels, PSD Increments and NAAQS/CAAQS. The PTMTPA model results also show that NO_2 and SO_2 impacts for all applicable averaging periods are predicted to exceed the SILs. For $PM_{2.5}$, although SILs have not yet been promulgated, they were estimated based on the same ratio of SILs to AAQS used for PM_{10} (i.e., 2 $\mu g/m^3$ and 0.3 $\mu g/m^3$, respectively, were estimated for the 24-hour and annual average $PM_{2.5}$ SILs). Based on use of these estimated values, $PM_{2.5}$ impacts were also predicted by the PTMTPA model to exceed the SILs. All other pollutant impacts predicted by the PTMPTA model were less than applicable SILs.

In summary, based on the results of the ISCST and PTMTPA single-source modeling, multiple-source modeling is required to be performed for the following pollutants and significant impact distances to demonstrate compliance with PSD Increments and NAAQS/CAAQS:

Pollutant	**Maximum Significant Impact Radius (meters)**
$PM_{2.5}$	10,360
NO_2	10,360
SO_2	10,360

[b] Plainfield is in a Class II Area and is more than 100 km from the closest Class I PSD Area in the northeastern part of the U.S. (Lye Brook in southern Vermont, located approximately 185 km northwest of Plainfield).

Table 4-5 – ISCST and PTMTPA Refined Single-Source Modeling Results

ISCST Modeled Impacts

Pollutant	Averaging Period	Max. Norm. (µg/m³)/(g/sec)[1]	Max. Impact (µg/m³)[1,4]	Signif. Impact Level (µg/m³)[5]	Signif. Impact Radius (m)	Pre-const. Monitoring De Minimis Levels (µg/m³)	Class II Allowable PSD Increments. (µg/m³)	Background Conc. (µg/m³)[6]	Total Conc. (µg/m³)	Ambient Standard (µg/m³)	Receptor Location of Maximum Impact: UTM East (m)	UTM North (m)	Distance from Stack (m)	Azimuth, degrees from N.
PM10	24-hour average	1.4	1.8	5	N/A	10	30	31	32.6	150	758,261	4,615,648	2,500	120
	Annual average	0.2	0.3	1	N/A	N/A	17	17	16.9	50	758,261	4,615,648	2,500	120
PM2.5	24-hour average	1.4	1.8	2	N/A	N/A	N/A	33	34.9	65	758,261	4,615,648	2,500	120
	Annual average	0.2	0.29	0.3	N/A	N/A	N/A	9.8	10.1	15	758,261	4,615,648	2,500	120
NO_2	Annual average	0.2	1.1	1	2,830	14	25	33	33.8	100	758,261	4,615,648	2,500	120
SO_2	3-hour average	4.3	10.0	25	N/A	N/A	512	92	10.0	1300	759,366	4,617,474	3,320	80
	24-hour average	1.36	3.2	5	N/A	13	91	55	58.2	260	758,261	4,615,648	2,500	120
	Annual average	0.2	0.5	1	N/A	N/A	20	11	11.5	60	758,261	4,615,648	2,500	120
CO	1-hour average	9.22	64	2,000	N/A	N/A	N/A	20,000	20,064	40,000	758,261	4,618,148	2,500	60
	8-hour average	2.89	20	500	N/A	575	N/A	5,000	5,020	10,000	758,261	4,615,648	2,500	120
Pb	Quarterly average[2]	1.36	0.01	0.3	N/A	0.1	N/A		0.01	1.5	758,261	4,615,648	2,500	120
Dioxins	Annual average	0.22	1.3E-09	1.00E-07	N/A	N/A	N/A		1.3E-09	1.00E-06	758,261	4,615,648	2,500	120

PTMTPA-CONN Modeled Impacts

Pollutant	Averaging Period	Max. Norm. (µg/m³)/(g/sec)[1,3]	Max. Impact (µg/m³)[3,4]	Signif. Impact Level (µg/m³)[5]	Signif. Impact Radius (m)	Pre-const. Monitoring De Minimis Levels (µg/m³)	Class II Allowable PSD Increments. (µg/m³)	Background Conc. (µg/m³)[6]	Total Conc. (µg/m³)	Ambient Standard (µg/m³)	Receptor Location of Maximum Impact: UTM East (m)	UTM North (m)	Distance from Stack (m)	Azimuth, degrees from N.
PM_{10}	24-hour average	3.0	4.0	5	N/A	10	30	31	34.8	150	758,261	4,615,648	2500	120
	Annual average	0.8	0.99	1	N/A	N/A	17	17	17.6	50	758,261	4,615,648	2500	120
PM2.5	24-hour average	3.0	4.0	2	10,360	N/A	N/A	33	37.1	65	758,261	4,615,648	2500	120
	Annual average	0.8	0.99	0.3	10,360	N/A	N/A	9.8	10.8	15	758,261	4,615,648	2500	120
NO_2	Annual average	0.8	3.7	1	10,360	14	25	33	36.4	100	758,261	4,615,648	2500	120
SO_2	3-hour average	19.0	44	25	4,410	N/A	512	92	44.4	1300	758,261	4,615,648	2500	120
	24-hour average	3.0	7.0	5	4,410	13	91	55	62.0	260	758,261	4,615,648	2500	120
	Annual average	0.8	1.8	1	10,360	N/A	20	11	12.8	60	758,261	4,615,648	2500	120
CO	1-hour average	21.1	145	2,000	N/A	N/A	N/A	20,000	20,145	40,000	758,261	4,615,648	2500	120
	8-hour average	14.8	102	500	N/A	575	N/A	5,000	5,102	10,000	758,261	4,615,648	2500	120
Pb	Quarterly average[2]	3.0	0.03	0.3	N/A	0.1	N/A		0.03	1.5	758,261	4,615,648	2500	120
Dioxins	Annual average	0.8	4.3E-09	1.00E-07	N/A	N/A	N/A		4.3E-09	1.00E-06	758,261	4,615,648	2500	120

Table 4-5 (Continued)

Notes:

1. For ISCST model results, highest second high modeled concentrations were used to evaluate all short-term impacts (1-hour to 24-hour). Highest modeled concentrations were used to evaluate annual impacts.
2. Lead impacts were conservatively determined using 24-hour impacts.
3. PTMTPA-CONN provides maximum 3-hour and 24-hour concentrations for each receptor modeled. 1-hour and 8-hour concentrations were calculated by dividing the 3-hour value by 0.9 to calculate a 1-hour average, and then multiplying the 1-hour value by 0.7 to calculate an 8-hour average. Annual average concentrations were estimated by multiplying the maximum 24-hour concentration by 0.25 (the maximum ratio of the annual to 24-hr second high concentration modeled with ISCST was 0.2 at the maximum PTMTPA impact receptor). Maximum modeled results from all receptors were used to evaluate impacts for each averaging period.
4. Maximum impacts calculated by multiplying normalized impacts (μg/m3)/(g/sec) by the respective maximum g/sec emission rates (for any operating scenario) for each pollutant and applicable averaging period.
5. Significant Impact Levels (SIL) for PM2.5 are estimated, based on same ratio of SIL to AAQS for PM10.

			Significant Impact Radius (meters)						
Pollutant	Averaging Period	**Normalized PTMTPA impacts that correspond to significant impacts[1]**	**Recept. 1 - 30**	**Recept. 31-60**	**Recept. 61-90**	**Recept. 91-120**	**Recept. 121-150**	**Recept. 151**	**Max.**
PM2.5	24-hour average	1.52	10,360	10,360	10,360	10,360	7,790	0	10,360
PM2.5	Annual average (24-hr)	0.91	10,360	10,360	10,360	10,360	7,790	0	10,360
NO2	Annual average (24-hr)	0.81	10,360	10,360	10,360	10,360	7,790	0	10,360
SO2	3-hour average	10.69	4,410	4,410	4,410	0	0	0	4,410
SO2	24-hour average	2.14	4,410	4,410	4,410	2,500	1,880	0	4,410
SO2	Annual average (24-hr)	1.71	10,360	10,360	10,360	10,360	7,790	0	10,360

1 Equivalent normalized impacts corresponding to significant impacts for annual averages were calculated by dividing the annual averages by 0.25.

4.9 Pre-Construction Monitoring Waiver Request

Table 4-5 also compares maximum ISCST- and PTMTPA-modeled impacts to Pre-Construction Monitoring De Minimis Levels. This comparison demonstrates that the maximum concentrations for all applicable pollutants and averaging times are below the threshold values. On this basis, as well as the availability of representative and conservative background air quality data from regional monitors, as discussed in Section 4.6, the Project is hereby requesting an exemption from pre-construction monitoring for all pollutants.

5.0 REFINED MULTIPLE-SOURCE CUMMULATIVE MODELING ANALYSIS

Based upon the results of the single-source refined modeling analysis, a multiple-source cumulative impact analysis is required for $PM_{2.5}$, SO_2 and NO_2 in order to demonstrate compliance with applicable AAQS and PSD Increments. Single-source impacts for all other regulated pollutants with the potential to be emitted from the FBG stack were demonstrated to be lower than applicable SILs. The multiple-source impact analysis was performed in accordance with the CTDEP's Ambient Impact Analysis Guideline and other guidance provided by CTDEP.

5.1 Emissions and Stack Parameters – PRE Sources

Based on the results of the screening and single-source modeling analysis, FBG stack operating Case 2 (25/75 C&D/wood case @ 100% load) was modeled with the maximum emission rates of any operating case for all multiple-source modeling runs. It was not necessary to run Case 1, which corresponded to maximum single-source CO impacts, because CO impacts were demonstrated to be insignificant based on single-source modeling. All other modeling input parameters for the FBG stack were identical to those used in the screening and single-source modeling analyses. Based on guidance provided by Mr. Catalano of the CTDEP modeling group, the proposed diesel emergency generator and cooling tower were also included in the multiple-source modeling analyses for $PM_{2.5}$, SO_2 and NO_2. Table 5-1 summarizes the model input data for all three PRE sources.

5.2 Emissions and Stack Parameters – Interactive Sources

Emission sources included in the AAQS and PSD Increment Consumption modeling analyses were obtained from CTDEP inventory radius search data files provided in response to a Freedom of Information Act (FOIA) request. Summaries of the original inventory data provided by CTDEP on October 24 and 26, 2006 are presented in Appendix C. In accordance with the AIAG and additional guidance provided by CTDEP, the following criteria were used to select emission sources from the inventories for the multiple source analyses:

AAQS Analysis

- All stacks with actual emissions of $\geq$ 15 TPY that lie within the applicable significant impact radius determined from the single-source modeling and all sources located within the PRE premise.
- All stacks with actual emission of $\geq$ 50 TPY that lie within 20 km of the PRE FBG stack.
- All stacks with actual emission of $\geq$ 500 TPY that lie within 50 km of the PRE FBG stack.

Table 5-1 – Refined Multiple-Source Analysis Input Data for PRE Sources

SOURCE INFORMATION:

Company Name:	Plainfield Renewable Energy LLC
Equipment Location Address:	Mill Brook Rd., Plainfield, CT
Equipment Description:	EPI Fluidized Bed Staged Gasifier Energy System
Stack base elevation above MSL[2]	177 Ft. 54 meters

OPERATING DATA AND STACK PARAMETERS:

FBG Stack (Stack 1)				
UTM, Zone 18 NAD27	X(m) =	756,096	Y(m) =	4,616,897
Exhaust Flow Rate	3443	ft^3/sec	97.51	m^3/sec
Stack Temp.	253	deg. F	395.93	deg. K
Stack Base Elev.	177	ft.	54	m
Physical Stack Ht.	155	ft.	47.24	m
Stack Height MSL	332	ft.	101.24	m
Stack Diameter	9	ft.	2.74	m
Stack Velocity	54.12	ft/sec	16.50	m/sec
Proposed Emission Rates (1-hour to 24-hour averages)[1]				
$PM_{2.5}$	10.46	lb/hr	1.32	g/sec
NO_2	39.23	lb/hr	4.94	g/sec
SO_2	18.56	lb/hr	2.34	g/sec
Proposed Emission Rates (annual averages)				
$PM_{2.5}$	45.82	TPY	1.32	g/sec
NO_2	171.84	TPY	4.94	g/sec
SO_2	81.29	TPY	2.34	g/sec

Emergency Generator Stack (Stack 2)				
UTM, Zone 18 NAD27	X(m) =	756,040	Y(m) =	4,616,867
Exhaust Flow Rate	65	ft^3/sec	1.85	m^3/sec
Stack Temp.	948	deg. F	782.04	deg. K
Stack Base Elev.	177	ft.	54	m
Physical Stack Ht.	10	ft.	3.05	m
Stack Height MSL	187	ft.	3.05	m
Stack Diameter	0.5	ft.	0.15	m
Stack Velocity	333	ft/sec	101.61	m/sec
Proposed Emission Rates (1-hour to 24-hour averages)[1]				
$PM_{2.5}$	0.47	lb/hr	0.06	g/sec
NO_2	16.09	lb/hr	2.03	g/sec
SO_2	0.01	lb/hr	0.001	g/sec
Proposed Emission Rates (annual averages)				
$PM_{2.5}$	0.07	TPY	0.002	g/sec
NO_2	2.41	TPY	0.07	g/sec
SO_2	0.001	TPY	0.00003	g/sec

Cooling Tower (Stack 3)				
UTM, Zone 18 NAD27	X(m) =	756,037	Y(m) =	4,616,892
Exhaust Flow Rate	30509	ft^3/sec	864.02	m^3/sec
Stack Temp.	98	deg. F	309.82	deg. K
Stack Base Elev.	174	ft.	53	m
Physical Stack Ht.	42.8	ft.	13.06	m
Stack Height MSL	217	ft.	13.06	m
Stack Diameter	39.6	ft.	12.07	m
Stack Velocity	24.77	ft/sec	7.55	m/sec
Proposed Emission Rates (1-hour to 24-hour averages)[1]				
$PM_{2.5}$	0.15	lb/hr	0.02	g/sec
NO_2		lb/hr	0.00	g/sec
SO_2		lb/hr	0.00	g/sec
Proposed Emission Rates (annual averages)				
$PM_{2.5}$	0.65	TPY	0.02	g/sec
NO_2		TPY	0.00	g/sec
SO_2		TPY	0.00	g/sec

1. To ensure conservativeness of modeling results, maximum lb/hr emission rates of any operating load scenario were used in the modeling analysis.
2. Stack base elevation automatically obtained in Lakes ISC-AERMOD View from imported USGS DEM data differs slightly from base elevation assumed for screening modeling (i.e., 54 m obtained from DEM data versus 56 m used in screening modeling).

PSD Increment Analysis

- All sources affecting PSD increment (defined in RCSA § 22a-174-3a(k)(6)(C)) and (6)) that lie within the significant impact radius and all sources located within the PRE premise.
- All sources affecting PSD increment with actual emission of $\geq$ 50 TPY that lie within 20 km of the PRE FBG stack.
- All sources affecting PSD increment with actual emission of $\geq$ 500 TPY that lie within 50 km of the PRE FBG stack.

Sources affecting PSD increment are defined in accordance with RCSA § 22a-174-3a(k)(6), § 22a-174-1(56) and § 22a-174-1(65) as follows:

- Sources at Major Stationary Sources permitted after the applicable Major Source baseline date:
  - January 6, 1975 for PM and SO_2
  - February 8, 1988 for NO_2
- Sources that increased actual emissions from modifications to Major Stationary Sources, which were required to be permitted after the Major Source baseline date and before the applicable minor source baseline date:
  - Between January 6, 1975 and June 7, 1988 for PM
  - Between January 6, 1975 and December 17, 1984 for SO_2
  - Between February 8, 1988 and June 7, 1988 for NO_2
- Sources other than Major Stationary Sources required to obtain a permit after the applicable minor source baseline date:
  - June 7, 1988 for PM
  - December 17, 1984 for SO_2
  - June 7, 1988 for NO_2

The CTDEP inventory files were sorted based upon the above criteria. Table 5-2 through Table 5-6 provide the specific modeling input parameters for the AAQS and PSD Increment analyses for each of the pollutants determined to be above SILs based upon the single-source modeling (NO_2, SO_2 and $PM_{2.5}$). Nine separate source groups, as identified in Table 5-7, were set up in the ISCST model to evaluate the PRE, AAQS and PSD increment consuming sources with the minimum number of model runs for each year of meteorological data. All short-term impacts for both AAQS and PSD increment analyses were modeled using the allowable emission rates. In general, CTDEP guidance was followed for selection of appropriate emission rates for modeling of annual average impacts, with exceptions (more conservative assumptions) as noted in Table 5-2 through Table 5-6.

The proposed PRE site is located approximately 11 km (outside of the significant impact radius) from the Rhode Island (RI) state line. Therefore, sources of NO_2, SO_2 and $PM_{2.5}$ emissions in RI were reviewed to determine if any met the distance and actual emission rate criteria for inclusion in the multiple-source AAQS and PSD increment analyses. Based on discussions with and recommendations by representatives of the Rhode Island Department of Environmental

Table 5-2 - Modeling Input for Refined Multiple-Source NO_2 AAQS Impact Analysis

AAQS Background Source			UTM Zone 19		UTM Zone 18									
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable NOX Emission Rate - Annual Avg. (g/sec)	Actual NOX Emission Rate - Annual Avg. (g/sec)	Notes
EXETER ENERGY L.P.	4	STANDARD KESSL INC/BLR #2	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.12	2.47	1.73	1
EXETER ENERGY L.P.	5	STANDARD KESSL INC/BLR #1	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.13	2.47	1.51	1
WHEELABRATOR LISBON INC	6	MSW & DEMO. WOOD INCIN	246.5	4607.8	746.7	4607.6	33.53	81.08	1.74	405.37	10.63	4.20	3.82	1
WHEELABRATOR LISBON INC	7	MSW & DEMO. WOOD INCIN	246.5	4607.8	746.7	4607.6	33.53	81.08	1.74	405.37	10.63	4.20	3.83	1
CASCADES BOXBOARD GROUP	8	BLR B&W PFI-22-0 #1	246.4	4611.8	746.3	4611.5	36.58	36.58	3.05	460.93	7.76	10.85	9.82	1

PRE Emission Units			UTM Zone 19		UTM Zone 18							
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable NOX Emission Rate - Annual Avg. (g/sec)
Plainfield Renewable Energy LLC	1	Biomass Fluid Bed Gasifier			756.0962	4616.897	54	47.2	2.74	395.9	16.50	4.94
Plainfield Renewable Energy LLC	2	Emergency Diesel Generator			756.040	4616.867	54	3.0	0.15	782.0	101.6	0.07

In accordance with the CTDEP Ambient Impact Analysis Guideline:

1. Source is located at major stationary source. Therefore, allowable emission rates were modeled.
2. Source is not located at major stationary source. Therefore, actual annual average emission rates were modeled for annual average impacts and allowable emission rates were modeled for short-term averages. For PTMTPA-CONN, allowable emission rates were modeled for all averaging periods.

Table 5-3 - Modeling Input for Refined Multiple-Source SO_2 AAQS Impact Analysis

AAQS Background Source			UTM Zone 19		UTM Zone 18										
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable SOX Emission Rate - Annual Avg. (g/sec)	Actual SOX Emission Rate - Annual Avg. (g/sec)	Short-term Avg. (g/sec)	Notes
EXETER ENERGY L.P.	4	STANDARD KESSL INC/BLR #2	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.12	2.21	1.44	2.21	1,3
EXETER ENERGY L.P.	5	STANDARD KESSL INC/BLR #1	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.13	2.21	1.34	2.21	1,3
KAMAN AEROSPACE CORP	9	BLR CB 668-400 #3	259.2	4626.3	758.1	4626.9	67.06	16.76	0.61	560.93	8.54	2.36	0.76	2.36	2
CASCADES BOXBOARD GR	8	BLR B&W PFI-22-0 #1	246.4	4611.8	746.3	4611.5	36.58	36.58	3.05	460.93	7.76	38.11	12.61	38.11	1
A E S THAMES, LLC	10	BLR CE FLUID BED #1	241.2	4591.1	742.5	4590.5	3.05	116.74	4.36	410.93	8.30	37.20	32.67	37.20	1,3
A E S THAMES, LLC	11	BLR CE FLUID BED #2	241.2	4591.1	742.5	4590.5	3.05	116.74	4.36	410.93	8.30	37.20	30.96	37.20	1,3

PRE Emission Units			UTM Zone 19		UTM Zone 18								
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable SOX Emission Rate - Annual Avg. (g/sec)	Short-term Avg. (g/sec)
Plainfield Renewable Energy LLC	1	Biomass Fluid Bed Gasifier			756.096	4616.897	53.95	47.2	2.74	395.9	16.50	2.34	2.34
Plainfield Renewable Energy LLC	2	Emergency Diesel Generator			756.040	4616.867	54.01	3.0	0.15	782.0	101.6	0.00003	0.001

In accordance with the CTDEP Ambient Impact Analysis Guideline:

1. Source is located at major stationary source. Therefore, allowable emission rates were modeled.
2. Source is not located at major stationary source. Therefore, actual annual average emission rates were modeled for annual average impacts and allowable emission rates were modeled for short-term averages. For PTMTPA-CONN, allowable emission rates were modeled for all averaging periods.
3. Source on both AAQS and PSD Increment consuming inventories. Allowable anuual average emission rates modeled for both AAQS and PSD Increment analyses to reduce number of model runs.

Table 5-4 - Modeling Input for Refined Multiple-Source $PM_{2.5}$ AAQS Impact Analysis*

AAQS Background Source			UTM Zone 19		UTM Zone 18									
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable PM2.5 Emission Rate - Annual Avg. (g/sec)	Actual PM2.5 Emission Rate - Annual Avg. (g/sec)	Short-term Avg. (g/sec)
No stacks met the criteria of > 15 TPY of actual PM10 (PM2.5) emissions within 10.4 km, > 50 TPY within 20 km or > 500 TPY within 50 km of the proposed PRE stack.														

PRE Emission Units			UTM Zone 19		UTM Zone 18								
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable PM2.5 Emission Rate - Annual Avg. (g/sec)	Short-term Avg. (g/sec)
Plainfield Renewable Energy LLC	1	Biomass Fluid Bed Gasifier			756.096	4616.89748	53.9	47.2	2.74	395.9	16.50	1.32	1.32
Plainfield Renewable Energy LLC	2	Emergency Diesel Generator			756.040	4616.867	54.0	3.0	0.15	782.0	101.61	0.002	0.06
Plainfield Renewable Energy LLC	3	Cooling Tower			756.037	4616.892	53	13.1	12.07	309.8	7.55	0.02	0.02

* PM2.5 emissions are not included in the CTDEP Point Source Inventory. Therefore, PM10 emissions were used to conservatively represent PM2.5 emissions.

Table 5-5 - Modeling Input for Refined Multiple-Source NO_2 PSD Increment Analysis

PSD Increment Background Source			UTM Zone 19		UTM Zone 18										
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable NOX Emission Rate - Annual Avg. (g/sec)	Actual NOX Emission Rate - Annual Avg. (g/sec)	Short-Term Avg. (g/sec)	Notes
QUIKRETE OF CONN	12	CONCRETE MIX DRYER	260.5	4625.8	759.4	4626.5	91.44	29.87	0.91	366.48	10.15	0.10	0.03	0.10	1
EXETER ENERGY L.P.	4	STANDARD KESSL INC/BLR #2	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.12	2.47	1.73	2.47	1
EXETER ENERGY L.P.	5	STANDARD KESSL INC/BLR #1	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.13	2.47	1.51	2.47	1
EXETER ENERGY L.P.	13	CUMMINS DIESEL #2	265.2	4621.4	764.4	4622.4	172.21	4.88	0.21	627.59	116.83	0.22	0.01	0.22	1
WASTE MANAGEMENT OF CT	14	ENCLOSED LANDFILL FLARE	253.7	4616.9	753.2	4617.1	33.53	9.14	1.83	1033.15	7.87	0.16	0.07	0.16	1
GRISWOLD HIGH SCHOOL	15	BLR PVI #12WBHE225ATPO #1	251.6	4609.2	751.7	4609.3	41.15	16.15	0.70	480.37	0.37	0.02	0.02	0.02	1
GRISWOLD HIGH SCHOOL	16	BLR PVI #12WBHE225ATPO #2	251.6	4609.2	751.7	4609.3	41.15	16.15	0.70	480.37	0.37	0.02	0.02	0.02	1
EARTHGRO, INC/SCOTT'S CO	17	MUSHROOM COMPOSTING	265.3	4612.9	765.1	4614	143.26	1.52	0.21	303.15	3.78	0.06	0.002	0.06	1
QUINEBAUG TROUT HATCH	18	CAT 600KW DIESEL	256.2	4623.7	755.2	4624.1	45.72	4.57	0.24	790.37	50.44	0.11	0.20	0.11	1
GRISWOLD RUBBER CO	19	KOHLER PROPANE EMER GEN	260.4	4622	759.6	4622.7	76.20	11.89	0.09	455.37	100.63	0.13	0.88	0.13	1,2
LISBON TEXTILE PRINTS INC	20	REGGIANI #2 PRINT MACHINE	250.5	4608.6	750.6	4608.6	38.10	9.75	0.61	408.15	8.09	0.01	0.004	0.01	1
LISBON TEXTILE PRINTS INC	21	REGGIANI #3 PRINT MACHINE	250.5	4608.6	750.6	4608.6	38.10	9.75	0.46	408.15	14.38	0.01	0.004	0.01	1
CONNECTICUT WATER CO	22	KOHLER 50RZ	260.8	4620.3	760.1	4621	106.68	1.83	0.09	866.48	39.53	0.19	0.0004	0.19	1
AMERICAN INDUSTRIES, INC	23	4T ASPHALT BATCH PLANT	252.4	4612.3	752.2	4612.5	30.48	9.75	0.61	422.04	109.97	0.32	0.32	0.32	1
JEWETT CITY DPUC	24	DETROIT DIESEL GENERATOR	251.3	4609.9	751.3	4610	45.72	7.62	0.24	744.26	65.80	0.10	0.10	0.10	1
WHEELABRATOR LISBON INC	6	MSW & DEMO. WOOD INCIN	246.5	4607.8	746.7	4607.6	33.53	81.08	1.74	405.37	10.63	4.20	3.82	4.20	1
WHEELABRATOR LISBON INC	7	MSW & DEMO. WOOD INCIN	246.5	4607.8	746.7	4607.6	33.53	81.08	1.74	405.37	10.63	4.20	3.83	4.20	1

PRE Emission Units			UTM Zone 19		UTM Zone 18							
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable NOX Emission Rate - Annual Avg. (g/sec)
Plainfield Renewable Energy LLC	1	Biomass Fluid Bed Gasifier			756.096	4616.897	54	47.2	2.74	395.9	16.50	4.94
Plainfield Renewable Energy LLC	2	Emergency Diesel Generator			756.040	4616.867	54	3.0	0.15	782.0	101.6	0.07

In accordance with the CTDEP Ambient Impact Analysis Guideline:

1. All PSD increment consuming sources were modeled at actual emission rates for annual average impact analysis and at allowable emission rates for short-term impact analysis.
2. Allowable emission rate modeled for both annual and short-term average impacts. Actual emission rate appears to be in error (exceeds allowable emissions). For PTMTPA-CONN, allowable emission rates were modeled for all averaging periods.

Table 5-6 - Modeling Input for Refined Multiple-Source SO_2 PSD Increment Analysis

PSD Increment Background Source			UTM Zone 19		UTM Zone 18										
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable SOX Emission Rate - Annual Avg. (g/sec)	Actual SOX Emission Rate - Annual Avg. (g/sec)	Short-Term Avg. (g/sec)	Notes
NEW ENGLAND FURNITURE	25	BOILER, 3WB-350 HP	251.7	4610.1	751.7	4610.2	41.76	24.38	1.22	463.71	0.46	0.11	0.11	0.11	1
QUIKRETE OF CONN	12	CONCRETE MIX DRYER	260.5	4625.8	759.4	4626.5	91.44	29.87	0.91	366.48	10.15	0.22	0.06	0.22	1
EXETER ENERGY L.P.	4	STANDARD KESSL INC #2	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.12	2.21	1.44	2.21	1
EXETER ENERGY L.P.	5	STANDARD KESSL INC #1	265.2	4621.4	764.4	4622.4	172.21	59.74	2.44	355.37	8.13	2.21	1.34	2.21	1
EXETER ENERGY L.P.	13	CUMMINS DIESEL #2	265.2	4621.4	764.4	4622.4	172.21	4.88	0.21	627.59	116.83	0.014	0.0009	0.014	1
GRISWOLD HIGH SCHOOL	15	BLR PVI #1	251.6	4609.2	751.7	4609.3	41.15	16.15	0.70	480.37	0.37	0.03	0.04	0.03	1
GRISWOLD HIGH SCHOOL	16	BLR PVI #2	251.6	4609.2	751.7	4609.3	41.15	16.15	0.70	480.37	0.37	0.03	0.04	0.03	1
WASTE MANAGEMENT	14	ENCLOSED LANDFILL FLARE	253.7	4616.9	753.2	4617.1	33.53	9.14	1.83	1033.15	7.87	0.003	0.0004	0.003	1
EARTHGRO, INC	17	MUSHROOM COMPOSTING	265.3	4612.9	765.1	4614	143.26	1.52	0.21	303.15	3.78	0.003	0.0020	0.003	1
QUINEBAUG TROUT HATCH	18	CAT 600KW DIESEL	256.2	4623.7	755.2	4624.1	45.72	4.57	0.24	790.37	50.44	0.009	0.01	0.01	1
GRISWOLD RUBBER CO	19	KOHLER PROP EMER GEN	260.4	4622	759.6	4622.7	76.20	11.89	0.09	455.37	100.63	0.27	0.0022	0.27	1
AMERICAN INDUSTRIES	23	4T ASPHALT BATCH PLANT	252.4	4612.3	752.2	4612.5	30.48	9.75	0.61	422.04	109.97	0.26	0.24	0.26	1
JEWETT CITY DPUC	24	DETROIT DIESEL GEN	251.3	4609.9	751.3	4610	45.72	7.62	0.24	744.26	65.80	0.003	0.0001	0.003	1
A E S THAMES, LLC	10	BLR CE FLUID BED #1	241.2	4591.1	742.5	4590.5	3.05	116.74	4.36	410.93	8.30	37.20	32.67	37.20	1
A E S THAMES, LLC	11	BLR CE FLUID BED #2	241.2	4591.1	742.5	4590.5	3.05	116.74	4.36	410.93	8.30	37.20	30.96	37.20	1

PRE Emission Units			UTM Zone 19		UTM Zone 18								
Company	Stack ID	Description	X (km)	Y (km)	X (km)	Y (km)	Base Elevation (m MSL)	Stack Height Above Grade (m)	Stack Diameter (m)	Stack Temp. (deg. K)	Exit Velocity (m/sec)	Allowable SOX Emission Rate - Annual Avg. (g/sec)	Short-Term Avg. (g/sec)
Plainfield Renewable Energy LLC	1	Biomass Fluid Bed Gasifier			756.096	4616.897	54	47.2	2.74	395.9	16.50	2.34	2.34
Plainfield Renewable Energy LLC	2	Emergency Diesel Generator			756.040	4616.867	54	3.0	0.15	782.0	101.6	0.00003	0.001

In accordance with the CTDEP Ambient Impact Analysis Guideline:

1. All PSD increment consuming sources were modeled at actual emission rates for annual average impact analysis and at allowable emission rates for short-term impact analysis. For PTMTPA-CONN, allowable emission rates were modeled for all averaging periods.

Table 5-7 – Source Groups Used in ISCST-PRIME Multiple-Source Analyses

Source Group	Description	Source IDs
1	PRE FBG stack only	1
2	PRE Emergency Generator	2
3	All PRE sources	1, 2, 3 (as applicable for each pollutant)
4	NO2 AAQS Sources w/ PRE Sources	1, 2, 4, 5, 6, 7, 8
5	NO2 PSD Sources w/ PRE Sources	1, 2, 4, 5, 6, 7, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
6	SO2 AAQS Sources w/ PRE Sources	1, 2, 4, 5, 8, 9, 10, 11
7	PM2.5 AAQS Sources w/ PRE Sources	1, 2, 3 (No offsite stacks met the criteria of > 15 TPY of actual PM2.5 emissions within 10.4 km, > 50 TPY within 20 km or > 500 TPY within 50 km of the proposed PRE stack).
8	SO2 PSD Sources w/ PRE Sources	1, 2, 4, 5, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 23, 24, 25
9	PM2.5 PSD Sources w/ PRE Sources	1, 2, 3, 4, 5, 12, 14, 15, 16, 18, 19, 23, 24, 26, 27

Management (RIDEM)[c], a review of Title V permits available on the RIDEM website was performed to identify sources meeting the criteria. In addition, actual emissions data were obtained from power plants in RI from EPA's Clean Air Markets Division (CAMD) online database (http://cfpub.epa.gov/gdm/). Based on this review, no sources located in RI between 20 and 50 km from the PRE stack were identified with actual emissions greater than 500 TPY. In addition, all of the Title V sources were either located more than 20 km from the PRE site or had actual or potential emissions less than 50 TPY. Therefore, no RI sources were included in the multiple-source AAQS or PSD increment modeling analyses.

Similarly, the closest distance from the PRE site to the Massachusetts (MA) state line is approximately 40 km. However, no sources have been identified with actual emissions greater than 500 TPY located within the small portion of MA that is within a 50 km radius of the PRE site.

5.3 Building Downwash – BPIP

Building downwash effects were evaluated for all PRE sources included in the refined modeling analysis using the EPA Building Profile Input Program (BPIP, dated 95086 - Lakes Environmental BPIP View, version 5.4.0). BPIP determines, in each of the 36 wind directions (10° sectors), which building may produce the greatest downwash effects on a stack. The direction-specific dimensions produced by the BPIP model were imported into the ISCST3-PRIME refined modeling input. The BPIP model setup is the same as previously depicted in Figure 4-1 and Figure 4-2, and the BPIP output data for all three PRE stacks are provided in Appendix B.

5.4 Receptor Network/Terrain Elevations

The same non-uniform polar grid receptor network used in the refined single-source modeling analysis was used in the multiple-source analyses. The non-uniform polar grid receptor network was set up in ISCST3 with the ISC-AERMOD View interface using rings of receptors spaced at 10 degree intervals on 36 radials originating at the stack location. The screening modeling analysis for both operating scenarios resulting in the maximum impacts indicated that 94 meters (3L) was the closest distance to a maximum impact for any stability condition. Therefore, the receptor rings were selected at distances starting at 94 meters and progressing geometrically by a factor of 1.33 (with minimum initial ring spacing of 100 meters). A total of 19 receptor rings were defined at the following distances in meters from the stack: 94, 194, 260, 340, 450, 600, 800, 1060, 1410, 1880, 2500, 3320, 4410, 5860, 7790, 10360, 13780, 18330, and 24380 meters. In order to import terrain elevations associated with each of the receptors, the polar grid was converted into discrete Cartesian receptors.

The proposed site will be fenced and not accessible to the general public. Therefore, a total of 58 discrete receptors were placed along the proposed fenceline, including 23 receptors at each node of the fenceline polygon and 35 receptors at intermediate points between nodes. An additional 40 discrete receptors were defined 50 meters from the plant fenceline at 50 meter spacing. Discrete Cartesian receptors located within the plant boundary were eliminated since the

[c] Recommendations of Doug McVay, through discussions with Ruth Gold, RIDEM, 10/27/06.

property will not be accessible by the general public. The near-field and entire receptor networks for the multiple-source modeling are the same as previously depicted in Figure 4-4 and Figure 4-5, respectively.

Terrain elevations at each of the receptor points were specified by importing 7.5 minute USGS Digital Elevation Model (DEM) data into ISC-AERMOD View. The DEM data was obtained from www.webgis.com. The ISC-AERMOD View program was able to import DEM data from different UTM zones by converting the UTM coordinates to a consistent zone and datum reference. UTM Zone 18 (NAD27) was used as the common reference for model setup. Following the procedure in the AIAG, the method used to select the elevation for each receptor involved importing the highest elevation from within a bounding polygon, where the bounding polygon is defined by half the distance to adjacent receptor grid nodes.

The receptor network for the PTMTPA-CONN complex terrain modeling was selected from the ISCST3 polar network based on the elevation of each receptor in relation to the FBG stack top. A total of 151 receptors were determined to have elevations at or above the proposed stack top. The UTM coordinates (referenced to zone 18, NAD27 datum) are summarized in Table 4-2. As required by the AIAG, these high terrain receptors were modeled using both the ISCST3 and PTMTPA-CONN models.

5.5 Meteorological Data

The same meteorological data used in the single-source modeling analysis was used in the multiple-source analyses. Surface data from National Weather Service (NWS) Station #14740 (Bradley International Airport) and upper air data from NWS Station # 14735 (Albany County Airport), both for the years 1970 to 1974, were selected for input in the ISCST3 modeling analysis. The set of 17 meteorological conditions listed in Table 5-3 of the AIAG was used for the PTMTPA-CONN modeling of complex terrain receptors.

5.6 Other Modeling Options

The ISC and PTMTPA control options used in the modeling analysis were consistent with the recommendations in the AIAG and are summarized in Section 4.7.

5.7 Background Air Quality

The same background air quality data used for the single-source modeling analysis, described in Section 4.6, was used for the multiple-source analyses.

5.8 Multiple-Source Modeling Results

The PTMTPA and ISC-PRIME multiple-source modeling results are summarized separately in Table 5-8. Maximum impacts from either model are summarized in Table 5-9 in comparison to applicable PSD Increments and AAQS. Detailed summaries of each model run output are provided in Appendix D.

Table 5-8 – Refined Multiple-Source ISCST and PTMTPA Modeling Results

ISCST-PRIME Modeled Impacts

Pollutant	Averaging Period	Max. Impact AAQS Sources (µg/m^3)[1]	Max. Impact PSD Increment Consuming Sources (µg/m^3)[1]	Class II Allowable PSD Increments. (µg/m^3)	Backgrd. Conc. (µg/m^3)[3]	Total Conc. (µg/m^3)	AAQS (µg/m^3)	Receptor Location of Maximum Impact: UTM East (m)	UTM North (m)	Distance from Stack (m)	Azimuth, degrees from N.	Year
PM2.5	24-hour average	9.6	N/A	N/A	33.2	42.7	65	756,015	4,616,892	81	266	1970
	Annual average	0.29	N/A	N/A	9.8	10.1	15	758,261	4,615,648	2,500	120	1971
NO_2 *	Annual average	3.3	2.4	25	32.7	36.0	100	746,361	4,613,354	10,360	250	1970
SO_2 **	3-hour average	174.0	35.7	512	92.0	266.0	1300	746,361	4,613,354	10,360	250	1973
	24-hour average	70.6	8.6	91	55.0	125.6	260	746,361	4,613,354	10,360	250	1972
	Annual average	9.3	1.5	20	11.0	20.3	60	746,361	4,613,354	10,360	250	1970

* Receptor location and year of maximum impact listed for cumulative AAQS sources. For PSD increment consuming sources, maximum modeled impact receptor was (X, Y, Dist., Azimuth, Year):

	X	Y	Dist.	Azimuth	Year
	756,121	4,616,771	129.4	168.9	1971

** Receptor locations and years of maximum impact listed for cumulative AAQS sources. For PSD increment consuming sources, maximum modeled impact receptors were (X, Y, Dist., Azimuth, Year):

	X	Y	Dist.	Azimuth	Year
3-hour:	738,045	4,613,715	18,330	260	1974
24-hour:	740,222	4,607,733	18,330	240	1971
annual:	740,222	4,607,733	18,330	240	1970

PTMTPA-CONN Modeled Impacts

Pollutant	Averaging Period	Max. Impact AAQS Sources (µg/m^3)[2]	Max. Impact PSD Increment Consuming Sources (µg/m^3)[2]	Class II Allowable PSD Increments. (µg/m^3)	Backgrd. Conc. (µg/m^3)[3]	Total Conc. (µg/m^3)	AAQS (µg/m^3)	Receptor Location of Maximum Impact: UTM East (m)	UTM North (m)	Distance from Stack (m)	Azimuth, degrees from N.
PM2.5	24-hour average	5.0	N/A	N/A	33.2	38.2	65	758,261	4,615,648	2500	120
	Annual average	1.3	N/A	N/A	9.8	11.1	15	758,261	4,615,648	2500	120
NO_2	Annual average	4.3	4.3	25	32.7	36.9	100	758,261	4,615,648	2500	120
SO_2	3-hour average	132.0	46.0	512	92.0	224.0	1300	758,261	4,615,648	2500	120
	24-hour average	29.0	9.0	91	55.0	84.0	260	758,261	4,615,648	2500	120
	Annual average	7.3	2.3	20	11.0	18.3	60	758,261	4,615,648	2500	120

Table 5-8 (Continued)

Notes:

1. For ISCST model results, highest second high modeled concentrations were used to evaluate all short-term impacts (1-hour to 24-hour), with the exception of PM2.5. For PM2.5, highest modeled concentrations were conservatively used. Highest modeled concentrations were used to evaluate annual impacts.
2. PTMTPA-CONN provides maximum 3-hour and 24-hour concentrations for each receptor modeled. 1-hour and 8-hour concentrations were calculated by dividing the 3-hour value by 0.9 to calculate a 1-hour average, and then multiplying the 1-hour value by 0.7 to calculate an 8-hour average. Annual average concentrations were estimated by multiplying the maximum 24-hour concentration by 0.25 (the maximum ratio of the annual to 24-hr second high concentration modeled with ISCST was 0.2 at the maximum PTPTPA impact receptor). Maximum modeled results from all receptors were used to evaluate impacts for each averaging period.
3. With exceptions noted as follows, background concentrations were obtained from the 2003-2005 average values from the 3 CT monitoring sites nearest to the project site (data provided by CTDEP). For PM2.5, background concentrations were obtained from the average of 2003-2005 data from the Norwich, CT and East Greenwich, RI monitoring sites. For PM10, the 24-hour background concentration was obtained from the average of the 2003-2005 values from East Hartford, CT and E. Greenwich, RI. The PM10 annual background concentration was obtained from the average of the 2003-2005 values from Waterbury, CT and E. Greenwich, RI.

Table 5-9 – Summary of Maximum Multiple-Source Impacts

Worst-Case of ISCST-PRIME and PTMTPA Impacts

Pollutant	Averaging Period	Max. Impact AAQS Sources (µg/m^3)[1,2]	Max. Impact PSD Increment Consuming Sources (µg/m^3)[1,2]	Class II Allowable PSD Increments. (µg/m^3)	Background Conc. (µg/m^3)[3]	Total Conc. (µg/m^3)	AAQS (µg/m^3)
PM2.5	24-hour	9.6	N/A	N/A	33.2	42.7	65
	Annual	1.3	N/A	N/A	9.8	11.1	15
NO_2	Annual	4.3	4.3	25	32.7	36.9	100
SO_2	3-hour	174.0	46.0	512	92.0	266.0	1300
	24-hour	70.6	9.0	91	55.0	125.6	260
	Annual	9.3	2.3	20	11.0	20.3	60

For the AAQS analysis, the results demonstrate that the maximum impacts from all modeled sources, when added to the applicable background concentrations, will comply with the AAQS for $PM_{2.5}$, NO_2 and SO_2 for all applicable averaging periods. For the PSD analysis, the results demonstrate that the NO_2 and SO_2 increment consumption is below the applicable PSD Increments. Total estimated NO_2 increment consumption is approximately 17 percent of the available increment. Total SO_2 increment consumption is less than 7 percent of the available 3-hour average increment and about 10 percent of the available 24-hour and annual average increments.

6.0 ADDITIONAL IMPACT ANALYSES

PSD regulations require additional impact analyses to be performed for each pollutant subject to PSD review that will be emitted by the proposed source. The additional analyses are performed to evaluate the potential for impairment to visibility, soils and vegetation that would occur as a result of the project. Additionally, the applicant must evaluate the potential for air quality impacts due to general commercial, residential, industrial and other secondary growth associated with the project.

6.1 Visibility Impairment Analysis

A stack plume visibility screening analysis was performed based upon the procedures described in EPA's Workbook for Plume Visual Impact Screening and Analysis (US EPA, 1992)[4]. The screening procedure involves calculation of plume perceptibility (ΔE) and contrast (C) with the US EPA VISCREEN (Version 1.01, dated 88341) model, using as inputs emissions of NO_2, PM/PM_{10}, and sulfates (SO_4), worst-case meteorological dispersion conditions and other default parameters. The screening procedure determines the light scattering impacts of particulates, including sulfates and nitrates, with a mean diameter of two micrometers and a standard deviation of 2 micrometers. The VISCREEN model evaluates both plume perceptibility and contrast against two backgrounds, sky and terrain.

Visibility impacts are a function of NO_2, SO_4 and PM emissions. Particles are capable of either scattering or absorbing light, while NO_2 absorbs light. These constituents, therefore, can either increase or decrease the light intensity (or contrast) of the plume against its background. VISCREEN plume contrast calculations are performed at three wavelengths within the visible spectrum (blue, green and red). Plume perceptibility as determined by VISCREEN is determined from plume contrast at all visible wavelengths and is a function of changes in both brightness and color.

The VISCREEN model provides three levels of analysis, the first two of which are screening approaches. The Level-1 analysis was selected for the PRE project. The Level-1 assessment uses a series of default criteria values to assess the visible impacts. If the source passes the criteria defined for a Level-1 assessment ($\Delta E \leq 2.0$ and $Cp \leq 0.05$), potential for visibility impairment is not expected to be significant and no further analysis is necessary. If a source fails the Level-1 criteria, a Level-2 or Level-3 analysis may be required.

A Level-1 analysis was performed for the two nearest Class I areas: the Lye Brook Wilderness, located in southwestern VT, approximately 185 km north-northwest of the PRE project site and the Edwin B. Forsythe National Wildlife Refuge (NWR), located in Brigantine, NJ, approximately 320 km southwest of the PRE site. Both of these Class I areas are more than 100 km from the PRE site; therefore, the VISCREEN analysis is optional.

The VISCREEN analysis was performed for the worst-case FBG operating scenario that resulted in highest impacts for NO_2, SO_2 and PM_{10} (Case #2). The analysis was performed assuming that all emitted particulate from the FBG stack would be PM_{10}, 10 percent of the emitted NO_X would be NO_2, and 5 percent of the emitted SO_2 would be SO_4, which result in a conservative assessment of visibility impacts. The emission rates and other VISCREEN input assumptions are summarized in Table 6-1:

Table 6-1 – VISCREEN Model Input Data

Parameter	Lye Brook Wilderness	Edwin B. Forsythe NWR
PRE Emission Rates (g/sec) • NO_X as NO_2 • PM_{10} • SO_4	 • 4.94 • 1.32 • 0.12	 • 4.94 • 1.32 • 0.12
Background visual range (km)	40	40
Source-observer distance (km)	185	320
Minimum source distance (km)	185	320
Maximum source distance	200	335
Default criteria: • ΔE • Cp	 • $\leq$2.0 • $\leq$0.05	 • $\leq$2.0 • $\leq$0.05

VISCREEN assesses visibility impacts for two sun angles (light scattering angles of 10º and 140º) and for hypothetical observers located at the closest and furthest Class I area boundaries (inside and outside surrounding areas). The VISCREEN model outputs are provided in Appendix F and the results are summarized in Table 6-2. The calculated plume perceptibility and contrast parameters were determined to be below the EPA default criteria for a visibility screening analysis. Therefore, the results demonstrate that the PRE FBG plume will not impact visibility at the two nearest Class I areas to the plant and no further visibility assessment is necessary.

Table 6-2 – VISCREEN Level-1 Analysis Results

VISCREEN Analysis Results[a] for Lye Brook Wilderness, VT

Background	Theta[b] (degrees)	Azimuth[c] (degrees)	Distance (km)	Alpha[d] (degrees)	Perceptibility (ΔE)[e]		Contrast (C)[f]	
					Criteria	Plume	Criteria	Plume
Inside Surrounding Area								
Sky	10	84	185.0	84	2.00	0.003	0.05	0.000
Sky	140	84	185.0	84	2.00	0.001	0.05	0.000
Terrain	10	85	185.4	84	2.00	0.000	0.05	0.000
Terrain	140	85	185.4	84	2.00	0.000	0.05	0.000
Outside Surrounding Area								
Sky	10	75	179.1	94	2.00	0.003	0.05	0.000
Sky	140	75	179.1	94	2.00	0.001	0.05	0.000
Terrain	10	60	169.2	109	2.00	0.000	0.05	0.000
Terrain	140	60	169.2	109	2.00	0.000	0.05	0.000

[a] Based on PRE FBG emissions
[b] Theta is the vertical angle subtended by the plume
[c] Azimuth is the angle between the line connecting the source, observer and the line of sight
[d] Alpha is the angle between the line of sight and the plume centerline
[e] Plume perceptibility parameter (dimensionless)
[f] Visual contrast against background parameter (dimensionless)

VISCREEN Analysis Results[a] for Brigantine National Wildlife Refuge, NJ

Background	Theta[b] (degrees)	Azimuth[c] (degrees)	Distance (km)	Alpha[d] (degrees)	Perceptibility (ΔE)[e]		Contrast (C)[f]	
					Criteria	Plume	Criteria	Plume
Inside Surrounding Area								
Sky	10	84	320.0	84	2.00	0.000	0.05	0.000
Sky	140	84	320.0	84	2.00	0.000	0.05	0.000
Terrain	10	90	326.3	79	2.00	0.000	0.05	0.000
Terrain	140	90	326.3	79	2.00	0.000	0.05	0.000
Outside Surrounding Area								
Sky	10	80	315.2	89	2.00	0.000	0.05	0.000
Sky	140	80	315.2	89	2.00	0.000	0.05	0.000
Terrain	10	100	338.1	69	2.00	0.000	0.05	0.000
Terrain	140	100	338.1	69	2.00	0.000	0.05	0.000

[a] Based on PRE FBG emissions
[b] Theta is the vertical angle subtended by the plume
[c] Azimuth is the angle between the line connecting the source, observer and the line of sight
[d] Alpha is the angle between the line of sight and the plume centerline
[e] Plume perceptibility parameter (dimensionless)
[f] Visual contrast against background parameter (dimensionless)

6.2 Soils and Vegetation Analysis

PSD regulations require an analysis of air quality impacts on sensitive vegetation types, with significant commercial or recreational value, or sensitive types of soil. Evaluation of potential impacts on sensitive vegetation was performed by comparison of maximum modeled impacts from the PRE project to Air Quality Related Value (AQRV) screening concentrations provided in the USEPA document "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals" (USEPA, 1980)[5]. The screening levels represent the minimum concentrations in either plant tissue or soils at which adverse growth effects or tissue injury was reported in the literature. Therefore, if the impacts of a proposed emission source are shown to be below these screening levels, the project is not likely to have an adverse impact on the vegetation grown in the region.

The designated vegetation screening levels for criteria pollutants are equivalent to or exceed NAAQS and/or PSD increments for applicable averaging periods. Therefore, compliance with the NAAQS and PSD increments would ensure compliance with sensitive vegetation screening levels for those averaging periods. However, screening levels are provided by EPA for additional averaging periods for some pollutants for which no applicable NAAQS or PSD increment have been established. Table 6-3 shows that maximum modeled impacts from the PRE facility would not exceed any of the applicable AQRVs, PSD Increments or AAQS. This analysis demonstrates that emissions from the proposed Project will not cause or contribute to air pollution that would adversely impact soils and vegetation in the area.

Table 6-3 – Comparison of PRE Impacts to AQRVs, PSD Increments and AAQS

Pollutant	Averaging Period	Background Concentration (µg/m³)	PRE Maximum Impacts (µg/m³)	AQRV Screening Levels (µg/m³)	PSD Increments (µg/m³)	AAQS (µg/m³)
PM10	24-hour	31	4	--	30	150
	Annual	17	1	--	17	50
PM2.5	24-hour	33	4	--	--	65
	Annual	10	1	--	--	15
NO_2	4-hour[1]	--	94	3760	--	--
	8 hour	--	73	3760	--	--
	1-month[2]	--	15	564	--	--
	Annual	33	4	100	25	100
SO_2	1-hour	--	49	917	--	--
	3-hour	92	44	786	512	1300
	24-hour	55	7	--	91	260
	Annual	11	2	18	20	60
CO	1-hour	20,000	145	--	--	40,000
	8-hour	5,000	102	--	--	10,000
	Weekly[3]	--	21	1,800,000	--	--
Pb	3-month	--	0.03	1.5	--	1.5
Dioxins	Annual	--	4E-09	--	--	1.00E-06

"—" = not applicable or not available.

1 4-hour average impact approximated by modeled 3-hour average impact.
2 1-month average impact approximated by modeled 24-hour average impact.
3 Weekly average impact approximated by modeled 24-hour average impact.

6.3 Growth Analysis

The PRE project is anticipated to provide approximately 200 jobs during the construction phase and 20 to 25 permanent jobs during the operational phase of the project. It is not anticipated that this will result in any significant industrial, commercial and residential growth necessary to support the project.

The proposed PRE project will be located proximate to a number of urban and populated areas with a sufficient construction workforce available to build the project. The availability of a suitable workforce is supported by the fact that significant construction activities have previously been supported in southeastern CT. Because the Project's construction can be supported by a workforce located within the region, new housing, commercial and industrial construction will not be necessary to support the Project during the construction period.

During the operational phase of the project, it is anticipated that many of the 20 – 25 permanent positions will be filled by individuals already residing in the region. For any new personnel moving to the area, a sufficient housing market is already available and significant new housing is not expected to be needed. In addition, no significant commercial or industrial development will be needed to support the operational phase of the Project.

Therefore, no significant additional emissions or air quality impacts from secondary growth are anticipated due to construction or operation of the PRE project.

7.0 SUMMARY AND CONCLUSIONS

Ambient impact analyses were performed in support of the air permit application by PRE to construct and operate a biomass energy project. The proposed project will be a Major Stationary Source subject to PSD review for PM_{10}, $PM_{2.5}$, NO_2, SO_2 and CO. Therefore, dispersion modeling was performed to demonstrate compliance with AAQS and applicable PSD Increments and additional analyses were conducted to satisfy other PSD impact analysis requirements.

Results of the AAQS and PSD Increment analyses are summarized in Table 7-1 and Table 7-2, respectively. The summary tables compare maximum PRE impacts to EPA Significant Impact Levels and multiple-source cumulative impacts (including representative background concentrations) to AAQS and allowable PSD Increments. Based on these results and additional impact analyses, the following conclusions are made:

- Potential emissions of PM_{10}, CO, Pb and dioxins from the proposed PRE facility will not result in ambient impacts above any applicable Significant Impact Levels for these pollutants. Therefore, the source is presumed to not cause or significantly contribute to a PSD Increment or AAQS violation and is not required to perform multiple source cumulative impact assessments for these pollutants.
- The cumulative impacts of $PM_{2.5}$, NO_2 and SO_2 due to emissions from the PRE facility and other potentially interacting sources will not cause an exceedance of any applicable AAQS.
- The cumulative impacts of PM_{10}, NO_2 and SO_2 due to emissions from the PRE facility and other potential PSD-consuming emission sources will not cause an exceedance of any applicable Class II PSD Increment.
- Emissions from the PRE facility will not impair visibility in any nearby Class I areas.
- Emissions from the PRE facility will not have any adverse effects on sensitive soils and vegetation in the area.
- No significant additional emissions or air quality impacts from secondary growth are anticipated due to construction or operation of the PRE project.
- Maximum impacts from the PRE facility will be less than applicable Pre-Construction Monitoring De Minimis Levels. This result, in addition to the availability of representative and conservative background air quality data from regional monitors, provides sufficient justification for exemption from pre-construction monitoring for all pollutants.

Table 7-1 – Summary of AAQS Analysis Results

Pollutant	Averaging Period	Max. PRE Impact[1] (µg/m³)	Signif. Impact Level (µg/m³)	Max. Multi-Source Impact (PRE Significant) (µg/m³)	Background Conc. (µg/m³)	Max. Total Conc. (µg/m³)	Ambient Standard (µg/m³)
PM_{10}	24-hour	4.0	5	NR	31	NR	150
	Annual	0.99	1	NR	17	NR	50
PM2.5	24-hour	4.0	2	9.6	33	42.7	65
	Annual	0.99	0.3	1.3	9.8	11.1	15
NO_2	Annual	3.7	1	4.3	33	36.9	100
SO_2	3-hour	44	25	174.0	92	266.0	1300
	24-hour	7.0	5	70.6	55	125.6	260
	Annual	1.8	1	9.3	11	20.3	60
CO	1-hour	145	2,000	NR	20,000	NR	40,000
	8-hour	102	500	NR	5,000	NR	10,000
Pb	3-Month	0.03	0.3	NR		NR	1.5
Dioxins	Annual	4.3E-09	1.00E-07	NR		NR	1.00E-06

NR = Not required because maximum PRE impacts are less than Significant Impact Levels

[1] PRE FBG stack

Table 7-2 – Summary of PSD Increment Consumption Analysis Results

Pollutant	Averaging Period	Max. PRE Impact[1] (µg/m³)	Signif. Impact Level (µg/m³)	Max. Multi-Source Impact (PRE Significant) (µg/m³)	Class II Allowable PSD Increments. (µg/m³)	Percent of PSD Increment Consumed
PM_{10}	24-hour	4.0	5	NR	30	NR
	Annual	0.99	1	NR	17	NR
NO_2	Annual	3.7	1	4.3	25	17%
SO_2	3-hour	44	25	46.0	512	7%
	24-hour	7.0	5	9.0	91	10%
	Annual	1.8	1	2.3	20	11%

NR = Not required because maximum PRE impacts are less than Significant Impact Levels

[1] PRE FBG stack.

8.0 REFERENCES

[1] CTDEP Ambient Impact Analysis Guideline, July 1989
[2] Robert J. Paine and Frances Lew, Consequence Analysis for Adoption of PRIME: an Advanced Building Downwash Model, AWMA 1998, 98-RA76B.03
[3] USEPA, AERMOD: Description of Model Formulation, EPA-454/R-03-004
[4] USEPA, Workbook for Plume Visual Impact Screening and Analysis (Revised), EPA-454/R-92-023.
[5] USEPA, A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals, EPA 450/2-81-078, December 12, 1980.