AIR DISPERSION MODELING REPORT

Algonquin Gas Transmission, LLC
Weymouth Compressor Station and M&R Station
Atlantic Bridge Project

Prepared For:

Algonquin Gas Transmission, LLC
Weymouth Compressor Station
50 Bridge Street
Weymouth, MA 02191

AND

Weymouth M&R Station
6 Bridge Street
Weymouth, MA 02191

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September 2016

Project 142201.0010

Trinity Consultants

Environmental solutions delivered uncommonly well

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1. INTRODUCTION

Algonquin Gas Transmission, LLC (Algonquin) is proposing to construct, install, own, operate, and maintain the Atlantic Bridge Project (AB Project). The AB Project will create additional firm pipeline capacity necessary to deliver natural gas supplies that will meet supply and load growth requirements in the Northeast market area. The AB Project will create additional capacity between a receipt point on Algonquin's system at Mahwah in Bergen County, New Jersey and various delivery points on the Algonquin system, including at Beverly, Massachusetts for further transportation and deliveries on the Maritimes system. Collectively, this project is referred to as the AB Project. As part of the AB Project, a new compressor station is proposed to be constructed in Weymouth, Massachusetts (Weymouth Compressor Station).

Algonquin's Weymouth Compressor Station will be located in Norfolk County, Massachusetts. As part of the AB Project, Algonquin is proposing to install the following emission units at the Weymouth Compressor Station:

- A new Solar Taurus 60-7802 natural gas-fired turbine-driven compressor unit;
- A new Waukesha VGF24GL natural gas-fired emergency generator;
- A new natural gas-fired turbine compressor fuel gas heater;
- Five (5) new natural gas-fired catalytic space heaters;
- A new parts washer;
- New separator vessels and storage tanks; and
- Fugitive Emission Sources (piping components, gas releases and truck loading).

In accordance with the pre-application meeting with the MassDEP, Algonquin is submitting a non-major comprehensive plan approval (Non-Major CPA) application for the Weymouth Compressor Station which includes an air dispersion modeling analysis.[1] There is an existing metering and regulating (M&R) station located approximately 100 meters from the proposed Weymouth Compressor Station. The existing equipment at the M&R station includes two natural gas-fired heaters, three natural gas-fired boilers, piping components, and gas releases. Algonquin is including the existing M&R station as part of the Non-Major CPA application and air dispersion modeling for the proposed Weymouth Compressor Station.

This modeling report outlines the methodologies used to conduct the state air dispersion modeling analysis for the Weymouth Compressor Station and existing M&R station. The methodologies outlined are generally consistent with those provided to the MassDEP in a modeling protocol submitted on August 21, 2015.[2] Air dispersion modeling is relied upon to demonstrate that the AB Project complies with the applicable National Ambient Air Quality Standards (NAAQS).

Algonquin has included, as Attachment A to this modeling report, a CD containing all the files associated with the air dispersion modeling analysis. This CD includes those files associated with importing terrain elevations, building downwash, meteorological data, and AERMOD.

[1] Pre-application meeting with the MassDEP (Tom Cushing, Pete Russell, Samrawit Dererie), Spectra (Reagan Mayces, Terry Doyle, Bill Welch and Owen McManus), TRC (Kate Brown) and Trinity Consultants (Wendy Merz) on March 10, 2015

[2] Comments on this protocol were provided verbally by Glenn Pacheco (MassDEP). These comments have been incorporated into the final air dispersion modeling analysis and are reflected in this report.

1.1. PROPOSED FACILITY LOCATION

The Weymouth Compressor Station will be located in Weymouth, Massachusetts (Norfolk County). Figure 2-1 presents an aerial map of the existing facility.

The Weymouth Compressor Station will be located at the following address:

50 Bridge Street
Weymouth, MA 02191

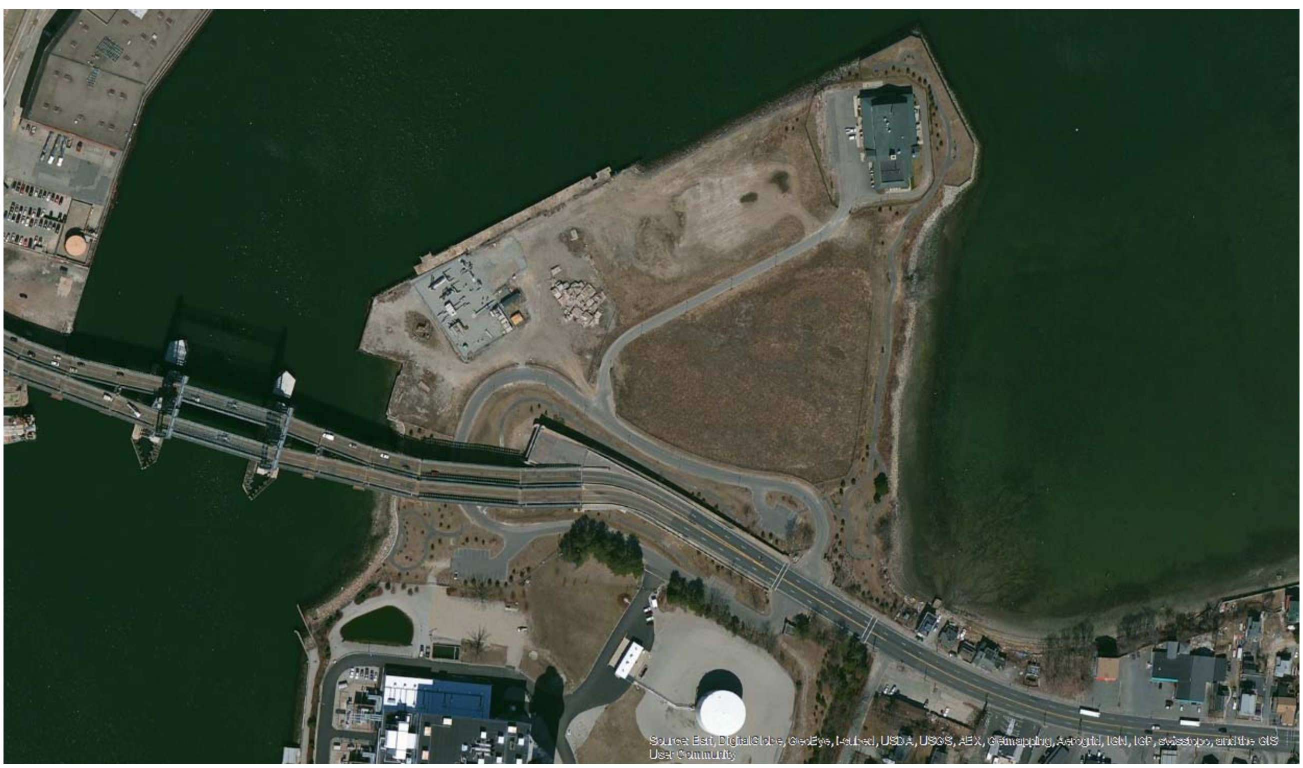
The M&R station is located at the following address:

6 Bridge Street
Weymouth, MA 02191

The following is the company contact information for the Weymouth Compressor Station:

Reagan Mayces
P.O. Box 1642
Houston, TX 77251
Office Phone: (713) 627-4790

Figure 1-1 Aerial Map of the Proposed Weymouth Compressor Station Location



The following sections outline the air dispersion modeling procedures used for this analysis.

2.1. SIGNIFICANCE ANALYSIS

As a first step in the air dispersion modeling analysis, a significance analysis was used to determine whether the calculated potential emissions from the proposed Weymouth Compressor Station will result in a significant impact upon the area surrounding the facility. For this project, a significance analysis was performed for each pollutant with an established Significant Impact Level (SIL).

SILs are ambient concentration thresholds that represent a fraction of the NAAQS and, based on U.S. Environmental Protection Agency (EPA) guidance, are deemed to indicate the level above which a particular facility may cause or contribute to air quality degradation.[3] In accordance with U.S. EPA and MassDEP guidance, predicted air quality impacts of a project in excess of the SILs indicate a need for further analysis to determine whether a project's emissions might cause or contribute to an exceedance of a NAAQS. In the significance analysis, the maximum-modeled ground-level concentrations are compared to the appropriate SIL established by the U.S. EPA (shown in Table 2-1).

Table 2-1. Significant Impact Levels

PSD Pollutant	Averaging Period	Federal Class II SIL (μg/m³)
PM_{10}	24-hour	5
	Annual	1
$PM_{2.5}$	24-hour [A]	1.2
	Annual [A]	0.3
NO_2	1-hour [B]	7.5
	Annual	1
CO	1-hour	2,000
	8-hour	500
SO_2	1-hour [C]	7.8
	3-hour	25
	24-hour	5
	Annual	1

[A] The $PM_{2.5}$ SILs were effectively remanded and vacated as result of a United States Court of Appeals decision, *Sierra Club v. EPA,* No. 1—1413. However, the MassDEP recognizes the previously established $PM_{2.5}$ SILS for the purposes of significance modeling.[4] As such, the SILs were utilized in this modeling analysis.

[B] 1-hour NO_2 SIL has not been formally proposed. Algonquin used the interim SIL of 4 ppb (or 7.5 μg/m³) presented in the June 28, 2010 Wood memo.[5]

[3] U.S. EPA Memorandum from Gerald Emison, U.S. EPA OAQPS, to Thomas Maslany, U. S EPA Air Management Division, *Air Quality Analysis for Prevention of Significant Deterioration (PSD)*, July 5, 1988.

[4] MassDEP Bureau of Waste Prevention, *Modeling Guidance for Significant Stationary Sources of Air Pollution*, June 2011.

[5] U.S. EPA Memorandum from Anna Marie Wood, General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 Significant Impact Level, June 28, 2010.

C The 1-hour SO_2 SIL has not been formally proposed. Algonquin used the interim SIL of 3 ppb (or 7.8 μg/m^3) presented in the August 23, 2010 Wood memo.[6]

Per MassDEP modeling guidance for new facilities, if maximum predicted impacts of a pollutant are below the applicable SILs, the facility's proposed emissions are considered to be in compliance with the NAAQS for that pollutant.[7]

The results of the significance analysis are outlined in Section 4.1.

2.2. BACKGROUND AIR QUALITY

In evaluating cumulative impacts with respect to the NAAQS, maximum modeled impacts were added to representative ambient background concentrations and compared to the applicable NAAQS. Selection of the existing monitoring station data that is "representative" of the ambient air quality in the area surrounding the proposed facility is determined based on the following three criteria: 1) monitor location, 2) data quality, and 3) data currentness. Key considerations based on the monitor location criteria include proximity to the significant impact area of the facility, similarity of emission sources impacting the monitor to the emission sources impacting the airshed surrounding the proposed compressor station, and the similarity of the land use and land cover (LULC) surrounding the monitor and proposed facility. The data quality criteria refers to the monitor being an approved State and Local Air Monitoring Station (SLAM) or similar monitor type subject to the quality assurance requirements in 40 CFR Part 58 Appendix A. Data currentness refers to the fact that the most recent three complete years of quality assured data are generally preferred.

The MassDEP provided the representative background concentrations from the Harrison Avenue site to be used for the air quality analysis which are shown in Table 2-2.[8]

[6] Ibid.
[7] MassDEP Bureau of Waste Prevention, *Modeling Guidance for Significant Stationary Sources of Air Pollution*, June 2011.
[8] Email from Mr. Glenn Pacheco (MassDEP) to Ms. Susan Barnes (Trinity Consultants) on July 20, 2015.

Table 2-2 Selected Background Concentrations

PSD Pollutant	Averaging Period	2012-2014 Monitor Background Concentration (μg/m³)	Metric	Monitor Location
PM_{10}	24-hour	40.0	3-yr average of second-high	Harrison Ave
$PM_{2.5}$	24-hour	16.4	3-yr average of 98th percentile	Harrison Ave
	Annual	7.2	3-yr arithmetic mean average	
NO_2	1-hour	91.0	3-yr average of 98th percentile	Harrison Ave
	Annual	32.8	3-yr arithmetic mean maximum	
SO_2	1-hour	30.9	3-yr average of 99th percentile	Harrison Ave
	3-hour	63.4	Highest-second-high (H2H)	
	24-hour	23.1	H2H	
	Annual	2.9	3-yr arithmetic mean maximum	
CO	1-hour	2,520	H2H	Harrison Ave
	8-hour	1,833	H2H	

2.3. NAAQS ANALYSIS

As discussed in the results section, the emissions increases from the proposed Weymouth Compressor Station were shown to have a significant impact (i.e., modeled ambient concentrations above the corresponding SILs) for 1-hour and annual average nitrogen dioxide (NO_2), 24-hour average sulfur dioxide (SO_2) and 24-hour and annual average particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). As such, a NAAQS analysis was conducted.

The primary NAAQS are the maximum concentration ceilings, measured in terms of total concentration of a pollutant in the atmosphere, which define the "levels of air quality which the U.S. EPA judges are necessary, with an adequate margin of safety, to protect the public health."[9] Secondary NAAQS define the levels that "protect the public welfare from any known or anticipated adverse effects of a pollutant." The primary and secondary NAAQS addressed in this air dispersion modeling analysis are shown in Table 2-3.

[9] 40 CFR §50.2(b).

Table 2-3. Applicable Primary and Secondary NAAQS

Pollutant	Averaging Period	Primary NAAQS ($\mu g/m^3$)	Secondary NAAQS ($\mu g/m^3$)
NO_2	1-hour	188 (100 ppb) [A]	--
	Annual	100 (0.053 ppm) [B]	--
SO_2	24-hour [C]	365 (0.14 ppm) [D]	--
$PM_{2.5}$	24-hour	35 [E]	35[D]
	Annual	12 [F]	15[E]

[A] The 3-year average of the 98th percentile of the daily maximum 1-hr average.
[B] Annual arithmetic average.
[C] The 24-hour SO_2 NAAQS will be revoked one year after the effective date in areas with a designated status for the 1-hour SO_2 NAAQS.
[D] Not to be exceeded more than once per calendar year.
[E] 3-year average of the 98th percentile 24-hour average concentration.
[F] 3-year average of the annual arithmetic average concentration.

In the NAAQS analysis, the potential emissions from all proposed and existing emission units at the Weymouth Compressor Station and M&R station combined with the maximum allowable emissions of sources included in the regional inventory (see Section 3.8.4) were modeled together to compute the modeled cumulative impact.

The objective of the NAAQS analysis is to demonstrate through air dispersion modeling that emissions from the proposed Weymouth Compressor Station and existing M&R station do not cause or contribute to an exceedance of the NAAQS at any ambient location at which the impact from the facility is greater than the SIL. The modeled cumulative impacts are added to appropriate background concentrations (see Section 2.2) and assessed against the applicable NAAQS to demonstrate compliance.

The following modeling results were used to determine the design concentration in the NAAQS analysis:

- **24-hour $PM_{2.5}$:** Maximum five-year average of the 98th percentile [approximated by the highest eighth-high (H8H)] modeled 24-hour average concentration;
- **Annual $PM_{2.5}$:** Modeled arithmetic mean concentration averaged over the full five years of meteorological data;
- **24-hour SO_2**: Highest second-high (H2H) 24-hour average modeled concentration of each year;
- **1-hour NO_2:** Maximum five-year average of the 98th percentile [approximated by the H8H] modeled 1-hour daily maximum concentration; and
- **Annual NO_2:** Maximum arithmetic annual mean modeled concentration.

2.4. TOXICS ANALYSIS

During review of the application, MassDEP requested an air dispersion modeling analysis for toxic pollutants. For the toxics analysis, all proposed and existing sources at the Weymouth Compressor Station and M&R station were modeled and the maximum modeled concentration results were compared to Massachusetts' 24-hour Threshold Effect Exposure Limits (TELs) and annual Ambient Air Limits (AALs). The applicable TELs and AALs are provided in Table 2-4.

Table 2-4. MassDEP TELs and AALs

Pollutant	TEL (μg/m³)	AAL (μg/m³)
Acetaldehyde	30.00	0.40
Acrolein	0.07	0.07
Benzene	0.60	0.10
1,3-Butadiene	1.20	0.003
Carbon Tetrachloride	85.52	0.07
Chlorobenzene	93.88	6.26
Chloroform	132.76	0.04
Dichloromethane (Methylene Chloride)	100.00	60.00
Diphenyl (Biphenyl)	0.34	0.09
Ethylbenzene	300.00	300.00
Formaldehyde	2.00	0.08
Methanol	7.13	7.13
2-Methylnaphthalene	14.25	14.25
Naphthalene	14.25	14.25
Phenol	52.33	52.33
Propylene Oxide	6.00	0.30
Styrene	200.00	2.00
1,1,2,2-Tetrachloroethane	18.67	0.02
Toluene	80.00	20.00
1,1,2-Trichloroethane	14.84	0.06
Vinyl Chloride	3.47	0.38
Xylenes (m-,o-,p- isomers)	11.80	11.80

In a toxics analysis, a facility's emissions are modeled and resulting concentrations are compared to the appropriate TEL and AAL. No regional sources or background concentration data is incorporated into the modeling analysis for toxics. The TELs and AALs are set at levels deemed appropriate by the MassDEP for emissions from a single facility to achieve ambient air concentrations at levels protective of human health and the environment which are much higher than the TELs and AALs.

3. MODELING METHODOLOGY

The air dispersion modeling analyses were generally conducted in accordance with the following guidance documents:

- U.S. EPA's *Guideline on Air Quality Models* 40 CFR Part 51, Appendix W (Revised, November 9, 2005) (*Guideline*);
- MassDEP's *Modeling Guidance for Significant Stationary Sources of Air Pollution (June 2011);*
- U.S. EPA's *AERMOD Implementation Guide* http://www.epa.gov/scram001/7thconf/aermod/aermod_implmtn_guide_19March2009.pdf;
- U.S. EPA's *New Source Review Workshop Manual* (Draft, October, 1990);
- U.S. EPA, Office of Air Quality Planning and Standards, Memorandum from Mr. Tyler Fox to Regional Air Division Directors. *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard* (March 1, 2011);
- U.S. EPA, Office of Air Quality Planning and Standards, Memorandum from Mr. Tyler Fox to Regional Air Division Directors. *Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 National Ambient Air Quality Standard* (August 23, 2010); and
- U.S. EPA, Office of Air Quality Planning and Standards, Memorandum from Mr. R. Chris Owen and Roger Brode to Regional Air Modeling Contacts. *Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard* (September 30, 2014).

3.1. MODEL SELECTION

Dispersion models predict ambient pollutant concentrations by simulating the evolution of the pollutant plume over time and space given data inputs including the quantity of emissions, stack exhaust parameters (e.g., velocity, flowrate, and temperature) and weather data. Building structures that obstruct wind flow near emission points may cause stack discharges to become caught in the turbulent wakes of these structures leading to downwash of the plumes. Wind blowing around a building creates zones of turbulence that are greater than if the building were absent. These effects generally cause higher ground-level pollutant concentrations since building downwash inhibits dispersion from elevated stack discharges. For this reason, building downwash algorithms are considered an integral component of the selected air dispersion model.

The latest version (v15181) of the AERMOD model was used to estimate maximum ground-level concentrations in all air pollutant analyses conducted for this application. AERMOD is a refined, steady-state, multiple source dispersion model that was promulgated in December 2005 as the U.S. EPA-preferred model to use for industrial sources in this type of air dispersion modeling analysis.[10] Following procedures outlined in the *Guideline*, the AERMOD modeling was performed using regulatory default options except as otherwise noted in this report. The AERMOD model has the Plume Rise Modeling Enhancements (PRIME) incorporated in the regulatory version, so the direction-specific building downwash dimensions used as input were determined by the Building Profile Input Program, PRIME version (BPIP PRIME), version 04274.[11] Table 3-1 summarizes the model control options that were utilized in this analysis.

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[10] 40 CFR 51, Appendix W–*Guideline on Air Quality Models*, Appendix A.1– AMS/EPA Regulatory Model (AERMOD), November 9, 2005.

[11] Earth Tech, Inc., Addendum to the ISC3 User's Guide, The PRIME Plume Rise and Building Downwash Model, Concord, MA, November 1997.

Table 3-1. Model Selection Options

Control Option	Option Selected	Justification
Pollutant ID	CO, NO_2, PM_{10}, $PM_{2.5}$, SO_2, Other	--
Terrain	Elevated, Meters	The receptor grid covers varying terrain elevations; as such, the elevated option was selected.
Flagpole Receptors	N/A	--
Run or Not	Run	--
Averaging Times	1-hour, 3-hour, 8-hour, 24-hour, and annual	Algonquin selected the appropriate averaging periods for each pollutant modeled
Model	PRIME	The PRIME algorithms are default.
Dispersion	Concentration, Rural, Regulatory Default Option	This modeling analysis is assessing compliance with concentration standards. Algonquin is located in a predominantly rural area (refer to Section 3.3). The regulatory default option was selected as it is recommended in Appendix W.
NO_2 Model Options	N/A	The ambient ratio method (ARM) was utilized but applied outside of AERMOD. Refer to Section 3.9 for specifics on this modeling mechanism.
Particulate Model Options	N/A	Algonquin did not utilize particle deposition or depletion options for particulate modeling.
Output Files	.aml	Model output file from Breeze User Interface

3.2. METEOROLOGICAL DATA

Site-specific dispersion models require a sequential hourly record of dispersion meteorology representative of the region within which the source is located. In the absence of site-specific measurements, readily available data are commonly used from the closest and most representative National Weather Service (NWS) station. Regulatory air dispersion modeling using AERMOD requires five years of quality-assured meteorological data that includes hourly records of the following parameters:

- Wind speed;
- Wind direction;
- Air temperature;
- Micrometeorological Parameters (e.g., friction velocity, Monin-Obukhov length);
- Mechanical mixing height; and

- Convective mixing height.

The first three of these parameters are directly measured by monitoring equipment located at typical surface observation stations. The friction velocity, Monin-Obukhov length, and mixing heights are derived from characteristic micrometeorological parameters and from observed and correlated values of cloud cover, solar insulation, time of day and year, and latitude of the surface observation station. Surface observation stations form a relatively dense network, are almost always found at airports, and are typically operated by the NWS. Upper air stations are fewer in number than surface observing points since the upper atmosphere is less vulnerable to local effects caused by terrain or other land influences and is therefore less variable. The NWS operates virtually all available upper air measurement stations in the United States.

Algonquin obtained processed 2009-2013 meteorological data from the MassDEP.[12] The meteorological data was processed through AERMET (14134) to include upper air measurements from the Gray, Maine National Weather Service site (WBAN ID# 74389) and surface data from the Logan International Airport (WBAN ID# 14739).

3.3. RURAL/URBAN OPTION SELECTION

AERSURFACE (13016) was used to determine whether the rural or urban option within AERMOD should be used for this modeling analysis. Based on the AERSURFACE user's guide, the analysis for landuse utilized 1992 National Land Cover Data (NLCD) and a three kilometer radius around the Weymouth Compressor Station. The center of the analysis was based on the location of the turbine stack, the largest source included in this analysis. Landuse categories 22 (high intensity residential) and 23 (commercial/industrial/transportation) are the only urban classifications under NLCD 1992. The results of the AERSURFACE analysis for the Weymouth Compressor Station are presented in Table 3-2. As shown in this table, the area surrounding the Weymouth Compressor Station is only 13.8 percent urban. Although the area has become more urbanized since 1992, the change is not significant enough to make the area predominantly urban. As such, the rural option was utilized within AERMOD.

[12] Email from Mr. Glenn Pacheco (MassDEP) to Ms. Susan Barnes (Trinity Consultants) on July 20, 2015.

Table 3-2 Urban/Rural Determination Results

NLCD 1992 Category		# of Cells
Code	**Description**	
11	Open Water:	9317
12	Perennial Ice/Snow:	0
21	Low Intensity Residential:	13389
22	High Intensity Residential:	1704
23	Commercial/Industrial/Transp:	2637
31	Bare Rock/Sand/Clay:	18
32	Quarries/Strip Mines/Gravel:	0
33	Transitional:	3
41	Deciduous Forest:	1606
42	Evergreen Forest:	190
43	Mixed Forest:	1085
51	Shrubland:	0
61	Orchards/Vineyard/Other:	1
71	Grasslands/Herbaceous:	0
81	Pasture/Hay:	0
82	Row Crops:	21
83	Small Grains:	0
84	Fallow:	0
85	Urban/Recreational Grasses:	336
91	Woody Wetlands:	249
92	Emergent Herbaceous Wetlands:	843
	Total	**31399**
	Total (Urban)	**4341**
	% Urban	**13.8**

3.4. TREATMENT OF TERRAIN

Through the use of the AERMOD terrain preprocessor (AERMAP), AERMOD incorporates not only the receptor heights, but also an effective height (hill height scale) that represents the significant terrain features surrounding a given receptor that could lead to plume recirculation and other terrain interaction.[13]

Receptor, facility sources and building terrain elevations input to the model were interpolated from 1/3 arc second National Elevation Dataset (NED) data obtained from the USGS. The array elevations were interpolated using the latest version of AERMAP (11103). Elevations for regional sources were provided by the MassDEP.

3.5. RECEPTOR GRIDS

For this air dispersion modeling analysis, ground-level concentrations were calculated along the facility boundaries and also within a Cartesian receptor grid. As an area of concern, the facility boundaries were lined with boundary receptors spaced 25 meters apart starting at an arbitrary point on each boundary. The Cartesian grid used the following receptors spacing:

[13] U.S. EPA, *Users Guide for the AERMOD Terrain Preprocessor (AERMAP)*, EPA-454/B-03-003, Research Triangle Park, NC, October 2004.

- 25 meter-spaced receptors from the edge of the facility boundaries out to 1 kilometer;
- 100 meter-spaced receptors from 1 to 2.5 kilometers;
- 500 meter-spaced receptors from 2.5 to 5 kilometers; and
- 1,000 meter-spaced receptors from 5 to 10 kilometers.

In general, the receptors covered a region extending from all edges of the facility boundaries to the point where impacts from the project are no longer expected to be significant. The boundaries were defined as all areas that are fenced and/or not accessible to the general public. The proposed Weymouth Compressor Station and existing M&R station will be separated by a public road which was treated as ambient air in this modeling analysis. Figures 3-1 and 3-2 depict the receptor grid to be used in the modeling analysis.

Figure 3-1 Receptor Grid

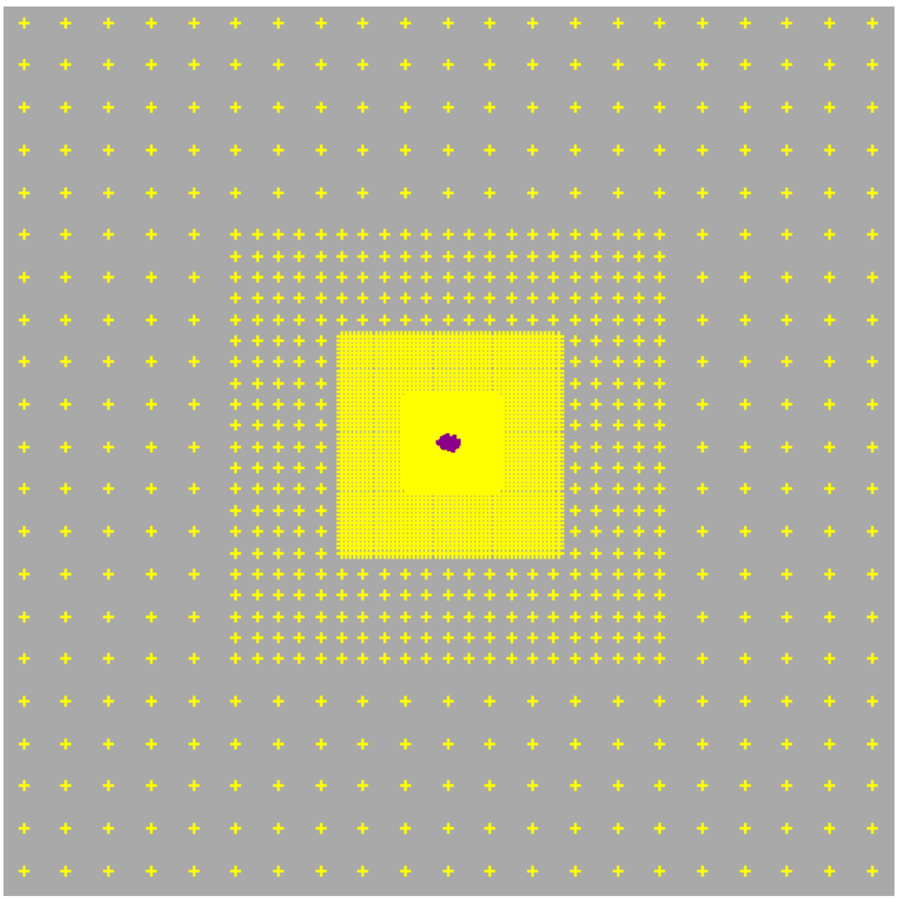
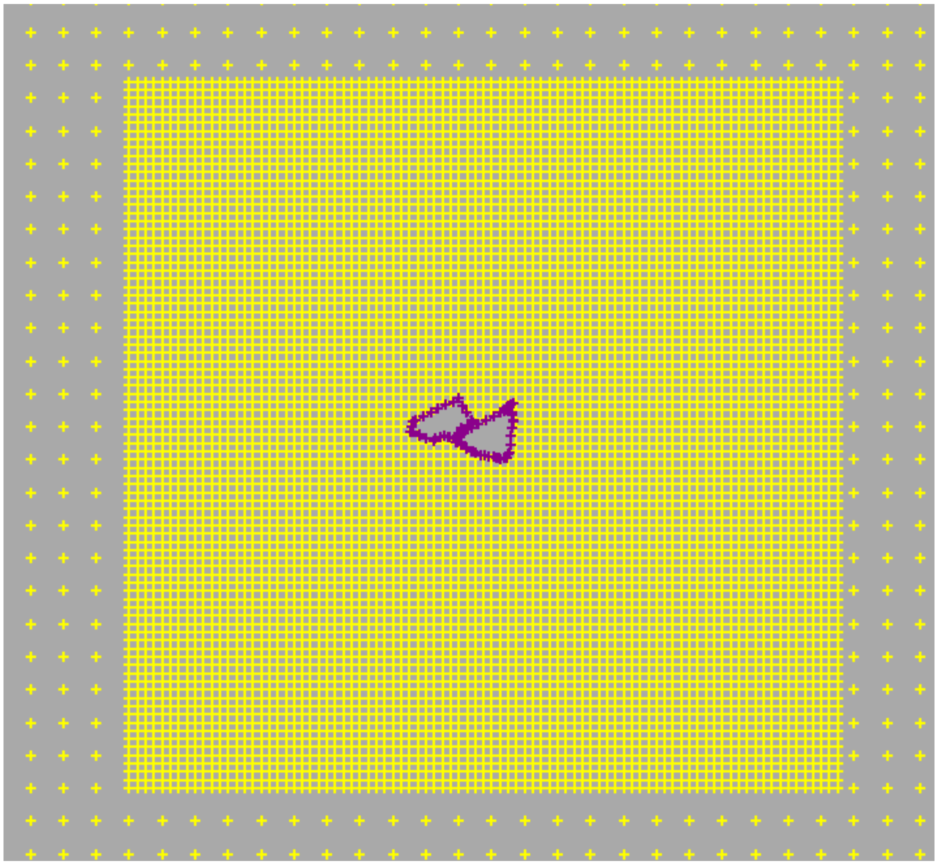


Figure 3-2 Receptor Grid (Zoom In)



3.6. BUILDING DOWNWASH

The emissions units were evaluated in terms of their proximity to nearby structures. The site buildings were digitized in the model using detailed project drawings. The purpose of the building downwash evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures, leading to downwash of the plumes. Wind blowing around a building creates zones of turbulence that are greater than if the building were absent.

All stacks modeled in this analysis were evaluated for cavity and wake effects from building downwash. The current version of the AERMOD dispersion model treats the trajectory of the plume near the building and uses the position of the plume relative to the building to calculate interactions with the building wake. AERMOD calculates fields of turbulence intensity, wind speed, and slopes of the mean streamlines as a function of the projected building dimensions.

The direction-specific building dimensions used as input to the AERMOD model were calculated using BPIP-PRIME (version 04274).[14] BPIP-PRIME is sanctioned by the U.S. EPA and is designed to incorporate the concepts

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[14] U.S. EPA, *User's Guide to the Building Profile Input Program*, (Research Triangle Park, NC: U.S. EPA), EPA-454/R-93-038, Revised February 8, 1995.

and procedures expressed in the "Good Engineering Practice" (GEP) Technical Support document, the Building Downwash Guidance document, and other related documents.[15]

3.7. GEP STACK HEIGHT ANALYSIS

The U.S. EPA has promulgated stack height regulations that restrict the use of stack heights in excess of GEP in air dispersion modeling analyses. Under these regulations, that portion of a stack in excess of the GEP is generally not creditable when modeling to determine source impacts. This essentially prevents the use of excessively tall stacks to reduce ground-level pollutant concentrations. The minimum stack height not subject to the effects of downwash, called the GEP stack height, is defined by the following formula:

$$H_{GEP} = H + 1.5L \qquad \text{(Eq. 3-1)}$$

Where:

H_{GEP}	=	Minimum GEP stack height	(meters)
H	=	Structure height	(meters)
L	=	Lesser dimension of the structure (height or projected width)	(meters)

The wind direction-specific downwash dimensions and the dominant downwash structures used in this analysis are determined using BPIP-PRIME. In general, the lowest GEP stack height for any source is 65 meters by default.[16] A source may construct a stack that exceeds GEP, but is limited to the GEP stack height in the air quality analysis demonstration. All proposed stacks at the Weymouth Compressor Station are less than 65 meters tall and therefore meet the requirements of GEP.

3.8. REPRESENTATION OF EMISSION SOURCES

3.8.1. Coordinate System

In all modeling analysis data files, the location of emission sources, structures, and receptors, are represented in the Universal Transverse Mercator (UTM) coordinate system. The UTM grid divides the world into coordinates that are measured in north meters (measured from the equator) and east meters (measured from the central meridian of a particular zone, which is set at 500 km). The datum for this modeling analysis is based on North American Datum 1983 (NAD 83). UTM coordinates for this analysis all reside within UTM Zone 19.

3.8.2. Source Types

The AERMOD dispersion model allows for emission units to be represented as point, area, or volume sources. In these air dispersion modeling analyses, all emission units were modeled as point sources except for the piping components and five catalytic space heaters. The piping components were modeled as two volume sources, one for the Weymouth Compressor Station and one for the existing M&R station, covering the general area where piping components are located because a volume source is the most representative way to characterize the gas

[15] U.S. EPA, Office of Air Quality Planning and Standards, Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised), (Research Triangle Park, NC: U.S. EPA), EPA 450/4-80-023R, June 1985.

[16] 40 CFR §51.100(ii).

potentially released from the numerous piping components located throughout the facility. The five catalytic space heaters vent into the compressor building. As such, these five heaters were modeled using six equally-spaced volume sources to divide the compressor building into approximately square portions and accurately represent the emissions from the heaters.

3.8.3. Source Parameters and Emission Rates

The source parameters and emissions utilized in this analysis are included in Attachment B. Intermittently operating sources located at the Weymouth Compressor Station (i.e., the emergency generator) were modeled in the 1-hour NO_2 and 1-hour sulfur dioxide (SO_2) modeling analyses at their long-term average emission rate in accordance with the March 1, 2011 U.S. EPA memo with regards to modeling of NO_2 and guidance provided by the MassDEP.

Modeling should contain sufficient detail to determine the maximum ambient concentration of the pollutant under consideration. As such, the modeling analysis for the proposed Weymouth Compressor Station and existing M&R station considered the combustion turbine operating at various loads. Algonquin included 50% and 100% load scenarios in this air dispersion modeling analysis. For each operating scenario, emission rates during normal, low temperature, and high temperature conditions were also evaluated. These scenarios encompass the variations in stack exit temperature and flow potentially resulting from reduced loading and varying temperatures. Specifically, Algonquin modeled the following scenarios:

- **Scenario 1** – Maximum Hourly “Normal” Operation under 100% load;
- **Scenario 2** – Maximum Hourly “Low Temperature” Operation under 100% load;
- **Scenario 3** – Maximum Hourly “High Temperature” Operation under 100% load;
- **Scenario 4** – Maximum Hourly “Normal” Operation under 50% load;
- **Scenario 5** – Maximum Hourly “Low Temperature” Operation under 50% load; and
- **Scenario 6** – Maximum Hourly “High Temperature” Operation under 50% load.

In this analysis, the “normal” operating condition represent an ambient air temperature of 46.65 degrees Fahrenheit (°F) which represents the annual average temperature at the proposed site location. The “low temperature” operating condition represents an ambient air temperature of -20 °F which is the assumed minimum temperature that would be recorded at the proposed site location. The “high temperature” operating condition represents an ambient air temperature of 100 °F which represent the high point of the temperature range for which manufacturer’s data is available.

With respect to modeling 1-hour NO_2 for turbine “low temperature” operation (Scenarios 2 and 5), these scenarios represent intermittent emissions and are therefore assessed in accordance with the USEPA’s March 1, 2011 memo entitled *“Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard”* guidance. For NO_2 emission rates, Algonquin has assumed that low temperature operations will occur for 12 hours per year in the potential emission calculations. As such, the calculated weighted average hourly low temperature emission rate is the low temperatures emission rate times 12/8760 (i.e., the fraction of the year that low temperature operation is assumed), with the normal emission rate occurring for the balance of the hours (8748/8760).

Since this averaging technique applies to NO_2 emission rates only, all other modeled emission rates represent maximum values for each scenario (i.e. averaging was not employed).

3.8.4. Regional Source Inventory

For any off-site impact calculated in the PSD Significance Analysis that is greater than the SIL for a given pollutant, a NAAQS analysis incorporating nearby sources is required. Algonquin and the MassDEP identified four nearby sources which could potentially significantly interact with the proposed Weymouth Compressor Station and existing M&R station as follows:

- Fore River Energy Center, located approximately 0.4 km south of the Weymouth Compressor Station;
- Braintree Electric Light Department, located approximately 1.2 km south of the Weymouth Compressor Station;
- Twin Rivers Technologies, located approximately 0.4 km northwest of the Weymouth Compressor Station; and
- Massachusetts Water Resources Authority (MWRA) Sludge Processing Facility, located approximately 0.7 km southwest of the Weymouth Compressor Station.

Emission rates and stack parameters of regional sources were provided by the MassDEP and are also included in Attachment B.[17]

3.9. NO_2 MODELING APPROACH

Algonquin utilized the Tier 2 Ambient Ratio Method (ARM) for modeling NO_2. Tier 2 ARM is an AERMOD option designed to consider the conversion of nitrogen oxide (NO_X) emissions to NO_2 in the atmosphere. Tier 2 multiplies NO_2 annual results by a national default ratio of 0.75 and NO_2 1-hour results by a national default ratio of 0.8.[18] These default ratios were applied to the NO_X emission rates entered into AERMOD. Attachment B provides emission rates for all sources both with and without the ARM ratios applied.

[17] Emails from Mr. Glenn Pacheco (MassDEP) to Ms. Susan Barnes (Trinity Consultants) on October 2 and 7, 2015.
[18] EPA, *Clarification on the use of AERMOD Dispersion Modeling for Demonstrating Compliance with NO_2 National Ambient Air Quality Standard*, Research Triangle Park, NC.

This section presents the results of the significant impact and NAAQS modeling analyses performed following the procedures outlined in Sections 2 and 3. Electronic input and output files for all AERMOD model runs are included in Attachment A.

4.1. SIGNIFICANT IMPACT ANALYSIS RESULTS

Emissions from the proposed Weymouth Compressor Station were modeled and compared to the appropriate SILs. The SILs are used to determine the level of impact associated with the station. This analysis was conducted to determine if refined NAAQS modeling analyses would be required.

The results of the Significant Impact Analysis are shown in Tables 4-1 through 4-12.

Table 4-1. Modeling Results - PM_{10} 24-Hour Significance

Scenario	H1H Modeled Concentration ($\mu g/m^3$)					SIL ($\mu g/m^3$)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	2.6	2.3	2.2	2.3	2.3	5	Yes
#2 – 100% load, low temperature	2.6	2.3	2.1	2.3	2.3		Yes
#3 – 100% load, high temperature	2.3	2.0	2.1	2.0	2.1		Yes
#4 – 50% load, normal temperature	2.2	1.9	2.1	2.0	2.0		Yes
#5 – 50% load, low temperature	2.2	1.9	2.1	2.0	2.0		Yes
#6 – 50% load, high temperature	1.9	1.8	2.1	2.0	1.9		Yes

Table 4-2. Modeling Results – PM_{10} Annual Significance

Scenario	1st High Modeled Concentration ($\mu g/m^3$)					SIL ($\mu g/m^3$)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	0.3	0.4	0.3	0.3	0.4	5	Yes
#2 – 100% load, low temperature	0.3	0.4	0.3	0.3	0.4		Yes
#3 – 100% load, high temperature	0.3	0.4	0.3	0.3	0.3		Yes
#4 – 50% load, normal temperature	0.3	0.4	0.3	0.3	0.3		Yes
#5 – 50% load, low temperature	0.3	0.4	0.3	0.3	0.3		Yes
#6 – 50% load, high temperature	0.3	0.4	0.3	0.3	0.3		Yes

Table 4-3. Modeling Results – $PM_{2.5}$ 24-Hour Significance

Scenario/ Load	5-year Average H1H Modeled Concentration (μg/m³)	SIL (μg/m³)	Below SIL?
#1 – 100% load, normal temperature	2.3	1.2	No
#2 – 100% load, low temperature	2.3		No
#3 – 100% load, high temperature	2.0		No
#4 – 50% load, normal temperature	2.0		No
#5 – 50% load, low temperature	1.9		No
#6 – 50% load, high temperature	1.9		No

Table 4-4. Modeling Results – $PM_{2.5}$ Annual Significance

Scenario/ Load	1st High Modeled Concentration (μg/m³)	SIL (μg/m³)	Below SIL?
#1 – 100% load, normal temperature	0.35	0.3	No
#2 – 100% load, low temperature	0.35		No
#3 – 100% load, high temperature	0.33		No
#4 – 50% load, normal temperature	0.34		No
#5 – 50% load, low temperature	0.33		No
#6 – 50% load, high temperature	0.31		No

Table 4-5. Modeling Results – SO_2 1-Hour Significance

Scenario/ Load	5-year Average H1H Modeled Concentration (μg/m³)	SIL (μg/m³)	Below SIL?
#1 – 100% load, normal temperature	6.5	7.8	Yes
#2 – 100% load, low temperature	6.5		Yes
#3 – 100% load, high temperature	5.6		Yes
#4 – 50% load, normal temperature	5.4		Yes
#5 – 50% load, low temperature	5.4		Yes
#6 – 50% load, high temperature	4.6		Yes

Table 4-6. Modeling Results – SO_2 3-Hour Significance

Scenario/ Load	H1H Modeled Concentration (µg/m³)					SIL (µg/m³)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	6.0	6.1	6.0	6.2	6.2	25	Yes
#2 – 100% load, low temperature	6.0	6.1	6.1	6.3	6.3		Yes
#3 – 100% load, high temperature	5.2	5.2	5.1	5.4	5.4		Yes
#4 – 50% load, normal temperature	5.0	5.0	5.0	5.2	5.2		Yes
#5 – 50% load, low temperature	4.9	5.0	4.9	5.1	5.1		Yes
#6 – 50% load, high temperature	4.3	4.2	4.2	4.4	4.4		Yes

Table 4-7. Modeling Results – SO_2 24-Hour Significance

Scenario/ Load	H1H Modeled Concentration (µg/m³)					SIL (µg/m³)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	5.5	4.9	4.5	4.9	4.9	5	No
#2 – 100% load, low temperature	5.4	4.9	4.5	4.9	4.9		No
#3 – 100% load, high temperature	4.7	4.2	4.0	4.3	4.3		Yes
#4 – 50% load, normal temperature	4.6	4.0	3.9	4.1	4.2		Yes
#5 – 50% load, low temperature	4.5	4.0	3.8	4.0	4.1		Yes
#6 – 50% load, high temperature	3.9	3.4	3.4	3.5	3.6		Yes

Table 4-8. Modeling Results – SO_2 Annual Significance

Scenario/ Load	1st High Modeled Concentration (µg/m³)					SIL (µg/m³)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	0.7	0.8	0.6	0.6	0.7	1	Yes
#2 – 100% load, low temperature	0.7	0.8	0.6	0.6	0.7		Yes
#3 – 100% load, high temperature	0.6	0.8	0.6	0.5	0.6		Yes
#4 – 50% load, normal temperature	0.6	0.8	0.6	0.5	0.6		Yes
#5 – 50% load, low temperature	0.6	0.8	0.6	0.5	0.6		Yes
#6 – 50% load, high temperature	0.6	0.7	0.5	0.5	0.6		Yes

Table 4-9. Modeling Results – NO_2 1-Hour Significance

Scenario/ Load	5-year Average H1H Modeled Concentration (µg/m³)	SIL (µg/m³)	Below SIL?
#1 – 100% load, normal temperature	14.4	7.5	No
#2 – 100% load, low temperature	14.4		No
#3 – 100% load, high temperature	14.4		No
#4 – 50% load, normal temperature	14.4		No
#5 – 50% load, low temperature	14.4		No
#6 – 50% load, high temperature	14.4		No

Table 4-10. Modeling Results – NO_2 Annual Significance

Scenario/ Load	1st High Modeled Concentration (µg/m³)					SIL (µg/m³)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	1.5	2.0	1.4	1.3	1.6	1	No
#2 – 100% load, low temperature	1.5	2.0	1.5	1.4	1.6		No
#3 – 100% load, high temperature	1.4	1.9	1.4	1.3	1.5		No
#4 – 50% load, normal temperature	1.4	1.9	1.4	1.3	1.5		No
#5 – 50% load, low temperature	1.4	1.9	1.4	1.3	1.5		No
#6 – 50% load, high temperature	1.3	1.8	1.3	1.2	1.4		No

Table 4-11. Modeling Results – CO 1-Hour Significance

Scenario/ Load	H1H Modeled Concentration (µg/m³)					SIL (µg/m³)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	116.3	122.8	118.6	120.7	120.4	2,000	Yes
#2 – 100% load, low temperature	116.3	122.8	118.6	120.7	120.4		Yes
#3 – 100% load, high temperature	116.3	122.8	118.6	120.7	120.4		Yes
#4 – 50% load, normal temperature	116.3	122.8	118.6	120.7	120.4		Yes
#5 – 50% load, low temperature	116.3	122.8	118.6	120.7	120.4		Yes
#6 – 50% load, high temperature	116.3	122.8	118.6	120.7	120.4		Yes

Table 4-12. Modeling Results – CO 8-Hour Significance

Scenario/ Load	H1H Modeled Concentration (µg/m³)					SIL (µg/m³)	Below SIL?
	2009	2010	2011	2012	2013		
#1 – 100% load, normal temperature	93.0	79.8	89.3	95.8	101.0	500	Yes
#2 – 100% load, low temperature	93.0	79.8	89.3	95.8	101.0		Yes
#3 – 100% load, high temperature	93.0	79.8	89.3	95.8	101.0		Yes
#4 – 50% load, normal temperature	93.0	79.8	89.3	95.8	101.0		Yes
#5 – 50% load, low temperature	93.0	79.8	89.3	95.8	101.0		Yes
#6 – 50% load, high temperature	93.0	79.8	89.3	95.8	101.0		Yes

As shown above in Tables 4-1 through 4-12, the maximum modeled impacts were above the SILs for 1-hour and annual NO_2, 24-hour SO_2 and 24-hour and annual $PM_{2.5}$. As such, a NAAQS analysis was conducted for all applicable averaging periods for these pollutants. The regional source inventories used in these analyses are included in Attachment B.

4.2. ISOPLETHS

MassDEP modeling guidance requires maps with 1 microgram per cubic meter ($\mu g/m^3$) annual average isopleths for SO_2, $PM_{2.5}$ and NO_2 to help identify Section 107 areas where minor source baseline would be triggered. SO_2 and $PM_{2.5}$ annual modeling for the proposed Weymouth Compressor Station did not result in any concentrations greater than 1 $\mu g/m^3$. Therefore, no isopleths were created for SO_2 or $PM_{2.5}$. NO_2 annual modeling for the proposed Weymouth Compressor Station resulted in too few receptors with concentrations greater than 1 $\mu g/m^3$ to make an isopleth. Therefore, the figures below show the receptors with annual average NO_2 concentrations greater than 1 $\mu g/m^3$ for the worst-case year from each scenario for the modeling analyses conducted for the Weymouth Compressor Station. The exceeding receptors are displayed in yellow and the corresponding concentration is indicated. The fence-line, sources, and buildings at the proposed Weymouth Compressor Station and existing M&R station are displayed in white.

Figure 4-1. Scenario 1 Annual NO_2 Receptors Greater than 1 μg/m³ (2010)

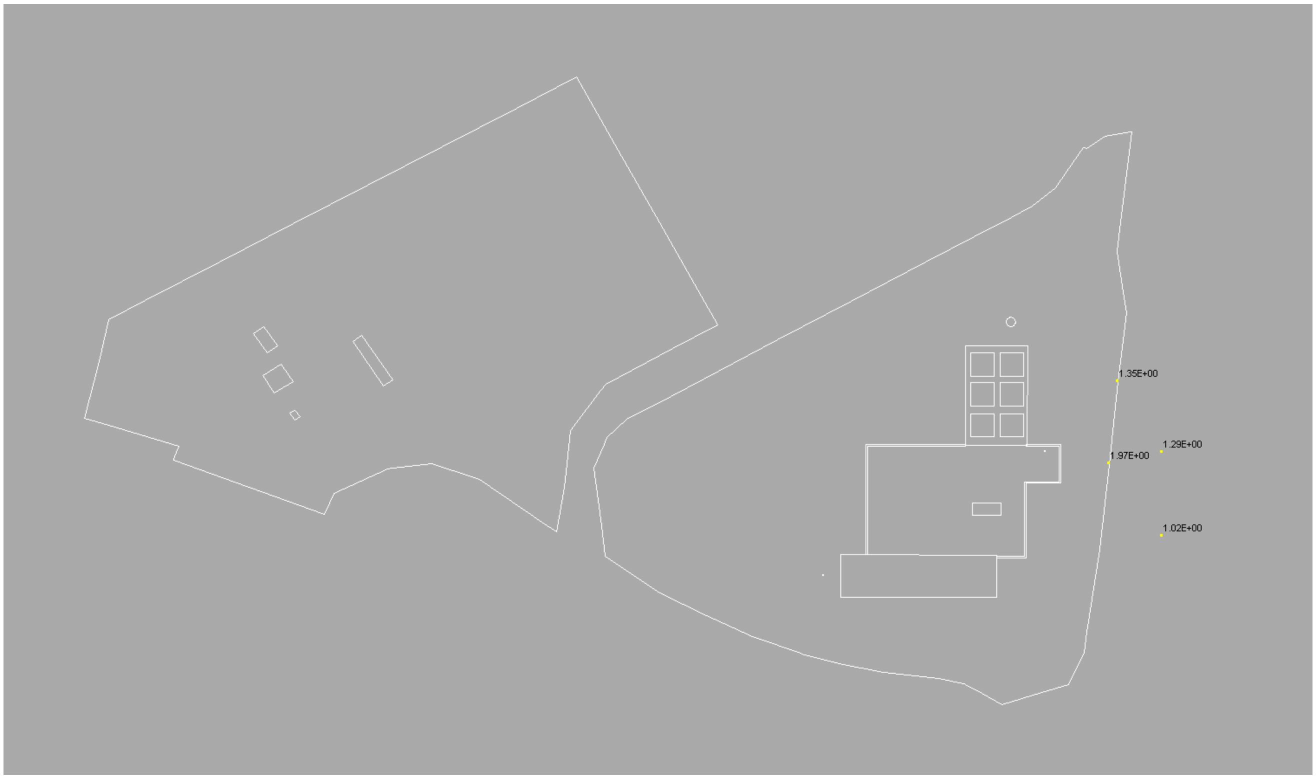


Figure 4-2. Scenario 2 Annual NO_2 Receptors Greater than 1 μg/m³ (2010)

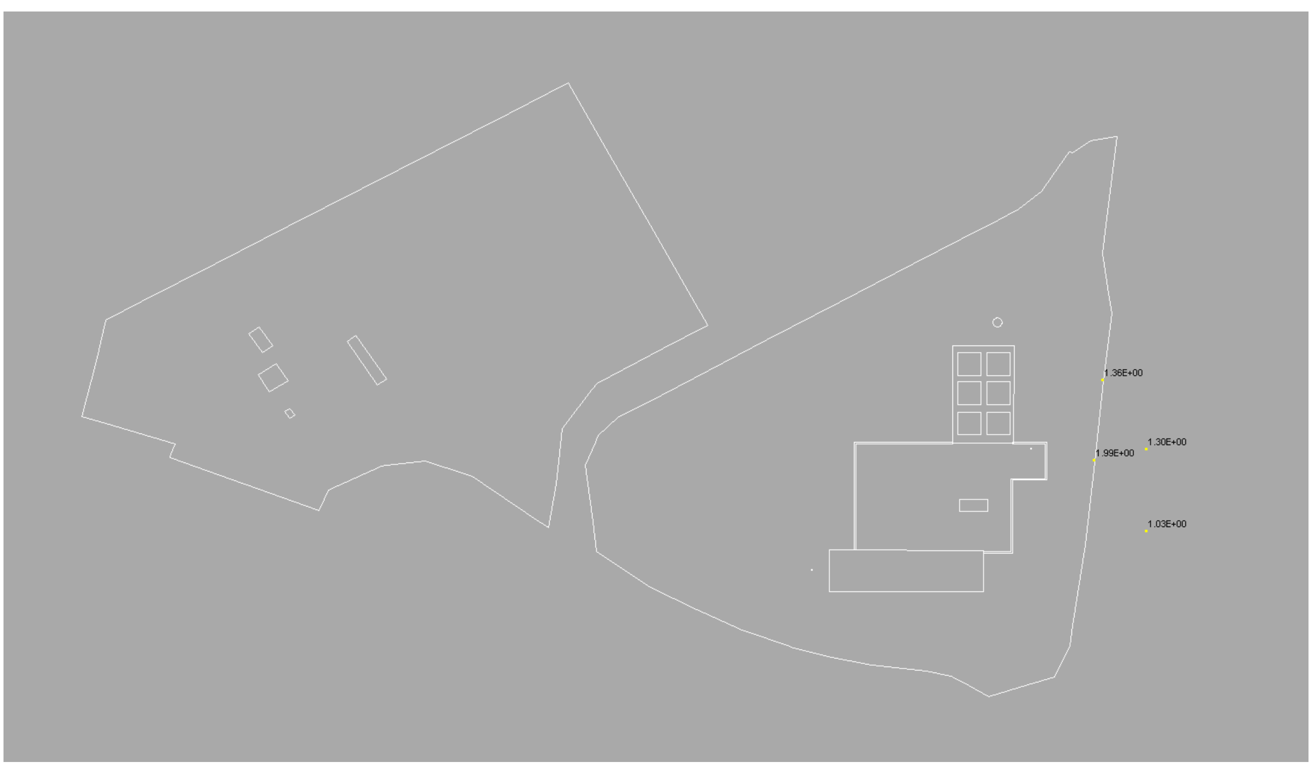


Figure 4-3. Scenario 3 Annual NO_2 Receptors Greater than 1 μg/m³ (2010)

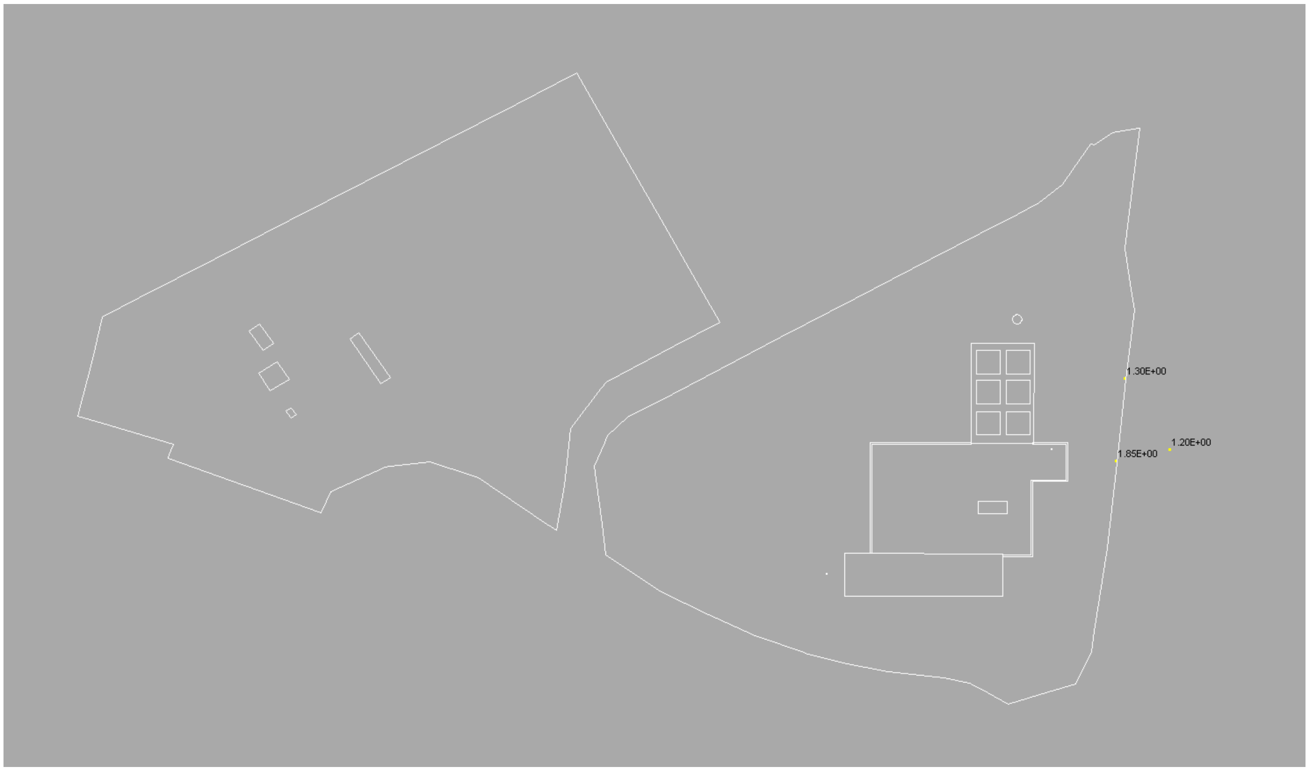


Figure 4-4. Scenario 4 Annual NO_2 Receptors Greater than 1 μg/m³ (2010)

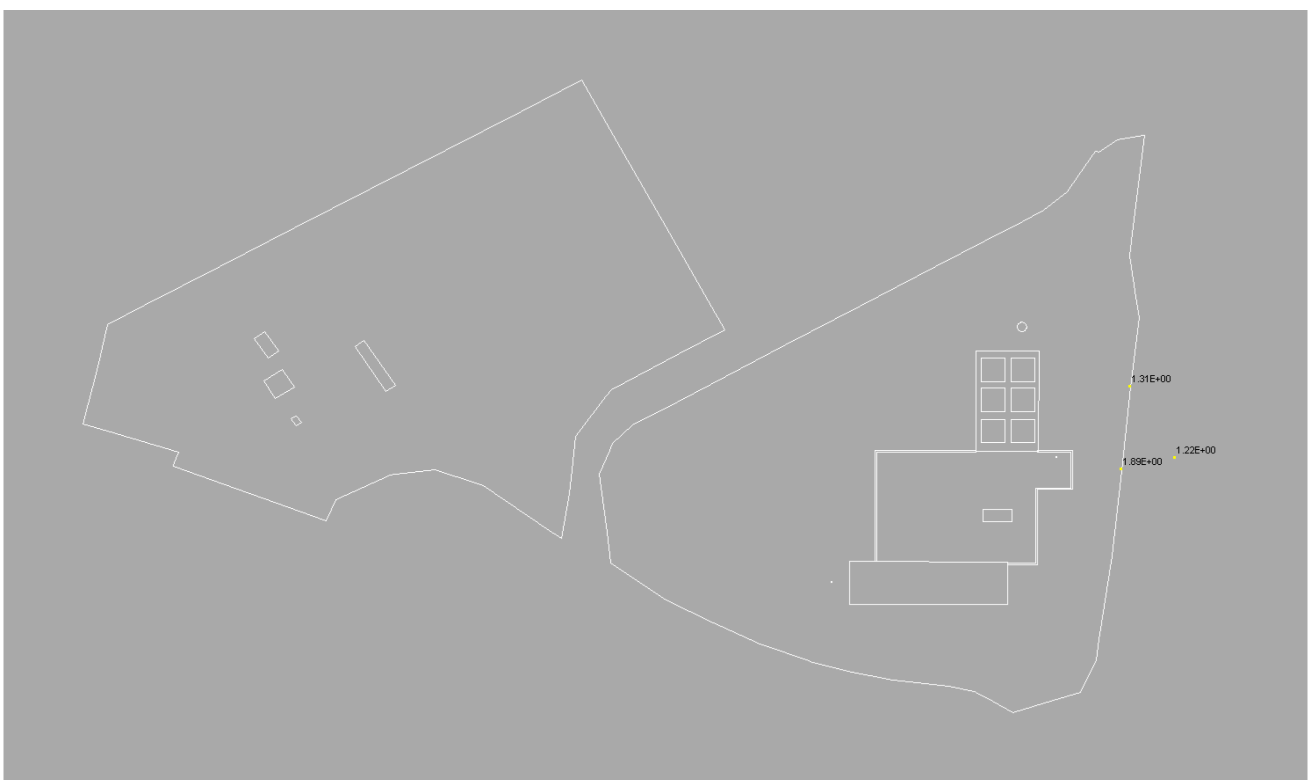


Figure 4-5. Scenario 5 Annual NO_2 Receptors Greater than 1 µg/m³ (2010)

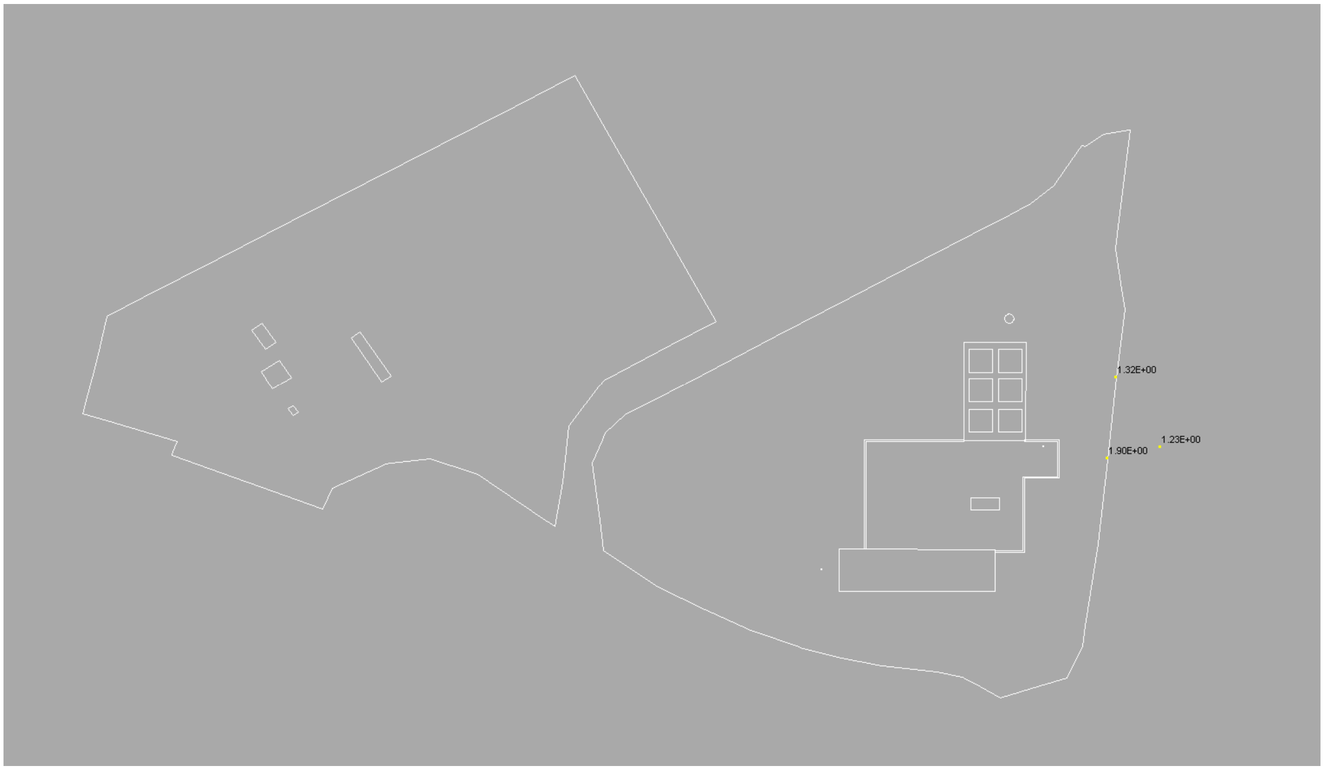
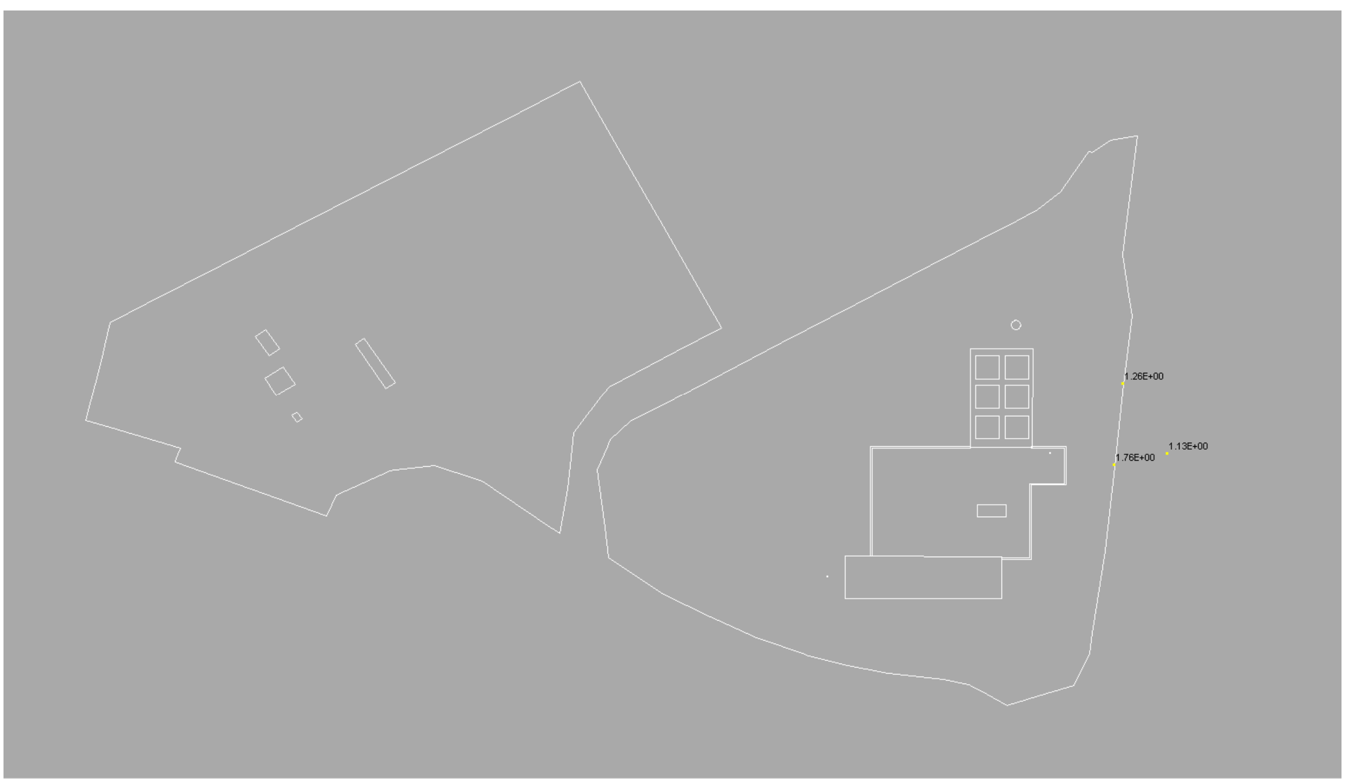


Figure 4-6. Scenario 6 Annual NO_2 Receptors Greater than 1 µg/m³ (2010)



4.3. NAAQS ANALYSIS RESULTS

The results of the NAAQS analysis are provided in Tables 4-13 to 4-17.

Table 4-13. Modeling Results – $PM_{2.5}$ 24-Hour NAAQS

Scenario/ Load	5-year Average H8H Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)	Below NAAQS?
#1 – 100% load, normal temperature	4.87	16.4	21.27	35	Yes
#2 – 100% load, low temperature	4.87		21.27		Yes
#3 – 100% load, high temperature	4.87		21.27		Yes
#4 – 50% load, normal temperature	4.87		21.27		Yes
#5 – 50% load, low temperature	4.87		21.27		Yes
#6 – 50% load, high temperature	4.87		21.27		Yes

Table 4-14. Modeling Results – $PM_{2.5}$ Annual NAAQS

Scenario/ Load	5-year Average Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)	Below NAAQS?
#1 – 100% load, normal temperature	1.34	7.2	8.54	12	Yes
#2 – 100% load, low temperature	1.34		8.54		Yes
#3 – 100% load, high temperature	1.34		8.54		Yes
#4 – 50% load, normal temperature	1.34		8.54		Yes
#5 – 50% load, low temperature	1.34		8.54		Yes
#6 – 50% load, high temperature	1.34		8.54		Yes

Table 4-15. Modeling Results - SO_2 24-hour NAAQS

Scenario/ Load	H2H Modeled Concentration (μg/m³)						Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)	Below NAAQS?
	2009	2010	2011	2012	2013	Max.				
#1 – 100% load, normal temperature	14.44	13.56	11.64	11.56	14.87	14.87	23.10	37.97	365	Yes
#2 – 100% load, low temperature	14.44	13.56	11.64	11.56	14.87	14.87		37.97		Yes
#3 – 100% load, high temperature	14.44	13.56	11.64	11.56	14.87	14.87		37.97		Yes
#4 – 50% load, normal temperature	14.44	13.56	11.64	11.56	14.87	14.87		37.97		Yes
#5 – 50% load, low temperature	14.44	13.56	11.64	11.56	14.87	14.87		37.97		Yes
#6 – 50% load, high temperature	14.43	13.56	11.64	11.56	14.87	14.87		37.97		Yes

Table 4-16. Modeling Results – NO_2 1-Hour NAAQS

Scenario/ Load	5-year Average H8H Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m³)	NAAQS (μg/m³)	Below NAAQS?
#1 – 100% load, normal temperature	57.85	91.0	148.85	188	Yes
#2 – 100% load, low temperature	57.85		148.85		Yes
#3 – 100% load, high temperature	57.85		148.85		Yes
#4 – 50% load, normal temperature	57.85		148.85		Yes
#5 – 50% load, low temperature	57.85		148.85		Yes
#6 – 50% load, high temperature	57.85		148.85		Yes

Table 4-17. Modeling Results – NO_2 Annual NAAQS

Scenario/ Load	1st High Modeled Concentration (µg/m³)						Background Concentration (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)	Below NAAQS?
	2009	2010	2011	2012	2013	Max.				
#1 – 100% load, normal temperature	6.16	7.67	5.62	5.91	7.16	7.67	32.8	40.47	100	Yes
#2 – 100% load, low temperature	6.16	7.67	5.62	5.91	7.16	7.67		40.47		Yes
#3 – 100% load, high temperature	6.16	7.66	5.62	5.90	7.16	7.66		40.46		Yes
#4 – 50% load, normal temperature	6.16	7.66	5.62	5.91	7.16	7.66		40.46		Yes
#5 – 50% load, low temperature	6.16	7.66	5.62	5.91	7.16	7.66		40.46		Yes
#6 – 50% load, high temperature	6.16	7.65	5.62	5.90	7.15	7.65		40.45		Yes

The results of the analysis indicate that the predicted ambient impacts from the proposed Weymouth Compressor Station and existing M&R station, combined with the regional sources identified by the MassDEP as potentially significantly interacting with the emissions from the facility are lower than the NAAQS for $PM_{2.5}$, SO_2 and NO_2.

4.4. TOXICS ANALYSIS RESULTS

The results of the toxics modeling analysis are provided in Tables 4-18 through 4-23 below.

Table 4-18. Modeling Results - Toxics Analysis - Scenario 1

Regulated Pollutant	Averaging Period	Limit (μg/m³)	Modeled Concentration (μg/m³)	Below limit?	Percent (%)
Acetaldehyde	24-hour	30.00	5.95E-02	Yes	0.2%
Acrolein		0.07	3.67E-02	Yes	52.5%
Benzene		0.60	3.96E-01	Yes	66.0%
1,3-Butadiene		1.20	1.91E-03	Yes	0.2%
Carbon Tetrachloride		85.52	2.60E-04	Yes	0.0%
Chlorobenzene		93.88	2.20E-04	Yes	0.0%
Chloroform		132.76	2.00E-04	Yes	0.0%
Dichloromethane (Methylene Chloride)		100.00	1.40E-04	Yes	0.0%
Diphenyl (Biphenyl)		0.34	1.52E-03	Yes	0.4%
Ethylbenzene		300.00	1.19E-01	Yes	0.0%
Formaldehyde		2.00	3.82E-01	Yes	19.1%
Methanol		7.13	1.79E-02	Yes	0.3%
2-Methylnaphthalene		14.25	2.40E-04	Yes	0.0%
Naphthalene		14.25	1.29E-03	Yes	0.0%
Phenol		52.33	1.70E-04	Yes	0.0%
Propylene Oxide		6.00	1.71E-02	Yes	0.3%
Styrene		200.00	1.70E-04	Yes	0.0%
1,1,2,2-Tetrachloroethane		18.67	3.00E-04	Yes	0.0%
Toluene		80.00	9.00E-01	Yes	1.1%
1,1,2-Trichloroethane		14.84	2.30E-04	Yes	0.0%
Vinyl Chloride		3.47	1.10E-04	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.20E+00	Yes	10.2%
Acetaldehyde	Annual	0.40	9.54E-03	Yes	2.4%
Acrolein		0.07	5.88E-03	Yes	8.4%
Benzene		0.10	5.66E-02	Yes	56.6%
1,3-Butadiene		0.00	3.10E-04	Yes	10.3%
Carbon Tetrachloride		0.07	4.00E-05	Yes	0.1%
Chlorobenzene		6.26	3.00E-05	Yes	0.0%
Chloroform		0.04	3.00E-05	Yes	0.1%
Dichloromethane (Methylene Chloride)		60.00	2.00E-05	Yes	0.0%
Diphenyl (Biphenyl)		0.09	2.40E-04	Yes	0.3%
Ethylbenzene		300.00	1.70E-02	Yes	0.0%
Formaldehyde		0.08	6.92E-02	Yes	86.5%
Methanol		7.13	2.86E-03	Yes	0.0%
2-Methylnaphthalene		14.25	4.00E-05	Yes	0.0%
Naphthalene		14.25	2.40E-04	Yes	0.0%
Phenol		52.33	3.00E-05	Yes	0.0%
Propylene Oxide		0.30	1.93E-03	Yes	0.6%
Styrene		2.00	3.00E-05	Yes	0.0%
1,1,2,2-Tetrachloroethane		0.02	5.00E-05	Yes	0.3%
Toluene		20.00	1.29E-01	Yes	0.6%
1,1,2-Trichloroethane		0.06	4.00E-05	Yes	0.1%
Vinyl Chloride		0.38	2.00E-05	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.72E-01	Yes	1.5%

Table 4-19. Modeling Results - Toxics Analysis - Scenario 2

Regulated Pollutant	Averaging Period	Limit (µg/m³)	Modeled Concentration (µg/m³)	Below limit?	Percent (%)
Acetaldehyde	24-hour	30.00	5.95E-02	Yes	0.2%
Acrolein		0.07	3.67E-02	Yes	52.5%
Benzene		0.60	3.96E-01	Yes	66.0%
1,3-Butadiene		1.20	1.91E-03	Yes	0.2%
Carbon Tetrachloride		85.52	2.60E-04	Yes	0.0%
Chlorobenzene		93.88	2.20E-04	Yes	0.0%
Chloroform		132.76	2.00E-04	Yes	0.0%
Dichloromethane (Methylene Chloride)		100.00	1.40E-04	Yes	0.0%
Diphenyl (Biphenyl)		0.34	1.52E-03	Yes	0.4%
Ethylbenzene		300.00	1.19E-01	Yes	0.0%
Formaldehyde		2.00	3.82E-01	Yes	19.1%
Methanol		7.13	1.79E-02	Yes	0.3%
2-Methylnaphthalene		14.25	2.40E-04	Yes	0.0%
Naphthalene		14.25	2.38E-03	Yes	0.0%
Phenol		52.33	1.70E-04	Yes	0.0%
Propylene Oxide		6.00	5.14E-02	Yes	0.9%
Styrene		200.00	1.70E-04	Yes	0.0%
1,1,2,2-Tetrachloroethane		18.67	3.00E-04	Yes	0.0%
Toluene		80.00	9.00E-01	Yes	1.1%
1,1,2-Trichloroethane		14.84	2.30E-04	Yes	0.0%
Vinyl Chloride		3.47	1.10E-04	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.20E+00	Yes	10.2%
Acetaldehyde	Annual	0.40	9.60E-03	Yes	2.4%
Acrolein		0.07	5.90E-03	Yes	8.4%
Benzene		0.10	5.67E-02	Yes	56.7%
1,3-Butadiene		0.00	3.10E-04	Yes	10.3%
Carbon Tetrachloride		0.07	4.00E-05	Yes	0.1%
Chlorobenzene		6.26	3.00E-05	Yes	0.0%
Chloroform		0.04	3.00E-05	Yes	0.1%
Dichloromethane (Methylene Chloride)		60.00	2.00E-05	Yes	0.0%
Diphenyl (Biphenyl)		0.09	2.40E-04	Yes	0.3%
Ethylbenzene		300.00	1.72E-02	Yes	0.0%
Formaldehyde		0.08	6.94E-02	Yes	86.8%
Methanol		7.13	2.86E-03	Yes	0.0%
2-Methylnaphthalene		14.25	4.00E-05	Yes	0.0%
Naphthalene		14.25	3.50E-04	Yes	0.0%
Phenol		52.33	3.00E-05	Yes	0.0%
Propylene Oxide		0.30	5.74E-03	Yes	1.9%
Styrene		2.00	3.00E-05	Yes	0.0%
1,1,2,2-Tetrachloroethane		0.02	5.00E-05	Yes	0.3%
Toluene		20.00	1.30E-01	Yes	0.7%
1,1,2-Trichloroethane		0.06	4.00E-05	Yes	0.1%
Vinyl Chloride		0.38	2.00E-05	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.73E-01	Yes	1.5%

Table 4-20. Modeling Results - Toxics Analysis - Scenario 3

Regulated Pollutant	Averaging Period	Limit (μg/m³)	Modeled Concentration (μg/m³)	Below limit?	Percent (%)
Acetaldehyde	24-hour	30.00	5.95E-02	Yes	0.2%
Acrolein		0.07	3.67E-02	Yes	52.5%
Benzene		0.60	3.96E-01	Yes	66.0%
1,3-Butadiene		1.20	1.91E-03	Yes	0.2%
Carbon Tetrachloride		85.52	2.60E-04	Yes	0.0%
Chlorobenzene		93.88	2.20E-04	Yes	0.0%
Chloroform		132.76	2.00E-04	Yes	0.0%
Dichloromethane (Methylene Chloride)		100.00	1.40E-04	Yes	0.0%
Diphenyl (Biphenyl)		0.34	1.52E-03	Yes	0.4%
Ethylbenzene		300.00	1.19E-01	Yes	0.0%
Formaldehyde		2.00	3.82E-01	Yes	19.1%
Methanol		7.13	1.79E-02	Yes	0.3%
2-Methylnaphthalene		14.25	2.40E-04	Yes	0.0%
Naphthalene		14.25	1.29E-03	Yes	0.0%
Phenol		52.33	1.70E-04	Yes	0.0%
Propylene Oxide		6.00	1.43E-02	Yes	0.2%
Styrene		200.00	1.70E-04	Yes	0.0%
1,1,2,2-Tetrachloroethane		18.67	3.00E-04	Yes	0.0%
Toluene		80.00	9.00E-01	Yes	1.1%
1,1,2-Trichloroethane		14.84	2.30E-04	Yes	0.0%
Vinyl Chloride		3.47	1.10E-04	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.20E+00	Yes	10.2%
Acetaldehyde	Annual	0.40	9.54E-03	Yes	2.4%
Acrolein		0.07	5.88E-03	Yes	8.4%
Benzene		0.10	5.66E-02	Yes	56.6%
1,3-Butadiene		0.00	3.10E-04	Yes	10.3%
Carbon Tetrachloride		0.07	4.00E-05	Yes	0.1%
Chlorobenzene		6.26	3.00E-05	Yes	0.0%
Chloroform		0.04	3.00E-05	Yes	0.1%
Dichloromethane (Methylene Chloride)		60.00	2.00E-05	Yes	0.0%
Diphenyl (Biphenyl)		0.09	2.40E-04	Yes	0.3%
Ethylbenzene		300.00	1.70E-02	Yes	0.0%
Formaldehyde		0.08	6.92E-02	Yes	86.5%
Methanol		7.13	2.86E-03	Yes	0.0%
2-Methylnaphthalene		14.25	4.00E-05	Yes	0.0%
Naphthalene		14.25	2.30E-04	Yes	0.0%
Phenol		52.33	3.00E-05	Yes	0.0%
Propylene Oxide		0.30	1.69E-03	Yes	0.6%
Styrene		2.00	3.00E-05	Yes	0.0%
1,1,2,2-Tetrachloroethane		0.02	5.00E-05	Yes	0.3%
Toluene		20.00	1.29E-01	Yes	0.6%
1,1,2-Trichloroethane		0.06	4.00E-05	Yes	0.1%
Vinyl Chloride		0.38	2.00E-05	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.72E-01	Yes	1.5%

Table 4-21. Modeling Results - Toxics Analysis - Scenario 4

Regulated Pollutant	Averaging Period	Limit ($\mu g/m^3$)	Modeled Concentration ($\mu g/m^3$)	Below limit?	Percent (%)
Acetaldehyde	24-hour	30.00	5.95E-02	Yes	0.2%
Acrolein		0.07	3.67E-02	Yes	52.5%
Benzene		0.60	3.96E-01	Yes	66.0%
1,3-Butadiene		1.20	1.91E-03	Yes	0.2%
Carbon Tetrachloride		85.52	2.60E-04	Yes	0.0%
Chlorobenzene		93.88	2.20E-04	Yes	0.0%
Chloroform		132.76	2.00E-04	Yes	0.0%
Dichloromethane (Methylene Chloride)		100.00	1.40E-04	Yes	0.0%
Diphenyl (Biphenyl)		0.34	1.52E-03	Yes	0.4%
Ethylbenzene		300.00	1.19E-01	Yes	0.0%
Formaldehyde		2.00	3.82E-01	Yes	19.1%
Methanol		7.13	1.79E-02	Yes	0.3%
2-Methylnaphthalene		14.25	2.40E-04	Yes	0.0%
Naphthalene		14.25	1.29E-03	Yes	0.0%
Phenol		52.33	1.70E-04	Yes	0.0%
Propylene Oxide		6.00	1.40E-02	Yes	0.2%
Styrene		200.00	1.70E-04	Yes	0.0%
1,1,2,2-Tetrachloroethane		18.67	3.00E-04	Yes	0.0%
Toluene		80.00	9.00E-01	Yes	1.1%
1,1,2-Trichloroethane		14.84	2.30E-04	Yes	0.0%
Vinyl Chloride		3.47	1.10E-04	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.20E+00	Yes	10.2%
Acetaldehyde	Annual	0.40	9.54E-03	Yes	2.4%
Acrolein		0.07	5.88E-03	Yes	8.4%
Benzene		0.10	5.66E-02	Yes	56.6%
1,3-Butadiene		0.00	3.10E-04	Yes	10.3%
Carbon Tetrachloride		0.07	4.00E-05	Yes	0.1%
Chlorobenzene		6.26	3.00E-05	Yes	0.0%
Chloroform		0.04	3.00E-05	Yes	0.1%
Dichloromethane (Methylene Chloride)		60.00	2.00E-05	Yes	0.0%
Diphenyl (Biphenyl)		0.09	2.40E-04	Yes	0.3%
Ethylbenzene		300.00	1.70E-02	Yes	0.0%
Formaldehyde		0.08	6.92E-02	Yes	86.5%
Methanol		7.13	2.86E-03	Yes	0.0%
2-Methylnaphthalene		14.25	4.00E-05	Yes	0.0%
Naphthalene		14.25	2.40E-04	Yes	0.0%
Phenol		52.33	3.00E-05	Yes	0.0%
Propylene Oxide		0.30	1.76E-03	Yes	0.6%
Styrene		2.00	3.00E-05	Yes	0.0%
1,1,2,2-Tetrachloroethane		0.02	5.00E-05	Yes	0.3%
Toluene		20.00	1.29E-01	Yes	0.6%
1,1,2-Trichloroethane		0.06	4.00E-05	Yes	0.1%
Vinyl Chloride		0.38	2.00E-05	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.72E-01	Yes	1.5%

Table 4-22. Modeling Results - Toxics Analysis - Scenario 5

Regulated Pollutant	Averaging Period	Limit (µg/m³)	Modeled Concentration (µg/m³)	Below limit?	Percent (%)
Acetaldehyde	24-hour	30.00	5.95E-02	Yes	0.2%
Acrolein		0.07	3.67E-02	Yes	52.5%
Benzene		0.60	3.96E-01	Yes	66.0%
1,3-Butadiene		1.20	1.91E-03	Yes	0.2%
Carbon Tetrachloride		85.52	2.60E-04	Yes	0.0%
Chlorobenzene		93.88	2.20E-04	Yes	0.0%
Chloroform		132.76	2.00E-04	Yes	0.0%
Dichloromethane (Methylene Chloride)		100.00	1.40E-04	Yes	0.0%
Diphenyl (Biphenyl)		0.34	1.52E-03	Yes	0.4%
Ethylbenzene		300.00	1.19E-01	Yes	0.0%
Formaldehyde		2.00	3.82E-01	Yes	19.1%
Methanol		7.13	1.79E-02	Yes	0.3%
2-Methylnaphthalene		14.25	2.40E-04	Yes	0.0%
Naphthalene		14.25	1.95E-03	Yes	0.0%
Phenol		52.33	1.70E-04	Yes	0.0%
Propylene Oxide		6.00	4.17E-02	Yes	0.7%
Styrene		200.00	1.70E-04	Yes	0.0%
1,1,2,2-Tetrachloroethane		18.67	3.00E-04	Yes	0.0%
Toluene		80.00	9.00E-01	Yes	1.1%
1,1,2-Trichloroethane		14.84	2.30E-04	Yes	0.0%
Vinyl Chloride		3.47	1.10E-04	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.20E+00	Yes	10.2%
Acetaldehyde	Annual	0.40	9.59E-03	Yes	2.4%
Acrolein		0.07	5.90E-03	Yes	8.4%
Benzene		0.10	5.67E-02	Yes	56.7%
1,3-Butadiene		0.00	3.10E-04	Yes	10.3%
Carbon Tetrachloride		0.07	4.00E-05	Yes	0.1%
Chlorobenzene		6.26	3.00E-05	Yes	0.0%
Chloroform		0.04	3.00E-05	Yes	0.1%
Dichloromethane (Methylene Chloride)		60.00	2.00E-05	Yes	0.0%
Diphenyl (Biphenyl)		0.09	2.40E-04	Yes	0.3%
Ethylbenzene		300.00	1.72E-02	Yes	0.0%
Formaldehyde		0.08	6.94E-02	Yes	86.7%
Methanol		7.13	2.86E-03	Yes	0.0%
2-Methylnaphthalene		14.25	4.00E-05	Yes	0.0%
Naphthalene		14.25	3.20E-04	Yes	0.0%
Phenol		52.33	3.00E-05	Yes	0.0%
Propylene Oxide		0.30	4.99E-03	Yes	1.7%
Styrene		2.00	3.00E-05	Yes	0.0%
1,1,2,2-Tetrachloroethane		0.02	5.00E-05	Yes	0.3%
Toluene		20.00	1.30E-01	Yes	0.6%
1,1,2-Trichloroethane		0.06	4.00E-05	Yes	0.1%
Vinyl Chloride		0.38	2.00E-05	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.72E-01	Yes	1.5%

Table 4-23. Modeling Results - Toxics Analysis - Scenario 6

Regulated Pollutant	Averaging Period	Limit ($\mu g/m^3$)	Modeled Concentration ($\mu g/m^3$)	Below limit?	Percent (%)
Acetaldehyde	24-hour	30.00	5.95E-02	Yes	0.2%
Acrolein		0.07	3.67E-02	Yes	52.5%
Benzene		0.60	3.96E-01	Yes	66.0%
1,3-Butadiene		1.20	1.91E-03	Yes	0.2%
Carbon Tetrachloride		85.52	2.60E-04	Yes	0.0%
Chlorobenzene		93.88	2.20E-04	Yes	0.0%
Chloroform		132.76	2.00E-04	Yes	0.0%
Dichloromethane (Methylene Chloride)		100.00	1.40E-04	Yes	0.0%
Diphenyl (Biphenyl)		0.34	1.52E-03	Yes	0.4%
Ethylbenzene		300.00	1.19E-01	Yes	0.0%
Formaldehyde		2.00	3.82E-01	Yes	19.1%
Methanol		7.13	1.79E-02	Yes	0.3%
2-Methylnaphthalene		14.25	2.40E-04	Yes	0.0%
Naphthalene		14.25	1.29E-03	Yes	0.0%
Phenol		52.33	1.70E-04	Yes	0.0%
Propylene Oxide		6.00	1.15E-02	Yes	0.2%
Styrene		200.00	1.70E-04	Yes	0.0%
1,1,2,2-Tetrachloroethane		18.67	3.00E-04	Yes	0.0%
Toluene		80.00	9.00E-01	Yes	1.1%
1,1,2-Trichloroethane		14.84	2.30E-04	Yes	0.0%
Vinyl Chloride		3.47	1.10E-04	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.20E+00	Yes	10.2%
Acetaldehyde	Annual	0.40	9.54E-03	Yes	2.4%
Acrolein		0.07	5.88E-03	Yes	8.4%
Benzene		0.10	5.66E-02	Yes	56.6%
1,3-Butadiene		0.00	3.10E-04	Yes	10.3%
Carbon Tetrachloride		0.07	4.00E-05	Yes	0.1%
Chlorobenzene		6.26	3.00E-05	Yes	0.0%
Chloroform		0.04	3.00E-05	Yes	0.1%
Dichloromethane (Methylene Chloride)		60.00	2.00E-05	Yes	0.0%
Diphenyl (Biphenyl)		0.09	2.40E-04	Yes	0.3%
Ethylbenzene		300.00	1.70E-02	Yes	0.0%
Formaldehyde		0.08	6.92E-02	Yes	86.5%
Methanol		7.13	2.86E-03	Yes	0.0%
2-Methylnaphthalene		14.25	4.00E-05	Yes	0.0%
Naphthalene		14.25	2.30E-04	Yes	0.0%
Phenol		52.33	3.00E-05	Yes	0.0%
Propylene Oxide		0.30	1.51E-03	Yes	0.5%
Styrene		2.00	3.00E-05	Yes	0.0%
1,1,2,2-Tetrachloroethane		0.02	5.00E-05	Yes	0.3%
Toluene		20.00	1.29E-01	Yes	0.6%
1,1,2-Trichloroethane		0.06	4.00E-05	Yes	0.1%
Vinyl Chloride		0.38	2.00E-05	Yes	0.0%
Xylenes (m-,o-,p- isomers)		11.80	1.72E-01	Yes	1.5%

As shown in Tables 4-18 through 4-23, maximum modeled concentrations of toxic pollutants are below the applicable TELs and AALs.

4.5. CONCLUSIONS

This analysis demonstrates that $PM_{2.5}$, 24-hour SO_2 and NO_2 emissions from the proposed Weymouth Compressor Station and existing M&R station will have maximum estimated impacts below the NAAQS. Furthermore, the analysis demonstrated that particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}), carbon monoxide (CO) and 1-hour, 3-hour and annual SO_2 emissions from the proposed Weymouth Compressor Station are insignificant. In accordance with U.S. EPA and MassDEP guidance, this modeling analysis demonstrates that the proposed project will not cause or significantly contribute to an exceedance of the NAAQS.

In addition, this analysis demonstrates that the proposed and existing emissions from the Weymouth Compressor Station and M&R station will not cause toxic pollutant concentrations above MassDEP's TELs or AALs.

ATTACHMENT A. MODELING FILES CD

ATTACHMENT B. SOURCE PARAMETERS AND EMISSION RATES

Weymouth Compressor Station
Stack Parameters

Weymouth Model Inputs - Point Source Parameters (CO, PM, SO_2, Toxics)

Model ID	Description	X Coordinate (m)	Y Coordinate (m)	Elevation (m)	Stack Height (m)	Stack Temp. (K)	Stack Velocity (m/s)	Stack Diameter (m)
WEMG01	New Emergency Generator	338008.4	4678763.5	4.42	9.14	724.26	29.57	0.25
WFHTR01	New Fuel Gas Heater	338074.7	4678800.3	3.95	4.60	510.93	10.07	0.20
WTBC01H	New Turbine - 1 High Temp 100%	338064.6	4678838.7	4.13	18.31	810.37	7.58	2.75
WTBC01H5	New Turbine - 1 High Temp 50%	338064.6	4678838.7	4.13	18.31	810.37	6.39	2.75
WTBC01L	New Turbine - 1 Low Temp 100%	338064.6	4678838.7	4.13	18.31	735.91	8.59	2.75
WTBC01L5	New Turbine - 1 Low Temp 50%	338064.6	4678838.7	4.13	18.31	727.58	7.73	2.75
WTBC01N	New Turbine - 1 Normal 100%	338064.6	4678838.7	4.13	18.31	779.37	8.27	2.75
WTBC01N5	New Turbine - 1 Normal 50%	338064.6	4678838.7	4.13	18.31	774.85	7.02	2.75
MGHTR1_1	Bigger heater at M&R Station_flue1	337830.5	4678846.4	1.74	8.79	433.15	3.24	0.58
MGHTR1_2	Bigger heater at M&R Station_flue2	337831.1	4678845.2	1.88	8.79	433.15	3.24	0.58
MGHTR2_1	Smaller heater at M&R Station_Flue1	337837.3	4678840.4	2.46	5.18	433.15	4.23	0.43
MGHTR2_2	Smaller heater at M&R Station_Flue2	337838.2	4678839.4	2.54	5.18	433.15	4.23	0.43
MBLR_1	Boiler 1 at M&R Station	337875.7	4678824.2	3.09	4.57	433.15	1.89	0.36
MBLR_2	Boiler 2 at M&R Station	337876.2	4678823.4	3.08	4.57	433.15	1.89	0.36
MBLR_3	Boiler 3 at M&R Station	337876.7	4678822.8	3.08	4.57	433.15	1.89	0.36

Weymouth Model Inputs - Point Source Parameters (NO_2)

Model ID	Description	X Coordinate (m)	Y Coordinate (m)	Elevation (m)	Stack Height (m)	Stack Temp. (K)	Stack Velocity (m/s)	Stack Diameter (m)
WEMG01	New Emergency Generator	338008.4	4678763.5	4.42	9.14	724.26	29.57	0.25
WFHTR01	New Fuel Gas Heater	338074.7	4678800.3	3.95	4.60	510.93	10.07	0.20
WTBC01H	New Turbine - 1 High Temp 100%	338064.6	4678838.7	4.13	18.31	810.37	7.58	2.75
WTBC01H5	New Turbine - 1 High Temp 50%	338064.6	4678838.7	4.13	18.31	810.37	6.39	2.75
WTBC01L	New Turbine - 1 Low Temp 100%	338064.6	4678838.7	4.13	18.31	779.31	8.27	2.75
WTBC01L5	New Turbine - 1 Low Temp 50%	338064.6	4678838.7	4.13	18.31	774.78	7.02	2.75
WTBC01N	New Turbine - 1 Normal 100%	338064.6	4678838.7	4.13	18.31	779.37	8.27	2.75
WTBC01N5	New Turbine - 1 Normal 50%	338064.6	4678838.7	4.13	18.31	774.85	7.02	2.75
MGHTR1_1	Bigger heater at M&R Station_flue1	337830.5	4678846.4	1.74	8.79	433.15	3.24	0.58
MGHTR1_2	Bigger heater at M&R Station_flue2	337831.1	4678845.2	1.88	8.79	433.15	3.24	0.58
MGHTR2_1	Smaller heater at M&R Station_Flue1	337837.3	4678840.4	2.46	5.18	433.15	4.23	0.43
MGHTR2_2	Smaller heater at M&R Station_Flue2	337838.2	4678839.4	2.54	5.18	433.15	4.23	0.43
MBLR_1	Boiler 1 at M&R Station	337875.7	4678824.2	3.09	4.57	433.15	1.89	0.36
MBLR_2	Boiler 2 at M&R Station	337876.2	4678823.4	3.08	4.57	433.15	1.89	0.36
MBLR_3	Boiler 3 at M&R Station	337876.7	4678822.8	3.08	4.57	433.15	1.89	0.36

Weymouth Model Inputs - Volume Source Parameters [1]

Model ID	Description	X Coordinate (m)	Y Coordinate (m)	Elevation (m)	Release Height (m)	Initial Vertical Dimension (m)	Initial Lateral Dimension (m)
WSHTRV1	New Space Heaters	338056.2	4678826.0	3.87	6.89	6.42	6.98
WSHTRV2	New Space Heaters	338065.0	4678826.0	3.87	6.89	6.42	6.98
WSHTRV3	New Space Heaters	338056.2	4678817.2	3.87	6.89	6.42	6.98
WSHTRV4	New Space Heaters	338065.0	4678817.2	3.87	6.89	6.42	6.98
WSHTRV5	New Space Heaters	338056.2	4678808.0	3.87	6.89	6.42	6.98
WSHTRV6	New Space Heaters	338065.0	4678808.0	3.87	6.89	6.42	6.98
W_PIPING[2]	Piping at Compressor Station	338032.9	4678796.6	3.95	1.22	60.00	0.28
M_PIPE[2]	Piping at M&R Station	337845.4	4678841.7	2.66	1.22	30.00	0.28

[1] The five space heaters exhaust inside of the compressor building and as such are modeled as volume sources. The compressor building was split into six approximately square portions and each is represented by a single volume source. Emissions from the five space heaters were divided evenly between these six volume sources.

[2] Piping only included in Toxics modeling.

Weymouth Model Inputs - Emission Rates (g/s)

Model ID	CO (1-hr, 8-hr)	NO_2 (without ARM)	NO_2 (1-hr)[1]	NO_2 (annual)[1]	$PM_{2.5}$ (24-hr, annual)	PM_{10} (24-hr)	SO_2 (1-hr)	SO_2 (3-hr, 24-hr, annual)
WEMG01	2.11E-01	1.11E-02	8.90E-03	8.35E-03	5.80E-03	5.80E-03	2.79E-04	8.15E-03
WFHTR01	4.28E-03	2.81E-03	2.24E-03	2.10E-03	2.16E-04	2.16E-04	4.09E-04	4.09E-04
WTBC01H	2.02E-02	2.39E-01	1.91E-01	1.79E-01	4.97E-02	4.97E-02	1.06E-01	1.06E-01
WTBC01H5	1.48E-02	1.75E-01	1.40E-01	1.32E-01	3.66E-02	3.66E-02	7.77E-02	7.77E-02
WTBC01L	1.56E-01	3.05E-01	2.44E-01	2.29E-01	6.23E-02	6.23E-02	1.32E-01	1.32E-01
WTBC01L5	1.17E-01	2.28E-01	1.82E-01	1.71E-01	4.73E-02	4.73E-02	1.00E-01	1.00E-01
WTBC01N	2.54E-02	3.00E-01	2.40E-01	2.25E-01	6.10E-02	6.10E-02	1.29E-01	1.29E-01
WTBC01N5	1.89E-02	2.24E-01	1.79E-01	1.68E-01	4.57E-02	4.57E-02	9.69E-02	9.69E-02
MGHTR1_1	N/A	5.79E-02	4.63E-02	4.34E-02	4.47E-03	N/A	N/A	8.40E-03
MGHTR1_2	N/A	5.79E-02	4.63E-02	4.34E-02	4.47E-03	N/A	N/A	8.40E-03
MGHTR2_1	N/A	4.14E-02	3.31E-02	3.10E-02	3.19E-03	N/A	N/A	6.00E-03
MGHTR2_2	N/A	4.14E-02	3.31E-02	3.10E-02	3.19E-03	N/A	N/A	6.00E-03
MBLR_1	N/A	8.21E-03	6.57E-03	6.16E-03	1.69E-03	N/A	N/A	3.18E-03
MBLR_2	N/A	8.21E-03	6.57E-03	6.16E-03	1.69E-03	N/A	N/A	3.18E-03
MBLR_3	N/A	8.21E-03	6.57E-03	6.16E-03	1.69E-03	N/A	N/A	3.18E-03
WSHTRV1	2.97E-04	6.98E-04	5.58E-04	5.23E-04	5.51E-05	5.51E-05	1.06E-04	1.06E-04
WSHTRV2	2.97E-04	6.98E-04	5.58E-04	5.23E-04	5.51E-05	5.51E-05	1.06E-04	1.06E-04
WSHTRV3	2.97E-04	6.98E-04	5.58E-04	5.23E-04	5.51E-05	5.51E-05	1.06E-04	1.06E-04
WSHTRV4	2.97E-04	6.98E-04	5.58E-04	5.23E-04	5.51E-05	5.51E-05	1.06E-04	1.06E-04
WSHTRV5	2.97E-04	6.98E-04	5.58E-04	5.23E-04	5.51E-05	5.51E-05	1.06E-04	1.06E-04
WSHTRV6	2.97E-04	6.98E-04	5.58E-04	5.23E-04	5.51E-05	5.51E-05	1.06E-04	1.06E-04
W_PIPING	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
M_PIPE	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1] The NO2-ARM setting was applied to AERMOD emission rates.

Weymouth Model Inputs - Toxics Emission Rates (g/s)

Model ID	Acetaldehyde	Acrolein	Benzene	Chlorobenzene	Butadiene (1,3-)	Carbon Tetrachloride	Diphenyl (Biphenyl)	Chloroform
WEMG01	1.67E-04	1.03E-04	8.80E-06	6.10E-07	5.35E-06	7.34E-07	4.26E-06	5.70E-07
WFHTR01	0.00E+00	0.00E+00	2.78E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WTBC01H	1.92E-04	7.70E-05	1.44E-04	0.00E+00	5.18E-06	0.00E+00	0.00E+00	0.00E+00
WTBC01H5	1.42E-04	5.68E-05	1.06E-04	0.00E+00	3.82E-06	0.00E+00	0.00E+00	0.00E+00
WTBC01L	7.42E-04	2.97E-04	5.57E-04	0.00E+00	1.99E-05	0.00E+00	0.00E+00	0.00E+00
WTBC01L5	5.59E-04	2.24E-04	4.20E-04	0.00E+00	1.50E-05	0.00E+00	0.00E+00	0.00E+00
WTBC01N	2.42E-04	9.68E-05	1.81E-04	0.00E+00	6.50E-06	0.00E+00	0.00E+00	0.00E+00
WTBC01N5	1.80E-04	7.23E-05	1.36E-04	0.00E+00	4.85E-06	0.00E+00	0.00E+00	0.00E+00
MGHTR1_1	0.00E+00	0.00E+00	5.73E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MGHTR1_2	0.00E+00	0.00E+00	5.73E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MGHTR2_1	0.00E+00	0.00E+00	4.09E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MGHTR2_2	0.00E+00	0.00E+00	4.09E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MBLR_1	0.00E+00	0.00E+00	4.90E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MBLR_2	0.00E+00	0.00E+00	4.90E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MBLR_3	0.00E+00	0.00E+00	4.90E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSHTRV1	0.00E+00	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSHTRV2	0.00E+00	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSHTRV3	0.00E+00	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSHTRV4	0.00E+00	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSHTRV5	0.00E+00	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WSHTRV6	0.00E+00	0.00E+00	1.63E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
W_PIPING	0.00E+00	0.00E+00	4.83E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
M_PIPE	0.00E+00	0.00E+00	1.82E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Weymouth Model Inputs - Toxics Emission Rates, Continued (g/s)

Model ID	Dichloropropene (1,3-)	Ethylbenzene	Ethylene Dibromide	Formaldehyde	Hexane (n-)	Methanol	Methylene Chloride	Methylnaphthalene (2-)
WEMG01	5.29E-07	7.94E-07	8.86E-07	1.06E-03	2.22E-05	5.01E-05	4.00E-07	6.64E-07
WFHTR01	0.00E+00	0.00E+00	0.00E+00	9.92E-06	2.38E-04	0.00E+00	0.00E+00	3.17E-09
WTBC01H	0.00E+00	3.84E-04	0.00E+00	8.54E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WTBC01H5	0.00E+00	2.84E-04	0.00E+00	6.30E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WTBC01L	0.00E+00	1.49E-03	0.00E+00	3.29E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WTBC01L5	0.00E+00	1.12E-03	0.00E+00	2.48E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WTBC01N	0.00E+00	4.84E-04	0.00E+00	1.07E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
WTBC01N5	0.00E+00	3.62E-04	0.00E+00	8.01E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MGHTR1_1	0.00E+00	0.00E+00	0.00E+00	2.05E-04	4.91E-03	0.00E+00	0.00E+00	6.55E-08
MGHTR1_2	0.00E+00	0.00E+00	0.00E+00	2.05E-04	4.91E-03	0.00E+00	0.00E+00	6.55E-08
MGHTR2_1	0.00E+00	0.00E+00	0.00E+00	1.46E-04	3.51E-03	0.00E+00	0.00E+00	4.67E-08
MGHTR2_2	0.00E+00	0.00E+00	0.00E+00	1.46E-04	3.51E-03	0.00E+00	0.00E+00	4.67E-08
MBLR_1	0.00E+00	0.00E+00	0.00E+00	1.75E-05	4.21E-04	0.00E+00	0.00E+00	5.61E-09
MBLR_2	0.00E+00	0.00E+00	0.00E+00	1.75E-05	4.21E-04	0.00E+00	0.00E+00	5.61E-09
MBLR_3	0.00E+00	0.00E+00	0.00E+00	1.75E-05	4.21E-04	0.00E+00	0.00E+00	5.61E-09
WSHTRV1	0.00E+00	0.00E+00	0.00E+00	5.84E-07	1.40E-05	0.00E+00	0.00E+00	1.87E-10
WSHTRV2	0.00E+00	0.00E+00	0.00E+00	5.84E-07	1.40E-05	0.00E+00	0.00E+00	1.87E-10
WSHTRV3	0.00E+00	0.00E+00	0.00E+00	5.84E-07	1.40E-05	0.00E+00	0.00E+00	1.87E-10
WSHTRV4	0.00E+00	0.00E+00	0.00E+00	5.84E-07	1.40E-05	0.00E+00	0.00E+00	1.87E-10
WSHTRV5	0.00E+00	0.00E+00	0.00E+00	5.84E-07	1.40E-05	0.00E+00	0.00E+00	1.87E-10
WSHTRV6	0.00E+00	0.00E+00	0.00E+00	5.84E-07	1.40E-05	0.00E+00	0.00E+00	1.87E-10
W_PIPING	0.00E+00	1.44E-04	0.00E+00	0.00E+00	8.60E-04	0.00E+00	0.00E+00	0.00E+00
M_PIPE	0.00E+00	5.53E-05	0.00E+00	0.00E+00	3.04E-04	0.00E+00	0.00E+00	0.00E+00

Weymouth Model Inputs - Toxics Emission Rates, Continued (g/s)

Model ID	Naphthalene	PAH	Phenol	Propylene Oxide	Styrene	Tetrachloroethane (1,1,2,2-)	Toluene	Trichloroethane (1,1,2-)
WEMG01	1.49E-06	5.38E-07	4.80E-07	0.00E+00	4.72E-07	8.51E-07	8.17E-06	6.36E-07
WFHTR01	8.07E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.50E-07	0.00E+00
WTBC01H	1.57E-05	2.64E-05	0.00E+00	3.49E-04	0.00E+00	0.00E+00	1.57E-03	0.00E+00
WTBC01H5	1.16E-05	1.95E-05	0.00E+00	2.58E-04	0.00E+00	0.00E+00	1.16E-03	0.00E+00
WTBC01L	6.03E-05	1.02E-04	0.00E+00	1.35E-03	0.00E+00	0.00E+00	6.03E-03	0.00E+00
WTBC01L5	4.55E-05	7.70E-05	0.00E+00	1.02E-03	0.00E+00	0.00E+00	4.55E-03	0.00E+00
WTBC01N	1.97E-05	3.33E-05	0.00E+00	4.38E-04	0.00E+00	0.00E+00	1.97E-03	0.00E+00
WTBC01N5	1.47E-05	2.48E-05	0.00E+00	3.28E-04	0.00E+00	0.00E+00	1.47E-03	0.00E+00
MGHTR1_1	1.66E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E-06	0.00E+00
MGHTR1_2	1.66E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.26E-06	0.00E+00
MGHTR2_1	1.19E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.61E-06	0.00E+00
MGHTR2_2	1.19E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.61E-06	0.00E+00
MBLR_1	1.42E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.94E-07	0.00E+00
MBLR_2	1.42E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.94E-07	0.00E+00
MBLR_3	1.42E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.94E-07	0.00E+00
WSHTRV1	4.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-08	0.00E+00
WSHTRV2	4.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-08	0.00E+00
WSHTRV3	4.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-08	0.00E+00
WSHTRV4	4.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-08	0.00E+00
WSHTRV5	4.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-08	0.00E+00
WSHTRV6	4.75E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.65E-08	0.00E+00
W_PIPING	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.05E-03	0.00E+00
M_PIPE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E-04	0.00E+00

Weymouth Model Inputs - Toxics Emission Rates, Continued (g/s)

Model ID	Trimethylpentane (2,2,4-)	Vinyl Chloride	Xylenes (M,O&P, M-, O-, P-.....)
WEMG01	5.01E-06	2.99E-07	3.68E-06
WFHTR01	0.00E+00	0.00E+00	0.00E+00
WTBC01H	0.00E+00	0.00E+00	7.70E-04
WTBC01H5	0.00E+00	0.00E+00	5.68E-04
WTBC01L	0.00E+00	0.00E+00	2.97E-03
WTBC01L5	0.00E+00	0.00E+00	2.24E-03
WTBC01N	0.00E+00	0.00E+00	9.68E-04
WTBC01N5	0.00E+00	0.00E+00	7.23E-04
MGHTR1_1	0.00E+00	0.00E+00	0.00E+00
MGHTR1_2	0.00E+00	0.00E+00	0.00E+00
MGHTR2_1	0.00E+00	0.00E+00	0.00E+00
MGHTR2_2	0.00E+00	0.00E+00	0.00E+00
MBLR_1	0.00E+00	0.00E+00	0.00E+00
MBLR_2	0.00E+00	0.00E+00	0.00E+00
MBLR_3	0.00E+00	0.00E+00	0.00E+00
WSHTRV1	0.00E+00	0.00E+00	0.00E+00
WSHTRV2	0.00E+00	0.00E+00	0.00E+00
WSHTRV3	0.00E+00	0.00E+00	0.00E+00
WSHTRV4	0.00E+00	0.00E+00	0.00E+00
WSHTRV5	0.00E+00	0.00E+00	0.00E+00
WSHTRV6	0.00E+00	0.00E+00	0.00E+00
W_PIPING	1.12E-05	0.00E+00	1.39E-03
M_PIPE	4.05E-06	0.00E+00	5.73E-04

Weymouth Model Inputs - Buildings

Model ID	Description	X Coordinate (m)	Y Coordinate (m)	Elevation (m)	Height (m)
AUX01	Auxilliary Building	338013.8	4678757	4.29	7.82
CLR01	Main Gas Coolers	338053	4678781.4	4.08	5.49
CB01	Compressor Building	338051	4678802	3.87	13.79
WWALL	West Courtyard Wall	338021.2	4678769.5	4.43	6.10
EWALL	East Courtyard Wall	338060.4	4678768.6	4.19	6.10
322_D	322 Data and Meter Building	337841.1	4678837.3	2.70	3.05
827_B	827 Data and Meter Building	337870.3	4678834.8	3.04	3.05
RTRD	Retired Data Building	337850.4	4678812.4	2.98	2.74
322_R	322 Regulator Building	337846.2	4678826.2	2.88	3.05

Regional Model Inputs - Point Source Parameters

Model ID	Description	X Coordinate (m)	Y Coordinate (m)	Elevation (m)	Stack Height (m)	Stack Temp. (K)	Stack Velocity (m/s)	Stack Diameter (m)
FRECEU3	Fore River Station	337866.18	4678557.18	4.69	77.72	358.43	15.91	6.25
FRECEU4	Fore River Station	337865.17	4678549.40	4.69	77.72	358.43	15.91	6.25
BELDPII	Braintree Electric Light Department	337663.91	4677721.41	4.57	39.62	477.59	19.50	5.21
BELDWI	Braintree Electric Light Department	337734.23	4677773.90	4.27	30.48	660.37	37.63	3.35
BELDWII	Braintree Electric Light Department	337751.00	4677753.00	4.27	30.48	660.37	37.63	3.35
TRTST32	Twin Rivers Technologies	337706.83	4679142.82	3.61	77.72	505.15	12.19	1.22
TRTCLAY	Twin Rivers Technologies	337698.96	4679156.41	3.70	24.38	622.15	12.43	0.81
TRTCHP	Twin Rivers Technologies	337686.55	4679155.26	3.66	24.38	394.15	27.31	0.91
TRTRTO	Twin Rivers Technologies	337757.65	4679117.20	1.59	30.48	422.15	13.72	0.70
MWRA	MWRA Sludge Processing Facility	337340.00	4678469.00	4.57	64.92	418.71	23.16	1.01

Regional Model Inputs - Emission Rates (g/s)

Model ID	CO (1-hr, 8-hr)	NO_2 (without ARM)	NO_2 (1-hr)[1]	NO_2 (annual)[1]	$PM_{2.5}$ (24-hr, annual)	PM_{10} (24-hr)	SO_2 (1-hr)	SO_2 (3-hr, 24-hr, annual)
FRECEU3	5.86E+00	8.28E+00	6.62E+00	6.21E+00	1.76E+01	N/A	N/A	1.81E+01
FRECEU4	5.86E+00	8.28E+00	6.62E+00	6.21E+00	1.76E+01	N/A	N/A	1.81E+01
BELDPII	1.85E+01	5.72E+01	4.58E+01	4.29E+01	1.50E+01	N/A	N/A	1.15E+00
BELDWI	7.80E-01	1.28E+00	1.02E+00	9.60E-01	1.82E+00	N/A	N/A	1.00E-01
BELDWII	7.80E-01	1.28E+00	1.02E+00	9.60E-01	1.82E+00	N/A	N/A	1.00E-01
TRTST32	5.71E-01	5.37E+00	4.29E+00	4.02E+00	5.97E-01	N/A	N/A	1.79E+01
TRTCLAY	9.92E-02	4.72E-01	3.77E-01	3.54E-01	2.77E-01	N/A	N/A	2.92E-01
TRTCHP	4.08E-02	6.71E-02	5.37E-02	5.03E-02	7.53E-02	N/A	N/A	1.63E-02
TRTRTO	2.57E-02	1.12E-02	9.00E-03	8.40E-03	3.20E-03	N/A	N/A	2.52E-04
MWRA	2.68E+00	1.39E+00	1.11E+00	1.04E+00	9.58E-01	N/A	N/A	1.18E+00

[1] The NO2-ARM setting was applied to AERMOD emission rates.