UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
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BOSTON, MA 02109-3912

FACT SHEET

Pioneer Valley Energy Center
Ampad Road
Westfield, MA

EPA Draft Permit (Revised)
Permit Number 052-042-MA14

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I. General Information

Name of source:	Pioneer Valley Energy Center
Location:	Westfield, Massachusetts
Applicant's name and address:	Ampad Road Westfield, MA 01803
Application Prepared by:	ESS Group, Inc. 888 Worcester Street, Suite 240 Wellesley, MA 02482
Draft PSD permit number:	052-042-MA14
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In November 2008, Pioneer Valley Energy Center (PVEC) submitted an initial application to EPA-New England (EPA) requesting a prevention of significant deterioration (PSD) permit for a new 431 MW combined cycle electric generating facility in Westfield, Massachusetts ("Facility"). PVEC submitted additional information on March 10, 2010, July 12, 2010, and October 27, 2010. On November 5, 2010, EPA issued a draft PSD permit for a 30 day public comment period.

As of January 2, 2011, any source required to obtain a PSD permit must assess greenhouse gas (GHG) emissions to determine if GHG emissions are subject to regulation under the PSD permitting program. Since greenhouse gas emissions for this project are estimated to be over 75,000 tons per year on a carbon dioxide equivalent basis (CO_2e), PVEC determined the project's GHG emissions would be subject to PSD. On March 9, 2011 and July 12, 2011, PVEC submitted additional information to support its request for a PSD permit, including a BACT analyses for GHG emissions. On September 22, 2011 and October 14, 2011, PVEC submitted modeling analysis using meteorological data from Barnes Airport. EPA considers the receipt of the additional information on October 14, 2011 as completing the application for this draft permit.

After reviewing the November 2008 PSD application and additional information, EPA prepared this Fact Sheet and draft PSD permit for the proposed PVEC project as required by 40 CFR Part 124-Procedures for Decision Making.

EPA's permit decisions are based on the information and analysis provided by the applicant and EPA's own technical expertise. This Fact Sheet documents the information and analysis EPA used to support the PSD permit decisions. It includes a description of the proposed facility, the applicable PSD regulations, and an analysis demonstrating how the applicant complied with the requirements.

Based on all submittals, EPA has concluded PVEC's application is complete and provides the necessary information showing the project meets federal PSD regulations. EPA is making PVEC's submitted information part of the official record for this Fact Sheet and PSD permit. The initial application and supplemental information for this permit are available on-line at EPA New England's Web Site http://www.epa.gov/ne/communities/nsemissions.html.

Please note this project is also subject to the Massachusetts Department of Environmental Protection's (MassDEP) Comprehensive Plan Approval (CPA) requirements under the Commonwealth's regulations at 310 Code of Massachusetts Regulations (CMR) 7.02. On December 31, 2010, the Commonwealth issued the CPA. The CPA regulates all pollutants affected by the proposed project, including the pollutants regulated under the PSD permit,[1] and also implements MassDEP's nonattainment New Source Review (NSR) program regulations at 310 CMR 7.00: Appendix A. PVEC must comply with both the federal PSD permit and the MassDEP's CPA, as well as other applicable federal and state requirements.[2]

II. Project Location

The proposed plant site is located in an industrial land-use area of Westfield, Massachusetts bounded by Servistar Industrial Way toward the south and east, Ampad Road toward the west, and an undeveloped wooded area toward the north.

This new facility will be located in an area which is classified as either "attainment" or "unclassifiable" for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter with diameters less than 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$), and lead. Therefore, the facility is located in a PSD area for these pollutants. EPA has also designated western Massachusetts as a moderate non-attainment area under the 8-hour ground level ozone NAAQS. See 40 CFR 81.322.

[1] For greenhouse gases, the CPA only regulates carbon dioxide (CO_2), not the full suite of GHGs regulated by this PSD permit.

[2] It is also possible that the facility may become subject to Section 112(r) of the Clean Air Act. Section 112(r) provides in relevant part:

> It shall be the objective of the regulations and programs authorized under this subsection to prevent the accidental release and to minimize the consequences of any such release of any substance listed [under CAA 112(r)(3)] or any other extremely hazardous substance. The owners and operators of stationary sources producing, processing, handling or storing such substances have a general duty ... to identify hazards which may result from such releases using appropriate hazard assessment techniques, to design and maintain a safe facility taking such steps as are necessary to prevent releases, and to minimize the consequences of accidental releases which do occur.

42 USC 7412(r)(1). For more information regarding Section 112(r) requirements, see http://www.epa.gov/osweroe1/docs/chem/gdc-fact.pdf.

III. Proposed Project

PVEC proposes to construct a 431 MW (gross) electrical generating facility located on an undeveloped site off of Ampad Road in Westfield, Massachusetts. The major system components will consist of a Mitsubishi M501G air-cooled combined cycle turbine, an auxiliary boiler, an emergency diesel engine/generator and emergency diesel engine/fire pump, a mechanical draft wet cooling tower, and tanks for the storage of ultra low sulfur distillate oil (ULSD) or a blend of 20% biodiesel oil and 80% ULSD (B20).

The combustion turbine will fire natural gas as a primary fuel and ULSD/B20 oil as a backup fuel. The combustion turbine will have a maximum heat input rate of 2,542 million British thermal units per hour (MMBtu/hr) at ISO conditions and a maximum gross power output (including the steam turbine) of 431 MW while firing natural gas. The maximum heat input rate and gross power output will be 2,016 MMBtu/hr and 306 MW, respectively, when firing ULSD/B20 oil.

The heat recovery steam generator (HRSG) will house a Selective Catalytic Reduction (SCR) emissions control system to minimize emissions of nitrogen oxides (NO_x) and an oxidation catalyst to minimize emissions of carbon monoxide (CO) and volatile organic compounds (VOC). Exhaust gases from the combustion turbine/HRSG will be discharged through an exhaust stack 23 feet in diameter and 180 feet tall.

The auxiliary boiler and emergency diesel engine/generator will be housed within the main plant building. The auxiliary boiler will have a maximum heat input rate of approximately 21 MMBtu/hr and will be fired by natural gas. The emergency diesel engine/generator will have a power output of approximately 2,174 horsepower (hp) and 1500 KWe-shaft. The emergency diesel fire pump is a 270 hp engine that will be housed in a separate, small building located to the north of the main plant building. Both diesel engines will be fueled with ULSD/B20.

PVEC has requested the combined cycle turbine be permitted for unrestricted operation on natural gas and for the usage of up to 1440 hours (equivalent to 60 days) per 12-month period on ULSD/B20. Assuming an ULSD/B20 oil heating value of 138,000 Btu/gallon, this is equivalent to approximately 14,609 gallons per hour fuel use rate or 21.0 million gallons per 12-month period.

The auxiliary boiler will be limited to the equivalent of no more than 1,100 hours of operation per rolling 12-month period. The emergency diesel engine/generator and fire pump will each be limited to no more than 300 hours of operation per rolling 12-month period. The emergency diesel engine/generator and fire pump will not operate concurrently with the combustion turbine/HRSG except for sometime between the hours of 12:00 pm and 3:00 pm for maintenance and testing.

IV. PSD Program Applicability and Review

As stated earlier, EPA currently classifies Western Massachusetts as a *moderate nonattainment area* for ground level ozone and *attainment/unclassifiable* for all other criteria pollutants. Under these classifications, MassDEP administers the nonattainment NSR program to regulate emissions of Volatile Organic Compounds (VOC) and Nitrogen Oxides as a precursor to ground level ozone. EPA administers the PSD program that applies to the emissions of all other regulated criteria pollutants, including NO_2. NO_2 is a constituent of NO_x.

Before March 2003, under a delegation agreement with the EPA, Massachusetts administered the federal PSD program at 40 CFR 52.21 and issued PSD permits to sources in Massachusetts. However, in March 2003, Massachusetts returned the PSD program to EPA. In April 2011, Massachusetts once again became the PSD permitting authority under a new delegation agreement with EPA. However, Section IV.K. of the delegation agreement specifies that EPA would retain the responsibility in issuing the PSD permit for PVEC. After this permit has taken final effect, MassDEP may implement the PSD program with respect to this permit and this facility to the same extent as any other facility in Massachusetts, and where this permit refers to communications to or approval by EPA, MassDEP may act on EPA's behalf.

The MassDEP continues to administer its state permitting regulations and to issue comprehensive plan approvals to sources in Massachusetts. Typically, sources that are subject to the federal PSD program are also subject to the state permitting program.

The PSD regulations require major new stationary sources or major modifications to an existing major stationary source to undergo a PSD review and to receive a PSD permit before commencement of construction.

40 CFR 52.21 (b)(1) of the federal PSD regulations defines a "major stationary source" as either (a) any of 28 designated stationary source categories with potential emissions of 100 tons per year or more of any regulated NSR pollutant, or (b) any other stationary source with potential emissions of 250 tons per year or more of any regulated NSR pollutant. Combined cycle generating facilities like PVEC are part of the 28 designated stationary source categories for which 100 tons per year of potential emissions qualifies the source as "major."[3]

In addition, once a new stationary source has been determined to be a "major" source, it is subject to PSD review for each regulated NSR pollutant that the source would have the potential to emit in "significant" amounts, which in some cases are lower than the "major" thresholds. Forty CFR 52.21(b)(50)(iv) includes pollutants "subject to regulation" as defined in 40 CFR 52.21(b)(49) as regulated NSR pollutants. For this project, GHG emissions become a regulated NSR pollutant if the project's total GHG emissions on a CO_2e basis equal or exceed 75,000 tons per year.

[3] "Determining Prevention of Significant Deterioration (PSD) Applicability Thresholds for Gas Turbine Based Facilities," memo from Edward J, Lillis, dated February 2, 1993.

If EPA determines a new stationary source or new modification is subject to the PSD program, the source must apply for and obtain a PSD permit that meets regulatory requirements including:

- Best Available Control Technology (BACT) requiring sources to minimize emissions to the greatest extent possible;

- An ambient air quality analysis to ensure all the emission increases do not cause or contribute to a violation of any applicable PSD increments or NAAQS;

- An additional impact analysis to determine direct and indirect effects of the proposed source on industrial growth in the area, soil, vegetation and visibility; and

- Public comment including an opportunity for a public hearing.

V. PSD Applicability

The Facility is considered a major source of air pollution as defined by EPA's PSD program. Potential emissions from the new turbine are significant for six different pollutants; PM_{10}, $PM_{2.5}$, CO, NO_x, sulfuric acid mist and GHG. Table 1 lists the significance level threshold for several pollutants and the potential emissions from the proposed new equipment at the site.

Table 1
Facility Potential Emissions (tons per year)

Pollutant	Combustion Turbine (8,215 hr/yr)	Auxiliary Boiler (1,100 hr/yr)	Emergency Generator (300 hr/yr)	Fire Pump (300 hr/yr)	PTE - Normal Operation(1)	CT Startup/ Shutdown(2) (545 hr/yr)	**Facility PTE(3)**	PSD Sig. Emission Rates (TPY)	PSD?
NO_x	91.9	0.3	5.6	0.5	98.4	12.6	**110.9**	40	**yes**
CO	59.9	0.4	1.8	0.3	62.5	487.4	**549.9**	100	**yes**
SO_2	16.7	0.0	0.5	0.1	17.2	0.8	**18.0**	40	**no**
H_2SO_4 mist	17.2	0.0	0.0	0.0	17.2	0.8	**18.0**	7.0	**yes**
$PM_{10}/PM_{2.5}$ (Total)	49.1	0.1	0.1	0.0	49.4	1.7	**51.0**	15 PM_{10} 10 $PM_{.25}$	**yes**
$PM_{10}/PM_{2.5}$ (Filterable)	24.6	0.0	0.1	0.0	24.7	0.8	**25.5**	–	–
$PM/PM_{10}/PM_{2.5}$ (Condensible)	24.6	0.0	0.1	0.0	24.7	0.8	**25.5**	–	–
VOC	23.8	0.0	0.3	0.1	24.2	0.6	**24.8**	40	**no**
Lead	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**	0.6	**no**
GHG (CO_2e basis)[4]	1,480,786	1,394	383	47			**1,482,610**	75,000 CO_2e and any amount of GHG	**yes**

1. Total emissions represent maximum potential of all equipment operating independently in normal operation, and are based on the operation of the combustion turbine for 8,215 hr/yr, the auxiliary boiler for 1,100 hr/yr, the emergency generator and fire pump for 300 hr/yr each, and on 545 hr/yr spent in startup or shutdown.

   The combustion turbine may operate in excess of 8,215 hours per year which would result in decreased startup and shutdown hours and decreased overall emissions.

2. Startup/shutdown emissions are estimated based on 141 warm starts (2 hrs each), 35 cold starts (5 hours each) and 176 shutdowns per year.

3. The Facility PTE is the sum of the PTE during normal operation and during startup/shutdown of the combustion turbine.

4. GHG emissions are calculated assuming 7,320 hours on natural gas and 1440 hours on ULSD. The value of 75,000 TPY CO_2e under "PSD Sig. Emission Rate(s)" represents the "subject to regulation" threshold for GHG, per 40 CFR 52.21 (b)(49).

VI. BACT Analysis

As required by the federal PSD program at 40 CFR 52.21(j)(2) and (3), PVEC is required to apply BACT to the NO_x, PM_{10}, $PM_{2.5}$, CO, GHG, and H_2SO_4 mist emissions from the new turbine and other emission units. BACT is defined as, *an emissions limitation ... based on the maximum degree of reduction for each pollutant subject to regulation under [the Clean Air] Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems and techniques ... for control of such pollutant*. 40 CFR 52.21(b)(12); Clean Air Act (CAA) 169(3).

In making its BACT determinations, EPA follows the following five step "top-down" methodology as outlined in several EPA policy memoranda.

1. **Identify all control technologies.** Identify all possible control options, including inherently lower emitting processes and practices, add-on control equipment, or combination of inherently lower emitting processes and practices and add-on control equipment.

2. **Eliminate technically infeasible options**. Eliminate technically infeasible options based on physical, chemical, and engineering principles.

3. **Rank remaining control technologies by control effectiveness**. Rank the remaining control options by control effectiveness, expected emission reduction, energy impacts, environmental impacts, and economic impacts.

4. **Evaluate most effective controls and document results**. Determine the economic, energy, and environmental impacts of the control technology on a case-by-case basis.

5. S**elect the BACT**. Select the most effective option not rejected as the BACT.

Combined Cycle Turbine

Clean Fuels

<u>*Background*</u>

For the turbine, a major element of the BACT analysis is the use of clean fuels. This Fact Sheet discusses the BACT analysis for fuels here, rather than repeating it for each individual pollutant.

PVEC has proposed to burn primarily natural gas, which is a clean-burning fuel. However, as an alternate fuel, PVEC has requested permission to burn ultra low sulfur distillate oil (ULSD) or a blend of ULSD and 20% biodiesel oil (B20) for up to 1440 hours per year.[4] While ULSD and B20 are the cleanest-burning fossil fuels *other than* natural gas, for several regulated NSR pollutants, air emissions from burning ULSD/B20 are higher than from burning natural gas.

Step 1: Identify all control technologies.

Since this section is focusing on fuels, the identified control technologies are:

1. use of natural gas only
2. primarily natural gas with ULSD as a backup fuel
3. primarily natural gas with B20 as a backup fuel
4. primarily natural gas with either ULSD or B20 as a backup fuel

Step 2: Eliminate technically infeasible options

None of the above fuel options are technically infeasible.

Step 3: Rank remaining control technologies by control effectiveness.

With respect to pollutant emissions, natural gas is the cleanest fuel identified. ULSD and B20 have higher emissions than natural gas, but their emissions are essentially identical. The additional daily emissions from burning ULSD/B20 are 0.27 tons of NO_x, 0.23 tons of CO, 0.20 tons of $PM_{10/2.5}$ (totaling 0.7 tons/day, or 42 tons/year), and 962 tons/year of GHGs (measured in CO_2e).

Since natural gas is a cleaner fuel than ULSD/B20, it ranks higher in terms of control effectiveness. However, as noted above, in determining the BACT, EPA is required to consider energy impacts, environmental impacts, and economic impacts. This section discusses the energy, environmental, and economic impacts of natural gas as opposed to ULSD/B20.[5]

Step 4: Evaluate most effective controls and document results.

1. Energy impacts- In order to understand the energy impacts associated with natural gas, a brief background on the New England energy market is helpful. Under extreme conditions, the Independent System Operator-New England ("ISO-NE"), which regulates the New England electricity market, may declare an "Energy Emergency" if there may be sustained national or regional shortages in fuel availability or deliverability to the New England region's generation resources. Such shortages of fuel may come in many forms, including, but not limited to: severe drought, or interruption to availability or transportation of natural gas, liquefied natural gas, oil, or coal.[6] In such circumstances,

[4] On October 19, 2009, the Commonwealth of Massachusetts Energy Facilities Siting Board (EFSB) issued its ruling limiting the amount of ULSD that PVEC can burn to this amount.
[5] As noted above, the emissions of ULSD and B20 are essentially identical, and EPA is unaware of any significant differences between ULSD and B20 with respect to energy, economic, or environmental impacts. Consequently, having no reason to prefer ULSD or B20, the rest of this analysis focuses on ULSD/B20 vs. natural gas.
[6] See ISO New England Operating Procedure No. 21, "Action During an Energy Emergency" (June 1, 2010), at http://www.iso-ne.com/rules_proceds/operating/isone/op21/op21_rto_final.pdf.

ISO-NE may ask dual-fuel units to voluntarily switch to operation on the fuel source that is not in short supply. While the natural gas transportation capacity in New England has improved in recent years, the possibility of a temporary gas shortage has not been completely eliminated.

Short of a declared energy emergency, there may also be practical constraints on a power plant's ability to obtain natural gas on a given day. It is important to distinguish two different types of natural gas service. "Firm" or "non-interruptible" service customers purchase, in advance, a right to a guaranteed supply. Pipeline companies must be prepared to provide daily service up to the maximum specified volume or service level under firm contracts or tariffs even though the firm customers may not actually purchase or request transportation of that volume of gas on any given day. In return for this service guarantee, firm customers pay rates that allow pipeline companies to recover most of the fixed costs associated with the firm load, e.g., constructing, maintaining, and operating the pipeline system. By contrast, "interruptible" gas service, which is generally priced substantially lower than firm service, does not guarantee supply, and the availability of capacity to serve interruptible customers is often limited during periods of peak gas demand.[7] Due to bottlenecks in distribution, there may be days when interruptible service customers simply cannot obtain sufficient natural gas at any price. There may also be extremely local disruptions where, for various reasons, natural gas is generally available in New England, but it cannot be delivered to a specific site due to a local system failure.

2. Economic impacts - Even when natural gas is available, under certain market conditions, natural gas may be so much more expensive than ULSD that natural gas becomes cost-ineffective as a means of pollution control, or, put another way, the economic impacts of natural gas make it no longer BACT. To the best of EPA's knowledge, this is determined by two factors: (1) whether the facility uses an interruptible or firm contract, and (2) whether there is a natural gas shortage. In simple terms, with a firm contract, the price of natural gas is always high but always available; with an interruptible contract, the price of gas is almost always lower than under a firm contract, but in rare events the spot market price could exceed the firm contract price. Since the primary reason that the spot market price could exceed the firm price is a curtailment, the economic impact analysis begins with a discussion of contract mechanisms. On March 10, 2010, PVEC supplemented its BACT analysis by including the cost differential between the two types of natural gas contracts. A non-interruptible contract for PVEC (which would enable it to burn 100% natural gas) would cost an additional $13,900,000 dollars per year. As noted above, this facility is already subject to an EFSB limitation that prevents it from burning more than 1440 hours of ULSD/B20. Since the total pollution (all non-GHG pollutants combined) avoided by burning 100% natural gas as opposed to 1440 hours' ULSD/B20 is 42 tons/year, use of 100% natural gas via a non-interruptible contract would involve a cost per ton of criteria pollutants avoided of $330,952/ton and $14,499/ton of GHG (measured in CO_2e). This is well outside the range of controls or fuels determined to be cost-effective in previous BACT determinations.

[7] For more background information, see http://www1.eere.energy.gov/cleancities/pdfs/glossary_ng_purchasing.pdf.

One final possibility deserves discussion. Since EPA (through BACT) regulates control technologies (including available clean fuels), not market mechanisms for purchasing such technologies, it is conceivable that an appropriate BACT determination would still be to require 100% natural gas, but to leave the facility to purchase natural gas on the spot market (if it so desired) through interruptible contracts, rather than commit to a non-interruptible contract. However, if PVEC were only authorized to burn natural gas and it proceeded with interruptible contracts, then there could be times when a curtailment in natural gas supply would sufficiently affect the cost and availability in such a manner that requiring natural gas only would have unacceptable energy impacts (because gas is not available to interruptible customers) or unacceptable economic impacts (because the spot market price of gas is not cost-effective as a means of pollution control). As a practical matter, the occasions on which gas is not available to interruptible customers or the spot market price of gas is not cost-effective as a means of pollution control are only likely to occur when there is a curtailment of supply. This means that the economic impacts of this option (i.e., the permit allowing only natural gas, but the facility pursuing interruptible contracts) are largely the same as the energy impacts (discussed on page 11).

3. Environmental impacts - When the turbine burns ULSD, water is injected into the combustion area to control the formation of thermal NO_x. This increase in water usage is approximately 410,000 gallons per day. Over a 60-day period, this would mean 24,600,000 excess gallons of water for burning ULSD/B20 as opposed to gas. The water used to control NO_x emissions represents 18% of the facility's water needs. Pioneer Valley will obtain its water from two municipal water sources, Westfield and Holyoke.

According to EPA's Water Sense program, an average family of four can use 400 gallons of water per day.[8] This means the water used to control NO_x emissions when burning ULSD is the equivalent of how much water 1025 households would use on a daily basis.

As previously discussed, EPA has limited Pioneer Valley's ability to burn ULSD to circumstances when the ability to burn natural gas is curtailed. During these times, PVEC may not be able to generate electricity if it is not capable of burning ULSD. The shutdown of PVEC would result in a loss of 306 MW per hour, or a total of 7344 MW/day. According to data obtained from the Massachusetts Department of Energy and Environmental Affairs,[9] the average household in Massachusetts uses 700 kw per month which equates to about 23 kw per day. Based on these numbers, preventing PVEC from generating electricity would remove enough electricity to power over 300,000 homes.

Within this step of the BACT analysis, EPA weighs the all of the environmental, energy, and economic impacts. Since the energy impact of requiring 100% natural gas (loss of electricity) outweighs the collateral environmental impact of allowing ULSD/B20 (additional water usage) by a factor of 300 on a per household basis, EPA concludes that the burning of ULSD under restricted circumstances is allowable even though the burning of ULSD uses more water.

[8] See http://www.epa.gov/WaterSense/pubs/indoor.html.
[9] See http://www.mass.gov/eea/energy-utilities-clean-tech/electric-power/electric-market-info/electric-customer-migration-data.html.

As noted above, natural gas is the most effective fuel for pollution reduction and also has lower collateral environmental impacts (water usage), but on the other hand, allowing only natural gas combustion could have adverse energy and/or economic impacts.

EPA finds that allowing only natural gas would not be BACT because of these potential adverse impacts. Rather, BACT includes burning ULSD/B20 as a backup fuel. However, EPA also finds that allowing unrestricted burning of ULSD/B20 for 1440 hours per year (as PVEC has requested) is not BACT, because it would allow the facility to burn the dirtier fuel beyond the point that may be justified by the need to avoid unacceptable energy and/or economic impacts.

Step 5: Select BACT

EPA is proposing to allow PVEC to burn ULSD/B20 as a backup fuel, but only under specifically defined circumstances that constrain its usage to those situations where *not* allowing ULSD/B20 would impair the facility's ability to generate at all. These situations include: a curtailment in the natural gas supply; commissioning the turbine (which may require firing with oil); government-required emissions testing; equipment maintenance; and maintaining appropriate turnover of the on-site oil inventory.[10]

To address these events, EPA is limiting the use of ULSD to the following circumstances:

1. The interruptible natural gas supply is curtailed at the Tennessee No. 6 gas terminal hub. A curtailment begins when the owner/operator receives a communication from the owner of the hub informing the owner/operator stating that the natural gas supply will be curtailed, and ends when the owner/operator receives a communication from the owner of the hub stating that the curtailment has ended.

2. Any equipment (whether on-site or off-site) required to allow the turbine to utilize natural gas has failed;

3. The owner/operator is commissioning the combined cycle turbine and, pursuant to the turbine manufacturer's written instructions, the owner/operator is required by the manufacturer to fire ULSD during the commissioning process;

4. The firing of ULSD is required for emission testing purposes as specified in the PSD permit or as required by the Commonwealth of Massachusetts;

5. Routine maintenance of any equipment requires the owner/operator to fire ULSD;

6. In order to maintain an appropriate turnover of the on-site fuel oil inventory, the owner/operator can fire ULSD when the age of the oil in the tank is greater than six

[10] Stored oil becomes less usable with time, and thus the facility may wish to combust oil at a certain point to avoid wastage.

months. A new waiting period for when oil can be used pursuant to this condition will commence once oil firing is stopped.

Finally, the total number of hours (including partial hours) of firing ULSD/B20 cannot exceed 1440 per year.

NO_x

NO_x emissions from the combustion of fossil fuels are largely the result of fuel-bound nitrogen content of the fuel and high combustion temperatures.

Natural gas has negligible fuel-bound nitrogen, and ULSD has lower levels of fuel bound nitrogen than other liquid fossil fuel. The majority of the NO_x emitted from the turbine is thermal.

Several design and add-on technologies have been developed to minimize NO_x emissions, and have been identified in Step 1 of the BACT analysis:

Step 1

1. **Dry Low-NO_x Combustors**

   In dry low-NO_x (DLN) burners, air and fuel are mixed before entering the combustor to provide more homogeneous charge. To achieve low NO_x emission levels, the mixture of fuel and air should be near the lean flammability limit of the mixture. However, at reduced load conditions, lean premixed combustors may lead to some combustion instability and increased CO emissions (which, as discussed below, will be controlled by an oxidation catalyst as part of the BACT for CO).

   PVEC proposed using DLN burners as part of its BACT determination for controlling NO_x emissions when burning natural gas.

2. **Water Injection**

   Water injection involves injection of water or steam into the immediate vicinity of the combustor burner flame. Instantaneous cooling reduces the NO_x formation in the combustion chamber. However water or steam injection may also lead to increases in emissions of CO and hydrocarbons (HC) resulting from incomplete fuel combustion. There is also a decrease in efficiency due to heat loss, resulting in an increase in greenhouse gases per megawatt of electricity.

   The technology of using water injection was proposed by PVEC as part of its BACT determination for controlling NO_x emissions when burning ULSD/B20.

3. **Catalytic Combustion/XONON**

Instead of burning the fuel with an open flame, a catalyst bed is first used to oxidize the fuel mixture. The use of the catalyst lowers the combustion temperature helping to minimize the formation of thermal NO_x during combustion.

4. **$SCONO_x$[11]**

SCONOx™ uses a potassium carbonate (K_2CO_3) coated catalyst to reduce oxide of nitrogen emissions from natural gas fired, water injected, turbines. The catalyst oxidizes carbon-monoxide (CO) to carbon-dioxide (CO_2), and nitric oxide (NO) to nitrogen-dioxide (NO_2). The CO_2 is exhausted while the NO_2 absorbs onto the catalyst to form potassium nitrites (KNO_2) and potassium nitrates (KNO_3). Dilute hydrogen gas is passed periodically across the surface of the catalyst to regenerate the K_2CO_3 coating. The regeneration cycle converts the KNO_2 and KNO_3 to K_2CO_3, water, and elemental nitrogen. The K_2CO_3 is thereby made available for further absorption and the water and nitrogen are exhausted.[12]

5. **Selective Catalytic Reduction (SCR)**

An SCR control system is a method for converting NO_x generated from the combustion turbine to nitrogen (N_2) and water by reaction with ammonia (NH_3) in the presence of a catalyst. NH_3 is vaporized and injected in the flue gas upstream of the catalyst, which, when passing over the catalyst, results in the following dominant chemical reactions.

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$$

NH_3 is added in slight excess in order to minimize the NO_x emissions. The excess NH_3 that remains unreacted is emitted from the stack and is referred to as "ammonia slip." In this application, NH_3 slip is expected to be ≤ 2 ppm at 15% O_2 while firing either natural gas or ULSD/B20.

Step 2

Under this step, EPA reviews all of the technologies identified in step 1 and eliminates any technology the Agency determines is technologically infeasible for this project.

1. **Catalytic Combustion/XONON**

EPA conducted a search to determine if this technology can be used for this project. The only literature the Agency was able to find in its search is the application of this technology on a 1.4 MW gas turbine. The literature further states multiple combustors would be

[11] $SCONO_x$ has since been renamed EM_x by its manufacturer. We use the more widely known name for consistency with earlier documents.
[12] Excerpt from the California Environmental Technology Certification Program

needed for larger turbines such as a 6.5 MW unit. The Agency did not find any evidence this technology is technically feasible for this project and we concur with the Applicant's findings which eliminated this technology in step 2. EPA is eliminating this technology from further analysis.

2. **$SCONO_x$**

In its November 24, 2008 letter, PVEC states $SCONO_x$ is not technically feasible for this project since the technology has not been demonstrated for a turbine source as large as this project. On December 20, 1999, the Regional Administrator for EPA Region I sent a letter to the Connecticut DEP Commissioner stating $SCONO_x$ is technically feasible for large combined-cycle turbine projects and therefore is subject to a full BACT evaluation. Although PVEC's position regarding the technical feasibility of $SCONO_x$ has not changed, PVEC submitted additional information regarding this technology in its July 12, 2011 letter to EPA. For purposes of Step 2 of this BACT analysis, EPA views SCONOx as technically feasible at this project.

3. **Use of DLN when burning ULSD**

In its July 12, 2011 letter, PVEC submitted information indicating that the DLN technology cannot be used for liquid fuels due to flame instability. EPA concurs with this statement and has eliminated using DLN when burning ULSD from further analysis. (However, DLN remains an option when burning natural gas.)

4. **Use of water/steam injection when burning natural gas**

The purpose of water/steam injection and DLN is the lowering of the combustion temperature to minimize formation of NO_x. The combination of using both DLN and water/steam injection is not feasible since the technologies use different mechanisms for reducing the combustion temperature, thereby reducing NO_x emissions. EPA concurs with PVEC that the use of water/steam injection in combination of DLN when burning natural gas is technically infeasible and has eliminated using water injection when burning natural gas from further analysis..

<u>Step 3</u>

Under this step, technologies, both individual and combination, are listed in order of the most effective to least effective.

1. SCR, in combination with DLN when burning natural gas and water injection when burning ULSD, is effective in reducing NO_x emission to 2 ppm at 15% O_2.

2. **$SCONO_x$**

There appears to be only one BACT analysis that determined that $SCONO_x$ was BACT for a large combined cycle turbine. However, the accompanying permit for the facility, Elk

Hills Power in California, allowed the use of SCR or SCONOx to meet a permit limit of 2.5 ppm, and the actual technology that was installed in that case was SCR.

A much smaller unit (43 MWh) at Redding Power Plant in California, was permitted with a 2.0 ppm demonstration limit using SCONOx. In a letter dated June 23, 2005 from the Shasta County Air Quality Management District (Shasta County AQMD) to the Redding Electric Utility, however, it was determined that the unit could not meet the demonstration limit and, as a result, the limit was revised to 2.5 ppm. Based on these two examples, it appears $SCONO_x$ has been demonstrated to achieve only 2.5 ppm and we are therefore evaluating it at this limit.

Step 4

EPA must consider the economic, environmental, and energy impacts between the technologies.

1. Energy Impact – The parasitic load (i.e., energy wasted operating the control technology itself) between $SCONO_x$ and SCR is virtually the same and therefore has no impact on the BACT selection. DLN and water injection were not analyzed since these technologies would be used in conjunction with either control technology.

2. Environmental Impact - $SCONO_x$ has an environmental benefit when compared to SCR because ammonia is not used in the process. In the SCR, ammonia reacts with NO_x to create nitrogen. However, as with most chemical reactions, there could be byproducts, including ammonia sulfate and ammonia, due to injecting slightly more ammonia than is required for the chemical reaction. In the July 12, 2011 letter, PVEC estimated ammonium sulfates and ammonium nitrates will contribute to 57 % of the $PM_{2.5}$ emissions when firing natural gas and 15 % of the $PM_{2.5}$ emissions when firing ULSD with an SCR. $SCONO_x$ avoids this problem. Therefore, EPA determines $SCONO_x$ has a smaller environmental impact than SCR.

   Even with SCR, however, the creation of ammonia sulfate can be limited through the use of low sulfur containing fuels. Excess ammonia is limited through the use of automatic process controllers which inject the rate of ammonia based on the amount of NO_x in the exhaust. PVEC will minimize the sulfur content in the fuels by using only natural gas and ULSD. As explained further in the BACT discussion regarding $PM_{10}/PM_{2.5}$ emissions, ULSD contains the lowest amount of sulfur in commercially available fuel oils. EPA has concluded PVEC has minimized the environmental impact from using SCR by using fuels with low sulfur content and the use of controllers to minimize ammonia emissions.

3. Economic Impact – In this section, EPA takes into account cost differences between technologies. A technology can be eliminated in this section if EPA determines the cost, usually based on a dollar per ton of pollutant removed, is determined to be outside the normal cost for controls meeting BACT.

   In the July 12, 2011 letter, PVEC stated the installation of $SCONO_x$ is at least five times higher than SCR. For a similar size project in Florida, it was determined the incremental cost of $SCONO_x$ was 21 million dollars. Operational costs are also significantly higher because $SCONO_x$ uses a catalyst made from platinum versus a base metal catalyst in the SCR system. These statements were supported by the only vendor of the $SCONO_x$ technology, EmeraChem. Since $SCONO_x$ has not been proven to remove additional NO_x versus SCR, the additional cost for installation and operation of $SCONO_x$ results in an infinite incremental cost since the denominator in such a calculation is zero.

Step 5

At this step EPA determines which controls or methods identified through the first 4 steps constitute BACT for this project. Further, EPA develops the appropriate permit terms and conditions to ensure BACT is meet during all operational times.

EPA has determined SCR with the use of dry low NO_x burners when firing natural gas and the use of SCR with water injection when firing ULSD meet BACT for minimizing NO_x emissions for this project. The costs for applying $SCONO_x$ to reduce the environmental impact of the SCR system is well outside the range of controls determined to be cost-effective in previous BACT determinations. Furthermore, the adverse environmental impact of SCR (from excess ammonia byproduct emissions) will be minimized by use of low sulfur fuels and automatic process controllers. With the use of SCR and thermal reducing NO_x formation technology, EPA is proposing setting the NO_x BACT emission limit at the stack at 2.0 ppm @ 15% O_2 when firing natural gas and 5.0 ppm @ 15% O_2 when firing ULSD/B20 (except during startup and shutdown operations which are addressed later in this document).

CO

CO emissions are formed due to incomplete combustion of the fuel. These emissions are typically higher during transient and low load operating conditions. Control technologies used to minimize CO emissions include state-of-the-art combustion technology, add-on oxidation catalyst systems, and establishing minimum load restrictions.

Step 1

1. $SCONO_x$: In addition to removing NO_x, this control also removes CO by converting it into CO_2 through the oxidation process.

2. Optimize combustor design and configuration to minimize the creation of CO.

3. Oxidation catalyst: Located in the HRSG, PVEC proposes to install a catalyst which is expected to remove greater than 90% of the CO in the exhaust stream.

Step 2

All technologies identified in step 1 were deemed technically feasible for this project.

Step 3

The effectiveness in removing CO emissions is the same for $SCONO_x$ and the CO catalyst. Optimizing combustor design and configuration will apply regardless of which add-on pollution control technology is determined as BACT.

Step 4

1. Environmental Impact – For this facility, there is no difference in collateral adverse impact on the environment between a CO catalyst and $SCONO_x$ technology.

2. Energy Impact - The parasitic load between $SCONO_x$ and the CO catalyst is virtually the same and therefore has no impact on the BACT selection.

3. Economic Impact – PVEC estimated the cost of $SCONO_x$ for removing CO emissions was $60,000/ton on average and is considered well outside the range of controls determined to be cost-effective in previous BACT determinations.

Step 5

EPA has determined the use of a CO catalyst and optimizing the unit's design and operations, meets BACT for minimizing CO for this project. With these emission controls, EPA is proposing setting the CO BACT emission limit at the stack at 2.0 ppm @ 15% O_2 when firing natural gas and 6.0 ppm @ 15% O_2 when firing ULSD/B20 (except during startup and shutdown operations which are addressed later in this document).

$PM_{10}/PM_{2.5}$

PM_{10} and $PM_{2.5}$ from fuel combustion is primarily the result of non-combustible constituents (ash) in the fuel and sulfates. For combustion turbines, all PM is typically less than 10 microns in diameter (PM_{10}). The emissions of fine particulate matter ($PM_{2.5}$) from the turbine have been conservatively assumed to be equal to the emissions of PM_{10}.

This discussion forgoes specifically identifying each individual step of the BACT process since add-on controls to minimize $PM_{10}/PM_{2.5}$ emissions are not available. Add-on Control devices for controlling $PM_{10}/PM_{2.5}$ emissions from stationary sources, such as fabric filters, wet scrubbers, or electrostatic precipitators, create back pressure which adversely affects the turbine's operations.

Particulate emission control is achieved at the source by efficiently burning low ash and low sulfur fuel. PVEC proposed using natural gas and being allowed to burn ULSD/B20 for up to 1440 hours at their discretion. The use of these fuels would be combined with state-of-the-art combustion technology and operating controls, to provide the most stringent degree of particulate emissions control available for combustion turbines. As previously discussed in the section ULSD versus natural gas, EPA has determined to limit PVEC's ability to burn ULSD to a specific list of conditions and to never use ULSD for more than 1440 hours in any 365 consecutive day period.

The use of natural gas as the primary fuel, limited use of ULSD/B20 as the back-up fuel for periods when natural gas in unavailable or too expensive, and proper combustion are the proposed controls for PM_{10} and $PM_{2.5}$ BACT. With these emission controls, EPA is proposing setting the PM_{10} and $PM_{2.5}$ BACT emission limit at 0.0040 lb/MMBtu heat input firing natural gas and 0.014 lb/MMBtu while firing ULSD/B20. To further control emissions, EPA is limiting the amount of ULSD combustion as discussed above. All of these PM_{10} and $PM_{2.5}$ emission limits are based on the applicable stack test since the proposed permit is not requiring a continuous emission monitor for measuring PM_{10} and $PM_{2.5}$ emissions. PM_{10} and $PM_{2.5}$ emissions are fairly consistent when operating a combined cycle turbine. Operators of turbines are very conscious about particulate emissions since these emissions cause damage to the turbine blades.

Sulfuric Acid Mist

Sulfuric acid mist is formed from oxidation of sulfur in fuel. The only means for controlling sulfuric acid mist emissions from PVEC is to limit the sulfur content of the fuel. Because this is the only method to minimize sulfuric acid mist, EPA is not specifically identifying each step of the BACT analysis.

Natural gas as the primary fuel, with its natural low sulfur content, is the cleanest, naturally occurring fossil fuel. To minimize sulfuric acid mist emissions during fuel oil combustion, EPA is proposing to require PVEC to use ULSD/B20 with a sulfur content of 15 ppm by weight or less. These fuels have the lowest sulfur content commercially available for fuel oil. As stated earlier, EPA is also proposing to limit the amount of ULSD PVEC can burn. The use of these fuels result in an emission limit of 0.0018 lb/MMBtu when burning ULSD and 0.0019 lbs/MMBtu when burning natural gas.

Greenhouse Gases

Greenhouse gases for PSD permitting is the aggregate of six pollutants: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Since each pollutant has a different effect on global warming, PSD applicability is based on a carbon dioxide equivalent (CO_2e), determined by multiplying each pollutant by its global warming potential. Like other combustion sources, the main constituent of greenhouse gases for a combined cycle turbine is carbon dioxide. For this combined cycle turbine, carbon dioxide constitutes 98.5% of greenhouse gases on a CO_2e basis. Nitrous oxide and methane make up the other 1.5 % of greenhouse gases from the combined cycle turbine on a CO_2e basis.

Step 1

1. Carbon capture and storage: This technology is available for large fossil-fuel fired power plants[13] and has been identified in Step 1 as an add-on control for reducing greenhouse gas emissions.

2. Energy efficiency: PVEC has proposed the use of a combined cycle gas turbine, which is more energy efficient than a simple cycle turbine. PVEC's letter dated March 9, 2011 identified combined cycle turbines from three of the major vendors. In its July 12, 2011 letter, PVEC clarified the turbines identified in the March letter are the most energy efficient models commercially available for a 430 MW size facility at this time from these vendors. For combustion units, efficiency can be measured by the heat rate, which for an electric generating unit can be expressed as Btu of the fuel combusted divided by kWh of electricity produced (Btu/kWh). The lower the overall numbers the less heat needed to produce a unit of electricity. PVEC identified the following models:

   a. GE model no. MS7001FB, lower heat rate[14] of 5,950 Btu/kWh.
   b. GE model no. MS7001FA, lower heat rate of 6,090 Btu/kWh.
   c. Siemens model no. SCC6-5000F, lower heat rate of 5,990 Btu/kWh.
   d. Proposed project using a Mitsubishi model no. 501G and water cooling, lower heat rate of 5,948 Btu/kWh.
   e. EPA identified Mitsubishi model no. MHI501J. This turbine is expected to have a heat rate lower than the 501G model.

   Since age and ambient conditions will affect efficiency, the heat rate numbers presented above are used to compare the efficiency between turbine models and do not translate directly into permit limitations.

Step 2

1. Carbon capture and storage: In its letters dated March 9, 2011 and July 12, 2011, PVEC states this control option is not technically feasible due to a number of factors including the lack of a nearby storage facility for captured CO_2. According to the US Department of Energy, the nearest storage site to PVEC's plant is in New York[15]. The terrain between PVEC and a potential storage site is also problematic due to a pipeline having to traverse the Berkshire Mountains, and probably the Hudson River. The offsite logistical barriers of constructing such a pipeline (e.g., land acquisition, permitting, liability, etc.) enormously complicates the technology of CCS and may arguably eliminate the technology because it is technically infeasible for this project. Putting aside the technical infeasibility issue, EPA and PVEC continued to include CCS in the GHG BACT analysis.

[13] "PSD and Title V Permitting Guidance for Greenhouse Gases", March 2011, *available at* http://www.epa.gov/nsr/ghgdocs/ghgpermittingguidance.pdf, page 32.
[14] Lower heat rate is determined by subtracting the heat of vaporization of the water from the higher heating value.
[15] Although the map of the Saline formation contained in the docket does not identify specific formations, the state border is approximately 40 miles away.

2. Energy efficiency: PVEC did not identify any technical feasibility issues between the different turbine models since all identified models are currently available for purchase within the United States. In response to EPA's queries regarding another turbine model from Mitsubishi, MHI501J, PVEC determined that this model is under development and currently unavailable in this country, and therefore is not technically feasible. EPA agrees with PVEC's statement regarding Mitsubishi MHI501J availability and has eliminated this turbine from further analysis.

Step 3

1. Capture and storage of CO_2 emissions is the most effective technology for reducing greenhouse gas emissions for this project.

2. Regarding energy efficiency, PVEC is requesting a permit for the turbine with the lowest heat rate (the Mitsubishi 501G), and therefore most energy efficient, among commercially available turbines in its class. The GE MS7001FB turbine's heat rate is only slightly less than the Mitsubishi 501G's and can be ranked equivalently for control effectiveness. The GE MS7001FA and Siemens SCC6-5000F turbine models are notably less energy efficient.

Step 4

1. Energy and environmental impact - The capture, control, and storage of CO_2 emissions would increase the environmental impact for this project due to the control equipment. In order to capture CO_2 emissions from a combustion source, a facility in West Virginia used a chilled ammonium carbonate system to absorb CO_2 and create ammonium bicarbonate. The resulting ammonium bicarbonate is then converted back to ammonium carbonate in a regenerator and is reused to repeat the process. The flue gas, cleaned of CO_2, flows back to the stack and the captured CO_2 is sent for storage in an underground reservoir.

   The energy requirement to operate such a system – often referred to as "parasitic load" – is very large. In a June 2010 report, the General Accounting Office estimated the parasitic load to capture and store CO_2 emissions is between 21-32%. Electrical generating plants similar to PVEC in New England operate on an intermittent basis and usually are not base-loaded. Under the current power structure in New England, it is likely that the electricity used by the CCS system would need to be created by other fossil fuel fired electric generating plants, many of which are less energy efficient (and may emit higher amounts of conventional pollutants and GHG/MWh) than PVEC's proposed project.

   The installation of a new pipeline from PVEC to the nearest CO_2 storage site would also have an environmental impact as the pipeline installation tries to avoid ecologically sensitive areas. Neither EPA nor PVEC quantified the additional environmental impact from the increase of electric generating facilities to power the parasitic load or from the construction and operation of a new pipeline to transfer CO_2 emissions to a storage site.

2. Economic impact - PVEC estimated the cost to construct a pipeline to carry the captured CO_2 emissions to a storage site at one to three million dollars per mile. PVEC did not estimate any potential economic penalty due to projects delays caused while PVEC obtains the rights and land to build a CO_2 pipeline. As stated in step 2, the nearest storage site to PVEC's plant is somewhere in New York which is approximately 40 miles away. Due to the terrain between PVEC's facility and New York State, the cost of the pipeline would probably be on the higher end of the estimate At $3 million/mile, the cost just to construct a pipeline would be at least $120 million dollars, and probably much higher because it is very unlikely a storage site is right at the state border. Because PVEC contends that the cost of just the pipeline exceeds what is a reasonable cost for BACT, PVEC did not estimate the cost for the carbon capture system.

   In a fact sheet, updated in February 2011, the Department of Energy estimated the cost of capturing CO_2 at $150/ton of carbon. In another study by the National Energy Technology Laboratory, the cost to capture CO_2 and compress it is $240 million dollars for a combined cycle turbine with a gross electrical output of 564 MWh. Based on this later study, it is reasonable to assume the capital cost of installing a system for capturing and compressing CO_2 emissions is $183 million

Due to the energy, environmental and economic impacts of installing and operating CCS for PVEC's proposed project, EPA has eliminated this technology as greenhouse gas BACT for this project.

Step 5

EPA has determined the installation and operation of PVEC's proposed combined cycle turbine project as meeting BACT for greenhouse gases.

With determining BACT as an energy efficient model for the combined cycle turbine, permit conditions must be developed to ensure PVEC installs an energy efficient turbine and will continue to operate the turbine in an energy efficient manner. To ensure these two goals are met, EPA is proposing two emission limits for greenhouse gases, along with appropriate monitoring recordkeeping, and reporting.

First, to determine an efficient combined cycle turbine is installed, EPA has developed an emission limit in lbs of GHG/MWh going to the electrical grid that must be met during the initial stack test. Since weather conditions, which affect efficiency during a stack test, cannot be predicted at this time, the emission limit is being set using International Organization for Standardization (ISO) conditions. ISO 3977-2 sets the standard conditions at 59 ^{o}F, 14.7 psia, and 60 % humidity. The weather conditions during the stack test will be corrected to these ISO values.

Based on the design low heat release rate of 5,948 Btu/kWh$_{grid}$, a CO_2 emission factor of 116 lb/MMBtu, and the fact that 98.5 % of all GHG emissions on a CO_2e basis are CO_2,[16] EPA calculated an emission rate of 776 lbs CO_2e/MWh$_{grid}$. To determine the emission limit which must be demonstrated during PVEC's initial stack test, accuracy in measuring CO_2 and the correction curves used to convert stack tests results to ISO conditions must be taken into account. Based on these factors, which are outside of PVEC's control, EPA has calculated an emission limit of 825 lbs CO_2e/MWh$_{grid}$. Since a turbine's efficiency will degrade with time and fluctuate due to ambient conditions, the emission limit of 825 lbs CO_2e/MWh$_{grid}$ will only apply during the initial stack test.

The greenhouse gas emission limit established for installation cannot feasibly be used for continuous operations due to a number of factors such as partial load, startups, shutdowns, and weather conditions which all affect the turbine's efficiency. To ensure PVEC operates its facility to minimize greenhouse gases, EPA is proposing to establish an ongoing CO_2e emission limit/MWh to the electric grid. Due to the factors previously listed affecting efficiency, the emission limit shall be determined by averaging the emissions for each day and averaging the day's emissions with the previous 364 days of emissions. These factors, along with system degradation, will also cause fluctuations with the combined cycle turbine efficiency.

EPA expects a decrease in efficiency of 2.5% over time even for a well-operated turbine.[17] In its March 9, 2011 application supplement, PVEC claimed a performance margin of 6%. EPA understands the performance margin addresses factors affecting the efficiency which cannot be controlled by PVEC such as ambient temperature. The actual effect of temperature on a combined cycle turbine will vary depending on the turbine's design. The variation can be as much as 10%.[18] Based on the information PVEC provided and on EPA's own research regarding unavoidable decreases in efficiency and variability of performance under a reasonable range of conditions, EPA has determined that BACT is met by an emissions limit that is 8.5% higher than the corrected value which must be met during the initial test. EPA is proposing an ongoing emission limit of 895 lbs CO_2e/MWh$_{grid}$ averaged over each 365 consecutive day period.

Turbine's startup and shutdown operations

During startup and shutdown operations,[19] gas turbines experience operational fluctuations resulting in increases of NO_x and CO emissions. In addition, minimum operating temperature for the SCR catalyst must be obtained before ammonia can be injected to control NO_x emissions.

[16] EPA used emission factors for N_2O and CH_4 supplied by PVEC instead of AP-42 because the vendor specific emission factors are usually better for estimating emissions. Note, emission factors for these pollutants provided by PVEC are higher than the presumptive emission factors in 40 CFR part 98, subpart C.

[17] "Combined-cycle gas & steam turbine power plants" by Rolf Kehlhofer, Bert Rukes, Frank Hannemann, Franz Stirnimann, page 242.

[18] "Thermodynamic performance analysis of gas-turbine power-plant" by M. M. Rahman, Thamir K. Ibrahim, and Ahmed N. Abdalla available at http://www.academicjournals.org/IJPS/PDF/pdf2011/18Jul/Rahman%20et%20al.pdf

[19] Unit startup commences when fuel is first ignited and shall not exceed 2.0 hours for a warm start and 5.0 hours for a cold start. Cold startups are defined as occurring after a period of greater than 24 hours of turbine shutdown, and warm startups are defined as occurring 24 hours or less since turbine shutdown. Shutdown is defined as the time

BACT for NO_x and CO during these transient operations is determined to be good engineering practices to minimize emissions and in accordance with manufacturer's recommendations. Emission reductions due to add-on controls do not occur since the controls do not function until a minimum exhaust temperature is maintained. The emission rates in the draft permit will be higher for both CO and NO_x on a concentration and mass basis. See Tables II and III. Emission rates are also higher when burning ULSD instead of natural gas. The attached permit has been drafted to take these facts into account.

The emission limits for all other pollutants regulated under the permit (i.e., besides NO_x and CO) apply at all times, including during startup and shutdown.

Table II
Startup and Shutdown Emission Limits – Natural Gas
(Averaging time is 1 hour)

Pollutant	Concentration Limit	Mass Limit
Nitrogen Oxides	40 ppmvd @ 15% O_2	62.0 lb/hr
Carbon Monoxide	1100 ppmvd @ 15% O_2 for first 60 minutes of startup and for shutdowns	2000 lb/hr
Carbon Monoxide	100 ppmvd @ 15% O_2 after first 60 minutes of startup and shutdown	400 lb/hr

Table III
Startup and Shutdown Emission Limits – ULSD
(Averaging time is 1 hour)

Pollutant	Concentration Limit	Mass Limit
Nitrogen Oxides	60 ppmvd @ 15% O_2	99 lb/hr
Carbon Monoxide	4000 ppmvd @ 15% O_2 for first 60 minutes of startup and for shutdowns	6000 lb/hr
Carbon Monoxide	250 ppmvd @ 15% O_2 after first 60 minutes of startup and shutdown	800 lb/hr

Although CO emissions during these transient operations are higher than other similar sources that have recently been issued a PSD permit, the NO_x emissions for PVEC are lower than the other permits. To control emissions during transient times, a facility can only rely on good combustion practices to minimize emissions. Pollution control equipment that removes CO and NO_x emissions from the gas stream is not operational during startup and shutdown due to the low exhaust temperature. When good combustion practices are relied on, there is a trade-off between

when the turbine operation is between minimum sustained operating load and flame-out in the turbine combustor occurs. Shutdown shall not exceed 1.0 hour.

CO and NO_x emissions. A decrease in one pollutant is usually offset by an increase in the other pollutant. As noted earlier, PVEC's proposed location is in a nonattainment area for ozone and attainment for CO. Since NO_x contributes to ozone formation, it is more important to control NO_x emissions than CO emissions.

In an e-mail to EPA dated February 8, 2010, PVEC's consultant proposed CO and NO_x emission limits for startup and shutdown. The emission limits proposed by PVEC for CO are higher than what EPA has proposed in the PSD permit. PVEC proposed CO emission rates when firing natural gas of 3,700 ppmvd at 15% O_2 and 7410 lbs/hr. When firing ULSD, PVEC proposed CO emission limits of 10,000 ppmvd at 15% O_2 and 13,341 lbs/hr. PVEC did not supply supporting information for the proposed emission limits other than stating the limits are based on data from the manufacturer.[20] EPA reviewed the RBLC clearinghouse and a database on combined cycle turbines maintained by Region IV and found scant information regarding short term emission limits during startup and shutdown.

EPA has based its determination for the proposed CO emission limits on two applications for modifications to existing PSD permits. The applications were submitted to EPA on March 31, 2009 by Boston Generating, LLC. EPA determined it is appropriate to use the information from these applications because the turbines operated by Boston Generating, LLC are similar to the model proposed for the PVEC facility (different versions of Mitsubishi Heavy Industries Model 501G).[21] EPA was informed by Boston Generating, LLC, that the proposed emission limits for Mystic and Fore River Stations are based on actual operations of its six turbines from 2007 and 2008. EPA has determined that given the information on the record, the emission limits in Tables II and III meet BACT during startup and shut down operations.

Cooling Water Tower

Out of the five pollutants regulated by this proposed PSD permit, only PM10/$PM_{2.5}$ are emitted from the cooling water tower. A cooling water tower emits PM_{10} and $PM_{2.5}$ due to the particle entrainment within escaped water droplets. Therefore, to control PM_{10} and $PM_{2.5}$ emissions, PVEC will install high efficiency drift eliminators that limit the amount of escaped water droplets to 0.0005 % of the total recirculating water. These eliminators will limit the PM_{10} and

[20] Regarding vendor guarantees, *In re Masonite Corp*., 5 E.A.D. 551, 562 n.12 (1994), the Environmental Appeals Board, citing the 1990 Draft NSR Workshop Manual, has explained:

> On the subject of vendor guarantees, EPA's New Source Review Workshop Manual at B-20 states:
>
> > Vendor guarantees may provide an indication of commercial availability and the technical feasibility of a control technique and could contribute to a determination of technical feasibility or technical infeasibility, depending on circumstances. However, EPA does not consider a vendor guarantee alone to be sufficient justification that a control option will work. Conversely, lack of a vendor guarantee by itself does not present sufficient justification that a control option or emissions limit is technically infeasible. Generally, decisions about technical feasibility will be based on chemical and engineering analyses (as discussed above) in conjunction with information about vendor guarantees.

[21] In an e-mail dated October 27, 2010 from ESS to Donald Dahl, ESS stated the proposed turbine for the Facility has been modified by Mitsubishi. ESS stated that the new model is more efficient and lowers NO_x and PM emissions. However, no evidence was provided about the effects these modifications would have on startup and shutdown emissions for CO compared to the turbines installed by Boston Generating LLC.

$PM_{2.5}$ emissions to 0.01 lbs/hr. This emission rate is consistent with other recent BACT determinations.[22]

Auxiliary Boiler

As part of this project, PVEC is installing a 21 MMBtu boiler, known as the auxiliary boiler. Since this is also a combustion unit, this unit will emit all of the 5 pollutants regulated by this permit. To minimize emissions, PVEC proposed limiting the boiler's operation to 1100 operating hours in any 12 month period and only combust natural gas. Add-on controls for reducing NO_x, H_2SO_4, $PM_{10}/PM_{2.5}$, and CO for such an emission unit are not economical since the boiler is limited to 0.8 tons per year of all of these CAA pollutants based on the limit on operations. Given these facts, EPA has not listed out the five step BACT analysis for these pollutants. EPA is proposing the following emission limits for the auxiliary boiler:

Table IV
Emission Limits – Natural Gas

Pollutant	Concentration Limit
Nitrogen Oxide	0.029 lbs/MMBtu
Sulfuric Acid Mist	0.0005 lb/MMBtu
$PM_{10}/PM_{2.5}$	0.0048 lb/MMBtu filterable + condensables
Carbon Monoxide	0.037 lbs/MMBtu

To ensure compliance with the modeling assumptions that PVEC used as part of its demonstration that the NAAQS will be attained, EPA is also proposing to limit the heat input to the auxiliary boiler to 21 MMBtu/hr.

Finally, with respect to GHGs, PVEC researched the feasibility of adding energy efficiency measures to the auxiliary boiler such as an air preheater. As discussed above, CCS is not cost-effective for this facility. Since the auxiliary boiler is only used during startups until the HRSG can produce steam, the exhaust gas temperature would not be significant enough to adequately transfer lost heat to the combustion air system. Air preheaters are mainly installed on boilers that are intended to be used in a steady-state mode. The auxiliary boiler for this project is not designed nor intended to be operated in a steady state mode. EPA concurs with PVEC and has determined efficient combustion controls installed on the auxiliary boiler meets BACT for greenhouse gases. Consequently, EPA is proposing that BACT for GHGs from the auxiliary boiler be the heat and hours-of-operation limits identified above, and an annual boiler tune-up.

[22] See PSD permit for the construction of new Cooling Towers at Dominion Energy, Brayton Point Facility, April 2, 2009. URL: http://www.epa.gov/region1/communities/pdf/braytonpoint/CoolingTowerPermit.pdf

Emergency Generator and Fire Pump

PVEC has applied to install a 2,174 KWh diesel generator to be used in case of a power outage at the plant and a 270 hp fire pump.

Unlike other combustion equipment (e.g., CTs and boilers), new engines are required to be certified in compliance with NSPS requirements, including emission limits, upon purchase. Different types of engines have different emission requirements based on the type of engine being purchased (emergency engine, emergency fire pump engine, or non-emergency engine). Engine manufacturers may need to employ some of the control technologies identified above in order to comply with the NSPS emission limits, depending on the type of engine and the applicable limits. The applicant is proposing to construct an emergency engine and an emergency fire pump engine. As a result, to comply with NSPS the applicant must purchase engines that meet the emission requirements for emergency engines and emergency fire pump engines.

PVEC proposed the requirements of 40 CFR part 60, subpart IIII, the NSPS standard for internal combustion engines, as BACT. Forty CFR 60.4202(a)(2) requires emergency engines to meet the model year 2007's emission requirements in 40 CFR 89.112 and 40 CFR 89.113. Table I of 40 CFR 89.112 requires the engines to meet Tier 2 requirements which are:

a. 6.4 g/KWhour of NO_x and Non-methane Hydrocarbon (NMHC) combined

b. 0.20 g/KWhour of $PM_{10}/PM_{2.5}$

c. 3.6 g/KWhour of CO

However, EPA has identified the use of a Tier 4 generator set (also known as an engine) as being commercially available in 2011. As such the BACT analysis must include a comparison between a TIER 2 and a TIER 4 engine for PVEC intended use.

Emissions are significantly reduced when using a Tier 4 engine versus a Tier 2 engine. The reduction is almost 90% for NO_x and 50 % for fine particulates. To achieve these emission limits, a TIER 4 engine must add post combustion controls, such as urea injection. In order for the post controls to be fully functional, a minimum temperature must be maintained (usually around 650 ^oF). PVEC is installing its engine for emergency purposes only so it can safely bring the facility off line in case the plant loses electricity. On most occasions, the emergency generator will only be operated for a short period of time for maintenance checks and readiness testing. These short operating periods are not conducive to achieving optimum operation of a urea injected control system since the minimum temperature is not achieved.

It is plausible that if the plant loses electricity, the emergency engine is operated for a period long enough to reach minimum temperature for the urea injection system to work. Even in this case, the urea system will only operate for a short period of time because the purpose of the generator is to safely shutdown the plant, which usually takes several hours, not days. Based on information from Caterpillar, the cost difference between a Tier 2 engine and a Tier 4 engine is between $350,000-400,000. Amortizing the cost over 20 years, assuming an 8 % interest rate, results in an annual cost of $40,000. Although emissions are significantly reduced on a percentage basis when using a Tier 4 engine, the amount of NO_x and $PM_{10/2.5}$ reduced will probably be less than one ton per year given the purpose of the emergency generator. Even without estimating the additional operating costs of a Tier 4 engine, costs of using a Tier 4 engine to reduce NO_x and $PM_{10/2.5}$ is well outside the range of controls determined to be cost-effective in previous BACT determinations. EPA is determining that BACT for the emergency generator is to meet EPA's Tier 2 emission standards for CO, NMHC + NO_x, and $PM_{10/2.5}$, listed above.

The Fire Pump will be required to meet the emission limits in Table IV of 40 CFR part 60, subpart IIII.

a. 4.0 g/KWhour of NO_x and NMHC combined

b. 0.20 g/KWhour of $PM_{10}/PM_{2.5}$

Although NMHC (non methane hydrocarbon) is not a pollutant required to be reviewed for BACT, the Part 60 standard for emergency generators combines NO_x with NMHC into one emission limit. A BACT emission limit must be at least as stringent as a 40 CFR parts 60 or 61 standard. See the definition of *Best Available Control Technology* at 40 CFR 52.21(b)(12). It should be noted Table IV does not specify a specific emission limit for CO for fire pump engines of model year 2009 or later with a horsepower between 175 and 300. EPA has determined BACT for minimizing CO emissions from the fire pump is implementing the manufacturer's operating specifications.

A review of EPA's BACT/LAER Clearinghouse determined that recently permitted emergency generators were required to meet emission rates similar to the emission standards found at 40 CFR part 60. Since the permitted emission limits are the same as the requirements in 40 CFR parts 60 and part 63, and these emission limits are similar to other BACT determinations, EPA has concluded the proposed emission limits meet BACT requirements. Furthermore, operation of the emergency generator is limited to 300 hours in any 12-consecutive month period.

Since only new engines can meet these emissions limits, and these new engines are more efficient than older models, BACT for GHG emissions is met.

Finally, after considering the environmental impact, EPA is proposing operational limits on the emergency generator and fire pump engine:

- Prohibiting operating the emergency generator or fire pump during startup or shutdown.[23]
- Prohibiting scheduled testing of the emergency generator or fire pump outside of the hours of 12:00pm-3:00pm.

[23] See page 36, footnote 32.

- Prohibiting scheduled testing of the emergency generator or fire pump during days when the most recent (before scheduled testing) hourly value for NO_2 at the nearest ambient NO_2 air quality monitor in Hampden County operated by the MassDEP exceeds 54 ppb.[24]

VII. Monitoring and Testing

PVEC will install, calibrate, and operate a dedicated continuous emission monitoring system for measuring CO, CO_2 and NO_x emissions from the combined cycle turbine. The system will consist of a probe, analyzer, and data acquisition system. The NO_x monitoring system shall meet the specifications and quality assurance procedures of 40 CFR Part 75. The CO and CO_2 monitoring systems will meet the specifications and quality assurance procedures of 40 CFR Part 60 Appendix B, Performance Specifications 4 and 4A (for CO) and Performance Specification 3 for CO_2. Emission data for CO and NO_x will be measured by the analyzer in ppmvd (parts per million on a volume and dry basis). This ppmvd data can be directly compared to the permit emission limits to determine compliance.

To obtain NO_x, CO_2 and CO mass emissions on an hourly basis, PVEC will use EPA methods contained in 40 CFR part 75 for NO_x and 40 CFR part 60, appendix A, method 19 for CO. PVEC will need to measure heat input on an hourly basis and moisture content to convert the measured ppmvd data to lbs/hr.

For determining CO_2 mass emissions, PVEC shall use the following equation:

E = CO_2 in lb/hr
K = 1.14×10^{-3} lb/scf/%CO_2
%CO_2 is the average percent CO_2 in the gas stream for the hour, dry basis
F_{8710} is the F-factor for natural gas, dscf/MMBtu
GCV is the gross calorific value, Btu/dscf
is the natural gas fuel flow rate, dscf/hr

PVEC is also required to monitor or keep records of the amount of sulfur in the fuel that is used in the combined cycle turbine.

PVEC is also required to conduct stack tests for PM_{10} and $PM_{2.5}$ emissions for both oil and natural gas within 180 days after initial start-up of the combined cycle turbine.

VIII. Endangered Species Act/ESA

Section 7 of the ESA requires that certain federal actions such as federal PSD permits address the protection of endangered species in accordance with the ESA. To comply with the ESA, Region 1 consulted with the United States Fish and Wildlife Department (FWS)-New England Field

[24] See Section XI below.

Office web site http://www.fws.gov/newengland/EndangeredSpec-Consultation.htm to determine if the proposed permit for PVEC posed any risk to endangered species. Our consultation is consistent with the direction EPA received from the FWS in an e-mail on another PSD permit EPA drafted. See the file for an e-mail from Anthony Tur of FWS to Phyllis Nelson of EPA dated November 20, 2007.

The website instructs EPA to review a list of endangered species by county and determine if an endangered species is located in the county for the permitted facility. PVEC is in Hampden County. According to the table on the web site, the only listed endangered species (Small Whorled Pogonia) in Hampden County is located in the Town of Southwick. Therefore, it has been concluded that the proposed permit revisions do not pose a threat to any endangered or proposed endangered species or their habitat in the area subject to FWS jurisdiction, and that no further ESA impact analysis is required. The web site directed EPA to print a letter dated January 3, 2011 and signed by Thomas R. Chapman, Supervisor, New England field Office of the FWS. The letter states that no further review is warranted. The file contains a copy of this letter.

IX. Impact Analysis Based on Modeling

As part of its application, PVEC submitted a modeling analysis that met the requirements of 40 CFR part 51, Appendix W.

In determining a project's impact, a source usually conducts a screening model to determine if there is a significant ambient impact from the proposed project outside the fence line. For most NAAQS, EPA has published pollutant levels called significant impact levels (SILs) where impacts below the SIL are considered de minimis. The facility's screening modeling (assuming worse case meteorological conditions) from the 2008 application showed all pollutants, except CO, were above the SIL at the facility fence line.[25] Therefore, PVEC conducted refined modeling for NO_2, PM_{10}, and $PM_{2.5}$. Because CO was below the SIL at the fence line, no further modeling was required for CO.

[25] PVEC did not submit results from a screening analysis for NO_2, instead opting to proceed directly to a refined modeling analysis.

Table V
Screening Model Results

Pollutant	Result from screening modeling	SIL
NO_2 (annual)	32.9 ppb	1 ppb
NO_2 (1 hour)	Not ascertained	4 ppb[26]
CO (1 hour)	461 µg/m^3	2000 µg/m^3
CO (8 hour)	195 µg/m^3	500 µg/m^3
PM_{10} 24 hour	63.5 µg/m^3	5.0 µg/m^3
PM_{10} annual	16.7 µg/m^3	1.0 µg/m^3
$PM_{2.5}$ 24 hour	63.5 µg/m^3	1.2 µg/m^3
$PM_{2.5}$ annual	16.7 µg/m^3	0.3 µg/m^3

In order to conduct a refined modeling analysis, the applicant is required to input meteorological data relevant to the project area. An applicant can either establish an on-site meteorological station to gather one year's worth of data prior to the application or propose to use five years' worth of meteorological data from a source where the applicant believes data is representative to its proposed site. Proximity and terrain are the two main elements taken into account when making this determination. In its original application in 2008, PVEC used 1991-1995 meteorological data from Westover Air Force Base. At the time of the original application this was acceptable because in 1996, changes were made to the gathering and coding of meteorological data which raised several issues with air dispersion models. Since these changes were made, EPA has been identifying and solving issues with the new methods for gathering and entering meteorological data. In February 28, 2011, EPA issued a model change bulletin (MCB#4) which addressed the remaining issues. As a result, PVEC has submitted a new air quality impact analysis, using data from years 2006-2010 and from a different site (Barnes Airport in Westfield) which is approximately one mile away from the proposed site.

Terrain is another factor impacting the selection of representative meteorological data. Based on figure 2-1 (USGS Locus Map containing elevation information) in the 2008 application, EPA has determined the use of meteorological data from Barnes Airport is acceptable since the terrain is similar to the proposed project site.

At the time of the original application in 2008, EPA had not developed a SIL for $PM_{2.5}$ so PVEC conducted refined modeling for both the 24-hour and annual $PM_{2.5}$ standard. The 24-hour and annual SILs EPA promulgated on October 20, 2010 (75 FR 64864) continue the need for PVEC to conduct refined modeling. EPA published SILs for both the 24 hour $PM_{2.5}$ (1.2 µg/m^3) and annual $PM_{2.5}$ (0.3 µg/m^3) which still requires PVEC to conduct a refined modeling analysis that is provided below

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[26] SIL is from EPA Guidance titled "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program" dated June 29, 2010 and is used by EPA until the agency formalizes a SIL through rulemaking.

Results from Refined Modeling

Table VI contains the results from the refined modeling. All modeled pollutants, except for 24-hour $PM_{2.5}$ and 1-hour NO_2 emissions, were below the SIL at the fence line. Since $PM_{2.5}$ 24 hour and one hour NO_2 emissions were above the SIL, further analysis is required to determine if this project would cause or contribute to a NAAQS or increment violation.

Table VI
Refined Model Results[27]

Pollutant	Result from refined modeling	SIL
NO_2 (annual)	0.68 ppb	1 ppb
NO_2 (1 hour)	57.4 ppb	4 ppb[28]
PM_{10} 24 hour	3.05 µg/m^3	5.0 µg/m^3
PM_{10} annual	0.106 µg/m^3	1.0 µg/m^3
$PM_{2.5}$ 24 hour	2.07 µg/m^3	1.2 µg/m^3
$PM_{2.5}$ annual	0.11 µg/m^3	0.3 µg/m^3

$PM_{2.5}$

Background concentration

When using results from refined modeling for NAAQS compliance, background concentration for the pollutant of concern must be determined either by modeling other sources or monitoring representative pollutant levels. There are two ways of determining the background concentration. First, the applicant can install an EPA approved ambient monitor to gather emission data at the site prior to the application. A second method is to use data from an existing ambient monitor which is representative of the ambient conditions for the proposed project. To guide applicants, EPA has published significant monitoring concentration (SMC) values for different pollutants. For $PM_{2.5}$ averaged over 24 hours the SMC is 4 µg/m^3. Forty CFR 52.21(i)(5) allows EPA to exempt a stationary source or modification from the requirement to gather site specific data [40 CFR 52.21(m)] if the emission increase from the project is less than the SMC value listed at 40 CFR 52.21(i)(5). Given the results from refined monitoring of 2.07 µg/m^3 for $PM_{2.5}$ averaged over 24 hours and PM_{10}, EPA has determined to exempt this project from preconstruction on-site monitoring for $PM_{2.5}$ emissions. Forty CFR 52.21(m)(2) allows EPA to require post construction monitoring as necessary. Since it has been established the

[27] The term "refined model" does not apply to the modeling for NO_2. The differences between Tables V and VI for NO_2, besides the more updated meteorological data, is Table VI represents model results using hour-by-hour meteorological data.
[28] SIL is from EPA Guidance titled "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program" dated June 29, 2010 and is considered to be used by EPA until the agency formalizes a SIL through rulemaking.

highest modeled impact from this project is less than the SMC for $PM_{2.5}$, EPA has determined not to require post construction ambient monitoring of $PM_{2.5}$ emissions.[29]

Now that it has been established that site specific ambient monitoring is not required, background levels of $PM_{2.5}$ must be determined and a decision must be made whether to require PVEC to include emissions from nearby sources. Nearby sources are described in 40 CFR part 51, Appendix W as follows:

> "*Nearby Sources:* All sources expected to cause a significant concentration gradient in the vicinity of the source or sources under consideration for emission limit(s) should be explicitly modeled. The number of such sources is expected to be small except in unusual situations. Owing to both the uniqueness of each modeling situation and the large number of variables involved in identifying nearby sources, no attempt is made here to comprehensively define this term. Rather, identification of nearby sources calls for the exercise of professional judgement by the appropriate reviewing authority (paragraph 3.0(b)). This guidance is not intended to alter the exercise of that judgement or to comprehensively define which sources are nearby sources."

The term "sources" in EPA's modeling guidance refers to point sources of air emissions. Air emissions from mobile sources are addressed through the use of ambient air monitors. EPA reviewed the latest compilation (2008) of Massachusetts' emission inventory for all point sources of $PM_{2.5}$ emissions in Hampden County. When determining whether a "nearby source" may cause a "significant concentration gradient" for $PM_{2.5}$, EPA's modeling reviewer determined it would be appropriate to look at 100 tpy sources within one mile of the proposed project and 1,000 tpy sources within 10 miles.

The largest source of $PM_{2.5}$ emissions in Hampden County is Mount Tom Generating Station in Holyoke. Mount Tom emitted 44 tons of $PM_{2.5}$ and 92 tons of PM_{10} emissions and is approximately 9 miles away. There is also John S Lane and Son Company located approximately 5 miles away in Westfield which had 12 tons of $PM_{2.5}$ emissions and 18 tons of PM_{10}. There are only 8 sources in Hampden County with $PM_{2.5}$ emissions above 10 tpy and 10 sources in Hampden County with PM_{10} emissions above 10 tons. Based on the emission inventory EPA has determined there are no nearby sources expected to cause a significant concentration gradient in the area of the proposed project. Therefore, interactive modeling using $PM_{2.5}$ emissions from other sources is not required for this project.

In determining background levels of $PM_{2.5}$ emissions, PVEC proposed using ambient monitoring data gathered at the Chicopee site (monitor ID 250130008). In EPA's analysis, the agency identified two other ambient monitoring stations, Springfield Liberty Street (monitor ID 250130016), Springfield 1860 Main Street (monitor ID 250132009)[30], within the vicinity of the project and based our analysis using emission data from all three ambient monitoring stations.

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[29] EPA also compared the model impact of 0.68 ppb NO_2 on an annual basis to the SMC of 7.5 ppb and determined not to require on-site monitoring. The annual standard is used because there is no SMC for the 1-hour NO_2 standard at this time. See 40 CFR 52.21(i)(5)(iii).

[30] Data from an additional continuous emission monitor in Springfield can be obtained from AirNowTech.Org. This monitor is not recognized by EPA for determining compliance with the NAAQS. A cursory review in comparing the

The results from the refined modeling (using the average of the maximum modeled 24-hour averages across 2006-2010) were added to the most recent design value (years 2008-2010) for each ambient monitoring station to determine if the emissions from PVEC would contribute to a violation of the $PM_{2.5}$ NAAQS averaged over 24 hours (35 µg/m^3)[31]. The background level for both of the Springfield monitoring stations is 27 µg/m^3, while the design value for the Chicopee monitoring station is 25 µg/m^3. When the background levels are added to the results from the modeling, the highest level is 29.07 µg/m^3 which is below the NAAQS level of 35.0 µg/m^3.

In addition to demonstrating compliance with the NAAQS, PVEC is required to demonstrate its emissions will not exceed available increment. States have the flexibility in how their state is divided geographically for determining and tracking PSD increment. For $PM_{2.5}$, increment is tracked on the county wide basis in Massachusetts. On October 20, 2010, EPA published an increment standard for $PM_{2.5,}$ averaged over both annual and 24-hour basis. In this rulemaking, EPA established the major source baseline date of October 20, 2010 and a requirement that all PSD sources required to address PM2.5 emissions demonstrate they will not consume more than the available increment. PVEC will be the first major source permitted after these dates and therefore will consume $PM_{2.5}$ increment and will need to demonstrate its modeled impact is less than the available increment. Because there are no other PSD permitted sources within Hampden County after October 20, 2010, and the minor source baseline date is triggered when EPA deems PVEC's PSD application is complete, 100 % of the increment is available to PVEC. The increment for a Class II area (which is the Class Hampden County is currently designated) is 9 µg/m^3. PVEC's maximum modeled impact is 2.07 µg/m^3, consuming 23% of the available increment. EPA has determined there is sufficient available increment for this project.

When analyzing the impact of $PM_{2.5}$ emissions, secondary formation of the pollutant should be addressed. Secondary emissions are formed when pollutants emitted by the source react with other ambient air pollutants. The model used by PVEC to demonstrate impacts from $PM_{2.5}$ emissions cannot address precursor emissions and secondary $PM_{2.5}$ formation and impacts. At this time, no Appendix W point source model can provide this data. EPA does not have a model which can adequately address these complex chemical reactions. That said, secondary $PM_{2.5}$ emissions from PVEC will form well away from the source, not locally, because time is required for the secondary $PM_{2.5}$ to form. As the plume of direct $PM_{2.5}$ and precursor emissions from PVEC moves away from the facility, dispersion results in diluting the pollutants even as they form.

The impact these secondary emissions would have within the vicinity of the proposed site is de minimis. These particles, if they impact an area within the United States, will be part of the background levels measured by existing downwind monitors. In lieu of an available method in calculating the impact of secondary emissions from this facility and the fact that once secondary $PM_{2.5}$ emissions do impact the surface, such impacts will be at a considerable distance from the facility, EPA reviewed the design values of monitors possibly downwind of the proposed project. The highest such value was 25 µg/m^3 in Suffolk County, Massachusetts. Given this information,

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data between the EPA reference monitor and the continuous emission monitor showed the continuous emission monitor reading 20-30% higher than the EPA reference monitor.

[31] "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS," March 23, 2010

EPA believes the secondary formation of $PM_{2.5}$ emissions will not cause or contribute to a violation of the $PM_{2.5}$ NAAQS.

NO_2

In "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program" issued on June 29, 2010, EPA explains procedures an applicant can follow when preliminary model estimates suggest potential violation of the 1-hour NO_2 standard. Additional guidance relating to modeling demonstration for the 1–hour NO_2 standard "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" was issued on March 1, 2011. These documents were used in determining whether the project would cause or contribute to a violation of the 1-hour NO_2 NAAQS. There is no increment for the 1-hour NO_2 standard at this time.

As allowed by the aforementioned guidance documents, the following assumptions were used in deriving the project's impact from the air model.

1. Assumption that 80% of NO_x exiting the stack is in the form of NO_2.

2. Use the results from the controlling receptor. The location of the maximum reading in each year can vary between receptors. In accordance with our guidance, PVEC calculated maximum impact based on the individual receptor with the highest reading averaged over 5 years.

3. Use design value of each model year (8th highest reading) and averaging the numbers over a five year period.

The largest impact from NO_2 emissions occur when the combined cycle turbine, auxiliary boiler, and firepump are simultaneously operated[32]. Although the operating hours are limited for both the auxiliary boiler and firepump, operation of these devices were assumed to be 8760 hours per year for modeling purposes. Although EPA guidance does allow for different treatment of intermittent operations such as the auxiliary boiler and firepump,[33] PVEC chose the more conservative approach in estimating the project's impact.

Based on this acceptable approach, PVEC calculated the maximum ambient impact to be 48 ppb. The next step is to make a determination whether a "nearby source" may cause a "significant concentration gradient" for NO_2. Using the latest emission data in NEI (2008), PVEC plotted

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[32] Although allowable CCT NO_x emissions are higher during startup and shutdown operations, PVEC modeling demonstration showed a smaller impact because they assumed the neither the firepump or emergency generator would be operated during these scenarios. EPA has included a permit condition prohibiting PVEC from operating the firepump and emergency generator for readiness testing when the combined cycle turbine is in startup or shutdown mode.

[33] *See* "Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO2 NAAQS" (Mar. 1, 2011), *available at* http://www.epa.gov/ttn/scram/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf, at 8-11.

sources of NO_x emissions within Hampden County on a map which included a wind rose and topography. In its October 14, 2011 supplemental application, PVEC articulated several reasons why interactive modeling was not done, including using the information contained in the map. EPA has reviewed PVEC's submittal and concurs with their judgment there are no sources within the project's vicinity to include in the modeling demonstration.

When interactive modeling is not done, an applicant relies on ambient monitoring data in determining background levels. To determine if emissions from this project would violate the NAAQS, the modeled impact was added to the highest design value (from years 2008-2010) of any EPA approved ambient monitor in the vicinity. The highest monitor design value, 49 ppb, was from a monitor located at Liberty St. in Springfield. When this background level is added to the results from the modeling, the highest level is 97 ppb which is below the NAAQS level of 100 ppb. Therefore, EPA has determined the NO_2 emissions from this project will not cause or contribute to a violation of the NO_2 NAAQS.

Impairment to Visibility, Soils, and Vegetation

Forty CFR 52.21(o) requires the applicant to conduct an analysis of the air quality impact and impairment to visibility, soils, and vegetation that would occur as a result of as a result of the project and general commercial, residential, industrial and other growth associated with the project. EPA reviewed the analysis and agrees with PVEC that CO, NO_x, PM_{10}, $PM_{2.5}$, and sulfuric acid mist emission increases from this new project and associated commercial, residential, industrial, and other growth will not result in an impairment to visibility, soils, or vegetation, nor a model exceedance of the National Ambient Air Quality Standards for these pollutants or increments. In addition, the modeling analysis demonstrated the project's emissions would not have an adverse visibility impact at the closest Class I area (Lye Brook Wilderness Area near Manchester, Vermont).

X. Mass Based Emission Limits

To ensure the NAAQS and increment are not violated, a PSD permit must contain enforceable permit terms and conditions which ensure the mass flow rates for each modeled pollutant are not exceeded. This is accomplished by establishing mass-based emission limits for each modeled pollutant with or without the use of a CEMS. When a CEMS is used, the PSD permit must establish the averaging time for each mass-based emission limit that ensures compliance with the NAAQS. Without a CEMS, the applicable stack test method establishes the averaging time by default. PVEC is required to install CEMSs for both CO and NO_x, therefore averaging times for these pollutants are specified in the permit.

The following table contains the mass-based emission limits PVEC used in demonstrating compliance with the NAAQS and increment and therefore become emission limits in the PSD permit.

NO_x	CO	$PM_{10}/PM_{2.5}$
Combined Cycle Turbine (maximum capacity)		
20.2 lbs/hr gas, 43 lbs/hr ULSD, one hr average	12.3 lbs/hr gas, 31.5 lbs/hr ULSD, one hr average	9.8 lbs/hr gas, 26.8 lbs/hr oil
Combined Cycle Turbine (startup/shutdown)		
See tables II and III	See tables II and III	Not applicable[34]
Auxiliary Boiler		
0.58 lbs/hr	0.74 lbs/hr	0.1 lbs/hr

Note: There are no mass-based emission limits for sulfuric acid mist or GHGs since there is no NAAQS or increment to protect. There are no mass-based emission limits for the emergency generator because the permit condition limiting maximum size of the generator combined with the BACT limit is in effect a limit on mass emissions.

XI. Environmental Justice (EJ)

Executive Order 12898, entitled "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," states in relevant part that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Exec. Order 12898, § 1-101, 59 Fed. Reg. 7,629 (Feb. 16, 1994). "Federal agencies are required to implement this order consistent with, and to the extent permitted by, existing law." *Id.* at 7,632. EPA policy further defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.[35]

The fact sheet for EPA's November 2010 draft permit included the Agency's analysis of environmental justice issues and the basis for the Agency's conclusion that the facility's emissions would not have disproportionately high and adverse human health or environmental effects on minority or low-income populations. During the public comment period on last year's draft permit, EPA received written comments from Alternatives for Community and the Environment (ACE) on behalf of Westfield Concerned Citizens. These comments stated that the environmental justice analysis supporting the draft permit was inadequate. EPA also met with ACE representatives in EPA's Boston office on August 8, 2011 to discuss these concerns. EPA has considered the comments it received last year and in the August 8 meeting, and is providing additional analysis and process for today's draft permit.

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[34] Due to issues with cyclonic flow, stack testing results for PM_{10} and $PM_{2.5}$ are not representative of actual emissions.

[35] *See* http://www.epa.gov/environmentaljustice/ for more information.

1. **Public Participation**

In response to the level of public interest and issues regarding public participation raised in the comments, EPA has agreed to conduct enhanced public outreach and communication. For this revised draft permit, EPA is undertaking the following actions:

- Conducting enhanced outreach to notify the public of the draft permit, i.e., beyond the minimum required by EPA regulations.
- Providing an extended comment period that is longer than the 30 days' minimum required by EPA regulations.
- Conducting an informal public informational meeting and formal public hearing. At the public hearing, people may submit comments on the record orally.
- Providing Spanish, Russian, French, and Polish interpreters at the informational meeting and public hearing.[36]
- Providing a simplified short-form summary of the permit action (available in English, Spanish, Russian, French, and Polish).

These steps will ensure an opportunity for meaningful involvement for all communities. For more details on these issues, see the public notice and associated documents.

2. **NAAQS Compliance**

As noted above, the PSD permitting program applies to pollutants for which western Massachusetts is classified as attainment or unclassifiable.[37] The facility's modeled air impact will not result in exceedance of the NAAQS for any PSD pollutant. The Agency sets the NAAQS using technical and scientific expertise, ensuring that the NAAQS protects the public health with an adequate margin of safety. *See* CAA § 109(b), 42 U.S.C. § 7409(b).

In general, for a PSD permit, compliance with the NAAQS is sufficient to demonstrate that emissions from a proposed facility will not have disproportionately high and adverse human health or environmental effects on a minority or low-income population. This is because the Executive Order concerns itself with effects that are "adverse," and air emissions that do not cause an exceedance of the NAAQS do not lead to an adverse impact cognizable under the PSD permit program. "In the context of an environmental justice analysis, compliance with the NAAQS is emblematic of achieving a level of public health protection that, based on the level of protection afforded by a primary NAAQS, demonstrates that minority or low-income populations will not experience disproportionately high and adverse human health or environmental effects due to exposure to relevant criteria pollutants." *In re Shell Gulf of Mexico, Inc.*, OCS Appeal Nos. 10-01 through 10-04 [hereafter "*Shell II*"], slip op. at 74 (EAB Dec. 30, 2010); *see also In re Shell Offshore Inc.*, 13 E.A.D. 357, 404-05 (2007); *In re Knauf Fiber Glass, GmbH*, 9 E.A.D.

[36] The commenters requested Spanish and Russian translators. We added Polish and French on our own initiative because our analysis shows that the area surrounding the facility has a number of Polish and French speakers.
[37] Western Massachusetts is designated nonattainment for 8-hour ozone. The nonattainment New Source Review (NANSR) permit for this facility's ozone precursor emissions was issued by MassDEP. MassDEP's NANSR analysis is beyond the scope of this PSD permit.

1, 16-17 (EAB 2000); *In re Sutter Power Plant*, 8 E.A.D. 680, 692 (EAB 1999) (describing the NAAQS as the "bellwether of health protection").

It is true that, by using a conservative methodology, NO_2 levels at one site (Liberty St. in Springfield) are modeled to be 97 ppb, or 97% of the NAAQS of 100 ppb. See Section IX. However, this is not cause for concern. As noted above, NAAQS are set with "an adequate margin of safety." CAA § 109(b)(1). Moreover, in determining the NAAQS, EPA considers the impact of the pollutant on sensitive subpopulations, such as children, the elderly, and asthmatics. *Shell II*, slip op. at 64 n.72; *see also Coalition of Battery Recyclers Ass'n v. EPA*, 604 F.3d 613, 617-18 (D.C. Cir. 2010); *Lead Indus. Ass'n v. EPA*, 647 F.2d 1130, 1152-53 (D.C.Cir.1980). Thus, compliance with the NAAQS by *any* margin means that public health, including that of sensitive subpopulations, will be protected with an adequate margin of safety. For this reason, emissions from the proposed facility will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations.

3. Additional Analysis of Surrounding Areas

As noted above, the facility's modeled air impact complies with the NAAQS at all points, and therefore there are no "adverse human health or environmental effects" cognizable under the PSD permit program. Nevertheless, in light of the public interest and comment regarding environmental justice issues, EPA further examined the local demographics to determine whether the facility's emissions, even at below-NAAQS (i.e. non-"adverse") levels, would disproportionately affect minority or low-income populations. In parallel, and as discussed in Section IX above, PVEC has conducted new air quality modeling: revised $PM_{2.5}$ (annual and 24-hour) air quality modeling using more up-to-date data, and 1-hour NO_2 modeling.

To analyze the communities potentially affected by these emissions, EPA examined an area known as the Significant Impact Area (SIA). The SIA is the area in which the facility's modeled impact exceeds the Significant Impact Level (SIL). The SIL, in turn, is a threshold value that, in PSD permitting, is used for modeling screening purposes: impacts below the SIL are not "significant" and do not need to undergo refined modeling.[38] It is important to emphasize that modeled impacts above the SIL do *not* necessarily mean a project's emissions would be unhealthy, or would have an "adverse" effect on any population. To the contrary, the SIL is typically set at a very small percentage of the NAAQS. For example, the 1-hour NO_2 SIL is set at 4 ppb, which is only 4 % of the NAAQS (100 ppb), which EPA recently promulgated in 2010 to protect human health with an adequate margin of safety. Thus, modeled impacts that exceed the SIL, but are below the NAAQS, do not present health risks. EPA is using the SIA as a basis for analysis not because of any concern that emissions impacts *inside* the SIA are adverse—since they are below the NAAQS, they are by definition *not* adverse—but rather because impacts *outside* the SIA are so insignificant as to be "de minimis."

[38] It also defines the level at which a facility's modeled exceedance of the NAAQS is considered to be "causing or contributing" to a violation of the NAAQS. See 40 C.F.R. § 51.165(a)(2)(D)(i). That is not an issue here since the NAAQS will not be exceeded.

A. <u>Additional $PM_{2.5}$ Analysis</u>

With respect to $PM_{2.5}$, EPA considered the revised modeled SIA for $PM_{2.5}$, and examined the demographics of two areas: (1) a circle around the facility site tightly drawn around the SIA (with a radius of 0.63 miles), and (2) a 1.0-mile circle around the facility site.[39] See Figures EJ-1 (map for $PM_{2.5}$ SIA with 0.63-mile and 1.0-mile circles), EJ-2 (demographic analysis of 0.63-mile circle), and EJ-3 (demographic analysis of 1.0-mile circle). These analyses reveal the following:

- The SIA itself contains no dwellings. In other words, no persons of any race or income are modeled to be exposed to $PM_{2.5}$ emissions from the facility at significant levels.

- Neither the 0.63-mile circle nor the 1.0-mile circle contains any Census block groups with high minority or low-income populations.[40]

- The 0.63-mile circle contains 0.4% percent persons of minority race (below the Massachusetts average of 15.5%) and 5.5% percent persons below the federal poverty line (below the Massachusetts average of 6.7%).

- The 1.0-mile circle contains 0.5% persons of minority race and 5.7% persons below the federal poverty line. Again, these values are well below the Massachusetts averages.

- The facility's maximum modeled contribution to ambient $PM_{2.5}$ levels in an area with a substantial minority or low-income population is 0.298 $\mu g/m^3$ (Area 2). This is 25% of the SIL and just 1% of the NAAQS.

EPA therefore concludes that the facility's $PM_{2.5}$ emissions will not have disproportionately high human health or environmental effects on minority or low-income populations.

B. <u>Additional NO_2 Analysis</u>

EPA also examined the impact from increased NO_2 emissions since the impact of this pollutant is also above the SIL. Current scientific evidence links short-term NO_2 exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma.

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[39] EPA used a one-mile circle because ACE suggested this as a radius of concern in its December 2010 comment.

[40] For the purpose of this analysis, EPA mapped both EPA Region 1's Potential Environmental Justice (EJ) Areas and the Massachusetts Environmental Justice Populations. EPA's Potential EJ Areas are based on the 2000 Census Block Group Boundary layer. The methodology used to determine how the areas are coded involved identifying those block groups with percentages in the top 15% of the six-state New England region for low-income residents and/or minorities. Low-income is defined as twice the Federal Poverty Level. The Massachusetts EJ Populations are defined by having one or more of the following attributes: a minority population of 25% or more; an average household income of less than 65% the Massachusetts state median income; a foreign-born population of 25% or more; and/or a non-English-proficient population of 25% or more.

As with other pollutants, PVEC modeled several different operating scenarios to determine which scenario represented the project's most significant impact from NO_2 emissions. At EPA's request, PVEC analyzed the potential impacts of its NO_2 emissions on minority and low-income communities. See PVEC October 14, 2011 submission ("Supplemental Information - 1 hour NO2 Impact Analysis") [hereafter "PVEC NO_2 Analysis"]. PVEC submitted two very detailed maps which provide information regarding topography, wind direction, other NO_x emitting sources in the area, and "Areas-of Concern" communities. As the PVEC NO_2 Analysis explained, PVEC used EPA's "Toolkit for Assessing Potential Allegations of Environmental Injustice" to define Areas-of-Concern communities as meeting either of the following two criteria:

> 1. The community's minority population percentage is above the statewide minority population percentage (15.5%), and/or
>
> 2. The community's percentage of population below the poverty level exceeds the statewide average population percentage below the poverty level (6.7%).

PVEC's conclusions, and EPA's further analyses, are discussed below separately for two different operating scenarios.

1. Normal Operations

The first map, Attachment 1 to this Fact Sheet, shows PVEC's modeled analysis of the impact of NO_2 emissions when PVEC is operating the gas turbine on ULSD. Although the use of ULSD is strictly limited by the permit, for these purposes PVEC mapped the 1-hour NO_2 impacts of ULSD rather than natural gas because burning ULSD has a higher impact than burning natural gas. Attachment 1 demonstrates that NO_2 emissions above the SIL occur only in areas which are not considered Areas-of-Concern communities. Indeed, the SIA for NO_2 from normal turbine operations is almost entirely west of the facility, whereas the Areas-of-Concern communities are north, south, and east of the facility.

Based on Attachment 1, EPA concludes that the facility's normal operations (turbine operating at steady state) will not have will not have disproportionately high human health or environmental effects on minority or low-income populations.

2. Weekly testing

At EPA's request, PVEC also modeled NO_2 emissions when the turbine is fully operational and when PVEC is conducting its weekly maintenance and safety checks on the emergency engine and fire pump. Although the permit limits the operation of the emergency engine and fire pump to 300 hours per year, and although EPA guidance allows facilities to ignore such "intermittent" sources when conducting modeling,[41] EPA asked PVEC to analyze this operating scenario

[41] *See* "Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO2 NAAQS" (Mar. 1, 2011), *available at* http://www.epa.gov/ttn/scram/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf, at 8-11.

because it has the highest modeled impact from NO_2 emissions. Impacts during these times are greater than the impact occurring when the turbine is in startup or shutdown mode, even though the NO_x emission rate is higher during startup and shutdown, because of the smaller volumetric flow from the stack during startup and shutdown. At EPA's suggestion, PVEC further investigated whether confining the weekly testing of the emergency engine and fire pump to a particular time of day would limit the spatial extent of the NO_2 plume (due to meteorological variability), and determined that the extent of the NO_2 plume would be minimized if the testing was limited to 12:00-3:00pm.

Attachment 2 to this Fact Sheet shows PVEC's modeled analysis of the impact of NO_2 emissions when PVEC is operating the gas turbine and also conducting its required weekly maintenance and safety checks on the emergency engine and fire pump. This map does indicate three different Areas-of-Concern communities in which the model results predict the impact of PVEC's NO_2 emissions to be higher than the SIL in at least part of the community.

Based on PVEC's analysis, EPA decided to further examine the demographics of the modeled SIA for NO_2 under the scenario of PVEC operating the gas turbine and also conducting its weekly testing of the emergency engine and fire pump. These analyses reveal the following:

- The SIA does include two Census block groups in Westfield that are both EPA Region 1 Potential EJ Areas and Massachusetts EJ Populations. These correspond to Area 1 and Area 2 in PVEC's maps.

- The SIA overlaps a Census block group in West Springfield that is a Massachusetts EJ Population but not an EPA Region 1 Potential EJ Area. This corresponds in part to Area 3 in PVEC's map.

Because of the extremely irregular shape of the modeled Significant Impact Area for 1-hour NO_2, EPA does not believe that a demographic analysis based on a circular region is an ideal method of evaluating the population affected by the NO_2 plume from emergency equipment testing. However, in the interest of completeness, EPA generated demographic analyses for circles of three different radii around the facility: 3.5 miles, 6 miles, and 8 miles.

The first two radii were selected so as to include the above-identified block groups. The 3.5-mile circle includes the two identified Westfield block groups (i.e., all of the Census block groups that have modeled NO_2 impacts above the SIL and meet the threshold of EPA Region 1 Potential EJ Areas) and has been expanded slightly beyond those block groups so as to ensure inclusion of three schools just south and west of these two areas. See Figures EJ-4 (map with 3.5-mile circle, NO_2 SIA, and locations of interest), EJ-5 (demographic analysis of 3.5-mile circle). The 6-mile circle includes the West Springfield block group as well. Thus, it includes all of Census block groups that have modeled NO_2 impacts above the SIL and meet the threshold of EPA Region 1 Potential EJ Areas *or* Massachusetts EJ Populations, and has been expanded to include the entirety of the West Springfield block group in question, not just the portion within the SIA. See Figures EJ-6 (map with 6-mile circle, NO_2 SIA, and locations of interest), EJ-7 (demographic analysis of 6-mile circle). The third radius (8 miles) was selected because it includes most (though not all) of the SIA. See Figure EJ-8 (map with 8-mile circle, NO_2 SIA, and locations of interest), EJ-9 (demographic analysis of 8-mile circle).

EPA's demographic analysis of these areas reveals that these circles contain higher-than-state-average percent of persons below poverty level, and, for the 8-mile circle, above-average minority residents as well.[42] However, as noted above, EPA does not believe that these circles accurately characterize the population affected by the NO_2 plume, for several reasons:

1. Because the SIA is extremely irregular in shape, demographic analysis of circular regions necessarily includes areas for which the facility's predicted NO_2 impact is in fact below the significant impact level.
2. The population density *increases* with distance from the facility, whereas emissions (generally, if not uniformly) *decrease* with distance from the facility. Specifically, the population densities in the 0.63-mile and 1-mile circles are 394 and 386 persons per square mile, respectively; the population densities in the 3.5-mile and 6-mile circles discussed below are 673 and 674 persons per square mile, respectively; and the population density in the 8-mile circle is 852 persons per square mile. Looking at this issue another way, the 8-mile circle includes 166,413 persons, the 6-mile circle includes 74,361 persons, the 3.5-mile circle includes 25,204 persons, and the 1-mile circle includes only 1,214 persons. Thus, 95.2% of the population of the 3.5-mile circle lives more than a mile away from the facility, 98.4% of the population of the 6-mile circle lives more than a mile away from the facility, and 99.3% of the population of the 8-mile circle lives more than a mile away from the facility (indeed, more than half of the population of the 8-mile circle lives between 6 and 8 miles away from the facility). Yet the NO_2 impacts are generally greatest closer to the facility. *See* Attachments 1 and 2. Thus, as circles are drawn with greater radii, they contain more and more people who (generally) will experience less and less NO_2 impact from the facility.

3. This trend is further exacerbated by the fact that the larger circles include more dense, lower-income populations *east* of the facility, whereas the 1-hour NO_2 plume generally extends further *west* of the facility. This is readily apparent from Figure EJ-8, which shows how the 8-mile circle is heavily influenced by minority and low-income neighborhoods of Holyoke, Chicopee, and Springfield that are not in fact within the SIA, but are included in the circle solely because they happen to be at the same distance (albeit opposite direction) from the facility as regions of Russell, Granville, and Westhampton that *are* in the SIA.

For these reasons, while EPA has provided the demographics for the 3.5-mile, 6-mile, and 8-mile circles in the interest of completeness, we believe they are not the most useful means of evaluating whether the impacts of the NO_2 plume during scheduled testing disproportionately affect minority or low-income populations.

[42] Specifically, the 3.5-mile circle contains 6.1% minority residents (below the state average of 15.5%) and 14.1% persons below the poverty level (above the state average of 6.7%). The 6-mile circle contains 8.2% minority residents and 10.3% persons below the poverty level. The 8-mile circle contains 21.9% minority residents and 15.7% persons below the poverty level.

Instead, EPA examined the facility's modeled NO_2 impact in the three identified Areas-of-Concern communities that are within or overlap the SIA, and compared it to the modeled NO_2 impact in other, *non*-Areas of Concern communities. The impacts in the three identified Areas-of-Concern communities are:

Area 1 (Westfield): 4.45 ppb
Area 2 (Westfield): 4.66 ppb
Area 3 (West Springfield): between 3.66 ppb and 4.12 ppb

Of these three Areas-of-Concern communities, the highest NO_2 impact from PVEC occurs in Area 2 with a modeled impact of 4.66 ppb, i.e., very slightly exceeding the SIL of 4.00 ppb. These impacts are in fact quite low, not just in absolute terms but also relative to other communities in the Significant Impact Area. EPA confirmed that there are other communities within the SIA that are *not* Areas-of-Concern communities and which have higher impacts from NO_2 emissions than Area 2. For example, the modeling analysis predicts an impact of 20 ppb (i.e., 20 % of the health-based standard of 100 ppb) in a neighborhood just north of the Victoria Estates Conservation Area that does not have high percentages of minority or low-income residents.

Since the project's maximum modeled air impact does not occur in Areas-of-Concern communities, it actually affects low-income communities *less* than other communities. Furthermore, as noted above, the project's maximum modeled air impact is not "adverse" because it is well below the NAAQS. For these reasons, EPA concludes that the project's air emissions will not cause disproportionately high and adverse human health or environmental effects on minority or low-income populations. *See, e.g., In re EcoEléctrica, L.P.*, 7. E.A.D. 56, 68 (1997).

C. <u>Actions taken</u>

While the facility's impacts will not cause disproportionately high and adverse human health or environmental effects on minority or low-income populations, EPA has decided, out of an abundance of caution, to implement several common-sense measures given the presence of potentially sensitive communities near the facility:

1. As discussed above, EPA is providing enhanced public participation to ensure that all members of the public have an opportunity for meaningful involvement.
2. Because PVEC's NO_2 modeling indicates that the plume from scheduled emergency testing would have the least impact if conducted between 12:00-3:00pm, the draft permit requires that testing be conducted only during this window.
3. Finally, to account for any remaining uncertainties in this analysis and for the potential sensitivity of vulnerable groups to cumulative impacts, the draft permit prohibits the facility from conducting scheduled testing of the emergency generator and fire pump during days when the hourly ambient NO_2 level measured just before testing at the nearest ambient NO_2 air quality monitor within Hampden County operated by the MassDEP and available at http://public.dep.state.ma.us/MassAir is 54 ppb or higher, the

starting point for the "moderate" air quality index for NO_2.[43] This prohibition shall apply except for the rare circumstance when this condition would prevent emergency equipment testing for more than five consecutive days and thereby pose a potential safety hazard.

The above-discussed analyses and actions fulfill EPA's obligations under Executive Order 12898 and EPA environmental justice policy.[44]

XII. National Historic Preservation Act

On November 5, 2010, EPA sent a letter to Brona Simon, Executive Director for the Massachusetts State Historic Preservation Office, notifying her of the earlier draft permit for PVEC and requesting consultation under Section 106 of the National Historic Preservation Act of 1966, as amended. Ms. Simon responded to EPA by a letter recommending that EPA make a finding of "no historic properties affected" under 36 CFR 800.4(d)(1) for this project. Today's draft permit does not change the scope of the previous draft permitted project; therefore, EPA is making a finding that our action does not affect any historic properties.

XIII. Comment Period, Hearings and Procedures for Final Decisions

All persons, including applicants, who believe any condition of the Draft Permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to Donald Dahl (OEP 05-2) U.S. Environmental Protection Agency 5 Post Office Square - Suite 100 Boston MA 02109 - 3912. Please note that this new Draft Permit completely replaces and supersedes the November 5, 2010 draft permit. Even if you commented on the November 2010 draft permit, if you believe that a condition of this new Draft Permit is inappropriate, you must, during the new public comment period, submit a comment raising all available issues.

A public hearing will be held during the public comment period. See the public notice for details. EPA will consider requests for extending the public comment period for good cause. In reaching a final decision on the Draft Permit, the EPA will respond to all significant comments and make these responses available to the public at EPA' s Boston Office.

Following the close of the public comment period, and after the public hearing, the EPA will issue a Final Permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice. Within 30 days following the notice of the permit decision, any interested parties may submit a petition for review of the permit to EPA's Environmental Appeals Board consistent with 40 CFR 124.19.

[43] An air quality index of "moderate" is defined as: "Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people. Unusually sensitive people should consider reducing prolonged or heavy exertion outdoors." http://www.mass.gov/dep/air/aqi/aqi.htm#How_AQI_Works.

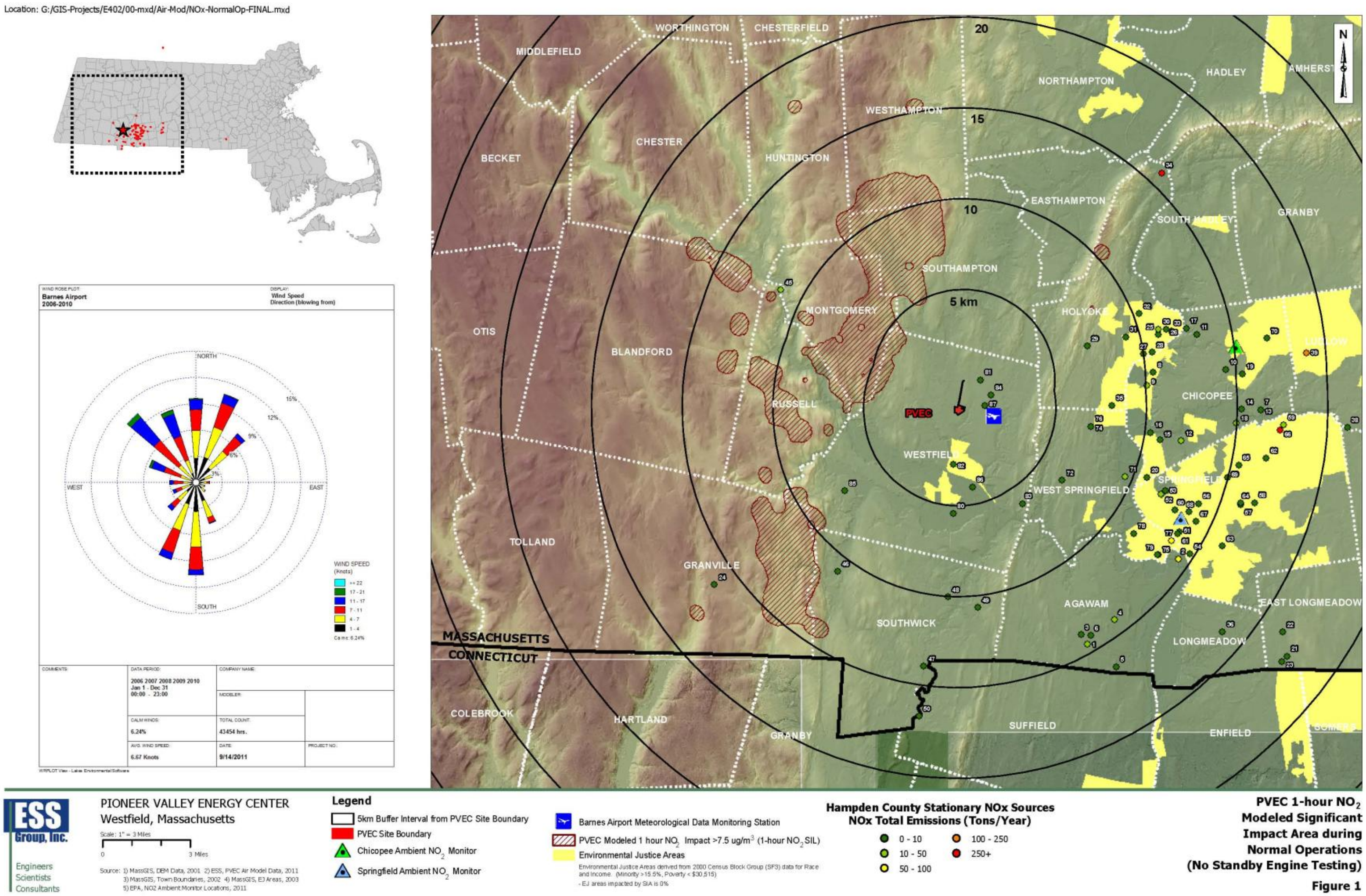
[44] EPA's conclusion that this particular PSD permit action will not cause disproportionately high and adverse human health or environmental effects on minority or low-income populations is based on the location and modeled environmental impact of this particular facility. Outside of the scope of this PSD permit, EPA has invested in a variety of environmental justice-related activities in Holyoke, Chicopee, and Springfield. See document entitled "EPA Community Initiative Supporting the Pioneer Valley Knowledge Corridor" in the permit file.

XIV. EPA Contacts

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

Donald Dahl (OEP 05-2)
U.S. Environmental Protection Agency
5 Post Office Square - Suite 100
Boston MA 02109 - 3912
Telephone: (617) 918-1657
Dahl.Donald@epa.gov

Attachment 1



PVEC 1-hour NO_2 Modeled Significant Impact Area during Normal Operations (No Standby Engine Testing)

Figure 1

Attachment 2

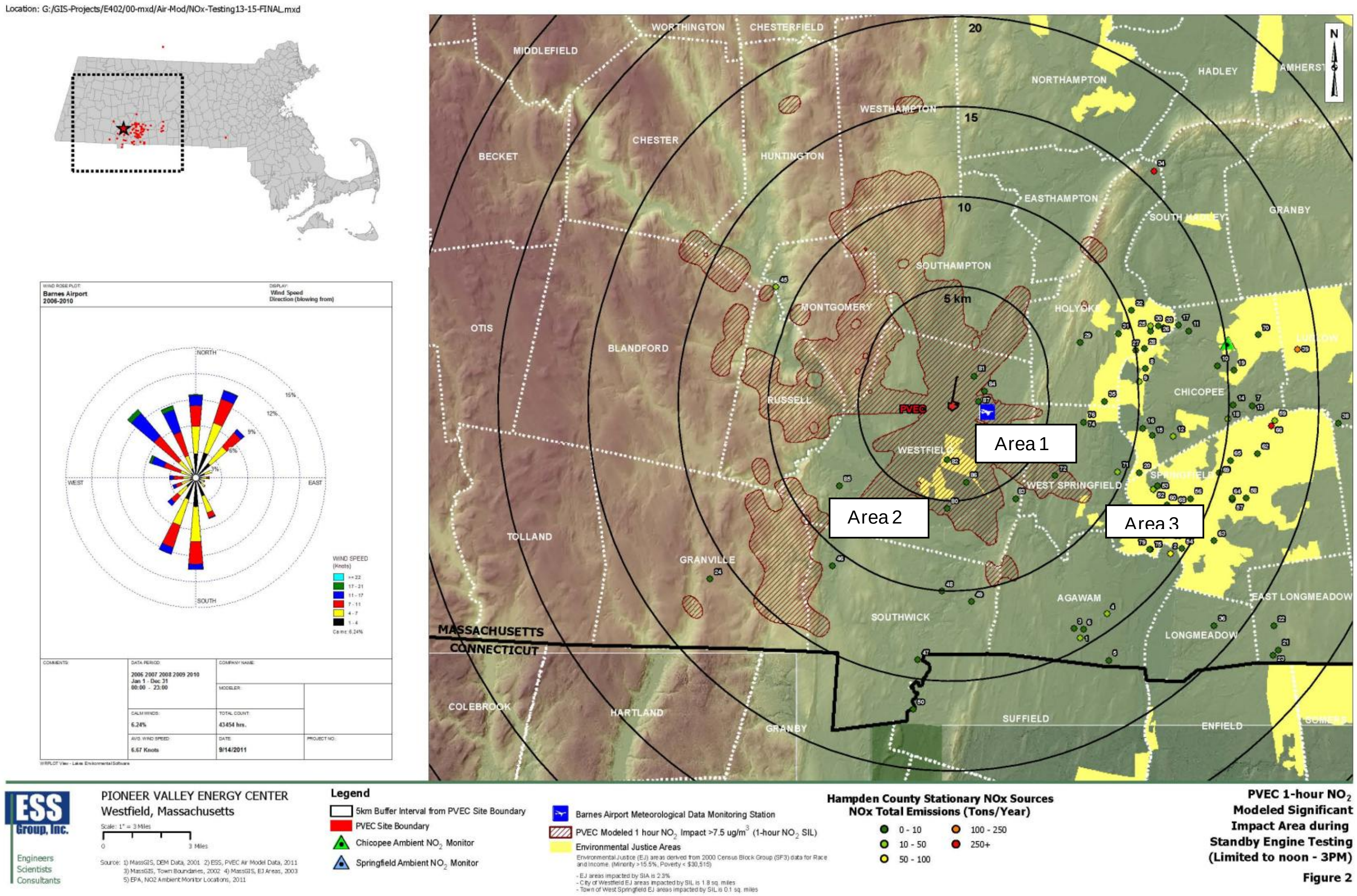
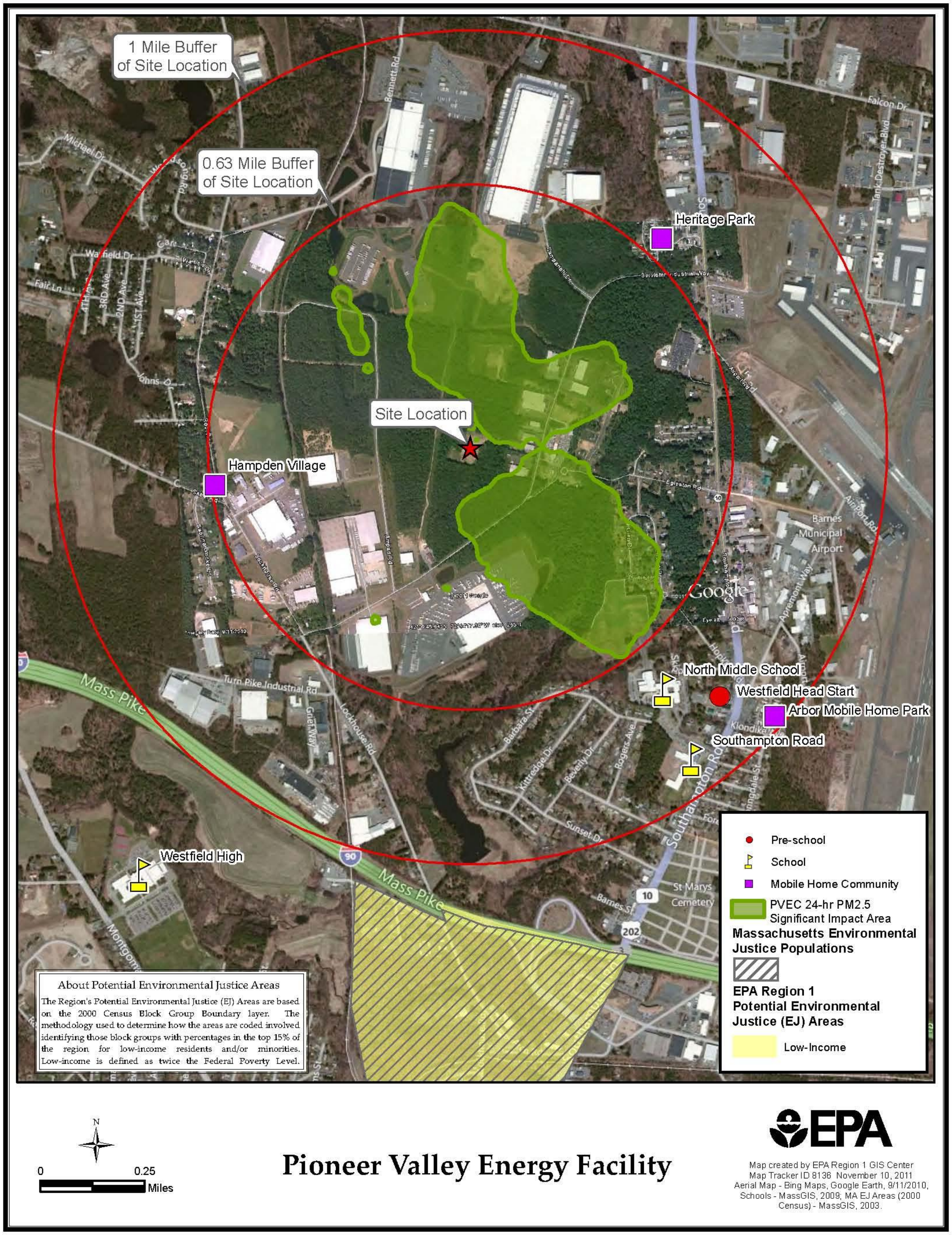


Figure EJ-1 (map for $PM_{2.5}$ SIA with 0.63-mile and 1.0-mile circles)



EJ-2: Demographics analysis of 0.63 mile circle

Overview					
Total Persons:	492	Land Area:	99.2%	Households in Area:	201
Population Density:	393.97 /sq mi	Water Area:	0.8%	Housing Units in Area:	209
Percent Minority:	.4%	Persons Below Poverty Level:	27 (5.5%)	Households on Public Assistance:	5
Percent Urban:	95%	Housing Units Built <1970:	21%	Housing Units Built <1950:	7%

Race and Age*			
(* Columns that add up to 100% are highlighted)			
Race Breakdown	**Persons (%)**	**Age Breakdown**	**Persons(%)**
White:	490 (99.6%)	Child 5 years or less:	29 (5.9%)
African-American:	0 (0.0%)	Minors 17 years and younger:	89 (18.1%)
Hispanic-Origin:	2 (0.4%)	Adults 18 years and older:	403 (81.9%)
Asian/Pacific Islander:	0 (0.0%)	Seniors 65 years and older:	118 (24.0%)
American Indian:	0 (0.0%)	*This space intentionally left blank*	
Other Race:	2 (0.4%)		
Multiracial:	0 (0.0%)		

Gender	
Gender Breakdown	**Persons (%)**
Males:	240 (48.8%)
Females:	252 (51.2%)

Education	
Education Level (Persons 25 & older)	**Persons (%)**
Less than 9th grade:	38 (10.9%)
9th -12th grade:	52 (15.0%)
High School Diploma:	123 (35.6%)
Some College/2 yr:	31 (8.9%)
B.S./B.A. or more:	102 (29.6%)

Language	
Ability to Speak English	**Persons (%)**
Population Age 5 and Over:	465
Speak only English:	437 (94.0%)
Non-English at Home:	27 (5.9%)
Speak English very well:	24 (5.1%)
Speak English well:	4 (0.8%)
Speak English not well:	0 (0.0%)
Speak English not at all:	0 (0.0%)
Speak English less than well:	0 (0.0%)

Language Spoken	
Language Spoken	**Persons (%)**
Speak only English:	429 (89.2%)
Spanish or Spanish Creole:	12 (2.5%)
French (incl. Patois, Cajun):	6 (1.3%)
French Creole:	1 (0.1%)
German:	2 (0.4%)
Greek:	1 (0.1%)
Russian:	8 (1.7%)
Polish:	15 (3.1%)
Other Slavic Languages:	1 (0.2%)
Other Indo-European Lanugages:	3 (0.7%)
Non-English Speaking:	52 (10.8%)

Place of Birth for the Foreign-Born	
Country	**Persons**
Foreign-Born Population:	34
Europe:	23 (67.6%)
Asia:	6 (18.5%)
Americas:	5 (13.8%)
United Kingdom:	4 (11.3%)
Ireland:	1 (2.6%)
France:	1 (1.9%)
Italy:	2 (5.6%)
Poland:	8 (23.2%)
Russia:	1 (1.6%)
Ukraine:	4 (11.5%)
Other Eastern Europe:	3 (9.9%)
Other Central Eastern Asia:	6 (18.5%)
El Salvador:	1 (4%)
Guatemala:	1 (1.9%)
Chile:	0 (1.2%)
Other South America:	0 (1.4%)
Canada:	2 (5.4%)

Income	
Income Breakdown	**Households (%)**
Less than $15,000:	37 (18.3%)
$15,000 - $25,000:	13 (6.4%)
$25,000 - $50,000:	61 (30.6%)
$50,000 - $75,000:	44 (21.9%)
Greater than $75,000:	58 (28.8%)

Tenure	
Tenure Breakdown	**Households (%)**
Occupied Housing Units:	201 (100.0%)
Owner Occupied:	183 (91.4%)
Renter Occupied	17 (8.6%)

EJ-3 Demographic Analysis of 1 mile circle

Overview					
Total Persons:	1214	Land Area:	99.2%	Households in Area:	494
Population Density:	386.2 /sq mi	Water Area:	0.8%	Housing Units in Area:	515
Percent Minority:	.5%	Persons Below Poverty Level:	69 (5.7%)	Households on Public Assistance:	11
Percent Urban:	94%	Housing Units Built <1970:	23%	Housing Units Built <1950:	8%

Race and Age*			
(* Columns that add up to 100% are highlighted)			
Race Breakdown	**Persons (%)**	**Age Breakdown**	**Persons(%)**
White:	1208 (99.5%)	Child 5 years or less:	72 (5.9%)
African-American:	0 (0.0%)	Minors 17 years and younger:	224 (18.5%)
Hispanic-Origin:	5 (0.4%)	Adults 18 years and older:	990 (81.5%)
Asian/Pacific Islander:	0 (0.0%)	Seniors 65 years and older:	286 (23.5%)
American Indian:	1 (0.1%)	*This space intentionally left blank*	
Other Race:	5 (0.4%)		
Multiracial:	0 (0.0%)		

Gender	
Gender Breakdown	**Persons (%)**
Males:	594 (48.9%)
Females:	620 (51.1%)

Education	
Education Level (Persons 25 & older)	**Persons (%)**
Less than 9th grade:	89 (10.6%)
9th -12th grade:	125 (14.8%)
High School Diploma:	304 (35.9%)
Some College/2 yr:	82 (9.7%)
B.S./B.A. or more:	245 (29.0%)

Language	
Ability to Speak English	**Persons (%)**
Population Age 5 and Over:	1147
Speak only English:	1080 (94.2%)
Non-English at Home:	67 (5.8%)
Speak English very well:	58 (5.1%)
Speak English well:	9 (0.8%)
Speak English not well:	0 (0.0%)
Speak English not at all:	0 (0.0%)
Speak English less than well:	0 (0.0%)

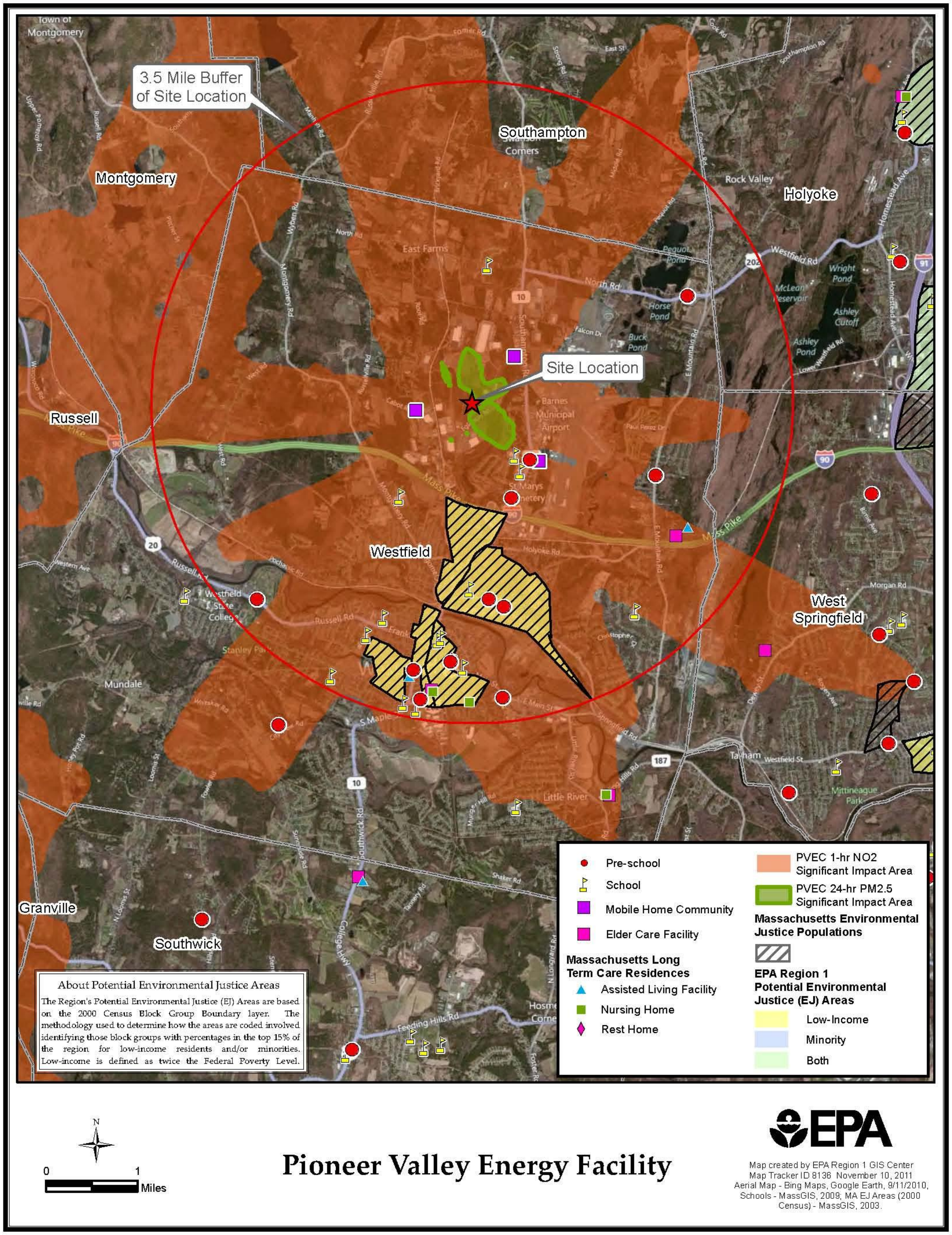
Language Spoken	
Language Spoken	**Persons (%)**
Speak only English:	1103 (88.9%)
Spanish or Spanish Creole:	33 (2.7%)
French (incl. Patois, Cajun):	15 (1.2%)
French Creole:	2 (0.1%)
Portuguese or Portuguese Creole:	0 (0.0%)
German:	4 (0.4%)
Greek:	2 (0.1%)
Russian:	24 (1.9%)
Polish:	37 (3.0%)
Other Slavic Languages:	3 (0.2%)
Hindi:	1 (0.0%)
Other Indo-European Lanugages:	8 (0.6%)
Japanese:	0 (0.0%)
Korean:	0 (0.0%)
Arabic:	0 (0.0%)
Non-English Speaking:	138 (11.1%)

Place of Birth for the Foreign-Born	
Country	**Persons**
Foreign-Born Population:	90
Europe:	61 (67.4%)
Asia:	17 (18.7%)
Americas:	13 (13.9%)
United Kingdom:	9 (10.4%)
Ireland:	2 (2.3%)
Austria:	0 (.1%)
France:	2 (1.7%)
Germany:	0 (.1%)
Greece:	0 (.1%)
Italy:	5 (5.5%)
Portugal:	0 (.1%)
Poland:	20 (21.9%)
Belarus:	0 (.1%)
Russia:	3 (2.9%)
Ukraine:	11 (12.3%)
Other Eastern Europe:	9 (10%)
Japan:	0 (.1%)
Korea:	0 (.1%)
India:	0 (.5%)
Other Central Eastern Asia:	16 (17.8%)
Lebanon:	0 (.1%)
Barbados:	0 (.1%)
Dominican Republic:	0 (.3%)
El Salvador:	3 (3.6%)
Guatemala:	2 (1.7%)
Chile:	1 (1.1%)
Other South America:	1 (1.3%)
Canada:	5 (5.9%)

Income	
Income Breakdown	**Households (%)**
Less than $15,000:	90 (18.1%)
$15,000 - $25,000:	32 (6.5%)
$25,000 - $50,000:	151 (30.7%)
$50,000 - $75,000:	109 (22.0%)
Greater than $75,000:	140 (28.4%)

Tenure	
Tenure Breakdown	**Households (%)**
Occupied Housing Units:	494 (100.0%)
Owner Occupied:	449 (90.9%)
Renter Occupied	45 (9.1%)

EJ-4: Map with 3.5-mile circle, NO_2 SIA, and locations of interest



EJ-5 (demographic analysis of 3.5-mile circle

Overview					
Total Persons:	25204	Land Area:	97.2%	Households in Area:	9518
Population Density:	673.37 /sq mi	Water Area:	2.8%	Housing Units in Area:	9994
Percent Minority:	9.2%	Persons Below Poverty Level:	3398 (14.1%)	Households on Public Assistance:	466
Percent Urban:	83%	Housing Units Built <1970:	63%	Housing Units Built <1950:	38%

Race and Age*

(* Columns that add up to 100% are highlighted)

Race Breakdown	Persons (%)		Age Breakdown	Persons(%)	
White:	23678	(93.9%)	Child 5 years or less:	1957	(7.8%)
African-American:	274	(1.1%)	Minors 17 years and younger:	6190	(24.6%)
Hispanic-Origin:	1689	(6.7%)	Adults 18 years and older:	19014	(75.4%)
Asian/Pacific Islander:	114	(0.5%)	Seniors 65 years and older:	3406	(13.5%)
American Indian:	45	(0.2%)	*This space intentionally left blank*		
Other Race:	750	(3.0%)			
Multiracial:	343	(1.4%)			

Gender

Gender Breakdown	Persons (%)	
Males:	12323	(48.9%)
Females:	12881	(51.1%)

Education

Education Level (Persons 25 & older)	Persons (%)
Less than 9th grade:	1047 (7.2%)
9th -12th grade:	1780 (12.2%)
High School Diploma:	5597 (38.5%)
Some College/2 yr:	2798 (19.2%)
B.S./B.A. or more:	3322 (22.8%)

Language	
Ability to Speak English	**Persons (%)**
Population Age 5 and Over:	23495
Speak only English:	20016 (85.2%)
Non-English at Home:	3479 (14.8%)
Speak English very well:	1651 (7.0%)
Speak English well:	874 (3.7%)
Speak English not well:	777 (3.3%)
Speak English not at all:	176 (0.8%)
Speak English less than well:	954 (4.1%)

Language Spoken	
Language Spoken	**Persons (%)**
Speak only English:	19766 (85.8%)
Spanish or Spanish Creole:	1033 (4.5%)
French (incl. Patois, Cajun):	230 (1.0%)
French Creole:	19 (0.1%)
Portuguese or Portuguese Creole:	33 (0.1%)
German:	57 (0.2%)
Other West Germanic Languages:	11 (0.0%)
Scandinavian Languages:	2 (0.0%)
Greek:	62 (0.3%)
Russian:	659 (2.9%)
Polish:	428 (1.9%)
Serbo-Croatian:	90 (0.4%)
Other Slavic Languages:	317 (1.4%)
Armenian:	2 (0.0%)
Persian:	1 (0.0%)
Hindi:	36 (0.2%)
Other Indo-European Lanugages:	51 (0.2%)
Chinese:	8 (0.0%)
Japanese:	22 (0.1%)
Korean:	6 (0.0%)
Mon-Khmer, Cambodian:	10 (0.0%)
Vietnamese:	6 (0.0%)
Tagalog:	9 (0.0%)

Other Native North American Languages:	5 (0.0%)
Arabic:	23 (0.1%)
Hebrew:	2 (0.0%)
Non-English Speaking:	3271 (14.2%)

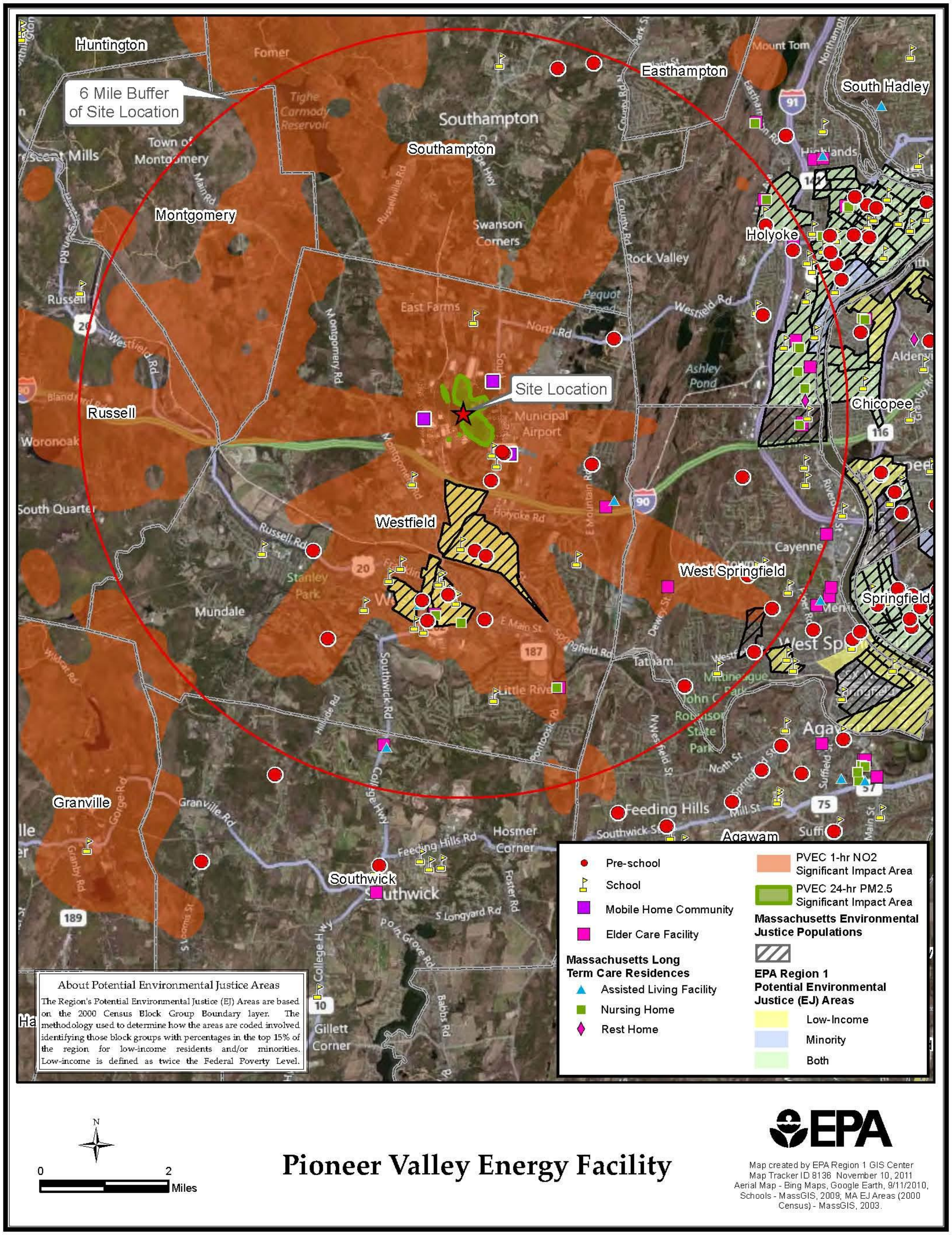
Place of Birth for the Foreign-Born	
Country	**Persons**
Foreign-Born Population:	1989
Europe:	1512 (76%)
Asia:	260 (13.1%)
Africa:	5 (.2%)
Oceania:	0 (0%)
Americas:	213 (10.7%)
United Kingdom:	78 (3.9%)
Ireland:	20 (1%)
Sweden:	0 (0%)
Other Northern Europe:	1 (0%)
Austria:	8 (.4%)
France:	14 (.7%)
Germany:	42 (2.1%)
Netherlands:	3 (.1%)
Greece:	27 (1.3%)
Italy:	91 (4.6%)
Portugal:	9 (.4%)
Spain:	3 (.1%)
Czechoslavakia:	0 (0%)
Poland:	262 (13.2%)
Belarus:	8 (.4%)
Russia:	252 (12.7%)
Ukraine:	473 (23.8%)
Yugoslavia:	15 (.7%)
Other Eastern Europe:	209 (10.5%)
Mainland China:	3 (.2%)
Taiwan:	0 (0%)
Japan:	6 (.3%)
Korea:	11 (.5%)
India:	35 (1.8%)
Iran:	1 (0%)
Pakistan:	0 (0%)
Other Central Eastern Asia:	153 (7.7%)
Cambodia:	6 (.3%)

Indonesia:	11 (.6%)
Philippines:	10 (.5%)
Vietnam:	10 (.5%)
Lebanon:	11 (.6%)
Other Eastern Africa:	0 (0%)
Egypt:	0 (0%)
South Africa:	0 (0%)
Other Western Africa:	2 (.1%)
Australia:	0 (0%)
Other Australian and New Zealand Subregion:	0 (0%)
Micronesia:	0 (0%)
Barbados:	7 (.3%)
Dominican Republic:	16 (.8%)
Jamaica:	14 (.7%)
Mexico:	0 (0%)
Costa Rica:	0 (0%)
El Salvador:	17 (.8%)
Guatemala:	8 (.4%)
Argentina:	0 (0%)
Brazil:	6 (.3%)
Chile:	5 (.2%)
Colombia:	2 (.1%)
Ecuador:	2 (.1%)
Venezuela:	1 (0%)
Other South America:	6 (.3%)
Canada:	129 (6.5%)

Income	
Income Breakdown	**Households (%)**
Less than $15,000:	1788 (18.8%)
$15,000 - $25,000:	1092 (11.5%)
$25,000 - $50,000:	2810 (29.5%)
$50,000 - $75,000:	2065 (21.7%)
Greater than $75,000:	1808 (19.0%)

Tenure	
Tenure Breakdown	**Households (%)**
Occupied Housing Units:	9518 (100.0%)
Owner Occupied:	5864 (61.6%)
Renter Occupied	3655 (38.4%)

EJ-6 (map with 6-mile circle, NO_2 SIA, and locations of interest)



EJ-7 (demographic analysis of 6-mile circle)

Overview					
Total Persons:	74361	Land Area:	97.5%	Households in Area:	28320
Population Density:	674.24 /sq mi	Water Area:	2.5%	Housing Units in Area:	29518
Percent Minority:	11.1%	Persons Below Poverty Level:	7308 (10.3%)	Households on Public Assistance:	1111
Percent Urban:	85%	Housing Units Built <1970:	64%	Housing Units Built <1950:	33%

Race and Age*			
(* Columns that add up to 100% are highlighted)			
Race Breakdown	**Persons (%)**	**Age Breakdown**	**Persons(%)**
White:	68269 (91.8%)	Child 5 years or less:	5377 (7.2%)
African-American:	1076 (1.4%)	Minors 17 years and younger:	17616 (23.7%)
Hispanic-Origin:	5943 (8.0%)	Adults 18 years and older:	56744 (76.3%)
Asian/Pacific Islander:	580 (0.8%)	Seniors 65 years and older:	11291 (15.2%)
American Indian:	84 (0.1%)	*This space intentionally left blank*	
Other Race:	3313 (4.5%)		
Multiracial:	1040 (1.4%)		

Gender	
Gender Breakdown	**Persons (%)**
Males:	36015 (48.4%)
Females:	38346 (51.6%)

Education	
Education Level (Persons 25 & older)	**Persons (%)**
Less than 9th grade:	2774 (6.3%)
9th -12th grade:	5071 (11.4%)
High School Diploma:	15823 (35.6%)
Some College/2 yr:	9133 (20.6%)
B.S./B.A. or more:	11586 (26.1%)

Language	
Ability to Speak English	**Persons (%)**
Population Age 5 and Over:	69850
Speak only English:	59452 (85.1%)
Non-English at Home:	10398 (14.9%)
Speak English very well:	6082 (8.7%)
Speak English well:	2212 (3.2%)
Speak English not well:	1544 (2.2%)
Speak English not at all:	560 (0.8%)
Speak English less than well:	2104 (3.0%)

Language Spoken	
Language Spoken	**Persons (%)**
Speak only English:	59452 (85.1%)
Spanish or Spanish Creole:	4811 (6.9%)
French (incl. Patois, Cajun):	940 (1.3%)
French Creole:	25 (0.0%)
Portuguese or Portuguese Creole:	242 (0.3%)
German:	152 (0.2%)
Other West Germanic Languages:	20 (0.0%)
Scandinavian Languages:	9 (0.0%)
Greek:	143 (0.2%)
Russian:	1037 (1.5%)
Polish:	1274 (1.8%)
Serbo-Croatian:	159 (0.2%)
Other Slavic Languages:	435 (0.6%)
Armenian:	6 (0.0%)
Persian:	15 (0.0%)
Hindi:	55 (0.1%)
Urdu:	21 (0.0%)
Other Indic Languages:	0 (0.0%)
Other Indo-European Lanugages:	130 (0.2%)
Chinese:	76 (0.1%)
Japanese:	51 (0.1%)
Korean:	24 (0.0%)
Mon-Khmer, Cambodian:	59 (0.1%)

Miao, Hmong:	8 (0.0%)
Vietnamese:	60 (0.1%)
Other Asian Languages:	16 (0.0%)
Tagalog:	42 (0.1%)
Other Native North American Languages:	12 (0.0%)
Hungarian:	10 (0.0%)
Arabic:	168 (0.2%)
Hebrew:	6 (0.0%)
African Languages:	25 (0.0%)
Non-English Speaking:	10398 (14.9%)

Place of Birth for the Foreign-Born	
Country	**Persons**
Foreign-Born Population:	4670
Europe:	3046 (65.2%)
Asia:	804 (17.2%)
Africa:	83 (1.8%)
Oceania:	6 (.1%)
Americas:	730 (15.6%)
United Kingdom:	196 (4.2%)
Ireland:	85 (1.8%)
Sweden:	1 (0%)
Other Northern Europe:	7 (.2%)
Austria:	18 (.4%)
France:	33 (.7%)
Germany:	213 (4.6%)
Netherlands:	7 (.1%)
Other Western Europe:	13 (.3%)
Greece:	51 (1.1%)
Italy:	182 (3.9%)
Portugal:	115 (2.5%)
Spain:	8 (.2%)
Czechoslavakia:	8 (.2%)
Hungary:	10 (.2%)
Poland:	695 (14.9%)
Belarus:	23 (.5%)
Russia:	359 (7.7%)
Ukraine:	693 (14.8%)
Bosnia and Herzegovina:	24 (.5%)
Yugoslavia:	23 (.5%)

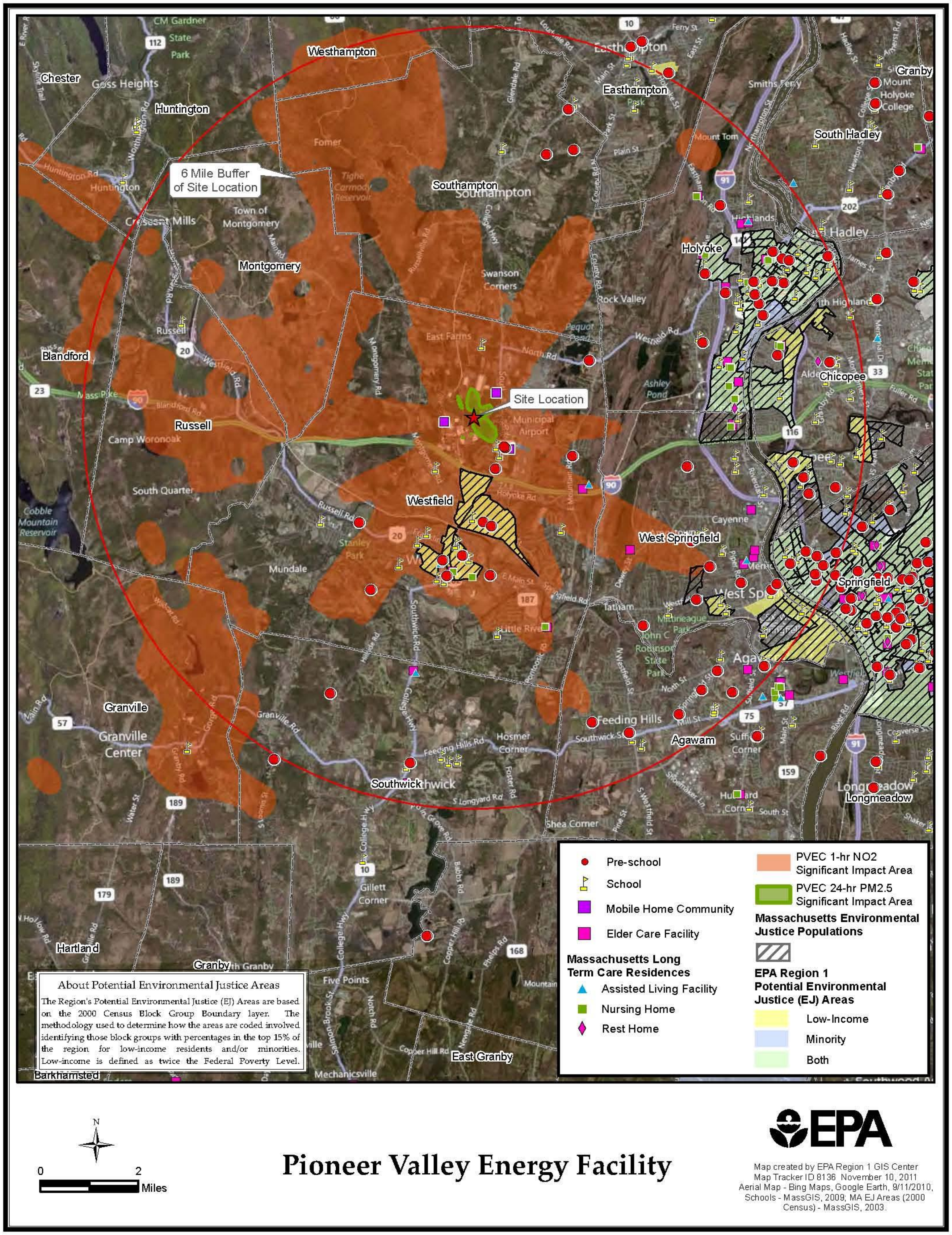
Other Eastern Europe:	283 (6.1%)
Mainland China:	33 (.7%)
Hong Kong:	11 (.2%)
Taiwan:	8 (.2%)
Japan:	23 (.5%)
Korea:	73 (1.6%)
India:	65 (1.4%)
Iran:	22 (.5%)
Pakistan:	21 (.5%)
Other Central Eastern Asia:	247 (5.3%)
Cambodia:	31 (.7%)
Indonesia:	16 (.4%)
Laos:	8 (.2%)
Philippines:	58 (1.2%)
Vietnam:	76 (1.6%)
Jordan:	22 (.5%)
Lebanon:	39 (.8%)
Syria:	5 (.1%)
Turkey:	9 (.2%)
Other Western Asia:	10 (.2%)
Other Eastern Africa:	22 (.5%)
Egypt:	11 (.2%)
South Africa:	0 (0%)
Ghana:	2 (.1%)
Nigeria:	24 (.5%)
Other Western Africa:	6 (.1%)
Australia:	0 (0%)
Other Australian and New Zealand Subregion:	6 (.1%)
Micronesia:	0 (0%)
Barbados:	13 (.3%)
Cuba:	8 (.2%)
Dominican Republic:	37 (.8%)
Jamaica:	47 (1%)
Trinidad Tobago:	4 (.1%)
Other Caribbean:	3 (.1%)
Mexico:	8 (.2%)
Costa Rica:	0 (0%)
El Salvador:	28 (.6%)
Guatemala:	28 (.6%)
Panama:	3 (.1%)
Argentina:	30 (.6%)
Brazil:	32 (.7%)
Chile:	5 (.1%)

Colombia:	41 (.9%)
Ecuador:	10 (.2%)
Guyana:	4 (.1%)
Venezuela:	15 (.3%)
Other South America:	32 (.7%)
Canada:	383 (8.2%)

Income	
Income Breakdown	**Households (%)**
Less than $15,000:	4337 (15.3%)
$15,000 - $25,000:	3208 (11.3%)
$25,000 - $50,000:	8001 (28.3%)
$50,000 - $75,000:	6450 (22.8%)
Greater than $75,000:	6351 (22.4%)

Tenure	
Tenure Breakdown	**Households (%)**
Occupied Housing Units:	28320 (100.0%)
Owner Occupied:	19158 (67.6%)
Renter Occupied	9163 (32.4%)

EJ-8 (map with 8-mile circle, NO_2 SIA, and locations of interest)



EJ-9 (demographic analysis of 8-mile circle)

Overview					
Total Persons:	166413	Land Area:	97.1%	Households in Area:	64551
Population Density:	852.08 /sq mi	Water Area:	2.9%	Housing Units in Area:	68010
Percent Minority:	21.9%	Persons Below Poverty Level:	25252 (15.7%)	Households on Public Assistance:	3913
Percent Urban:	91%	Housing Units Built <1970:	69%	Housing Units Built <1950:	39%

Race and Age*			
(* Columns that add up to 100% are highlighted)			
Race Breakdown	**Persons (%)**	**Age Breakdown**	**Persons(%)**
White:	138703 (83.3%)	Child 5 years or less:	13137 (7.9%)
African-American:	4048 (2.4%)	Minors 17 years and younger:	42796 (25.7%)
Hispanic-Origin:	29700 (17.8%)	Adults 18 years and older:	123617 (74.3%)
Asian/Pacific Islander:	1648 (1.0%)	Seniors 65 years and older:	23964 (14.4%)
American Indian:	246 (0.1%)	*This space intentionally left blank*	
Other Race:	18319 (11.0%)		
Multiracial:	3449 (2.1%)		

Gender	
Gender Breakdown	**Persons (%)**
Males:	79740 (47.9%)
Females:	86673 (52.1%)

Education	
Education Level (Persons 25 & older)	**Persons (%)**
Less than 9th grade:	8877 (9.0%)
9th -12th grade:	14279 (14.4%)
High School Diploma:	35607 (36.0%)
Some College/2 yr:	19293 (19.5%)
B.S./B.A. or more:	20797 (21.0%)

Language	
Ability to Speak English	**Persons (%)**
Population Age 5 and Over:	155611
Speak only English:	118547 (76.2%)
Non-English at Home:	37064 (23.8%)
Speak English very well:	20883 (13.4%)
Speak English well:	8046 (5.2%)
Speak English not well:	5610 (3.6%)
Speak English not at all:	2525 (1.6%)
Speak English less than well:	8135 (5.2%)

Language Spoken	
Language Spoken	**Persons (%)**
Speak only English:	118547 (76.2%)
Spanish or Spanish Creole:	23763 (15.3%)
French (incl. Patois, Cajun):	2817 (1.8%)
French Creole:	45 (0.0%)
Portuguese or Portuguese Creole:	984 (0.6%)
German:	372 (0.2%)
Yiddish:	1 (0.0%)
Other West Germanic Languages:	43 (0.0%)
Scandinavian Languages:	16 (0.0%)
Greek:	265 (0.2%)
Russian:	1869 (1.2%)
Polish:	3456 (2.2%)
Serbo-Croatian:	198 (0.1%)
Other Slavic Languages:	556 (0.4%)
Armenian:	16 (0.0%)
Persian:	21 (0.0%)
Gujarathi:	16 (0.0%)
Hindi:	73 (0.0%)
Urdu:	101 (0.1%)
Other Indic Languages:	30 (0.0%)
Other Indo-European Lanugages:	222 (0.1%)
Chinese:	324 (0.2%)
Japanese:	135 (0.1%)

Korean:	79 (0.1%)
Mon-Khmer, Cambodian:	101 (0.1%)
Miao, Hmong:	12 (0.0%)
Thai:	9 (0.0%)
Laotian:	12 (0.0%)
Vietnamese:	235 (0.2%)
Other Asian Languages:	80 (0.1%)
Tagalog:	104 (0.1%)
Other Pacific Island Languages:	1 (0.0%)
Other Native North American Languages:	28 (0.0%)
Hungarian:	18 (0.0%)
Arabic:	277 (0.2%)
Hebrew:	15 (0.0%)
African Languages:	65 (0.0%)
Non-English Speaking:	37064 (23.8%)

Place of Birth for the Foreign-Born	
Country	**Persons**
Foreign-Born Population:	10509
Europe:	6083 (57.9%)
Asia:	1923 (18.3%)
Africa:	149 (1.4%)
Oceania:	10 (.1%)
Americas:	2343 (22.3%)
United Kingdom:	310 (3%)
Ireland:	163 (1.5%)
Sweden:	7 (.1%)
Other Northern Europe:	15 (.1%)
Austria:	33 (.3%)
France:	67 (.6%)
Germany:	407 (3.9%)
Netherlands:	14 (.1%)
Other Western Europe:	35 (.3%)
Greece:	93 (.9%)
Italy:	334 (3.2%)
Portugal:	645 (6.1%)
Spain:	20 (.2%)
Czechoslavakia:	19 (.2%)
Hungary:	18 (.2%)

Poland:	1674 (15.9%)
Belarus:	95 (.9%)
Russia:	667 (6.3%)
Ukraine:	1006 (9.6%)
Bosnia and Herzegovina:	52 (.5%)
Yugoslavia:	42 (.4%)
Other Eastern Europe:	368 (3.5%)
Mainland China:	139 (1.3%)
Hong Kong:	44 (.4%)
Taiwan:	19 (.2%)
Japan:	96 (.9%)
Korea:	135 (1.3%)
India:	170 (1.6%)
Iran:	32 (.3%)
Pakistan:	73 (.7%)
Other Central Eastern Asia:	416 (4%)
Cambodia:	69 (.7%)
Indonesia:	29 (.3%)
Laos:	32 (.3%)
Philippines:	126 (1.2%)
Thailand:	4 (0%)
Vietnam:	256 (2.4%)
Israel:	0 (0%)
Jordan:	50 (.5%)
Lebanon:	62 (.6%)
Syria:	19 (.2%)
Turkey:	37 (.4%)
Other Western Asia:	57 (.5%)
Other Eastern Africa:	43 (.4%)
Egypt:	11 (.1%)
South Africa:	1 (0%)
Ghana:	5 (0%)
Nigeria:	49 (.5%)
Sierra Leone:	5 (0%)
Other Western Africa:	6 (.1%)
Australia:	4 (0%)
Other Australian and New Zealand Subregion:	6 (.1%)
Micronesia:	0 (0%)
Barbados:	34 (.3%)
Cuba:	32 (.3%)
Dominican Republic:	286 (2.7%)
Jamaica:	95 (.9%)
Trinidad Tobago:	25 (.2%)

Other Caribbean:	13 (.1%)
Mexico:	152 (1.5%)
Costa Rica:	8 (.1%)
El Salvador:	54 (.5%)
Guatemala:	43 (.4%)
Honduras:	2 (0%)
Panama:	18 (.2%)
Other Central America:	6 (.1%)
Argentina:	59 (.6%)
Brazil:	58 (.6%)
Chile:	5 (0%)
Colombia:	260 (2.5%)
Ecuador:	42 (.4%)
Guyana:	15 (.1%)
Peru:	12 (.1%)
Venezuela:	52 (.5%)
Other South America:	71 (.7%)
Canada:	1000 (9.5%)
Other North America:	0 (0%)

Income	
Income Breakdown	**Households (%)**
Less than $15,000:	13092 (20.3%)
$15,000 - $25,000:	8221 (12.7%)
$25,000 - $50,000:	18658 (28.9%)
$50,000 - $75,000:	12977 (20.1%)
Greater than $75,000:	11691 (18.1%)

Tenure	
Tenure Breakdown	**Households (%)**
Occupied Housing Units:	64551 (100.0%)
Owner Occupied:	37422 (58.0%)
Renter Occupied	27129 (42.0%)