Chapter 6 Air Quality

6.1 INTRODUCTION

This chapter assesses the potential operational air quality impacts of the No Action and the Build Alternative. Baseline conditions are first established by describing the applicable air pollutants for analysis as well as the relevant air quality standards, the air quality attainment status of the study area, and the most recent representative monitored ambient air quality data.

While the Build Alternative will affect both local and regional air quality levels, this analysis focuses on estimating potential localized air quality impacts in order to determine whether the emissions from operation of the Build Alternative would significantly impact air quality levels at nearby sensitive land uses (which are also referred to as “sensitive receptors”). There are two project components that could potentially affect air quality: Project Component A and Project Component F.

Preferred Alternative Project Component A includes the Main Facility with five natural gas-fired turbines, one steam-driven turbine which recycles heat waste as power, and two black-start engines. Under normal operating conditions, it is expected that up to four natural gas-fired turbines would operate continuously, with the fifth turbine acting as a back-up, and to allow for maintenance activities. For the air quality analysis, it was assumed that all five natural gas turbines would be operating continuously, to provide a conservative approach to the analysis. The steam-driven turbine would not contribute to air emissions as it has no emissions. The Main Facility of the microgrid (Preferred Alternative Project Component A) will be designed to operate during both normal conditions and emergency conditions, when the commercial grid is not available. The two black-start engines at the Main Facility would consist of natural gas-fired reciprocating engines that would drive two generators with an output of approximately 2.5MW each, which would only be used in emergency conditions to start the gas-fired turbines and would be run one hour per month for testing and maintenance under normal operating conditions. During emergency conditions, when the need for very precise power output is higher, the emission control systems may not be fully operational, but emissions generated by the proposed facility during an emergency would likely be offset by a reduction in emissions from the commercial plants that would be offline, and not contributing to regional emission levels. On a regional basis, it is anticipated that the effects of Preferred Alternative Project Component A of the Build Alternative on air quality would not be significant, as only clean burning natural gas and efficient and Best Available Technology combustion equipment and emission control devices would be used. In addition, the microgrid will be designed to operate in parallel with the commercial grid, providing dedicated power for railroad operations, thereby potentially offsetting commercial power grid supplies and reducing air emissions from the commercial grid to some extent under normal and emergency operating conditions.

Preferred Alternative Project Component F includes a nanogrid at HBLR Headquarters on Caven Point Avenue in Jersey City that will provide emergency power to the southern portion of the HBLR independently of the microgrid during emergencies only. The nanogrid would be energized by two approximately 2MW generators to provide emergency power run by two natural gas-fired reciprocating engines. During normal conditions, both engines of the nanogrid would only be run for maintenance once a month for one hour. During emergency conditions, the nanogrid in Preferred Alternative Project Component F would be in full-time operation, but the commercial grid would not be producing power for the HBLR (Preferred Alternative Project Component G [i.e., by definition these would not be receiving power from the commercial grid], so emissions from operating the nanogrid during emergencies would be partially offset by the reduction in emissions from the reduced output of the commercial grid.

The methodologies and assumptions used to assess the potential localized air quality impacts of Preferred Alternative Project Component A of the Build Alternative are discussed below (and in detail in Appendix B, "Air Quality Technical Appendix"), and a summary of the results of these analyses is provided in this chapter. Because nanogrid engines for Preferred Alternative Project Component F and the black-start engines would only be used during emergency conditions, their assessments are discussed briefly in this chapter, but not included in the detailed air quality analysis presented in Appendix B, "Air Quality Technical Appendix." Potential air quality impacts related to construction activities are presented in Chapter 17, "Construction Effects."

6.2 REGULATORY CONTEXT

6.2.1 Air Pollutants for Analysis

Several air pollutants have been identified by the EPA as being of concern nationwide. These pollutants, known as "criteria pollutants," are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). Ambient concentrations of CO are predominantly influenced by motor vehicle activity (i.e., mobile sources). Emissions of volatile organic compounds (VOCs) and nitrogen oxides (NOx) are associated with both mobile and stationary sources (e.g., industrial facilities, power plants, etc.). These can react to form O_3, which is the main constituent of smog. NO_2 is emitted from both mobile and stationary sources. Emissions of SO_2 are associated mainly with stationary sources. Emissions of particulate matter are associated mainly with stationary sources and diesel-fueled mobile sources (e.g., heavy trucks and buses). Lead emissions, which historically were principally influenced by motor vehicle activity, have been substantially reduced due to the elimination of lead from gasoline. Hazardous air pollutants (HAPs), also known as toxic air pollutants or air toxics, are emitted from both mobile and stationary sources, as well as natural sources (e.g., volcanic eruptions and forest fires). HAPs are pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. Ambient concentrations of each of these air pollutants will be impacted by the proposed project, and each of these air pollutants from the proposed Project are evaluated in this chapter.

Carbon Monoxide

CO is a colorless and odorless gas that is generated in the urban environment primarily by the incomplete combustion of fossil fuels in motor vehicles. In New Jersey, most of the CO emissions are from motor vehicles. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, or heart disease. CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban "street canyon" conditions.

VOCs, Nitrogen Oxides, and Photochemical Oxidants (Ozone)

VOCs are emitted principally from the storage, handling, and use of fossil fuels. NOx constitutes a class of compounds that include NO_2 and nitric oxide, both of which are emitted by motor vehicles (e.g., cars, trucks and buses, and off-road equipment) and stationary sources (e.g., power plants). In addition to contributing to the formation of ground-level O_3 and fine particle pollution, NO_2 is linked with a number of adverse effects on the respiratory system. Both VOCs and NOx are also of concern because most of those compounds react in sunlight to form photochemical oxidants, including O_3. This reaction occurs comparatively slowly and ordinarily takes place far downwind from the site of actual pollutant emission sources. O_3 is a colorless toxic gas that interferes with the transfer of oxygen in the bloodstream, depriving sensitive tissues (e.g., brain and heart) of oxygen. The effects of VOCs, NOx, and O_3 are eye, nose, and throat irritation, as well as headaches, loss of coordination, and nausea. Long-term exposure may increase the risk of contracting respiratory diseases, such as asthma or chronic obstructive pulmonary disease.

Particulate Matter

Particulate matter is a broad class of air pollutants that exist as liquid droplets or solids, with a wide range of sizes and chemical composition. Particulate matter is emitted by a variety of sources, both natural and man-made. Natural sources include the condensed and reacted forms of natural organic vapors, salt particles resulting from the evaporation of sea spray, wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and debris from live and decaying plant and animal life, particles eroded from beaches, desert, soil and rock, and particles from volcanic and geothermal eruptions and forest fires. Major man-made sources of particulate matter include the combustion of fossil fuels such as vehicular exhaust, power generation and home heating, chemical and manufacturing processes, all types of construction (including that from equipment exhaust and re-entrained dust), agricultural activities, and wood-burning fireplaces. Fine particulate matter is also derived from combustion material that has volatilized and then condensed to form primary particulate matter (often after release from a stack or exhaust pipes) or from precursor gases reacting in the atmosphere to form secondary particulate matter. It is also derived from mechanical breakdown of coarse particulate matter (e.g., from building demolition or roadway surface wear). Of particular health concern are those particles that are smaller than or equal to 10 microns (PM_{10}) in size and 2.5 microns ($PM_{2.5}$) in size. The principal health effects of airborne particulate matter are on the respiratory system.

Sulfur Oxides

High concentrations of SO_2 affect breathing and may aggravate existing respiratory and cardiovascular disease. SO_2 emissions are generated from the combustion of sulfur-containing fuels (e.g., oil and coal) largely from stationary sources such as coal and oil-fired power plants, steel mills, refineries, pulp and paper mills, and nonferrous smelters. In urban areas, especially in the winter, smaller stationary sources such as residential boilers contribute to elevated SO_2 levels. Ambient SO_2 levels recorded in the area have complied with ambient air quality standards for over twenty years.

Lead

Lead emissions are principally associated with industrial sources and motor vehicles using gasoline containing lead additives. Lead poisoning can cause abdominal pain, constipation, headaches, irritability, memory problems, and tingling in the hands and feet. As the availability of leaded gasoline has decreased, motor vehicle-related lead emissions have decreased resulting in a significant decline of concentrations of lead and atmospheric lead concentrations in the region are well below national standards. Lead emissions are not expected to result from the burning of natural gas. Since natural gas turbines generate minimal amounts of lead emissions, an analysis of lead is not warranted.

Hazardous Air Pollutants

EPA is working with state and local governments to reduce air emissions of 187 toxic air pollutants, also known as HAPs, to the environment. These pollutants could be carcinogenic and/or damage the immune system, as well as cause neurological, reproductive (e.g., reduced fertility), developmental, respiratory and other health problems. Examples of toxic air pollutants include benzene, which is found in gasoline; perchloroethylene, which is emitted from some dry-cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by several industries. Examples of other listed air toxics include dioxin, asbestos, toluene, and metals such as cadmium, mercury, chromium, and lead compounds.

6.2.2 National/State Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS) are concentrations for each of the criteria pollutants specified by EPA that have been developed primarily to protect human health. Secondary standards have been developed to protect the nation's welfare and account for the effect of air pollution on soil, water, vegetation and other aspects of general welfare. Based on how these pollutants adversely affect health, health-related averaging periods have also been established for these pollutants. These standards, together with their health-related averaging periods, are presented in Table 6-1.

New Jersey's ambient air quality standards are similar to the NAAQS but include a 12-month and a 24-hour secondary standard for SO_2; and 12-month and 24-hour primary and secondary standards for total suspended particulate matter. These were not considered in this analysis because the project's impacts on these pollutants over these time periods are considered to be minimal, but they will be considered as part of the Title V permitting process.

Table 6-1 National Ambient Air Quality Standards (NAAQS)

	Primary		Secondary	
	ppm	µg/m³	ppm	µg/m³
Carbon Monoxide (CO)				
8-Hour Average [(1)]	9	10,000	None	
1-Hour Average [(1)]	35	40,000		
Lead (Pb)				
Rolling 3-Month Average	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [(2)]	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [(3)]	0.070	150	0.070	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [(1)]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean	NA	12	NA	15
24-Hour Average [(4)]	NA	35	NA	35
Sulfur Dioxide (SO_2)				
1-Hour Average [(5)]	0.075	196	NA	NA
Maximum 3-Hour Average [(1)]	NA	NA	0.50	1,300

Notes:

ppm – parts per million (unit of measure for gases only)
µg/m³ – micrograms per cubic meter (unit of measure for gases and particles, including lead)
NA – not applicable
All annual periods refer to calendar year.
Standards are defined in ppm. Approximately equivalent concentrations in µg/m³ are presented.

(1) Not to be exceeded more than once a year.
(2) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration, which is equivalent to the 8th highest concentration. Effective April 12, 2010.
(3) 3-year average of the annual fourth highest daily maximum 8-hr average concentration. EPA has lowered the NAAQS down from 0.075 ppm effective December 2015.
(4) Not to be exceeded by the annual 98th percentile (which is equivalent to the 8th highest concentration) when averaged over 3 years.
(5) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010. 3-year average of the annual 99th percentile daily maximum 1-hr average concentration (which is equivalent to the 15th highest concentration).

Source: National Primary and Secondary Ambient Air Quality Standards, 40 CFR 50 § [1970].

6.2.3 Attainment Designations

EPA has designated areas of the country as meeting (attainment) or not meeting (nonattainment) for the NAAQS on a pollutant by pollutant basis – these areas are known as attainment and nonattainment areas. Also, previously designated nonattainment areas that have demonstrated attainment are known as maintenance areas. When an area is designated as nonattainment by EPA, the state is required to develop and implement a State Implementation Plan (SIP), which delineates how a state plans to achieve air quality that meets the NAAQS under the deadlines established by the Clean Air Act (CAA), followed by a plan for maintaining attainment status once the area is in attainment.

6.2.4 Nonattainment New Source Review and Prevention of Significant Deterioration (NNSR/PSD) Increments

Projects that emit pollutants in nonattainment areas are required to offset emissions (i.e., reduce emissions elsewhere to compensate for emissions generated), and dispersion modeling is usually required to demonstrate that no new exceedances would occur and/or that the existing exceedance would not be exacerbated. Emissions are reviewed under the "Nonattainment New Source Review" (NNSR) program, which requires strict emission controls meeting the Lowest Achievable Emission Rate (LAER) with no regard to cost. The need for emission offsets is also determined as part of the permitting process.

PSD increments are the amounts of pollution an attainment/maintenance area is allowed to increase. PSD increments prevent the air quality in clean areas from deteriorating to the level set by the NAAQS. The NAAQS is a maximum allowable concentration "ceiling." A PSD increment, on the other hand, is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration (usually an existing condition concentration) for a pollutant. Significant deterioration is said to occur in an attainment area when the amount of new pollution would cause an exceedance of an applicable PSD increment. It is important to note, however, that pollutant levels are not permitted to deteriorate beyond the concentrations allowed by the applicable NAAQS regardless of the PSD increment. Air dispersion computer modeling is used to demonstrate compliance with PSD increments.

The proposed Project includes portions of Bergen, Essex, and Hudson Counties. All three counties are part of the Northern New Jersey-New York-Connecticut area designated as moderate non-attainment for ozone and maintenance for CO and $PM_{2.5}$. The area is in attainment for NO_2, SO_2, and PM_{10}.

Emissions of O_3 precursors (NOx and VOCs) will require LAER emission controls and offsets; however, since O_3 impacts are felt far downwind of an emission source, dispersion modeling for O_3 is not required under NNSR/PSD. The applicable PSD increments for these designations are provided in Table 6-2. Dispersion modeling has been performed to confirm compliance with the PSD increments and NAAQS.

Table 6-2 Applicable PSD Increments (µg/m³)

Pollutant	Averaging Period	PSD Increment
$PM_{2.5}$	24-hr Annual	9 4
PM_{10}	24-hr Annual	30 17
NO_2	Annual	25
SO_2	3-hr 24-hr Annual	512 91 20

Note: No PSD increments have been developed for CO, 1-hour NO_2, or 1-hour SO_2.
Source: 40 C.F.R. 52.21 [1990] - Prevention of Significant Deterioration of Air Quality, last amended March 30, 2011.

6.2.5 Applicable Emissions Regulations

Federal regulations applicable to a new power generating facility include the EPA's Title V and NNSR/PSD Emissions Offset Rule permitting requirements. In addition, New Source Performance Standards (NSPS) have been promulgated that establish allowable emission rates on a pollutant-by-pollutant basis that apply to all new fuel combustion systems. Also, EPA has developed Maximum Achievable Control Technology (MACT) standards to reduce the effects of HAPs generated by industry by establishing emission limits based on air toxic emission levels already achieved by the best-performing similar facilities.

EPA has delegated authority to administer these programs to the NJDEP. Applicable State regulations provided in the N.J.A.C. include SOTA criteria and RACT requirements. Additional N.J.A.C. regulations that may be applicable to the proposed facility include Title 7, Chapter 27, Subchapters 8 (N.J.A.C. § 7:27-8 Permits and Certificates for Minor Facilities and Major Facilities without an Operating Permit), 18 (N.J.A.C. § 7:27-18 Emission Offset Rules), and 22 (N.J.A.C. § 7:27-22 Title V Operating Permits).

In addition, in accordance with NJDEP permitting policy, all new or modified sources of air pollution applying for pre-construction or operating permits are required to conduct a risk assessment for air toxics if they emit certain amounts of these contaminants. As such, an air toxics analysis was conducted in accordance with New Jersey's Risk Assessment for Air Contaminant Emissions contained in NJDEP's Technical Manual 1003.

In general, Transportation and/or General Conformity requirements apply to proposed major projects in nonattainment or maintenance areas. However, the Build Alternative is exempt from these requirements (for both operation and construction) since NJ TRANSIT is designing it to conform with the approved emissions budget for the area through the Title V permitting process (see 40 CFR 93.153(d)(1)). Consultation with NJDEP on the Title V permitting process has been initiated and is ongoing.

6.2.6 Emission Control Requirements of Applicable Regulations

An operating permit is a comprehensive regulatory document that is enforceable. It lists all air pollution sources including combustion equipment, air pollution control devices, and the rules and regulations that apply to the facility as well as operational requirements, emission limits, and monitoring and reporting requirements. Permitting requirements are determined by the type of source, operation of the source, potential emissions, and the location of the facility.

Emission control technologies are required on a pollutant-by-pollutant basis under the NNSR/PSD program. If a proposed facility is classified as a “major” facility for a pollutant in a nonattainment area, the use of LAER technology (i.e., with no regard to costs) and emission offsets may be required for that pollutant. If the plant’s permitted emissions are estimated to be below the threshold limits for pollutants in attainment with NAAQS, less restrictive best available control technology (BACT) requirements will apply to that pollutant. BACT/LAER determinations will be completed for the selected turbine types and sizes based on an analysis of the EPA database of recent permits, and BACT/LAER analyses of recent NNSR/PSD applications. These requirements will be determined by NJDEP on a case-by-case basis.

Emission controls may also be required under the MACT and NSPS programs based on the type of emission source, and to meet New Jersey’s RACT and SOTA requirements.

Based on estimated emission rates of the preferred equipment configuration for the Build Alternative, it is anticipated that the use of Dry Low NOx (DLN) combustion, SCR, and oxidation catalyst systems will be required to successfully permit the proposed facility in accordance with NJDEP and EPA requirements. These technologies, which will be incorporated into the design of the microgrid and are assumed for this analysis, substantially reduce NOx and CO emissions and cause smaller reductions in VOC and HAP emissions. A wet injection system, which was not assumed for this analysis, may also be included to further reduce NOx emissions. Per the NJDEP Emission Offset Rule, N.J.A.C § 7:27-18, if NOx emissions exceed the 25 tons per year threshold level and is located in a non-attainment area for that criteria pollutant, then a one-time NOx emission credit purchase will be required to obtain a Title V permit. The final emission control requirements will be determined as part of the Title V permitting process.

6.2.7 Conformity with State Implementation Plans

The conformity requirements of the CAA and regulations promulgated thereunder (conformity requirements) limit the ability of federal agencies to assist, fund, permit, and approve projects in non-attainment or maintenance areas that do not conform to each applicable SIP. When subject to this regulation, the lead federal agency is responsible for demonstrating conformity of its proposed action. Conformity determinations for federal actions related to transportation plans, programs, and projects which are implemented, funded, or approved under title 23 U.S.C. or the Federal Transit Act (49 U.S.C. 1601 et seq.) must be made in accordance with 40 CFR § 93 Subpart A (federal transportation conformity regulations). Conformity determinations for all other federal actions must be made according to the requirements of 40 CFR § 93 Subpart B (federal general conformity regulations).

Federal actions with the Federal Transit Administration (FTA) as the lead agency are subject to the transportation conformity regulations. An area's Metropolitan Planning Organization (MPO), together with the state, is responsible for demonstrating conformity with respect to the regional Transportation Improvement Programs (TIP). A TIP outlines the transportation projects proposed for the region over a five-year period. The analysis of transportation conformity for projects listed in the TIP includes the entire transportation network and all projects that are classified as regionally significant.

Conformity needs to be addressed for each pollutant of concern in a non-attainment or maintenance area affected by a federal action. Conforming actions would not:

- Cause or contribute to any new violation of any standard in any area;
- Interfere with provisions in the applicable SIP for maintenance of any standard;
- Increase the frequency or severity of any existing violation of any standard in any area; or
- Delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

According to the transportation conformity regulations, federal actions whose criteria pollutant emissions have already been included in the local SIP's attainment or maintenance demonstrations are assumed to conform to the SIP.

6.3 AFFECTED ENVIRONMENT

6.3.1 Meteorology and Climate

Local meteorological and topographical features influence the dispersion of plumes from the plant's exhaust stacks and greatly affect the impacts of a plant's emissions. To account for these factors in this analysis, five years of data collected by the National Weather Service at Newark Airport were used in the modeling analyses for this project to represent the types of meteorological conditions (wind directions, wind speeds, temperatures, mixing heights, etc.) experienced in the study area. The topography surrounding the project site was also included.

The dominant feature of the atmospheric circulation over North America is the broad, undulating flow from west to east across the middle latitudes of the continent. These "prevailing westerlies" shift north and south and vary in strength during the year, exerting a major influence on the weather throughout the State. Local meteorological data show that the prevailing wind directions are from the southwest and north. Lighter winds are most frequently from the southeast quadrant, while higher wind speeds are most often associated with westerly winds. Terrain in the study area is relatively flat and marshy. To the northeast are ridges oriented roughly in a south-southwest to north-northeast direction. They rise to an elevation of about 200 feet at 4.5 to 5 miles and to 500 to 600 feet at 7 to 8 miles.

6.3.2 Monitored Ambient Pollutant Levels

Representative monitored ambient air quality data for the project area are shown in Table 6-3. These data, which were, in general, collected from ambient monitoring stations closest to the Main Facility

(Preferred Alternative Project Component A), were used to develop the baseline data used in the modeling analyses. These baseline values were then added to predicted project impacts under the Build Alternative to estimate total pollutant concentrations.

These data were compiled by the NJDEP and are for the years 2013 through 2015, the latest calendar years for which data are currently available. Except for O_3, the monitored levels for all pollutants do not exceed national or State ambient air quality standards.

Table 6-3 Representative Monitored Ambient Air Quality Data for Criteria Pollutants 2015 to 2017

Pollutants and Averaging Times	Monitored Data				NAAQS	Monitoring Site Location
	2015	2016	2017	3 Year Avg		
Carbon monoxide (ppm) 8-hour (2nd Max)	1.6	1.4	1.1	NA	9	2828 Kennedy Blvd Jersey City, NJ
1-hour (2nd Max)	2.1	1.9	1.7	NA	35	2828 Kennedy Blvd Jersey City, NJ
Nitrogen dioxide (ppb) 1-hour (98th percentile) Annual (ppb)	57 16.53	58 16.26	56 15.04	57 NA	100 53	Veterans Park on Newark Bay, 25th Street near Park Road, Bayonne, NJ
PM_{10} ($\mu g/m^3$) 24-Hour (2nd Max)	43	32	32	NA	150	Consolidated Firehouse 355 Newark Avenue Jersey City, NJ
$PM_{2.5}$ ($\mu g/m^3$) Annual Arithmetic Mean	9.0	9.5	8.14	8.4	12	Consolidated Firehouse 355 Newark Avenue Jersey City, NJ
$PM_{2.5}$ ($\mu g/m^3$) 24-Hour (98th percentile)	25.7	19.2	18.5	21	35	Health Department 714 31st Street Union City, NJ
Sulfur dioxide (ppb) 1-hour (99th percentile)	5	4	4	4	75	Veterans Park on Newark Bay, 25th Street near Park Road, Bayonne, NJ
Sulfur dioxide (ppb) 3-hour (2nd max)		4	3	3	NA	Veterans Park on Newark Bay, 25th Street near Park Road, Bayonne, NJ
Sulfur dioxide (ppb) 24-hour (2nd max)		2	1	0	NA	
Sulfur dioxide (ppb) Annual		0	0	0	NA	
Lead (ug/m3) 3-month average		0	0	0	NA	

Notes:
1. NA = not applicable; ppb = parts per billion.

Source: NJDEP (Letter dated March 12, 2019).

6.4 ANALYSIS METHODOLOGY FOR THE MAIN FACILITY

6.4.1 Dispersion Model

The EPA Atmospheric Dispersion Modeling (AERMOD) model, which was used in this analysis, is a steady-state dispersion model that is most often used to estimate pollutant concentrations to determine compliance with regulatory requirements. The latest version of EPA's AERMOD stationary sources air quality dispersion model (version 16216r; USEPA, 2017) was employed to predict ambient pollutant concentrations resulting from the range of equipment configurations for the Build Alternative of the Main Facility (Project Component A) using reasonable worst-case assumptions. The model was utilized in this analysis in accordance with the NJDEP Division of Air Quality Technical Manual 1002, *Guideline on Air Quality Impact Modeling Analysis* (NJDEP 2009). Highlights of the modeling approach include the following:

- While multiple equipment and building configurations have been considered, the option of a large enclosed Main Facility building was assumed for this analysis. This option would affect local wind flow dispersion patterns the least, resulting in a more conservative pollutant concentration near the site boundary.
- Inputs to the model for the dispersion modeling analysis include the location and stack parameters of the five gas turbine stacks located on the roof of the main heating plant building; heating plant parameters for downwash calculations; calculated emission rates and stack parameters under each equipment configuration; five consecutive years of meteorological data (to capture typical and atypical weather characteristics); background pollutant concentrations; and applicable information on nearby land use and topography.
- The analysis was conducted using regulatory default options such as elevated terrain algorithms, calm processing routines, missing data processing routines, and the use of a 4-hour half-life for exponential decay of SO_2 for urban sources.
- An urban dispersion surface roughness length was applied in the model based on the land use and population density in a two-mile radius from the site (as required by Air Quality Technical Manual 1002).
- While not required by the Air Quality Technical Manual 1002, a broader receptor grid with a conservative five-mile radius from the site was also used to evaluate air quality.
- The AERMOD Building Profile Input Parameters algorithm was employed to estimate building profile input parameters for downwash effect calculations.
- This analysis applied the $PM_{2.5}$ special procedure incorporated into AERMOD, which calculates concentrations at each receptor for each year modeled, averages those concentrations across the number of years of data, and then selects the highest values across all receptors of the five-year averaged highest values.

- Analyses were conducted employing the downwash algorithm of the AERMOD model. This algorithm accounts for the effects of wind flows around physical structures.
- Equipment configurations that were examined included simple-cycle plants (i.e., only natural gas turbines), combined-cycle plants (i.e., natural gas turbines with heat recovery systems to run steam turbines), and a combination of the two configurations (i.e., some natural gas turbines with and some without heat recovery systems to run steam turbines).
- Results are particularly affected under design options with steam turbines that capture exhaust heat due to a lower stack exit temperature and exit velocity. For this analysis, two configurations of five natural gas turbines were modeled. A simple-cycle plant was evaluated, and a combined-cycle plant with heat recovery on all natural gas turbines to run two steam turbines was evaluated. While the addition of the heat recovery system and steam turbines would not increase the amount of emissions, it would change the dispersion of the emissions in the atmosphere. The current project design includes one steam turbine, which would reduce stack exit temperatures to a lesser extent, which would have a lower effect on nearby ground-level emissions concentrations.
- Additional applicable parameters incorporated into the modeling analysis, such as surface characteristics and land use, are discussed in the Air Quality Technical Appendix.

6.4.2 Receptors

Receptor sites (i.e., locations at which pollutant concentrations are estimated through dispersion modeling analyses) were selected at locations anticipated to be most impacted by emissions from the proposed Project. Receptor grids consisting of more than 14,000 discrete receptors and 700 boundary receptors were developed specifically for this analysis that contains five nested (overlapping) Cartesian grids. The grids have a total land coverage of 10 miles by 10 miles (16 kilometers by 16 kilometers) centered around the Main Facility (see Figure 4 in Appendix B). The Main Facility would be located approximately 0.7 miles from the nearest residential buildings in Jersey City, New Jersey, and approximately 2.7 miles from the nearest residential buildings in the Town of Kearny, New Jersey.

The following receptor grids were developed:

- Boundary receptors = 7.6 meters (m) (25 feet) spacing around the perimeter of the Project Development Area, delineating the area to which the public will not have access;
- Inner grid = 25 m (82 feet) spacing out to a distance of 500 m (1,641 feet);
- Second grid = 50 m (164 feet) spacing out to a distance of 1,000 m (3,281 feet);
- Third grid = 100 m (328 feet) spacing out to a distance of 5,000 m (3.1 miles); and
- Fourth grid = 250 m (820 feet) spacing out to a distance of 8,000 m (5 miles).

The 25-meter inner receptor spacing grid was extended to provide higher resolution in the vicinity of peak predicted impacts. For NO_2, the fourth grid was extended to a distance of 8,000 meters (five miles) from the Main Facility, with 250-meter spacing, in order to define the Significant Impact Area for this pollutant.

6.4.3 Stack Heights

The EPA Building Profile Input Program (BPIP) (EPA 1995) produces the model input information necessary to account for building wake effects, based on the dimensions of buildings in the vicinity of the stacks. The Plume Rise Model Enhancement (PRIME) version of BPIP (BPIPPRM) (Schulman et al. 2000) was used with the AERMOD atmospheric dispersion modeling system. BPIP uses a digitized blueprint of the facility's buildings and stacks as well as other nearby, existing structures.

Based on preliminary design, the height of the turbine exhaust stacks was evaluated at 150 feet above ground surface.

6.4.4 Air Toxics

Pollutants

The EPA AP-42 (Compilation of Air Pollutant Emissions Factors) lists numerous toxic pollutants associated with burning natural gas that have the potential to be emitted from the natural gas-fired combustion turbines. Of the toxic air pollutants emitted from combustion turbines, eleven individual toxic pollutants – acetaldehyde, acrolein, benzene, 1,3-butadiene, benzo(a)pyrene, ethylbenzene, formaldehyde, naphthalene, propylene oxide, toluene, xylenes – and a group of Polycyclic Aromatic Hydrocarbons (PAHs) are identified as potential pollutants. (EPA 2000)

Short-term and annual emission rates were estimated for each of eleven pollutants based on AP-42 emission factors and the heat input of turbines (with each natural gas turbine rated at 237 million British Thermal Units [MMBtu]/hour heat input). Annual emission rates are based on 8,760 hours of continuous operation per year, with five 22MW natural gas turbines, which would result in the greatest potential (i.e., worst-case) emission rate. Estimated hourly and annual emission rates of each pollutant together with computed hazardous quotients and cancer risks are provided in the Air Quality Technical Appendix.

Assessment Methodology

NJDEP utilizes two approaches to perform risk assessment for the Air Quality Permitting Program: risk screening and comprehensive risk assessment. Risk screening consists of a simplified first-level (conservative) screening procedure, and, if adverse health impacts are predicted, a more detailed second-level screening is required. First-level risk screening uses generalized worst-case assumptions and simple worksheet calculations to estimate cancer and noncancer risks from inhalation of emissions proposed in a permit application. In place of dispersion modeling, air impact values are used to estimate dispersion and dilution of emitted pollutants, and the resulting ambient air concentrations. For detailed analyses, EPA's AERMOD dispersion model is used following the same methodologies used for the criteria pollutant analysis.

The "NJDEP Division of Air Quality Risk Screening Worksheet for Long-Term Carcinogenic and Noncarcinogenic Effects and Short-Term Effects" was used for this first-level risk screening. The details of the methodologies used for both the screening-level and detailed analyses used for this project are provided in the Air Quality Technical Appendix.

6.5 EMISSION RATES OF THE MAIN FACILITY

Under the No Action Alternative, the microgrid facility would not be constructed and NJ TRANSIT and Amtrak would continue to rely on the existing commercial grid for traction power in the core service territory. The potential benefits to regional air quality, including possible reduced levels of criteria pollutants that would result from using clean burning natural gas and efficient modern equipment, would not be realized.

Preliminary estimates have been made to predict short-term and annual emission rates that would be generated by the gas-fired turbines under the Build Alternative and evaluated both a simple-cycle plant (with five 22MW natural gas turbines) and a combined-cycle plant (with five 22MW natural gas turbines, and steam-driven turbines). These emission rates were then used to determine whether the impacts of these conservative design configurations have the potential to significantly impact localized air quality levels. The conservative design configurations were used to evaluate the emission rates to determine the potential for significant impacts to localized air quality. These conservative design configurations assume full time operation of all equipment, which is not the anticipated normal operating scenario.

6.5.1 Worst-Case Combined-Cycle Emission Rates

The emission sources responsible for most of the potential emissions from this configuration are the five natural gas turbines. Maximum emission rates from these turbines under peak load conditions, therefore, are the focus of this worst-case atmospheric dispersion modeling analysis. It is assumed that all five turbines would operate 8,760 hours per year under full load. Subsequent modeling for the Title V permit will include consideration of operations over a range of turbine loads and operating scenarios.

Short-term and annual emissions of all pollutants from the proposed equipment have been estimated based upon emission factors associated with the application of LAER DLN+SCR control technology for

NOx, CO, and VOCs (HAPS); oxidation catalyst systems; NJDEP's SOTA emission standards; EPA's AP-42 emission factor for SO_2; and EPA's recently developed $PM_{2.5}$/PM_{10} emission factors. The PM emission factors used in this analysis are based on recent studies developed by EPA in 2010. It is estimated by the project's engineers that each gas-turbine will consume up to 237 MMBtu/hour of heat input and use SCR (per NJDEP SOTA) to control CO, NOx, and other emissions.

Emission rates estimated for the applicable pollutants as well as the stack parameters used in the analysis for the combined-cycle units are summarized in Table 6-4. The simple-cycle units would have a higher stack exit velocity, which would result in a lower impact to air quality.

Table 6-4 Stack Parameters and Per Unit Emission Rates Used in the Analysis of the Combined-Cycle Units*

Parameter	Units	Combined-Cycle
Fuel Type		Natural Gas
Ambient Temperature	degrees Kelvin	293 (68°F)
Percent Load Rate	%	100
Duct Burner Operation		No
Stack Diameter	feet	10
Stack Heights	feet	150
Stack Temperature	°F	300
Stack Exit Velocity	feet/second	33
NOx Emission Rate	grams/second	0.29
$PM_{2.5}$ Emission Rate	grams/second	0.0126
PM_{10} Emission Rate	grams/second	0.0152
SO_2 Emission Rate	grams/second	0.0179
CO Emission Rate	grams/second	0.209

* Data are per turbine

While it is possible that short-term emission rates would be higher under emergency conditions because the emission control systems may not be fully operational during these conditions, emergency conditions are not normally quantified because the number of times such a condition would occur, and the duration of each occurrence, is unknown. In addition, emissions generated by the proposed facility during an emergency would likely be offset by a reduction in emissions from the commercial plants that would be offline, and not contributing to regional emission levels.

6.6 ASSESSMENT OF POTENTIAL AIR QUALITY IMPACTS FROM THE MAIN FACILITY

6.6.1 No Action Alternative

Under the No Action Alternative, the microgrid would not be constructed and NJ TRANSIT and Amtrak would continue to rely on the commercial grid for traction power in the core service territory, which includes facilities that burn oil and coal. The potential benefits to regional air quality, including possible reduced levels of criteria pollutants that would result from using clean burning natural gas and efficient modern equipment would not be realized. The benefits provided by the proposed 0.6MW solar generating facility at Preferred Alternative Project Component A would also not be realized.

6.6.2 Worst-Case Combined-Cycle Plant

The results of the modeling analysis are summarized in Table 6-5 and discussed below.

$PM_{2.5}$ Results

As shown in Table 6-5, the maximum estimated 24-hour and annual $PM_{2.5}$ impacts are less than the allowable PSD increments of 9 µg/m^3 and 4 µg/m^3, respectively. The maximum estimated total concentration, which includes the background concentration, is less than the 24-hour $PM_{2.5}$ NAAQS of 35 µg/m^3. The total annual $PM_{2.5}$ concentration with added background concentration is less than the annual $PM_{2.5}$ NAAQS of 12 µg/m^3. As such, the maximum potential impact of the $PM_{2.5}$ emissions is not considered to be significant.

PM_{10} Results

The maximum estimated 24-hour impact is less than the allowable PSD increment of 30 µg/m^3, and the maximum estimated total concentration is less than the 24-hour PM_{10} NAAQS of 150 µg/m^3. As such, the potential impact of the PM_{10} emissions is not considered to be significant.

NO_2 Results

The results of the analysis demonstrate compliance with 1-hour NO_2 NAAQS. The 8th highest daily maximum 1-hour NO_2 total concentration (which corresponds with the 98th percentile level, as defined in Table 6-1, with the added background concentration) is less than the 1-hour NO_2 NAAQS of 188 µg/m^3. In addition, the total annual NO_2 concentration, with added background concentration, is also less than the annual NO_2 NAAQS of 100 µg/m^3. As such, the potential impact of the NO_2 emissions is not considered to be significant.

CO and SO_2 Results

The results of the analysis for these pollutants are that the estimated maximum concentrations are below the applicable NAAQS for these pollutants. As such, the potential impacts of the CO and SO_2 emissions are not considered to be significant.

Therefore, the air quality impacts of the proposed facility emissions for the worst-case combined-cycle plant with five 22MW natural gas turbines are not considered to be significant.

Table 6-5 Maximum Predicted Pollutant Impacts for the Worst-Case Combined-Cycle Plant (µg/m³)

Pollutant	Averaging Period	Max Impact	Background Concentration	Total Conc.	NAAQS	Applicable PSD Increment
$PM_{2.5}$	24-hr	0.91	26	26.9	35	9
	Annual	0.14	10.4	10.5	12	4
PM_{10}	24-hr	1.1	41	42.1	150	30
	Annual	Negligible (1)	N/A (2)	N/A	N/A	17
NO_2	1-hr	26.8	107 (3)	133.8	188	N/A
	Annual	3.2	16.6 (3)	19.8	100	25
SO_2	1-hr	1.7	20.9	22.6	196	N/A
	3-hr	Negligible (4)	N/A	N/A	N/A	512
	24-hr	Negligible (4)	N/A	N/A	N/A	91
	Annual	Negligible (4)	N/A	N/A	N/A	20
CO	8-hr	18.1	1,889	1,907	10,000	N/A

Notes:

(1) Negligible based on the results of the 24-hour analysis.

(2) N/A = not applicable

(3) ppm values shown in Table 6-3 were converted to µg/m³.

(4) Negligible based on the results of the 1-hour analysis.

Based on the results of the modeling analysis of the worst-case scenario (i.e., the combined-cycle plant), no significant adverse air quality impacts would occur from the operation of the Main Facility for the Build Alternative. The results of the modeling analysis indicate that the Build Alternative would not result in criteria pollutant concentrations above the federal NAAQS or result in project impacts that exceed PSD increment levels since emission control technology for applicable pollutants is being incorporated into the design of the Main Facility. While it is possible that short-term emission rates would be higher under emergency conditions because the emission control systems may not be fully operational during emergencies, emergency conditions are not normally quantified because the number of times such a condition would occur, and the duration of each occurrence, is unknown. In addition, emissions generated by the proposed facility during an emergency would likely be offset by a reduction in emissions from the commercial plants that would be offline, and not contributing to regional emission levels.

6.7 ASSESSMENT OF POTENTIAL AIR TOXICS IMPACTS OF THE MAIN FACILITY

A conservative, screening-level HAPS analysis was conducted, as per NJDEP guidance, which assumed that all emissions from the turbines would be released from five 150-foot tall stacks, and that these units would be operating 8,760 hours per year. Both potential short-term effects and long-term risks were estimated.

The results of the short-term HAPS screening analysis, which are provided in the Air Quality Technical Appendix, show that the short-term hazard quotient (representing non-carcinogenic health effects) for each of the pollutants is less than 1. As such, the estimated short-term ambient impact is expected to be less than the reference concentration; therefore, the short-term non-carcinogenic health effect is negligible, and no further analysis is required.

The results of the long-term screening analysis, which are provided in the Air Quality Technical Appendix, indicate that long-term non-carcinogenic health effects are also negligible. However, results of the long-term HAPS screening-level analysis show that cancer risks for two carcinogens: formaldehyde (which account for about two-thirds of all HAPS emissions); and benzo(a)pyrene, which represents the group of PAHs, exceed the guideline value of one in a million. Because the first-level risk screening results exceed the guideline values, a more detailed analysis was conducted. This detailed analysis, using the AERMOD model, more accurately estimates ambient air concentrations by using anticipated annual operations, actual stack and source-specific data, and actual meteorological data.

According to EPA AP-42, *Compilation of Air Pollutant Emission Factors*, Section 3.1, *Stationary Gas Turbines*, utilizing an oxidation catalyst for CO emission control could also reduce HAPS emissions, particularly formaldehyde, by approximately 85 to 90 percent. Similar emission reductions are also applicable, as per EPA, for other VOC/HAPS pollutants. Because of uncertainties regarding the exact percent of control, and for the conservative purpose of this analysis, a lower control efficiency of 80 percent was applied to conservatively estimate formaldehyde (as well as benzo(a)pyrene) emissions impacts.

An analysis of formaldehyde, using the AERMOD model, was conducted for the more conservative combined-cycle plant configuration. The results were that the estimated cancer risk of formaldehyde would be less than the one-per-million EPA/NJDEP threshold. To estimate the benzo(a)pyrene cancer risk, the annual concentration of the benzo(a)pyrene was proportionally estimated from the concentration of the formaldehyde. The results were that the incremental cancer risk of benzo(a)pyrene was estimated to be less than one-per-million. Therefore, no significant impact of the VOC/HAPS emissions on either a short-term or annual basis is predicted based upon regulatory definitions.

6.8 ASSESSMENT OF BLACK-START ENGINE EMISSIONS

The Main Facility will include two natural gas-fired reciprocating engines, which would run two generators to provide start-up power for the Main Facility if no power is available from the commercial grid and the main turbines are not operating. Except for testing and maintenance, the engines would only be run long enough to start the Main Facility during emergencies.

While emissions would be generated from the engines, no quantitative air quality analysis was conducted for the black-start engines for the following reasons:

- With a small exception for testing purposes, the black-start engines would not operate under normal conditions. They would only operate under emergency conditions, which are not usually quantitatively considered in air quality analyses.

- During emergency operations, the emissions from the black-start engines would be offset by the reduction in emissions from the commercial power system, which, by definition, would not be supplying power to commercial customers in the area.

- Under normal conditions, each engine would only operate for maintenance purposes for only one hour per month. These short-term emissions would not measurably affect daily and annual criteria pollutant levels.

As such, the two natural gas-fired black-start engines at the Main Facility would not have a significant impact on air quality.

6.9 ASSESSMENT OF NANOGRID EMISSIONS

The nanogrid will be powered by two natural gas-fired reciprocating engines, which would run two generators to provide power to the southern portion of the HBLR. The engines would only be run full-time during emergencies, when commercial power was not available to the substations of the HBLR (Project Component G).

While emissions would be generated from the engines, no quantitative air quality analysis was conducted for the nanogrid for the following reasons:

- With a small exception for testing purposes, the nanogrid would not operate under normal conditions. It would only operate for extended periods under emergency conditions, which are not usually quantitatively considered in air quality analyses.

- During emergency operations, the emissions from the nanogrid would be offset by the reduction in emissions from the commercial power system, which, by definition, would not be supplying power to the substations of the HBLR (Project Component G).

- Under normal conditions, each engine would only operate for maintenance purposes for one hour per month. These short-term emissions would not measurably affect daily and annual criteria pollutant levels.

- As the nanogrid will be located several miles from the Main Facility, the impact of the nanogrid emissions during normal (testing) conditions on the maximum estimated air quality impacts of the microgrid emissions will be negligible.

As such, the two natural gas-fired engines for the nanogrid would not have a significant impact on air quality. This feature will be included in the Title V permit.

6.10 CONFORMITY WITH STATE IMPLEMENTATION PLANS

As an FTA action, the proposed Project is subject to federal transportation conformity regulations, but the proposed Project elements are not subject to federal general conformity regulations. The proposed Project is included in the Fiscal Year (FY) 2018-2021 TIP prepared by the North Jersey Transportation

Planning Authority (NJTPA), the authorized Metropolitan Planning Organization for the 13-county northern New Jersey region. In collaboration with the Interagency Consultation Group (ICG)[9, 10], the NJTPA has determined that the FY 2018-2021 Transportation Improvement Program for northern New Jersey conforms to the SIPs established by the New Jersey Department of Environmental Protection (NJDEP). The proposed Project was included in the TIP as an exempt project for the engineering, design, right-of-way acquisition, and construction phases, under NJTPA exemption code "MT6" for construction or renovation of power, signal, and communications systems. This addresses federal transportation conformity regulations. Stationary source emissions associated with the Main Facility will be accounted for in the applicable SIPs via the NNSR program, which is included in the New Jersey SIP. Therefore, as the proposed Project is included in a conforming TIP and would be subject to the NNSR program, no further conformity determination is warranted.

6.11 SUMMARY OF SIGNIFICANT ADVERSE IMPACTS AND MITIGATION MEASURES

As designed, the preferred equipment option of the Build Alternative for the Main Facility (Preferred Alternative Project Component A) would not cause significant air quality impacts; therefore, no mitigation is needed for this component. Any impact on air quality would be minimized through use of modern technology and could be further offset by reduced demand from the commercial power generation plant. While it is possible that short-term emission rates would be higher under emergency conditions because the emission control systems may not be fully operational during these conditions, emissions generated by the proposed facility during an emergency would likely be offset by a reduction in emissions from the commercial plants that would be offline, and not contributing to regional emission levels. Additional emission reduction controls technologies, however, may be incorporated into the proposed Project's design during the facility's Title V permitting process to further reduce emissions, which could reduce the NOx credits needed to be purchased for emissions greater than 25 tons per year.

Additionally, neither the normal operation nor the emergency operation of the reciprocating engines for the black-start engines at the Main Facility (Preferred Alternative Project Component A) or the nanogrid (Preferred Alternative Project Component F) would cause significant air quality impacts; therefore, no mitigation is needed for these components.

[9] The Interagency Consultation Group (ICG) is a group of stakeholders consisting of state and federal agency representatives empowered to guide the transportation conformity process, review and approve the conformity demonstration's assumptions and methodology, and fulfill the federal requirement of interagency consultation.

[10] EPA and USACE are Cooperating Agencies and NJDEP and other Federal and local agencies are Participating Agencies for the proposed Project. Cooperating and Participating Agencies and other stakeholders were involved through the scoping process, through regulatory coordination, and participation on the Technical Advisory Committee and will continue to be involved as the project moves forward.