Chapter 7: Air Quality, Greenhouse Gas Emissions, and Resilience

7.1 INTRODUCTION

Emissions from stationary sources, mobile sources, and construction sources, all have the potential to affect air quality. This chapter presents the analysis of the potential construction-related and operational effects of the No Action Alternative and the Preferred Alternative on air quality emissions in the Study Area in accordance with transportation and general conformity requirements of the Clean Air Act (CAA).

This chapter also presents the analysis of the effects of the Preferred Alternative on greenhouse gas (GHG) emissions, and discusses the Preferred Alternative's conformity to the current New York City and New York State emission reduction goals and policies as laid out in *OneNYC* and the Climate Leadership and Community Protection Act (CLCPA), respectively. In addition, this chapter includes an analysis of the effects of climate change on the Preferred Alternative related to resilience to future severe weather events, and the effects of climate change from the Preferred Alternative due to GHG emissions generated by the construction and operation of the Preferred Alternative.

7.2 REGULATORY FRAMEWORK

In accordance with the CAA (42 U.S.C. § 7401 et seq.), the United States Environmental Protection Agency (USEPA) established primary and secondary National Ambient Air Quality Standards (NAAQS) for six criteria air pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, respirable particulate matter (PM) [both $PM_{2.5}$ and PM_{10}], sulfur dioxide (SO_2), and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The CAA, as amended in 1990, includes a definition for non-attainment areas (NAA) which are geographic regions that do not meet one or more of the NAAQS. When an area is designated as non-attainment by USEPA, the state is required to develop and implement a State Implementation Plan (SIP), which identifies how a state plans to attain and maintain compliance with the NAAQS under the deadlines established by the CAA. **Table 7-1** summarizes the attainment status in New York City.

The general conformity requirements of the CAA and its implementing regulations (40 CFR part 93 subpart B) limit the ability of federal agencies to assist, fund, permit, and approve projects in non-attainment and maintenance areas where the action's direct and indirect emissions have the potential to impact one or more of the six criteria air pollutants or their precursor pollutants at rates equal to or exceeding prescribed *de minimis* thresholds.

Table 7-1
Attainment Status in New York City

Pollutant	Averaging Period	Attainment Status
CO	1-Hour, 8-Hour	Attainment[1]
PM_{10}	24-Hour	Non-attainment (Moderate)
$PM_{2.5}$	Annual, 24-Hour	Attainment[2]
O_3	8-Hour	Non-attainment (Serious)
NO_2	Annual, 1-Hour	Attainment, Unclassified
SO_2	1-Hour	Attainment

Notes:
1 USEPA redesignated the New York City Metropolitan area as in attainment for the 1-hour and 8-hour CO NAAQS in 2002. The area is currently under a second maintenance plan.
2 USEPA redesignated the New York area as in attainment for the 1997 annual and 24-hour NAAQS effective April 18, 2014. The area is now under maintenance plans.

As discussed in the *CEQR Technical Manual*,[1] climate change is projected to have wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be felt at the local level. New York State and New York City have each established sustainability initiatives and goals for greatly reducing GHG emissions and for adapting to climate change.

Per the *CEQR Technical Manual,* the citywide GHG reduction goal is currently the most appropriate standard by which to analyze a project under CEQR. The *CEQR Technical Manual* recommends that a GHG consistency assessment be undertaken for any project preparing an environmental impact statement expected to result in the greatest potential to produce GHG emissions that may result in inconsistencies in the City's GHG reduction goal. Accordingly, a GHG consistency assessment is provided.

Additionally, the *CEQR Technical* Manual recommends the potential effects of global climate change on the proposed project are also considered for project with portions of the proposed project constructed or operated within the current and/or future floodplain.

The pollutants for analysis, the NAAQS, attainment status and state implementation plan, and the transportation and general conformity requirements of the CAA are all described in detail in **Appendix B**, "Methodology Report," Chapter 4, "Air Quality, Greenhouse Gas Emissions, and Resilience," Section A, "Pollutants for Analysis," and Section B, "Regulatory Context."

7.3 ANALYSIS METHODOLOGY

This EIS analyzed the potential for local air quality impacts from operational and construction-related sources at sensitive locations within a Study Area extending to at least 400 feet from the Project Site. The Study Area for mobile sources relates directly to the Study Area used for the construction transportation analysis presented in Chapter 6, "Transportation." The Study Area for this resource category includes the Project Site and extends outward to include routes for travel of construction workers, materials, and services, and represents the distance that, based on *CEQR Technical Manual* guidelines, defines the area in which the Preferred Alternative could cause impacts. The Study Area is consistent with study areas for the environmental analysis of similar projects in New York City.

1 New York City Mayor's Office of Environmental Coordination. *CEQR Technical Manual*. December, 2020.

Please see **Appendix B**, Chapter 4, for a complete description of the operational and construction air quality analysis methodology for this resource category, and **Appendix D**, "Air Quality," for further discussion of modeling parameters used for the air quality analyses.

7.3.1 OPERATIONAL AIR QUALITY

The potential for air quality impacts associated with emission sources were analyzed for the No Action Alternative and the Preferred Alternative.

The primary emission sources evaluated are emissions associated with fossil fuel-fired systems that are part of the Preferred Alternative. This includes fossil fuel-fired equipment and infrastructure related to life-safety and ventilation components of the Platform and its associated infrastructure (such as venting of diesel locomotive emissions from the area below the Platform). Life-safety equipment generally operates in the event of an emergency involving the loss of utility electrical power, or for periodic testing for short periods to ensure the reliability and availability of the equipment in the event of an actual emergency. The dual-mode (diesel-electric) locomotives serving LIRR stations without electric rail infrastructure entering Penn Station in the morning would continue to idle in diesel mode under the proposed Platform in the Western Rail Yard until departing Penn Station in the evening. Additionally, locomotives would perform a 15-minute test of the diesel engine at higher load levels before departing. While under the Platform, hoods integrated into a dedicated ventilation system to prevent emissions from dispersing in the area below the Platform would capture locomotive engine exhaust. Diesel-fueled delivery, maintenance, and garbage trucks would also continue to operate in the yard. However, these vehicles would operate intermittently as needed. The Preferred Alternative includes a proposed mechanical ventilation system that would exhaust these emissions above the Platform.

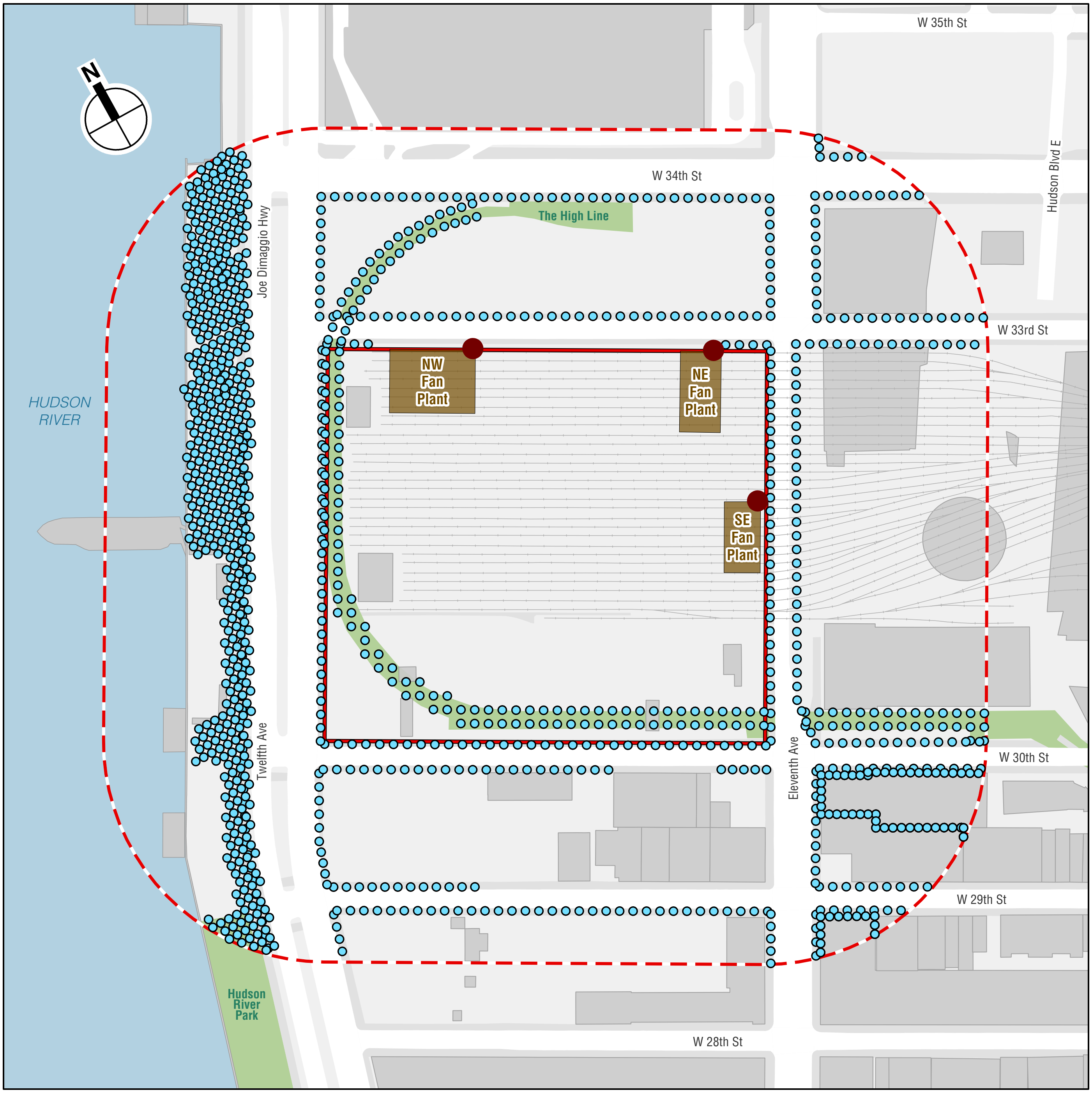
The analysis provides the potential air quality impacts of these emissions, as described in detail below. The locations of all modeled ventilation exhaust louvers and receptors included in the air quality analysis are shown in **Figure 7-1**.

7.3.1.1 LIFE SAFETY EQUIPMENT

As discussed in **Appendix D**, FRA estimated that emissions from the diesel generators would be minor on an annual basis due to their limited usage, and are not anticipated to result in a significant effect on ambient concentrations. Furthermore, USEPA has determined that emission sources, such as emergency generators normally only operated intermittently for testing, as not having a significant effect on 1-hour average ambient concentrations of NO_2 and SO_2.[2] Therefore, FRA concluded that further analysis of air quality impacts from the proposed life safety generators was not warranted.

[2] USEPA, Additional Clarification Regarding Application of Appendix W Modeling for the 1-hour NO_2 National Ambient Air Quality Standard, March 11, 2011.

11.16.20



Project Site (Western Rail Yard)

Study Area (400-foot perimeter)

Fan Plant

Receptor Location

Source Location

0 200 FEET

Air Quality Source and Receptor Locations

WESTERN RAIL YARD INFRASTRUCTURE PROJECT

Figure 7-1

7.3.1.2 PLATFORM VENTILATION SYSTEM

As discussed in **Appendix D**, short-term and annual emission rates were estimated (see **Table 7-1**) from the proposed ventilation system associated with localized exhaust hoods placed over locations where LIRR dual-mode locomotives would park in the railyard. The estimates of short-term and annual emission rates were based on LIRR projections that the types and sizes of engines currently operating would remain in operation in the future as well as anticipated daily train schedules provided by LIRR. Based on previous information provided by LIRR, FRA assumed that LIRR's dual-mode locomotives would operate engines primarily at a low idle load while being stored at the Western Rail Yard (between the hours of 6 AM and 3 PM) and would perform 15-minute pre-run testing for each engine before departing Penn Station (between 3 PM and 6 PM). FRA calculated emission rates associated with the pre-run testing using a representative time distribution among engine load levels to determine an average load level during the 15-minute period.

FRA conservatively assumed all locomotive emissions would vent through a single fan plant location; FRA performed an assessment at each of the three proposed fan plant locations (see **Figure 7-1**) in order to identify maximum potential air quality impacts. Additionally, FRA obtained stack parameters (stack height, diameter) shown in **Table 7-2** for the ventilation exhausts from available design information.

Table 7-2
Stack Parameters and Emission Rates

Parameter	Northeast Fan Plant	Northwest Fan Plant	Southeast Fan Plant
Exhaust Release Height (ft)(1)	30	30	30
Stack Exhaust Temp. (°F)(2)	70	70	70
Stack Exhaust Diameter (ft)(2)	2.82	3.57	3.09
Stack Exhaust Flow (ACFM)(3)	4,687	7,500	5,625
Stack Exhaust Velocity (ft/s)(4)	12.5	12.5	12.5
Emission Rate per Train (g/s)(5)	**Idle Locomotive**	**Pre-Run Test Locomotive**	
NO_x	1.85×10^{-2}	5.13×10^{-1}	
CO	5.50×10^{-3}	1.53×10^{-1}	
PM_{10}	5.50×10^{-4}	1.53×10^{-2}	
$PM_{2.5}$	5.50×10^{-4}	1.53×10^{-2}	

Notes:
(1) Exhaust release height is relative to the top of the constructed Platform.
(2) The stack diameter is representative of a circular stack of equivalent area as the exhaust louver.
(3) ACFM = actual cubic feet per minute.
(4) The stack exhaust flow rate was estimated based on the type of fuel and heat input rates.
(5) Emission rates are based on USEPA Tier I Line-Haul Locomotive Emission Standards.

7.3.2 CONSTRUCTION AIR QUALITY

Emissions from on-site construction equipment and on-road construction vehicles, as well as dust-generating construction activities, have the potential to affect air quality. The construction air quality impacts included both on-site and on-road sources of air emissions, and the combined impact of both sources, where applicable. The analysis addresses both local (microscale) and regional (mesoscale) construction period emissions.

In general, much of the heavy equipment used in construction is powered by diesel engines that produce relatively high levels of nitrogen oxides (NO_x) and PM emissions. Fugitive dust generated by construction activities is also a source of PM emissions and gasoline engines produce relatively high levels of CO. Since USEPA mandates the use of ultra-low sulfur diesel (ULSD)[3] fuel for all highway and non-road diesel engines, sulfur oxides (SO_x) emitted from the Preferred Alternative's construction activities would be negligible. Therefore, FRA analyzed NO_2, a component of NO_x that is a regulated pollutant, along with PM_{10}, $PM_{2.5}$, and CO, for the local construction period analysis. The pollutants of concern on a regional basis are CO, PM_{10}, $PM_{2.5}$, NO_x, SO_2, and VOCs, and FRA analyzed these pollutants for the regional construction period analysis.

7.3.2.1 CONSTRUCTION MICROSCALE ANALYSIS

FRA predicted concentrations using the USEPA AERMOD dispersion model to determine the potential for air quality impacts during on-site construction activities and due to construction-generated traffic on local roadways. Concentrations for each pollutant of concern from construction activities at each sensitive receptor were predicted during the most representative worst-case time period(s). The potential for adverse impacts was determined by comparing modeled concentrations to NAAQS, and modeled increments to applicable *CEQR Technical Manual de minimis* thresholds, as shown in **Table 7-3**. Please see Chapter 4 in **Appendix B** for a general description of the construction air quality analysis methodology for this resource category. **Appendix D** provides additional detail on the methodology and assumptions used for modeling.

Table 7-3
***CEQR Technical Manual De Minimis* Thresholds**

Pollutant	De Minimis Criteria
CO	• An increase of 0.5 parts per million (ppm) or more in the maximum 8-hour average CO concentration at a location where the predicted No Action 8-hour concentration is equal to or between 8 and 9 ppm; or • An increase of more than half the difference between baseline (i.e., No Action) concentrations and the 8-hour standard, when No Action concentrations are below 8.0 ppm.
$PM_{2.5}$	• Predicted increase of more than half the difference between the background concentration and the 24-hour standard; or • Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.1 μg/m^3 at ground level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or • Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.3 μg/m^3 at a discrete or ground level receptor location.

Source: *CEQR Technical Manual*, Chapter 17, Section 412.

7.3.2.2 CONSTRUCTION MESOSCALE ANALYSIS

FRA calculated emissions from on-road construction trucks and worker vehicles and from non-road construction equipment on an annual basis for each year of the Preferred Alternative's construction period.

[3] USEPA required a major reduction in the sulfur content of diesel fuel intended for use in locomotive, marine, and non-road engines and equipment, including construction equipment. As of 2015, the diesel fuel produced by all large refiners, small refiners, and importers must be ULSD fuel, with sulfur levels in non-road diesel fuel limited to a maximum of 15 ppm.

7.3.3 GREENHOUSE GAS EMISSIONS AND RESILIENCY

As discussed in **Appendix D**, FRA assessed GHG emissions generated by the construction and operation of the Preferred Alternative as well as the effect of climate change on the Preferred Alternative in terms of resilience to severe weather events under future conditions. Please see Chapter 4 in **Appendix B** for a general description of the analysis methodology for this resource category.

7.3.3.1 GREENHOUSE GAS EMISSIONS

As discussed above, on-site fossil fuel-fired equipment included in the Preferred Alternative would operate intermittently and was not included in the GHG analysis. Therefore, the analysis only includes emissions associated with electricity consumption required to operate the ventilation systems. FRA used an emission factor of 0.289 kg carbon dioxide equivalent (CO_2e)[4] per kWh based on New York City electrical consumption and the associated GHG emissions.[5] Since the Preferred Alternative would not substantially affect locomotive operation, FRA did not include emissions associated with locomotives in the analysis.

The construction analysis included emissions associated with on-road vehicle and non-road equipment use, and emissions embedded in the materials used during construction. FRA has estimated these emissions based on specific estimates of construction activity provided by the Project Sponsor.

7.3.3.2 RESILIENCE

The Preferred Alternative would introduce critical infrastructure—the Platform and the Tunnel Encasement—with very long design lifespans (assumed to be greater than 100 years). Accordingly, FRA reviewed the Preferred Alternative in the context of climate scenarios projected for 2100. FRA also considered interim years (2050s, 2080s) for adaptive resilience design (i.e., considering potential future resilience measures if necessary, which may not be implemented by the 2026 operational analysis year).

FRA considered flooding impacts on the Preferred Alternative as well as any potential impact for affecting other uses by reviewing the elevations of infrastructure and uses introduced by the Preferred Alternative. Furthermore, FRA considered relevant protection measures and identified any potential vulnerabilities or potential flooding risks.

7.4 AFFECTED ENVIRONMENT

7.4.1 AIR QUALITY

Table 7-4 presents representative background concentrations of all criteria pollutants of concern for the air quality analysis within the Study Area. NYSDEC collects the concentrations at NYSDEC air quality monitoring stations nearest the Preferred Alternative in New York. Reported concentrations were calculated in a manner consistent with the definitions of the NAAQS for the relevant averaging period. As shown in the table, the monitored levels do not exceed the NAAQS.

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4 CO_2e emissions represent the quantity of each GHG weighted by its effectiveness using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP).

5 The City of New York Mayor's Office of Long-Term Planning and Sustainability. *Inventory of New York City Greenhouse Gas Emissions in 2019*. https://nyc-ghg-inventory.cusp.nyu.edu/

Table 7-4
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	CCNY	ppm	1-hour	1.68	35
CO	CCNY	ppm	8-hour	1.1	9
SO_2	IS 52	µg/m^3	1-hour	14.6	196
PM_{10}	Division Street	µg/m^3	24-hour	43	150
$PM_{2.5}$	Division Street	µg/m^3	Annual	9	12
$PM_{2.5}$	Division Street	µg/m^3	24-hour	19.7	35
NO_2	IS 52	µg/m^3	Annual	31.7	100
NO_2	IS 52	µg/m^3	1-hour	110.6	188
Lead	IS 52	µg/m^3	3-month	0.0027	0.15
Ozone	IS 52	ppm	8-hour	0.070	0.075

Notes:
(1) The CO concentration for the short-term average is the second-highest from the most recent year with available data.
(2) The PM_{10} concentration for the short-term average is the highest from the most recent year with available data.
(3) $PM_{2.5}$ annual concentrations are the average of 2017–2019 annual concentrations, and the 24-hour concentration is the average of the annual 98th percentiles in the same period.
(4) The SO_2 1-hour and NO_2 1-hour concentrations are the average of the 99th percentile and 98th percentile, respectively, of the highest daily 1-hour maximum from 2017 to 2019.
(5) The lead concentrations are based on the highest quarterly average concentration measured in 2019.
(6) The ozone concentration is based on the 3-year average (2017–2019) of the 4th highest daily maximum 8-hour average concentrations.
Source: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2017–2019.

7.4.2 GREENHOUSE GAS EMISSIONS AND RESILIENCY

7.4.2.1 GREENHOUSE GAS EMISSIONS

The environment affected by GHG emissions includes the global atmospheric GHG concentrations and the long-term effect they have on the earth's energy balance, the ensuing climatic conditions, and the resulting effect on many human and natural systems. Detailed information on this topic is not included in this EIS but is available in reference documents, such as the Intergovernmental Panel on Climate Change (IPCC)'s latest synthesis report,[6] the U.S. *Third National Climate Assessment*,[7] and the most recent New York City Panel on Climate Change (NPCC) report.[8]

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6 *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Intergovernmental Panel on Climate Change. 2014.

7 *Climate Change Impacts in the United States: The Third National Climate Assessment.* U.S. Global Change Research Program. October, 2014.

8 *Advancing Tools and Methods for Flexible Adaptation Pathways and Science Policy Integration.* New York City Panel on Climate Change 2019 Report. March, 2019.

7.4.2.2 RESILIENCY

As discussed in **Appendix D**, FRA considered the existing climatic conditions in the Study Area related to sea level rise and storm surge, temperature and precipitation, and the locations of elements of the Preferred Alternative that could be affected by changes to these climatic conditions. The best, most recent, and most complete analysis of potential future climate conditions in the Study Area are those available from the NPCC. The following summarizes the NPCC's findings that are most relevant to the Preferred Alternative.

7.4.2.2.1 Sea Level Rise and Storm Surge

The NPCC report characterizes the probability of increased sea levels as "extremely likely," but there is uncertainty regarding the probability of the projected levels and timescale. In addition, the severity of storms is also likely to increase. Intense hurricanes are characterized as "more likely than not" to increase in intensity and/or frequency, and the likelihood of changes in other large storms (Nor'easters) are characterized as unknown. Therefore, the projections for future 1-percent probability coastal storm surge levels for the area include only sea level rise at this time, and do not account for changes in storm frequency.

NPCC analyzed three sea-level rise scenarios for each projection year: Low, Middle Range, and High. The Low scenario represents approximately a case in which sea level would continue to rise at the average rate it has been in recent decades. Most studies indicate that sea level rise is already accelerating, and the probability of this scenario is therefore unsuitable for most planning purposes. Note also that the High scenario, while representing the 90th percentile of current modeling, does not represent the potential worst-case scenario, and does not yet include additional factors being studied (such as accurate GHG emissions accounting, the effects on local weather patterns, the interaction with artic ice sheets and warming temperatures, etc.), which may lead to higher projections for the end of the century. The NPCC's sea level rise estimates ranging from the high end of the Middle Range scenario to the High scenario indicate the following:

- 2080s: 39 to 58 inches
- 2100: 50 to 75 inches

There are two approaches to predicting future coastal flooding, accounting for the potential impact of sea level rise on storm surge: a static approach that adds sea level rise onto current storm tide levels, and a dynamic approach using models that capture the roles of friction and wind as well as sea level rise and tides. NPCC has studied the potential impact of sea level rise on storm surge, including a study of the effect of dynamic modeling. NPCC concluded that both static and dynamic modeling approaches are valid and reliable approximations of coastal flooding for most locations in the New York metropolitan region. FRA used the static approach for the assessment presented in this chapter.

Applying the static approach, potential future flood levels consist of the range of projected sea level rise from NPCC described above added to the Base Flood Elevation (BFE) for the specific area of concern. The Federal Emergency Management Agency (FEMA) defines the BFE as the currently projected 1-percent probability storm elevations available from the preliminary Flood Insurance Rate Map (FIRM). The 1-percent probability storm (sometimes referred to as the 100-year storm) is a storm that has a 1 percent chance of occurring in any given year. The area that would be flooded in a 100-year storm is mapped by FEMA on its FIRMs. FEMA's maps also indicate the BFE, which is the height of flooding that can be expected in the 1-percent probability storm within the floodplain. The BFE is measured not from ground or sea level, but from a benchmark called the North American Vertical Datum of 1988 (NAVD88) established by the National Oceanic and Atmospheric Administration, which holds fixed the height of the primary tidal benchmark because of variations in sea surface topography.

For the Preferred Alternative, the areas of concern for flooding in Manhattan are the areas of the Project Site within the current and future flood hazard area, which include:

- The area of the below-grade tracks west of Penn Station under the proposed Platform that was flooded during Superstorm Sandy; and
- The proposed locations for the Northeast, Northwest and Southeast fan plants.

Potential future flood levels at these locations consist of the range of projected sea level rise from NPCC added to the BFE. The current BFE available from the preliminary FIRM[9] is 12 feet NAVD88 by the Northwest ventilation shaft and fan plant and 11 feet NAVD88 by the Northeast and Southeast fan plants.

As shown in **Table 7-5**, the resulting range of potential future flood elevations taking into account the current BFE and potential future sea level rise is up to 17 feet NAVD88 by the 2080s and up to 18 feet NAVD88 by 2100 at the Twelfth Avenue fan plant site, and up to 16 feet NAVD88 by the 2080s and up to 17 feet NAVD88 by 2100 at the portal sites.

Table 7-5
Projected Potential 1-Percent Annual Probability Flood Elevations Locations within the Study Area (feet NAVD88)

Site	Current Base Flood Elevation[1]	NPCC Projection of Future Flood Elevations (Middle to High Range)[2] 2020s (+8” to +10” over Current BFE)	NPCC Projection of Future Flood Elevations (Middle to High Range)[2] 2080s (+39” to +58” over Current BFE)	NPCC Projection of Future Flood Elevations (Middle to High Range)[2] 2100 (+50” to +75” over Current BFE)
Northwest Fan Plant	11’	12’	14’ to 16’	15’ to 17’
Northeast and Southeast and Fan Plants	12’	13’	15’ to 17’	16’ to 18’

Sources:
[1] FEMA, 2013.
[2] NPCC, 2015.

7.4.2.2.2 Temperature

NPCC projected that annual average temperature is extremely likely to increase. An average increase of up to 12ºF by the end of the century was projected (less in some scenarios). Heatwaves (events with a duration of three or more days with maximum temperatures exceeding 90ºF) are very likely to increase in frequency, with up to nine events projected in the high estimate by the 2080s in an average year, up from two events per average year in the baseline, and a duration of up to eight days per event, up from four days in the baseline. The number of days per average year with a maximum temperature exceeding 90ºF in that same timeframe could increase from 18 to 87.

[9] FEMA. *Flood Insurance Rate Map, New York County, New York—Preliminary*. Panel 69 of 457. Map 3604970069G. December 5, 2013.

7.4.2.2.3 Precipitation

NPCC projected that annual average precipitation is likely to increase, with projections ranging up to 25 percent by the end of the century (less in some scenarios). The number of downpours (intense precipitation events shorter than a day and often shorter than an hour) is "very likely" to increase. By the 2080s, downpours of 1 inch or more could increase from an annual average of 13 events in the baseline to 18 events, and downpours of 4 inches or more from an annual average of 0.3 to 0.7 events.

More recently, the Northeast Regional Climate Center (NRCC) has partnered with the New York State Energy Research and Development Authority (NYSERDA) to downscale global climate model output and create extreme precipitation projections for New York State and the surrounding area, including the downstate area and meteorological stations in northern New Jersey.[10] Detailed data for each station are also available online.[11] **Table 7-6** presents a summary of the projected increases in precipitation for nearby stations in New York for the return periods relevant to runoff and drainage design.

Table 7-6
Projected Precipitation Increases, High Scenario
New York Central Park, NY

Projection Period	Return Period[1] 100-Year (%)	Return Period[1] 25-Year (%)	Return Period[1] 10-Year (%)	Return Period[1] 5-Year (%)
2050s	27%	13%	11%	12%
2080s	39%	28%	23%	20%

Note:
[1] The return period represents a probability of occurrence, and not an actual period of expected occurrence. The "100-year" represents a storm with a probability of occurrence of 1 percent in any given year. Similarly, "25-year" represents a 4 percent probability, and "10-year" represents a 10-percent probability in any given year.
Source: NRCC 2017

7.5 ENVIRONMENTAL CONSEQUENCES

FRA used the reports and recommendations described above to make a determination of potential effects to air quality from the No Action Alternative and the Preferred Alternative.

7.5.1 NO ACTION ALTERNATIVE

For purposes of analysis in this EIS, FRA assumed that with the No Action Alternative, the Project Sponsor would not build the Preferred Alternative. Under the No Action Alternative, existing activities in the rail yard (including train movements and ongoing general maintenance of the yard and LIRR facilities) would continue unchanged. Therefore, the No Action Alternative would not result in increased pollutant concentrations above existing levels and would not adversely affect air quality.

[10] Arthur T. DeGaetano, Christopher M. Castellano. *Future projections of extreme precipitation intensity-duration-frequency curves for climate adaptation planning in New York State*. Climate Services, Volume 5. January 2017.

[11] NRCC/NYSERDA *Intensity Duration Frequency Curves for New York State: Future Projections for a Changing Climate*. http://ny-idf-projections.nrcc.cornell.edu. Accessed May 2017.

7.5.2 OPERATIONAL IMPACTS OF THE PREFERRED ALTERNATIVE

Table 7-7 presents the maximum predicted concentrations associated with ventilation of dual-mode locomotive engine exhaust. To estimate the maximum total pollutant concentrations, FRA added the modeled concentrations from the Preferred Alternative to a background value that accounts for existing pollutant concentrations from other nearby sources.

Table 7-7
Maximum Pollutant Concentrations from Platform Ventilation Systems

Pollutant	Averaging Period	Units	Maximum Modeled Impact	Background Concentration(1)	Total Concentration	NAAQS
NO_2	1-hour	μg/m³	N/A(2)	N/A(2)	155.8	188
NO_2	Annual	μg/m³	2.1	37.9	40.0	100
CO	1-hour	ppm	0.1	2.5	2.6	35(3)
CO	8-hour	ppm	< 0.1	1.2	1.2	9(3)
PM_{10}	24-hour	μg/m³	0.7	38	38.7	150
$PM_{2.5}$	24-hour	μg/m³	0.7	19.7	20.3	35
$PM_{2.5}$	Annual	μg/m³	0.08	9.0	9.08	15

Notes:
N/A—Not Applicable
(1) The background levels are based on the most representative concentrations monitored at NYSDEC ambient air monitoring stations. Due to the statistical form of the associated NAAQS background concentrations may differ from values in **Table 7-4**.
(2) The 1-hour average NO_2 concentration represents the maximum of the total 98th percentile 1-hour concentration predicted at any receptor using seasonal-hourly background concentrations. Modeling impacts are added to background concentrations for each hour within the AERMOD model. Therefore, the maximum modeled impact and background concentration are not shown.

As shown in **Table 7-7**, the maximum predicted total concentrations are below the applicable NAAQS. Furthermore, $PM_{2.5}$ and CO incremental concentrations are below the City's *de minimis* criteria for these pollutants (see **Table 7-8**); therefore, FRA has predicted no adverse air quality impacts during operation of the Preferred Alternative**.**

Table 7-8
Maximum Pollutant Incremental Concentrations from Platform Ventilation Systems

Pollutant	Averaging Period	Units	Maximum Modeled Impact	*CEQR De Minimis* Criteria
CO	8-hour	ppm	< 0.1	4.7(1)
$PM_{2.5}$	24-hour	μg/m³	0.7	7.7(2)
$PM_{2.5}$	Annual	μg/m³	0.08	0.3(2)

Notes:
(1) While NEPA does not require projects under assessment to utilize impact criteria from the *CEQR Technical Manua*l, the 8-hour average CO *de minimis* incremental concentration threshold is considered as one factor in determining whether the Preferred Alternative may result in environmental impacts.
(2) While NEPA does not require projects under assessment to utilize impact criteria from the *CEQR Technical Manua*l, the 24-hour and annual average $PM_{2.5}$ *de minimis* incremental concentration thresholds are considered as one factor in determining whether the Preferred Alternative may result in environmental impacts.

7.5.3 CONSTRUCTION IMPACTS OF THE PREFERRED ALTERNATIVE

Table 7-9 presents the maximum concentrations FRA predicted during the representative worst-case construction periods. To estimate the maximum total NO_2, CO, and PM_{10} concentrations, FRA added the modeled concentrations from the Preferred Alternative to a background value that accounts for existing pollutant concentrations from other nearby sources.

Table 7-9
Maximum Pollutant Concentrations from Peak Construction Period

Pollutant	Averaging Period	Units	Maximum Modeled Impact	Background Concentration[1]	Total Concentration	NAAQS
NO_2	Annual	$\mu g/m^3$	15.2	37.9	53.1	100
CO	1-hour	ppm	0.3	2.5	2.8	35[2]
CO	8-hour	ppm	0.1	1.2	1.3	9[2]
PM_{10}	24-hour	$\mu g/m^3$	11	38	49	150
$PM_{2.5}$	24-hour	$\mu g/m^3$	6.2	19.7	25.9	35
$PM_{2.5}$	Annual—Local	$\mu g/m^3$	0.23	9.0	9.23	15

Notes:
N/A—Not Applicable
(1) The background levels are based on the most representative concentrations monitored at NYSDEC ambient air monitoring stations

As shown in **Table 7-9**, the maximum predicted total concentrations of NO_2, CO, PM_{10}, and $PM_{2.5}$ are below the applicable NAAQS for the peak construction. In addition, $PM_{2.5}$ and CO incremental concentrations are below the City's *de minimis* criteria for these pollutants (see **Table 7-10**). Emissions from the other less intensive construction periods would be less than the emissions during the modeled worst-case periods; therefore, the resulting concentrations from these non-peak periods are expected to be less than the concentrations presented in **Table 7-9 and Table 7-10**.

Table 7-10
Maximum Pollutant Incremental Concentrations from Peak Construction Period

Pollutant	Averaging Period	Units	Maximum Modeled Impact	***CEQR De Minimis* Criteria**
CO	8-hour	ppm	0.3	4.7[1]
$PM_{2.5}$	24-hour	$\mu g/m^3$	6.2	7.7[2]
$PM_{2.5}$	Annual	$\mu g/m^3$	0.23	0.3[2]

Notes:
(1) While NEPA does not require projects under assessment to utilize impact criteria from the *CEQR Technical Manua*l, the 8-hour average CO *de minimis* incremental concentration threshold is considered as one factor in determining whether the Preferred Alternative may result in environmental impacts.
(2) While NEPA does not require projects under assessment to utilize impact criteria from the *CEQR Technical Manua*l, the 24-hour and annual average $PM_{2.5}$ *de minimis* incremental concentration thresholds are considered as one factor in determining whether the Preferred Alternative may result in environmental impacts.

7.5.4 CONFORMITY WITH STATE IMPLEMENTATION PLAN

As discussed in **Appendix D**, the annual on-site and on-road construction-related emissions were estimated for the scheduled construction duration (2021 through 2026) and are presented in **Table 7-11**. The values presented in the table are the total of direct and indirect emissions (including indirect emissions associated with construction truck and worker vehicle trips within the non-attainment area), consistent with General Conformity requirements. The pollutant emissions associated with construction under the Preferred Alternative would be well below any of the *de minimis* criteria. Therefore, the Preferred Alternative would conform to the SIP and does not require a full conformity determination.

Table 7-11
Mesoscale Emissions from Construction Activities (ton/yr)

	$PM_{2.5}$	PM_{10}	NO_x	VOC	SO_2	CO
De Minimis Criteria	100	100	50	50	100	100
2021	0.02	0.04	0.39	0.09	<0.01	0.17
2022	0.32	0.69	5.89	1.28	0.04	6.15
2023	0.36*	0.81*	6.78*	1.52*	0.05*	7.47*
2024	0.26	0.64	5.03	1.22	0.04	6.03
2025	0.15	0.41	3.01	0.78	0.02	4.03
2026	0.04	0.12	0.90	0.30	0.01	2.01

Note: * Highest annual emissions

7.5.5 GREENHOUSE GAS EMISSIONS AND RESILIENCY

7.5.5.1 GREENHOUSE GAS EMISSIONS

The electricity use associated with the Platform's ventilation systems, emission factors, and resulting GHG emissions associated with the Platform's ventilation systems would result in 7,000 metric tons of CO_2e per year. FRA conservatively assumed an electricity emission factor that represents the latest data available for New York City and not the future build year. Both New York State and New York City have proposed policies to reduce GHG emissions associated with electrical power generation in future years with expanded utilization of renewable energy and the elimination of high emission fuels. Therefore, FRA expects GHG emissions from the Preferred Alternative to be lower in 2026 and future years.

Table 7-12 presents the estimated GHG emissions FRA calculated from construction of the Preferred Alternative. The total emissions associated with construction throughout the construction period, including both direct energy and emissions embedded in materials (extraction, production, and transport), would be approximately 68 thousand metric tons CO_2e.

Table 7-12
GHG Emissions from Construction (metric tons CO_2e)

	Total
Non-road Construction Equipment	16,115
On-Road Vehicles	29,645
Construction Materials:	
Cement	12,617
Steel	9,612
Total	**67,990**

7.5.5.2 RESILIENCY

Given the vulnerability of the Project Site, the Project Sponsor would construct the Platform at DBE of approximately +33 feet NAVD88 and would remain above the 1 percent annual chance BFE over the entire lifespan of the project under all sea level rise projections (see **Table 7-5**). While the Platform's structural support system would extend through the floodplain, it would be designed for the wave, stream flow and other forces applied to the platform supporting elements by the potential flood event. The Tunnel Encasement would be constructed below grade, would be fully enclosed, and flood proofed. No other project elements included in the Preferred Alternative would be located below the elevation of the 1 percent annual chance BFE over the lifespan of the project.

In addition to the design for resilience, described below, the Project Sponsor designed the Preferred Alternative with redundancy by providing the new trans-Hudson connection into New York Penn Station as an additional resilient option once all construction is completed.

7.5.5.2.1 Coastal Flooding

Since the Preferred Alternative would not introduce any substantial changes in a coastal area such that it could affect wave impacts or otherwise affect flooding of other areas and uses, the Preferred Alternative would otherwise not affect or be affected by flooding.

The Design Flood Elevation (DFE) for the Preferred Alternative is at least 21 feet higher than the current BFE at any given location, and would account for an additional 1 foot of "freeboard" over the BFE to cover uncertainty in the data and rounding. Therefore, additional protection is not anticipated to be needed.

7.5.5.2.2 Temperature

As described in **Section 7.4.2.2.2**, average annual temperature will continue to increase over time, and heatwaves (events with a duration of three or more days with maximum temperatures exceeding 90ºF) may quadruple in frequency, and double in duration (more heatwave events per year and longer events). The effect of high temperature on the Preferred Alternative would include increased energy use for Platform ventilation and train air conditioning, but since the design for these needs is conservative, no special consideration needs to be given to capacities of those systems.

High temperatures have also been known to affect railway tracks if buckling (rail deformation) occurs. In general, track buckling occurs predominately on continuously welded rail, though it also can occur on older jointed track when the ends of the track become frozen in place.[12,13] Track buckling is most prevalent on an isolated hot day in the springtime or early summer, rather than mid to late summer when temperatures are more uniformly hot. Buckling also is more likely to occur in alternating sun/shade regions and in curves. Track design generally accounts for track buckling via design criteria and prevents buckling even at rail temperatures of up to 150ºF.[14] The design would also accommodate changes in length of segments due to thermal movement, such as would occur during a heatwave. Since the track is more stable when the rail is in tension at temperatures below the neutral temperature, the target neutral temperature is generally 75 percent of the expected maximum temperature of the region. An increase in temperature may slightly raise the neutral temperature used for installation, but is unlikely to necessitate track design changes. The Project Sponsor has included a new ventilation system for the covered rail yard, which complies with LIRR requirements that would be used to vent hot air from the rail yard when temperatures exceed specified levels to help avoid conditions that could lead to rail deformation.

Preventive measures to reduce rail buckling derailment risk include:

- Improving weather forecast and predictive capacity for rail track temperature;
- Utilizing track materials that can withstand projected temperatures (such as concrete ties, continuous welded rail, and rail fasteners); and
- Applying speed limit restrictions during periods of high temperatures.

Overall, appropriate design, maintenance, and operational procedures for track buckling in the current condition would also address the future condition when heatwaves may be more frequent or intense.

7.5.5.2.3 Precipitation

As described in **Section 7.4.2.2.3**, NPCC projected that annual average precipitation is likely to increase and the number of downpours (intense precipitation events shorter than a day and often shorter than 1 hour) is “very likely” to increase. Shorter term downpour intensity is also projected to increase. In addition to coastal flood conditions discussed above, stormwater facilities would be designed to accommodate runoff based on short-term precipitation events, including 10- or 20-percent annual probability (“10-year” and “5-year”) events for New York City and New Jersey/New York State roadway and parking lot storm systems, respectively, 4-percent annual probability (“25-year”) events for track roadbed and for drains at low points that could flood roadways or track roadbed, and 1-percent annual probability (“100-year”) events for enclosed structures that could flood roadways or track roadbed. The projected increase in short-term precipitation intensity, presented in **Table 7-6** above, would be accounted for where relevant and practicable for drainage and runoff design purposes.

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[12] European Commission. *Impacts of Climate Change on Transport: A Focus on Road and Rail Transport Infrastructures.* Available: http://ftp.jrc.es/EURdoc/JRC72217.pdf. 2012.

[13] FEMA. *Flood Insurance Rate Map, New York County, New York—Preliminary*. Panel 69 of 457. Map 3604970069G. December 5, 2013.

[14] FHWA. *U.S. Climate Change Science Program Synthesis and Assessment Product 4.7: Impacts of Climate Change and Variability on Transportation Systems and Infrastructure: Gulf Coast Study, Phase I.* March 2008.

7.5.5.2.4 Construction

During construction, the existing Western Rail Yard would continue to be at risk of severe storm flooding at the current levels. As part of the design of the Preferred Alternative, the Project Sponsor would be responsible to develop a stormwater management plan and identify measures to address risk. At a minimum, the plan would identify the potential risks during the construction period and would prepare for potential storms and/or flooding up to the levels identified. These requirements would be included in the contract documents between the Project Sponsor and the Project Sponsor's Contractor, and the Contractor would be responsible for implementing the stormwater management plan.

Changes in temperature and precipitation climate in the short term, throughout the construction period, would be very small and would have no measurable impact on construction operations.

7.6 AVOIDANCE, MINIMIZATION, AND MITIGATION MEASURES

- The Project Sponsor would undertake measures to reduce both criteria pollutant and GHG emissions during construction in accordance with all applicable laws, regulations, and building codes. In addition, the Preferred Alternative would include the implementation of an emissions reduction program to minimize the air quality effects from construction.
- In conformance with the Emission Reduction Program included in the CEPP (as described in detail in Chapter 22, "Mitigation Measures and Project Commitments"), the Project Sponsor would include contract specifications requiring the use of the following BMPs:
  - *Clean Fuel*. Only ULSD fuel would be used for all diesel engines throughout the construction site.
  - *Diesel Equipment Reduction*. Electrically powered equipment such as welders and saws would be used instead of diesel-powered versions of that equipment, to the extent feasible and practicable.
  - *Dust Control Measures*. Contract specifications would require a dust control plan, including a watering program, to minimize dust emissions from construction activities. For example, all trucks hauling loose material would be equipped with tight-fitting tailgates and their loads securely covered prior to leaving the Project Site and water sprays would be used for all demolition, excavation, and transfer of soils to ensure that materials would be dampened as necessary to avoid the suspension of dust into the air.
  - *Idling Restriction*. As required by local law, all stationary vehicles on roadways adjacent to the Project Site would be prohibited from idling for more than three minutes. The idling restriction excludes vehicles that are using their engines to operate a loading, unloading, or processing device (e.g., concrete-mixing trucks) or otherwise required for the proper operation of the engine.
  - *Engine Retrofits*. Non-road diesel engines with a power rating of 50 horsepower (hp) or greater and controlled truck fleets (i.e., truck fleets under long-term contract with the Preferred Alternative), including but not limited to, concrete mixing and pumping trucks would utilize the best available technology (BAT) (e.g., diesel particulate filters) for reducing diesel particulate matter emissions.

- *Utilization of Newer Equipment.* USEPA's Tier 1 through 4 standards for non-road engines regulate the emission of criteria pollutants from new engines, including PM, CO, NO_x, and hydrocarbons (HC). All diesel-powered non-road construction equipment with a power rating of 50 hp or greater would meet at least the Tier 3 emissions standard.[15]

- The Project Sponsor would develop a stormwater management plan and identify measures to address risk from potential flooding due to precipitation, as discussed above in Section 7.5.2.3, "Precipitation."

FRA has accounted for the implementation of the emissions reduction measures listed above in the analysis of construction air quality impacts under the Preferred Alternative. The Preferred Alternative would include a new ventilation system with several fan plants which would be designed to ventilate daily emissions and emergency smoke events to maintain air quality under operational conditions. The new ventilation system would be designed in compliance with all applicable laws, regulations, and building codes to ensure no adverse air quality effects from operation of these systems.

- The Project Sponsor would be responsible for implementing these BMPs. With the implementation of those measures, no adverse construction or operational air quality impacts would result from the Preferred Alternative and no mitigation is required. ✷

[15] The first federal regulations for new non-road diesel engines were adopted in 1994 and signed by USEPA into regulation in a 1998 Final Rulemaking. The 1998 regulation introduces Tier 1 emissions standards for all equipment 50 hp and greater and phases in the increasingly stringent Tier 2 and Tier 3 standards for equipment manufactured in 2000 through 2008. In 2004, the USEPA introduced Tier 4 emissions standards with a phased-in period of 2008 to 2015. The Tier 1 through 4 standards regulate the USEPA criteria pollutants, including PM, HC, NO_x and CO. Prior to 1998, emissions from non-road diesel engines were unregulated. These engines are typically referred to as Tier 0.