

APPENDIX F: Air Quality Technical Report

F.1 Introduction

This analysis presents the results of the air quality study conducted for the proposed Lackawanna Cut-off Study. The proposed project consists of eight new rail stations and a rail yard. The effects of each station on air quality are analyzed pursuant to the Clean Air Act requirements and applicable air quality guidelines and standards.

F.1.1 Primary Pollutants

Six pollutants have been identified by the US Environmental Protection Agency as a national concern: carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), particulate matter (PM), sulfur dioxide (SO₂), and lead (Pb). The primary pollutant emissions from automobiles are CO, hydrocarbon (HC), and nitrogen oxides (NO_x). Levels of NO_x are influenced by both mobile and stationary sources, while levels of PM and SO₂ are directly associated with stationary sources. A summary of the characteristics of the pollutants follows:

- Carbon monoxide is a colorless and odorless gas that is associated with the incomplete combustion of vehicle fuel. Carbon monoxide (CO) concentrations are limited to short distances near crowded intersections and along slow-moving, heavily traveled roadways. Under the Clean Air Act of 1990, each state is committed to offset any CO emissions resulting from Vehicle Miles Traveled (VMT) growth in a nonattainment area. For projects of regional significance, it is also important to predict CO emissions on a regional, or mesoscale, basis.
- Nitrogen oxides are produced when fuels are burned at high temperatures. Only nitric oxide (NO) and nitrogen dioxide (NO₂) are released by motor vehicles into the atmosphere in appreciable quantities. Together, nitrogen oxides are often referred to as NO_x. Nitrogen oxides are of particular concern due to their role in the formulation of ozone.
- Ozone (O₃) is formed through a series of chemical reactions, which occur in the presence of sunlight and hot weather. Motor vehicle exhaust and industrial emissions, gasoline vapors and chemical solvents are some of the major contributors to the formation of ground-level ozone. Elevated levels of ozone typically occur miles from the source since the series of chemical reactions is slow and pollutants are diffused downwind.
- Lead (Pb) emissions are associated with industrial uses and motor vehicles that use gasoline containing lead additives. Most U.S. vehicles available since 1975, and all after 1980, are designed to use unleaded fuel. As these older vehicles have been replaced by newer models, lead emissions have decreased.
- Sulfur dioxide (SO₂) emissions are primarily associated with the combustion of sulfur-containing fuels such as oil and coal. The major sources of this emission are fossil fuel fired power plants and oil refineries. No significant quantities are emitted from mobile sources.
- Inhalable particulates are broken down into coarse particulate matter (PM₁₀) and fine particulate matter (PM_{2.5}).

Coarse Particulate Matter (PM₁₀) - Particulate matter is emitted into the atmosphere from a variety of sources including industrial facilities, power plants, and construction activity. Diesel-powered vehicles, especially heavy trucks and buses, emit particulates. Inhalable particulate concentrations may, therefore, be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. The primary concern is with particulates that are less than 10 microns (mm, 1 micron equals 0.000001 meter or one one-millionth of a meter) in diameter, which can affect human respiratory functions.

Fine Particulate Matter (PM_{2.5}) - Recent scientific developments have indicated a connection between respiratory problems such as asthma and bronchitis with fine particulate particles that have an aerodynamic diameter of 2.5 microns or smaller. Recognizing the adverse health risk associated with fine particulate matter, in 1997, EPA promulgated the NAAQS for PM_{2.5} to protect the public health. PM_{2.5} emissions are primarily from stationary and mobile sources that burn fossil fuels.

F.1.2 Air Quality Standards

National and State Ambient Air Quality Standards

National Ambient Air Quality Standards (NAAQS), Pennsylvania State and New Jersey State standards (shown in Table F.1) have been established for the major air pollutants identified above. The primary standards are intended to protect the public health with an adequate margin of safety while the secondary standards protect the public welfare against material damage (such as damage to crops, vegetation, and buildings) and decreased visibility.

State Implementation Plan (SIP)

Each state defines geographic regions which do not meet one or more of the standards. These areas are called nonattainment areas. The Clean Air Act requires each state to submit a State Implementation Plan (SIP) to the U.S. EPA for attainment of NAAQS. The SIP describes how the state will attain and maintain air quality standards in non-attainment areas, and must be approved by U.S. EPA. Projects that do not cause or contribute to new violations of the NAAQS, exacerbate existing violations, or interfere with the attainment plans in the SIP are considered consistent with the SIP.

The USEPA has designated Warren, Sussex, and Morris Counties in New Jersey as nonattainment areas for the eight-hour ozone NAAQS. These areas are covered by the New Jersey State Implementation Plan (“SIP”) for ozone, which is a plan for attaining the standard by 2010.

Since the Pennsylvania portion of the study area is not within a designated (or previously designated) nonattainment area, it is not covered by the Pennsylvania SIP; therefore, conformity with the Pennsylvania SIP is not applicable.

Table F.1: Pennsylvania State, New Jersey State and National Ambient Air Quality Standards

Pollutant	Averaging Period	Pennsylvania Standards		New Jersey Standards		NAAQS	
		Primary	Secondary	Primary	Secondary	Primary	Secondary
Carbon Monoxide (CO)	1 hr.	35 ppm	None	35 ppm	35 ppm	35 ppm	--
	8 hr.	9 ppm	None	9 ppm	9 ppm	9 ppm	--
Ozone (O ₃)	1 hr.	Revoked ¹					
	8 hr.	0.075 ppm	0.075 ppm	--	--	0.075 ppm	0.075 ppm
Nitrogen Dioxide (NO ₂)	1 yr.	0.053 ppm	0.053 ppm	0.053 ppm	0.053 ppm	0.053 ppm	0.053 ppm
Lead (Pb)	3 mos.	1.5 µg/m ³	1.5 µg/m ³	1.5 µg/m ³	1.5 µg/m ³	1.5 µg/m ³	1.5 µg/m ³
Inhalable Particulates (PM ₁₀)	24 hrs.	150 µg/m ³	150 µg/m ³	150 µg/m ³	150 µg/m ³	150 µg/m ³	150 µg/m ³
	1 yr.	Revoked ²					
Fine Particulates (PM _{2.5})	24 hrs.	35 µg/m ³	35 µg/m ³	35 µg/m ³	35 µg/m ³	35 µg/m ³	35 µg/m ³
	1 yr.	15 µg/m ³	15 µg/m ³	15 µg/m ³	15 µg/m ³	15 µg/m ³	15 µg/m ³
Sulfur Dioxide (SO ₂)	3 hr.	--	0.50 ppm (1300 µg/m ³)	--	0.50 ppm (1300 µg/m ³)	--	0.50 ppm (1300 µg/m ³)
	24 hr.	0.14 ppm (365 µg/m ³)	--	0.14 ppm (365 µg/m ³)	0.10 ppm (260 µg/m ³)	0.14 ppm (365 µg/m ³)	--
	1 yr.	0.03 ppm (80 µg/m ³)	--	0.03 ppm (80 µg/m ³)	0.02 ppm (60 µg/m ³)	0.03 ppm (80 µg/m ³)	--

(1) For areas that have an approved maintenance plan for ozone, the 1-hour standard was revoked (effective June 15, 2005).
(2) Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the annual PM₁₀ standard was revoked (effective December 17, 2006).

Source: 2008, USEPA AIRS database: www.epa.gov/air/data.com.

F.2 Methodology

Mobile Source Analysis

Methodology for Predicting Carbon Monoxide (CO) Concentrations from Mobile Sources

The prediction of vehicle-generated CO concentrations in an urban environment is dependent upon environmental and meteorological conditions, traffic characteristics and the physical configuration of each affected intersection in the study area. Air pollutant dispersion models simulate how meteorological, physical, and environmental characteristics of the project area affect pollutant concentrations. Most of these models are conservative and tend to over-predict pollutant concentrations.

The prediction of CO was conducted using the CAL3QHC (Version 2.0) air quality dispersion model (EPA-454/R-92-006). This model is currently recommended in the *EPA Guidelines for Modeling Carbon Monoxide from Roadway Intersection* (EPA-454/R-92-005) for estimating CO levels near congested intersections and along heavy traveled roadways. This model estimates air pollutant concentrations downwind of a roadway and simulates the rate that pollutants disperse as a function of wind speed, direction, and ambient temperatures. To ensure the most conservative prediction of pollutant concentrations, the worst-case meteorological conditions were used for wind speed and wind direction, and a neutral condition was used for atmospheric stability. Vehicular emission variables were developed using the EPA emission factor program MOBILE6.2.

CAL3QHC estimates the average number of vehicles that would queue during the red phase of an intersection based on the characteristics of both the intersection and the traffic flows. The model estimates the maximum 1-hour concentrations of the pollutants. The 8-hour concentration is developed by applying a persistence factor of 0.70 to the maximum 1-hour concentration. Background concentrations are then added to account for CO independent of the project. A background level of 2.9 ppm was added to the 1-hour concentrations and 1.8 ppm was added to the 8-hour concentrations, which correspond with the maximum annual averaging period concentrations noted in Table F.2.

The 1-hour and 8-hour concentrations for each alternative are then compared to the New Jersey, Pennsylvania, and National Ambient Air Quality Standards to determine the potential project impact.

Methodology for Predicting PM Concentrations from Mobile Sources

The prediction of PM concentrations is similar to those employed for the CO analysis. PM modeling of on-street vehicular emissions was conducted with CAL3QHCR. CAL3QHCR is an enhanced version of CAL3QHC that utilizes the dispersion algorithm of CAL3QHC, and can process up to a year of meteorological data. Five separate years of meteorological data, 1999 to 2003, is processed with the highest concentration reported. Particulate matter emission factors were obtained from the EPA model, MOBILE6.2.

Table F.2: Existing Ambient Air Quality in Pennsylvania and New Jersey

Pollutant	Averaging Period	Maximum Averaging Period Concentrations		
		Pennsylvania	New Jersey	NAAQS
Carbon Monoxide (CO)	1 hr.	2.9 ppm ⁽¹⁾	2.2 ppm ⁽⁴⁾	35 ppm
	8 hr.	1.8 ppm ⁽¹⁾	1.3 ppm ⁽⁴⁾	9 ppm
Ozone (O₃)	1 hr.	Revoked ⁽⁸⁾		
	8 hr.	0.076 ppm ⁽²⁾	0.086 ppm ⁽⁵⁾	0.075 ppm ⁽¹⁰⁾
Nitrogen Dioxide (NO₂)	1 yr.	0.011 ppm ⁽¹⁾	0.007 ppm ⁽⁵⁾	0.053 ppm
Lead	3 mos.	0.03 µg/m ³ ⁽³⁾	0.094 µg/m ³ ⁽⁶⁾	1.5 µg/m ³
Inhalable Particulates (PM₁₀)	24 hrs.	53 µg/m ³ ⁽¹⁾	58 µg/m ³ ⁽⁷⁾	150 µg/m ³
	1 yr.	Revoked ⁽⁹⁾		
Fine Particulates (PM_{2.5})	24 hrs.	31.3 µg/m ³ ⁽¹⁾	30.7 µg/m ³ ⁽⁵⁾	35 µg/m ³ ⁽¹¹⁾
	1 yr.	11.3 µg/m ³ ⁽¹⁾	11.4 µg/m ³ ⁽⁵⁾	15 µg/m ³
Sulfur Dioxide (SO₂)	3 hr.	0.032 ppm ⁽¹⁾	0.028 ppm ⁽⁵⁾	0.50 ppm
	24 hr.	0.020 ppm ⁽¹⁾	0.015 ppm ⁽⁵⁾	0.14 ppm
	1 yr.	0.005 ppm ⁽¹⁾	0.003 ppm ⁽⁵⁾	0.03 ppm

ppm = parts per million; µg/m³ = micrograms per cubic meter
(1) Scranton, Lackawanna County, PA ; (2) Wilson, Northampton County, PA; (3) Philadelphia, Philadelphia County, PA; (4) Morristown, Morris County, NJ; (5) Chester, Morris County, NJ; (6) New Brunswick, Middlesex County, NJ (2005 is the most recent data available for this area); (7) Jersey City, Hudson County, NJ.
(8) For areas that have an approved maintenance plan for ozone, the 1-hour standard was revoked (effective June 15, 2005).
(9) Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM₁₀ standard in 2006 (effective December 17, 2006).
(10) On March 12, 2008, USEPA strengthened the 9-hour ozone standard to 0.075 (calculated as the three-year average of the annual 4th highest daily maximum 8-hour average).
(11) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m³ (effective December 17, 2006).
Note: 2007 data reported unless noted.

Source: 2008, U.S. EPA AIRS database..

Stationary Source Analysis

An area source screening analysis was conducted for the largest of the parking areas to be built adjacent to the candidate stations and the candidate rail yard using the EPA recommended area source model SCREEN3. The results of the screening analysis were compared to the corresponding standards for each pollutant to determine if the project would be within compliance.

Mesoscale Analysis

A mesoscale, or regional, analysis was conducted to assess the net effects of the proposed rail service on the emissions of pollutants. This analysis assessed the change in regional air quality based on the reduction in vehicle-related emissions, as compared to the increase in locomotive-related emissions. Relative differences in vehicle-related emissions were a function of the net change in VMT, average vehicle travel speed, and the corresponding pollutant emission rates. The emission rates for vehicles were determined for the project's build year of 2025 using EPA's model MOBILE6.2. These calculations included the effect of the I/M and anti-tampering programs. Locomotive-related emissions were obtained from the EPA's *Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines*.

F.3 Existing Conditions

Existing Ambient Air Quality

The representative ambient air quality levels along the study corridor are shown in Table F.3. As noted in Table F.2, the new 8-hour standard (which averages data over the past three years) for ozone was exceeded at the monitoring stations in both Pennsylvania (Northampton County), and New Jersey (Morris County).

F.4 Impacts

F.4.1 Microscale Analysis

Mobile Source

The intersection within the study corridor that is anticipated to experience the greatest peak hour volumes with associated congestion, LOS D, E, or F, was selected for detailed analysis. This location chosen was the intersection of PA Route 611 and PA Route 940 in Pocono Mountain, PA, with a PM peak hour volume in the Build scenario estimated to be approximately 3,000, and with several movements expected to operate at LOS F. It is assumed that if this intersection results in no impact from the project, then intersections with lower volumes or congestion would not be impacted. Modeling receptors were placed at multiple locations at the selected intersection in accordance with EPA modeling guidelines. Table F.3 shows the maximum predicted concentrations for CO, PM₁₀ and PM_{2.5}, as compared to the existing and No-Build conditions. As shown the predicted concentrations are below the NAAQS.

Table F.3: Predicted Mobile Source Air Quality Concentrations

Pollutant	Averaging Period	NAAQS	Maximum Predicted Concentrations		
			Existing	No Build	Build
Carbon Monoxide	1 hr.	35 ppm	4.3 ppm	3.6 ppm	5.1 ppm
	8 hr.	9 ppm	2.8 ppm	2.3 ppm	3.3 ppm
Inhalable Particulates (PM ₁₀)	24 hrs.	150 µg/m ³	61.8 µg/m ³	63.4 µg/m ³	63.6 µg/m ³
	1 yr.	Revoked	N/A	N/A	N/A
Fine Particulates (PM _{2.5})	24 hrs.	65 µg/m ³	34.1 µg/m ³	35.2 µg/m ³	35.3 µg/m ³
	1 yr.	15 µg/m ³	12.4 µg/m ³	12.7 µg/m ³	12.8 µg/m ³

All concentrations include the higher of the ambient concentrations noted in Table F.3 for Pennsylvania and New Jersey, as follows: CO – 1 hour (2.9 ppm), 8 hour (1.8 ppm); PM₁₀ – 24 hours (58 µg/m³); PM_{2.5} – 24 hours (31.3 µg/m³), 1 year (11.4 µg/m³). A persistence factor of 0.7 was used to convert one-hour CO concentrations to eight-hour concentrations.

Source: Edwards and Kelcey, 2006, 2008.

Stationary Source

Station Parking

A worst-case analysis was performed at the largest station, Pocono Mountain, which will have a maximum parking capacity of 1,000 vehicles, with a maximum of 307 vehicles during the peak hours. The maximum one-hour carbon monoxide levels would be 4.6 parts per million (ppm), and the eight-hour levels would be 3.0 ppm. The maximum 24-hour inhalable particulate (PM₁₀) levels would be 64.3 micrograms per meter cubed (µg/m³). The total concentrations comply with the corresponding standards for each pollutant. Therefore, the proposed parking areas would not cause significant impacts to air quality.

Scranton Yard Facility

The proposed rail service will originate in a new yard immediately west of the proposed Scranton station. To accommodate operations, one locomotive at a time would idle in the proposed rail yard prior to beginning each service run. The results of the screening analysis showed that at the yard the maximum one-hour carbon monoxide levels would be 3.6 ppm and the maximum eight-hour levels would be 2.3 ppm. The maximum 24-hour inhalable particulate (PM₁₀) levels would be 94.4 µg/m³. The total concentrations comply with the corresponding standards for each pollutant. Therefore, the proposed rail yard would not cause a significant impact.

F.4.2 Mesoscale Analysis

The proposed new rail service would extend and connect the existing rail service from Dover, New Jersey to Scranton, Pennsylvania, and would effect a change in the mode of traveling in areas where new services are planned. Since a substantial number of commuters are projected to switch modes from driving to using the rail service, the proposed project would reduce the regional vehicle-miles traveled (VMT), and consequently, the quantities of vehicular-emitted pollutants. However, new emissions resulting from locomotives would partially negate the benefits of reduced vehicle emissions. This mesoscale analysis assesses the net effects of the proposed rail service on the emissions of pollutants.

Three pollutants were assessed in the mesoscale analysis: carbon monoxide (CO), particulate matter (PM₁₀ and PM_{2.5}), hydrocarbons (HC), and nitrogen oxides (NO_x). Hydrocarbons and nitrogen oxides are included because of their role as precursors for ozone (O₃); ozone is formed through a series of reactions involving hydrocarbons and nitrogen oxides in the presence of sunlight. By calculating the change in the emissions for hydrocarbons and nitrogen oxides, the effect on ozone would be assessed indirectly.

The mesoscale analysis combines the effect of reduced vehicle-miles traveled (VMT), increase rail miles traveled, and stationary source emissions associated with parking facilities and the rail yard.

- *Vehicle-Related Emissions* - The proposed project was estimated to reduce vehicle-miles traveled (VMT) by 145,559 per day.
- *Locomotives in Service* – Sixteen trains are scheduled to operate daily from Scranton and an additional five trains are scheduled to operate daily from Andover, for an increase of rail miles traveled of 1,475 miles per day.
- *Parking Facilities* – The project is proposed to provide a maximum parking capacity of 2,865 vehicles.

- *Rail Yard* – 16 locomotives would idle for a maximum of one hour each per day.

At the regional level, a substantial number of commuters are projected to switch modes from driving to using the rail service; therefore, the proposed project would reduce the regional VMT, and consequently, the quantities of vehicular-emitted pollutants. However, new emissions resulting from locomotives would partially negate the benefits of reduced vehicle emissions. The net effects of each of these emissions (build compared to no build) are summarized in Table F.4. While the Build Alternative would slightly increase NO_x, PM₁₀ and PM_{2.5} emissions; CO and HC emissions would be slightly reduced.

Table F.4: Net Effects of the Proposed Rail Service on Emissions (tons/day)

Pollutant	Highway Emissions	Locomotives in Service	Parking Facilities	Rail Yard Idling	Net Effect
Hydrocarbons	-0.058	0.013	0.000	0.002	-0.043
Carbon Monoxide	-0.832	0.070	0.000	0.008	-0.754
PM ₁₀	-0.005	0.005	0.000	0.001	0.001
PM _{2.5}	-0.005	0.005	0.000	0.001	0.001
Nitrogen Oxides	-0.050	0.071	0.000	0.009	0.030

Source: Edwards and Kelcey, 2005

F.4.3 Consistency with the State Implementation Plan

Conformity Determination

Conformity to the State Implementation Plan is required under the Clean Air Act. Conformity means that the project would not cause new air quality violations, worsen existing violations, or delay attainment of the standards. Projects that are listed on the NJTPA's Regional Transportation Plan (RTP) and Transportation Improvement Program (TIP) are included in the Air Quality Conformity Determination. The New Jersey-Pennsylvania Lackawanna Cut-Off Passenger Rail Service Restoration Project is included in NJTPA's 2005 RTP and amended FY 2008-2012 TIP for northern New Jersey as a non-exempt project and is included in the fiscally-constrained long range plan. This project was analyzed in the Northern New Jersey Air Quality Conformity Determination. In this Conformity Determination, the NJTPA demonstrated that each nonattainment area or maintenance area in the NJTPA region passes the appropriate budget test. Therefore the 2005 Regional Transportation Plan and the amended FY 2008-2012 Transportation Improvement Program for northern New Jersey conforms to the SIP established by NJDEP. This Conformity Determination was approved by NJTPA Board of Trustees on May 12, 2008.

Hot-Spot Analysis

According to 40 CFR 93.116, the project may not cause or contribute to any new localized CO, PM₁₀, or PM_{2.5} violations, or increase the frequency or severity of any violations in nonattainment or maintenance areas. Since none of the counties within the project area are designated as nonattainment for the CO, PM₁₀, or PM_{2.5} NAAQS, a quantitative hot-spot analysis is not required.

F.5 Mitigation

The project would not cause a significant impact to local or regional air quality; therefore, mitigation is not required. At the local level, the project would not cause or contribute to exceedances of the NAAQS.

At the regional level, rail operations associated with this project would comply with the NJ State Implementation Plan for ozone.

Measures that will be considered during design and implementation to reduce particulate matter and NOx emissions include the following:

- Implement idle reduction technology at the Scranton yard;
- Evaluate options to purchase new locomotives that meet or exceed EPA's emission standards;
- Retrofit and/or rebuild older locomotives to achieve a better air quality rating;
- Repower equipment with generator set/hybrid technology; and,
- Use cleaner diesel fuel or alternative fuel.