A. INTRODUCTION

This chapter assesses how operation of the Proposed Project would affect ambient air quality. The potential short-term temporary impact on air quality from construction of the Build Alternatives is discussed in Chapter 17, "Construction Effects."

The air quality analyses are based on the anticipated changes in train operations with the Build Alternatives, as described in Chapter 3, "Transportation." (The alternatives are described in detail in Chapter 2, "Project Alternatives.") This chapter examines the effect of changes in train operations and track alignment on both regional (mesoscale) emissions and local (microscale) concentrations of air pollutants. The Project would not introduce any new, permanent stationary emission sources, such as boilers or generators.

B. REGULATORY CONTEXT AND METHODOLOGY

The methodology, including train volumes and other assumptions, regulatory context, and detailed discussion of the results are presented in **Appendix F**, "Air Quality, Noise, and Vibration."

C. AFFECTED ENVIRONMENT

Cecil County and Harford County are within a nonattainment area for ozone. In addition, Harford County is within a maintenance area for $PM_{2.5}$, as described in more detail in **Appendix F**. Pollutant levels measured at area monitoring stations are used to characterize existing conditions. **Table 12-1** shows relevant regulated pollutants studied, including:

- Carbon monoxide (CO)
- Sulfur dioxide (SO_2)
- PM_{10}: Particulate matter (PM) with aerodynamic diameter of less than or equal to 10 micrometers
- $PM_{2.5}$: Particulate matter with aerodynamic diameter of less than or equal to 2.5 micrometers
- Nitrogen dioxide (NO_2)
- Ozone (measured in 2014 at monitoring stations closest to the project area)

These values are the most recent data available at the time the analysis was undertaken, and are consistent with the background conditions used in the future conditions analyses (see below). Monitored levels of ozone exceed the National Ambient Air Quality Standards (NAAQS), as discussed in **Appendix F**.

While the measured concentrations of pollutants other than ozone are lower than the NAAQS, the monitors are not located adjacent to specific sources such as highways or rail lines and do not represent concentrations specifically-affected by such operations, but rather the background concentrations in the area in general. Concentrations of PM, CO, and NO_2 in the existing condition near the tracks are likely higher than those presented in **Table 12-1**.

Table 12-1
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration(1)	NAAQS
CO	Essex, Baltimore County	Ppm	8-hour	1.3	9
			1-hour	1.8	35
SO_2	Essex, Baltimore County	$\mu g/m^3$	3-hour	N/A	1,300
			1-hour	68	196
PM_{10}	Baltimore, Baltimore County	$\mu g/m^3$	24-hour	41	150
$PM_{2.5}$	Fair Hill, Cecil County	$\mu g/m^3$	Annual	8.6	12
	Edgewood, Harford County			10.3	
	Fair Hill, Cecil County	$\mu g/m^3$	24-hour	24	35
	Edgewood, Harford County			21	
NO_2	Essex, Baltimore County	$\mu g/m^3$	Annual	21	100
			1-hour	87	188
Ozone	Fair Hill, Cecil County	Ppm	8-hour	**0.074**	0.070
	Churchville, Harford County			0.070	

Notes: 1. All concentrations presented are based on 2014 data. CO and PM_{10} concentrations are the second-highest values. SO_2 1-hour is the 99th percentile of daily maximum 1-hour average concentrations. NO_2 1-hour is the 98th percentile of daily maximum 1-hour average concentrations averaged over the 3-year period of 2012 to 2014. 24-hour average $PM_{2.5}$ is the 98th percentile. Annual value is the mean for the year. 8-hour average ozone concentrations are the 4th highest-daily values for 2014. Concentrations in **bold** exceed the NAAQS.

Sources: USEPA, Air Data, Monitor Values Report for 2014 http://www.epa.gov/airdata/ad_rep_mon.html, accessed January 6, 2016.

D. NO ACTION ALTERNATIVE

REGIONAL (MESOSCALE) ANALYSIS

Regional (mesoscale) emissions are assessed on an incremental basis (emissions change resulting from a Build Alternative as compared with the No Action Alternative). Therefore, a mesoscale analysis is not presented for the No Action Alternative separately.

LOCAL (MICROSCALE) ANALYSIS

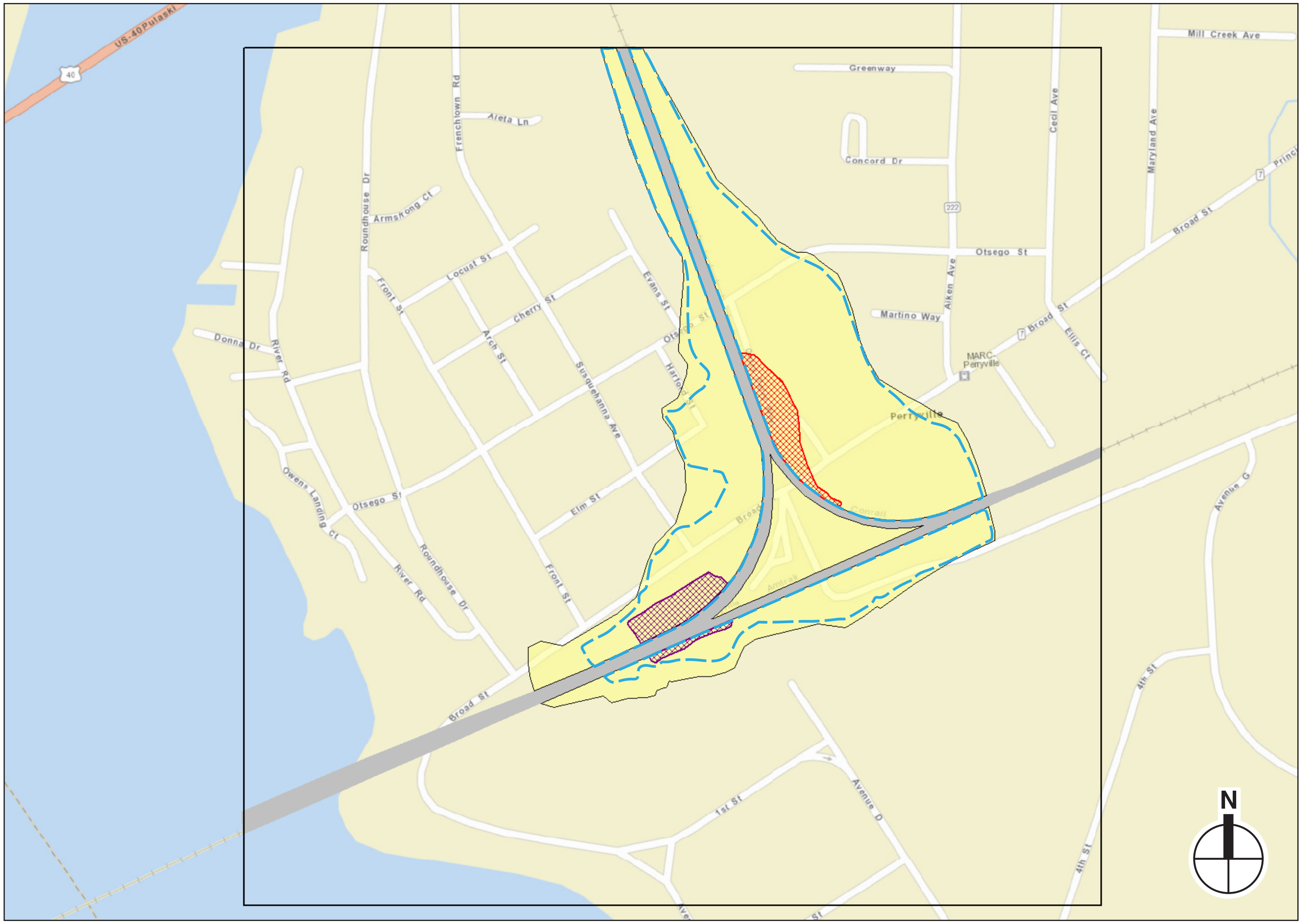
Projected maximum concentrations of pollutants in 2040 at locations near the south wye track for the No Action Alternative are presented in **Table 12-2**. The reasons why this location was selected for the microscale analysis are discussed in **Appendix F**. Maximum projected $PM_{2.5}$ (24-hour and annual average), PM_{10} (24-hour average), and annual average NO_2 concentrations would be lower than the respective NAAQS. However, 1-hour average NO_2 concentrations could potentially exceed the NAAQS in the No Action Alternative. Exceedances could potentially occur all along the tracks, up to 500 feet to the east and west of the at-grade crossing of the Norfolk Southern (NS) Port Road at Ostego Street in Perryville; and up to 200 feet to the north and south of the Susquehanna River Rail Bridge approach in Perryville (see **Figure 12-1**). Concentrations at other locations along the track, including areas outside the study area, may be lower due to lower engine loads (lower grade and/or less track curvature), fewer freight trains, and a lack of idling locomotives; however, 1-hour NO_2 exceedances are, nonetheless, possible in all areas where this level of diesel operations would occur, as discussed in more detail in **Appendix F**. Note that while detailed concentrations in existing conditions were not analyzed, it is expected that the concentrations near the tracks in the existing conditions would be similar to those projected for the No Action Alternative.

Table 12-2
Maximum Projected Concentrations— No Action Alternative (µg/m³)

Pollutant	Time Period	Background Concentration	No Action: Modeled Concentration	No Action: Total Concentration	NAAQS
NO_2	1-Hour	(1)	(1)	**283**	188
	Annual	24.7	8.29	33.0	100
$PM_{2.5}$	24-Hour	23.5	0.5	24.0	35
	Annual	10.9	0.1	11.0	12
PM_{10}	24-Hour	44	0.5	44.5	150

Notes:
Results in **bold** exceed the NAAQS.
1. Consistent with EPA guidance, total NO_2 1-hour concentrations include seasonal hourly background concentrations developed from hourly monitored NO_2 concentrations at the Fair Hill monitoring station over the years 2010 to 2014.

The above 1-hour average NO_2 concentrations were predicted using a conservative modeling approach where peak activity within the overnight and daytime periods were modeled throughout these respective periods at all hours. Peak overnight activity assumed in the model includes three diesel powered freight locomotives, while daytime activity assumed includes one diesel powered freight locomotive and three diesel powered MARC locomotives. The approach of applying peak activity to all hours a peak may occur ensures that the combination of worst-case emission rates and worst-case meteorological conditions, resulting in peak potential concentrations at each of the nearby receptors, are captured. However, due to the infrequent number of times that peak activity would occur, it is unlikely that peak activity would consistently occur during worst-case meteorological conditions at any one receptor, and therefore, this approach results in conservatively high estimates of potential 1-hour NO_2 concentrations. To demonstrate this effect, the Project Team analyzed the effect of actual hourly freight train activity recorded on the Northeast Corridor (NEC) from September 2015 to April 2016. With actual recorded hourly freight activity (including hourly number of freight trains by direction and train tonnage) projected 1-hour NO_2 concentrations resulting from freight rail fell below the NAAQS threshold of 188 $\mu g/m^3$. While concentrations are only representative of freight locomotive sources, these sources would result in the worst-case 1-hour concentrations.



Extent of Potential Exceedance – Build Alternatives

Extent of Potential Exceedance – No Action Alternative

Area of Highest Potential Concentrations

Area of Highest Potential Increment

Extent of Model Projections

Modeled Railroad Source

Areas of Potential Exceedance of the 1-Hour NO_2 Standard

Figure 12-1

E. POTENTIAL IMPACTS OF THE BUILD ALTERNATIVES

REGIONAL (MESOSCALE) ANALYSIS

Table 12-3 illustrates projected increases in emissions associated with the Build Alternatives within each Air Quality Control Region (AQCR) in the study area. These represent the total increase in emissions with the Build Alternatives, associated with increased freight movement along the rail track between areas to the north towards Pennsylvania and either Baltimore or Wilmington. Additionally, the increased MARC train volumes traveling between Baltimore and Elkton as well as the exclusive utilization of diesel powered trains are included in the regional annual emissions. Note that this analysis does not present the net change in emissions in the non-attainment areas, nor does it account for the overall benefits of the NEC FUTURE region-wide. This analysis conservatively compares only the increments with the de minimis thresholds for general conformity, demonstrating that the Build Alternatives would not require a conformity determination. The projected increases presented do not take into account the shift in intercity travel within the nonattainment area from motor vehicles to the improved Amtrak high speed rail and MARC service. The Build Alternatives would promote this shift to more fuel efficient transportation, reducing vehicle miles traveled—and consequently pollutant emissions—within the region.

Table 12-3
Predicted Increases in Regional Annual Emissions

Criteria Pollutant	Emissions Increases (ton/year)		De Minimis Threshold
	Baltimore	Philadelphia-Wilmington-Atlantic City	
NO_x	39	14	100
$PM_{2.5}$	0.5	0.2	100
VOC	1.5	0.5	50

Note: This table conservatively present potential increases only, and does not show the net change which would include decreases associated with the shift from highway travel to rail.

Regulations under the Clean Air Act ("conformity regulations") require that federal agencies, when taking action to assist, fund, permit, or approve projects in areas with a non-attainment or maintenance status regarding any of the NAAQS, ensure that the projects conform to the applicable State Implementation Plans (SIPs) for attaining those standards, so as not to interfere with the state's ability to attain and maintain the NAAQS. The total projected emissions in each AQCR represent a small fraction of the *de minimis* levels defined in the conformity regulations. This demonstrates that the operation of the Build Alternatives would not require a conformity determination and would not interfere with SIPs for attainment of the ozone NAAQS or maintenance of the $PM_{2.5}$ NAAQS within each AQCR. Emissions increases may also occur in other non-attainment areas traversed by affected rail lines beyond the project study area; those emissions increases would likely be on the order of those shown in **Table 12-3**; therefore, no conformity determinations would be required for any other non-attainment or maintenance areas. Overall, the Proposed Project would not substantially affect regional air quality in the nonattainment areas.

As described above, the conformity analysis for the non-attainment area does not include the benefits of shifting of travel from highway to the more efficient rail mode. Furthermore, in the larger region including the NEC, the NEC FUTURE would promote the more efficient passenger rail service. As described in Chapter 13, "Greenhouse Gas Emissions and Climate Change," overall, Amtrak service is 33 percent more efficient per passenger-mile than average highway travel (nationwide), and is likely more efficient than that along the NEC where ridership is high. The Build Alternatives are a component of the larger sustained effort to enhance passenger rail and freight rail for the long term, benefitting air quality and reducing pollutant emissions overall.

LOCAL (MICROSCALE) ANALYSIS

Table 12-4 presents maximum total concentrations projected to occur at locations near the south wye track west of Perryville Station due to track realignment and increased locomotive activity. The projected maximum concentrations and increments presented in **Table 12-4** are the same for with Alternative 9A and Alternative 9B. **Appendix F** includes a more detailed discussion of results. Similar to the No Action Alternative, maximum projected $PM_{2.5}$ (24-hour and annual average), PM_{10} (24-hour average), and annual average NO_2 concentrations with the Build Alternatives would be lower than the respective NAAQS. As with the No Action Alternative, the 1-hour average NO_2 concentrations were projected to potentially exceed the NAAQS up to 500 feet to the east and west of the at-grade crossing of the NS Port Road at Otsego Street in Perryville. Peak hourly freight train volume and alignment will be the same with the Build Alternatives and the No Action Alternative; therefore the 1-hour NO_2 exceedances in these areas would occur in both the No Action Alternative and Build Alternatives, and would not be a result of the Proposed Project. The 1-hour average NO_2 concentrations were projected to potentially exceed the NAAQS up to 280 feet north and south of the Susquehanna River Rail Bridge approach in Perryville where diesel locomotives operate—80 feet farther from the freight track than in the No Action Alternative because of the track realignment and grade changes.

Table 12-4
Maximum Projected Concentrations

Pollutant	Time Period	Background Concentration ($\mu g/m^3$)	No Action Concentration ($\mu g/m^3$)	Build Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	1-Hour	[1]	**283**	**292**	188
	Annual	24.7	33.0	34.2	100
$PM_{2.5}$	24-Hour	23.5	24.0	24.3	35
	Annual	10.9	11.0	11.1	12
PM_{10}	24-Hour	44	44.5	44.8	150

Notes:
Results in **bold** exceed the NAAQS.
Project concentrations represent results at the wye track under Alternative 9A and Alternative 9B.
1. Consistent with EPA guidance, NO_2 1-hour concentrations utilized seasonal hourly background concentrations developed from hourly monitored NO_2 concentrations at Fair Hill monitoring station over the years 2010 to 2014.

While total concentrations at residences adjacent to the track curve re-alignment (south of Broad Street and west of the wye track) are projected to be lower than the above maximums (at most 209 $\mu g/m^3$ and 226 $\mu g/m^3$ in the No Action and Build Alternatives, respectively), the concentrations at those locations would nonetheless also potentially exceed the NAAQS, and would represent an increase of up to 3 percent over the levels predicted under the No Action Alternative (see **Figure 12-1**). (Note that this section focuses only on potential local effects; for discussion of the benefits of efficient rail travel and freight in region-wide air quality and greenhouse gas emissions, see the "Regional (Mesoscale) Analysis" section above and Chapter 13, "Greenhouse Gas Emissions and Climate Change.")

As described for the No Action scenario, the above Build Alternative concentrations were predicted using a modeling approach that necessarily results in conservative estimates of potential 1-hour NO_2 concentrations. Due to the infrequent number of times that peak activity would occur, it is unlikely that peak conditions would consistently occur during worst-case meteorological conditions at any one receptor. To demonstrate this effect, additional modeling was performed using actual hourly freight train activity recorded on the NEC from September, 2015 to April, 2016. When actual hourly freight train activity was modeled, projected 1-hour NO_2 concentrations fell below the NAAQS threshold of 188 $\mu g/m^3$. While concentrations are only representative of freight locomotive sources, these sources would result in the worst-case 1-hour concentrations. Therefore, it is possible that the predicted 1-hour average NO_2 NAAQS exceedance shown in **Table 12-4** is purely due to the conservative nature of the regulatory modeling approach. Actual 1-hour NO_2 concentrations and the increase in those concentrations with the Build Alternatives will likely be lower than shown in **Table 12-4**.

The increment as compared with the No Action Alternative is associated with the proposed track realignments described above and the increase in freight movement and MARC diesel train volumes with the Build Alternatives. Concentrations at other locations near the freight tracks between the wye track in Perryville and areas to the north and areas along the NEC to the south of the bridge (Havre de Grace and farther south) are also anticipated to increase somewhat with the Build Alternatives when compared with the No Action Alternative due to the growth in daily and annual freight movement, but would be less than the results presented above since there would be no change in track location or grade at those locations. However, peak hourly concentrations, including 1-hour average NO_2, would not increase in areas outside the study areas as compared with the No Action Alternative since peak hour freight train volume would not increase.

In summary, local 1-hour average NO_2 concentrations may increase near the proposed bridge that would be used by MARC and freight trains. Concentrations with the Build Alternatives (both the Preferred Alternative 9A and Alternative 9B) could increase by up to 8.6 percent in areas where the model predicts an exceedance of the 1-hr NO_2 NAAQS under the No Action Alternative. Given the necessarily conservative modeling approach required to address the complex form of the 1-hour NO_2 standard, actual increases of 1-hour NO_2 concentrations would likely be much lower than the modeled 8.6 percent and actual total concentrations would likely not exceed the NAAQS. Furthermore, concentration increases would likely be limited to smaller areas than those shown in **Figure 12-1**. Overall, local air quality with and without the Proposed Project is likely to be very similar. Considering all of the above, the low probability of NAAQS exceedance, the small potential increment, and the limited area potentially affected, the Build Alternatives would not result in a significant adverse impact on air quality.

F. MINIMIZATION AND MITIGATION OF IMPACTS

Measures to minimize and mitigate the effects of the Proposed Project on air quality that can be implemented by the Project Team are discussed in Chapter 17, "Construction Effects." During operation, the Project Team will have limited influence on emissions from rail.

Amtrak trains are electric and therefore have zero emissions at the local level. Furthermore, Amtrak actively works on increasing ridership and efficiency. This helps to avoid emissions from personal vehicle travel and to minimize per passenger use of electricity (and associated regional emissions) to operate the trains.

Freight trains have diesel locomotives and are operated by Norfolk Southern. Their emissions are subject to USEPA regulations and cannot be reduced by the Proposed Project. MARC currently has a program to purchase diesel locomotives meeting Tier IV emission standards. While Tier IV locomotives would emit less than the diesel locomotives in the existing fleet, further emission reductions would be possible if MARC trains were electric. The electrification of MARC fleet is beyond the control of the Proposed Project and is therefore not part of minimization and mitigation measured for the Proposed Project.

Should MARC switch to an electric fleet independent of the Proposed Project, total concentrations would be only slightly lower than those shown for the Proposed Project in **Table 12-4**. However, excluding ambient backgrounds, the 24-hour average and annual concentrations would decrease by approximately 5 percent and 22 percent, respectively. The emission reduction benefits of possible electrification of MARC service would not decrease the 1-hour average NO_2 concentrations reported in **Table 12-4**, as the 1-hour NO_2 concentrations are affected by diesel freight trains to a much greater extent than by MARC trains (whether they run on diesel or electricity). ✷