B&P TUNNEL PROJECT

B&P Tunnel Project
Baltimore, Maryland

AIR QUALITY TECHNICAL REPORT

August 2015

U.S. Department of Transportation
Federal Railroad Administration

Maryland Department of Transportation

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I. INTRODUCTION

This technical report presents a detailed analysis of the air quality impacts potentially generated by the alternatives being studied for the Baltimore and Potomac (B&P) Tunnel Project. This technical report has been prepared in support of the Environmental Impact Statement (EIS)[1] being prepared by the Federal Railroad Administration (FRA)[2], in coordination with the Maryland Department of Transportation (MDOT)[3].

The project Study Area surrounds the existing 1.4-mile B&P Tunnel in the west-central portion of Baltimore City and includes Amtrak's Northeast Corridor (NEC) between Penn Station to the north and the Gwynns Falls Bridge to the south, as illustrated in **Figure 1**.

Please note that all environmental evaluation in this technical report is current through August 2015.

II. PROJECT BACKGROUND

As shown in **Figure 1**, the B&P Tunnel is located beneath several West Baltimore neighborhoods, including Bolton Hill, Madison Park, and Upton. The tunnel is currently used by Amtrak[4], MARC[5], and Norfolk Southern Railway (NS)[6], and is owned by Amtrak. Built in 1873, the tunnel is one of the oldest structures on the NEC. It is approximately 7,500 feet (1.4 miles) long and is comprised of three shorter tunnels: the John Street Tunnel, the Wilson Street Tunnel, and the Gilmor Street Tunnel. The B&P Tunnel is a centerpiece of the Baltimore rail network that contributes to the economic vitality of the Northeast region. The B&P Tunnel is important not only for Baltimore, but also the NEC (NEC MPWG, 2010). The NEC is the nation's most congested rail corridor and one of the highest volume corridors in the world (Amtrak, 2010).

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[1] The EIS and associated technical reports are being conducted in compliance with the National Environmental Policy Act of 1969 (42 United States Code [USC] 4321 et seq.), the Council of Environmental Quality NEPA Regulations (40 CFR 1500-1508), the FRA Procedures for Considering Environmental Impacts (64 FR 28545, May 26, 1999), and FRA's Update to NEPA Implementing Procedures (78 FR 2713, January 14, 2013).
[2] FRA is serving as the lead Federal agency for the B&P Tunnel Project.
[3] MDOT is the funding grantee for the B&P Tunnel Project. MDOT oversees six modal state agencies, including the Maryland Transit Administration (MTA).
[4] Amtrak is the nation's high-speed rail operator and owns the existing B&P Tunnel.
[5] MARC (Maryland Area Regional Commuter) is administered by MTA. MARC is a commuter rail system comprised of three rail lines of service. One of the lines (the MARC Penn Line) operates along the NEC and through the B&P Tunnel, providing service between Washington, D.C. and Perryville, Maryland.
[6] NS is a freight transportation provider that manages a nearly 20,000-mile rail network across the United States, including freight service through the existing B&P Tunnel (NS, 2014a).

III. PROJECT PURPOSE AND NEED

A. Purpose of the Project

The primary purpose of the project is to address the structural and operational deficiencies of the B&P Tunnel. In addition, the project would: improve travel time, accommodate existing and projected travel demand for passenger services (regional and commuter), eliminate impediments to existing and projected operations along the NEC, provide operational reliability, and take into account the value of the existing tunnel as an important element of Baltimore's rail infrastructure.

B. Need for the Project

The purpose of the project was derived from the following needs:

- The existing B&P Tunnel is more than 140 years old and is approaching the end of its useful life with regard to its physical condition. While the tunnel currently remains safe for rail transportation, it requires substantial maintenance and repairs, and it does not meet current design standards. The tunnel is considered to be structurally deficient due to the horizontal radius of the original design, its age, and wear and tear.

- The tunnel is also functionally obsolete, meaning that it is not able to meet current and future rail demands due to its vertical and horizontal track alignment. The low-speed tunnel creates a bottleneck at a critical point in the NEC, affecting operations of the most heavily-traveled rail line in the United States.

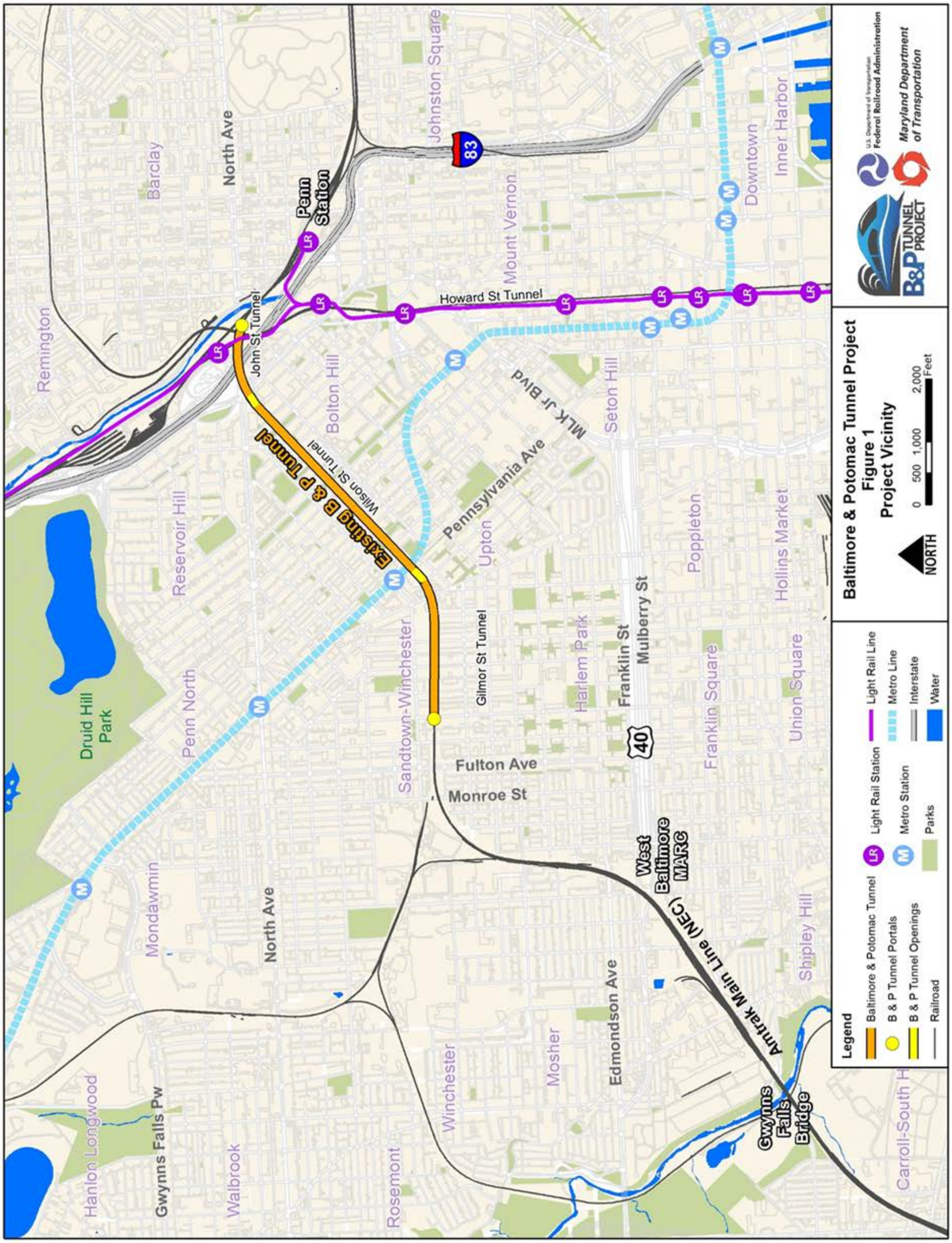
- The existing double-track tunnel does not provide enough capacity to support existing and projected demands for regional and commuter passenger service.

- The existing tunnel is not suited for modern high-speed usage due to the current horizontal and vertical track alignment, which limits passenger train speeds through the tunnel to 30 MPH.

- The existing tunnel is a valuable resource. The disposition of the existing tunnel needs to be considered in the project.

IV. ALTERNATIVES

Sixteen preliminary alternatives were identified, evaluated using a two-level progressive screening approach, and narrowed to four alternatives in the *B&P Tunnel Project – Preliminary Alternatives Screening Report* (FRA/MDOT, December 2014). The four preliminary alternatives retained for further design development and environmental study included: Alternative 1: No-Build, Alternative 2: Restore/Rehabilitate Existing B&P Tunnel, Alternative 3: Great Circle Passenger Tunnel, and Alternative 11: Robert Street South.


Baltimore & Potomac Tunnel Project
Figure 1
Project Vicinity
NORTH
0 500 1,000 2,000 Feet
Legend
Baltimore & Potomac Tunnel
B & P Tunnel Portals
B & P Tunnel Openings
Railroad
Light Rail Station
Metro Station
Parks
Light Rail Line
Metro Line
Interstate
Water
Maryland Department of Transportation
U.S. Department of Transportation Federal Railroad Administration
Existing B & P Tunnel
John St Tunnel
Wilson St Tunnel
Howard St Tunnel
Gilmor St Tunnel
Penn Station
West Baltimore MARC
Amtrak Main Line (NEC)
Gwynns Falls Bridge
Druid Hill Park
North Ave
Pennsylvania Ave
MLK Jr Blvd
Franklin St
Mulberry St
Fulton Ave
Monroe St
Edmondson Ave
Gwynns Falls Pw
Remington
Barclay
Johnston Square
Mount Vernon
Bolton Hill
Reservoir Hill
Penn North
Upton
Seton Hill
Downtown
Inner Harbor
Sandtown-Winchester
Harlem Park
Poppleton
Hollins Market
Franklin Square
Union Square
Mondawmin
Shipley Hill
Mosher
Winchester
Walbrook
Rosemont
Hanlon Longwood
Carroll-South H

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These conceptual alternatives have evolved as the preliminary designs advanced. It was determined upon more detailed study of Alternatives 3 and 11 that several options could be accommodated within the general corridors of each, and that each of the options should be considered as part of the Project. This technical report considers Alternative 3 Options A, B, and C as well as Alternative 11 Options A and B (**Figure 2**). Alternative 2 is hereafter referred to as "Reconstruction and Modernization of the Existing Tunnel" to more accurately reflect the components of the alternative.

A. Alternative 1: No Build

Alternative 1 would entail continued use with no significant improvements to the existing B&P Tunnel. Routine maintenance of the tunnel would continue. The tunnel's basic geometry and structure would not be improved; the existing tunnel and tracks would be left in place. This alternative would not modernize the tunnel or bring it into a "state of good repair," but would rather maintain the existing service and ongoing maintenance as currently practiced with minimal disruption.

Necessary maintenance required to continue using the existing tunnel may include replacing damaged track slabs, repairing leaking utility lines above the tunnel, rebuilding deteriorated manholes, repairing brick and mortar, replacing catenary supports, and repairing the Gilmor Street portal.

B. Alternative 2

Alternative 2 includes the complete reconstruction of the existing B&P Tunnel in its current location. This alternative would address the existing B&P Tunnel's deteriorating conditions and eliminate restrictions on the size of railcar traffic over the NEC through Baltimore. This alternative would completely replace the existing tunnel liner, lower the tunnel invert for greater vertical clearance, and widen the tunnel for greater horizontal clearance. The geometry of the existing tunnel, such as curves and grades, would not be altered. The resulting tunnel would accommodate a two-track alignment through the Study Area.

C. Alternative 3

Alternative 3 consists of three options (A, B, and C), all of which would extend in a wide arc north of the existing B&P Tunnel. Each option would include a north portal located in the vicinity of the MTA North Avenue Light Rail station, north of where I-83 crosses North Avenue. The south portal for each option would be constructed at one of two sites located south of Presstman Street, between Bentalou and Payson Streets. Each option would result in a four-track alignment through the Study Area, and would involve construction of four separate tunnel bores. Each option would require three ventilation plants – one at each portal and one mid-tunnel plant. All of the alternatives have similar north portal locations but differ in their south portal locations and underground alignment.

Alternative 3 Option A would include a south portal located at the existing P. Flanigan Asphalt plant, just south of the athletic fields at Carver Vocational-Technical High School, roughly a third of a mile west of the existing B&P Tunnel south portal. The alignment would rejoin the existing NEC corridor at the curve located south of the asphalt plant. Option A would result in a total travel distance of approximately 3.7 miles between Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 1.9 miles of this total length.

Alternative 3 Option B would include a south portal located southeast of the P. Flanigan Asphalt plant, adjacent to the existing NEC between Mosher Street and Riggs Avenue, roughly a third of a mile southwest of the existing B&P Tunnel south portal. Much of the underground portion of the alignment is identical to Option A. However, the alignment south of the south portal would be located east of the existing NEC. Alternative 3 Option B would result in a total travel distance of approximately 3.7 miles between Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 2.0 miles of this total length.

Alternative 3 Option C would include a south portal located at the P. Flanigan Asphalt plant, just south of the athletic fields at Carver Vocational-Technical High School, roughly a third of a mile west of the existing B&P Tunnel south portal. The underground portion of the tunnel would parallel the alignments identified under Options A and B; however, the alignment would be shifted further north. The alignment south of the south portal would be located west of the existing NEC. Option C would result in a total travel distance of approximately 3.8 miles between Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 2.2 miles of this total length.

D. Alternative 11

Alternative 11 includes two options (A and B) that provide for relatively straight alignments between Penn Station and the West Baltimore MARC Station, crossing diagonally underneath the existing B&P Tunnel. Each option would include a north portal in the vicinity of the MTA North Avenue Light Rail station, north of where I-83 crosses North Avenue. The south portal for each option would be located in the general vicinity of the West Baltimore MARC Station in the Midtown-Edmondson neighborhood. Each option would result in a four-track alignment through the Study Area, and would involve construction of four separate tunnel bores. Each option would require three ventilation plants – one at each portal and one mid-tunnel plant. Options A and B differ primarily in the south portal location and underground alignments.

Alternative 11 Option A would include a south portal located just west of the intersection of Harlem Avenue and Appleton Street, northeast of the West Baltimore MARC Station. The alignment would cross over Franklin and Mulberry Streets. Option A would result in a total travel distance of approximately 3.3 miles between Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 1.9 miles of this total length.

Alternative 11 Option B would exit the bored tunnel portion at a south portal located just southwest of the intersection of Edmondson Avenue and Pulaski Street, adjacent to the existing West Baltimore MARC Station. The underground portion of the alignment would run parallel to Option A, but would be shifted slightly north for the length of the tunnel alignment. The alignment would cross under Franklin and Mulberry Streets. Alternative 11 Option B would result in a total travel distance of approximately 3.3 miles between Penn Station and the Amtrak Gwynns Falls Bridge. The tunnel segment of the alignment comprises 2.2 miles of this total length.

Figure 2. B&P Tunnel Project Alternatives

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V. AFFECTED ENVIRONMENT

This section provides background information on the management of air quality in Maryland, existing air quality conditions, and applicable federal regulations.

A. Air Quality Management Agencies

The management of air quality conditions in Maryland is the responsibility of federal, state, regional, and local governmental air quality regulatory agencies. Under the federal Clean Air Act (CAA), the U.S. Environmental Protection Agency (USEPA) establishes the guiding principles and policies for protecting air quality conditions throughout the nation. The USEPA's primary responsibilities in this area include promulgating the National Ambient Air Quality Standards (NAAQS) which define ambient (i.e., outdoor) levels of air pollutants that are considered safe for public health, welfare and the environment, as well as approving State Implementation Plans (SIPs), plans that demonstrate compliance with the NAAQS. The CAA requires states to develop, update and maintain SIPs that define attainment timeframes or milestones, area-wide emissions inventories and budgets and control and mitigation strategies that are to be employed.

The Federal Railroad Administration (FRA) is the primary agency involved in, and responsible for, ensuring that air quality impacts associated with proposed railroad projects adhere to the reporting and disclosure requirements of the National Environmental Policy Act (NEPA) as well as the General Conformity rule of the CAA.

On the state level, the Maryland Department of the Environment (MDE) is the primary authority for ensuring that federal (and state) air quality regulations are met. MDE is responsible for air quality monitoring throughout the state as well as the development and implementation of the SIP. The permitting of stationary emission sources, the regulation of mobile source emissions, and air programs related to criteria pollutants are also under the jurisdiction of MDE.

Baltimore City and Baltimore County are part of the Baltimore Regional Transportation Board (BRTB). The BRTB is the federally-designated Metropolitan Planning Organization (MPO) for the Baltimore region. The local MPO along with the Baltimore Metropolitan Council (BMC), assists the MDE with SIP development and compliance with Transportation Conformity regulations as they pertain to air quality. The Maryland Department of Transportation (MDOT) is involved in air quality management of Maryland's surface transportation facilities by means of coordination with the BMC and Federal Highway Administration (FHWA) in the development of Transportation Improvement Plans (TIP), the Long Range Transportation Plan (LRTP), and adherence to the Transportation Conformity rules.

B. National Ambient Air Quality Standards

Pursuant to the requirements of the CAA, the USEPA establishes, enforces, and periodically reviews the NAAQS. The NAAQS are set to safeguard public health and environmental welfare against the detrimental impacts of outdoor air pollution and are defined as primary and/or secondary standards. Primary NAAQS are health-based standards geared toward protecting sensitive or at-risk portions of the population such as asthmatics, children, and the elderly. Secondary NAAQS are welfare oriented and are designed to prevent decreased visibility and damage to animals, vegetation, and physical structures. NAAQS have been established for six common air pollutants, referred to as criteria pollutants--carbon monoxide (CO), lead, nitrogen dioxide (NO_2), ozone, particulate matter (PM) which includes particulate matter with a diameter of 10 microns or less (PM_{10}) and $PM_{2.5}$, and sulfur dioxide (SO_2). Nitrogen oxides (NO_x) and volatile organic compound (VOC) emissions are precursors to ozone formation. The NAAQS are summarized in **Table 1**.

Table 1: National Ambient Air Quality Standards

Pollutant		Primary/ Secondary	Averaging Time	Level
Carbon Monoxide (CO)[a]		Primary	8-hour	9 ppm
			1-hour	35 ppm
Lead (Pb)[b]		Primary and Secondary	Rolling 3 month average	0.15 µg/m^3
Nitrogen Dioxide (NO_2)[c]		Primary	1-hour	100 ppb
		Primary and Secondary	Annual	53 ppb[d]
Ozone (O_3)[e]		Primary and Secondary	8-hour	0.075 ppm[f]
Particulate Matter	$PM_{2.5}$[g]	Primary	Annual	12 µg/m^3
		Secondary	Annual	15 µg/m^3
		Primary and Secondary	24-hour	35 µg/m^3
	PM_{10}[h]	Primary and Secondary	24-hour	150 µg/m^3
Sulfur Dioxide (SO_2)[i]		Primary	1-hour	75 ppb[j]
		Secondary	3-hour	0.5 ppm

Source: USEPA, National Ambient Air Quality Standards (NAAQS), 2015, http://www.epa.gov/air/criteria.html.
Notes: ppb = parts per billion, ppm = parts per million, and µg/m^3 = micrograms per cubic meter of air.
[a] CO 1-hour and 8-hour standard not to be exceeded more than once per year.
[b] Lead rolling three month average standard not to be exceeded. Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.
[c] NO_2 1-hour standard represents the 98th percentile, averaged over three years.
[d] The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is presented for the purpose of clearer comparison to the 1-hour standard.
[e] Ozone 8-hour standard represents the annual fourth-highest daily maximum 8-hr concentration, averaged over three years.
[f] Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, the USEPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.
[g] $PM_{2.5}$ annual standards represent annual mean, averaged over three years. $PM_{2.5}$ 24-hour standard represents 98th percentile, averaged over three years.
[h] PM_{10} 24-hour standard not to be exceeded more than once per year on average over three years.
[i] SO_2 1-hour standard represents 99th percentile of 1-hour daily maximum concentrations, averaged over three years. SO_2 3-hour standard not to be exceeded more than once per year.
[j] Final rule signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

C. Criteria Air Pollutants

The general characteristics of the six criteria pollutants and their impacts on human health are described below.

1. Carbon Monoxide

CO is produced in urban environments primarily by the incomplete combustion of fossil fuels. CO concentrations can vary greatly over relatively short distances. In the environment, it may temporarily accumulate into localized “hot-spots”, especially in calm weather conditions and in the wintertime when CO forms easily and is chemically most stable. Elevated concentrations are typically along heavily travelled and congested roadways and can have impacts on human health by reducing oxygen delivery to the body's vital organs such as the heart and brain, and tissues. People with heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia, often accompanied by chest pain, when exercising or under increased stress.

2. Lead

Lead emissions are primarily associated with industrial sources and motor vehicles that use gasoline containing lead additives. Most U.S. vehicles produced since 1975, and all produced after 1980, are designed to use unleaded fuel. As newer vehicles have replaced the older ones, motor vehicle related lead emissions have substantially decreased, thus, ambient concentrations of lead have declined significantly. In 1996, the CAA banned the sale of the small amount of leaded fuel that was still available in some parts of the U.S. for use in on-road vehicles, concluding the 25-year effort to phase out lead in gasoline. However, the USEPA still allows fuel containing lead to be sold for off-road uses, including aircraft, racing cars, farm equipment, and marine engines. In humans, lead exposures can cause nervous system damage.

3. Nitrogen Dioxide and Volatile Organic Compounds

NO_2, nitric oxide (NO), and the nitrate radical (NO_3) are collectively called oxides of nitrogen (NO_x). These three compounds are interrelated, often changing from one form to another in chemical reactions. The main source of NO_x is fuel combustion in motor vehicles and power plants. Reactions of NO_x with other chemicals, such as VOCs, can lead to ozone formation. Additionally, secondary PM can be formed within the atmosphere from precursor gases, such as NO_x. In humans, NO_2 can lead to respiratory illnesses.

4. Ozone

Ozone occurs both in the earth's upper atmosphere and at ground level. It occurs naturally in the upper atmosphere, where it forms a protective layer that shields the earth from the sun's harmful ultraviolet rays. Tropospheric, or ground-level ozone, is not emitted directly into the air, but is a result of VOCs and NO_x reacting in the presence of sunlight in the atmosphere. Typically ozone levels are highest during warm-weather months. VOCs and NO_x are termed "ozone precursors" and their emissions are regulated in order to control the creation of ozone. VOCs, which are a subset of hydrocarbons (HC), are released in industrial processes, mobile sources and from the evaporation of gasoline, solvents and other hydrocarbon-based compounds.

Ozone concentrations can easily reach unhealthy levels when the weather is hot and sunny with relatively light winds. Even at relatively low levels, ozone may cause inflammation and irritation of the respiratory tract, particularly during physical activity. Groups that are most sensitive to ozone include children and adults who are active outdoors, and people with respiratory disease such as asthma.

5. Particulate Matter

PM is emitted into the atmosphere from a variety of sources: industrial facilities, power plants, construction activity, as well as some natural sources. Gasoline-powered vehicles emit relatively small quantities of particles. Conversely, exhaust emitted from diesel-powered vehicles, especially heavy trucks and buses, contains large quantities of particles, which are considered a health risk in humans because of their ability to penetrate into the human respiratory system.

The USEPA has two regulatory standards for PM: 1) less than or equal to 10 micrometers (denoted PM_{10} and also known as "inhalable coarse particles") and 2) less than or equal to 2.5 micrometers (denoted $PM_{2.5}$ and also known as "fine particles"). PM_{10} forms as a result of incomplete fuel combustion, industrial processes, or wind erosion. $PM_{2.5}$ are more characteristically formed from the combustion of fuel and other various industrial processes (such as smelters, foundries, aluminium production, glass manufacturing, etc.).

6. Sulfur Dioxide

SO_2 is emitted into the atmosphere by both natural processes and by man-made sources such as the combustion of sulfur-containing fuels and sulfuric acid manufacturing. When combined with other substances in the air, SO_2 can precipitate out as rain, fog, snow, or dry particles (commonly referred to as "acid rain"). SO_2 sources include stationary sources as well as non-road diesel-powered sources such as diesel trains, marine vessels and non-road equipment/vehicles. No significant quantities are emitted from mobile sources. In humans, the inhalation of elevated concentrations of SO_2 can cause respiratory diseases.

D. Attainment/Nonattainment Status

The USEPA designates areas as either meeting (attainment) or not meeting (nonattainment) the NAAQS. An area with measured pollutant concentrations which are lower than the NAAQS is designated as an attainment area and an area with pollutant concentrations that exceed the NAAQS is designated as a nonattainment area. Once a nonattainment area meets the NAAQS and the additional redesignation requirements in the CAA, the USEPA will designate the area as a maintenance area. Ozone nonattainment areas are further classified as extreme, severe, moderate, or marginal. An area is designated as unclassifiable when there is a lack of sufficient data to form the basis of an attainment status determination.

The CAA requires states to develop a general plan to attain and/or maintain the primary and secondary NAAQS in all areas of the country and to develop a specific plan to attain the standards for each area designated nonattainment for a NAAQS. These plans, known as SIPs, are developed by state and local air quality management agencies and submitted to the USEPA for approval.

The B&P Tunnel project is located in Baltimore City, Maryland, which is presently designated by the USEPA as a moderate nonattainment area for the 8-hour ozone and a maintenance area for CO and PM equal to or less than 2.5 micrometers in diameter (fine particulates or $PM_{2.5}$).

E. General Conformity Requirements

The General Conformity Rule of the federal CAA prohibits federal agencies (such as FRA) from permitting or funding projects that do not conform to an applicable SIP. The General Conformity Rule applies only to areas that are in nonattainment or within a maintenance status. Under the Rule, project-related emissions of the applicable nonattainment/maintenance pollutants are compared to *de-minimis* level thresholds. If the emissions exceed the thresholds, a formal Conformity Determination is required to demonstrate that the action conforms to the applicable SIP. Conversely, if project-related emissions are below the *de-minimis* levels the project is assumed to conform to the SIP. The proposed project is funded by, and would require approval by, the FRA and it is located in a nonattainment/maintenance area; therefore, the General Conformity requirements of the CAA are applicable. The General Conformity *de-minimis* levels for the B&P Tunnel Replacement Project are presented in **Table 2**.

Table 2: General Conformity *De-Minimis* Thresholds

Pollutant	Primary/ Secondary (tons per year)
Ozone (NO_x)	100
Ozone (VOC)	50
$PM_{2.5}$	100

Note: Ozone thresholds are for locations inside an Ozone Transport Region (OTR).
Source: USEPA, De-Minimis Levels, h*ttp://www.epa.gov/oar/genconform/deminimis.html*.

F. Transportation Conformity Requirements

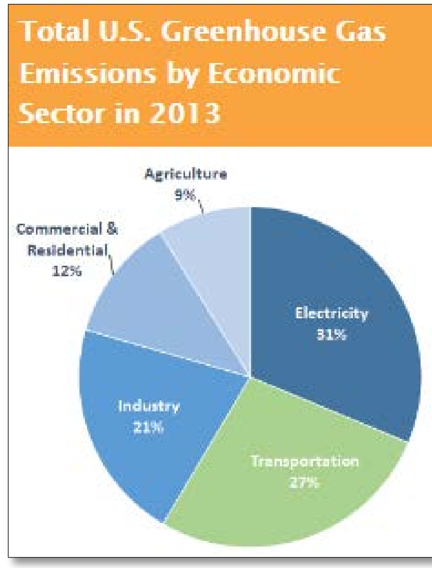
The CAA also contains a Transportation Conformity Rule that functions similarly to the General Conformity Rule. The Transportation Conformity Rule restricts federal funding to highway or transportation projects that do not conform to an applicable SIP. The responsibility of transportation conformity determination is vested in the Federal Highway Administration (FHWA) and Federal Transit Administration (FTA). It is assumed that the proposed project is not subject to the Transportation Conformity Rule because it is not an FHWA/FTA project (i.e., will not receive funding assistance and approval from Federal-Aid Highway program and will not require FHWA or FTA approval for any aspect of the project).

G. Greenhouse Gases

Another emerging issue of global and national air quality concern is greenhouse gas (GHG) emissions. GHG emissions from transportation sources include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and various hydrofluorocarbons (HFCs). The majority of GHG emissions from transportation are CO_2 emissions resulting from the combustion of petroleum-based products, like gasoline, in internal combustion engines. Small amounts of CH_4 and N_2O are emitted during fuel combustion, and HFCs are predominately the result of refrigerants used in vehicles, refrigeration, heating and air-conditioning systems.

In 2013, in the U.S. GHG emissions from transportation accounted for about 27 percent, making it the second largest contributor of U.S. GHG emissions after the Electricity sector.[6]

Figure 3. Greenhouse Gases



Historically, GHG emissions have not been regulated under the CAA as air pollutants. However, after the U.S. Supreme Court in 2007 clarified that CO_2 is an "air pollutant" subject to regulation under the CAA, the USEPA embarked on developing requirements and standards for GHG emissions from mobile and stationary sources under the CAA. However, currently there are no national ambient air quality standards or *de-minimis* thresholds in place for GHG.

The following summarizes the main GHG regulatory initiatives recently undertaken by the USEPA in the transportation sector.

- USEPA and the National Highway Traffic Safety Administration (NHTSA) are taking steps to enable the production of a new generation of clean vehicles, through the reduction of GHG emissions and improved fuel use. Together, the enacted and proposed standards are expected to save more than six billion barrels of oil through 2025 and reduce more than 3,100 million metric tons (MT) of CO_2 emissions. (USEPA 2015)

- USEPA is also responsible for developing and implementing regulations to ensure that transportation fuel sold in the U.S. contains a minimum volume of renewable fuel. By 2022, the Renewable Fuel Standard (RFS) Program, which was created under the Energy Policy Act (EPAct) of 2005, anticipates reducing GHG emissions by 138 million MT, equivalent to the annual emissions of 27 million passenger vehicles. (USEPA 2015)

Additionally, Maryland has been at the forefront in addressing global climate change and GHGs. The following summarizes relevant regulations and initiatives in place and planned in Maryland that address these concerns.

- *Regional Greenhouse Gas Initiative (RGGI)* **–** Maryland is part of the RGGI which is a cooperative effort by nine Northeast and Mid-Atlantic States to reduce CO_2 emissions from fossil fuel-fired power plants, while maintaining electricity affordability and reliability.

- *Commission on Climate Change* - In April 2007 Governor Martin O'Malley issued Executive Order 01.01.2007.07, *Commission on Climate Change*, which established the Maryland Commission on

[6] USEPA, Sources of Greenhouse Gas Emissions, http://www.epa.gov/climatechange/ghgemissions/sources/transportation.html.

Climate Change (MCCC). The MCCC is charged with developing a Climate Action Plan (CAP) to address the drivers and consequences of climate change, to prepare for its ensuing impacts in the State, and to establish firm benchmarks and timetables for Plan implementation. In August 2008 the MCCC released its final *Climate Action Plan (2008 Plan)* which lays out a strategy, including specific recommendations to address climate change and reduce its GHG emissions.

- *Maryland Greenhouse Gas Emissions Reduction Act (GGRA)* - On May 7, 2009, Governor Martin O'Malley passed into law the GGRA requiring Maryland to develop and implement a Plan that will achieve a 25 percent reduction in 2006 GHG emissions by 2020. While the majority of GHG emissions are related to power generation, the transportation sector produces approximately three percent of Maryland's GHG emissions. Achieving a significant reduction in GHG emissions from the transportation sector is critical to supporting the requirements of the Act. On June 20, 2012 the *2011 GGRA Draft Plan* was published, which puts Maryland on track to achieve the 25 percent GHG reduction required by the law.

- *Maryland Climate Action Plan* – As stated previously, Maryland's Climate Action Plan was released in August 2008 and the first Draft Implementation Status Report was released on November 2009. On April 11, 2011 the MDOT released the most recent *Draft 2012 Implementation Plan* which supports Maryland's ongoing efforts to develop a state-wide GHG Reduction Plan. Transportation GHG reduction measures and strategies are a key element to this plan; in fact, MDOT has identified plans, programs and strategies that could reduce transportation related emissions by 8.44 million MT of CO_2 by 2020.

Furthermore, the Council on Environmental Quality (CEQ) in February 2010 released a draft guidance memorandum addressing the ways Federal agencies can improve their consideration of the effects of GHG emissions and climate change in their evaluation of proposals for Federal actions under NEPA.[7] On December 2014, CEQ released a revised draft guidance which supersedes the guidance released in February 2010. The revised guidance explains that agencies should consider both the potential effects of a proposed action on climate change, as indicated by its estimated GHG emissions, and the implications of climate change for the environmental effects of a proposed action. The guidance also emphasizes that agency analyses should employ quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations. CEQ recommends that agencies consider 25,000 metric tons of carbon dioxide equivalent (CO_{2e}) emissions on an annual basis as a reference point below which a quantitative analysis of GHG is not recommended unless it is easily accomplished based on available tools and data.[8]

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[7] CEQ, *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*, February 18, 2010, https://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf.

[8] CEQ, *Revised Draft Guidance on the Considerations of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews*, December 18, 2015,
https://www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf.

VI. OPERATIONAL EMISSIONS ANALYSIS

The tunnel operations data for existing year 2014, No Build year 2040, and Build year 2040 (i.e., Build alternatives 2, 3A, 3B, 3C, 11A, and 11B) are summarized in **Tables 3, 4, and 5**, respectively. Although the number of Amtrak operations increases with the Build Year, the Acela, Northeast Regional, and Metropolitan trains are powered by electric locomotives which do not directly generate significant air emissions. The regional MARC commuter train service plans to replace all existing electric locomotives with diesel-powered locomotives by 2019,[9] as well as doubling operations in 2040 with the operation of the proposed tunnel.

Table 6 summarizes the analysis of MARC diesel locomotive emissions. The No Build and Build diesel emissions were estimated based upon emissions factors provided by USEPA[10]. Emission estimates were developed for Alternative 3C (i.e., the longest tunnel out of the six alternatives). Alternative 3C has the highest potential to affect air quality due to having the greatest tunnel length.

As shown in **Table 6**, the MARC equipment and operational changes would not have any significant effects on air quality, as the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between the 2040 No Build and the 2040 Build scenarios would be below the *de-minimis* levels. Of note, freight rail operations, which are also powered by diesel locomotives, would not increase as a result of the Build alternative and therefore were not included in the diesel emissions calculations.

Table 3: Tunnel Operating Characteristics in the Existing Year (2014)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	# of Locos	# of Cars	
MARC (Regional)	Diesel (~60%) & Electric (~40%)	55	4	1	8	30/30
Acela (Intercity Express)	Electric	39	2	1	8	30/30
NE Regional (Intercity Corridor)	Electric	49	3	1	8	30/30
Freight	Diesel	2	0	1	30	30/30
Total	**All**	**145**	**9**			

*Note: Average train speed entering and exiting the North Portal (N) and South Portal (S).
Source: Amtrak General Orders Timetable, December 2012, and 2014 public timetables.

[9] Maryland Transit Authority, *MARC Train*, https://mta.maryland.gov/sites/default/files/mgip_update_2013-09-13.pdf.
[10] USEPA, Office of Transportation and Air Quality, *Emission Factors for Locomotives* [EPA-420-F-09-025], April 2009.

Table 4: Tunnel Operating Characteristics in the No Build Year (2040)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	# of Locos	# of Cars	
MARC (Regional)	Diesel	82	7	1	8	30/30
Acela (Intercity Express)	Electric	58	4	N/A	14	30/30
NE Regional (Intercity Corridor)	Electric	52	3	1	8	30/30
Metropolitan	Electric	0	0	N/A	N/A	30/30
Freight	Diesel	2	0	1	30	30/30
Total	**All**	**194**	**14**			

*Note: Average train speed entering and exiting the North Portal (N) and South Portal (S).
Source: Federal Railroad Administration NEC FUTURE Project, Tier I EIS Alternatives (Alternative 1).

Table 5: Tunnel Operating Characteristics in the Build Year (2040)

Train Service	Locomotive Type	Total Bi-directional Frequencies		Consist Data		Speed N/S* (mph)
		Daily	Peak Hour	# of Locos	# of Cars	
MARC (Regional)	Diesel	164	15	1	8	30/70
Acela (Intercity Express)	Electric	82	8	N/A	14	30/70
NE Regional (Intercity Corridor)	Electric	48	4	1	8	30/70
Metropolitan	Electric	92	8	N/A	14	30/70
Freight	Diesel	2	0	1	30	30/70
Total	**All**	**388**	**35**			

*Note: Average train speed entering and exiting the North Portal (N) and South Portal (S).
Source: Federal Railroad Administration, NEC FUTURE Project, February 2015 (NEC Future Data Responses).

Table 6: MARC Diesel Locomotive Emissions Estimates (tons per year)

Scenario	CO	NO_x	VOC	$PM_{2.5}$
2040 No Build	8.6	6.7	0.3	0.1
2040 Build*	19.4	15.2	0.6	0.2
Net Increase	**10.9**	**8.5**	**0.3**	**0.1**
De-Minimis Threshold	N/A	100	50	100
Below *De-Minimis*?	**N/A**	**Yes**	**Yes**	**Yes**

*Note: Emission estimates are for Build Alternative 3C (the longest tunnel out of the six alternatives). It has the highest potential to affect air quality due to the greatest tunnel length.

Values of "Net Increase" subject to rounding. All values rounded to the nearest 0.1 tons.

VII. CONSTRUCTION EMISSIONS ANALYSIS

Construction emissions stem from dust generated from earth moving activities and gaseous emissions generated from diesel-powered equipment at the project site. Six Build Alternatives (i.e., Alternatives 2, 3A, 3B, 3C, 11A, and 11B) are being considered for this project. As shown in **Figure 1**, Alternative 3C represents the longest tunnel out of the six alternatives, and therefore has the highest potential to affect air quality. This alternative would entail the largest amount of volume to be excavated (e.g., underground, in addition to cut and cut-and-cover at each portal), thus requiring more material handling as well as haul truck trips to and from staging areas. Alternative 3A is similar in length to 3B, however, the length of the tunnel, and cut and cut-and-cover areas, is slightly less than 3B. The tunnel lengths for Alternatives 11A and 11B are shorter than Alternatives 3A and 3B (and, Alternative 11A is slightly shorter than 11B). Alternative 2, which follows the alignment of the existing B&P Tunnel, is not yet fully defined in terms of the number of new bores to be constructed and the cut and cut-and-cover dimensions. Of note, emissions produced during construction activities will be temporary in nature and will not result in a long-term impacts to local air quality.

In order to mitigate these emissions, construction activities will be performed in accordance with Maryland's *Standard Specifications for Construction and Materials*[11] which outline the procedures to be followed by contractors involved in site work. In addition, the Maryland Air and Radiation Management Administration has determined that the specifications are consistent with the requirements of the "Regulations Governing the Control of Air Pollution in the State of Maryland". Therefore, during the construction period, all appropriate measures cited in the Code of Maryland Regulations (COMAR)

11 Maryland DOT, SHA, http://www.roads.maryland.gov/index.aspx?pageid=44; and Baltimore County Department of Public Works, http://resources.baltimorecountymd.gov/Documents/Public_Works/standardsandspecs/feb2007/stdspec20002007.pdf.

26.11.06.03D[12] would be employed to minimize the impact of the proposed project on the air quality of the area (such as, but not limited to the installation and use of hoods, fans, and dust collectors to enclose and vent the handling of materials). Application of these measures would help minimize emissions.

VIII. CONCLUSION

It is assumed that the proposed project would not have any impacts on operational emissions, due mainly to no projected increase in diesel freight train operations, and no significant direct air emissions generated by electric locomotive trains (e.g., Amtrak and Acela). Additionally, the increase of the MARC operations in 2040 and the replacement of existing electric locomotives with diesel-powered locomotives by 2019 would not adversely affect air quality, as the net change in emissions of NO_x, VOC, and $PM_{2.5}$ between the 2040 No Build and the proposed project would be below the *de-minimis* levels.

Emissions associated with the construction of the tunnel would be short-term and not result in a long-term change to local air quality. Alternatives 2, 3A, 3B, 3C, 11A, and 11B were assessed for this report using the information currently available about the design and construction of these alternatives. Alternative 3C represents the longest tunnel out of the six alternatives, and therefore has the highest potential to affect air quality. This alternative would entail the largest amount of volume to be excavated (e.g., underground, in addition to cut and cut-and-cover at each portal), thus requiring more material handling as well as haul truck trips to and from staging areas.

Future analysis will focus on the preferred alternative, once it is selected as part of the development of the EIS. In order to conduct that analysis, additional information will be used to develop a more detailed air quality assessment, including but not limited to: detailed construction schedule, construction equipment type and characteristics (e.g., fuel type, horsepower, etc.), construction equipment usage and operational times, location of staging areas, construction footprint, and volume of material to be moved or demolished.

IX. REFERENCES

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12 COMAR 26.11.06.03, http://www.dsd.state.md.us/comar/getfile.aspx?file=26.11.06.03.htm.

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USEPA, *National Ambient Air Quality Standards (NAAQS),* http://www.epa.gov/air/criteria.html.

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X. ACRONYMS

BMC - Baltimore Metropolitan Council
BRTB - Baltimore Regional Transportation Board
CAA - Clean Air Act
CAP - Climate Action Plan
CEQ – Council on Environmental Quality
CH_4 - methane
CO - carbon monoxide
CO_2 - carbon dioxide
COMAR - Code of Maryland Regulations
DEIS - Draft Environmental Impact Statement
EPAct - Energy Policy Act of 2005
FEIS - Final Environmental Impact Statement
FHWA - Federal Highway Administration
FRA - Federal Railroad Administration
FTA - Federal Transit Administration

GGRA - Maryland Greenhouse Gas Emissions Reduction Act
GHG - greenhouse gas
HFCs – hydrofluorocarbons
LRTP - Long Range Transportation Plan
MCCC - Maryland Commission on Climate Change
MDE - Maryland Department of the Environment
MDOT - Maryland Department of Transportation
MPO - Metropolitan Planning Organization
MT - Metric tons
N_2O - Nitrous oxide
NAAQS - National Ambient Air Quality Standards
NEPA - National Environmental Policy Act
NHTSA - National Highway Traffic Safety Administration
NO - nitric oxide
NO_2 - nitrogen dioxide
NO_3 - nitrate radical
NO_x - Nitrogen oxides
PM - particulate matter
PM_{10} - particulate matter with a diameter of 10 microns or less
$PM_{2.5}$ - particulate matter with a diameter of 2.5 microns or less
RGGI - Regional Greenhouse Gas Initiative
SIP - State Implementation Plans
SO_2 - sulfur dioxide
TIP - Transportation Improvement Plan
USEPA - U.S. Environmental Protection Agency
VOC - volatile organic compound