



Overview of Air Quality in the Baltimore Region

Levels of air pollution significantly influence human health and environmental outcomes. Air quality has vastly improved in the Baltimore region since the 1960s when air pollution was at its worst thanks to action directed by the Clean Air Act and 300+ Maryland Department of the Environment regulations. Actions which have reduced air

pollution include advancements in fuel composition and curbing power plant emissions. However, there is more work to be done to support healthy and sustainable living. The transportation sector is one major source of air pollution, including ozone and greenhouse gases.



As of 2022, the last remaining transportation related pollutant exceeding the National Ambient Air Quality Standards (NAAQS) in the Baltimore region is ozone at 0.072 parts per million. Ground level ozone can have a variety of health and environmental impacts, such as lung inflammation and slowed plant growth. Ground level ozone is not directly emitted into the air, but rather is created by chemical reactions between volatile organic compounds (VOC) and oxides of nitrogen (NOx). Therefore, these two pollutants are considered when evaluating potential emissions from projects funded through Transportation Improvement Programs (TIPs) and Long-Range Transportation Plans (LRTP), like the upcoming LRTP, Resilience 2050: Adapting to the Challenges of Tomorrow.

On a yearly basis, the Baltimore Metropolitan Council conducts air quality analyses of TIP and LRTP updates, in coordination with the Baltimore Regional Transportation Board (BRTB), Maryland Department of the Environment (MDE), Maryland Department of Transportation, Environmental Protection Agency (EPA), Federal Highway Administration, Federal Transit Administration, and the public. This process is known as transportation conformity. Transportation conformity analyses are required under the Clean Air Act and conducted according to requirements laid out in the Code of Federal Regulations (40 CFR 93 Subpart A). Ultimately, the anticipated emissions from implementing TIP and LRTP projects are compared to set emissions budgets. In order for the conformity determination to be approved by the EPA, the estimated emissions must be less than or equal to the set budgets.

Along with air quality conformity analyses, the BMC staff take part in MDE's Air Quality Control Advisory Council (AQCAC) and Clean Air Partners (CAP). AQCAC provides guidance to MDE regarding draft air quality rules and regulations

under consideration for adoption in order to achieve air quality and public health goals and protect the environment. CAP educates individuals, businesses, and organizations in the greater metropolitan Baltimore-Washington region





about health risks associated with poor air quality and the impacts on our environment. Additionally, the counties and cities which comprise the Baltimore region are hard at work incorporating local projects that contribute to emissions reductions, including developing new bike lanes and replacing fleet vehicles with alternative fuel options.

Air quality is a key consideration that will be addressed throughout development of *Resilience 2050: Adapting to the Challenges of Tomorrow.* Both project scoring and analysis will address air emissions for the upcoming LRTP. For a deeper understanding of air quality considerations and analysis, read on for the full air quality white paper!

Interested in learning more?

Visit *publicinput.com/Resilience2050* to subscribe to updates.







Clean Air Progress

In 1967, the Baltimore region had the second dirtiest air in the country. On a hot summer afternoon, you might hardly make out the Washington Monument through the haze. The next morning, a film of soot could be covering your car. This and the many other regions experiencing smog and poor air quality in the United States prompted passage of the 1970 **Clean Air Act (CAA)**. Through the Clean Air Act, with its 1977 and 1990 updates, the Environmental Protection Agency identified air pollutant limits needed to ensure human and environmental health in regularly reviewed and updated **National Ambient Air Quality Standards (NAAQS)**.



NAAQS are set for six major pollutants, referred to by the Environmental Protection Agency (EPA) as criteria air pollutants. NAAQS were first set in 1970. These standards are extensively reviewed through periodic scientific analyses and updated to reflect advancements in our understanding health and environmental of impacts. Transportation emissions from vehicles including cars. trucks, buses, and trains contribute to four of the six pollutants. These pollutants, along with their NAAQS, are listed in Figure 1.

Downtown Baltimore shrouded in smog captured in this Baltimore Sun photo dated July 10, 1973.





Figure 1. Criteria Pollutants related to Transportation Emissions

POLLUTANT		NATIONAL AMBIENT AIR QUALITY STANDARD
Particulate Matter (PM2.5 and PM10)	PM 2.5	12 μg/m ³ §: 1 year average
		35 μg/m³: 24 hour average
	PM10	150 μg/m³: 24 hour average
Carbon Monoxide (CO)		9 ppm ⁺ : 8 hour average
		35 ppm: 1 hour average
Ozone (O_3)		0.070 ppm: 8 hour average
Nitrogen Dioxide (NO_2)		100 ppb [‡] : 1 hour average
		53 ppb: 1 year average

§ μg/m³ = microgram per meter cubed † ppm = parts per million

‡ ppb = parts per billion

The EPA measures levels of criteria pollutants with monitoring stations across the United States. Based on these measurements, the EPA determines whether geographic regions are meeting the NAAQS. The **Baltimore region** as defined by the EPA includes:

- Baltimore City
- Baltimore County
- Carroll County
- Harford County
- Howard County
- · Anne Arundel County

When compared to 1967 conditions, and even 2000 levels, air quality in the Baltimore region has come a long way. As of 2020, the whole state of Maryland is on the verge of meeting all health based air quality standards for the first time ever. These improvements are thanks to a combination of policies and







regulations including the 2006 Maryland Healthy Air Act, 2007 Maryland Clean Cars Act, and the 300+ additional MDE adopted regulations covering a wide swath of emissions sources ranging from hairspray to incinerators. Improvements in particle pollution in particular have largely been attributed to reductions in sulfur dioxide (SO₂) and nitrogen oxides (NOx) from power plants and other industrial sources.

As of 2022, the last remaining transportation related criteria pollutant exceeding the NAAQS in the Baltimore region is ozone at 0.072 ppm. Cars today and the fuels that power them are significantly cleaner than they were just a decade ago. However, there are more vehicles on Maryland roads now, and those numbers will continue to increase. With the growth in the number of vehicles on the road and reductions from power plant emissions, pollution from mobile sources are now the largest contributing source category to Maryland's ozone and climate change problems. Despite these challenges, Maryland has been at the forefront in regulating ozone-forming and toxic pollutants from vehicles and fuels and will continue to drive down emissions from this category. Figure 2 shows progress from 2000 to 2020 in Maryland's ozone levels.









Ozone at the ground level can have a variety of health and environmental impacts, depending on the concentration.

POTENTIAL GROUND-LEVEL OZONE IMPACTS

...to human health:

- Cause coughing and sore or scratchy throat.
- Make it more difficult to breathe deeply and vigorously and cause pain when taking a deep breath.
- · Inflame and damage the airways.
- Make the lungs more susceptible to infection.
- Aggravate lung diseases such as asthma, emphysema, and chronic bronchitis.
- Increase the frequency of asthma attacks.

...to the environment:

- For sensitive plants
 - Reduce photosynthesis, which is the process that plants use to convert sunlight to energy to live and grow.
 - ^o Slow the plant's growth.
 - Increase risk of disease, damage from insects, effects of other pollutants, and harm from severe weather.
- Loss of species diversity (less variety of plants, animals, insects, and fish)
- Changes to the specific assortment of plants
 present in a forest
- · Changes to habitat quality
- Changes to water and nutrient cycles

Planning for Cleaner Air

The technical term for exceeding NAAQS is **nonattainment**, whereas meeting NAAQS is referred to as **attainment**. It can be said that the Baltimore region is in attainment of all transportation related pollutants except ozone. The Baltimore region is a designated ozone nonattainment area.





When a geographic region is identified as nonattainment, the Clean Air Act requires a plan to be developed for attaining the standard, technically referred to as a **State Implementation Plan**, or **SIP**. The Maryland Department of the Environment (MDE) published the most recent ozone SIP document in June 2020. SIPs establish measures to reduce emissions from all types of sources. Sources of ozone addressed in the June 2020 MDE SIP include municipal waste combustors, electric generating stations, manufacturing facilities, and the transportation sector.

A major tool established by the Clean Air Act to regulate transportation sector emissions is the transportation conformity requirement. This transportation conformity requirement applies to federally funded projects and non-federally-funded yet regionally significant projects, as well as short term and long term transportation plans – including a Long-Range Transportation Plan (LRTP) like the upcoming LRTP for the Baltimore region, *Resilience 2050*. Before federal approval and funding is received, project sponsors and Metropolitan Planning Organizations such as the BRTB must demonstrate that a given project, short-range Transportation Improvement Program (TIP), or LRTP WILL NOT:

- cause any new violations of the NAAQS,
- · increase the frequency or severity of violations of the NAAQS, or
- delay timely attainment of the NAAQS or any interim milestone.

This demonstration is referred to as a **conformity determination**, which ensures that Federally supported transportation activities are consistent with ("conform to") the purpose of the SIP. On behalf of the BRTB, the Baltimore Metropolitan Council (BMC) develops a draft conformity determination any time there is a new TIP or LRTP for the Baltimore region. The TIP is updated annually, and the LRTP is updated approximately every four years. As a result, a conformity determination is completed every year in conjunction with the approval of the new TIP. Every conformity determination for the Baltimore region is developed in conjunction with members of the BRTB, MDE, MDOT, EPA, FHWA, and FTA. This coordination group is referred to as the **Interagency Consultation Group**, or ICG. It is federally required that this coordination







be completed and open to the public. BMC ensures **meetings are available to the public** by providing meeting times and locations, as well as associated minutes and presentations, on the BMC website. **Follow the ICG** <u>here</u>!

Public involvement is an important part of the conformity determination process. Every time a conformity determination is completed, the public must be given the opportunity to comment. As such, the BRTB conducts a public comment period of at least 30 days in conjunction with the draft TIP and LRTP for every conformity determination. Once public comments are addressed and the draft conformity determination finalized, EPA is responsible for final approval of the document. The target schedule for development of annual conformity determinations is noted in Figure 3.



Figure 3. Target Annual Conformity Determination Schedule



Estimating Air Pollution

As part of the SIP, budgets are developed to limit the amount of emissions allowable from planned transportation improvements. A major component of conformity determination is estimating the amount of emissions anticipated from projects funded through the TIP and LRTP. The ozone budget for the Baltimore region as of May 2022 consists of two pollutants: volatile organic compounds (VOC) and oxides of nitrogen (NOx). See Figure 4 for the current allowances. The budget consists of VOC and NOx limitations because ground level ozone is not directly emitted into the air, but rather is created by chemical reactions between VOC and NOx. This happens when VOC and NOx emitted by vehicles, and other sources, chemically react in the presence of sunlight (see image below). Ozone is most likely to reach unhealthy levels on hot sunny days in urban environments, but can still reach high levels during colder months. Ozone can also be transported long distances by wind, so even rural areas can experience high ozone levels.

Figure 4. Current Ozone SIP Budget for the Baltimore Region			
CURRENT OZONE SIP BUDGET			
PRECURSOR POLLUTANT	ALLOWABLE EMISSIONS LIMIT		
VOC	40.2 tons per day		
NOx	93.5 tons per day		







Emissions are calculated for the near term and long term in multiple **horizon years**. Calculations for each horizon year are compared to the budget. The Clean Air Act transportation conformity rule requires that horizon years:

- are 10 years apart or less
- include the year the region is required to have attained the NAAQS (as long as this year is within the timeframe of the LRTP)
- · include the last year of the LRTP

For example, the conformity determination of the 2022-2025 TIP and the current LRTP for the Baltimore region, *Maximize 2045*, included the following horizon years:

- 2022 ensures horizon years are 10 years apart or less (the attainment year was 2021, and was not included in the analysis because it was not within the planning timeframe)
- 2025 ensures horizon years are 10 years apart or less
- · 2035 ensures horizon years are 10 years apart or less
- · 2045 last year of the LRTP

For each horizon year, emissions are calculated for the projects anticipated to have been constructed by that date. So, for the 2022-2025 TIP and *Maximize 2045*, a project with an anticipated year of operation of 2035 would only be included in horizon year 2035 and 2045 calculations. The horizon years for the upcoming LRTP, *Resilience 2050*, will extend to 2050.

Additionally, only certain projects are included in emissions calculations. According to the CAA transportation conformity rule, certain projects are exempt and can be left out of the analysis. **Exempt projects** are left out

because they will not significantly affect or contribute to emissions levels. Such projects include roadway shoulder improvements, pavement resurfacing, replacing a bridge without changing the number of lanes, and replacing old buses. For a complete list of exempt project types, check out the Code of Federal Regulations <u>here</u>. Before calculations are made for the Baltimore region, the ICG reviews each proposed TIP and LRTP project and determines at a publicly accessible meeting whether each should be considered exempt or not-exempt.

Once the list of TIP and LRTP projects that are not exempt is determined, VOC and NOx emissions are calculated by BMC utilizing a variety of software programs and databases.

The first major step BMC takes in the conformity determination analysis is calculating travel demand. Travel demand is an estimate of how much traffic is predicted for each horizon year for the planned roadway network. The number of trips, for each type of vehicle (such as cars and commercial trucks),

10

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on the length of lanes for each road type (such as divided interstates, undivided highways, and arterials) is calculated for each horizon year. This is done using the travel demand modeling program called **InSITE**. To learn more about InSITE, check out the details <u>here</u>.

The next major step BMC takes is estimating anticipated emissions for each horizon year's expected traffic levels on the planned roadway network using the EPA's MOtor Vehicle Emission Simulator (**MOVES**). MDE also completes these calculations to confirm the results. MOVES is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the regional level for criteria air pollutants, including ozone's precursors VOC and NOx. Emissions are calculated by entering a variety of data into the MOVES software including the InSITE travel demand estimates, vehicle emissions rates, miles travelled per roadway type, anticipated turnover in vehicle types, and weather (temperature and humidity); and then running the MOVES program. The MOVES program utilizes multiple algorithms to complete the emissions calculations. The most recent version of this modeling program is MOVES3. For more details on how MOVES works, see EPA's resources <u>here</u>.

If the resulting predicted emissions for each horizon year are less than or equal to the SIP budget, then the TIP and LRTP conform to the SIP.

Furthering Clean Air Progress

Transportation conformity is just one of the many measures being taken in the Baltimore region to curb air emissions. Not only is there activity working towards NAAQS reduction, but also towards greenhouse gas (GHG) mitigation.



The project scoring process for *Resilience 2050* serves as one example. *Resilience 2050* will include a list of planned major federally funded capital projects, their estimated costs, and the revenues reasonably expected to be available to fund the projects through the year 2050. Since there is not enough money available to implement every transportation project, there must be a prioritization process for candidate projects. All candidate projects submitted for inclusion in *Resilience 2050* will be scored based on various criteria such as accessibility, mobility, safety, and environmental conservation. As part of the environmental conservation scoring criteria, all projects will be scored based on their potential

to reduce GHG emissions. Candidate projects that contribute to GHG emissions reductions, such as new bicycle lanes, sidewalks, and transit lines, will receive higher environmental conservation scores. See our <u>Project Scoring White Paper</u> to learn more about project prioritization.





Outside of the TIP and LRTP, the counties and cities which comprise the Baltimore region are hard at work incorporating local projects that contribute to emissions reductions. BMC tracks these projects and their progress in the conformity determination Appendix I. Click <u>here</u> for an example from the conformity determination for the 2022-2025 TIP and *Maximize 2045*.

Generally speaking, whether included as part of a TIP, LRTP, or local program, types of transportation projects which contribute to emissions reductions include:

- · Rideshare programs for commuters
- Telework opportunities
- · Developing new bike lanes
- · Improving bike lane connectivity and safety
- · Sidewalk installations and improvements
- · Bus/metro line and infrastructure improvements
- Traffic flow improvements reducing congestion
- · Electronic toll collection
- · Alternative fuel vehicle fleet purchases
- · Alternative fuel vehicle incentives
- · Alternative fuel vehicle infrastructure improvements



BMC staff also represent the Baltimore region by serving on MDE's Air Quality Control Advisory Council (AQCAC). **AQCAC** provides guidance to MDE regarding draft air quality rules and regulations under consideration for adoption in order to achieve air quality and public health goals and protect the environment. State level measures to meet air quality standards, legislation proposed by the General Assembly or MDE, and strategic plans created by the MDE Air and Radiation Management Administration are also evaluated by AQCAC prior to adoption. AQCAC members recommend adoption, rejection, or modification for all actions under AQCAC review. AQCAC consists of 15 members in total appointed by the MDE Secretary. Members include representatives from industry, labor, professional associations, local and regional government organizations, academia, farming, the medical community and the general public. Click here for more AQCAC details.





Clean Air Partners (CAP) is another organization staffed by BMC. BMC founded CAP in conjunction with the Metropolitan Washington Council of Governments (MWCOG) in 1995 to improve air quality, reduce GHG emissions through voluntary actions, and increase public awareness about the health effects of air quality. The mission of CAP is to educate individuals, businesses, and organizations in the greater metropolitan Baltimore-Washington region about health risks associated with poor air quality and the impacts on our environment. CAP conducts a wide range of public outreach activity including:

- Presenting an air quality curriculum supporting inquiry-based science education to students in grades 5-12
- · Providing regional air quality forecasts online and through the Clean Air Partners app
- Creating social media campaigns which expand understanding of the Air Quality Index for protection of lung health, as well as simple emissions reductions tips we can all incorporate into daily life to mitigate climate change

Follow CAP and join the action on Facebook, Instagram, and Twitter!







Significant progress has been made in reducing air pollution levels in the Baltimore region through a variety of regulatory actions. The Baltimore Regional Transportation Board continues working to build on this success while providing a reliable transportation system. Air quality is a key consideration that will be addressed throughout development of *Resilience 2050*. In summer 2022, BMC staff will score projects and in the fall the BRTB will develop a draft list of projects for *Resilience 2050*, known as the preferred alternative. From there, a range of analyses will be done and the draft plan will be released for public review and comment. Air pollution considerations will be factored into both the project scoring process and a transportation conformity determination of *Resilience 2050*. Track our progress and engage with us during public comment periods through our website at <u>Resilience2050.com</u>

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Resources

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