4.2 Air Quality and Greenhouse Gas

Federal agencies are required under the Clean Air Act (CAA) to ensure that projects they fund (such as the Center City Connector) are in compliance with existing federal air quality standards and the state's and metropolitan transportation improvement programs. This section evaluates potential project impacts on air quality.

4.2.1 Air Quality Standards and Conformity

Major transportation projects must meet both the U.S. Environmental Protection Agency's (EPA's) National Ambient Air Quality Standards (NAAQS), which set limits on concentration levels of the criteria pollutants in the air, and federal and state conformity requirements.

The major airborne pollutants, also known as criteria pollutants, for transportation projects are carbon monoxide (CO), particulate matter (PM), ozone and the ozone precursors, volatile organic compounds (VOCs), and oxides of nitrogen (NO_X). In addition, mobile source air toxic (MSAT) air pollutants in vehicle exhaust, particularly from diesel-fueled vehicles, have been addressed in both local and national studies. These are important because toxic air pollutants are known or suspected to cause cancer or other serious health effects.

The NAAQS consists of two sets of standards: primary standards that are intended to protect public health, and secondary standards that are intended to protect the natural environment. The Washington Department of Ecology (Ecology) and Puget Sound Clean Air Agency (PSCAA) monitor air quality in the Puget Sound region by measuring the levels of criteria pollutants found in the atmosphere and comparing them with the NAAQS; therefore, the study area for the air quality analysis is measured at regional level.

In addition to these standards, Ecology and PSCAA have adopted state and local ambient air quality standards. The Puget Sound region is currently in attainment or unclassified for all criteria pollutants except CO and PM. EPA designated the Puget Sound region as maintenance status for CO in 1996. Figure 4.2-1 shows the air quality maintenance area for CO and the nonattainment areas for PM in the Puget Sound region.

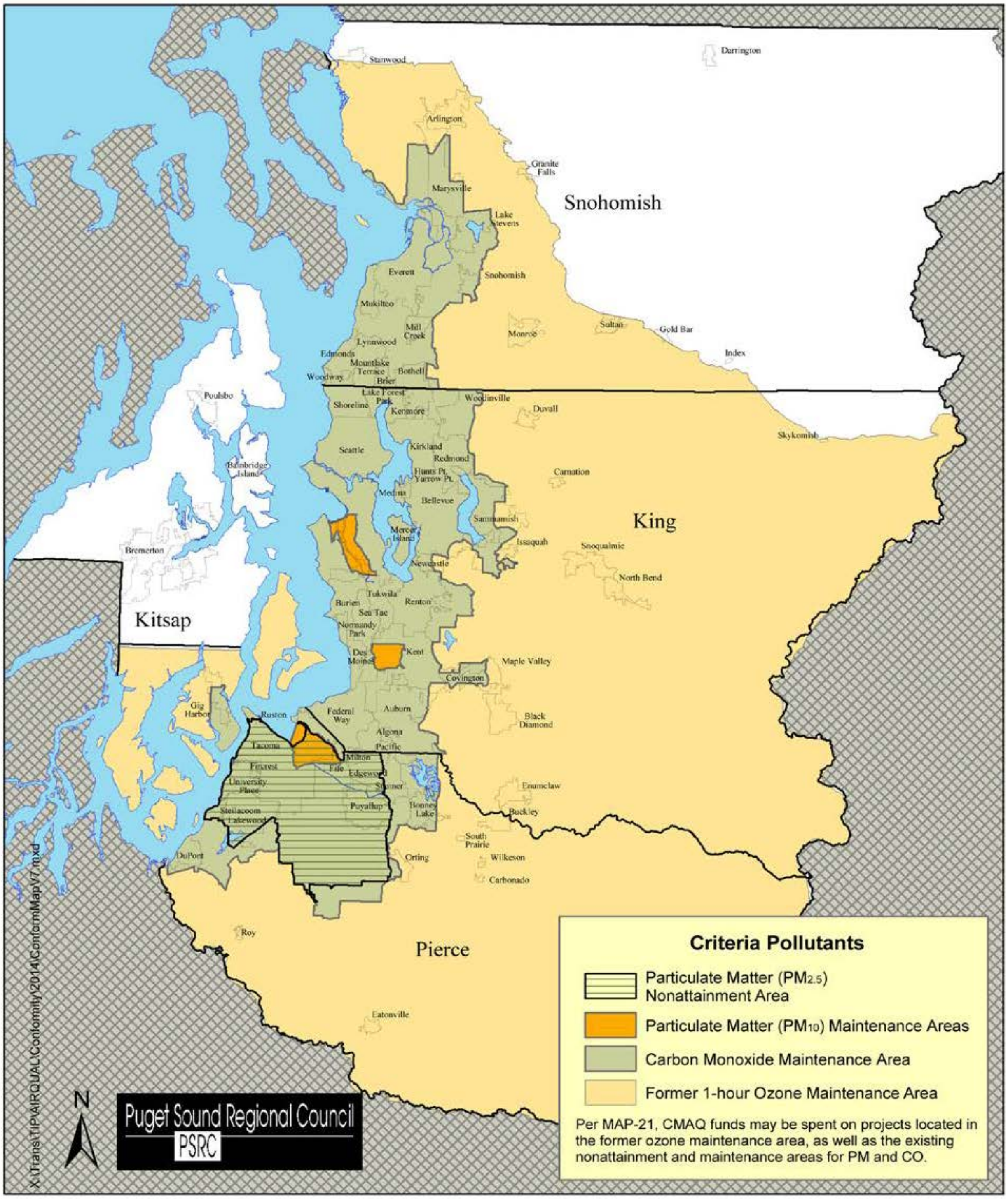
Applicable Regulations

Conformity Requirements of federal Clean Air Act (CAA; 40 CFR 51 and 93) and Washington CAA: In nonattainment and maintenance areas, the federal and Washington CAA require transportation projects to conform to the State Implementation Plan (SIP), the state's plan for meeting and maintaining compliance with the NAAQS. To conform with the SIP, transportation activities must not produce new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS.

The Center City Connector is subject to these conformity requirements because it is located in a maintenance area for CO.

The Center City Connector is located in a maintenance area for CO, which requires each transportation project to be in conformity with the regional air quality model for maintenance of CO levels. The proposed project is included in the *Regional Transportation Plan* (PSRC, 2014), and the Transportation Improvement Plan, both of which conform to the State Implementation

Figure 4.2-1 Air Quality Maintenance Areas



Source: PSRC (2014).

Plan. The Transportation Improvement Plan is used to develop the regional air quality model, which confirms that maintenance for CO can be met for the region.

In addition to affecting air quality, a change in energy or fuel use can change the amount of greenhouse gas (GHG) emissions. This analysis provides a qualitative review of potential changes in GHG emissions from a change in transportation use.

4.2.2 Air Quality Conditions

Ecology operates ambient air quality monitoring stations to assess the levels of regulated pollutants and to verify continued compliance with the NAAQS. The most recent 3-year data available were gathered from two monitoring stations close to the downtown Seattle. In addition, data were gathered from the NW AIRQUEST database, which is based on a centralized coordinate within the study area. NW AIRQUEST compiles design ambient background values for Washington State based on monitoring values from 2009 through 2011 for all criteria pollutants. Ambient air concentrations of the most recently monitored pollutants are summarized in Table 4.2-1.

Table 4.2-1 Ambient Criteria Pollutant Concentration Levels

Monitoring Location	Parameter	EPA/Ecology Station Maximum Concentration			NW AIRQUEST[a] Design Concentrations	NAAQS
PM_{10}		**2011**	**2012**	**2013**		
Seattle-Beacon Hill[b]	24-Hour Average (µg/m^3)	-	28	30	53	150
$PM_{2.5}$		**2011**	**2012**	**2013**		
Seattle-Queen Anne Hill[c]	Annual Arithmetic Mean (µg/m^3)	6.3	5.8	7	6.3	12
	24-Hour Average (µg/m^3)	21.6	21.8	26.4	17	35
CO		**2011**	**2012**	**2013**		
Seattle-Beacon Hill[b]	8-Hour Average (ppm)	0.9	0.7	1.4	2.198	9
	1-Hour Average (ppm)	1.078	1.043	1.832	3.186	35
Ozone		**2011**	**2012**	**2013**		
Seattle-Beacon Hill[b]	Max 8-Hour Average (ppm)	0.046	0.049	0.047	0.048	0.075
Nitrogen Dioxide						
NW AIRQUEST[a]	Annual Arithmetic Average (ppm)				0.014	0.053
	1-Hour Average (ppm)				0.048	0.100

Monitoring Location	Parameter	EPA/Ecology Station Maximum Concentration			NW AIRQUEST[a] Design Concentrations	NAAQS
Sulfur Dioxide		**2010**	**2011**	**2012**		
Seattle-Beacon Hill[b]	Annual Arithmetic Average (ppm)	0.00113	0.001077	0.000961	0.0015	0.02
	24-Hour Average (ppm)	0.0088	0.0108	0.0049	0.0072	0.10
	3-Hour Average (ppm)	0.0203	0.0218	0.0159	0.018	0.40
	1-Hour Average (ppm)	0.03	0.0275	0.0303	0.024	0.075

[a] NW AIRQUEST, http://lar.wsu.edu/nw-airquest/lookup.html (latitude: 47.61026, longitude : -122.3414)

[b] EPA, http://www.epa.gov/airdata/ad_maps.html

[c] Ecology, https://fortress.wa.gov/ecy/enviwa/

μg/m^3 = micrograms per cubic meter

$PM_{2.5}$ = particulate matter 2.5 microns in diameter or less

PM_{10} = particulate matter 10 microns in diameter or less

ppm = parts per million

Emission projections and ongoing monitoring throughout the Puget Sound region over the past decade indicate that the ambient air pollution concentrations for CO have decreased. Measured ozone concentrations, in contrast, have remained fairly static. The decline of CO is due primarily to improvements to emission controls on motor vehicles and the retirement of older, higher polluting vehicles.

4.2.3 Impacts

Air quality impacts for the Center City Connector are based on the existing attainment status with established air quality standards in the project vicinity for each regulated pollutant, and it presents existing air quality monitoring data that support the trend of how existing air pollution control measures improve air quality in the region.

4.2.3.1 No Build Alternative

The No Build Alternative represents future conditions without the Center City Connector. Population growth, economic growth, and land development would continue, which could increase emissions. However, increasingly stringent federal and state emission control requirements and the replacement of older, higher polluting vehicles with newer, less-polluting ones would reduce basin-wide emissions under the No Build Alternative. Therefore, air quality is expected to improve in the basin under the No Build Alternative compared to existing conditions.

4.2.3.2 Locally Preferred Alternative

Operational Impacts

Microscale Carbon Monoxide Analysis. Because the proposed Center City Connector project is in a maintenance area for CO, a project-level analysis is necessary to verify that no localized impacts would cause or contribute to a violation of the NAAQS.

The analysis evaluates whether the project meets the project-level conformity requirements for CO and analyze whether CO concentrations near intersections with high levels of traffic and delay would cause a violation of the air quality standards. The results of this analysis are discussed in the following sections.

Carbon Monoxide Hot Spot analysis is the modeling of CO emissions from vehicles at the anticipated most-congested traffic intersections as a result of a project. CO Hot Spot analyses are used as a basis to determine whether a project may result in localized concentrations of carbon monoxide that would exceed ambient air quality standards

Site Selection. Existing intersections along the alignment were analyzed using data generated for the project traffic analysis. Based on changes in intersection volume, delay, and level of service (LOS) between the existing conditions and LPA, three intersections that might be adversely affected by the Center City Connector were identified. (Appendix D4.2-A summarizes affected intersection data, and Appendix D4.2-B provides more detailed data [output files from the Synchro8 model].) The affected intersections are listed below:

- Westlake Avenue/ Republican Street
- Alaskan Way/ S King Street
- First Avenue/ S Jackson Street

CO levels were then estimated using the MOVES2014 and CAL3QHC air quality dispersion models for the existing condition (2014), the opening year (2018), and the horizon year (2040) levels at locations listed above. The CAL3QHC analysis is contained in Appendix D4.2-C. EPA's *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (1992) and *Using MOVES in Project-Level Carbon Monoxide Analyses* (2014) were used as guidance in evaluation of CO hot spots in the study area.

Emission factors were obtained for posted speeds without congestion and periods of idle for the existing year (2014), opening year (2018), and horizon year (2040). A speed of 25 mph[1] was used to represent free-flow speeds for the intersections. A speed of 0 mph was used to calculate an idle emission factor. The CAL3QHC model was used to estimate peak 1-hour CO concentrations near the affected intersections. Peak 8-hour CO concentrations were obtained by multiplying the highest peak-hour CO estimates by a persistence factor of 0.7 (EPA, 1992). The background CO concentrations were added to the respective modeled 1-hour and 8-hour CO impacts to establish the design values for each of the project intersections. The predicted 1-hour and 8-hour CO design value concentrations at the three intersections evaluated for CO hot spots are presented in Tables 4.2-2 and 4.2-3, respectively. As shown, CO concentrations from traffic

[1] Currently, the speed limit on First Avenue is 30 mph, but the Center City Connector would reduce the roadway speed to 25 mph, which is the speed used for project projections.

at the worst-case intersections would not cause or contribute to an exceedance of the 1-hour or 8-hour CO NAAQS of 35 ppm and 9 ppm, respectively.

Table 4.2-2 Modeled 1-Hour Carbon Monoxide Design Values

Intersection	Maximum 1-Hour Carbon Monoxide Design Values (ppm)				
	Existing 2014	No Build 2018	LPA 2018	No Build 2040	LPA 2040
Westlake Ave/Republican St	5.5	5.4	5.4	5.1[a]	5.1 [a]
Alaskan Way/S King St	5.4	5.8	5.9	5.2	5.2
First Ave/ S Jackson St	5.5	5.4	5.5	5.1[a]	5.1[a]
NAAQS	35				

Results include a background of 5 ppm.

[a] CAL3QHC impact less than 0.1 ppm.

Table 4.2-3 Modeled 8-Hour Carbon Monoxide Design Values

Intersection	Maximum 8-Hour Carbon Monoxide Design Values (ppm)				
	Existing 2014	No Build 2018	LPA 2018	No Build 2040	LPA 2040
Westlake Ave/Republican St	3.9	3.8	3.8	3.6	3.6
Alaskan Way/S King St	3.8	4.1	4.1	3.6	3.6
First Ave/ S Jackson St	3.9	3.8	3.9	3.6	3.6
NAAQS	9				

Results include a background of 3.5 ppm.

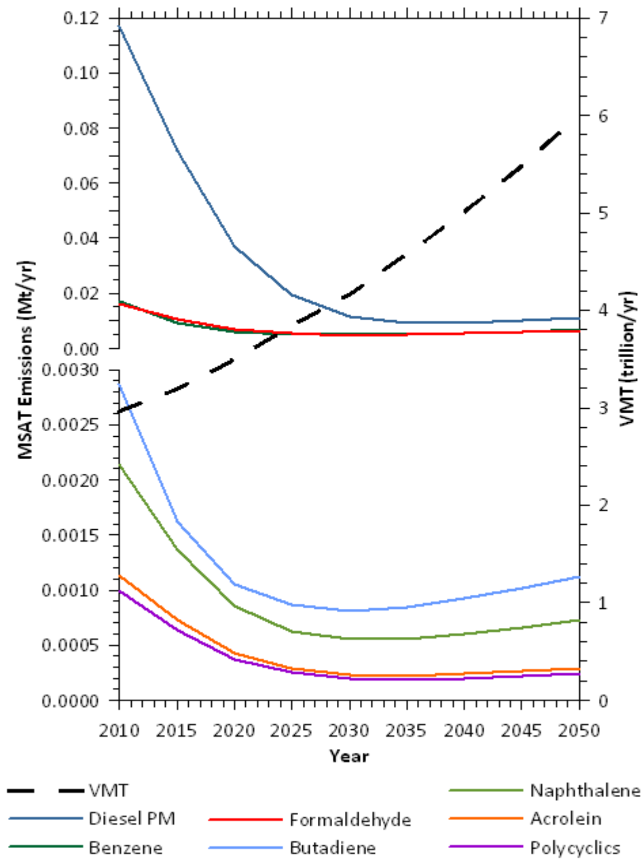
Mobile Source Air Toxics (MSAT). MSAT assessments are required for most federal transportation projects. Based on the example projects defined in *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA* (FHWA, 2012), the Center City Connector would be classified as a project with Low Potential MSAT Effects. Most air toxics originate from manmade sources, including on-road mobile sources (e.g., vehicles), non-road mobile sources (e.g., airplanes), area sources (e.g., dry cleaners), and stationary sources (e.g., factories or refineries). This project only reviews MSATs (as opposed to non-mobile sources) due to the project that may change existing air toxics.

Based on an FHWA analysis using EPA's MOVES2010b model, even if vehicle miles traveled (VMT) increased by 102 percent, as assumed from 2010 to 2050, a combined reduction of 83 percent in the total annual emissions for the priority MSATs is projected for the same time period, as shown on Figure 4.2-2.

The LPA is expected to lower VMT in the study area compared to the No Build Alternative. The LPA may result in slightly higher short-term MSAT emissions at interchanges than the No Build Alternative because of vehicle delay along the project route; however, the reduction in overall VMT would reduce MSAT emissions along the entire corridor.

Climate Change and Greenhouse Gas. Anthropogenic (human-caused) GHG emissions are believed to contribute to a rapid change in climate that accelerates as more GHG accumulates. Carbon dioxide makes up the largest component of these GHG emissions. Other prominent transportation GHGs include methane and nitrous oxide. GHGs are different from other air pollutants evaluated in environmental reviews because their impacts are not localized or regional, but rather the affected environment for carbon dioxide and other GHG emissions is the entire earth. Therefore, it is difficult to isolate and understand the GHG emissions impacts for a particular transportation project.

Figure 4.2-2 MSAT Trends



Source: FHWA (2012).
Mt/yr = megatons per year

The Center City Connector is intended to reduce traffic volume and VMT in the study area. Because the LPA would be electric-powered and would reduce vehicle trips in the study area compared to the No Build Alternative, direct emissions of GHGs from the proposed project would be not be expected. However, indirect emissions of GHG would be generated to support the electric trains. The Pacific Northwest electricity grid is mostly composed of clean hydroelectric power sources compared to fossil-fueled power sources. Therefore, the reduction of GHGs from the reduced VMT in the study area would be expected to offset the GHGs indirectly emitted from the electric trains.

Construction Impacts

During construction, soil-disturbing activities, operations of heavy-duty equipment, commuting workers, and paving could generate emissions that would temporarily affect air quality. The total emissions and the timing of the emissions from these sources would vary depending on the phasing of the project and options chosen for the project.

Typical sources of emissions during construction of transportation projects include the following:

- Fugitive dust generated during vehicle movement on paved and unpaved roads, excavation, grading, and loading and unloading activities
- Dust generated during demolition of structures and pavement
- Engine exhaust emissions from construction vehicles, worker vehicles, and diesel fuel-fired construction equipment
- Increased motor vehicle emissions associated with increased traffic congestion during construction
- VOC and odorous compounds emitted during asphalt paving

The regulated pollutants of concern for the first two source types (dust) are $PM_{2.5}$ and PM_{10}. Engine and motor vehicle exhaust would result in emissions of VOCs, NO_x, $PM_{2.5}$, PM_{10}, sulfur dioxide (SO_2), air toxics, and GHGs. The scale and duration of construction would not result in substantial pollutants, but best management practices would be required by PSCAA to control PM_{10}, $PM_{2.5}$, and emissions of CO and NO_x during construction.

GHG would result from the emissions of fossil-fueled construction equipment, and these emissions would be directly proportional to the quantity of fuel used. Because this is a relatively short project (the duration of construction is under a 2-year program) and the number and type of construction equipment to be used have not been developed, GHG was not calculated. The scale and duration of the project will have a minimal GHG emissions impact because the project construction would only affect local circulation. The impacts of construction on regional facilities and regional travel would be negligible, as the proposed detours would only use local roads and short term.

Seattle Climate Action Plan

As of 2008, approximately 40 percent of Seattle's GHG emissions came from road-related transportation sources. Seattle is updating its Climate Action Plan with a goal of achieving zero net GHG emission by 2050. The City of Seattle also signed on to the 2005 U.S. Mayor's Climate Protection Agreement, which adopted the goal of the Kyoto Protocol to reduce citywide GHG emissions by 7 percent below 1990 levels.

4.2.4 Mitigation Measures

No mitigation is required for the operational phase of the Center City Connector because there would be no impacts on carbon monoxide, MSATs or GHG impacts.

During construction, impacts on air quality will be reduced and controlled in accordance with the City's Standard Specifications for Road, Bridge, and Municipal Construction [Section 1-07.5(3)] and dust control BMPs described in the City's *Construction Stormwater Control Technical Requirements Manual – Volume 2.*

Reducing air quality impacts during construction would involve BMPs such as the following:

- Spray exposed soil with water or other suppressants to reduce emissions of PM_{10} and deposition of particulate matter during dry periods.
- Use phased development to minimize disturbed areas.
- Use wind fencing to reduce disturbance to soils.

- Minimize dust emissions during transport of fill material or soil by wetting down or by providing adequate freeboard (space from the top of the material to the top of the truck bed) on trucks.
- Promptly clean up spills of transported material on public roads.
- Schedule work tasks to minimize disruption of the existing vehicle traffic on streets.
- Restrict traffic on the site to reduce soil upheaval and the transport of material to roadways.
- Locate construction equipment and truck staging areas away from sensitive receptors as practical and in consideration of potential impacts on other resources.
- Provide wheel washers to remove particulate matter that would otherwise be carried off the site by vehicles to decrease deposition of particulate matter on area roadways.
- Cover dirt, gravel, and debris piles as needed to reduce dust and wind-blown debris.
- Minimize odors on the site by covering loads of hot asphalt.

Emissions of $PM_{2.5}$, $PM_{10,}$ VOCs, NO_X, SO_2, and CO would be minimized whenever reasonable and possible. Because these emissions primarily result from construction equipment, machinery engines would be kept in good mechanical condition to minimize exhaust emissions. Additionally, contractors would be encouraged to reduce idling time of equipment and vehicles and to use newer construction equipment or equipment with add-on emission controls.