Section 3.2

Air Quality & GHG

This section assesses the potential air quality and greenhouse gas (GHG) emission impacts associated with implementing the alternatives under consideration.

The air quality section includes a description of regulatory standards for air quality, air emission sources and individual criteria pollutants of concern, with a focus on carbon monoxide (CO), particulate matter (PM) emissions, ozone precursors, and Toxic Air Pollutants (TAPs). The chapter also includes a discussion of potential sensitive populations in and near the industrial and maritime areas of Seattle, the methods used to assess air quality and impacts from those emissions, and an assessment of impacts associated with each alternative, as well as potentially feasible mitigation measures where appropriate. This analysis evaluates air quality conditions and potential impacts for each MIC on an area-wide cumulative basis and, and for PM2.5 and TAPs, a localized analysis is provided at specific areas to identify potential public health impacts from locating new sensitive receptors closer to or within MIC areas.

Under the SEPA Rules (see WAC 197-11-330, WAC 197-11-440 and WAC 197-11-794), the evaluation of the significance of potential impacts considers whether there is a reasonable likelihood of more than a moderate adverse impact on environmental quality (WAC 197-11-794). In making this assessment, the following are considered:

- The context of the proposal, including the physical setting
- The intensity of the impact, which depends on its magnitude and duration
- The likelihood of the impact’s occurrence
- The duration of the impact.

In many cases, regulatory thresholds are used to judge significance, that is, if actions would meet regulatory thresholds (e.g., surface water quality standards, wetland/stream buffers, noise standards, endangered species) then the determination is typically that the level of impact is unlikely to be significant. For the purposes of this programmatic impact analysis, air quality is analyzed by examining whether:

- The alternative would prevent or deter achieving the National Ambient Air Quality Standards (NAAQS) for criteria pollutants.

The GHG section includes a description of community goals for GHG emissions and climate change, transportation, and land use emission sources in the industrial and maritime areas of Seattle, the methods used to measure GHG emissions, and how implementation of the alternatives considered may contribute to global climate change. This section also identifies potentially feasible emissions mitigation measures where appropriate. This analysis evaluates potential GHG emission impacts from each alternative on a cumulative basis.

There is no standard significance threshold for GHG emissions in the SEPA rules (WAC 197-11-330). However, Chapter 173-441 WAC requires mandatory GHG reporting for facilities that emit at least 10,000 metric tons of GHGs per year in Washington. For the purposes of this programmatic impact analysis, GHG emissions are analyzed by examining whether:

- The alternative would prevent or deter efforts to reduce emissions in comparison to local or regional goals or targets for GHG reductions.
- The alternative would cause the cumulative difference in GHG emissions between an alternative and Alternative 1 No Action to exceed Washington Department of Ecology's GHG reporting threshold of 10,000 metric tons per year.

The analysis confirms that changes to the MIC areas do not prevent or deter from meeting the National Ambient Air Quality Standards (NAAQS) for criteria pollutants. It illustrates increases in greenhouse gases (GHGs) in comparison to local or regional goals or targets for GHG reductions and identifies mitigation that, if implemented and tracked, could reduce impacts to a less than significant level.

This chapter relies on information that is contained in the Seattle Comprehensive Plan (Seattle 2035) EIS, which incorporated by reference herein. (City of Seattle 2016)

The study area for air quality is defined as the area that could be directly or indirectly affected by the construction activities or land uses that result from implementation of the industrial and maritime strategy. Given that air emissions cross county and state lines, the assessment here is considered to apply to air quality effects over the entire Seattle-King County area. With respect to GHG emissions and its effect on climate, the study area is the global environment. The study area for indirect impacts is the area affected by the transport of construction workers and materials to the project area.

3.2.1 Affected Environment

Data & Methods

The project team collected data from the following sources to support analysis of existing air quality conditions and potential effects of the project alternatives:

- U.S. Environmental Protection Agency (EPA) Greenbook (EPA 2021)
- Puget Sound Clean Air Agency (PSCAA) and Ecology Air Monitoring Network
- 2019 PSCAA Air Quality Data Summary (PSCAA 2019)
- 2016 Puget Sound Maritime Emissions Inventory (PSMEI 2018)
- Duwamish Valley Regional Modeling and Health Risk Assessment (WDOH 2008)
- Washington State Greenhouse Gas Emissions Inventory 1990–2018 (Ecology 2021)
- 2018 Community Greenhouse Gas Emissions Inventory (Seattle 2018)
- Direct monitoring of eight sites within the BINMIC and Greater Duwamish MIC during 2021

Air Quality

Current Policy & Regulatory Frameworks

Air quality in the Puget Sound region is regulated and enforced by federal, state, and local agencies—the Environmental Protection Agency (EPA), Department of Ecology (Ecology), and the Puget Sound Clean Air Agency (PSCAA); each have their own role in regulating air quality.

U.S. EPA

The 1970 Clean Air Act established National Ambient Air Quality Standards (NAAQS), with primary and secondary standards, to protect the public health and welfare from air pollution. As required by the Clean Air Act, EPA identified Ozone, CO, PM, nitrogen dioxide (NO2), sulfur dioxide (SO2) and lead as the six criteria air pollutants. Since then, subsets of PM have been identified for which permissible levels have been established. These include PM10 (particles that are less than or equal to 10 microns in diameter) and PM2.5 (particles that are less than or equal to 2.5 microns in diameter).

The NAAQS set limits on concentration levels of the criteria pollutants in the air. Concentration levels of the criteria pollutants must not exceed the NAAQS over specified time periods. These ambient air quality standards are designed to protect those segments of the public most susceptible to respiratory distress, including asthmatics, the very young, the elderly, people whose health is compromised from other illness or disease, or those engaged in strenuous work or exercise. Areas of the U.S. that do not meet the NAAQS for any pollutant are designated by the EPA as nonattainment areas. Areas that were once designated nonattainment but are now achieving the NAAQS are termed maintenance areas. Areas that have air pollution levels below the NAAQS are termed attainment areas. In nonattainment areas, states must develop plans to reduce emissions and bring the area back into attainment of the NAAQS.

The Clean Air Act also requires the EPA to regulate toxic air pollutants (or air toxics) from mobile sources and large industrial facilities. Air toxics are air pollutants known or suspected to cause health problems, including cancer. EPA's primary effort focuses on developing standards for controlling the emissions of air toxics from sources in industry groups (or source categories). These maximum achievable control technology (MACT) standards are based on emissions levels that are already being achieved by the controlled and low emitting sources in an industry.

Washington Department of Ecology

Ecology maintains an air quality program with a goal of safeguarding public health and the environment by overseeing the development and conformity of the State Implementation Plan (SIP), which is the state's plan for meeting and maintaining NAAQS. In addition to the NAAQS standards, Ecology has adopted state ambient air quality standards for 1-hour ozone concentrations and its own more stringent air quality standards for annual NO2, SO2 and PM concentrations. Ecology also monitors air quality in the Puget Sound Region by measuring the levels of criteria pollutants found in the atmosphere and comparing them with the NAAQS. Ecology has also monitored 17 air toxics since 2000 in Seattle at a site on Beacon Hill.

Puget Sound Clean Air Agency

The PSCAA has local authority for setting regulations and permitting of stationary air pollutant sources and construction emissions. PSCAA also maintains and operates a network of ambient air quality monitoring stations measuring the levels of criteria pollutants found in the atmosphere throughout its jurisdiction. The NAAQS are summarized in **Exhibit 3.2-1**.

Exhibit 3.2-1 National Ambient Air Quality Standards

Pollutant	Averaging Times	Primary NAAQS	Secondary NAAQS
Carbon monoxide	8-hour a	9 ppm (10 mg/m3)	None
	1-hour a	35 ppm (40 mg/m3)	None
Lead	Rolling 3-Month Average	0.15 µg/ m3	Same as Primary
	Quarterly Average	1.5 µg/ m3	Same as Primary
NO2	Annual (Arithmetic Mean)	0.053 ppm (100 µg/m3)	Same as Primary
	1-hour b	0.100 ppm (188 ug/m3)	Same as Primary
PM10	24-hour c	150 µg/m3	Same as Primary
PM2.5	Annual d (Arithmetic Mean)	12.0 µg/m3	Same as Primary
	24-hour e	35 µg/m3	Same as Primary
Ozone	8-hour f	0.075 ppm (2008 std.)	Same as Primary
	8-hour f	0.070 ppm (2015 std.)	Same as Primary
SO2	3-hour a	none	0.5 ppm (1,300 µg/m3)
	1-hour g	0.075 ppm (196 ug/m3)	Same as Primary

Notes: µg/m3 = micrograms per cubic meter; NO2 = nitrogen dioxide; PM2.5 = particulate matter less than or equal to 2.5 micrometers in diameter; PM10 = particulate matter less than or equal to 10 micrometers in diameter; ppm = parts per million; ppb = parts per billion; SO2 = sulfur dioxide.

A Not to be exceeded more than once per year.

B Standard is attained when the 3-year average of the eighth-highest daily maximum 1-hour average NO2 concentration does not exceed 0.100 ppm (100 ppb).

C Not to be exceeded more than once per year on average over 3 years.

D To attain this standard, the 3-year average at any monitor must not exceed 12.0 µg/m3.

E To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m3. PSCAA maintains a stricter standard for PM2.5 of 35 µg/m3

f To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed the standard. While both the 2008 and 2015 standards are still in place, the 2015 standard is the controlling one, given its greater stringency.

G Standard is attained when the 3-year average of the fourth-highest daily maximum 1-hour average NO2 concentration does not exceed 0.100 ppm (100 ppb).

Source: 40 Code of Federal Regulations part 50, EPA 2016.

Pollutants of Concern

This section discusses the main pollutants of concern and their impact on public health and the environment. Air quality is affected by pollutants that are generated by both natural and human sources. In general, the largest human sources of air emissions are transportation vehicles and power-generation, both of which typically burn fossil fuels. Criteria air pollutants are carbon monoxide (CO); particulate matter (PM); ozone, and the ozone precursors (volatile organic compounds [VOCs] and oxides of nitrogen [NOX]); sulfur dioxide (SO2); and lead. Both federal and state standards regulate these pollutants. Industrial sources such as metal processing are currently the primary source of lead emissions.

The largest contributors of pollution related to land development activity are construction equipment, motor vehicles and off-road construction equipment. The main pollutants emitted from these sources are CO, PM, ozone precursors (VOC and Nox), GHGs, and mobile source air toxics (MSATs). Motor vehicles and diesel-powered construction equipment also emit pollutants that contribute to the formation of ground-level ozone.

Carbon Monoxide

CO is an odorless, colorless gas usually formed as the result of the incomplete combustion of fuels. The largest sources of CO are motor vehicle engines and traffic, and industrial activity and woodstoves. Exposure to high concentrations of CO reduces the oxygen-carrying capacity of the blood and can cause headaches, nausea, dizziness, and fatigue; impair central nervous system function; and induce angina (chest pain) in persons with serious heart disease. Very high levels of CO can be fatal. The federal CO standards have not been exceeded in the Puget Sound area for the past 20 years (PSCAA 2019).

Lead

Lead is a highly toxic metal that was used for many years in household products such as paints, transportation fuel, and industrial chemicals. With lead now excluded from paint and most fuels, most lead emissions nationally are industrial processes and battery manufacturers though lead found in aviation fuel used by small aircraft remains a concern nationally. In October 2008, EPA strengthened the lead standard from 1.5 µg/m3 to 0.15 µg/m3 (rolling three-month average; PSCAA 2020).

Ozone

Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOCs and Nox. The main sources of VOC and Nox—ozone precursors—are combustion processes (including motor vehicle engines) and the evaporation of solvents, paints, and fuels. Ozone levels are usually highest in the afternoon because of the intense sunlight and the time required for ozone to form in the atmosphere. Ecology currently monitors ozone from May through September because this is the period of concern for elevated ozone levels in the Pacific Northwest. No violations of the NAAQS for ozone have occurred at the Seattle monitoring station since monitoring commenced there in 1999.

Elevated concentrations of ground-level ozone can cause reduced lung function and respiratory irritation and can aggravate asthma. Ozone has also been linked to immune system impairment. People with respiratory conditions should limit outdoor exertion if ozone levels are elevated. Even healthy individuals may experience respiratory symptoms on a high-ozone day. The Puget Sound region is designated as an attainment area for federal ozone standards.

Nitrogen Dioxide

Nitrogen dioxide (NO2) is a reddish brown, highly reactive gas that forms from the reaction of nitrogen oxide (NO) and free radicals in the atmosphere. NO2 can cause coughing, wheezing and shortness of breath in people with respiratory diseases such as asthma and long-term exposure can lead to respiratory infections.[7]

The term Nox is defined as NO + NO2. Nox participates in a complex chemical cycle with volatile organic compounds (VOCs) which can result in the production of ozone. Nox can also be oxidized to form nitrates, which are an important component of fine particulate matter. On-road vehicles such as trucks and automobiles and off-road vehicles such as construction equipment, marine vessels and port cargo-handling equipment are the major sources of Nox in Seattle’s industrial areas. Industrial boilers and processes, home heaters, and gas stoves also produce Nox (PSCAA 2020).

Particulate Matter

PM is a class of air pollutant that is a mix of solid and liquid particles from human and natural sources. PM is measured in two size ranges: PM10 and PM2.5. Fine particles are emitted directly from a variety of sources, including wood burning (both outside and indoor wood-burning stoves and fireplaces; and wildfire), vehicles (both vehicle emissions and from generation of fugitive roadway dust) and industry. They also form when gases from some of these same sources react in the atmosphere.

Exposure to particle pollution is linked to a variety of significant health problems, such as increased hospital admissions and emergency department visits for cardiovascular and respiratory problems, including non-fatal heart attacks and premature death. People most at risk from fine and coarse particle pollution exposure include those with chronic heart and lung disease (like asthma, bronchitis, and emphysema), children, and the elderly. It worsens these diseases, which can lead to hospitalization or even early death. Pregnant women, newborns, and people with certain health conditions, such as obesity or diabetes, also may be more susceptible to PM-related effects.

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[7] EPA Airnow, NOX Chief Causes for Concern; www.epa.gov/airquality/nitrogenoxides/.

The federal annual PM2.5 standard has not been exceeded in the Puget Sound area since the U.S. EPA established its NAAQS in 2007. The daily federal PM2.5 standard has not been exceeded in the Puget Sound dating back to the initiation of monitoring for this pollutant in 2001 (PSCAA 2014). The U.S. EPA adopted a more stringent federal standard for PM2.5 in December 2012, and Seattle-King County is designated as an attainment area. Portions of the Puget Sound region, including an area encompassing the Greater Duwamish MIC, were designated as a maintenance area for PM10 through May 2021.

Sulfur Dioxide

Sulfur dioxide (SO2) is a colorless, reactive gas produced by burning fuels containing sulfur, such as oil, coal, and diesel, and by industrial processes. Historically, the greatest sources of SO2 were industrial facilities that derived their products from raw materials such as metallic ore, coal, and crude oil, or that burned coal or oil to produce process heat (petroleum refineries, cement manufacturing and metal processing facilities). Marine vessels, on-road vehicles, and diesel construction equipment are the main contributors to SO2 emissions today. Historically, Washington has measured very low levels of SO2. Because the levels were so low, most monitoring was stopped.

SO2 may cause people with asthma who are active outdoors to experience bronchial constriction, the symptoms of which include wheezing, shortness of breath and tightening of the chest. People should limit outdoor exertion if SO2 levels are high. SO2 can also form sulfates in the atmosphere, a component of fine particulate matter (PSCAA 2020).

Toxic Air Pollutants

Air toxics are defined by Washington State and PSCAA to include hundreds of chemicals and compounds that are associated with a broad range of adverse health effects, including cancer. Many air toxics are a component of either particulate matter or volatile organic compounds (a precursor to ozone).

There are no ambient air quality standards for toxic air pollutants. PSCAA is working with state, local, and tribal governments to reduce air toxics releases. While there are no ambient standards, there are several regulatory tools that are used to reduce air toxics emissions. These tools include: national regulations on industrial sources that require emission reducing technology, “new source review” for sources in Washington State, local regulations for specific industries that require specific technology, and national regulations to reduce emissions from mobile sources (including cars, trucks, and buses as well as marine vessels and locomotives; WDOH 2008)

Ecology began monitoring air toxics at the Seattle Beacon Hill site in 2000. The Clean Air Act identifies 188 air toxics; the U.S. EPA later identified 21 of these air toxics as mobile source air toxics (MSATs) and then a subset of seven priority MSATs: benzene, formaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, naphthalene, polycyclic organic matter, and 1,3-butadiene. Exposure to these pollutants for long durations and sufficient concentrations increases the chances of cancer, damage to the immune system, neurological problems, reproductive, developmental, respiratory, and other serious health problems.

Diesel particulate matter poses the greatest potential cancer risk (70% of the total risk from air toxics) in the Puget Sound area (PSCAA 2011). This pollution comes from diesel-fueled trucks, cars, buses, construction equipment, rail, marine and port activities. Particulate matter from wood smoke (a result of burning in woodstoves and fireplaces or outdoor fires) presents the second-highest potential cancer health risk. Wood smoke and auto exhaust also contain formaldehyde, chromium, benzene, 1,3-butadiene and acrolein. Chromium is also emitted in industrial plating processes.

Current Conditions

Puget Sound Climate & Air Quality

The City of Seattle is in the Puget Sound lowland and the region has a relatively mild, marine climate with cool summers and mild, wet, and cloudy winters. The prevailing wind direction in the summer is from the north or northwest. The average wind velocity is less than 10 miles per hour. Persistent high-pressure cells often dominate summer weather and create stagnant air conditions. This weather pattern sometimes contributes to the formation of photochemical smog. During the wet winter season, the prevailing wind direction is south or southwest.

Although the Puget Sound region contains some of the most densely populated and industrialized areas in Washington, there is sufficient wind most of the year to disperse air pollutants released into the atmosphere. Air pollution is usually most noticeable in the late fall and winter, under conditions of clear skies, light wind, and a sharp temperature inversion. Temperature inversions occur when cold air is trapped under warm air, thereby preventing vertical mixing in the atmosphere. These can last several days. If poor dispersion persists for more than 24 hours, the PSCAA can declare an “air pollution episode” or local “impaired air quality.”

Regionally, weather conditions such as temperature, fog, rain, and snowfall can vary within short distances, influenced by such factors as the distance from Puget Sound, the rolling terrain, and air from the ocean moving inland. Wildfires typically occur during the warmer, drier summer months and recent years have seen increased incidence of more dense smoke episodes lasting days or weeks. Wildfire smoke carries the same health risks as wood smoke because of the presence of small particles, which can be especially dangerous for infants, children, and people over 65, or those that are pregnant, have heart or lung diseases (such as asthma or COPD), respiratory infections, diabetes, stroke survivors, and those suffering from COVID-19. (PSCAA 2021)

Full Study Area

Both Ecology and PSCAA operate ambient air quality monitoring stations to assess the levels of regulated pollutants and to verify continued compliance with the NAAQS. The monitoring stations used for this analysis are the nearest to the BINMIC and Greater Duwamish MIC areas and shown in **Exhibit 3.2-2** along with the criteria pollutants monitored.

Exhibit 3.2-2 Seattle Air Quality Monitoring Stations and Criteria Pollutants

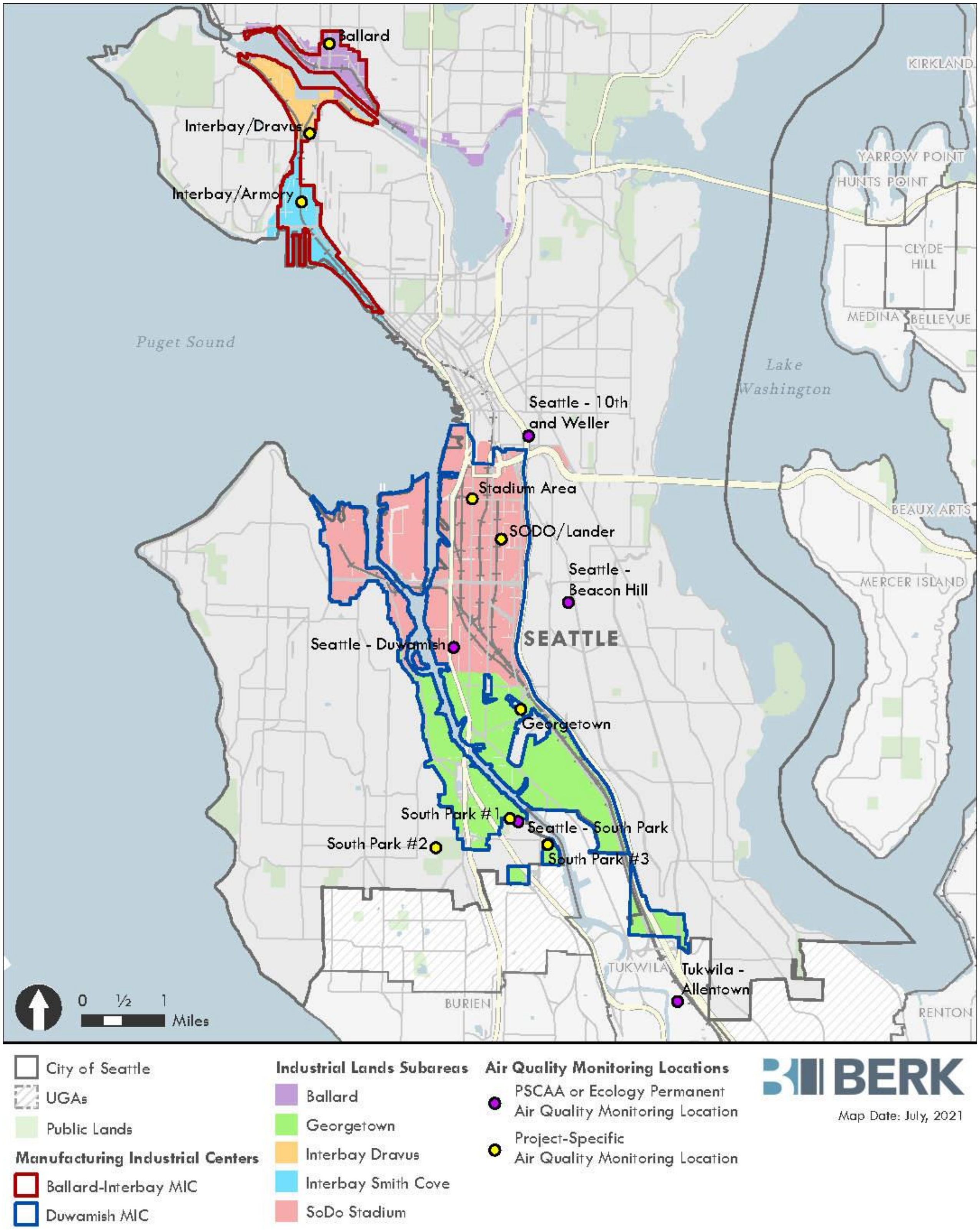
Site	Owner	PM2.5	Ozone	CO	SO2	Nox
10th & Weller	Ecology	●		●		●
Beacon Hill Site, 4103 Beacon Ave S	Ecology	●	●	●	●	●
Duwamish Site, 4700 East Marginal Way	PSCAA	●				
South Park Site, 8201 10th Ave S	PSCAA	●				
Tukwila Allentown Site, 11675 44th Ave E	PSCAA	●				

Source: PSCAA, 2021.

In addition, eight sites within the BINMIC and Greater Duwamish MIC were monitored directly to provide additional baseline data on ambient air quality conditions for this EIS. The sites are described below and **Exhibit 3.2-3** shows the site locations. They were selected due to the location of potential zoning changes in alternatives at the time of Scoping or due to their proximity to air quality emission sources.

1. Ballard: 5007 14th Avenue Northwest. This site is also close to the future Sound Transit light rail station.
2. Interbay/Dravus: 3425 16th Avenue West. This is also close to a future Sound Transit light rail station, a BNSF rail yard, and facilities.
3. Interbay/Armory site: 1561 W Armory Way. This is a site that is close to the BNSF rail yard.
4. Stadium area: 1730 1st Avenue South
5. Georgetown: 5707 Airport Way South.
6. South Park 1: 8620 16th Avenue South. An area close to the King County airport
7. SODO/Lander: 2437 6th Avenue South. An existing light rail station.
8. South Park 2: 8100 8th Avenue South. An area in proximity to SR 99 and SR 509.

Exhibit 3.2-3 Air Quality Monitoring Locations



Source: Herrera, 2021.

Air Quality Information and Trends

According to PSCAA, over the last two decades, many pollutant levels have declined, and air quality has improved overall. For Seattle area monitoring stations closest to the MICs, as it is within the Puget Sound area overall, the following trends exist:

- Carbon monoxide: CO has been declining, primarily due to improvements made to emission controls on motor vehicles and the retirement of older, higher-polluting vehicles. Reductions in motor vehicle emissions have occurred despite comparative increases in demographics (i.e., population, licensed drivers, registered vehicles) over the past 40+ years.
- Lead: Since the phase-out of lead in most fuels and the closure of the Harbor Island secondary lead smelter in Seattle in 1984, levels of lead in ambient air have decreased substantially.
- Ozone, and the ozone precursors (volatile organic compounds (VOCs) are at their highest concentrations in the communities downwind of large urban areas. In the Puget Sound region, the hot sunny days favorable for ozone formation also tend to have light north-to-northwest winds. Ozone levels remain a concern in the region, as measured ozone concentrations have remained fairly static since 2010 (PSCAA 2020)
- Nox: Motor vehicle and non-road engine manufacturers have been required by EPA to reduce Nox emissions from cars, trucks, and non-road equipment. As a result, emissions have declined dramatically since the 1970s. Nitrogen dioxide levels in the Puget Sound region, as currently monitored by Ecology, are typically below (cleaner than) EPA's 1-hour standard and are trending slightly downward in the last 10 years (PSCAA 2020). (PSCAA 2020)
- Particulate matter (PM): Elevated fine particle levels (PM2.5) pose the greatest air quality challenge in the region. Fine particle levels met the EPA's health-based standard of 35 micrograms per cubic meter in 2019 when days with wildfire smoke are excluded, though when wildfire is included some monitoring sites exceeded the federal standard in 2017 and 2018. There were no wildfire-impacted days in 2019.
- PSCAA's more stringent local PM2.5 health goal of 25 micrograms per cubic meter was exceeded on 22 days in winter months at Seattle monitoring sites (PSCAA 2020).
- Sulfur dioxide (SO2): The Puget Sound area has experienced a significant decrease in SO2 because control measures were added for some sources (e.g., cement plants), some larger SO2 sources shut down (e.g., pulp mills and smelters) and the sulfur content of gasoline and diesel fuel was cut by nearly 90% (Ecology 2011b) and continues to be far below the federal NAAQ Standard. (PSCAA 2020).
- Air toxics: Some air toxics continue to be measured at levels known to cause adverse health effects. These health effects include, but are not limited to, increased cancer risk, respiratory effects, and developmental effects. (PSCAA 2020)

Overall, the air quality in the Puget Sound has continued to improve to meet the standards, though the number of wildfire-impacted days has increased in the last five years.

Ambient air concentrations of the monitored pollutants for years 2018 through 2020 are summarized in **Exhibit 3.2-4** and shows that the air pollutant concentration trends for these pollutants remain below the NAAQS when wildfire is excluded. Ecology and PSCAA no longer collect particulate matter smaller than 10 microns in diameter (PM10) data in the Puget Sound Region.

Exhibit 3.2-4 **Ambient Criteria Pollutant Concentration Levels Measured for the four Seattle Sites (10th & Weller, Beacon Hill, Duwamish, and South Park) from 2018-2020**

Pollutant	Primary / Secondary	Averaging Time	NAAQS	Form	Wildfire Included			Wildfire Excluded		
					2018	2019	2020	2018	2019	2020
Carbon Monoxide (CO)	primary	8 hours	9 ppm	Not to be exceeded more than once per year	1.4	1.7	1.8	nc	nc	nc
		1 hour	35 ppm		1.8	2.3	2.1	nc	nc	nc
Lead (Pb)	primary and secondary	Rolling 3 month average	0.15 ug/m3	Not to be exceeded	nm	nm	nm	nm	nm	nm
Nitrogen Dioxide (NO2)	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years	62.6*	62.1*	59.2	nc	nc	nc
	primary and secondary	1 year	53 ppb	Annual mean	20.0	18.1	15.8	nc	nc	nc
Ozone (O3)	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	0.045	0.046	0.052	nc	nc	nc
PM2.5	primary	1 year	12.0 ug/m3	annual mean, averaged over 3 years	8.9**	9.3	9.1	7.9**	8.2	8.0
	secondary	1 year	15.0 ug/m3		8.9**	9.3	9.1	7.9**	8.2	8.0
	primary and secondary	25 hours	35 ug/m3	98th percentile, averaged over 3 years	37.2**	36.7	37.5	20.7	21.5	19.3
PM10	primary and secondary	24 hours	150 ug/m3	Not to be exceeded more than once per year on average over 3 years	nm	nm	nm	nm	nm	nm
SO2	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	6.0***	7.0***	6.0	nm	nm	nm
	secondary	3 hours	0.5 ppm	Not to be exceeded more than 1x per year	0.011	0.006	0.037	nm	nm	nm

nc Not calculated
nm Not measured
nm Meets standard
🟧 Does not meet standard

*<75% data completeness for one quarter in 2017
**<75% data completeness for one quarter in 2016
***<75% data completeness for one quarter in 2016 and 2017

Source: Herrera, 2021.

Ambient air concentrations of PM10 at target sites throughout the MICs for 2021 are summarized in **Exhibit 3.2-5** and show that the PM10 concentration for these pollutants remain below the NAAQS.

Exhibit 3.2-5 Ambient PM10 Concentration Levels Measured in 2021

Pollutant	Station	Averaging Time	2021 Concentration	NAAQS
Particulate Matter (PM10)	Ballard	24-Hour (µg/m3)	17.25	150
	Interbay/Dravus	24-Hour (µg/m3)	16.46	150
	Interbay/Armory	24-Hour (µg/m3)	19.42	150
	Stadium	24-Hour (µg/m3)	20.17	150
	Georgetown	24-Hour (µg/m3)	14.96	150
	South Park 1	24-Hour (µg/m3)	8.92	150
	SODO/Lander	24-Hour (µg/m3)	8.33	150
	South Park 2	24-Hour (µg/m3)	7.08	150

Note: Results represent the singular 24-hour PM10 concentrations for the respective sample day and location.

Source: Herrera and Ramboll, 2021.

Ambient air concentrations of detected metals and VOCs at target sites throughout the MICs for 2021 are summarized in **Exhibit 3.2-6** and show that the concentration for these pollutants remain below the NAAQS.

Exhibit 3.2-6 Detected Pollutants and Measured Concentration Levels in 2021

Pollutant	Station	Constituent	2021 Max Concentration	NAAQS/RSL
Metals	Ballard	Lead	ND	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3
		Chromium	0.0021	n/a
		Nickel	ND	0.015*
	Interbay/Dravus	Lead	ND	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3
		Chromium	ND	n/a
		Nickel	ND	0.015*
	Interbay/Armory	Lead	ND	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3
		Chromium	0.0025	n/a
		Nickel	0.0018	0.015*
	Stadium	Lead	0.0033	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3

Pollutant	Station	Constituent	2021 Max Concentration	NAAQS/RSL
		Chromium	0.0032	n/a
		Nickel	0.001	0.015*
	Georgetown	Lead	0.0018	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3
		Chromium	0.0026	n/a
		Nickel	ND	0.015*
	South Park 1	Lead	0.0014	0.15 µg/m3
		Arsenic	ND	0.002 µg/m3
		Chromium	ND	n/a
		Nickel	ND	0.015*
	SODO/Lander	Lead	0.0015	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3
		Chromium	0.0022	n/a
		Nickel	ND	0.015*
	South Park 2	Lead	ND	0.15 µg/m3
		Arsenic	ND	0.0016~~2~~ µg/m3
		Chromium	0.0024	n/a
		Nickel	0.0009	0.015*
VOCs	Ballard	Ethanol	15	n/a
		2-Proponal	ND	~~211~~20.1 µg/m3
		Toluene	ND	520 µg/m3
		Heptane	ND	42 µg/m3
	Interbay/Dravus	Ethanol	ND	n/a
		2-Proponal	ND	~~211~~20.1 µg/m3
		Toluene	2.7	520 µg/m3
		Heptane	ND	42 µg/m3
	Interbay/Armory	Ethanol	16	n/a
		2-Proponal	24	~~211~~20.1 µg/m3
		Toluene	ND	520 µg/m3
		Heptane	ND	42 µg/m3
	Stadium	Ethanol	ND	n/a
		2-Proponal	ND	~~211~~20.1 µg/m3
		Toluene	ND	520 µg/m3
		Heptane	ND	42 µg/m3
	Georgetown	Ethanol	13	n/a
		2-Proponal	36	~~211~~20.1 µg/m3
		Toluene	ND	520 µg/m3

Pollutant	Station	Constituent	2021 Max Concentration	NAAQS/RSL
		Heptane	ND	42 μg/m3
	South Park 1	Ethanol	ND	n/a
		2-Proponal	ND	~~211~~20.1 μg/m3
		Toluene	ND	520 μg/m3
		Heptane	ND	42 μg/m3
	SODO/Lander	Ethanol	38	n/a
		2-Proponal	8.5	~~211~~20.1 μg/m3
		Toluene	3.7	520 μg/m3
		Heptane	3.5	42 μg/m3
	South Park 2	Ethanol	ND	n/a
		2-Proponal	10	~~211~~20.1 μg/m3
		Toluene	ND	520 μg/m3
		Heptane	ND	42 μg/m3

NAAQS=National Ambient Air Quality Standard; RSL=EPA Region 9 Regional Screening Level; ND= Not Detected
* Represents the RSL for Nickel Subsulfide
Note: RSLs are available at EPA's Regional Screening Levels website (https://www.epa.gov/risk/regional-screening-levels-rsls). The noncarcinogenic screening levels with a target hazard quotient of 0.1 are provided.
Source: Herrera and Ramboll, 2022~~1~~.

An area remains a nonattainment area for a particular pollutant until concentrations are in compliance with the NAAQS. Only after measured concentrations have fallen below the NAAQS can the state apply for redesignation to attainment, and it must then submit a 10-year plan for continuing to meet and maintain air quality standards that follow the Clean Air Act. During this 10-year period, the area is designated as a maintenance area.

The Puget Sound region, including the industrial and maritime areas of Seattle, is currently classified as an attainment area for ozone, Nox, lead, particulate matter and SO2. The region was designated as a maintenance area for CO until recently and is now considered in attainment. The U.S. EPA designated Seattle Duwamish area as a maintenance area for PM10 in 2000 and in 2002; the area is now in attainment.[8] Tacoma is currently classified as attainment with maintenance provisions for PM2.5.

The Puget Sound Regional Council estimates that by 2050, the Puget Sound region population will grow by 1.6 million people, increasing 38%, to reach a population of 5.8 million people (PSRC 2021). The highest population increase is estimated to be in King County. Estimates such as this indicate that CO, PM2.5 and ozone emissions will increase, which could lead to future challenges meeting the NAAQS.

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[8] EPA 2021, https://www3.epa.gov/airquality/greenbook/anayo_wa.html

Air toxic pollutant emissions remain a concern because of the projected growth in vehicle miles traveled. The U.S. EPA has been able to reduce benzene, toluene, and other air toxics emissions from mobile sources by placing stringent standards on tailpipe emissions and requiring the use of reformulated gasoline.

Sources of Air Pollution in Seattle's MIC Areas

For this analysis, the existing air pollution sources in the BINMIC and Greater Duwamish MIC are divided into several categories: transportation sources such as surface vehicle traffic; rail operations including freight and commuter trains, shipping and marine terminal operations, and aircraft overflights; point sources such as commercial/industrial equipment and processes; and construction vehicles and equipment sources.

Transportation sources include vehicles on highways and major arterial roadways, particularly those supporting a high percentage of diesel truck traffic. These include routes such as Interstate 5 (I-5), State Route 99 (SR 99), State Route 599 (SR 599), and the major arterials that traverse the MICs such as E. Marginal Way S., W. Marginal Way SW, and Airport Way S. in the Greater Duwamish MIC, and 15th Avenue W in the BINMIC. Diesel-fueled trucks, particularly older trucks that emit more pollutants than newer trucks, are the focus of federal, state, and local effort to reduce pollutant emissions (see previous section). Drayage trucking (local trucking that moves shipping containers between Port of Seattle ship terminals and distribution centers in Seattle, Kent Valley, and elsewhere) represent a ~~sizeable portion~~component of local trucking in the MICs. These trucks, which are often older and independent operations, are often required to queue and idle near port facilities. Older truck fleets are undergoing turnover to newer truck fleets and cleaner burning fuels. Port of Seattle staff have invested more than $15 Million in the last ten years, and significant staff time to transition the drayage fleet to year 2007 model or newer truck engines. As of 2019, more than 400 trucks had been scrapped and replaced with the help of federal, state, and local funding, and all trucks serving the Port's international container terminals had a 2007 or newer engine.

MIC areas in Seattle are also affected by air pollution from freight and passenger rail operations. Additional transportation sources include railway lines supporting diesel locomotive operations BNSF Railway Company (BNSF) owns and operates a mainline dual-track from Portland through the Greater Duwamish MIC to Seattle, and then extends north from downtown Seattle through the BINMIC to Snohomish County. A connecting spur, operated by the Ballard Terminal Rail Company, serves the Ballard and the western ship canal area. Union Pacific owns and operates a single mainline track with two-way train operations between Tacoma and Seattle that also passes through the Greater Duwamish MIC. While these operations generate air emissions in the immediate vicinity of the railways, train operations, including both freight and Commuter rail such as Sound Transit's Sounder system are intermittent. The contribution of air emissions from rail compared to the overall ambient air quality environment in the Seattle MIC areas is relatively minor compared to other sources such as traffic. However, areas near train yards may experience higher exposure to air emissions from assembling railcars into long trains and idling engines (WDOH 2008).

Shipping and marine terminal operations include emissions from ocean-going vessels, harbor support vessels, ferries, and cargo-handling equipment at marine facilities near Interbay (Pier 90), along the Seattle waterfront, alongside Harbor Island, and in the Duwamish waterway. These marine sources also contribute to regional and localized pollutant concentrations. These vessels typically use a range of fuels, including marine diesel oil, Intermediate fuel oil, medium fuel oil, and heavy fuel oil (also known as bunker fuel). Implementation in 2015 of the North American Emissions Control Area (ECA) established by the International Maritime Organization (IMO) requiring that ocean going vessels use fuels with 0.1% sulfur within 200 miles from the U.S. coast rather than the typical higher sulfur content bunker fuel (2.7%), SO_2 and diesel particulate emissions have been significantly reduced (PSMEI 2018).

Aircraft using King County International Airport, also known as Boeing Field and Seattle-Tacoma International Airport (Sea-Tac) frequently fly over Seattle MICs, with some arriving and departing flight paths at lower altitudes, depending on atmospheric conditions. These operations contribute to the overall ambient air quality environment. Atmospheric conditions may contribute to the direction of aircraft operations (flow) and affect aircraft emissions distribution.

Point sources of air pollution in the Seattle MICs include a wide variety of industrial and other non-transportation air emissions sources and are almost always required to have a permit to operate from PSCAA. These include manufacturing plants, and other heavy and general industrial facilities, and others. Industrial turbines, paper and packaging manufacturing, building materials manufacturing, steel manufacturing and fabrication, airplane manufacturing and assembly, and cement manufacturing plants are examples of point sources of air pollution in the MICs. Wood smoke is also considered an important point source contributor, either from wood-burning fireplaces or wildfire.

Construction vehicles and equipment sources include diesel-powered construction equipment such as excavators, dump trucks, pile drivers, cranes, and small equipment such as conveyors, generators, and mixers. Industrial and equipment sources include industrial boilers, cleaning/solvent use, coating and printing, wastewater systems, VOC processes, cooling towers, leaking components, flares, storage tanks, and combustion.

Sensitive Populations in and Around Seattle's MIC Areas

A health risk assessment conducted by the Washington State Department of Health (DOH) found that point sources (e.g., manufacturing facilities, cement plants) make up only about 4% of the overall long-term health risk associated with air pollution in the region. Mobile sources (i.e., cars, trucks, buses, ships, planes, trains) and wood stove/fireplace emissions likely make up the bulk of air pollution health risk in the region. Diesel particulate, benzene and formaldehyde from car and truck emissions, and wood smoke were identified as being the toxic air pollutants that make up the bulk of risk (WDOH 2008). These on-road mobile sources contribute to the highest cancer and non-cancer risks near major roadways over a large area of south Seattle and those risks and hazards are greatest near major highways and drop dramatically about 200 meters (656 feet) from the center of highways (WDOH 2008).

However, residential communities that border industrial areas like the BINMIC and Greater Duwamish MIC may be at risk of increased impact from pollutants due to their proximity to both transportation and point sources of pollution. The majority of land use in the BINMIC and Duwamish Valley are commercial or industrial, with most areas surrounding those industrial and maritime areas zoned as residential. The exception is the two residential communities of Georgetown and South Park, which are in the Duwamish Valley and surrounded by industrial uses.

Populations that are more sensitive to the health effects of air pollutants include the elderly and the young; groups with higher rates of respiratory disease, such as asthma; and those with other environmental or occupational health exposures (e.g., indoor air quality) that affect cardiovascular or respiratory diseases. Therefore, land uses and facilities such as schools, children’s daycare centers, hospitals and nursing and convalescent homes are considered to be more sensitive than the general public to poor air quality because the population groups associated with these uses are more susceptible to respiratory distress.

Open spaces and playgrounds are considered moderately sensitive to poor air quality because those engaged in strenuous work or exercise have increased sensitivity to poor air quality; however, exposure times are generally shorter in parks and playgrounds than in residential locations and schools. Residential areas are considered more sensitive to air quality conditions compared to commercial and industrial areas because people generally spend longer periods of time at their residences, with proportionally greater exposure to ambient air quality conditions. Workers are not considered sensitive receptors because all employers must follow regulations set forth by the Occupational Safety and Health Administration to ensure the health and well-being of their employees with regard to their own operations.

Maps indicating disparities in the potential exposure of populations in census tracts in the subarea are addressed in **Section 3.9 Housing**.

Greenhouse Gases & Climate Change

Background

The accumulation of greenhouse gases (GHGs) has been identified as a driving force in global climate change. Definitions of climate change vary between and across regulatory authorities and the scientific community. In general, however, climate change can be described as the changing of earth’s climate caused by natural fluctuations and anthropogenic activities (i.e., activities relating to, or resulting from the influence of human beings) that alter the composition of the global atmosphere.

The principal GHGs of concern are Carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulfur hexafluoride (SF6), perfluorocarbons (PFCs) and hydrofluorocarbons (HFCs). Electric utilities use SF6 in electric distribution equipment. Each of the principal GHGs has a long atmospheric lifetime (one year to several thousand years). In addition, the potential heat-trapping ability of each of these gases varies significantly. CH4 is 25 times as potent as CO2 at trapping heat, while SF6 is 23,900 times more potent than CO2. Conventionally, GHGs have been reported as CO2 equivalents (CO2e). CO2e takes into account the relative potency of non-CO2 GHGs and converts their quantities to an equivalent amount of CO2 so that all emissions can be reported as a single quantity.

The primary human-made processes that release GHGs include combustion of fossil fuels for transportation, heating, and electricity generation; agricultural practices that release CH4, such as livestock production and crop residue decomposition; industrial processes that release smaller amounts of high global warming potential gases such as SF6, PFCs, and HFCs, and waste decomposition that releases CH4. Deforestation and land cover conversion have also been identified as contributing to global warming by reducing the earth’s capacity to remove CO2 from the air and altering the earth’s albedo (surface reflectance) thus allowing more solar radiation to be absorbed.

Global mean temperatures in the United States (U.S.) have warmed during the 20th century and continue to warm into the 21st century. According to data compiled by NOAA, the rate of warming for the entire period of record (1880–2020) is 0.13°F per decade across the contiguous 48 States. The 10 warmest years on record have all occurred since 2005, and 7 of the 10 have occurred just since 2014. (NOAA 2021)

Ecology estimated that in 2018, Washington produced about 99.6 million gross metric tons (MMTCO2e; about 109.7 million U.S. tons) of CO2e (Ecology 2021). Ecology found that transportation is the largest source, at 45% of the state’s GHG emissions; followed by residential, commercial, and industrial (RCI) energy use at 23% and electricity generation (in-state and purchased from out-of-state) at 16%. The sources of the remaining 16% of emissions are fossil fuel and industrial processes, agriculture, and waste management.

Current Policy & Regulatory Frameworks

U.S. EPA

The U.S. EPA regulates emission of GHGs through two approaches: the first establishes Corporate Average Fuel Economy (CAFÉ) and GHG emission standards for light-duty vehicles (passenger cars and trucks), for medium and heavy duty commercial trucks and buses, and for commercial marine diesel engines above 30 Liters per cylinder (Category 3 Engines), which include large marine engines; the second covers GHG emissions from the largest stationary sources (buildings, structures, facilities, or installations) by the Prevention of Significant Deterioration (PSD) and title V Operating Permit Programs under the Clean Air Act (40 CFR 52.21(b)(3)).

Because the Action Alternatives propose land use changes to the Seattle MICs and do not propose construction of specific facilities or use of specific types of vehicles, federal regulatory requirements are not applicable to this impact analysis, though these standards will help reduce anticipated emissions in the future compared to existing conditions. Individual facilities and vehicle manufacturers will be responsible to ensure compliance in the MICs with EPA rules regarding GHG emissions.

Washington State

Washington has adopted a variety of regulations, programs, and initiatives designed to reduce GHG emissions.

Chapter 173-441 WAC—Reporting of Emissions of Greenhouse Gas, as adopted by Ecology, requires some facilities and transportation fuel suppliers to annually report their GHG emissions. The program uses the same emission calculation methods as EPA's GHG reporting program, and include:

- Facilities that emit at least 10,000 metric tons of carbon dioxide equivalent (CO2e) per year in Washington.
- Suppliers of liquid motor vehicle fuel, special fuel, or aircraft fuel that provide products equivalent to at least 10,000 metric tons of carbon dioxide per year in Washington.

In 2020, the Washington Legislature set new GHG emission limits (RCW 70A.45.020) in order to combat climate change. Under the law, the state is required to reduce emissions levels:

- 2020—reduce to 1990 levels.
- 2030—45% below 1990 levels.
- 2040—70% below 1990 levels.
- 2050—95% below 1990 levels and achieve net zero emissions.

The State Agency Climate Leadership Act (RCW 70.235.050 and 060) requires some state agencies to reduce their GHG emissions. The Act was updated in 2020 to require state agencies to reduce their carbon pollution to these targets:

- 2020—15% below 2005 levels
- 2030—45% below 2005 levels
- 2040—70% below 2005 levels
- 2050—95% below 2005 and achieve net-zero GHG emissions.

The 2019 Clean Energy Transformation Act (CETA) (SB 5116) requires all electric utilities in Washington to transition to carbon-neutral electricity by 2030 and to 100% carbon-free electricity by 2045. The Washington Department of Commerce and the Washington Utilities and Transportation Commission (UTC) are leading the implementation efforts.

The Motor Vehicle Emission Standards—Zero Emission Vehicles (ZEV) bill (RCW 70A.30.010) directs Ecology to adopt California vehicle emission standards, including zero emission vehicle standards that require a percentage of the vehicles sold in Washington to be zero emission. The 2021Clean Fuel Standard will require fuel suppliers to reduce the carbon intensity of their fuels 20% by 2038.

The 2021 Climate Commitment Act establishes a “cap and invest” program that sets a limit on the amount of GHGs that can be emitted in Washington (the cap) and then auctions off allowances for companies and facilities that emit GHGs until that cap is reached. Over time, the cap will be reduced, allowing total emissions to fall to match the GHG emission limits set in state law. Rulemaking will begin in 2021, and the program’s first compliance period will begin in 2023.

Ecology adopted a rule in 2019 to transition away from using GHGs known as hydrofluorocarbons (HFCs) in products and equipment starting in 2020. A law passed in 2021 expands on that program, establishing a program to reduce leaks from large air conditioning and refrigeration equipment, limiting the impacts for refrigeration chemicals, and requiring Ecology to recommend options for capturing HFCs when equipment reaches the end of its useful life.

The Clean Buildings for Washington law (HB 1257), establishes energy use intensity (EUI) targets for large commercial buildings (over 50,000 square feet), which will be updated over time. Owners of these buildings must first meet these energy performance standards between 2026 and 2028, depending on square footage of the building.

There is no standard significance threshold for GHG emissions in the Washington SEPA rules (Washington Administrative Code [WAC] 197-11-330).

Seattle Climate Change Policies

Seattle is a member of the Carbon Neutral Cities Alliance, a collaboration of cities working to cut GHG emissions by 80-100% by 2050 or sooner—the most aggressive GHG reduction targets undertaken anywhere by any city. The City of Seattle is also a member of the King County-Cities Climate Collaboration (K4C). This Collaboration is working toward achieving shared countywide GHG reduction targets that reduce direct countywide sources of GHG emissions by at least 50% by 2030, and 80% by 2050, compared to a 2007 baseline. The City of Seattle is also a steering committee member of the Puget Sound Climate Preparedness Collaborative, a network of local and tribal governments, public agencies, and organizations working together towards regional climate resiliency.

Seattle Climate Action Plan

In 2011, the City Council adopted a long-term climate protection vision for Seattle (through Resolution 31312) which included achieving net zero GHG Emissions by 2050 and preparing for the likely impacts of climate change. To achieve these goals the City prepared a Climate Action Plan (2013 CAP) which detailed the strategy for realizing this vision. In 2017, the City Council adopted Resolution 31757, affirming Seattle’s commitment to the goals established in the Paris Agreement, and resulting in the updated 2018 Climate Action Strategy, which identifies the actions necessary to limit atmospheric warming to 1.5 degrees Celsius.

City actions in the 2013 CAP and the updated 2018 Strategy focus on those sources of emissions where City action and local community action will have the greatest impact: road transportation and building energy, which comprise the majority of local emissions. With 2008 as the baseline year, the 2013 CAP identifies the following as targets by 2030. These goals remained unchanged by the updated 2018 Strategy:

- 82% reduction in passenger vehicle emissions
- 20% reduction in vehicle miles traveled
- 75% reduction in GHG emissions per mile of Seattle vehicles
- 45% reduction in commercial building emissions
- 10% reduction in commercial building energy use
- 32% reduction in residential building emissions
- 20% reduction in residential building energy use
- 39% reduction in building energy emissions
- 25% reduction in combined commercial and residential building energy use

City of Seattle Comprehensive Plan 2015-2035

The current City of Seattle Comprehensive Plan, Seattle 2035 addresses climate change within its Environmental Element (City of Seattle, 2020). Climate change-related goals and policies contained within the environmental element of the current Comprehensive Plan are listed below.

> *Goal EN G3 Reduce Seattle's greenhouse gas emissions by 58 percent from 2008 levels by 2030, and become carbon neutral by 2050.*
>
> - *Policy EN 3.1 Expand transit, walking, bicycling, and shared-transportation infrastructure and services to provide safe, affordable and effective options for getting around that produce low or zero emissions, particularly for lower-income households and communities of color.*
> - *Policy EN 3.2 Implement the urban village strategy with the goal of meeting the growing demand for conveniently located homes and businesses in pedestrian-friendly neighborhoods where residents can walk to a variety of recreation and service offerings, in order to increase the number of trips that do not require automobile use and increase access to opportunity for lower-income households and communities of color.*
> - *Policy EN 3.3 Implement innovative policies, such as road pricing and parking management, that better reflect the true cost of driving and therefore lead to less automobile use, while employing strategies that mitigate impacts on low-income residents.*
> - *Policy EN 3.4 Encourage energy efficiency and the use of low-carbon energy sources, such as waste heat and renewables, in both existing and new buildings.*
> - *Policy EN 3.5 Reduce the amount of waste generated while at the same time increasing the amount of waste that is recycled and composted.*

- *Policy EN 3.6 Reduce the emissions associated with the life cycle of goods and services by encouraging the use of durable, local products and recycled-content or reused materials, and recycling at the end of products' lives.*
- *Policy EN 3.7 Support a food system that encourages consumption of local foods and healthy foods with a low carbon footprint, reduces food waste, and fosters composting.*

Goal EN G4 Prepare for the likely impacts of climate change, including changing rain patterns, increased temperatures and heat events, shifting habitats, more intense storms, and rising sea level.

- *Policy EN 4.1 Consider projected climate impacts when developing plans or designing and siting infrastructure, in order to maximize the function and longevity of infrastructure investments, while also limiting impacts on marginalized populations and fostering resilient social and natural systems.*
- *Policy EN 4.2 Prioritize actions that reduce risk and enhance resilience in populations nearest the likely impacts of climate change, including actions that are driven by the communities most impacted by climate change.*
- *Policy EN 4.3 Focus strategies to address the impacts of climate change, in particular, on the needs of marginalized populations and seniors, since these groups often have the fewest resources to respond to changing conditions and therefore may be more severely impacted.*
- *Policy EN 4.4 Partner with communities most impacted by climate change to identify local community assets, including infrastructure, cultural institutions, community centers, and social networks that can be supported and leveraged in adaption planning.*

Building & Energy Policies

In 2021, the City of Seattle adopted new energy code updates for commercial and large multifamily buildings that:

- Eliminate all gas and most electric resistance space heating systems
- Eliminate gas water heating in large multifamily buildings and hotels
- Improves building exteriors to improve energy efficiency and comfort
- Requires electrical infrastructure necessary for future conversion of any gas appliances in multifamily buildings

Energy code updates do not apply to single family homes or low-rise multifamily homes, as the state prohibits city amendments to the residential energy code; nor does it apply to equipment used by a manufacturing, industrial or commercial process other than for conditioning spaces or maintaining comfort and amenities for the occupants (Seattle 2021c). Seattle also has a variety of other policies and programs specific to reductions in building energy use, including:

- Energy Benchmarking Program requires owners of non-residential and multifamily buildings (20,000 sf or larger) to track energy performance and annually report to the City of Seattle.
- Tune-ups aim to optimize energy and water performance by identifying low- or no-cost actions related to building operations and maintenance, that generate 10-15% in energy savings, on average.
- Passage of a new law to help phase out oil heat by 2028 in order to reduce climate pollution, prevent soil and groundwater contamination, and improve air quality.
- Adoption of policies addressing new construction and major renovations, as well as day-to-day operations of buildings owned and maintained by the City.

Maritime Policies

Seattle City Light and the Port of Seattle are committed to reducing the GHG emissions from marine activities. In 2020, the Northwest Ports, of which the Port of Seattle and the Northwest Seaport Alliance are~~is a~~ members, committed to phase out seaport related air and GHG emissions and transition to zero-emission operations by 2050 as part of the Northwest Ports Clean Air Strategy (NWP 2020). The commitment, independent of the Industrial and Maritime Strategy, covers all of the activities that are included in each participating port's emissions inventory, which includes direct emissions from port operations, as well as emissions from seaport-related activities.

Greenhouse Gas Emissions in Seattle

Seattle updated its GHG emissions inventory in 2018, documenting 5.7 million metric tons (MMTCO2e; about 6.3 million U.S. tons) of CO2e. Primary sources (core emissions) of GHG emissions include on-road buses, cars, light/medium/heavy duty trucks, residential and commercial building energy use, waste (residential, commercial, and self-haul) generation, and credits for offsets. Expanded sources of GHG emissions include core emissions plus marine, rail, and air transportation, waste (construction and demolition, wastewater) generation, industrial energy use and processes, and credits for offsets and sequestration of waste.

Overall, total emissions rose from 5.75 MMTCO2e in 2008 to 5.76 MMTCO2e in 2018, a 0.2% increase, despite an overall increase in population of over 25%. Per capita emissions dropped from 9.7 metric tons (MTCO2e) in 2008 to 7.7 MTCO2e per person in 2018, a decrease of over 20%. Core GHG emissions of GHGs declined from 3.2 MMTCO2e in 2008 to 3.1 MMTCO2e CO2e in 2018, a 4% decline (Seattle 2020).

Like Washington State, emissions in Seattle from transportation represent the largest percentage of overall emissions at 61%. The second largest emission source is building energy use at 24%, followed by emissions from industrial processes at 18%. City Light achieved GHG neutrality in 2005 through eliminating and reducing emissions, inventorying remaining emissions and purchasing offsets to offset the remaining emissions (SCL 2012) and has maintained GHG neutrality since that date.

Transportation Related GHG Emissions

Core transportation emissions decreased around 3% since 2008—from 2 MMTCO2e in 2008 to 1.94 million MMTCO2e in 2018. Road transportation has been the largest category of emissions since Seattle started tracking emissions in 1990. Total emissions in this sector increased through 2008; however, they have been decreasing since 2008 due to changes in the fuel economy of vehicles and changes in miles traveled. Most emissions from road transport, greater than 85%, are from gasoline fuel sources. Advances in vehicle technology have increased the average fuel economy for cars and light-duty trucks (including SUVs) in Seattle from about 20 miles per gallon of fuel in 2008 to about 23.6 miles per gallon in 2018 (Seattle 2020). Medium and heavy-duty truck diesel fuel sources contributed about 15% of the road transport emissions in 2008 and have increased about 2.5%—from 0.289 MMTCO2e in 2008 to 0.297 million MMTCO2e in 2018. This increase has occurred despite freight emissions per mile decreased 8% between 2008 and 2018, due largely to more vehicle miles traveled. Expanded GHG emissions increased almost 10% since 2008, with most of the increase attributed to greater air travel. Air transport emissions increased by 40% from 972,000 MTCO2e to 1.37 MMTCO2e in 2018 (Seattle 2020).

Shipping and marine terminal operations include GHG emissions from ocean-going vessels, harbor support vessels, ferries, and cargo-handling equipment at marine facilities near Interbay (Pier 90), along the Seattle waterfront, alongside Harbor Island, and in the Duwamish waterway.

Building Related GHG Emissions

Core building GHG emissions decreased 5.9% since 2008—from 1.27 MMTCO2e to 1.19 MMTCO2e in 2018. Expanded building emissions decreased 1.9% since 2008—from 1.43 MMTCO2e in 2008 to 1.40 MMTCO2e in 2018. However, both core and expanded building sector emissions increased by about 8% between 2016 and 2018, primarily as a result of an increase in fossil gas use.

About 90% of the electricity that Seattle City Light (SCL) provides to consumers in Seattle comes from low-carbon hydroelectric dams. SCL purchases local carbon offsets equal to the GHG emissions resulting from all other aspects of SCL's operations, including those created by fossil fuels included in the mix of power the utility buys, employees' travel, and the trucks and other equipment used in its operations. Because of variation in hydroelectricity production from year to year, SCL's external power purchases and the consequent amount of carbon offsets purchases varies annually. While electricity consumption is trending down, it is the largest source of energy for Seattle's buildings (54%) but is responsible for only 9% of emissions in the building sector before offsets. Fossil gas is currently responsible for 86% of building sector emissions, none of which are offset. (Seattle 2020)

Industrial Emissions

Industry emissions decreased 22.6% since 2008—from 1.36 MMTCO2e in 2008 to 1.05 MMTCO2e in 2018. This decrease in process emissions was largely due to reduction in cement process emissions which was halved since 2008. Meanwhile fossil gas use has increased 24.9% since 2008 from .27 to .33 million MTCO2e (Seattle 2020).

Maritime Activities Related Emissions

Maritime activities taking place within and adjacent to the MICs emit GHG emissions, including from ocean-going vessel hoteling (operations while stationary at dock) and maneuvering, harbor vessel movements, ferry transits, recreational vessels, and shore-side cargo handling equipment. Additional context and information for maritime emissions in general, and in relation to the MIC areas affected by the proposal, can be found in the 2016 Puget Sound Maritime Emissions Inventory (PSMEI 2018), which is incorporated into this EIS by reference.

SCL is working with the Port of Seattle, Washington Department of Transportation (WSDOT), and the U.S. Coast Guard (USCG) to install electrical infrastructure along the Seattle waterfront (including in the MIC areas), at Fisherman's Terminal, and in the Port to provide shore power to cargo vessels, cruise ships, ferries, USCG vessels, and some recreation/commercial fishing vessels. This work will eliminate the necessity for those vessels to run their engines while dockside. The U.S. EPA indicates that under the right circumstances when a vessel is connected to shore power, overall pollutant emissions can be reduced by up to 98% when utilizing power from the regional electricity grid (EPA 2017). The Port of Seattle is also actively replacing diesel-powered cargo handling equipment with electric power equipment over time.

3.2.2 Impacts

Air quality impacts related to each alternative were evaluated by reviewing proposed land use changes and anticipated changes in employment, vehicle miles traveled (VMT), and commercial, industrial, and housing construction and post-construction activities. Because construction is considered a temporary activity, a qualitative analysis of construction impacts common to all alternatives is presented.

For impacts related to longer-term changes in land use, the proposed alternatives would increase housing, employment, and vehicle miles traveled (VMT) in the study area in increments through the horizon year (2044) compared to the baseline year (2021). The projected area-wide increases in vehicle miles traveled (VMT) for the p.m. peak periods were used as a basis for comparison of the alternatives to the base year.

This section also describes how implementation of any of the Action Alternatives could affect GHG emissions in the study area compared to Alternative 1 No Action, primarily through changes in transportation patterns and land uses. Transportation systems contribute to climate change primarily through the emissions of carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) primarily from gasoline and diesel fuels used to operate cars, trucks, and rail vehicles. Land use changes contribute to climate change through construction and operational use of electricity and natural gas. GHG emission impacts related to each alternative were evaluated by reviewing proposed land use changes and anticipated changes in employment, vehicle miles traveled (VMT), and commercial, industrial, and housing construction and post-construction activities.

For impacts related to longer-term changes in land use, the proposed alternatives would increase housing, employment, industrial and non-industrial building space, and VMT in the study area in increments through the horizon year (2044) compared to the baseline year (2018-2021 depending on source). The projected area-wide increases in VMT for the p.m. peak periods were used as a basis for calculation of road transportation sources of GHG. The projected total and incremental increases in industrial and non-industrial building space and housing units were used as a basis for calculation of building related GHG emissions. The sum of these emissions were used as a basis for comparison of the alternatives to the No Action.

Impacts Common to All Alternatives

Air Quality

This discussion of impacts common to all alternatives covers all of the industrial lands subareas due to the regional nature of air quality, the mobility of transportation sources, and the dispersion of air pollutants. Air quality impacts specific to industrial lands subareas and for the locations targeted for air sampling, are discussed in the individual alternative discussions.

Construction Related Emissions

Future growth under any alternative would result in development of new maritime, industrial, design and research, and office uses, and some industry-supportive housing. Most development projects in the study area would entail a combination of demolition and removal of existing structures or parking lots, excavation and site preparation, construction of new buildings, and retrofit or adaptive reuse of existing buildings. Emissions generated during construction activities would include exhaust emissions and associated odors from construction equipment, commuting workers, trucks used to haul construction materials to and from sites, asphalt paving and painting, as well as fugitive dust emissions associated with soil-disturbing activities, demolition and construction work, and grading. Increased vehicle emissions associated with increased traffic congestion during construction could also occur.

The pollutants of concern from fugitive dust are PM2.5 and PM10. The PSCAA requires dust emission control measures on construction projects through Article 9, Section 9.15, including:

1. Using control equipment, enclosures or wet suppression techniques, and curtailment during high winds
2. Surfacing roadways and parking areas with asphalt, concrete, or gravel as soon as possible
3. Treating construction sites with water or chemical stabilizers, reducing vehicle speeds, installing pavement rip rap exit aprons, and cleaning vehicle undercarriages before entering public roadways
4. Covering or wetting truck loads or providing freeboard in truck loads.

With implementation of these requirements, impacts related to construction dust are expected to be less than significant.

Criteria air pollutants would be emitted during construction activities from construction equipment, much of it diesel fueled. Other emissions during construction would result from trucks used to haul construction materials to and from sites, and from vehicle emissions generated during worker travel to and from construction sites. Engine and motor vehicle exhaust produce emissions of VOCs, NOX, PM2.5, PM10, air toxics, and GHGs (assessed in Section 3.2.4). The primary emissions of concern with regard to construction equipment and trucking are Nox and PM2.5. Nox is primarily an air quality concern with respect to its role in (regional) ozone formation.

A number of federal regulations require emission and fuel standards that have or will lead to cleaner light- and heavy-duty truck and nonroad diesel equipment emissions. U.S. EPA Tier 3 Motor Vehicle Emission and Fuel Standards, established in 2014, set new vehicle emissions standards and a new gasoline sulfur standard beginning in 2017. The vehicle emissions standards reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. Tier 4 emission standards, established in 2004 and fully phased in by 2014, targeted a reduction in Nox and PM emissions of more than 90% from nonroad diesel engines and sulfur reductions in nonroad diesel fuel (U.S. EPA 2004).

The Puget Sound air shed is currently designated as an attainment area with respect to ozone. Construction-related Nox emissions are not expected to generate significant adverse air quality impacts nor lead to violation of standards under any of the alternatives. The same conclusion is reached for diesel-related emissions of PM2.5, which could generate temporary localized adverse impacts within a few hundred feet of construction sites.

Consequently, given the intermittent and temporary nature of construction-related emissions and regulatory improvements that have been or are scheduled to be phased in, construction related emissions associated with all alternatives would be considered only a minor adverse air quality impact.

Land Use Change-Related Emissions

Under all alternatives, redesignation of some areas from strictly industrial land uses to those that support increased employment density, multi-story mixed-uses, and multi-modal access around future light rail stations would change growth and development patterns.

Anticipated total square footage of building space for industrial and non-industrial uses in each MIC under existing conditions and each of the ~~four~~ alternatives are presented in **Exhibit 3.2-7.**

Exhibit 3.2-7 Estimated Industrial and Non-Industrial Square Footage for All Alternatives Compared to the Existing Conditions (2019), 2044 (million square feet)

	Existing		Alt. 1 No Action		Alt. 2		Alt. 3		Alt. 4		Pref. Alt.	
Geographic Area	**I**	**NI**	**I**	**NI**	**I**	**NI**	**I**	**NI**	**I**	**NI**	**I**	**NI**
BINMIC	6.8	5.4	9.2	6.5	12.1	6.3	14.5	8.3	14.6	8.6	11.6	7.7
Greater Duwamish MIC	34.6	13.9	40.4	15.7	46.7	15.4	47.2	18.1	46.9	18.3	41.2	16.4
Total	41.4	19.3	49.7	22.1	58.8	21.6	61.7	26.4	61.6	26.9	52.8	24.1

Estimates for the MIC areas under all alternatives are approximate. Rounding error may cause total not to sum. Industrial employment estimated based on the 2019 share of industrial employment by sector based on the 2015 PSRC Industrial Lands Study NAICs-based definition of industrial activities.
I=Industrial; NI=Non-Industrial
Sources: CAI, Herrera, 2022~~1~~.

Anticipated development resulting from all alternatives would alter the proximity and number of future workers in the study area to mobile and stationary sources of air toxics and particulate matter PM2.5. The degree of potential for adverse impacts on sensitive receptors would depend on proximity to sources, the emissions from these sources and the density of future development. In addition, areas surrounding the MICs could be subject to any emissions from increased employment density, new industrial development, and any additional traffic arising from worker commute or commercial transportation activity. However, because all the alternatives include some focus on increased employment density and land uses changes around light rail stations, some emission increases associated with growth in background traffic, worker commuting, and commercial activities may be muted.

Vehicle emissions for all of the alternatives would be minor relative to the overall regional vehicle emissions in the Puget Sound air shed. Photochemical smog (the regional haze produced by ozone and fine particles) is caused by regional emissions throughout the Puget Sound region, rather than localized emissions from any individual neighborhood. As discussed previously, the Puget Sound region was designated a maintenance area for ozone, with the 20-year maintenance period ending in 2016. Since that time, the region has been a designated attainment area for ozone. In addition, the U.S. EPA Tier 3 Motor Vehicle Emission and Fuel Standards and Tier 4 Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel (discussed in the previous section) have reduced vehicular emissions further. During the maintenance period, regional transportation emission budgets were set for three pollutants: CO, nitrogen oxides (Nox), and PM2.5. Based on the latest Puget Sound Regional Council (PSRC) air quality conformity analysis, forecasted regional emissions for its 2040 planning year are below the allowable budgets (PSRC 2018):

- CO: 38% of 2040 budget
- Nox: 62% of 2040 budget
- PM2.5: 83% of 2040 budget

Numerical forecasts of increased area wide vehicle miles traveled (VMT) during the PM Period are shown in **Exhibit 3.2-8**, below. Estimated road transportation emissions for each alternative are presented in the individual alternative's sections.

Exhibit 3.2-8 Estimated VMT During the PM Period for Action Alternatives (2044) Compared to Existing (2019) and Alternative 1 No Action (2042)

Geographic Area	2019 Existing	2042 No Action	2044 Alt. 2	2044 Alt. 3	2044 Alt. 4	2044 Pref. Alt.
BINMIC	54,840	56,100	56,900	58,540	58,980	57,600
Greater Duwamish MIC	641,560	643,440	648,480	658,050	659,520 ~~657,900~~	649,950
Seattle	2,964,540	3,089,000 ~~3,083,140~~	3,100,740 ~~3,094,870~~	3,126,670 ~~3,121,270~~	3,130,700 ~~3,121,420~~	3,107,430

Sources: Fehr & Peers, 2022~~1~~; Herrera, 2022~~1~~.

Population growth and VMT can be used as indicators of future transportation-related emissions. For each alternative, the forecasted VMT from the MIC area-wide modeling (see Transportation Chapter) is only a small fraction of the Puget Sound regional totals. Therefore, the forecasted similar VMT for all the Action Alternatives compared to Alternative 1 No Action would not alter PSRC's conclusion that future Puget Sound regional emissions will be less than the allowable emission budgets that were mandated by the air quality maintenance plans when they were in effect. It appears that neither of the alternatives would result in a significant impact on regional air quality.

Road transportation-related air pollutant emissions in each MIC under existing conditions and each of the ~~four~~ alternatives are presented in **Exhibit 3.2-9, Exhibit 3.2-10**, and **Exhibit 3.2-11**. Anticipated for Seattle overall are shown for comparison. These emissions are based on existing and projected VMT.

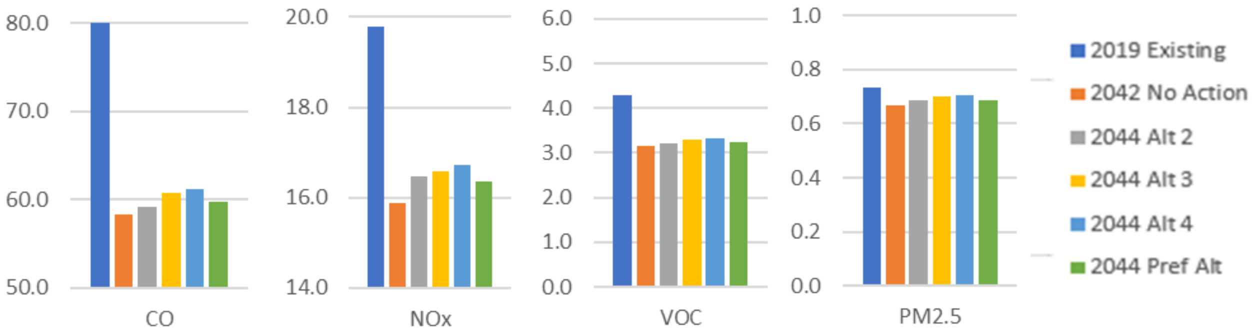
Exhibit 3.2-9 Estimated Tons of Criteria Pollutant Emissions from Road Transportation for Action Alternatives (2044) Compared to Existing and Alternative 1 No Action (2042)

Geographic Area	Pollutant	2019 Existing	2042 No Action	2044 Alt 2	2044 Alt 3	2044 Alt 4	2044 Pref. Alt.
BINMIC	CO	85.7	58.2	59.2	60.7	61.2	59.8
	Nox	19.8	15.9	16.5	16.6	16.7	16.4
	PM10	3.7	3.7	3.8	3.9	3.9	3.8
	PM2.5	0.7	0.7	0.7	0.7	0.7	0.7
	VOC	4.3	3.2	3.2	3.3	3.3	3.2
	Sox	0.2	0.2	0.2	0.2	0.2	0.2

Geographic Area	Pollutant	2019 Existing	2042 No Action	2044 Alt 2	2044 Alt 3	2044 Alt 4	2044 Pref. Alt.
Greater Duwamish MIC	CO	1,078.1	794.5	800.7	809.6	811.0~~809.5~~	800.4
	Nox	641.2	552.8	557.1	557.2	557.3~~557.2~~	552.4
	PM10	58.0	57.2	57.7	58.2	58.3~~58.2~~	57.6
	PM2.5	15.0	12.5	12.5	12.6	12.6~~12.6~~	12.5
	VOC	62.5	47.2	47.6	48.0	48.1~~48.0~~	47.5
	Sox	3.8	3.4	3.4	3.4	3.4~~3.4~~	3.4
Seattle	CO	4,783.0	3,465.8 ~~3,459.5~~	3,480.5 ~~3,474.2~~	3,504.7 ~~3,498.9~~	3,508.5 ~~3,499.0~~	3,484.8
	Nox	1,900.8	1,645.8 ~~1,643.6~~	1,656.7 ~~1,654.4~~	1,657.1 ~~1,654.8~~	1,657.2 ~~1,654.8~~	1,651.4
	PM10	229.6	234.9~~234.5~~	236.0~~235.6~~	237.4~~237.1~~	237.7~~237.1~~	236.2
	PM2.5	52.9	47.0~~46.9~~	47.2~~47.1~~	47.4~~47.4~~	47.5~~47.4~~	47.2
	VOC	256.6	196.7~~196.3~~	197.6~~197.2~~	198.8~~198.5~~	199.0~~198.5~~	197.7
	Sox	14.7	13.1~~13.1~~	13.2~~13.2~~	13.3~~13.2~~	13.3~~13.2~~	13.2

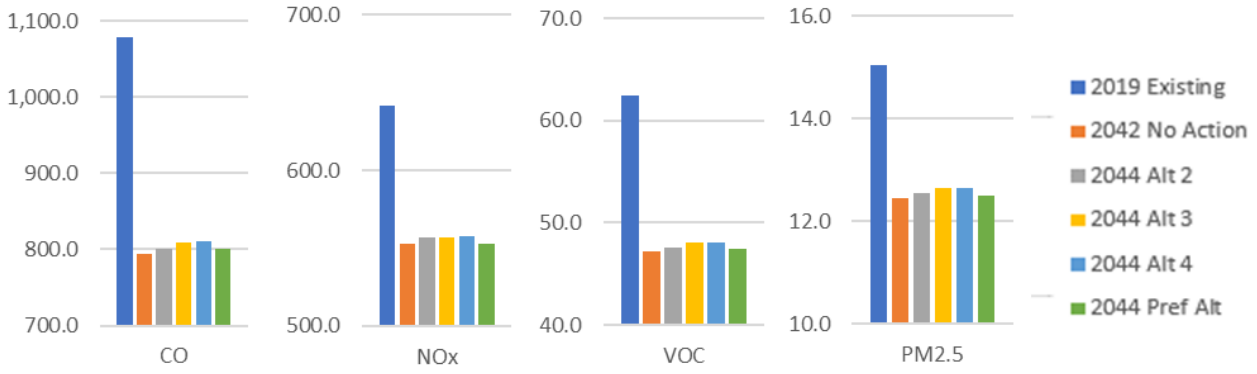
All measurements in Tons.
Sources: Fehr & Peers, 2022~~1~~; Herrera, 2022~~1~~.

Exhibit 3.2-10 Estimated Tons of Criteria Pollutant Emissions from Road Transportation in BINMIC, All Alternatives



Note: This chart was updated to include the Preferred Alternative.
Source; Herrera, 2022~~1~~.

Exhibit 3.2-11 Estimated Tons of Criteria Pollutant Emissions from Road Transportation in Greater Duwamish MIC, All Alternatives



Note: This chart was updated to include the Preferred Alternative.
Source; Herrera, 2022~~1~~.

The Seattle Comprehensive Plan (Seattle 2035) EIS discusses the health risk associated with stationary emissions sources, including those near maritime uses where ship emissions and diesel locomotive emissions and diesel forklift emissions can all occur. Likewise, distribution centers that involve relatively high volume of diesel truck traffic can also represent a risk hazard to nearby sensitive land uses. That discussion is relevant to the proposal for the MICs and is incorporated here by reference. Land use changes that promote new or additional industrial and maritime uses of this type could add to the associated health risk of increased emissions associated with these uses, including the potential for criteria air pollutants and TAPs. Subarea plans developed for the MIC areas could consider setbacks for adjacent sensitive land uses from industrial sources and identify measures for receptors proposed in areas nearby such sources to reduce the potential risk.

The Washington State Department of Health (DOH) health disparities map (DOH 2021) indicates the Greater Duwamish MIC and the BINMIC census tracts rank among the highest for a comparison of pollution burden from Diesel Nox emissions and social factors that may contribute to disparities across the state. Where housing within the industrial zones is established under all alternatives, those residents would experience higher emissions resulting from industrial and other non-transportation air emissions. In addition, some of the housing units and anticipated growth could be placed near major highways, rail lines, or port facilities that produce greater vehicle emissions, particularly from diesel sources. Despite this potential, the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, technology improvements, and overall fuel mix, local emissions and associated odors under the alternatives would likely be lower than under existing background conditions and the alternatives would result in a less than significant impact to air quality, and a moderate but less than significant impact on health related to air quality.

Local emissions of particulates could, however, impact residents of new residential development anticipated within the subareas, especially under alternatives 3 and 4 and the

Preferred Alternative if the new residential development occurs adjacent to major arterials. It would be prudent to consider risk-reducing mitigation strategies such as setbacks, improved building materials and structures, and improved air purification systems for residential and other sensitive land uses from major traffic corridors, rail lines, port terminals and similar point sources of particulates from diesel fuel.

Overall, given the regulatory improvements that have been or are schedule to be phased in, and the marginal increase in VMT associated with all of the alternatives, land use-related emissions would be considered only a less than significant impact adverse air quality impact.

Maritime Activities

Maritime activities taking place within and adjacent to the MICs, including ocean-going vessel (OGV) hoteling (operations while stationary at dock) and maneuvering, commercial harbor, and government vessel movements (including ferry transits), recreational vessels, and shore-side cargo handling equipment would continue to produce emissions under all alternatives.

Exhibit 3.2-12 shows 2016 air emissions in total annual tons associated with maritime sources in and adjacent to the study area.

Exhibit 3.2-12 Maritime Activities Air Emissions, Tons per Year, 2016

Source	Nox	VOC	CO	SO2	PM10	PM2.5	Black Carbon*
OGV, hoteling**	450.2	15.2	40.8	22.9	10.5	9.9	0.6
OGV, maneuvering*	70.0	4.8	7.0	2.0	1.2	1.2	0.0
Recreational Vessels	138.2	13.6	87.7	0.1	4.6	4.2	3.2
Locomotives	167.0	10.7	29.1	0.1	5.1	4.7	3.6
Cargo-handling equipment	115.0	8.5	45.0	0.1	6.0	5.8	4.4
Heavy-duty vehicles	73.3	8.2	22.4	0.1	3.5	3.3	1.7
Fleet vehicles	1.9	0.4	6.6	0.0	0.0	0.0	0.0
Commercial Harbor/Govt. Vessel	2,105.0	92.0	599.0	1.0	77.0	71.0	54.0
Total	3,120.6	153.4	837.6	26.4	108.0	100.1	67.5

Notes: *Black Carbon is soot, part of PM 2.5. **Ocean-going vessel (OGV)
Source: 2016 Puget Sound Maritime Emissions Inventory.

The U.S. EPA has established Tier 4 emission standards for commercial marine diesel engines above 30 Liters per cylinder (Category 3 Engines), which align with International Maritime Organization (IMO) Annex VI marine engine Nox standards and low sulfur requirements. These standards require the use of exhaust aftertreatment technology, phased in between 2022 and 2024. In addition, SCL and the Port of Seattle are committed to reducing the air emissions from the marine activities they interact with and have embarked on a widespread effort to reduce or eliminate them by installing electrical infrastructure to provide shore power to cargo vessels, cruise ships, and ferries. The Port of Seattle is also actively replacing diesel-powered cargo handling equipment with electric power equipment over time to address existing emissions from Port operations. With these additional regulatory requirements and with local infrastructure improvements beyond what the Port is already planning, these maritime emissions are expected to drop significantly under all alternatives, even if cargo volumes and cruise ship visits increase.

Greenhouse Gases & Climate Change

Like the air quality section, this discussion of impacts common to all alternatives covers all of the industrial lands subareas due to the global nature of climate change, and the mobility and dispersion of GHG emissions. It is unlikely that a series of land use changes, even on the areawide scale of the alternatives under consideration, would have a perceptible impact on global climate change. It is more appropriate to conclude that GHG emissions from changes in future development in the Greater Duwamish MIC and the BINMIC would combine with emissions across the city, state, country, and planet to cumulatively contribute to global climate change.

Construction Related Emissions

Future growth under any alternative would result in development of new maritime, industrial, design and research, and office uses, and some industry-supportive housing. Most development projects in the study area would entail a combination of demolition and removal of existing structures or parking lots, excavation and site preparation, construction of new buildings, and retrofit or adaptive reuse of existing buildings. GHG emissions would occur as “embodied emissions” related to material extraction, manufacturing, transportation, building construction, maintenance, demolition or deconstruction, and disposal. Also included are emissions from demolition and construction equipment, and from vehicle emissions generated during worker travel to and from construction sites. Increased vehicle emissions associated with increased traffic congestion during construction could also occur. Construction-related GHG emissions from any individual development project that may occur by 2044 would be temporary and would not represent an on-going source of emissions.

However, any accumulation of CO2 in the atmosphere, even if from a temporary source, can influence climate change when considered cumulatively with other global emissions. Over the course of the proposal’s implementation, varying levels of construction activities within the MICs would be ongoing under any of the alternatives. Cumulatively, construction related emissions would be more than an insignificant contributor to GHG emissions within the study area between 2018 and 2044. An estimate of the GHG emissions resulting from 20 years of construction envisioned under the alternatives was calculated using research data from the Carbon Leadership Forum (CLF 2017) as a comparative tool. The total additional “embodied“ emissions is estimated at between about 340,000 MTCO2e to 647,000 MTCO2e compared to Alternative 1 No Action, and includes emissions related to material extraction, manufacturing, transportation, building construction, maintenance, demolition or deconstruction, and disposal.

A number of federal regulations require emission and fuel standards that have or will lead to cleaner light- and heavy-duty truck and nonroad diesel equipment emissions (see Section 3.2.3.2.1). These standards also facilitate the adoption of new technologies necessary to meet GHG standards already promulgated by EPA (CRC 2014). The 2013 Seattle CAP and the updated 2018 Climate Action Strategy recognized the relevance of construction related GHG emissions and included several actions to be implemented by 2030 to address them, along with general actions to address transportation emissions.

Consequently, although construction related emissions would not be negligible, because of the combination of regulatory improvements and Climate Plan Actions under way, construction related GHG emissions associated with all alternatives would be considered a moderate adverse air quality impact.

Transportation Related GHG Emissions

Under all alternatives, redesignation of some areas from strictly industrial land uses to those that support increased employment density, multi-story mixed-uses, and some additional housing around future light rail stations would change growth and development patterns. These changes in development would result in changes in VMT, which were derived from the transportation analysis in **Section 3.10 Transportation**.

Existing and projected changes in VMT are estimated for cars, trucks, and buses and reflect all trips that start or end within the study area. GHG emissions from vehicle transportation were calculated based on estimated increases in VMT, emission factors reflecting future improvements to the vehicle fleet, and projected fuel economy for each vehicle class. Increased employment density and land uses changes around light rail stations may mute GHG emissions associated with worker commuting, and commercial activities, but these changes are reflected in VMT estimates.

Exhibit 3.2-13 shows GHG emissions in total annual metric tons of CO2e (MTCO2e) associated with road transportation sources in the study area under existing conditions and resulting from each of the ~~four~~ alternatives.

Exhibit 3.2-13 Estimated Road Transportation GHG Emissions for All Alternatives Compared to Existing Conditions (2019) and Alternative 1 No Action (2042) (MTCO2e)

MIC	2019 Existing	2042 No Action	2044 Alt 2	2044 Alt 3	2044 Alt 4	2044 Pref. Alt.
Ballard Interbay ~~Northend~~	41,497	35,523	36,192	36,988	37,254	36,470
Greater Duwamish	662,025	577,635	582,056	586,450	~~586,381~~ 587,125	580,387
Total	703,522	613,158	618,248	623,438	624,379 ~~623,635~~	616,857
Seattle	2,582,481	2,294,069 ~~2,290,282~~	2,304,812 ~~2,300,999~~	2,316,717 ~~2,313,120~~	2,318,567 ~~2,313,189~~	2,305,153

Sources: Fehr & Peers, 2022~~1~~; Herrera, 2022~~1~~.

The transportation analysis generally assumed continuation of current economic and demographic trends, with minor shifts toward shorter trips and more trips made by modes other than automobile travel. This reduces VMT per capita, but total VMT in the study area would continue to rise due to employment growth and some resident population growth.

A number of federal regulations require emission and fuel standards that have or will lead to cleaner light- and heavy-duty truck emissions (see **Section 3.2.1 Affected Environment**). These standards also facilitate the adoption of new technologies necessary to meet GHG standards already promulgated by EPA (CRC 2014). In addition, in August 2021, EPA proposed to revise existing national GHG emissions standards for passenger cars and light trucks for model years 2023–2026. The proposed standards would achieve significant GHG emissions reductions along with reductions in other criteria pollutants (U.S. EPA 2021). The proposed revised standards would result in substantial reductions in both GHG emissions and fuel consumption. According to the proposed standards, GHG emissions would decrease roughly 6% for new passenger cars and light trucks entering the vehicle fleet (U.S. EPA 2021).

Fuel economy for buses was also considered and fuel consumption were assumed to be reduced by 20% between 2018 and 2044. This is a conservative assumption given that King County Metro has targeted replacement of much of its fleet with battery-electric buses (Metro 2021).

All ~~four ~~future year alternatives produce similar annual GHG emissions, as shown in **Exhibit 3.2-13**. Alternative 1 No Action is expected to have the lowest GHG emissions among the alternatives. Alternative 2, which includes limited land use changes, is expected to have the lowest GHG emissions among the proposed alternatives, with Alternative 4 having the highest. All of the 2044 alternatives are expected to generate lower road transportation GHG emissions than in 2019. This is because the projected improvements in fuel economy outweigh the projected increase in VMT.

When compared to the Alternative 1 No Action, road transportation emissions under all the Action ~~A~~alternatives~~ 2, 3 and 4~~ would be higher, but only ~~A~~alternatives 3 and 4 would exceed the 10,000 MTCO2e mandatory reporting threshold for the State of Washington for facilities in the study area.

Maritime Activities Related Emissions

Maritime activities taking place within and adjacent to the MICs, including ocean-going vessel hoteling (operations while stationary at dock) and maneuvering, commercial harbor, and government vessel movements (including ferry transits), recreational vessels, and shore-side cargo handling equipment would continue to produce GHG emissions under any of the alternatives. **Exhibit 3.2-14** shows current GHG emissions in total annual metric tons of CO2e (MTCO2e) associated with maritime sources in and adjacent to the study area.

Exhibit 3.2-14 Estimated GHG Emissions from Maritime Activities, 2016 (MTCO2e)

Source	CO2e
OGV, hoteling	36,129
OGV, maneuvering	3,147
Recreational Vessels	8,616
Locomotives	10,894
Cargo-handling equipment	15,924
Heavy-duty vehicles	8,128
Fleet vehicles	463
Commercial Harbor / Government Vessel	138,019
Total	221,320

Source: 2016 Puget Sound Maritime Emissions Inventory

Because changes to Comprehensive Plan policies, development standards and land use designations under all alternatives would protect and enhance industrial and maritime uses within the MICs, some of the increased employment and industrial and non-industrial space would likely include businesses that support maritime activities, which could indirectly increase GHG emissions from vessels, shore-side cargo handling equipment, and waterfront visitors. These potentially small and indirect increases are not quantified due to uncertainty.

With the existing and additional regulatory requirements and with ongoing local infrastructure improvements such as shore power, existing and future maritime GHG emissions are expected to decrease under all alternatives, even if cargo volumes and cruise ship visits increase.

Buildings & Energy Related Emissions

Under all alternatives, increased use of electricity could be generated in the MIC areas from any increases or changes in building space that result in heating and cooling, lighting, cooking and refrigeration, commercial and industrial equipment /machinery and processes, office equipment and computers, public transit operations (light rail), and streetlights and signal operations. In the MIC areas, all electricity is supplied by Seattle City Light. Seattle City Light is carbon neutral and, consistent with the 2013 CAP, no GHG emissions related to electricity would be generated from the alternatives and none are included in this analysis, as it is assumed that City Light would continue to produce carbon neutral electricity through 2044.

GHG emissions could be produced in the MIC areas from additional industrial and non-industrial building space and housing that combusts natural gas for heating, cooking, or other industrial purposes. 2021 Seattle Energy Code changes that prohibit new natural gas connections would reduce GHG emissions from some of the anticipated development in the MIC where the code applies, such as commercial developments and some multi-family housing.

GHG emissions from anticipated industrial and non-industrial building space, and housing units, for the alternatives was calculated using the City of Seattle's Energy Benchmarking data and CO2 emission coefficients from the U.S. Energy Information Administration (EIA). Because SCL is assumed to be carbon neutral through 2040, building emissions estimates include only those from combusted natural gas. The calculations use weather-normalized energy use intensity factors per square foot to estimate the GHG emissions from natural gas usage, adjusted to account for reductions due to planned and anticipated changes to Seattle's energy code.

Exhibit 3.2-15 shows existing and potential 2044 GHG Emissions from natural gas use in the study area under all alternatives.

Exhibit 3.2-15 Estimated Building-Related GHG Emissions for Action Alternatives Compared to Existing Conditions (2017) and Alternative 1 No Action (2042) (MTCO2e)

Building Type	2017 Existing	2042 No Action	2044 Alt 2.	2044 Alt 3.	2044 Alt 4.	2044 Pref. Alt.
Industrial	40,877	49,098	58,080	60,913	60,774	52,175
Non-Industrial	8,488	9,766	9,535	11,616	11,836	10,602
Total	49,365	58,864	67,615	72,528	72,610	62,777

Source: Herrera, 2022~~1~~.

Exhibit 3.2-16 shows existing and potential 2044 GHG Emissions from housing units in the study area under all alternatives.

Exhibit 3.2-16 Estimated Housing-Related GHG Emissions for All Alternatives Compared to Existing Conditions (2021) and Alternative 1 No Action (2042) (MTCO2e)

Subarea	2021 Existing	2042 No Action	2044 Alt. 2	2044 Alt. 3	2044 Alt 4.	2044 Pref Alt
Ballard	537	558	559	1,263	2,745	1,973
Interbay Dravus	8	29	31	218	498	327
Interbay Smith Cove	3	24	25	45	3	3
SODO/Stadium	59	143	148	618	2,826	1,859
Georgetown/South Park	548	611	615	716	1,219	1,118
Total	1,154	1,364	1,378	2,859	7,289	5,280
Added MU Housing						
With MIC Adjustments—Seattle Mixed-Use Zone Housing				3,013	3,013	4,288
Grand Total	1,154	1,364	1,378	5,872	10,302	9,564

Source: Herrera, 2022~~1~~.

Future building related GHG emissions from the use of natural gas are expected to increase under all alternatives, in line with increases in employment, building spaces, and housing. These results assume only the most recent changes to Seattle's energy code are in place in 2044, though it is reasonable to assume that future changes to the Code would further seek to reduce GHG emissions in line with updated climate action planning and that these future increases may be overestimated.

Other GHG Emissions

Because employment and some population would increase under all three Alternatives, waste generation and its associated GHG emissions would also increase. GHG emissions from solid waste generation were estimated using emission factors from the EPA's WARM model and the most recent (2018) waste generation rates from SPU. These emissions were then adjusted to account for waste diversion implemented through waste reduction, recycling, and composting fostered by the City's carbon-neutral goal target of 70%~~ percent~~ waste diversion by 2030.

Exhibit 3.2-17 shows existing and potential 2044 GHG Emissions from waste in the study area under all alternatives.

Exhibit 3.2-17 Estimated Waste-Related GHG Emissions for All Alternatives Compared to Existing Conditions and Alternative 1 No Action (MTCO2e)

Subarea	Existing	2042 No Action	2044 Alt. 2	2044 Alt. 3	2044 Alt 4.	**2044 Pref. Alt.**
C&D	—	(332)~~(3)~~	(586)~~(6)~~	(811)~~(8)~~	(821)~~(8)~~	(481)
Industrial	(526)~~(950)~~	(640)~~(1,176)~~	(766)~~(1,282)~~	(805)~~(1,503)~~	(803)~~(1,521)~~	(683)
Non-Industrial	(424)~~(526)~~	(536)~~(640)~~	(516)~~(766)~~	(698)~~(805)~~	(717)~~(803)~~	(609)
Housing	(2)~~(424)~~	(3)~~(536)~~	(3)~~(516)~~	(5)~~(698)~~	(14)~~(717)~~	(10)
Total	(952)~~(1,900)~~	(1,511)~~(2,356)~~	(1,870)~~(2,569)~~	(2,320)~~(3,015)~~	(2,356)~~(3,050)~~	(1,783)

Source: Herrera, 2022~~1~~.

Equity & Environmental Justice Considerations

Air Quality

While air quality impacts under all alternatives are expected to be less than significant, the primary equity and environmental justice concern for the proposal would be the emissions associated with industrial activities and road transportation emissions on vulnerable communities in the study area, on the periphery of industrial zones, and alongside higher-volume transportation routes. Depending on the transportation routes that are used, emissions of air pollutants from mobile sources could concentrate along routes that pass through vulnerable communities, leading to inequitable exposure to air pollution. Similar effects could be experienced with activities related to employee and material transport during the construction phase of any of the alternatives.

At various thresholds of exposure, pollutants from mobile source operation can cause health effects such as cancer, asthma, and cardiovascular diseases, among others. Sensitivity to air pollution can depend on factors such as age, sex, and access to healthcare, the latter being correlated to income level. By race, asthma prevalence in the United States is greatest among American Indian/Alaska Natives and Black Americans (CDC 2019). Populations with preexisting conditions that make them more sensitive to air pollution could be at greater risk from the activities associated with the alternatives.

The incremental traffic-related emissions of the proposed alternatives would represent a minor portion of all traffic emissions on any transportation route near vulnerable communities. In addition, due to EPA emission standards for motor vehicles and clean fuel standards, the total emissions from road transportation are expected to drop even as traffic levels increase in the study area. Thus, exposures to air pollution in the study area are expected to continue trending downward.

Greenhouse Gases & Climate Change

GHG emissions under all alternatives are expected to have a potentially significant impact when combined with other global emissions, though mitigation opportunities, local and state climate actions, and expected continued regulatory changes would likely decrease the incremental contribution from the proposal to a moderate level of impact. The primary equity and environmental justice concern for the proposal would be the potential effect of emissions to accelerate climate change, which could disproportionately harm vulnerable communities in the study area. This could occur as the result of emissions from both the construction and operational phases of the proposal.

A new EPA analysis (EPA 2021) shows that the most severe harms from climate change fall disproportionately on vulnerable communities who are least able to prepare for, and recover from, exposure to extreme temperatures, poor air quality, flooding, sea level rise, and other impacts. EPA's analysis indicates that racial and ethnic minority communities are particularly vulnerable to the greatest impacts of climate change.

The incremental emissions of the proposed alternatives would represent a minor portion of all emissions that cumulatively contribute to climate change. However, planning for climate change should place emphasis on shoreline areas at risk from sea-level rise (see **Section 3.3 Water Resources**), among other risks, and prescribe adaptation measures that would help existing and new employees and residents, particularly vulnerable populations, in the MIC areas to reduce risks.

Impacts of Alternative 1 No Action

Air Quality

Under Alternative 1 future growth would continue based on current land use designations and comprehensive plan policies. No new land use concepts nor changes to MIC boundaries are proposed.

Transportation Related Emissions

Population and employment increases would continue, and area-wide VMT would increase in proportion. Projected changes in VMT were extracted from the projected travel demand model for cars, trucks, and buses. The travel demand model generally assumes existing economic and demographic trends continue with minor changes due primarily to mode share shifts and shortened trips due to increased traffic congestion. These changes cause projected VMT per capita to decline slightly by 2042. However, total VMT would continue to rise modestly due to population and employment growth.

The area wide estimated VMT for each of the MICs for the baseline year (2019) and the Alternative 1 No Action are presented in **Exhibit 3.2-18**.

Exhibit 3.2-18 Estimated VMT For the Baseline Year (2019) And Alternative 1 No Action (2042)

Geographic Area		PM Period VMT			PM Peak Hour VMT		
		2019 Existing	2042 No Action	Increase / Decrease	2019 Existing	2042 No Action	Increase / Decrease
BINMIC	Cars	51,370	52,420	1,050	18,750	19,130	380
	Trucks	2,550	2,760	210	930	1,010	80
	Buses	920	920	0	340	340	0
	Total	54,840	56,100	1,260	20,020	20,480	460
Greater Duwamish MIC	Cars	531,320	516,020	-15,300	193,930	188,350	-5,580
	Trucks	105,980	123,310	17,330	38,680	45,010	6,330
	Buses	4,260	4,110	-150	1,550	1,500	-50
	Total	641,560	643,440	1,880	234,160	234,860	700

PM Period = 3-6 PM
Net increase/decrease compares Alternative 1 with the Baseline year.
Sources: Fehr & Peers, Herrera, 2021.

Under the Alternative 1 No Action, overall area-wide VMT could increase in the Greater Duwamish MIC by roughly 1,880 VMT during the PM period and 700 during the PM peak hour compared to the baseline year, and in the BINMIC by roughly 1,260 VMT during the PM period and 460 during the PM peak hour compared to the baseline year. In the Greater Duwamish

MIC, the overall slight increase in total VMT includes an anticipated decrease in car VMT for the PM period and the PM peak hour, and a similar anticipated increase in truck VMT for the PM period and the PM peak hour. Overall slight increases in VMT for the BINMIC are also reflected across vehicle types.

Road transportation-related air pollutant emissions in each MIC for Alternative 1 No Action compared to existing conditions are presented in **Exhibit 3.2-19**. Anticipated for Seattle overall are shown for comparison.

Exhibit 3.2-19 Estimated Tons of Criteria Pollutant Emissions from Road Transportation for Alternative 1 No Action (2042) Compared to Existing Conditions (2019)

Geographic Area	Pollutant	2019 Existing	2042 No Action	Increase / Decrease
BINMIC	CO	85.7	58.2	-27.5
	Nox	19.8	15.9	-3.9
	PM10	3.7	3.7	0.0
	PM2.5	0.7	0.7	-0.1
	VOC	4.3	3.2	-1.1
	Sox	0.2	0.2	0.0
Greater Duwamish MIC	CO	1,078.1	794.5	-283.6
	Nox	641.2	552.8	-88.5
	PM10	58.0	57.2	-0.8
	PM2.5	15.0	12.5	-2.6
	VOC	62.5	47.2	-15.3
	Sox	3.8	3.4	-0.5
Seattle	CO	4,783.0	3,465.8~~3,459.5~~	-1,317.2~~-1,323.4~~
	Nox	1,900.8	1,645.8~~1,643.6~~	-254.9~~-257.2~~
	PM10	229.6	234.9~~234.5~~	5.3~~4.9~~
	PM2.5	52.9	47.0~~46.9~~	-6.0~~-6.0~~
	VOC	256.6	196.7~~196.3~~	-59.9~~-60.3~~
	Sox	14.7	13.1~~13.1~~	-1.6~~-1.6~~

Sources: Fehr & Peers, 2022; Herrera, 2022~~1~~.

In addition to the road transportation emissions in **Exhibit 3.2-19**, vehicle travel would also generate PM2.5 through tire and brake wear and, more significantly, from entrained road dust. These non-vehicle emissions would not benefit from future improvements to the vehicle fleet as a whole or from improvements to fuel economy.

Regional emissions under Alternative 1 would be substantially lower than under existing background conditions. This is because the projected improvement in fuel economy, emission reduction, and new technology implementation would offset the projected increase in VMT. Therefore, the No Action Alternative would result in a less than significant impact to air quality.

Land Use Change-Related Emissions

Under Alternative 1 No Action, existing Comprehensive Plan policies, development standards and zoning maps would dictate the patterns of development and the density of employment in the MIC areas. Alternative 1 No Action would result in continued growth in employment in the study area in 2044 compared to the baseline year of 2018 (see **Exhibit 3.8-13** in **Section 3.8 Land & Shoreline Use**). **Exhibit 3.2-7** on page 3-48 shows the square footage of industrial and non-industrial space in each MIC for existing conditions (2018) and anticipated under Alternative 1 No Action.

Where development occurs as current land use designations and Comprehensive Plan policies allow, and depending on the types of industry, those areas and employees would encounter the emissions resulting from existing and new industrial and other non-transportation air emissions. In addition, in areas with current industrial land use designations that maintain an industrial focus under new land use designations, residents or workers in adjacent areas with a residential or mixed-use focus could experience higher emissions resulting from industrial and other non-transportation air emissions. Areas particularly subject to these potential impacts include residential areas of Queen Anne and Magnolia adjacent to Interbay and commercial and mixed-use areas of Interbay itself, South Park, and Georgetown. However, with existing requirements for operating permits from PSCAA, these manufacturing plants, and other heavy and general industrial facilities are expected to remain compliant with air pollution control regulations that assure criteria air pollutant and TAP emissions meet standards, as they do currently.

Alternative 1 No Action would also result in some continued growth in housing in the study area in 2044 compared to the baseline year of 2018. **Exhibit 3.2-20** shows the number of housing units in each MIC for current conditions (2021) and anticipated under Alternative 1, No Action.

Exhibit 3.2-20 Estimated Number of Housing Units for Industrial Subareas Under Alternative 1 No Action (2044) Compared to the Current Conditions (2021)

	Current Conditions (2021)	Alternative 1 No Action Existing Policies (2044)		
Subarea	**Existing**	**Total**	**Growth**	**% Growth**
Ballard	192	199	7	3.9%
Interbay Dravus	3	11	8	250.0%
Interbay Smith Cove	1	9	8	750.0%
SODO/Stadium	21	51	30	142.9%
Georgetown/South Park	196	218	22	11.5%
Total: Ind Zone Housing	413	488*	75*	18.2%

*Rounded

Sources: Fehr & Peers, 2021; Herrera, 2021.

Where housing within the industrial zones is existing or would be established, those residents would experience higher emissions resulting from industrial and other non-transportation air emissions. In addition, some of the housing units and anticipated growth, particularly in South Park and Georgetown, could be placed near major highways, rail lines, or port facilities that produce vehicle emissions in the highest concentrations. The DOH health disparities map (DOH 2021) indicates the South Park and Georgetown census tracts, including those surrounding SR 99 and SR509, as currently ranking either a 9 or a 10 out of 10 for a comparison of pollution burden from Diesel Nox emissions and social factors that may contribute to disparities across the state. Despite this potential, the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, technology improvements, and overall fuel mix, local emissions under Alternative 1 would be lower than under existing background conditions and Alternative 1 No Action would result in a less than significant impact to air quality, and a moderate but less than significant impact on health related to air quality.

Given this, it would be prudent to consider risk-reducing mitigation strategies such as setbacks for residential and other sensitive land uses from major traffic corridors, rail lines, port terminals and similar point sources of particulates from diesel fuel and/or to identify measures for sensitive populations proposed to be in areas near such sources.

Maritime Activities

Maritime activities that emit criteria pollutants within and adjacent to the MICs would be similar to those discussed and shown in **Exhibit 3.2-12**. With existing and planned regulatory requirements and local infrastructure improvements, these maritime emissions are expected to decrease under all alternatives, even if cargo volumes and cruise ship visits increase.

Greenhouse Gases & Climate Change

Changes in operational GHG emissions associated with development under Alternative 1 No Action would result from increases in VMT and improvements to the vehicle fleet, increased natural gas usage associated with new industrial and non-industrial development, and solid waste generation. These developments would be guided by existing Comprehensive Plan policies and existing land use designations. Potential operational GHG emissions from the Alternative 1 No Action are presented in **Exhibit 3.2-21**.

Exhibit 3.2-21 Total Estimated Annual MTCO2e Emissions Under Alternative 1 No Action Compared to Existing Conditions

Source	Existing MTCO2e	2042 No Action MTCO2e
Transportation	703,522	613,158
Ind. And Non-Ind. Building—Gas	49,365	58,864
Housing	1,154	1,364
Waste	-1,904~~3,799~~	-2,690~~4,709~~
Total	752,137~~750,242~~	670,696~~68,677~~
Difference from Existing	*0*	*-81,441~~565~~*
Difference from No Action	*0*	*0*

Source: Herrera, 2022~~1~~.

Total annual GHG emissions under Alternative 1 No Action could decrease by over 80,000 MTCO2e as compared to the baseline, which is the smallest increase in GHG emissions of all the alternatives when compared to existing conditions. However, this alternative contributes the least towards supporting growth and development for industrial and maritime uses, with less emphasis on development near existing and planned light rail transit. Growth that might otherwise be accommodated in the MIC buffer areas would occur in peripheral areas of the city or region where there are fewer jobs and services in close proximity, or fewer emission reduction policies driving change, resulting in greater net GHG emissions than are shown here.

Alternative 1 No Action would result in a less than significant impact for GHG emissions. None of the sources increases compared to the existing conditions by more than the 10,000 MTCO2e mandatory reporting threshold for the State of Washington for facilities. In fact, the increase in building natural gas emissions may be overestimated. Emissions associated with housing could also increase but by a small margin over existing conditions. In any case, taken as a whole, the individual source increases in GHG emissions are offset by decreases in all other source categories.

Impacts of Alternative 2

Air Quality

Alternative 2 could result in a very slight growth in overall VMT in the study area in 2044 compared to Alternative 1 No Action, and air quality impacts would be similar.

Transportation Related Emissions

Estimated VMT for the Greater Duwamish MIC and the BINMIC are presented in **Exhibit 3.2-22** comparing Alternative 1 No Action and Alternative 2.

Exhibit 3.2-22 Estimated VMT For Alternative 2 (2044) Compared to Alternative 1 No Action (2042)

Geographic Area		PM Period VMT			PM Peak Hour VMT		
		2042 No Action	2044 Alt 2	Increase/ Decrease	2042 No Action	2044 Alt 2	Increase/ Decrease
BINMIC	Cars	52,420	53,080	660	19,130	19,370	240
	Trucks	2,760	2,900	140	1,010	1,060	50
	Buses	920	920	0	340	340	0
	Total	56,100	56,900	800	20,480	20,770	290
Greater Duwamish MIC	Cars	516,020	520,080	4,060	188,350	189,830	1,480
	Trucks	123,310	124,290	980	45,010	45,370	360
	Buses	4,110	4,110	0	1,500	1,500	0
	Total	643,440	648,480	5,040	234,860	236,700	1,840

PM Period = 3-6 PM
Net increase/decrease compares Alternative 1 with the Baseline year.
Sources: Fehr & Peers, 2021; Herrera, 2021.

Under Alternative 2, VMT in the Greater Duwamish MIC could increase by roughly 5,040 in the PM period compared to Alternative 1 No Action and by 1,840 in the PM peak hour compared to Alternative 1. Most of those slight increases are from passenger cars. In the BINMIC, VMT could increase by roughly 800 in the PM period compared to Alternative 1 No Action and by 290 in the PM peak hour compared to Alternative 1.

Road transportation-related air pollutant emissions under Alternative 2 compared to Alternative 1 No Action are shown in **Exhibit 3.2-23** for both the Greater Duwamish MIC and the BINMIC. Anticipated for Seattle overall are shown for comparison.

Exhibit 3.2-23 Estimated Tons of Criteria Pollutant Emissions from Road Transportation for Alternative 2 (2044) Compared to Alternative 1 No Action (2042)

Geographic Area	Pollutant	2042 No Action	2044 Alt 2	Increase/ Decrease
BINMIC	CO	58.2	59.2	1.0
	Nox	15.9	16.5	0.6
	PM10	3.7	3.8	0.1
	PM2.5	0.7	0.7	0.0
	VOC	3.2	3.2	0.1
	Sox	0.2	0.2	0.0
Greater Duwamish MIC	CO	794.5	800.7	6.2
	Nox	552.8	557.1	4.3
	PM10	57.2	57.7	0.4

Geographic Area	Pollutant	2042 No Action	2044 Alt 2	Increase/ Decrease
	PM2.5	12.5	12.5	0.1
	VOC	47.2	47.6	0.4
	Sox	3.4	3.4	0.0
Seattle	CO	3,465.8~~3,459.5~~	3,480.5~~3,474.2~~	14.7~~14.7~~
	Nox	1,645.8~~1,643.6~~	1,656.7~~1,654.4~~	10.9~~10.8~~
	PM10	234.9~~234.5~~	236.0~~235.6~~	1.1~~1.1~~
	PM2.5	47.0~~46.9~~	47.2~~47.1~~	0.2~~0.2~~
	VOC	196.7~~196.3~~	197.6~~197.2~~	0.9~~0.9~~
	Sox	13.1~~13.1~~	13.2~~13.2~~	0.1~~0.1~~

Sources: Fehr & Peers, 2022; Herrera, 2022~~1~~.

Area wide road transportation pollutant emissions under Alternative 2 would also be substantially lower than under existing conditions, but slightly higher than Alternative 1. As with Alternative 1, this is because the projected improvement in fleet mix, emission reduction, and technology implementation due to fuel economy standards could offset this increase in VMT. Generation of PM2.5 through tire and brake wear and from entrained road dust would also likely be greater with Alternative 2 than with Alternative 1 due to greater VMT. These non-vehicle emissions would not benefit from future improvements to the vehicle fleet as a whole or from improvements to fuel economy. Air emissions from the MIC areas under Alternative 2 as a percentage of overall City road transportation emissions would remain at or below that anticipated for Alternative 1 No Action. Therefore, Alternative 2 would likely result in a less than significant impact to air quality.

Land Use Change-Related Emissions

Under Alternative 2, revised Comprehensive Plan policies, development standards and land use designations would result in generally more employment and additional development in the study area in 2044 compared to Alternative 1 No Action 2042. **Exhibit 3.2-7** on page 3-48 shows the square footage of industrial and non-industrial space in each MIC anticipated under Alternative 2 compared with Alternative 1 No Action, including the amount of anticipated growth.

As with Alternative 1 No Action, existing and new employees, depending on the types of businesses locating in the MICs, may encounter the emissions resulting from existing and new industrial and other non-transportation air emissions.

This alternative would place the emphasis for growth in industrial and maritime uses within appropriate land use zones, with a slight decrease in space devoted to non-industrial uses. Potentially a greater portion of projected growth in the MICs would be closer to and access major highway, rail line or port terminals, and contribute to the emissions from those sources. As with Alternative 1 No Action, in areas with current industrial land use designations that maintain an industrial focus under new land use designations, residents or workers in adjacent areas with a residential or mixed-use focus could experience higher emissions resulting from industrial and other non-transportation air emissions in areas of Queen Anne and Magnolia, Interbay, South Park, and Georgetown. However, as shown in **Exhibit 3.2-24**, with existing requirements for operating permits from PSCAA, these manufacturing plants, and other heavy and general industrial facilities are expected to remain compliant with air pollution control regulations that assure criteria air pollutant and TAP emissions meet standards, as they do currently.

Alternative 2 would also result in some continued growth in housing in the study area in 2044 compared to Alternative 1 No Action 2044. **Exhibit 3.2-24** shows the number of housing units in each MIC for Alternative 2 compared to those anticipated under Alternative 1, No Action.

Exhibit 3.2-24 Estimated Number of Housing Units for Industrial Subareas Under Alternative 2 (2044) Compared to Alternative 1 No Action (2044)

	Alternative 1 No Action (2044)	Alternative 2 Future of Industry—Limited (2044)		
Subarea	Total Units	Total Units	Growth	% Growth
Ballard	199	200	1	0.3%
Interbay Dravus	11	11	0	4.8%
Interbay Smith Cove	9	9	0	5.9%
SODO/Stadium	51	53	2	3.9%
Georgetown/South Park	218	220	2	0.7%
Total: Ind Zone Housing	488*	493*	5	1.0%

*Rounded
Source: City of Seattle, 2021.

Impacts to existing and new residents within and adjacent to the MICs under Alternative 2 would not be appreciably different from impacts under Alternative 1 No Action. Where housing within the industrial zones is existing or newly established, those residents would experience higher emissions resulting from industrial and other non-transportation air emissions. As with Alternative 1, the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, technology improvements, and overall fuel mix, local emissions under Alternative 2 would be lower than under existing background conditions and Alternative 2 would result in a less than significant impact to air quality. Similar mitigation strategies should be considered.

Maritime Activities

Maritime activities and their impact on the Puget Sound air shed, including the MICs, would continue similarly as they would under Alternative 1 No Action. With existing and planned regulatory requirements and local infrastructure improvements, these maritime emissions are expected to decrease under all alternatives, even if cargo volumes and cruise ship visits increase.

Greenhouse Gases & Climate Change

GHG emissions under development of Alternative 2 were calculated using the same methodologies as those described previously but reflect the land use differences of increased industrial and non-industrial building space, added industry-supportive housing, and corresponding increased VMT in each of the MICs. These developments would be guided by changes to Comprehensive Plan policies and land use designations as outlined in the City's Industrial and Maritime Strategy and the resulting subarea plan policies to be developed. Operational GHG emissions from Alternative 2 are presented in **Exhibit 3.2-25**.

Exhibit 3.2-25 Total Estimated Annual MTCO2e Emissions Under Alternative 2 Compared to Alternative 1 No Action

Source	No Action MTCO2e	Alt. 2 MTCO2e
Transportation	613,158	618,247
Ind. And Non-Ind. Building—Gas	58,864	67,615
Housing	1,364	1,378
Waste	-2,690~~4,709~~	-3,154~~5,132~~
Total	670,696~~68,677~~	684,085~~2,108~~
Difference from Existing	*-81,441~~565~~*	*-68,052~~134~~*
Difference from No Action	*0*	*13,389~~431~~*

Source: Herrera, 2022~~1~~.

Alternative 2 could decrease GHG emissions by approximately 68,000 MTCO2e per year compared to existing conditions but would represent an increase of over 13,000 MTCO2e compared to Alternative 1 No Action, which is above the 10,000 MTCO2e mandatory reporting threshold for the State of Washington. This is due largely to the GHG emissions associated with natural gas use with new industrial and non-industrial space increases compared to No Action conditions. As stated previously, these emissions may be overestimated.

Growth in the MICs that would otherwise be accommodated within other parts of the city would result in greater progress toward reducing overall transportation related emissions because the MICs have a high concentration of industrial and industry supporting jobs and services in close proximity with each other. This suggests that VMT per job could be lower in these areas than in most neighborhoods in the city. To the extent that Alternative 2 attracts growth that would otherwise occur outside of Seattle, it would result in an increase in total VMT within the city, making it more difficult to achieve City goals for a net reduction in citywide VMT over time.

It should be noted that despite the moderate increase in transportation-related emissions associated with VMT, Alternative 2 would support higher density growth patterns, particularly near planned light rail stations consistent with regional planning, as well as the long-term planning goals of the City's Comprehensive Plan and 2013 CAP, which are expected to assist in controlling GHG emissions. The Seattle Comprehensive Plan Final EIS (2016) presented analysis that showed that the VMT per job and resident in Seattle would be approximately 40% lower than VMT per job and resident outside of Seattle (City of Seattle, 2016b). Therefore, by increasing employment density in the MICs, Alternative 2 could contribute to regional efforts to limit vehicular GHG emissions.

Overall, Alternative 2 could result in an increase in GHG emissions compared to Alternative 1—No Action that could be considered potentially significant and additional mitigation measures would be warranted.

Impacts of Alternative 3

Air Quality

Alternative 3 could result in more robust growth in the study area in overall employment, industrial and non-industrial development, and in housing compared to Alternative 1 No Action and Alternative 2.

Transportation Related Emissions

Alternative 3 could result in a slight growth in overall VMT in the study area compared to Alternative 1 No Action and Alternative 2, but air quality impacts would be similar. Estimated VMT for the Greater Duwamish MIC and the BINMIC are presented in **Exhibit 3.2-26** comparing Alternative 1 No Action and Alternative 3.

Exhibit 3.2-26 Estimated VMT for Alternative 3 (2044) Compared to Alternative 1 No Action (2042)

Geographic Area		PM Period VMT			PM Peak Hour VMT		
		2042 No Action	2044 Alt 3	Increase/ Decrease	2042 No Action	2044 Alt 3	Increase/ Decrease
BINMIC	Cars	52,420	54,700	2,280	19,130	19,970	840
	Trucks	2,760	2,920	160	1,010	1,070	60
	Buses	920	920	0	340	340	0
	Total	56,100	58,540	2,440	20,480	21,380	900
Greater Duwamish MIC	Cars	516,020	529,650	13,630	188,350	193,320	4,970
	Trucks	123,310	124,290	980	45,010	45,370	360
	Buses	4,110	4,110	0	1,500	1,500	0
	Total	643,440	658,050	14,610	234,860	240,190	5,330

PM Period = 3-6 PM
Net increase/decrease compares Alternative 1 with the Baseline year.
Sources: Fehr & Peers, Herrera, 2021.

Under Alternative 3, VMT in the Greater Duwamish MIC could increase by roughly 14,610 in the PM period compared to Alternative 1 No Action and by 2,440 in the PM peak hour compared to Alternative 1. Like Alternative 2, most of those increases are from passenger cars. In the BINMIC, VMT could increase by roughly 5,330 in the PM period compared to Alternative 1 No Action and by 900 in the PM peak hour compared to Alternative 1.

Road transportation-related air pollutant emissions under Alternative 3 compared to Alternative 1 No Action are shown in **Exhibit 3.2-27** for both the Greater Duwamish MIC and the BINMIC. Anticipated for Seattle overall are shown for comparison.

Exhibit 3.2-27 Estimated Tons of Criteria Pollutant Emissions from Road Transportation for Alternative 3 (2044) Compared to Alternative 1 No Action (2042)

Geographic Area	Pollutant	2042 No Action	2044 Alt 3	Increase/ Decrease
BINMIC	CO	58.2	60.7	2.5
	Nox	15.9	16.6	0.7
	PM10	3.7	3.9	0.2
	PM2.5	0.7	0.7	0.0
	VOC	3.2	3.3	0.1
	Sox	0.2	0.2	0.0
Greater Duwamish MIC	CO	794.5	809.6	15.1
	Nox	552.8	557.2	4.4
	PM10	57.2	58.2	1.0
	PM2.5	12.5	12.6	0.2
	VOC	47.2	48.0	0.8
	Sox	3.4	3.4	0.0
Seattle	CO	3,465.8~~3,459.5~~	3,504.7~~3,498.9~~	39.0~~39.4~~
	Nox	1,645.8~~1,643.6~~	1,657.1~~1,654.8~~	11.3~~11.3~~
	PM10	234.9~~234.5~~	237.4~~237.1~~	2.5~~2.5~~
	PM2.5	47.0~~46.9~~	47.4~~47.4~~	0.5~~0.5~~
	VOC	196.7~~196.3~~	198.8~~198.5~~	2.1~~2.2~~
	Sox	13.1~~13.1~~	13.3~~13.2~~	0.1~~0.1~~

Sources: Fehr & Peers, 2022~~1~~; Herrera, 2022~~1~~.

Area wide road transportation pollutant emissions under Alternative 3 would also be substantially lower than under existing conditions, but slightly higher than alternatives 1 and 2. As with the other alternatives, this is because the projected improvement in fleet mix, emission reduction, and technology implementation due to fuel economy standards could offset this increase in VMT. Generation of PM2.5 through tire and brake wear and from entrained road dust would also likely be slightly higher than alternatives 1 and 2 due to greater VMT and because these emissions would not benefit from future improvements to the vehicle fleet as a whole or from improvements to fuel economy. Air emissions from the MIC areas under Alternative 3 as a percentage of overall City road transportation emissions would remain ~~at or below~~similar to that anticipated for Alternative 1 No Action. Therefore, Alternative 3 would likely result in a less than significant impact to air quality.

Land Use Change-Related Emissions

Compared to Alternative 2, this alternative would increase the acreage within the MICs that would be redesignated for use in proposed Industry / Innovation and Urban Industrial zones in targeted geographies, including an estimated 1/2 mile from planned light rail stations. Some of the projected growth would likely be closer to existing and future sources of industrial, transportation, and non-transportation emissions and associated risks. Like the other alternatives, this growth includes new development for industrial and non-industrial employment. **Exhibit 3.2-7** on page 3-48 shows the square footage of industrial and non-industrial space in each MIC anticipated under Alternative 3 compared with Alternative 1 No Action, including the amount of anticipated growth.

As with the other alternatives, existing and new employees, depending on the types of businesses locating in the MICs, may encounter the emissions resulting from existing and new industrial and other non-transportation air emissions.

This alternative would also place the emphasis for growth in industrial and maritime uses within appropriate land use zones, as well as allowances for moderate growth in space devoted to non-industrial uses. Potentially a greater portion of projected growth in the MICs would be closer to and access major highway, rail line or port terminals, and contribute to the emissions from those sources. As with alternatives 1 and 2, in areas with current industrial land use designations that maintain an industrial focus under new land use designations, residents or workers in adjacent areas with a residential or mixed-use focus could experience higher emissions resulting from industrial and other non-transportation air emissions in areas of Queen Anne and Magnolia, Interbay, South Park, and Georgetown. However, as shown in **Exhibit 3.2-28**, with existing requirements for operating permits from PSCAA, these manufacturing plants, and other heavy and general industrial facilities are expected to remain compliant with air pollution control regulations that assure criteria air pollutant and TAP emissions meet standards, as they do currently.

Alternative 3 would result in a much greater growth in housing in the study area in 2044 compared to Alternative 2 and Alternative 1 No Action. **Exhibit 3.2-28** shows the number of housing units in each MIC for Alternative 3 compared to those anticipated under Alternative 1, No Action.

Exhibit 3.2-28 Estimated Number of Housing Units for Industrial Subareas Under Alternative 3 (2044) Compared to Alternative 1 No Action (2044)

	Alternative 1 No Action (2044)	Alternative 3 Future of Industry—Targeted (2044)		
Subarea	Total Units	Total Units	Growth	% Growth
Ballard	199	452	253	126.6%
Interbay Dravus	11	78	67	642.9%
Interbay Smith Cove	9	16	7	88.2%
SODO/Stadium	51	221	170	333.3%
Georgetown/South Park	218	256	38	17.2%
Total: Ind Zone Housing	488*	1,023	535	109.6%

*Rounded
Sources: City of Seattle, 2021.

In addition to increased industrial zone caretakers' quarters/makers' space of 535 units there would be an increase in residential development in land removed from the MIC that would be rezoned to Seattle Mixed. This would mean an increase in dwellings of 1,078 units in the Georgetown and South Park areas.

Impacts to existing and new residents within and adjacent to the MICs under Alternative 3 have the potential to be greater than the impacts under both Alternative 2 and Alternative 1 No Action. This is due mostly to the greater number of employees and residents within the MICs resulting from anticipated development. Where housing within the industrial zones is established, those residents would experience higher emissions resulting from industrial and other non-transportation air emissions. In SODO/Stadium, where over 30% of the housing growth is to occur is also adjacent to areas of high-capacity highways, major commute arterials, and a busy rail corridor. In Georgetown, where the triangular area bounded by Corson Avenue S, Carleton Avenue S and I-5 would be removed from the MIC and placed into a mixed-use zone and in the areas to be designated as Urban Industrial, existing or new residents would experience higher emissions resulting from nearby industrial, transportation, and other non-transportation air emissions, including the WSDOT Corson facility on Corson Avenue S.

However, as with alternatives 1 and 2, the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, technology improvements, and overall fuel mix, local emissions under Alternative 3 would be lower than under existing background conditions. While rail emissions were not calculated for this assessment as they are not affected by the proposed action, they do contribute to the overall cumulative air emissions in the MICs. Nonetheless, Alternative 3 would likely result in a less than significant impact to air quality. Similar mitigation strategies as have been mentioned for the other alternatives should be considered.

Maritime Activities

Maritime activities and their impact on the Puget Sound air shed, including the MICs, would continue similarly as they would under Alternative 1 No Action. With existing and planned regulatory requirements and local infrastructure improvements, these maritime emissions are expected to decrease under all alternatives, even if cargo volumes and cruise ship visits increase.

Greenhouse Gases & Climate Change

GHG emissions under development of Alternative 3 reflect greater increases in industrial and non-industrial building space, added industry-supportive housing, added mixed-uses, and corresponding increased VMT in each of the MICs. These developments would also be guided by changes to Comprehensive Plan policies and land use designations as outlined in the City's Industrial and Maritime Strategy and the resulting subarea plan policies to be developed. Operational GHG emissions from Alternative 3~~2~~ are presented in **Exhibit 3.2-29**.

Exhibit 3.2-29 Total Estimated Annual MTCO2e Emissions Under Alternative 3 Compared to Alternative 1 No Action

Source	No Action MTCO2e	Alt. 3 MTCO2e
Transportation	613,158	623,437
Ind. And Non-Ind. Building—Gas	58,864	72,528
Housing	1,364	5,872
Waste	-2,690~~4,709~~	-3,828~~6,022~~
Total	670,696~~68,677~~	698,010~~5,816~~
Difference from Existing	*-81,441~~565~~*	*-54,127~~425~~*
Difference from No Action	*0*	*27,314~~139~~*

Source: Herrera, 2022~~1~~.

Alternative 3 could decrease GHG emissions by approximately 54,000 MTCO2e per year compared to existing conditions but would represent an increase of over 27,000 MTCO2e compared to Alternative 1 No Action, which is above the 10,000 MTCO2e mandatory reporting threshold for the State of Washington. As with Alternative 2, this is due largely to the GHG emissions associated with natural gas use with new industrial and non-industrial space but also includes increases from the addition of approximately 1,600 housing units compared to Alternative 1.

Like Alternative 2, reducing transportation related emissions through increasing density of employment growth in the MICs rather than in other Seattle neighborhoods or regionally would be consistent for Alternative 3. It should be noted for Alternative 3 also that despite the moderate increase in transportation-related emissions associated with VMT, Alternative 3 would support higher density growth patterns, particularly near planned light rail stations consistent with regional planning, as well as the long-term planning goals of the City's

Comprehensive Plan and 2013 CAP, resulting in contributions to regional efforts to limit vehicular GHG emissions.

Overall, Alternative 3 could result in an increase in GHG emissions compared to Alternative 1—No Action that could be considered potentially significant and additional mitigation measures would be warranted.

Impacts of Alternative 4

Air Quality

Alternative 4 could also result in more robust growth in the study area in 2044 in overall employment, industrial and non-industrial development, and the most growth in housing compared to Alternative 1—No Action and the other alternatives.

Transportation Related Emissions

Alternative 4 could result in a slight growth in overall VMT in the study area in 2044 compared to Alternative 1—No Action and Alternative 2 and similar to Alternative 3; air quality impacts would also be similar. Estimated VMT for the Greater Duwamish MIC and the BINMIC are presented in **Exhibit 3.2-30** comparing Alternative 1—No Action and Alternative 4.

Exhibit 3.2-30 Estimated VMT For Alternative 4 (2044) Compared to Alternative 1 No Action (2042)

Geographic Area		PM Period VMT			PM Peak Hour VMT		
		2042 No Action	2044 Alt 4	Increase/ Decrease	2042 No Action	2044 Alt 4	Increase/ Decrease
BINMIC	Cars	52,420	55,110	2,690	19,130	20,120	990
	Trucks	2,760	2,950	190	1,010	1,080	70
	Buses	920	920	0	340	340	0
	Total	56,100	58,980	2,880	20,480	21,540	1,060
Greater Duwamish MIC	Cars	516,020	531,120 ~~529,500~~	15,100 ~~13,480~~	188,350	193,270	4,920
	Trucks	123,310	124,290	980	45,010	45,370	360
	Buses	4,110	4,110	0	1,500	1,500	0
	Total	643,440	659,520 ~~657,900~~	16,080 ~~14,460~~	234,860	240,140	5,280

PM Period = 3-6 PM

Net increase/decrease compares Alternative 1 with the Baseline year.

Sources: Fehr & Peers, 2022~~1~~; Herrera, 2022~~1~~.

Under Alternative 4, VMT in the Greater Duwamish MIC could increase by roughly ~~14,460~~16,080 in the PM period compared to Alternative 1 No Action and by ~~2,880~~5,280 in the PM peak hour compared to Alternative 1. Like the other alternatives, most of those increases are from passenger cars. In the BINMIC, VMT could increase by roughly ~~5,280~~2,880 in the PM period compared to Alternative 1 No Action and by 1,060 in the PM peak hour compared to Alternative 1.

Road transportation-related air pollutant emissions under Alternative 4 compared to Alternative 1 No Action are shown in **Exhibit 3.2-31** for both the Greater Duwamish MIC and the BINMIC. Anticipated for Seattle overall are shown for comparison.

Exhibit 3.2-31 Estimated Tons of Criteria Pollutant Emissions from Road Transportation for Alternative 4 (2044) Compared to Alternative 1 No Action (2042)

Geographic Area	Pollutant	2042 No Action	2044 Alt 4	Increase/ Decrease
BINMIC	CO	58.2	61.2	3.0
	Nox	15.9	16.7	0.9
	PM10	3.7	3.9	0.2
	PM2.5	0.7	0.7	0.0
	VOC	3.2	3.3	0.2
	Sox	0.2	0.2	0.0
Greater Duwamish MIC	CO	794.5	809.5	15.0
	Nox	552.8	557.2	4.4
	PM10	57.2	58.2	1.0
	PM2.5	12.5	12.6	0.2
	VOC	47.2	48.0	0.8
	Sox	3.4	3.4	0.0
Seattle	CO	3,465.8~~3,459.5~~	3,508.5~~3,499.0~~	42.7~~39.5~~
	Nox	1,645.8~~1,643.6~~	1,657.2~~1,654.8~~	11.4~~11.3~~
	PM10	234.9~~234.5~~	237.7~~237.1~~	2.7~~2.6~~
	PM2.5	47.0~~46.9~~	47.5~~47.4~~	0.5~~0.5~~
	VOC	196.7~~196.3~~	199.0~~198.5~~	2.3~~2.2~~
	Sox	13.1~~13.1~~	13.3~~13.2~~	0.1~~0.1~~

Sources: Fehr & Peers, 2022~~1~~; Herrera, 2022~~1~~.

Area wide road transportation pollutant emissions under Alternative 4 would also be substantially lower than under existing conditions, but slightly higher than the other alternatives. As with the other alternatives, this is because the projected improvement in fleet mix, emission reduction, and technology implementation due to fuel economy standards could offset this increase in VMT. Generation of PM2.5 through tire and brake wear and from entrained road dust would also likely be slightly higher than the other alternatives due to greater VMT and because these emissions would not benefit from future improvements to the vehicle fleet as a whole or from improvements to fuel economy. Air emissions from the MIC areas under Alternative 4 as a percentage of overall City road transportation emissions would remain at or below that anticipated for Alternative 1 No Action. Therefore, Alternative 4 would likely result in a less than significant impact to air quality.

Land Use Change-Related Emissions

Compared to Alternative 2, Alternative 4 would increase the acreage within the MICs that would be redesignated for use in proposed Industry / Innovation and Urban Industrial zones in targeted geographies, including an estimated 1/2 mile from planned light rail stations. Alternative 4 would designate slightly less than Alternative 3 in this regard. As with Alternative 3, some of the projected growth under Alternative 4 would likely be closer to existing and future sources of industrial, transportation, and non-transportation emissions and associated risks. Like the other alternatives, this growth under Alternative 4 includes new development for industrial and non-industrial employment. **Exhibit 3.2-7** on page 3-48 shows the square footage of industrial and non-industrial space in each MIC anticipated under Alternative 4 compared with Alternative 1 No Action, including the amount of anticipated growth.

As with the other alternatives, existing and new employees, depending on the types of businesses locating in the MICs, may encounter the emissions resulting from existing and new industrial and other non-transportation air emissions.

This alternative would also place the emphasis for growth in industrial and maritime uses within appropriate land use zones, as well as allowances for moderate growth in space devoted to non-industrial uses. Like Alternative 3, Alternative 4 projected growth in the MICs would be closer to and use access to major highway, rail line or port terminals, and contribute to the emissions from those sources. Like the other alternatives, in areas with current industrial land use designations that maintain an industrial focus under new land use designations, residents or workers in adjacent areas with a residential or mixed-use focus could experience higher emissions resulting from industrial and other non-transportation air emissions in areas of Queen Anne and Magnolia, Interbay, South Park, and Georgetown. However, as shown in **Exhibit 3.2-32**, with existing requirements for operating permits from PSCAA, these manufacturing plants, and other heavy and general industrial facilities are expected to remain compliant with air pollution control regulations that assure criteria air pollutant and TAP emissions meet standards, as they do currently.

Alternative 4 would result the greatest growth in housing in the study area in 2044 compared to the other alternatives and Alternative 1 No Action. **Exhibit 3.2-32** shows the number of housing units in each MIC for Alternative 4 compared to those anticipated under Alternative 1, No Action.

Exhibit 3.2-32 Estimated Number of Housing Units for Industrial Subareas Under Alternative 4 (2044) Compared to Alternative 1 No Action (2044)

	Alternative 1 No Action (2044)	Alternative 4 Future of Industry—Expanded (2044)		
Subarea	**Total Units**	**Total Units**	**Growth**	**% Growth**
Ballard	199	982	783	392.2%
Interbay Dravus	11	178	167	1595.2%
Interbay Smith Cove	9	1	-8	-88.2%
SODO/Stadium	51	1011	960	1882.4%
Georgetown/South Park	218	436	218	99.5%
Total: Ind Zone Housing	488*	2,608	2,120	434.4%

* Rounded
Sources: City of Seattle, 2021.

In addition to increased industrial zone caretakers' quarters/makers' studios of 2,120 units above Alternative 1 No Action there would be an increase in residential development in land removed from the MIC that would be rezoned to Seattle Mixed. This would mean an increase in dwellings of 1,078 units in the Georgetown and South Park areas.

Impacts to existing and new residents within and adjacent to the MICs under Alternative 4 ~~have the potential to~~would likely be greater than the impacts under ~~all~~ other alternatives and Alternative 1 No Action. This is due mostly to the high~~est number~~ combination of employees and residents within the MICs resulting from anticipated development. Where housing within the industrial zones is established, those residents would experience higher emissions resulting from industrial and other non-transportation air emissions. ~~In~~ The SODO/Stadium Subarea, where 45% of the housing growth is to occur, is also adjacent to areas of high-capacity highways, major commute arterials, and a busy rail corridor. As with Alternative 3, in Georgetown—where the triangular area bounded by Corson Avenue S, Carleton Avenue S, and I-5 would be removed from the MIC and placed into a mixed-use zone and in the areas to be designated as Urban Industrial—existing or new residents would experience higher emissions resulting from nearby industrial, transportation, and other non-transportation air emissions, including the WSDOT Corson facility on Corson Avenue S.

However, as with all other alternatives, the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, technology improvements, and overall fuel mix, local emissions under Alternative 4 would be lower than under existing background conditions. Similar cumulative air emissions from rail would occur in the MICs under all alternatives. Nonetheless, Alternative 3 would likely result in a less than significant impact to air quality. Similar mitigation strategies as have been mentioned for the other alternatives should be considered.

Maritime Activities

Maritime activities and their impact on the Puget Sound air shed, including the MICs, would continue similarly as they would under Alternative 1 No Action. With existing and planned regulatory requirements and local infrastructure improvements, these maritime emissions are expected to decrease under all alternatives, even if cargo volumes and cruise ship visits increase.

Greenhouse Gases & Climate Change

GHG emissions under development of Alternative 4 reflect the greatest increases in industry-supportive housing~~,~~ and office uses in places served by light rail within the MICs, ~~and~~ added mixed-uses slightly smaller than the Preferred Alternative, and~~, along with~~ increases in industrial and non-industrial building space slightly smaller than Alternative 3. VMT increases for Alternative 4 are anticipated at about the same as Alternative 3 for the Greater Duwamish MIC and slightly greater than Alternative 3 for the BINMIC. ~~Operational~~ Total estimated GHG emissions from Alternative 4~~2~~ are presented in **Exhibit 3.2-33**.

Exhibit 3.2-33 Total Estimated Annual MTCO2e Emissions Under Alternative 4~~3~~ Compared to Alternative 1 No Action

Source	No Action MTCO2e	Alt 4. MTCO2e
Transportation	613,158	624,379~~623,635~~
Ind. And Non-Ind. Building—Gas	58,864	72,610
Housing	1,364	10,302
Waste	-2,690~~4,709~~	-3,890~~6,091~~
Total	670,696~~68,677~~	703,401~~700,456~~
Difference from Existing	*-81,441~~565~~*	*-48,736~~49,785~~*
Difference from No Action	*0*	*32,705~~31,779~~*

Source: Herrera, 2022~~1~~.

Alternative 4 could decrease GHG emissions by approximately ~~50~~49,000 MTCO2e per year compared to existing conditions but would represent an increase of ~~almost~~ more than 32,000 MTCO2e compared to Alternative 1 No Action, which is above the 10,000 MTCO2e mandatory reporting threshold for the State of Washington. Compared to the other alternatives, Alternative 4 results in increases in all source categories except waste, most notably different from the other alternatives those associated with increased housing.

Like alternatives 2 and 3, reducing transportation related emissions through increasing density of employment growth in the MICs rather than in other Seattle neighborhoods or regionally would be consistent for Alternative 4, despite the moderate increase in transportation-related emissions in the MIC areas.

Overall, Alternative 4 could result in an increase in GHG emissions compared to Alternative 1—No Action that could be considered potentially significant and additional mitigation measures would be warranted.

Impacts of the Preferred Alternative

Air Quality

The Preferred Alternative could also result in growth in the study area in 2044 in overall employment, industrial and non-industrial development, and growth in housing compared to Alternative 1—No Action and alternatives 2 and 3, but less than Alternative 4.

Transportation Related Emissions

The Preferred Alternative could result in a slight growth in overall VMT in the study area in 2044 compared to Alternative 1—No Action and similar to Alternative 2; air quality impacts would also be similar. Estimated VMT for the Greater Duwamish MIC and the BINMIC are presented in **Exhibit 3.2-34** comparing Alternative 1—No Action and the Preferred Alternative.

Exhibit 3.2-34 Estimated VMT For the Preferred Alternative (2044) Compared to Alternative 1 No Action (2042)

		PM Period VMT			PM Peak Hour VMT		
Geographic Area		**2042 No Action**	**2044 Pref. Alt.**	**Increase/ Decrease**	**2042 No Action**	**2044 Pref. Alt.**	**Increase/ Decrease**
BINMIC	Cars	52,420	53,800	1,380	19,130	19,640	510
	Trucks	2,760	2,880	120	1,010	1,050	40
	Buses	920	920	0	340	340	0
	Total	56,100	57,600	1,500	20,480	21,030	550
Greater Duwamish MIC	Cars	516,020	522,640	6,620	188,350	190,760	2,410
	Trucks	123,310	123,200	-110	45,010	44,970	-40
	Buses	4,110	4,110	0	1,500	1,500	0
	Total	643,440	649,950	6,510	234,860	237,230	2,370

PM Period = 3-6 PM
Net increase/decrease compares Alternative 1 with the Baseline year.
Sources: Fehr & Peers, 2022; Herrera, 2022.

Under the Preferred Alternative, VMT in the Greater Duwamish MIC could increase by roughly 6,510 in the PM period compared to Alternative 1 No Action and by 2,370 in the PM peak hour compared to Alternative 1. Like the other alternatives, most of those increases are from passenger cars. In the BINMIC, VMT could increase by roughly 1,500 in the PM period compared to Alternative 1 No Action and by 550 in the PM peak hour compared to Alternative 1.

Road transportation-related air pollutant emissions under the Preferred Alternative compared to Alternative 1 No Action are shown in **Exhibit 3.2-35** for both the Greater Duwamish MIC and the BINMIC. Emissions anticipated for Seattle overall are shown for comparison.

Exhibit 3.2-35 Estimated Tons of Criteria Pollutant Emissions from Road Transportation for the Preferred Alternative (2044) Compared to Alternative 1 No Action (2042)

Geographic Area	Pollutant	2042 No Action	2044 Pref Alt	Increase/ Decrease
BINMIC	CO	58.2	59.8	1.6
	Nox	15.9	16.4	0.5
	PM10	3.7	3.8	0.1
	PM2.5	0.7	0.7	0.0
	VOC	3.2	3.2	0.1
	Sox	0.2	0.2	0.0
Greater Duwamish MIC	CO	794.5	800.4	5.9
	Nox	552.8	552.4	-0.4
	PM10	57.2	57.6	0.3
	PM2.5	12.5	12.5	0.1
	VOC	47.2	47.5	0.3
	Sox	3.4	3.4	0.0
Seattle	CO	3,465.8	3,484.8	19.1
	Nox	1,645.8	1,651.4	5.5
	PM10	234.9	236.2	1.2
	PM2.5	47.0	47.2	0.2
	VOC	196.7	197.7	1.0
	Sox	13.1	13.2	0.1

Sources: Fehr & Peers, 2022; Herrera, 2022.

Area wide road transportation pollutant emissions under the Preferred Alternative would also be substantially lower than under existing conditions, and nearly the same as with Alternative 2. Transportation related emission impacts would be similar to Alternative 2, and as a percentage of overall City road transportation emissions would remain at or below that anticipated for Alternative 1 No Action. Therefore, the Preferred Alternative would likely result in a less than significant impact to air quality.

Land Use Change-Related Emissions

Compared to Alternative 4, the Preferred Alternative would decrease the acreage within the MICs that would be redesignated for use in proposed Industry/Innovation and MML and increase the acreage for use in Urban Industrial zones in targeted geographies, including an estimated 1/2 mile from planned light rail stations. The Preferred Alternative would also designate additional acreage to mixed uses compared to all other alternatives, with the same increase as Alternative 4 in Georgetown and South Park, and new acreages in West Ballard and Judkins Park; overall, a higher total amount of housing production outside of MICs would result compared to Draft EIS alternatives—an additional 1,534 dwellings, 42% more than alternatives 3 and 4. Like the other alternatives, this growth under the Preferred Alternative includes new development for industrial and non-industrial employment. **Exhibit 3.2-7** on page 3-48 shows the square footage of industrial and non-industrial space in each MIC anticipated under the Preferred Alternative compared with Alternative 1 No Action.

As with the other alternatives, existing and new employees, depending on the types of businesses locating in the MICs, may encounter the emissions resulting from existing and new industrial and other non-transportation air emissions.

This alternative would also place the emphasis for growth in industrial and maritime uses within appropriate land use zones, as well as a more focused distribution of space devoted to non-industrial uses similar to Alternative 4 inside the MICs with elements of Alternative 1 outside the MICs. Like Alternative 4, projected growth in the MICs would be closer to and use access to major highway, rail line, or port terminals, and would contribute to the emissions from those sources. Like the other alternatives, in areas with current industrial land use designations that maintain an industrial focus under new land use designations, residents or workers in adjacent areas with a residential or mixed-use focus could experience higher emissions resulting from industrial and other non-transportation air emissions in areas of Queen Anne and Magnolia, Interbay, South Park, and Georgetown. However, as shown in **Exhibit 3.2-35**, with existing requirements for operating permits from PSCAA, these manufacturing plants and other heavy and general industrial facilities are expected to remain compliant with air pollution control regulations that assure criteria air pollutant and TAP emissions meet standards.

The Preferred Alternative would result in more housing growth in the study area in 2044 compared to Alternative 1 No Action and alternatives 2 and 3, but less than Alternative 4. **Exhibit 3.2-36** shows the number of housing units in each MIC for the Preferred Alternative compared to those anticipated under Alternative 1 No Action.

Exhibit 3.2-36 Estimated Number of Housing Units for Industrial Subareas Under the Preferred Alternative (2044) Compared to Alternative 1 No Action (2044)

	Alternative 1 No Action (2044)	Preferred Alternative Balanced (2044)		
Subarea	**Total Units**	**Total Units**	**Growth**	**% Growth**
Ballard	199	706	507	254%
Interbay Dravus	11	117	107	1014%
Interbay Smith Cove	9	1	-8	-88%
SODO/Stadium	51	665	614	1204%
Georgetown/South Park	218	400	182	83%
Total: Ind Zone Housing	488*	1,888	1,400*	287%

*Rounded
Sources: City of Seattle, 2022.

In addition to increased industrial zone caretakers' quarters/makers' studios of 1,400 units above Alternative 1 No Action, there would be an increase in residential development in land removed from and outside the MIC that would be rezoned to Seattle Mixed. This would mean an increase in dwellings of 1,534 units in the Georgetown, South Park, west Ballard, and Judkins Park areas.

Impacts to existing and new residents within and adjacent to the MICs under the Preferred Alternative have the potential to be greater than the impacts under alternatives 2 and 3 and Alternative 1 No Action, but less than under Alternative 4. This is due mostly to the number of residents within and adjacent to the MICs resulting from anticipated development. Where housing within the industrial zones is established, those residents would experience higher emissions resulting from industrial and other non-transportation air emissions. The areas where the housing growth is to occur may also be adjacent to areas of high-capacity highways, major commute arterials, and a busy rail corridor.

In Georgetown, where the triangular area bounded by Corson Avenue S, Carleton Avenue S, and I-5 and a smaller node north of the triangle would be removed from the MIC and placed into a mixed-use zone and in the areas to be designated as Urban Industrial, existing or new residents would experience higher emissions resulting from nearby industrial, transportation, and other non-transportation air emissions, including the WSDOT Corson facility on Corson Avenue S.

However, as with all other alternatives, the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, technology improvements, and overall fuel mix, local emissions under the Preferred Alternative would be lower than under existing background conditions. Similar cumulative air emissions from rail would occur in the MICs under all alternatives. Nonetheless, the Preferred Alternative would likely result in a less than significant impact to air quality. Similar mitigation strategies as have been mentioned for the other alternatives should be considered.

Maritime Activities

Maritime activities and their impact on the Puget Sound air shed, including the MICs, would continue similarly as they would under Alternative 1 No Action. With existing and planned regulatory requirements and local infrastructure improvements, these maritime emissions are expected to decrease under all alternatives, even if cargo volumes and cruise ship visits increase.

Greenhouse Gases & Climate Change

Compared to Alternative 1 No Action, GHG emissions under the Preferred Alternative reflect the increases in industry-supportive housing within the MICs between alternatives 3 and 4; increased office and non-industrial uses within the MICs between alternatives 2 and 3; added mixed-uses within and adjacent to the MICs larger than all alternatives; and increases in industrial building space between Alternative 1 and Alternative 2. VMT increases for the Preferred Alternative are anticipated slightly higher than Alternative 2 for both the Greater Duwamish MIC and the BINMIC. Total estimated GHG emissions from the Preferred Alternative are presented in **Exhibit 3.2-37**.

Exhibit 3.2-37 Total Estimated Annual MTCO2e Emissions Under the Preferred Alternative Compared to Alternative 1 No Action

Source	No Action MTCO2e	Pref. Alt. MTCO2e
Transportation	613,158	616,896
Ind. And Non-Ind. Building—Gas	58,864	62,777
Housing	1,364	9,564
Waste	-2,690	-3,086
Total	670,696	686,151
Difference from Existing	*-81,441*	-65,986
Difference from No Action	*0*	15,455

Source: Herrera, 2022.

The Preferred Alternative could decrease GHG emissions by approximately 66,000 MTCO2e per year compared to existing conditions but would represent an increase of more than 15,000 MTCO2e compared to Alternative 1 No Action, which is above the 10,000 MTCO2e mandatory reporting threshold for the State of Washington. Compared to the other alternatives, the Preferred Alternative results in increases in all source categories except waste.

Like the other Action Alternatives, reducing transportation related emissions through increasing density of employment growth in the MICs and in mixed use zones within the MICs and new mixed use zones rather than in other Seattle neighborhoods or regionally would be consistent for the Preferred Alternative, despite the moderate increase in transportation-related emissions in the MIC areas.

Overall, the Preferred Alternative could result in an increase in GHG emissions compared to Alternative 1—No Action that could be considered potentially significant and additional mitigation measures would be warranted.

3.2.3 Mitigation Measures

It is notable that it is anticipated that the amount of development and activity projected under the alternatives, if confined within the ~~MICs~~study area, would result in less GHG emissions than if that same development and activity were spread out to other parts of the city or region. While Alternative 1 No Action would result in lower GHG emissions within the MICs, it is likely that the population and employment growth anticipated to occur under the alternatives would occur elsewhere and those GHG emissions are not quantified but are expected to be greater than if focused in the MICs as proposed by the industrial and maritime strategy alternatives. The alternatives under the Industrial and Maritime Strategy serve to structure residences, employment, and activities in relatively efficient ways so that the GHG emission associated with their activities are less than what they would be if those people and jobs were more dispersed, and their activities conducted less efficiently.

Nonetheless, GHG emissions from future projects need to be mitigated so that future projects do not result in a significant environmental impact. A list of potential mitigation measures is given below; some measures would need to be integrated into Subarea Plan policies or codes as requirements and incentives to apply to future development.

Incorporated Plan Features

Air Quality

All Action Alternatives would change land use designations and development regulations applicable to the study area to target enhancement of industrial and maritime uses, and to allow a wider latitude of commercial/industrial development and industry supportive housing, while protecting adjacent residential areas. Increasing density in some areas of the MICs around light rail stations and with access to multiple mobility options could lead to more use of public transportation, biking, and walking, and less use of cars. These policies and actions recognize the value of planning for the type and density of future industries and employment as a way to reduce the need for future residents and workers to travel by automobile, thereby reducing transportation-related emissions in the region.

Greenhouse Gases & Climate Change

All alternatives—in particular alternatives 3 and 4—contribute to increased GHG emissions through future growth and development in the study area. All Action Alternatives result in GHG emissions above the 10,000 MTCO2e mandatory reporting threshold compared to Alternative 1 No Action.

All Action Alternatives would change land use designations and development regulations applicable to the study area to target enhancement of industrial and maritime uses, and to allow a wider latitude of commercial/industrial development and industry supportive housing, while protecting adjacent residential areas. These policies and actions recognize the value of planning for the type and density of future industries and employment as a way to optimize the coordination of complementary industries, and to reduce the transportation demand of businesses activities. The policies also allow increasing density in some areas of the MICs around light rail stations and with access to multiple mobility options, which could lead to more use of public transportation, biking, and walking, and less use of cars; and to reduce the need for future residents and workers to travel by automobile, thereby reducing transportation-related emissions in the region.

The Industrial and Maritime Strategy includes policy concepts particularly relevant to Air Quality/GHG:

- Introduce new or strengthened policies into chapters of the Comprehensive Plan that may include the Transportation, Environment, or Container Port elements encouraging transitions to clean fuels and decarbonization of industrial and maritime activities.

Regulations & Commitments

Air Quality

Several federal, state, and regional regulations or efforts apply to construction and allowed land uses (see also **Section 3.2.1 Affected Environment**):

- NAAQS: As described above, the EPA established NAAQS and specifies future dates for states to develop and implement plans to achieve these standards.
- Washington State: Ecology established state ambient air quality standards for the same six pollutants (CO, VOCs, NO2, PM, SO2, and ozone) that are at least as stringent as the national standards.
- PSCAA Regulations: All construction sites in the Puget Sound region are required to implement emission controls to minimize fugitive dust and odors during construction, as required by PSCAA Regulation 1, Section 9.15, Fugitive Dust Control Measures.

  PSCAA manages permitting of stationary air pollutant sources and all industrial and commercial air pollutant sources in the Puget Sound region are required to register with the PSCAA.

Greenhouse Gases & Climate Change

- Washington State Energy Code: Development in the study area would be subject to the requirements of the Washington State Energy Code, which regulates the energy-use features of new and remodeled buildings.
- The City's 2013 CAP and the 2018 Climate Action Strategy includes strategies and actions to limit atmospheric warming to 1.5 degrees Celsius. The strategies and actions focus on road

transportation and building energy, which comprise the majority of local emissions, and which drive the GHG emissions in the study area.

- All buildings with 50,000 square feet or more of nonresidential space (excluding parking) must comply with the Building Tune-Ups requirement every five years (SMC 22.930). Building Tune-Ups involve assessment and implementation of operational and maintenance improvements to achieve energy (and water) efficiency, which helps to reduce GHG emissions.
- The Port of Seattle, independent of the Industrial and Maritime Strategy, is increasing shore power available at terminals to reduce maritime emissions (Starcrest 2018). Upcoming projects within the SODO/Stadium Subarea include planned shore power improvements in Terminal ~~15~~5, Terminal 18, and possibly the electrification of Terminal 30 and the Coast Guard Station.

Other Potential Mitigation Measures

Air Quality

Mitigation strategies are not required due to a lack of significant adverse impacts, however potential for exposure of existing and new employees, residents, and visitors to potential air emissions in areas around arterials, along industrial buffers, and near port operations should be considered in future planning~~:~~.

The Seattle Comprehensive Plan and MIC Subarea Plans could:

- Include policy guidance that recommends that residences and other sensitive land uses (i.e., schools, day care) be separated from freeways, railways, and port facilities, and new MML, II, and UI zones by a buffer area of no less than 500 feet, and possibly as much as 1,000 feet, depending on the height of the source, to reduce the potential exposure of sensitive populations to air toxics. (US Department of Transportation 2015)
- Include policy guidance that recommends and funds support for~~s~~ the electrification of industrial and maritime activities that currently rely on fossil fuels, including the transportation related assets that are an integral part of those land uses.
- Incorporate new development standards that include requirements that recommend that residences and other sensitive land uses (i.e., schools, day care) include enhanced air filtering and circulation to address pollutant transportation generated particulates. Specifically, U.S. EPA identifies that mechanical ventilation/filtration systems with a Minimum Efficiency Reporting Value (MERV) of 9 through 12 are adequate for removing 25 to 80% of automobile emission particles (U.S. EPA 2009a).
- Consider locations for schools, daycares, and residential uses that increases buffers from high-volume roadways or other measures to reduce exposure to criteria pollutant emissions.
- Assure design standards for parks in proximity to high-volume roadways and industrial areas incorporate landscaping with full bottom to top of canopy coverage, higher canopy

heights, and multiple rows of vegetation types, including denser tree canopies, that help reduce exposure to criteria pollutant emissions.

- Add a denser tree canopy near high-volume roadways and industrial areas.
- Incorporate standards for more frequent street sweeping to reduce roadway dust and prevent emissions of PM2.5 in fugitive dust associated with increased vehicle miles traveled.
- Consider inclusion of a City-owned and operated air monitoring station in Ballard-Interbay and the Duwamish Valley to provide the public with access to daily air monitoring data.
- Where the City has authority to do so, consider designating truck routes serving industrial and manufacturing areas away from residential areas, particularly those residential areas with vulnerable populations.

Greenhouse Gases & Climate Change

- Subarea Plan Policies: As part of Subarea Plan development, the City could establish policies that:
    - ~~i~~Incentivize use of electrical infrastructure to serve industrial process needs, industrial, commercial, and residential space heating needs, rather than natural gas.
    - Strengthen climate resiliency requirements and City support for business engagement and continuity planning for developments throughout the MICs.
    - Expand City-sponsored development and training pathways for workers in resilient industries who locate in the MICs.
    - Incentivize industries focused on clean technologies or processes to locate within the MICs.
- Green Building Standards: To lower the GHG contribution from industrial and commercial uses, policies that encourage or mandate new construction projects in the study area to:
    - Achieve one of the following green building standards: LEED In Motion: Industrial Facilities, Built Green, the Living Building Challenge, or the Evergreen Sustainable Development Criteria.
    - Use low-embodied carbon construction material types, such as low-carbon concrete mixes.
    - Limit carbon-intensive materials or incentivize use of lower carbon alternatives such as a wood structure instead of steel and concrete, or agricultural products that sequester carbon.
    - Salvage materials like brick, metals, broken concrete, or wood.
    - Use high-recycled content materials.
    - Prioritize adaptive reuse for existing buildings to avoid additional embodied carbon emissions.
    - Include embodied carbon goals in building codes (AIA, 2021).
- Building Demolition Waste Reduction: The City could consider programs to require or encourage building deconstruction rather than bulk demolition for older industrial buildings demolished in the study area.

- Puget Sound Energy (PSE): Seattle is served by PSE for natural gas service. PSE has established a target to reach net zero carbon emissions for natural gas used in customer homes and businesses by 2045, with an interim target of a 30% emissions reduction by 2030. The City could promote or incentivize PSE and/or study area employers to integrate greater volumes of renewable natural gas into their systems or processes. Coordination with King County Wastewater Treatment Division and with SPU' Solid Waste Division could enhance efforts.
- Electric Vehicles: The City could adopt regulations for the study area that support the placement of infrastructure for charging of electric vehicles (including commercial and industrial vehicles) in applicable new developments. Seattle Public Utilities is exploring the creation of a city-owned electrical vehicle charging facility in the Duwamish MIC intended for drayage trucks. ~~The City and Port of Seattle could expand on the effort to establish multiple such facilities in strategic locations in proximity to Port terminals that require drayage.~~
- Trees: The City could adopt regulations/incentives for the study area that preserve and/or replace on-site trees and encourage planting of more trees. Trees and shrubs can provide shade and lower temperatures in urban areas and can assist with GHG reductions.
- Expand electrification of marine terminals: The City, Port of Seattle and private partners could accelerate the extension of shore power to terminals and docks throughout the Seattle waterfront, including at Coleman Dock and Terminals 5, 18, 30, 46, and 66, and where appropriate for US Coast Guard vessels, and other research vessel berths. Consider commitment of public funding for the infrastructure investment. Consider regulations requiring vessels to connect to shore power if it is present.
- Where the City of Seattle has authority, consider imposing restrictions on maritime air emissions for ocean-going vessels while underway.
- Consider commitment of public funding for the necessary infrastructure to expand availability of shore power, and electrify cargo and passenger handling equipment to include those areas and ships not covered by the Port of Seattle's existing plans.
- The City and partner agencies could improve coordination and improve the user experience for community members registering complaints or requesting information about enforcement related to emissions from sites or businesses.

3.2.4 Significant Unavoidable Adverse Impacts

Because of the combination of existing requirements for industrial operating permits from PSCAA, and ongoing requirements for improvements in vehicle emissions control, fuel economy, and technology improvements, and overall changes in fleet and fuel mix toward electrification and cleaner fuels, respectively, no significant unavoidable adverse impacts to air quality are anticipated.

Potentially significant impacts to GHG emissions could be expected for all alternatives as they could have the potential for increased GHG emissions above the 10,000 MTCO2e mandatory reporting threshold. However, through mitigation implementation, local and state climate actions, and expected continued regulatory changes, the alternatives may result in a decrease of the growth in GHG emissions such that the impacts from future development allowed by the changes in plans and zoning could be considered less than significant for SEPA. As proposed, the alternatives would not prevent or deter efforts to reduce emissions in comparison to local or regional goals or targets for GHG reductions.

While each alternative would create a net increase in GHG emissions generated from growth and development in the study area, the region-wide benefit of capturing development that might otherwise occur in peripheral areas of the city or region could serve to offset these impacts.