8. Air Quality and Greenhouse Gas Emissions

This chapter describes **air quality** and **greenhouse gas (GHG)** emissions at Logan Airport for 2023 and 2024, comparing them with emission levels in 2022 and with historical air quality benchmark years. These comparisons provide a contextual framework for assessing trends over time. These findings also demonstrate Massport's continued progress in improving air quality in and around Logan Airport by reducing emissions from those sources under Massport's control and encouraging owners of other emissions sources not controlled by Massport to take action to reduce emissions.

Specifically, this 2023/2024 **Environmental Data Report (EDR)** documents Massport's continued efforts in implementing and promoting energy efficiency, emissions reduction, and clean energy initiatives. Many of these initiatives are part of a strategic plan aimed at achieving net zero GHG emissions by 2031, specifically for sources under Massport's direct control. This strategic plan coincides with the organization's 75th anniversary and is outlined in Massport's *Roadmap to Net Zero by 2031*.

The most significant indicators of changes in emissions are directly linked to fluctuations in airport activity levels, primarily the number of passengers utilizing Logan Airport and the volume of **aircraft operations**. In 2023 and 2024, both key metrics increased relative to prior years. These trends in increasing passenger traffic and aircraft movements are directly correlated with the observed changes in emissions levels.

With increased airport activity levels, overall emissions associated with Logan Airport have risen for most pollutants analyzed, as detailed in the following sections. However, Massport's proactive initiatives, such as **sustainability** programs, operational efficiencies, and infrastructure improvements, have helped mitigate the potential environmental impacts of these increases. It is also important to note that the regulatory models applied in the *2023/2024 EDR* are subject to on-going revisions, reflecting the latest research findings and technological advancements. These updates ensure that emissions estimates remain

Scope 1 emission sources are owned or controlled by Massport, including:

- Gound support vehicles
- Massport shuttles
- Stationary sources, like boilers

Scope 2 emissions are from using electricity generated off-Airport at power plants.

Scope 3 emissions come from aircraft, ground service equipment (GSE) and auxiliary power units (APUs), and vehicles traveling to and from the Airport.

accurate and aligned with current scientific understanding. These model changes are further discussed in Section 8.2.2.

Massport's annual emissions inventory estimates air emissions from a wide variety of airport-related sources, which are then compared to levels computed in previous years. The inventoried emissions include the **U.S. Environmental Protection Agency (U.S. EPA) criteria air pollutants** and their precursors, as well as GHGs. Data used to develop this chapter's content is provided in Appendix J, *Air Quality and Greenhouse Gas Emissions Supporting Documentation*, and analyses, assumptions, and modeling methodologies are more thoroughly described in the **User's Guide, Section U8**.

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Massport remains committed to implementing its longstanding emissions reduction strategies as described in previous EDR and Environmental Status and Planning Report (ESPRs) publications, the **User's Guide, Section U8.5**, this chapter, and Chapter 10, *Project Mitigation*.

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2023 Air Quality and GHG Key Findings

The following details key findings for air quality and GHG emissions at the Airport in 2023:

- In 2023, total modeled airport-related emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_X) increased from 2022 levels, while particulate matter (PM_{10}/$PM_{2.5}$) decreased. Carbon monoxide (CO) emissions from aircraft and GSE sources increased in 2023, while motor vehicle sources and total other sources decreased.

Brake dust from brake pads on vehicles and aircraft, as well as particulates in engine exhaust, are primary sources for PM_{10}/$PM_{2.5}$ emissions.

However, motor vehicle technology advancements have been made over the last 10+ years to reduce brake pad wear and produce cleaner emissions.

  - Air travel demand continued to increase throughout 2023, which meant more passenger vehicles traveling to the Airport and more flights taking off and landing throughout the year, and as a result, emissions increased. Although Massport implemented ground access initiatives to reduce emissions, reducing emissions associated with increased demand for air travel is beyond Massport's direct control.
  - The latest MOtor Vehicle Emission Simulator (MOVES) (version 5) model includes updated data on motor vehicle technology advancements that more accurately capture current conditions, so model results showed a significant decrease in PM_{10}/$PM_{2.5}$ emissions as vehicles have become cleaner in recent

years. Prior model versions likely overestimated Airport vehicle emissions by assuming older, less efficient technologies or vehicles were still in use.

- GHG emissions results for 2023 were generally unaffected by model version changes, but increased from 2022. These were primarily Scopes 2 and 3 emissions not under Massport's direct control resulting from increased aircraft operations, or more flights; more passengers traveling to and from the airport; and more electricity used after the Terminal E modernization and expansion project completed in August 2023.

2023 vs 2022: passenger activity levels increased by 13% and aircraft operations increased by 4%.

2024 vs 2023: passenger activity levels increased by 7% and aircraft operations increased by 5%.

- Logan Airport's total GHG emissions in 2023 were 1 percent of the most recent statewide total emissions estimates and 12 percent of Boston's citywide emissions.[1,2]

2024 Air Quality and GHG Key Findings

The following details key findings for air quality and GHG emissions at the Airport in 2024:

- Total modeled airport-related emissions of VOCs, NO_X, CO, and PM_{10}/$PM_{2.5}$ increased on average from 2023 to 2024 when the most recent model versions of **Aviation Environmental Design Tool (AEDT)** (version 3g) and MOVES5 were used.
  - Although this continuing trend was also primarily due to more passengers seeking air transportation and the increasing number of flights associated with that demand, the airlines serving Logan Airport also made changes to their aircraft fleets, which are the airplane and engine models put into service by the airlines, between 2023 and 2024.
- Similarly, Logan Airport's 2024 total GHG emissions increased from 2023 to 2024, but Logan Airport's total GHG emissions in 2024 were 1 percent of the most recent statewide total emissions estimates and 13 percent of Boston's citywide emissions.[3 4]

1 Based on 2022 data sources. Percentage based on relative amount of total emissions to 2022 (latest available) statewide total from MassDEP, 2nd Addendum to the Statewide Greenhouse Gas Emissions Level: 1990 Baseline Update, June 2022, available at https://www.mass.gov/doc/2nd-addendum-to-statewide-ghg-level-proposed-1990-baseline-update-june-2022/download.

2 Based on 2022 emissions. City of Boston, Boston Community GHG Emissions, updated July 09, 2025, https://www.boston.gov/departments/environment/bostons-carbon-emissions; and City of Boston, Boston Community GHG Emissions, updated March 21, 2022, https://www.boston.gov/departments/environment/bostons-carbon-emissions.

3 Based on 2022 data sources. Percentage based on relative amount of total emissions to 2022 (latest available) statewide total from MassDEP, 2nd Addendum to the Statewide Greenhouse Gas Emissions Level: 1990 Baseline Update, June 2022, available at https://www.mass.gov/doc/2nd-addendum-to-statewide-ghg-level-proposed-1990-baseline-update-june-2022/download.

4 Based on 2022 emissions. City of Boston, Boston Community GHG Emissions, updated July 09, 2025, https://www.boston.gov/departments/environment/bostons-carbon-emissions; and City of Boston, Boston Community GHG Emissions, updated March 21, 2022, https://www.boston.gov/departments/environment/bostons-carbon-emissions.

Air Quality Management and Key Initiatives Progress Summary

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Massport is a national leader in studying, tracking, and reporting on Logan Airport's air quality environment, as well as promoting and implementing measures to reduce emissions. Massport's air quality management strategy and key initiatives to reduce air pollutants and GHG emissions from Airport operations are thoroughly discussed within Chapter 11, *Sustainability and Climate Resilience*, and within the **User's Guide, Section U8.5**, but initiatives that made substantive progress in 2023 and 2024 include:

- Continued efforts to secure **Sustainable Aviation Fuel (SAF)** supplies in the Northeast and supported the **Zero Impact Aviation Alliance (ZIAA)** to promote net zero operations and SAF adoption.
- Initiated a fleet decarbonization assessment to identify **electric vehicle (EV)** replacements for its on-road fleet and explore electric alternatives for off-road equipment and continued expanding EV charging infrastructure.
- Collaborated with **Massachusetts Clean Energy Center (MassCEC)** to enable conversion of ride-for-hire fleets to EVs, supported by a 2022 grant.
- Promoted **high-occupancy vehicle (HOV)** services and achieved or exceeded HOV ridership goals for 2022, 2023, and 2024.
- Provided extensive commuting options for Airport employees, including 24/7 free shuttle services, extended **Logan Express** services, subsidies for alternative transit, and bike infrastructure at facilities.
- Implemented Clean Air Construction Initiative (CACI) requirements for diesel particulate filters or oxidation catalysts on heavy equipment for large construction projects.
- Operated fuel storage and distribution systems to reduce vapor loss and minimize emissions from mobile fueling trucks.
- Employed Reasonable Available Control Technologies (RACT) for NO_X at the Central Heating Plant (CHP) while studying options to transition away from fossil fuels.
- Piloted renewable diesel use in snow melters to reduce GHGs, PM, NO_X, CO, total hydrocarbons (THC), polycyclic aromatic hydrocarbons (PAHs), and VOCs.
- Pursued green building certifications, including **Leadership in Energy and Environmental Design®**, **Envision™**, and **ParkSmart™**, for new and existing projects.
- Worked with the **Federal Aviation Administration (FAA)** and MIT to promote single-engine taxiing and operational improvements to reduce aircraft emissions and airfield congestion, and managed aircraft run-up locations away from adjacent communities.
- Increased the portion of energy generated from renewable sources and implemented energy efficiency upgrades, including LEED® projects and heating, ventilation, and air conditioning (HVAC) improvements.

8.1 Regulatory Framework

Federal and state requirements govern air quality and GHG emissions associated with Logan Airport activities. Massport voluntarily reports on GHG emissions in the ESPRs and EDRs. For more information on Logan Airport's regulatory framework, see **User's Guide, Section U8.2**. Additional information on statewide, national, and international initiatives and regulations to improve air quality is provided in the **User's Guide, Section U8.2.4**.

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- The federal Clean Air Act (CAA), **National Ambient Air Quality Standards (NAAQS)** administered by the U.S. EPA, and similar state laws administered by the **Massachusetts Department of Environmental Protection (MassDEP)** govern air quality issues in Massachusetts.
- The NAAQS and the *Massachusetts State Implementation Plans*, collectively referred to as *MassSIP*, describe measures to attain and maintain compliance with the NAAQS, regulate air quality in the Boston Metropolitan Area and other areas of the State.
- In May 2010, the **Massachusetts Environmental Policy Act Office (MEPA) Executive Office of Energy and Environmental Affairs (EEA)** revised the MEPA Greenhouse Gas Emissions Policy and Protocol.[5] Under the revised policy, specific projects are subject to review under MEPA (though not annual EDR and ESPR filings). As part of **MEPA review**, projects are required to quantify GHG emissions generated by a proposed project and identify measures to avoid, minimize, or mitigate such emissions.
- In 2021, the Massachusetts EEA released a revised MEPA GHG Emissions Policy and Protocol to align with the "*Next-Generation Roadmap for Massachusetts Climate Policy*."

8.2 Assessment Methodology

The following sections provide a brief overview of the emission sources and pollutants inventoried, as well as the modeling tools used to estimate emissions for reporting years 2023 and 2024 as well as to compare those estimates to emissions results from the prior reporting year (2022) and benchmark years. The benchmark year was 1990 with the exception of particulate matter, which is 2005 as that was the first year it was tracked. A thorough discussion of modeling tools, assumptions, and methodologies is provided in the **User's Guide, Section U8.3**.

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8.2.1 Sources and Pollutants

As with prior EDRs and ESPRs, for the *2023/2024 EDR*, the Logan Airport-related sources inventoried are aircraft engines, **ground support equipment (GSE)**, including auxiliary power units (APUs), motor

5 EEA. Revised MEPA Greenhouse Gas Emissions Policy and Protocol. Effective May 5, 2010, https://www.mass.gov/doc/greehouse-gas-emissions-policy-and-protocol/download.

Operational time-in-mode (TIM) refers to the amount of time a vehicle operates under certain conditions.

Some examples of vehicle modes are:

- Starting the vehicle;
- Acceleration or deceleration; and
- Idling.

vehicles, and an "other" category that includes a variety of stationary sources, fuel storage, and handling facilities that are owned and operated by Massport.

Aircraft-related sources are modeled based on the actual number of aircraft operations for each aircraft and engine type, fleet mix, and operational times-in-mode (TIM) at Logan Airport. Aircraft emissions are computed from ground level up to the mixing height of 3,000 feet. GSE and APU emissions are based on the latest Logan Airport-specific TIM survey, fuel type, and fleet mix from Massport's Vehicle Aerodrome Permit Application Program for Logan Airport and AEDT's aircraft-specific default data. Motor vehicles and other sources are modeled based on activity levels or material throughput rates (fuel usage, **vehicle-mile-traveled [VMT]**, electricity consumption, etc.).

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Sources of emissions modeled (i.e., aircraft, GSE/APUs, and other) are further discussed within the **User's Guide, Section U8.4**. The input data for the *2023/2024 EDR*, such as landing and takeoff (LTO) cycle operations, GSE/APU TIM data, and fuel storage/handling and stationary source fuel throughputs, are presented in Appendix J. Chapter 6, *Ground Access*, Section 6.4 provides detailed information on Massport's ground access VMT data.

Inventoried emissions include U.S. EPA defined criteria air pollutants and their precursors, including VOCs, NO_X, CO, and PM_{10}/$PM_{2.5}$.

There are no source emission rates for the air pollutant ozone (O_3) because it is formed through the interaction between VOCs and NO_X in the presence of sunlight and is considered a regional pollutant. Airport emission sources are minimal generators of lead (Pb) and sulfur dioxide (SO_2), two U.S. EPA criteria air pollutants, so these emissions are not computed. This is because very few aircraft use leaded fuel, and SO_2 is primarily generated by fuel combustion at power plants and other industrial facilities not affiliated with Logan Airport. U.S. EPA research has correlated adverse health effects with exposure to high levels of criteria air pollutants, and as a result, has set regulatory thresholds.

Estimates of primary GHGs, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), associated with Logan Airport operations were also modeled. The results of the *2023/2024 EDR* GHG emissions inventories are reported in units of **metric tons (MT) of CO_2 equivalents (CO_2e),** or **MT CO_2e**, based on the appropriate Global Warming Potentials (GWPs). The GWPs and emission factors used to prepare the GHG estimates were obtained from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) and the U.S. EPA. For more information on sources of airport emissions and pollutant types, see **User's Guide, Section U8.1.**

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8.2.2 Models and Databases

The modeling tools and emission factor databases used to estimate emissions for calendar years 2023 and 2024 include the following:

- FAA **Aviation Environmental Design Tool, Version 3g (AEDT3g)**,
- U.S. EPA **MOtor Vehicle Emission Simulator, Version 5 (MOVES5)**,
- U.S. EPA GHG Emission Factors Hub for 2023 (modified on September 12, 2023),
- U.S. EPA GHG Emission Factors Hub for 2024 (modified on June 5, 2024), and
- Independent System Operator New England (ISO-NE) CO_2 emission factor data.

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For more information on the modeling tool, see the **User's Guide, Section U8.3**. As stated in the User's Guide, the primary modeling tool for aircraft-related emissions is AEDT, and the modeling tool for motor vehicles is MOVES.

8.2.3 Emissions Inventory Model Updates

In 2023, emissions were modeled using the latest version of AEDT (version 3g) and MOVES (version 5), whereas the 2022 emissions were modeled with the prior versions available at the time of analysis (i.e., AEDT version 3e and MOVES version 3.1). To better understand and highlight the effects of AEDT's and MOVES' model version changes on emission results, the *2023/2024 EDR* presents estimates for 2023 emissions using both current (i.e., AEDT3g and MOVES5) and prior model versions (i.e., AEDT3e and MOVES3.1). The 2024 emissions are only estimated using the current model versions.

Emissions Factors represent the average emission rate of a pollutant for a given airport activity, like the amount of VOCs released during a single aircraft operation or CO released from running a diesel engine for one hour.

The AEDT model contains a database of **Emissions Factors**, which are specific to each aircraft type and airplane engine, since each engine type will produce different emissions in different quantities.

For example, the smaller Boeing 737 has different emissions factors than the larger Boeing 777 Dreamliner.

8.2.3.1 AEDT Model Changes and Output Effects

Since its initial release, the FAA has continuously improved the AEDT model by expanding its capabilities, correcting computational errors, and enhancing user accessibility. Updated versions are regularly released for future use. For more information on the FAA's AEDT model and emissions factors, refer to the **User's Guide, Section U8.3.1**. AEDT 3g includes the following air quality-related updates and improvements from AEDT 3e: [6]

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- Comprehensive update of emissions factors for GSE and stationary sources, like emergency generators.

6 FAA, AEDT3g Release Notes, https://aedt.faa.gov/3g_information.aspx.

Table 8-1 Aircraft Emissions Inventory AEDT3e and AEDT3g Model Comparison

Year	Model Version	Pollutant (kg/day)			
		VOCs	NO_X	CO	$PM_{10}/PM_{2.5}$
2023	AEDT3e	677	5,989	5,748	46
2023	AEDT3g	727	6,063	6,524	50
% Difference between 2023 AEDT3g versus 2023 AEDT3e:		**7.4%**	**1.2%**	**13.5%**	**8.7%**

Source: Massport and CMT, 2025.
Notes: Modeled emissions totals are rounded numbers. Percent calculations are based on exact numbers.
CO – carbon monoxide; NO_X – oxides of nitrogen; $PM_{10}/PM_{2.5}$ – particulate matter with a diameter that is 10 micrometers and smaller (PM_{10}) which is inclusive of particulate matter with a diameter that is 2.5 micrometers and smaller ($PM_{2.5}$); VOCs – volatile organic compounds

- Adjust fuel flow rates for emissions associated with aircraft taxiing procedures to and from gates and runways (SAE AIR-8035 implementation).
- Update airport, aircraft fleet, and other model databases and emissions factors for greater data accuracy and to reflect changes in aircraft and engine model types and their associated emissions.

Table 8-1 presents pollutant-specific differences resulting from model version changes from AEDT3e to AEDT3g for analysis year 2023. When comparing the 2023 aircraft emissions inventory using AEDT3g to the same year's aircraft emissions inventory using AEDT3e, emissions for all pollutants are greater, illustrating the effect of AEDT's model version updates.

Specifically, the fuel flow adjustments in model version AEDT3g had the most notable effects on CO emissions during aircraft taxiing operations, which are when aircraft are driving around the airfield under their own engine power (i.e. not being towed or pulled by GSE vehicles) to get between the runway and the terminal aprons or terminal gates. These model updates contribute to differences in VOC, NO_X, CO, and $PM_{10}/PM_{2.5}$ emission results between analysis years.

8.2.3.2 AEDT Model Version Analysis Year Comparisons

While changes between AEDT model versions can affect the output results based on updates to later model versions, when data from different reporting years are analyzed using the same model version, the differences between the results for the reporting years reflect changes in conditions at Logan Airport rather than differences between the models.

Comparing emissions data using the same model version for two or more reporting years will show the differences in air quality conditions and emissions from Logan Airport sources since the same model version was used in both scenarios.

Table 8-2 presents pollutant-specific differences due to changes in conditions, operations, and passenger air travel demand at Logan Airport for the reporting years by using the same model version to analyze the data from both reporting years being compared. changes in aircraft fleet mix among the airlines, where different airplane types are brought into service and others are taken out

Table 8-2 Aircraft Emissions Inventory Comparison between Analysis Years

Year	Model Version	Pollutant (kg/day)			
		VOCs	NO_X	CO	$PM_{10}/PM_{2.5}$
2022	AEDT3e	681	5,650	5,586	47
2023	AEDT3e	677	5,989	5,748	46
% Difference between 2023 AEDT3e versus 2022 AEDT3e:		**-0.6%**	**6.0%**	**2.9%**	**-2.4%**
2023	AEDT3g	727	6,063	6,524	50
2024	AEDT3g	714	6,465	6,959	54
% Difference between 2024 AEDT3g versus 2023 AEDT3g:		**-1.8%**	**6.6%**	**6.7%**	**8.0%**

Source: Massport and CMT, 2025.
Notes: Modeled emissions totals are rounded numbers. Percent calculations are based on exact numbers.
CO – carbon monoxide; NO_X – oxides of nitrogen; $PM_{10}/PM_{2.5}$ – particulate matter with a diameter that is 10 micrometers and smaller (PM_{10}) which is inclusive of particulate matter with a diameter that is 2.5 micrometers and smaller ($PM_{2.5}$); VOCs – volatile organic compounds

of service, or changes in operations and flight frequencies between analysis years. For more information on how aircraft engine technology can affect emissions, refer to the **User's Guide, Section U8.1.3**.

User's Guide Section U8.1.3

2022 and 2023 Reporting Year Comparisons Using AEDT 3e

When comparing 2023 to 2022 using the same mode version (i.e., AEDT 3e), 2023 aircraft emissions increased for NO_X and CO, but decreased for VOCs and $PM_{10}/PM_{2.5}$ compared to the 2022 inventory. These results are discussed in greater detail in Section 8.3, but factors contributing to the differences between results using the same AEDT model for different years include changes in the airline's aircraft fleet composition operating out of Logan Airport and the frequency of their operations. Specifically, the observed decrease in VOC and $PM_{10}/PM_{2.5}$ emissions is attributed to airlines introducing aircraft in 2023 with lower VOC and $PM_{10}/PM_{2.5}$ emission profiles into service within the aircraft fleet compared to the 2022 fleet.

2023 and 2024 Reporting Year Comparisons Using AEDT 3g

When comparing 2024 to 2023, using the same mode version (i.e., AEDT 3g), aircraft emissions of NO_X, CO, and $PM_{10}/PM_{2.5}$, increased and VOC emissions decreased, compared to the 2023 inventory. These changes are primarily driven by increased operational activity and fleet changes. Similarly, the observed decrease in VOC emissions is attributed to the introduction of aircraft with lower VOC emission profiles in the 2024 aircraft fleet mix compared to the 2023 fleet.

8.2.3.3 MOVES Model Changes and Output Effects

MOVES5 introduced several significant updates compared to prior versions (i.e., MOVES4 and MOVES3), including updated assumptions based on new vehicle performance enhancements and emissions reduction technologies.[7] These enhancements more accurately capture current conditions, whereas prior model versions likely overestimated emissions by assuming older, less efficient technologies or vehicles were still in use. The following is an expanded summary of these key enhancements in the new model versions:

- Incorporates U.S. EPA's *Light- and Medium-Duty Multi-Pollutant Rule*, which includes:
  - Higher projected EV fractions.
  - More stringent standards for CO_2, PM, NO_X, and non-methane organic gases.
- Includes U.S. EPA's *Heavy-Duty GHG Emissions Phase 3 Rule*, with:
  - Updated energy consumption estimates for heavy-duty EVs.
  - Higher projected EV fractions for heavy-duty vehicles.
- Emissions calculations now include vehicles up to 40 years old, whereas prior versions were only able to compare vehicles up to 30 years old.
- Incorporates new data on brake wear of brake dust $PM_{2.5}/PM_{10}$ emissions for both light-duty and heavy-duty vehicles.
- Updates to on-road and off-road fuel properties for calendar year 2021 and beyond.
- Updates to historic and forecasted default VMT, vehicle populations, age distributions, and fuel distributions.

For more information on the U.S. EPA's MOVES, see the **User's Guide, Section U8.3.2**, or visit the U.S.EPA website at https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

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As shown in **Table 8-3**, the 2023 motor vehicle emissions inventory developed using MOVES5 indicates increased emissions of NO_X, CO, and VOCs, along with a notable decrease in $PM_{10}/PM_{2.5}$ emissions compared to the same inventory modeled with MOVES3.1.

Table 8-3 Motor Vehicle Emissions Inventory MOVES3.1 and MOVES5 Model Comparison

Year	Model Versions	Pollutant (kg/day)			
		VOCs	NO_X	CO	$PM_{10}/PM_{2.5}$
2023	MOVES3.1	20.9	5.2	309.7	41.1
2023	MOVES5	25.4	9.6	504.1	3.0
% Difference 2023 (MOVES5) to 2023 (MOVES3.1)		**21.4%**	**85.3%**	**62.7%**	**-92.7%**

Source: Massport and CMT, 2025.

Notes: Modeled emissions totals are rounded numbers. Percent calculations are based on exact numbers.
MOVES – MOtor Vehicle Emission Simulator; VOCs – volatile organic compounds; NO_X – oxides of nitrogen; CO – carbon monoxide; $PM_{10}/PM_{2.5}$ – particulate matter with a diameter of 10 micrometers or smaller (PM_{10}) which is inclusive of particulate matter with a diameter of 2.5 micrometers or smaller ($PM_{2.5}$).

7 U.S. EPA, Latest Version of MOtor Vehicle Emission Simulator (MOVES), September 2025, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

These differences are primarily attributed to updates in MOVES5, including revised on-road fuel properties and other changes which now reflect more vehicle acceleration and less braking, which are reflected in the model outputs as increased NO_X, CO, and VOCs emissions and decreased $PM_{10}/PM_{2.5}$ emissions. For example, more fuel efficient engines burn less fuel, but combustion temperatures in the engine are greater with more oxygen available for combustion, so more NO_X emissions are produced, even though less fuel overall is burned. Conversely, better transmissions capable of engine braking or regenerative braking in electric vehicles to charge the batteries are examples of new technologies that use the engine to slow down the vehicle, thereby reducing the need to apply the brakes, which creates particulate emissions as brake dust when brake pads wear down. The result is a significant reduction in $PM_{10}/PM_{2.5}$ emissions is attributed to updated assumptions in MOVES5 regarding brake system technologies and materials, which have resulted in lower emissions.

8.2.3.4 MOVES Model Version Analysis Year Comparisons

Similar to the AEDT discussion in Section 8.2.3.2 above, changes between MOVES model versions can be distinguished from changes in conditions at the Airport when data from different reporting years are analyzed using the same model version. The results from these comparisons reflect changes in conditions at Logan Airport between reporting years rather than differences between the model versions. **Table 8-4** presents pollutant-specific differences due to changes in motor vehicle fleet mix and VMT between analysis years using the same model versions.

2022 and 2023 Reporting Year Comparisons Using MOVES3.1

When comparing 2023 to 2022, using the same mode version (i.e., MOVES3.1), emissions decreased for all criteria air pollutants compared to the 2022 inventory. Although VMT increases between the two analysis years, in other words, more vehicles were driven on the Airport property more often, emissions decrease due to advancements in engine efficiency and the introduction of cleaner vehicle technologies which produce fewer emissions.

Table 8-4 Motor Vehicle Emissions Inventory Comparison between Analysis Years

Year	Model Versions	Pollutant (kg/day)			
		VOCs	NO_X	CO	$PM_{10}/PM_{2.5}$
2022	MOVES3.1	22.2	6.5	322.0	50.4
2023	MOVES3.1	20.9	5.2	309.7	41.1
% Difference 2023 (MOVES3.1) and 2022 (MOVES3.1)		**-5.6%**	**-20.4%**	**-3.8%**	**-18.5%**
2023	MOVES5	25.4	9.6	504.1	3.0
2024	MOVES5	26.8	15.9	531.0	3.0
% Difference 2024 (MOVES5) and 2023 (MOVES5)		**5.5%**	**64.4%**	**5.3%**	**-1.4%**

Source: Massport and CMT, 2025.

Notes: Modeled emissions totals are rounded numbers. Percent calculations are based on exact numbers.
MOVES – MOtor Vehicle Emission Simulator; VOCs – volatile organic compounds; NO_X – oxides of nitrogen; CO – carbon monoxide; $PM_{10}/PM_{2.5}$ – particulate matter with a diameter that is 10 micrometers and smaller (PM_{10}) which is inclusive of particulate matter with a diameter that is 2.5 micrometers and smaller ($PM_{2.5}$).

The change in emissions from year to year is a function of several variables. These include:

- Number of aircraft operations and changes in aircraft fleet mixes
- Advancements in aircraft engine technologies
- Improved airfield efficiencies
- GSE and APU TIM data
- Changes in VMT data
- Massport's emission reduction measures, such as the GSE replacement initiatives

2023 and 2024 Reporting Year Comparisons Using MOVES5

When comparing 2024 to 2023, using the same model version (i.e., MOVES5), emissions of VOC, NO_X, and CO increased, with minimal changes in $PM_{10}/PM_{2.5}$ levels compared to 2023. These increases were primarily driven by increased passenger VMT, or passengers traveling to or from the Airport, as well as updates to the motor vehicle mode share to reflect the number of passengers taking HOV options, like Logan Express, versus driving their own vehicles or being dropped off and picked up. These changes are discussed further in Section 8.3, and the MOVES5 input and output example files are presented in Appendix J, Section J.1.3.

8.3 Criteria Air and Precursor Pollutants Emission Inventory Results

This section provides the results of the 2023 and 2024 Logan Airport emissions inventories for the criteria air pollutants and precursor pollutants (VOC, NO_X, CO, and $PM_{10}/PM_{2.5}$) using the AEDT3g and MOVES5 models and standard U.S. EPA emission factors for other sources (i.e., stationary and non-mobile sources).

As in previous EDRs and ESPRs, the 2023 and 2024 emissions inventories for Logan Airport are compared to the previous year's inventory results, extending back to the benchmark year when emissions were at their highest.

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Another variable contributing to annual changes is the continuous evolution of air quality models and emission factor databases as described in Section 8.2.2 of this report and within **User's Guide, Section U8.3**. Information on the data inputs and assumptions used to estimate the 2023 and 2024 Logan Airport emissions is provided in Appendix J.

8.3.1 Volatile Organic Compounds (VOCs)

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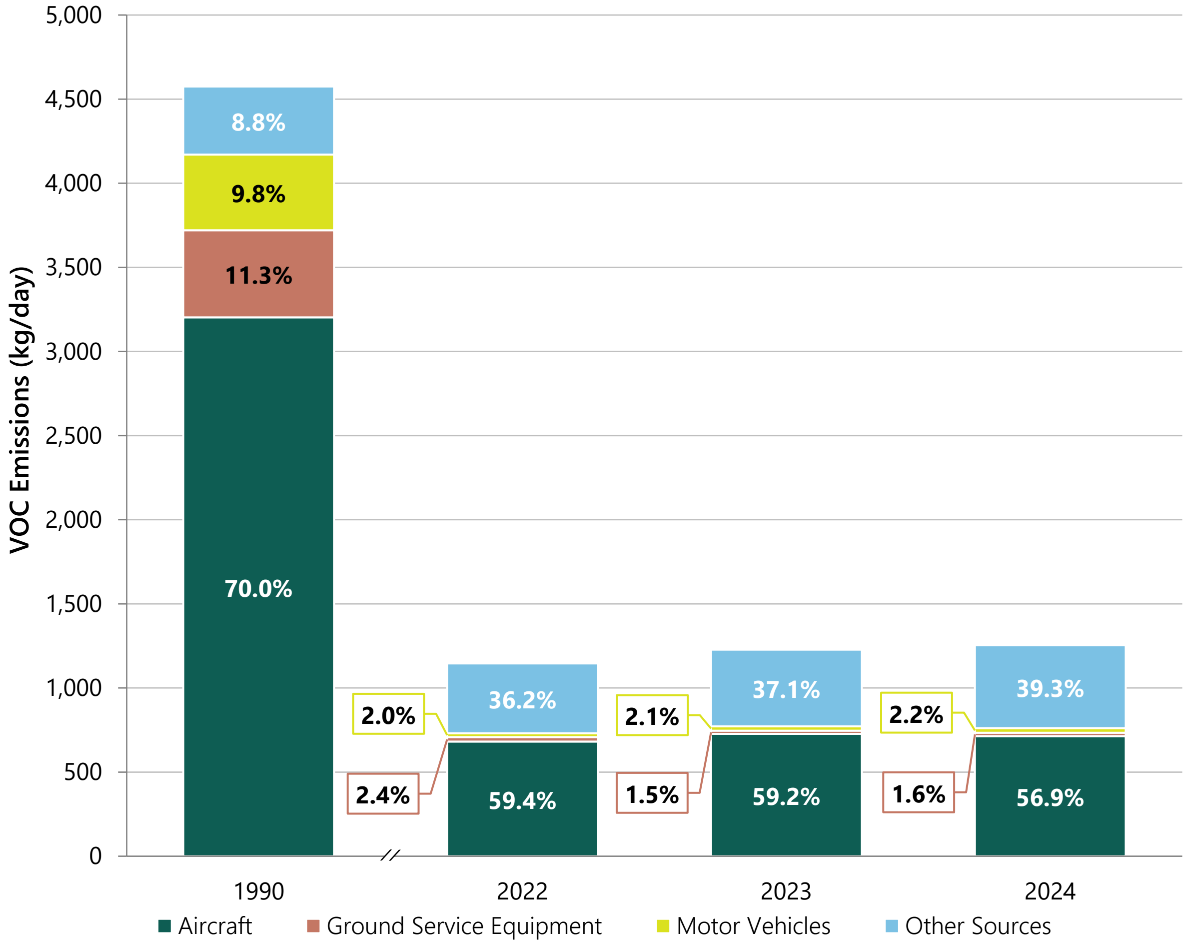
VOCs are precursors to O_3, which is a regional-scale criteria air pollutant. While VOCs themselves are not regulated as criteria air pollutants, they are regulated under other U.S. EPA programs. For additional information on O_3, see **User's Guide, Section U8.1**.

Figure 8-1 Modeled Emissions of VOCs at Logan Airport, 1990, 2022-2024



Source: Massport and CMT, 2025.

Figure 8-1 illustrates VOC emissions for Logan Airport for the benchmark year 1990, and 2022 through 2024, showing the percentage contribution of each emission source category (i.e., aircraft, GSE, motor vehicles, and other sources) over the same period.

Table 8-5 provides the computed total VOC emissions for each emission source category modeled at Logan Airport for the years 1990 and 2022 through 2024. For comparison purposes, the prior model versions of AEDT and MOVES are also presented. The VOC emission results for 2023 and 2024 are presented in Section 8.3.1.2 and Section 8.3.1.3, respectively.

Table 8-5 Estimated VOC Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Aircraft/GSE Model:	LDMS	AEDT Version 3e	AEDT Version 3e	AEDT Version 3g	AEDT Version 3g
Total Aircraft Sources	3,203	681	677	727	714
Ground Service Equipment (GSE)[2]	518	27	21	19	20
Motor Vehicle Model:	MOBILE 5a	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Total Motor Vehicle Sources	450	23	21	25	27
Total Other Sources[3]	404	415	456	456	493
Total Airport Sources	**4,575**	**1,145**	**1,175**	**1,226**	**1,254**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the *Boston Logan International Airport 2022* Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.
2 GSE emissions include aircraft auxiliary power units (APUs) as well as vehicles and equipment converted to alternative fuels.
3 Includes the Central Heating Plant, emergency generators, snow melters, and other stationary sources.

The source categories of aircraft, motor vehicles and other sources are further broken down by more specific emission source types. **Table 8-6** summarizes VOC emissions for air carriers, commuter aircraft, cargo aircraft, and **general aviation (GA)**, under the aircraft category.

Table 8-6 Estimated Aircraft VOC Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Model	LDMS	AEDT Version 3e	AEDT Version 3e	AEDT Version 3g	AEDT Version 3g
Air Carriers	2,175	422	476	508	500
Commuter Aircraft	681	93	94	103	112
Cargo Aircraft	303	85	31	34	31
General Aviation (GA)	44	80	76	82	70
Total Aircraft Sources	**3,203**	**681**	**677**	**727**	**714**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results. .

Table 8-7 Estimated Motor Vehicles VOC Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Model	MOBILE 5a	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Parking / curbside	192	4	3	4	4
On-Airport vehicles	258	19	18	22	23
Total Motor Vehicle Sources	**450**	**23**	**21**	**25**	**27**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

Table 8-7 presents VOC emissions from motor vehicles idling at parking areas and terminal curbsides, as well as vehicles traveling on airport roadways under the motor vehicle category. **Table 8-8** details VOC emissions from other sources, including fuel storage and handling facilities, and stationary sources such as boilers, emergency generators, and snow melters. VOC emissions from GSE are reported only in **Table 8-5**, as this category is not broken down into specific emission source types. For comparison, emissions estimates from prior versions of AEDT and MOVES are also included in the tables.

Table 8-8 Estimated Other Sources VOC Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2024
Fuel storage / handling	400	410	452	489
Miscellaneous sources[2]	4	5	3	4
Total Other Sources	**404**	**415**	**456**	**493**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.
2 Includes the Central Heating Plant, emergency generators, snow melters, and other stationary sources.

8.3.1.2 2023 Volatile Organic Compounds (VOCs)

In 2023, total VOC emissions at Logan Airport were estimated at 493 tons per year (tpy), equivalent to approximately 1,226 kilograms per day (kg/day). As shown in **Figure 8-1**, aircraft were the largest source of VOC emissions at Logan Airport in 2023, accounting for approximately 59 percent of the total. Other emission sources contributed around 37 percent, while GSE, APU, and motor vehicles made up the remaining 2 percent. The 2023 VOC emission results are compared to the 2022 levels in the following sections, categorized by source.

Aircraft

As shown in **Table 8-6**, total aircraft-related VOC emissions increased by 7 percent in 2023 (modeled using AEDT3g) compared to 2022 (modeled using AEDT3e). This change is attributable primarily to updates to the AEDT model version in combination of higher aircraft operations and changes in the aircraft fleet.

However, it is notable that when emissions are compared using the same model versions (i.e., AEDT 3e) from 2022 to 2023, VOC emissions decreased slightly directly due to the changes in aircraft fleet mix between the two analysis years. Specifically, the observed decrease in VOC emissions is attributed to the introduction of aircraft with lower VOC emission profiles in the 2023 aircraft fleet mix compared to the 2022 fleet.

GSE

As shown in **Table 8-5**, GSE-related VOC emissions, including emissions from APUs, were 30 percent lower in 2023 (modeled using AEDT3g) compared to 2022 (modeled using AEDT3e). There is a similarly significant reduction seen when the same model version is applied in 2023 as in 2022 (i.e., AEDT3e), indicating that this reduction is primarily due to comprehensive updates to the GSE fleet mix operating at Logan Airport.

Motor Vehicles

As shown in **Table 8-7**, VOC emissions from motor vehicles in 2023 (modeled using MOVES5) increased by 15 percent compared to 2022 levels (modeled using MOVES3.1). When comparing 2022 to 2023 with the same model version (i.e., MOVES3.1), VOC emissions decreased slightly. Therefore, the increase seen in 2023 with MOVES5 is primarily attributable to the updates to the newer model version.

Other Sources

As shown in **Table 8-8**, VOC emissions from stationary and other non-mobile sources, including fuel storage and handling, Central Heating Plant (CHP) operations, snow melter usage, and firefighter training activities, increased by 10 percent in 2023 compared to 2022. This increase is due to changes in fuel throughputs associated with Massport’s fuel storage and handling activities.

8.3.1.3 2024 Volatile Organic Compounds (VOCs)

In 2024, total VOC emissions at Logan Airport were estimated at 505 tpy, equivalent to approximately 1,254 kg/day. As shown in **Figure 8-1**, aircraft were the largest source of VOC emissions at Logan Airport in 2024, accounting for approximately 57 percent of the total. Other emission sources, specifically fuel storage and handling, contributed 39 percent, while GSE, APU, and motor vehicles made up the remaining 4 percent, with 2 percent each. The 2024 VOC emission results are compared to the 2023 levels in the following sections, categorized by source.

Aircraft

Total aircraft-related VOC emissions decreased by 2 percent in 2024 compared to 2023, based on modeling with AEDT3g for both years. This reduction is primarily attributable to the introduction of more aircraft operations with lower VOC emission profiles in the 2024 aircraft fleet mix compared to the 2023 fleet.

GSE

GSE-related VOC emissions, including those from APUs, were 9 percent higher in 2024 compared to 2023, based on modeling using AEDT3g for both years. This increase is attributable primarily to changes in aircraft operations between the two analysis years, which in turn influenced the assignment of GSE and APU usage to individual aircraft.

Motor Vehicles

VOC emissions from motor vehicles in 2024 (modeled using MOVES5) increased by 6 percent compared to 2023 levels, also modeled with MOVES5. This increase is primarily attributable to an increase in VMT data in 2024.

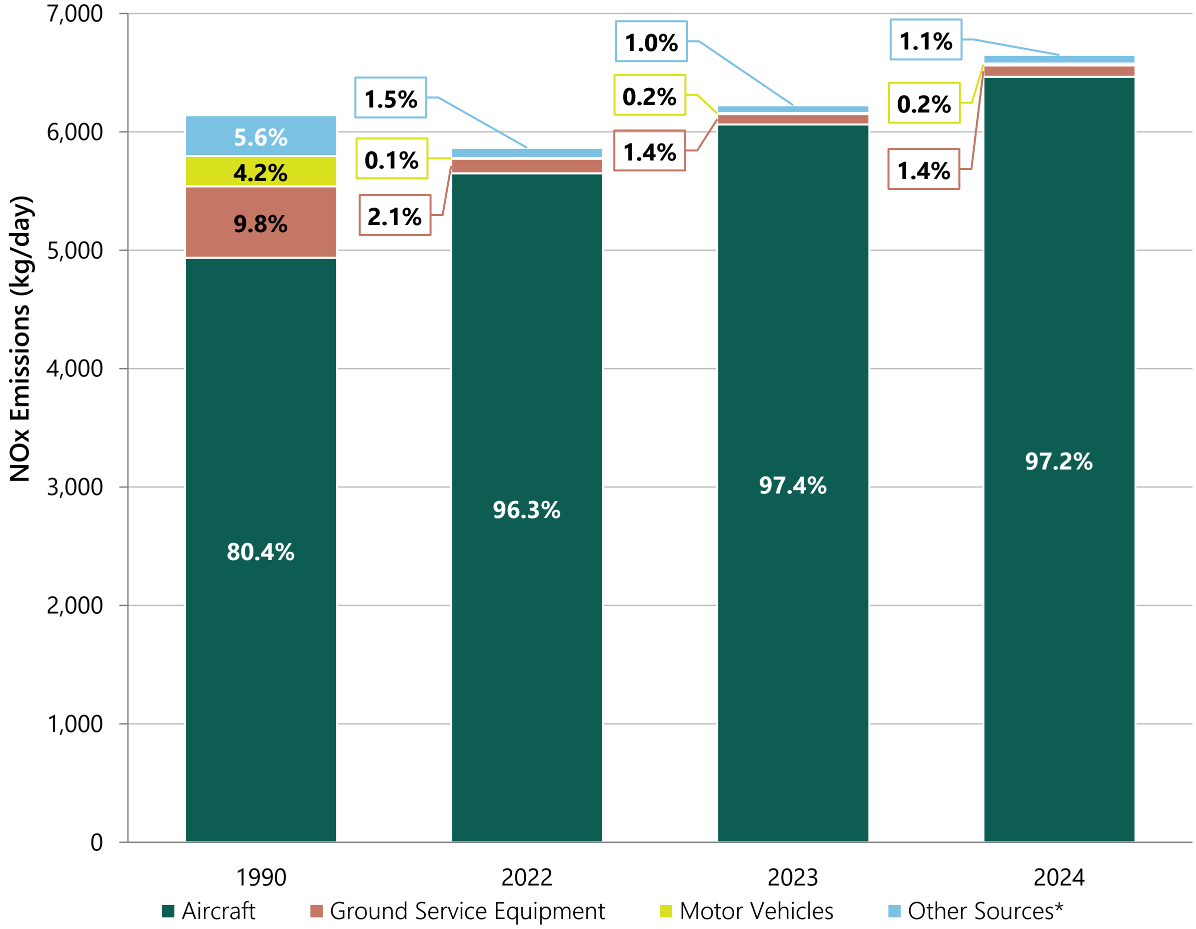
Other Sources

VOC emissions from stationary sources and other non-mobile sources increased by 8 percent in 2024 compared to 2023, primarily due to increased fuel throughputs associated with Massport's fuel storage and handling activities.

8.3.2 Oxides of Nitrogen (NO_X)

Figure 8-2 illustrates NO_x emissions for Logan Airport for the benchmark year 1990, and 2022 through 2024, showing the percentage contribution of each emission source category (i.e., aircraft, GSE, motor vehicles, and other sources) over the same time period.

Figure 8-2 Modeled Emissions of NO_X at Logan Airport, 1990, 2022-2024



Source: Massport and CMT, 2025.

Table 8-9 shows the NO_X contribution for each emission source category at Logan Airport for each emission source in 1990 and 2022 through 2024. For comparison purposes, the prior model versions of AEDT and MOVES are also presented. The 2023 and 2024 NO_x emission results are presented in Section 8.3.2.2 and Section 8.3.2.3, respectively.

Table 8-9 Estimated NO_X Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Aircraft/GSE Model:	LDMS	AEDT Version 3e	AEDT Version 3e	AEDT Version 3g	AEDT Version 3g
Total Aircraft Sources	4,937	5,650	5,989	6,063	6,465
Ground Service Equipment (GSE)[2]	603	123	106	87	96
Motor Vehicle Model	MOBILE 5a	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Total Motor Vehicle Sources	257	7	5	10	16
Total Other Sources[3]	344	86	65	65	73
Total Airport Sources	**6,141**	**5,866**	**6,165**	**6,225**	**6,650**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.
2 GSE emissions include aircraft auxiliary power units (APUs) as well as vehicles and equipment converted to alternative fuels.
3 Includes the Central Heating Plant, emergency generators, snow melters, and other stationary sources.

Similar to the previous pollutant section, the source categories of aircraft, motor vehicles, and other sources are further broken down by more specific emission source types. **Table 8-10** and **Table 8-11** present the computed NO_X emissions for each of these emission source types at Logan Airport for the years 1990 and 2022 through 2024. Notably, NO_X emissions from GSE and other sources are reported only in **Table 8-9**, as these categories are not broken down into specific emission source types for this pollutant. For comparison, emissions estimates from prior versions of AEDT and MOVES are also included in the tables.

Table 8-10 Estimated Aircraft NO_X Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Model	LDMS	AEDT Version 3e	AEDT Version 3e	AEDT Version 3g	AEDT Version 3g
Air carriers	4,554	4,834	5,182	5,244	5,688
Commuter aircraft	133	322	309	317	342
Cargo aircraft	237	423	426	432	369
General aviation (GA)	13	71	72	71	65
Total Aircraft Sources	**4,937**	**5,650**	**5,989**	**6,063**	**6,465**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

Table 8-11 Estimated Motor Vehicles NO_X Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Model	MOBILE 5a	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Parking / curbside	25	2	1	1	2
On-Airport vehicles	232	5	4	8	14
Total Motor Vehicle Sources	**257**	**7**	**5**	**10**	**16**

Source: Massport and CMT, 2025.

Notes: Values may reflect rounding.

LDMS – Logan Dispersion Modeling System

AEDT – Aviation Environmental Design Tool

MOVES – Motor Vehicle Emission Simulator

kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

8.3.2.2 2023 Oxides of Nitrogen (NO_X)

The 2023 total NO_X emissions from all Airport-related sources were estimated to be 2,505 tpy (6,225 kg/day). As shown in **Figure 8-2**, aircraft continues to represent the largest source of NO_X emissions at Logan Airport in 2023, accounting for approximately 97 percent of the total; while GSE and APU, other sources and motor vehicles made up the remaining 3 percent. The 2023 NO_X emission results are compared to the 2022 levels in the following sections, categorized by source.

Aircraft

As shown in Table 8-10, total aircraft-related NO_X emissions (modeled using AEDT3g) in 2023 were 7 percent higher than 2022 levels (modeled using AEDT3e). A similar increase in emissions is seen from 2022 to 2023 when the same model version is applied. Therefore, the increase in emissions is attributable primarily to a combination of higher aircraft operations, changes in the aircraft fleet, and updates to the AEDT3g model version. For more information on how aircraft fleet changes, including aircraft sizes and engine technology, can effect NO_X emissions and other pollutant emissions types, see **User's Guide, Section U8.1.2.**

GSE

As shown in **Table 8-9**, total GSE-related NO_X emissions, including emissions from APUs, decreased by 29 percent in 2023 (modeled using AEDT3g) compared to 2022 (modeled using AEDT3e). There is also a significant reduction seen when the same model version is applied in 2023 as in 2022 (i.e., AEDT3e), indicating that this reduction is primarily due to Massport's continued efforts to implement the use of GSE alternative-fueled vehicles (AVFs) at Logan Airport. These reductions in GSE emissions are further discussed in Section 8.6.

Motor Vehicles

As shown in **Table 8-11**, NO_X emissions from motor vehicles in 2023 (modeled using MOVES5) increased by 47 percent compared to 2022 levels (modeled using MOVES3.1). When comparing 2022 to 2023 with the same model version (i.e., MOVES 3.1), NOx emissions decreased slightly. Therefore, the increase seen in 2023 with MOVES5 is primarily attributable to the updates to the newer model version.

Other Sources

As shown in **Table 8-9**, NO_X emissions from stationery and other non-mobile sources decreased by 24 percent in 2023 compared to 2022. This reduction is primarily due to lower fuel usage from stationary sources, with the most significant decreases observed in generator and snow melter operations.

8.3.2.3 2024 Oxides of Nitrogen (NO_X)

In 2024, total NO_X emissions from all airport-related sources were estimated at 2,675 tpy, or approximately 6,650 kg/day. As shown in **Figure 8-2**, aircraft continue to be the largest source of NO_X emissions at Logan Airport in 2024, accounting for approximately 97 percent of the total, while GSE, APU, other sources, and motor vehicles make up the remaining 3 percent.

Aircraft

Total aircraft-related NO_X emissions increased by 7 percent in 2024 compared to 2023, based on modeling with AEDT3g for both years. This increase is primarily attributable to the increase in aircraft operations between the two analysis years.

GSE

Total GSE-related NO_X emissions, including emissions from APUs, increased by 10 percent in 2024 compared to 2023, based on modeling with AEDT3g for both years. As in previous years, this increase is primarily due to changes in aircraft operations, which directly impact the assignment and usage of GSE and APUs across the fleet.

Motor Vehicles

NO_X emissions from motor vehicles in 2024 (modeled using MOVES5) increased by 65 percent compared to 2023 levels, also modeled using MOVES5. This increase is primarily attributable to a 12 percent rise in passenger VMT, driven by changes in passenger activity levels between the two analysis years.

Additionally, the motor vehicle mode share distribution in 2024 differed from that of 2023, with a higher proportion of transit buses, which typically emit higher amounts of NO_X, contributing to overall higher emissions.

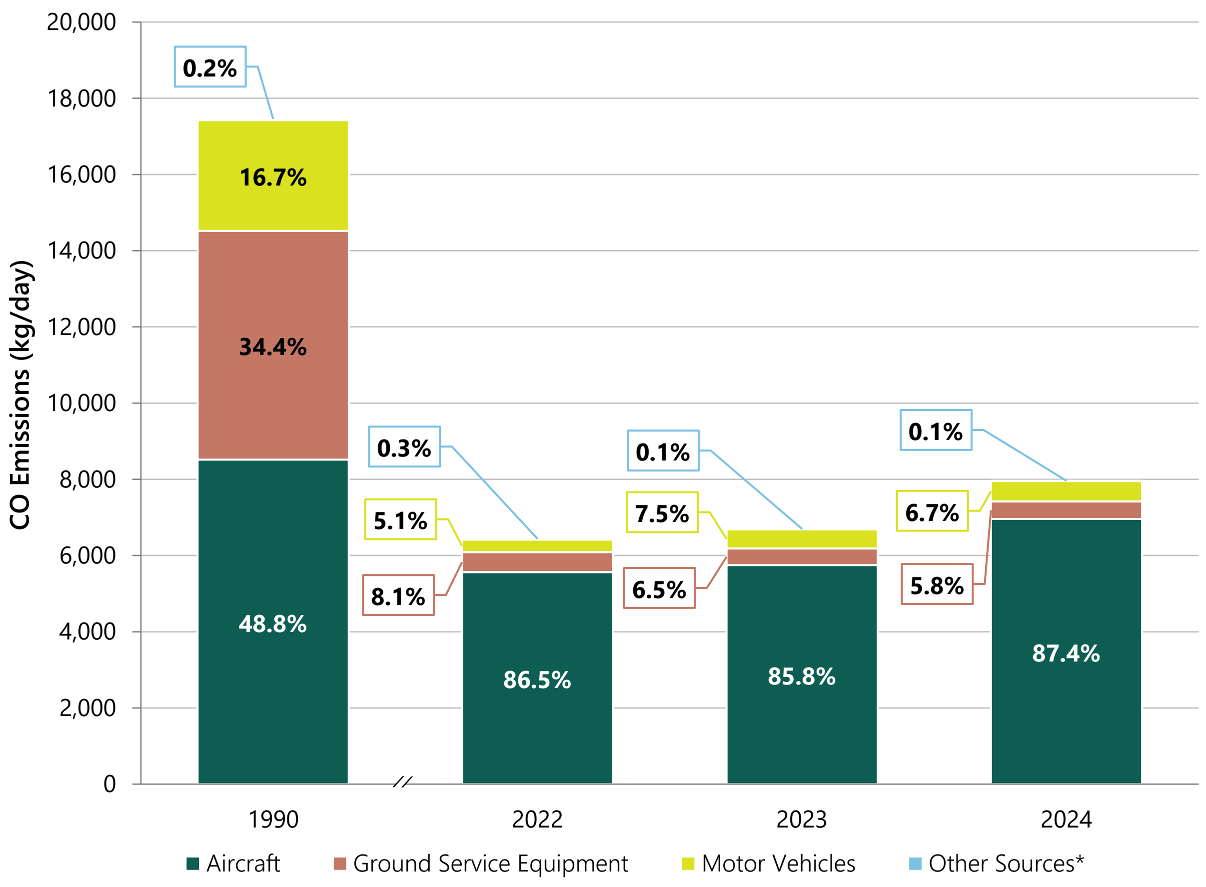
Other Sources

NO_X emissions from stationary and other non-mobile sources increased by 12 percent in 2024 compared to 2023. This increase is primarily due to greater usage of stationary equipment, particularly snow melters, during the analysis year.

8.3.3 Carbon Monoxide (CO)

Figure 8-3 illustrates CO emissions for Logan Airport for the benchmark year 1990, and 2022 through 2024, showing the percentage contribution of each emission source category (i.e., aircraft, GSE, motor vehicles, and other sources) over the same period.

Figure 8-3 Modeled Emissions of CO at Logan Airport, 1990, 2022-2024



Source: Massport and CMT, 2025.

Table 8-12 Estimated CO Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Aircraft/GSE Model:	LDMS	AEDT Version 3e	AEDT Version 3e	AEDT Version 3g	AEDT Version 3g
Total Aircraft Sources	8,518	5,586	5,748	6,524	6,959
Ground Service Equipment (GSE)[2]	6,001	522	332	436	462
Motor Vehicle Model	MOBILE 5a	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Total Motor Vehicle Sources	2,907	328	310	504	531
Total Other Sources[3]	31	20	10	10	10
Total Airport Sources	**17,457**	**6,456**	**6,410**	**7,474**	**7,962**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.
2 GSE emissions include aircraft auxiliary power units (APUs) as well as vehicles and equipment converted to alternative fuels.
3 Includes the Central Heating Plant, emergency generators, snow melters, and other stationary sources.

Table 8-12 presents the breakdown of CO emissions for Logan Airport by source category for the years 1990 and 2022 through 2024. For comparison purposes, the prior model versions of AEDT and MOVES are also presented. The 2023 and 2024 CO emission results are presented in Sections 8.3.3.2 and 8.3.3.3, respectively. Similar to the previous pollutant sections, the source categories of aircraft, motor vehicles, and other sources are further broken down by more specific emission source types. **Table 8-13** and **Table 8-14**

Table 8-13 Estimated Aircraft CO Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Model	LDMS	AEDT Version 3e	AEDT Version 3e	AEDT Version 3g	AEDT Version 3g
Air carriers	6,613	3,042	3,410	3,721	3,860
Commuter aircraft	977	1,849	1,816	2,230	2,584
Cargo aircraft	576	393	241	263	238
General aviation (GA)	352	302	281	310	277
Total Aircraft Sources	**8,518**	**5,586**	**5,748**	**6,524**	**6,959**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

Table 8-14 Estimated Motor Vehicles CO Emissions (kg/day) at Logan Airport, 1990, 2022-2024[1]

Year	1990	2022	2023	2023	2024
Model	MOBILE 5a	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Parking / curbside	1,218	10	8	8	9
On-Airport vehicles	1,689	319	302	496	522
Total Motor Vehicle Sources	**2,907**	**328**	**310**	**504**	**531**

Source: Massport and CMT, 2025.

Notes: Values may reflect rounding.

LDMS – Logan Dispersion Modeling System

AEDT – Aviation Environmental Design Tool

MOVES – Motor Vehicle Emission Simulator

kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

present the computed CO emissions for each of these emission source types at Logan Airport for the years 1990 and 2022 through 2024. Notably, CO emissions from GSE and other sources are reported only in **Table 8-12**, as these categories are not broken down into specific emission source types for this pollutant. For comparison, emissions estimates from prior versions of AEDT and MOVES are also included in the tables.

8.3.3.2 2023 Carbon Monoxide (CO)

Total CO emissions at Logan Airport in 2023 were estimated at 3,007 tpy, or approximately 7,474 kg/day. As shown in **Figure 8-3**, aircraft continue to represent the largest source of CO emissions at Logan Airport in 2023, accounting for approximately 87 percent of the total. Motor vehicle, GSE, and APU sources contributed nearly 13 percent, while other sources made up the remaining, less than 1 percent. The 2023 CO emission results are compared to the 2022 levels in the following sections, categorized by source.

Aircraft

As shown in **Table 8-13**, total aircraft-related CO emissions (modeled in AEDT3g) increased 17 percent in 2023 compared to 2022 levels (modeled in AEDT3e). When the same model version (i.e., AEDT3e) is applied to both years, the increase was not as significant. This indicates that the increase between 2023 (modeled in AEDT 3g) and 2022 (modeled in AEDT 3e) is primarily due to updates to the AEDT 3g model version and secondarily due to increases in aircraft operations.

GSE

As shown in **Table 8-12**, GSE-related CO emissions, including APUs, were 16 percent lower in 2023 (modeled using AEDT3g) than in 2022 (modeled using AEDT3e). A reduction is also observed when the same model version is applied in 2023 as in 2022 (i.e., AEDT3e), indicating that this reduction is primarily due to Massport's continued efforts to implement the use of GSE AVFs at Logan Airport. These reductions in GSE emissions are further discussed in Section 8.6.

Motor Vehicles

As shown in **Table 8-14**, in 2023, CO emissions from motor vehicles (modeled in MOVES5) increased by 57 percent compared to 2022 levels (modeled in MOVES3.1). When comparing 2022 to 2023 with the same model version (i.e., MOVES3.1), CO emissions decreased, despite an increase in VMT. Therefore, the increase seen in 2023 with MOVES5 is due to the updates to the newer model version.

Other Sources

As shown in **Table 8-12**, In 2023, stationary and other non-mobile sources experienced a 48 percent decrease in CO emissions compared to 2022 levels. This decline was mainly driven by reduced fuel consumption, particularly from generators and snow melters.

8.3.3.3 2024 Carbon Monoxide (CO)

In 2024, Logan Airport recorded 3,203 tpy CO emissions, averaging 7,962 kg/day. Similar to 2023, and as shown in **Figure 8-3**, aircraft continue to represent the largest source of CO emissions at Logan Airport in 2023, accounting for approximately 87 percent of the total. Motor vehicle and GSE and APU sources contributed nearly 13 percent, while other sources made up the remaining, less than 1 percent.

Aircraft

Total aircraft-related CO emissions increased by 7 percent in 2024 (modeled using AEDT3g) compared with 2023 (modeled using AEDT3g). This increase is primarily attributable to the increase in aircraft operations between the two analysis years.

GSE

GSE-related CO emissions, including APUs, were 6 percent higher in 2024 (modeled using AEDT3g) than in 2023 (modeled using AEDT3g). Again, the differences in emissions between 2024 and 2023 are attributable primarily to changes in aircraft operations, which directly influence the assignment and usage of GSE and APUs across the fleet.

Motor Vehicles

In 2024, CO emissions from motor vehicles increased by 5 percent compared to 2023 levels. Both years were modeled using MOVES5, so the year-over-year change is primarily attributed to differences in passenger VMT between the two analysis years.

Other Sources

CO emissions from stationary sources and other non-mobile sources at Logan Airport decreased by 3 percent in 2024 compared to 2023. While snow melters continued to show an increase in operational activity, this reduction is due to lower overall usage of other stationary equipment, including boilers, emergency generators, space heaters, and fire training activities.

8.3.4 Particulate Matter (PM)

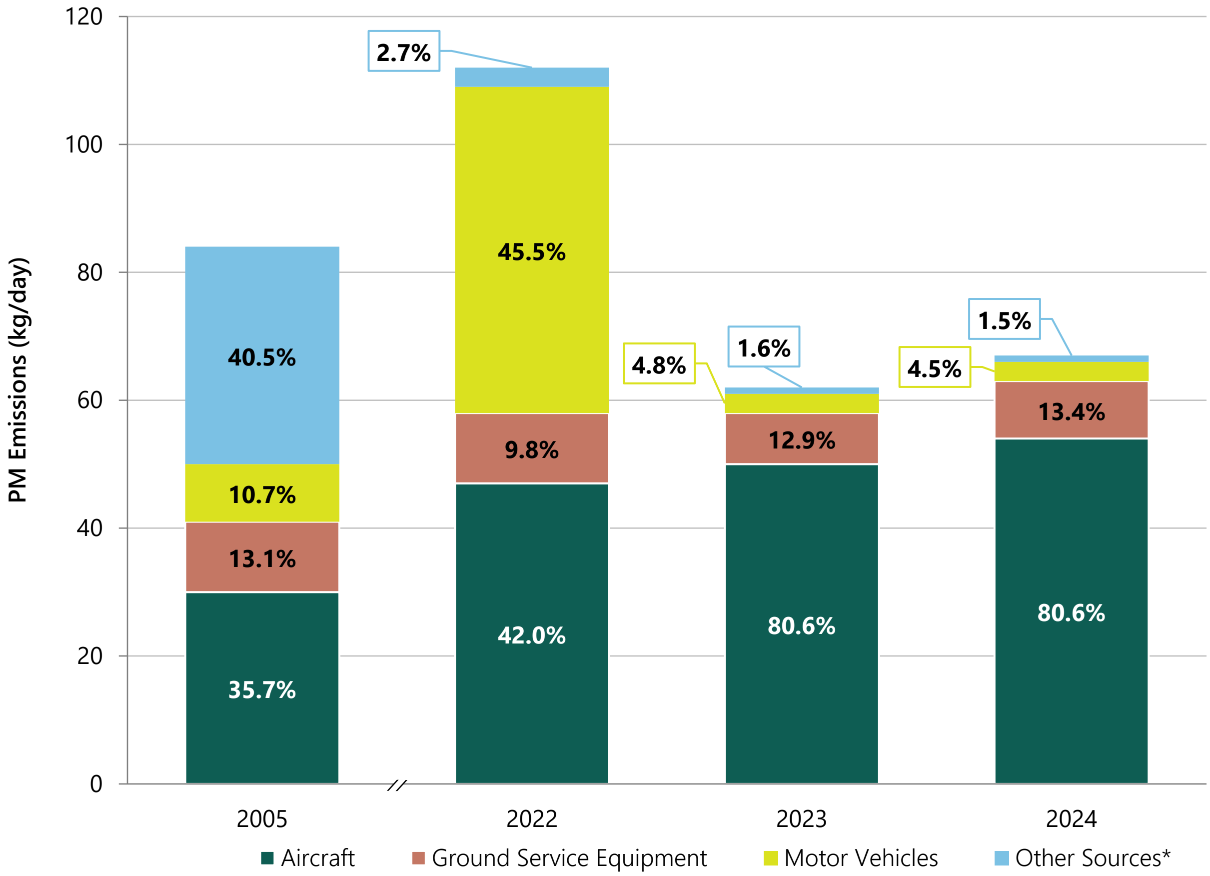
Figure 8-4 shows the PM_{10}/$PM_{2.5}$ contribution by source category (i.e., aircraft, GSE, motor vehicles, and other sources) for 2005, and from 2022 through 2024. Notably, for PM_{10}/$PM_{2.5,}$ the benchmark year is 2005, as it was the first year that these emissions were included in the Logan Airport ESPR/EDR emission inventories.

Notably, as discussed in the *2022 ESPR*, published in May 2024, the contribution of PM_{10}/$PM_{2.5}$ emissions in 2022 was significant due to the differences in database servers, specifically, MariaDB versus MySQL, used in MOVES3 and earlier versions. These database discrepancies led to elevated PM_{10}/$PM_{2.5}$ emission outputs. In subsequent modeling with MOVES5, further revisions were implemented related to brake system technologies and materials, resulting in significantly lower PM_{10}/$PM_{2.5}$ emissions.

Particulate Matter and Hazardous Air Pollutant Research

Conducted by the ICAO, FAA, U.S. EPA, and others, research continues to better characterize PM_{10}/$PM_{2.5}$ and HAPs emissions (including Pb) from aircraft engines. Similarly, air quality monitoring efforts at other airports were also conducted at various locations to advance what is known about ambient levels of these air pollutants in the vicinities of airports. Massport continues to closely track these issues through its involvement in aviation industry organizations such as ACI-NA and AAAE.

Figure 8-4 Modeled Emissions of $PM_{10}/PM_{2.5}$ at Logan Airport, 2005, 2022-2024



Source: Massport and CMT, 2025.

Table 8-15 shows the $PM_{10}/PM_{2.5}$ contribution for each emission source category at Logan Airport for each emission source in 2005 and 2022 through 2024. For comparison purposes, the prior model versions of AEDT and MOVES are also presented. The 2023 and 2024 $PM_{10}/PM_{2.5}$ emission results are presented in Sections 8.3.4.2 and 8.3.4.3, respectively.

Table 8-15 Estimated $PM_{10}/PM_{2.5}$ Emissions (kg/day) at Logan Airport, 2005, 2022-2024[1]

Year	2005	2022	2023	2023	2024
Aircraft/GSE Model:	**LDMS v4.5**	**AEDT Version 3e**	**AEDT Version 3e**	**AEDT Version 3g**	**AEDT Version 3g**
Total Aircraft Sources	30	47	46	50	54
Ground Service Equipment (GSE)[2]	11	11	10	8	9
Motor Vehicle Model	**Mobile 6.2.03**	**MOVES3.1**	**MOVES3.1**	**MOVES5**	**MOVES5**
Total Motor Vehicle Sources	9	51	41	3	3
Total Other Sources[3]	34	3	1	1	1
Total Airport Sources	**84**	**113**	**99**	**63**	**68**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.
2 GSE emissions include aircraft auxiliary power units (APUs) as well as vehicles and equipment converted to alternative fuels.
3 Includes the Central Heating Plant, emergency generators, snow melters, and other stationary sources.

Similar to the previous pollutant sections, the source categories of aircraft, motor vehicles and other sources are further broken down by more specific emission source types. **Table 8-16** and **Table 8-17** present the computed $PM_{10}/PM_{2.5}$ emissions for each of these emission source types at Logan Airport for the years 1990 and 2022 through 2024. For comparison, emissions estimates from prior versions of AEDT and MOVES are also included in the tables. Notably, $PM_{10}/PM_{2.5}$ emissions from GSE and other sources are reported only in **Table 8-15**, as these categories are not broken down into specific emission source types for this pollutant.

Table 8-16 Estimated Aircraft $PM_{10}/PM_{2.5}$ Emissions (kg/day) at Logan Airport, 2005, 2022-2024[1]

Year	2005	2022	2023	2023	2024
Model	**LDMS v4.5**	**AEDT Version 3e**	**AEDT Version 3e**	**AEDT Version 3g**	**AEDT Version 3g**
Air carriers	25	39	39	42	46
Commuter aircraft	1	3	3	4	4
Cargo aircraft	2	3	2	2	2
General aviation (GA)	2	2	2	2	2
Total Aircraft Sources	**30**	**47**	**46**	**50**	**54**

Source: Massport and CMT, 2025.
Notes: Values may reflect rounding.
LDMS – Logan Dispersion Modeling System
AEDT – Aviation Environmental Design Tool
MOVES – Motor Vehicle Emission Simulator
kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).
1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

Table 8-17 Estimated Motor Vehicles $PM_{10}/PM_{2.5}$ Emissions (kg/day) at Logan Airport, 2005, 2022-2024[1]

Year	2005	2022	2023	2023	2024
Model	Mobile 6.2.03	MOVES3.1	MOVES3.1	MOVES5	MOVES5
Parking / curbside	1	1	1	<1	<1
On-Airport vehicles	8	50	40	3	3
Total Motor Vehicle Sources	**9**	**51**	**41**	**3**	**3**

Source: Massport and CMT, 2025.

Notes: Values may reflect rounding.

LDMS – Logan Dispersion Modeling System

AEDT – Aviation Environmental Design Tool

MOVES – Motor Vehicle Emission Simulator

kg/day - kilograms per day. 1 kg/day is equivalent to approximately 0.40234 tons per year (tpy).

1 See the Boston Logan International Airport 2022 Environmental Status and Planning Report (ESPR), published in May 2024, for historical emission inventory results.

8.3.4.2 2023 Particulate Matter ($PM_{10}/PM_{2.5}$)

In 2023, total $PM_{10}/PM_{2.5}$ emissions from all airport-related sources at Logan Airport were estimated at 25 tpy, or approximately 63 kg/day. As shown in **Figure 8-4**, aircraft represent the largest source of $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2023, accounting for approximately 80 percent of the total. GSE and APU sources contributed approximately 13 percent, while motor vehicles and other sources made up the remaining 7 percent. The 2023 $PM_{10}/PM_{2.5}$ emission results are compared to the 2022 levels in the following sections, categorized by source.

Aircraft

As shown in **Table 8-16**, total aircraft-related $PM_{10}/PM_{2.5}$ emissions increased by 6 percent in 2023 (modeled using AEDT3g) compared to 2022 (modeled using AEDT3e). However, it is notable that when emissions are compared using the same model versions (i.e., AEDT 3e), $PM_{10}/PM_{2.5}$ emissions decreased slightly. Therefore, this 6 percent increase is attributable primarily to updates to AEDT3g and secondarily due to higher aircraft operations.

GSE

As shown in **Table 8-15**, GSE-related $PM_{10}/PM_{2.5}$ emissions, including APUs, were 24 percent lower in 2023 (modeled using AEDT3g) than in 2022 (modeled using AEDT3e). A reduction is also observed when the same model version is applied in 2023 as in 2022 (i.e., AEDT3e), indicating that this reduction is due to Massport's continued efforts to implement the use of GSE AVFs at Logan Airport.

Motor Vehicles

As shown in **Table 8-17**, in 2023, $PM_{10}/PM_{2.5}$ emissions (modeled using MOVES5) from motor vehicles at Logan Airport decreased by 94 percent compared to 2022 levels (modeled in MOVES3.1). This sharp decline is primarily due to the transition from MOVES3.1 to MOVES5. Specifically, in MOVES5, the U.S. EPA incorporated revisions to passenger vehicles and trucks' brake system technologies and materials, which have led to lower $PM_{10}/PM_{2.5}$ emissions.

Other Sources

As shown in **Table 8-15,** in 2023, $PM_{10}/PM_{2.5}$ emissions from stationery and other non-mobile sources at Logan Airport decreased by 53 percent compared to 2022 levels. This reduction is primarily due to lower fuel usage, with the most significant decreases observed in generators and snow melter operations.

8.3.4.3 2024 Particulate Matter ($PM_{10}/PM_{2.5}$)

The 2024 total $PM_{10}/PM_{2.5}$ emissions from all airport-related sources at Logan Airport were estimated at 68 tpy, or approximately 27 kg/day. As shown in **Figure 8-4**, aircraft continue to represent the largest source of $PM_{10}/PM_{2.5}$ emissions at Logan Airport in 2024, accounting for approximately 79 percent of the total. GSE and APU sources contributed approximately 14 percent, while motor vehicles and other sources accounted for the remaining 7 percent.

Aircraft

Total aircraft-related $PM_{10}/PM_{2.5}$ emissions increased by 7 percent in 2024 compared to 2023, based on modeling with AEDT3g for both years. This increase was primarily due to the rise in aircraft operations and adjustments to fleet mixes.

GSE

In 2024, $PM_{10}/PM_{2.5}$ emissions from GSE, including APUs, were 11 percent higher than in 2023, based on modeling with AEDT3g. This increase is attributed mainly to changes in aircraft operations and fleet mix between the two analysis years, which directly influence GSE and APU assignments to aircraft.

Motor Vehicles

In 2024, $PM_{10}/PM_{2.5}$ emissions from motor vehicles at Logan Airport increased by 1 percent compared to 2023, based on modeling using MOVES5. This increase is primarily attributable to an increase in VMT data in 2024.

Other Sources

In 2024, $PM_{10}/PM_{2.5}$ emissions from stationary and other non-mobile sources at Logan Airport increased by 7 percent compared to 2023. This rise is primarily due to higher activity levels among stationary equipment, with the most significant increases observed in boilers, generators, and snow melters.

8.4 Greenhouse Gas Emissions Inventory Results

Massport continues to voluntarily report on GHG emissions associated with airport activities in EDRs and ESPRs. GHG emission inventories computed for this *2023/2024 EDR* are consistent, wherever applicable, with the data provided by Massport for the MassDEP and U.S. EPA GHG inventories for Logan Airport for 2023/2024.

The *2023/2024 EDR* emissions inventories presented are more comprehensive, as they cover all three scopes of GHG emissions, including those from tenants and the public. In contrast, the MassDEP and U.S. EPA GHG Reporting Programs cover only stationary sources (Scope 1 sources) such as buildings, the CHP, snow melters, and emergency generators.

Logan Airport recently entered the ACA program and has achieved Level 1 – Mapping.

The *2023/2024 EDR* GHG inventories are consistent with the Airport Carbon Accreditation (ACA) Program administered by Airports Council International (ACI). For more information on Massport's ownership categorization and Logan Airport's GHG emission sources by Scope, see **User's Guide, Section U8.2.5.**

User's Guide Section U8.2.5

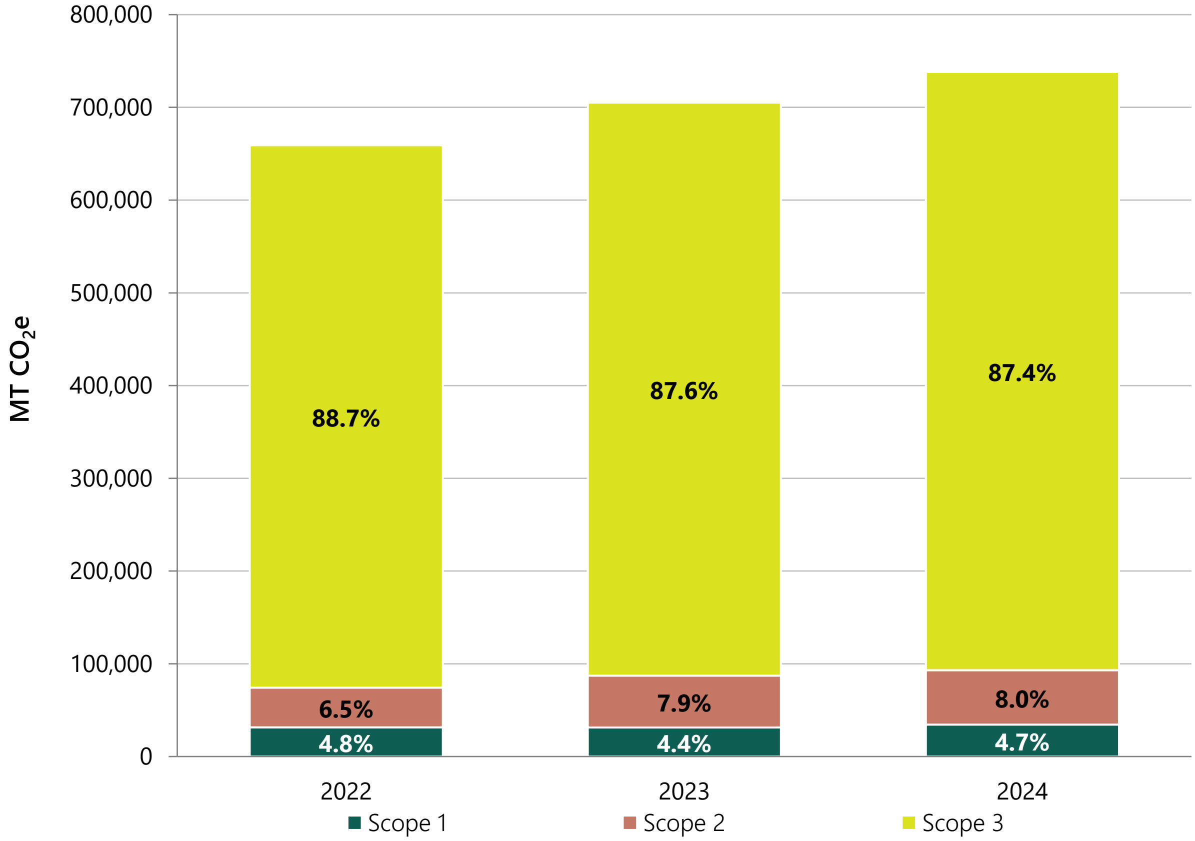
8.4.1 GHG Emissions

Table 8-18 presents 2022 to 2024 GHG emissions inventories. The emissions are broken out by Scopes 1, 2, and 3 and are reported in MT CO_2e.[8] Data inputs and emission factors used to estimate GHG emissions are found in Appendix J, Section J.1.5.

Figure 8-5 and **Table 8-19** present the share of GHG emissions for Logan Airport by scope for the years 2022 through 2024. Additionally, **Table 8-19** provides a comparison of the GHG emissions to statewide and Boston citywide totals, in MT CO_2e for years 2022 through 2024. Increased GHG emissions for Scopes 1, 2, and 3 are generally attributed to an increase in aircraft and passenger activity levels, as well as updates to air quality models and revised methodologies. Estimated total GHG emissions at Logan Airport from 2017 through 2022 are provided in the *2022 ESPR*, published in May of 2024.

8 CO_2 equivalent values are based upon the GWP values of 1 for CO_2, 29.8 for CH_4, and 273 for N_2O (based on a 100-year period) as presented in the IPCC Sixth Assessment Report (2023).

Figure 8-5 Figure 8-5 Sources of GHG Emissions by Scopes, 2022-2024



Source: Massport and CMT, 2025.

Notes: Scope 1 emissions are from sources that are owned or controlled by Massport (i.e., ground support vehicles, Massport shuttles, on-Airport traffic, and stationary sources), Scope 2 emissions are from electricity consumption (both Massport and tenant), which are generated off-Airport at power generating plants, and Scope 3 emissions are from aircraft, ground service equipment (GSE) including auxiliary power units (APUs), and ground transportation to and from the Airport.

Table 8-18 Estimated Greenhouse Gas Emissions (GHG) Inventory (in MT of CO_2e) by Scope at Logan Airport, 2022 through 2024

Scope	Source	2022				2023				2024			
		CO_2	N_2O	CH_4	Total	CO_2	N_2O	CH_4	Total	CO_2	N_2O	CH_4	Total
Scope 1	Massport ground service equipment[1]	4,523	10	5	4,538	4,692	11	6	4,709	4,932	12	6	4,950
	Massport shuttle bus	1,483	4	2	1,488	1,797	4	2	1,804	2,238	6	3	2,246
	Massport Logan Express bus	4,086	8	5	4,099	4,685	10	6	4,701	4,896	10	6	4,912
	Stationary sources[2]	21,298	14	12	21,324	19,982	11	11	20,004	22,209	12	13	22,234
	Fire training	56	<1	<1	57	38	<1	<1	38	29	<1	<1	29
Total Scope 1 by Emission Type		**31,446**	**36**	**24**	**31,506**	**31,194**	**36**	**25**	**31,256**	**34,304**	**40**	**28**	**34,371**
Total Scope 1 Emissions in MT of CO_2e		**31,506**				**31,256**				**34,371**			
Scope 2	Massport	4,524	23	18	4,564	--	--	--	46,081	--	--	--	48,301
	Tenant/Common area	37,950	190	149	38,289	--	--	--		--	--	--	
Total Scope 2 by Emission Type		**42,474**	**213**	**167**	**42,853**	**--**	**--**	**--**	**46,081**	**--**	**--**	**--**	**48,301**
Total Scope 2 Emissions in MT of CO_2e[3]		**42,853**				**46,081**				**48,301**			
Scope 3	Aircraft – Ground[4]	190,267	1,549	12	191,828	230,053	1,930	13	231,997	230,373	1,934	14	232,321
	Aircraft – Ground to 3,000 feet[5,6]	231,360	1,883	18	233,260	247,856	2,076	31	249,963	257,172	2,157	25	259,354
	Aircraft – Engine Startups	4,492	37	5	4,534	5,288	44	7	5,339	4,918	41	6	4,965
	APU	10,439	85	12	10,536	11,032	93	14	11,139	15,808	133	20	15,960
	GSE	13,362	192	28	13,582	14,482	451	65	14,998	14,712	456	66	15,234
	Passenger/Employee transportation[7]	50,029	131	34	50,194	98,173	164	68	98,405	110,987	197	72	111,255
	On-Airport parking lots[8]	6,465	28	2	6,496	5,980	27	2	6,009	6,044	26	2	6,073
Total Scope 3 by Emission Type		**506,414**	**3,905**	**111**	**510,430**	**612,864**	**4,785**	**200**	**617,850**	**640,014**	**4,944**	**205**	**645,162**
Total Scope 3 Emissions in MT of CO_2e		**510,430**				**617,851**				**645,163**			
Total Logan Airport Emissions in MT of CO_2e		**584,790**				**695,188**				**727,834**			

Source: Massport and CMT, 2025.

Notes: MT - metric tons of CO_2 equivalents (1 MT = 1.1 Short Tons). CO_2 equivalents (CO_2e) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition. CO – carbon monoxide, NO_X – oxides of nitrogen, and CH_4 – methane, APU - Auxiliary power units, and GSE - Ground service equipment.

1 Ground service equipment includes Massport-owned ground service vehicles.

2 Stationary sources include Central Heating Plant, emergency generators, snow melters, and the distributed building heating and cooling network.

4 Aircraft – Ground emissions include taxi-in, taxi-out, and ground-based delay emissions based on AEDT fuel usages.

5 Aircraft – Ground to 3,000 feet include takeoff, climb out, and approach emissions up to a height of 3,000 feet based on AEDT fuel usages.

6 The U.S. EPA published that: "…methane is no longer considered to be an emission from aircraft gas turbine engines burning Jet A at higher power settings and is, in fact, consumed in net at these higher powers. https://nepis.epa.gov/Exe/ZyPDF.cgi/P1003YX3.PDF?Dockey=P1003YX3.PDF.

7 Passenger and Employee Transportation includes off- and on-Airport employee/tenant/public vehicle trips.

8 The On-Airport parking lots category represents vehicles idling at terminal curbsides and parking garages/lots/areas.

Table 8-19 Comparison of Estimated Total Greenhouse Gas (GHG) Emissions (MT CO_2e) by Scope at Logan Airport – 2022 through 2024

Scope	2022		2023		2024	
	MT CO_2e	Percent Total	MT CO_2e	Percent Total	MT CO_2e	Percent Total
Scope 1 Emissions	31,506	5%	31,256	4%	34,371	5%
Scope 2 Emissions	42,853	7%	46,081	7%	48,301	7%
Scope 3 Emissions	510,430	87%	617,851	89%	645,163	89%
Total Emissions[1]	**584,790**	**100%**	**695,188**	**100%**	**727,834**	**100%**
Percent of State Totals[2]	**<1%**		**1%**		**1%**	
Percent of Boston's Citywide[3]	**9%**		**12%**		**13%**	

Source: Massport and CMT, 2025.

Notes: Totals may not add exactly due to rounding.

MT – metric tons of CO_2 equivalents (1 MT = 1.1 Short Tons). CO_2 equivalents (CO_2e) are bases for reporting the three primary GHGs (e.g., CO_2, N_2O, and CH_4) in common units. Quantities are reported as "rounded" and truncated values for ease of addition.

1 Total Emissions = Scope 1 + Scope 2+ Scope 3.

2 Percentage based on relative amount of total emissions to 2022 (latest available) statewide total from MassDEP, 2nd Addendum to the Statewide Greenhouse Gas Emissions Level: 1990 Baseline Update, June 2022, available at https://www.mass.gov/doc/2nd-addendum-to-statewide-ghg-level-proposed-1990-baseline-update-june-2022/download.

3 City of Boston, Boston Community GHG Emissions, updated July 09, 2025, https://www.boston.gov/departments/environment/bostons-carbon-emissions; and City of Boston, Boston Community GHG Emissions, updated March 21, 2022, https://www.boston.gov/departments/environment/bostons-carbon-emissions.

8.4.1.2 2023 GHG Emissions

As in previous years, the 2023 GHG emission inventories Scope 3 (e.g., aircraft, GSEs, and APUs) represented the largest source of Logan Airport emissions, followed by Scope 2 (i.e., electricity consumption), and Scope 1 (e.g., stationary sources, airport fleet vehicles), as shown in **Figure 8-5** and **Table 8-18**. Overall, total GHG emissions in 2023 increased by 19 percent from 2022 levels. The changes in GHGs are attributable to increases in operational and passenger activity levels, air quality model updates, as well as an increase in electrical usage due to the modernization and the expansion of Boston-Logan's Terminal E, which started in 2019 and concluded in August 2023. Furthermore, as shown in **Table 8-18**, GHG emissions associated with Logan Airport in 2023 represent 1 percent of the most recent statewide emissions estimates,[9] and approximately 12 percent of Boston's citywide emissions.[10] Massport plans to continue updating its GHG emissions inventory for Logan Airport annually.

9 2023 statewide totals are derived from Massachusetts Annual Greenhouse Gas emissions inventory 1990-2022, available at https://www.mass.gov/lists/massdep-emissions-inventories

10 City of Boston, Boston Community GHG Emissions, updated July 09, 2025, https://www.boston.gov/departments/environment/bostons-carbon-emissions.

8.4.1.3 2024 GHG Emissions

As in previous years, the 2024 GHG emission inventories Scope 3 (e.g., aircraft, GSEs and APUs) represented the largest source of Logan Airport emissions, followed by Scope 2 (i.e., electricity consumption), and Scope 1 (e.g., stationary sources, airport fleet vehicles), as shown in **Figure 8-9**.

In 2024, total GHG emissions at Logan Airport increased by 5 percent compared to 2023 levels. This rise is primarily attributed to a 5 percent increase in aircraft operational activity and a 7 percent increase in passenger volumes.

Furthermore, as shown in **Table 8-18**, GHG emissions associated with Logan Airport in 2024 represent 1 percent of the most recent statewide emissions estimates,[11] and approximately 13 percent of Boston's citywide emissions.[12] Massport plans to continue updating its GHG Emissions Inventory for Logan Airport on an annual basis.

8.5 Air Quality and GHG Emission Reduction Efforts

Massport aims to achieve Net Zero GHG emissions by 2031. The Roadmap to Net Zero focuses on reducing GHG emissions from Scope 1 sources directly controlled by Massport, such as Massport-owned facilities and equipment, and Scope 2 sources, namely purchased electricity. However, Massport will continue to influence Scope 3 sources, which are areas where Massport does not have direct or indirect control.

As part of implementing and advancing its on-going air quality management strategy for Logan Airport, Massport has established goals and objectives to address air emissions from Airport operations, including the minimization of Airport-related emissions through the reduction of GSE and Massport vehicle fleet emissions. This section presents an update on these initiatives at Logan Airport and highlights the progress made with other on-going Logan Airport-related air quality and emission reduction efforts as well as current studies on aviation-related air quality and public health issues.

Sustainable Aviation Fuel (SAF)

As part of the Roadmap to Net Zero effort and to support the federal goal of 3 billion gallons of Sustainable Aviation Fuel (SAF) use by 2030 for the aviation industry nationwide, Massport is collaborating with fuel vendors, airlines, and state and federal entities to secure SAF supplies in the Northeast. Massport is a founding member of the Zero Impact Aviation Alliance (ZIAA), which is a consortium of airports, aviation industry businesses, aircraft manufacturers, and academic institutions focused on achieving net zero for airport operations, including promoting SAF use. ZIAA is spearheaded by the Massachusetts Institute of Technology (MIT) through the Department of Aeronautics and Astronautics, and with their

11 2024 statewide totals are derived from Massachusetts Annual Greenhouse Gas emissions inventory 1990-2022, available at https://www.mass.gov/lists/massdep-emissions-inventories

12 City of Boston, Boston Community GHG Emissions, updated March 21, 2022, https://www.boston.gov/departments/environment/bostons-carbon-emissions.

support, ZIAA provides research-driven thought leadership across the aviation system to reduce environmental impacts. For more on the Roadmap to Net Zero and SAF, refer to Chapter 11, Section 11.2.

Single-Engine Taxiing

Single-engine taxiing is one measure being used by air carriers to help reduce fuel consumption and emissions. Prior studies have shown single-engine taxiing to be a crucial operational measure used by airlines to conserve fuel, which is widely employed at Logan Airport. However, some single-engine taxi challenges noted in prior studies include:

- Excessive thrust and associated issues;
- Maneuverability problems, particularly related to tight taxiway turns and weather;
- Problems starting the second engine; and
- Distractions and workload issues.

As a result, Massport supports the use of single-engine taxiing when it can be done safely, voluntarily, and at the pilot's discretion, but Massport continues to encourage the practice of single or reduced-engine taxiing and the use of idle reverse thrust. For more information on single-engine taxiing and effects on air quality and emissions, see the **User's Guide, Section U8.5.3**.

User's Guide Section U8.5.3

Ground Access Management Strategies

A comprehensive ground access strategy is essential to diversify and enhance passenger and employee transportation options while efficiently moving vehicles on the Airport property, thereby supporting Massport's emissions reduction initiatives. Massport is committed to reducing on-Airport VMT and emissions associated with airport roadways and curbsides, parking facilities, and vehicle staging areas, as well as reducing the VMT by Airport users traveling to and from the Airport. Chapter 6, Section 6.5 provides updates on Massport's ground access management strategies and their implementation over the 2023 and 2024 reporting years. In addition, the **User's Guide, Section U6.2** offers more detailed information on Massport's ground access, HOV, and parking management strategies.

User's Guide Section U6.2

8.5.1 Alternative Fuel Vehicles (AFV) Program and GSE Conversion

A component of Massport's Air Quality Management Program is the Alternative Fuel Vehicles (AFV) Program. The AFV Program is designed to replace Massport's conventionally fueled fleet with alternatively fueled or powered vehicles, when feasible, to help reduce emissions associated with Logan Airport operations. Massport operates more than 100 vehicles powered by alternative fuels like propane, E85 flex fuel, and electricity, or which use both alternative and traditional fuels, like diesel-electric hybrids and gasoline-electric hybrids. Future EDRs and ESPRs will provide a detailed inventory within Appendix J.

Table 8-20 presents the criteria air and precursor pollutant emissions reductions achieved by using AVF GSEs for 2023 and 2024 as well as what emissions would have been if these same GSE still had traditional, fossil fuel combustion engines.

Table 8-20 GSE Alternative Fuel Conversion Summary (kg/day)

Year	Pollutant	Emissions without AFV Use	Emissions Reduction with AFV Use	Emissions with AFV Use	Percent Reduction
2023	VOCs	13.2	3.6	9.6	-27.3%
	NO_X	19.7	5.3	14.4	-26.9%
	CO	505.5	136.5	369.0	-27.0%
	$PM_{10}/PM_{2.5}$	1.1	0.3	0.8	-27.3%
2024	VOCs	13.7	3.7	10.0	-27.0%
	NO_X	19.7	5.3	14.4	-26.9%
	CO	529.2	142.9	386.3	-27.0%
	$PM_{10}/PM_{2.5}$	1.1	0.3	0.8	-27.3%

Source: CMT and Massport, 2025.
Notes: Emission reductions may reflect rounding.
VOC – volatile organic compounds; NO_X – nitrogen oxides; CO – carbon monoxide; $PM_{10}/PM_{2.5}$ – particulate matter equal to or less than 10 microns in diameter (PM_{10}) and equal to or less than 2.5 microns in diameter ($PM_{2.5}$); and AFVs – alternative fuel vehicles.

8.5.2 Air Quality and GHG Management Plan

Massport's air quality and GHG management strategy for Logan Airport focuses on decreasing emissions from Airport-related sources, in addition to furthering innovative means to achieve emissions reductions Airport-wide. Massport's air quality and GHG improvement goals, the measures proposed to accomplish them, and some of the 2023 and 2024 milestones are listed in **Table 8-21**.

Table 8-21 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2023 and 2024 Updates
Reduce emissions from Massport/Tenant fleet vehicles	Convert Massport and Tenant fleet vehicles to electric, hybrid, or other alternative fuel by retrofitting or through new procurements.	Massport initiated a fleet decarbonization assessment to review the Authority's existing on-road fleet inventory and identify recommendations for electric vehicle (EV) replacements over the next 15 years, beginning in 2024, while examining the financial and environmental benefits of such transitions. The assessment is also identifying electric alternatives for Massport's off-road equipment. Refer to Section 11.2.3.3 for more information.

Table 8-21 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2023 and 2024 Updates
Encourage use of alternative fuel and alternative power vehicles by private fleet and airside service vehicle owners	Provide infrastructure to support alternative fuels including electricity and green hydrogen.	Massport continues to operate one of New England's largest retail compressed natural gas (CNG) stations, which is open to the public. Massport continued to expand upon the existing charging structure in 2023 and 2024. See Section 11.2.3.3 for more information.
Encourage use of alternative fuel and alternative power vehicles by private fleet and airside service vehicle owners	Work with ground access fleet and airside service vehicle owners to encourage conversion.	Massport is collaborating with the Massachusetts Clean Energy Center (MassCEC) to study opportunities to enable the conversion of ride-for-hire fleets serving Logan Airport to EVs. Massport received a grant in 2022 for further developing this infrastructure. See Section 11.2.3.3 for more information.
Minimize emissions from motor vehicles	Implement a program to increase high-occupancy vehicle (HOV) ridership by air passengers and employees.	As described in detail in Chapter 6, *Ground Access*, Section 6.5, there are numerous HOV services at Logan Airport that are aimed at air passengers, including the Massachusetts Bay Transportation Authority (MBTA) Blue Line and Silver Line, Massport's Logan Express, and water transportation. Massport promotes the use of these services by employees and passengers, primarily through various pricing incentives. Massport has developed a robust strategy to increase HOV options and use. Massport has a goal of reaching 35.5 percent HOV by 2022 and 40 percent HOV by 2027. Massport achieved the 2022 goal and continued to exceed it in 2023 and 2024.
	Expand HOV options for Airport employees.	Massport continues to provide commuting information to all Airport employees, including Sunrise and Logan Express Shuttles in 2023 and 2024. Logan Express offers extended service, providing nearly 24-hour service at several Logan Express locations, with significant discounts available to Airport-wide and Massport employees. Refer to Section 6.4 for more information.

Table 8-21 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2023 and 2024 Updates
	Encourage employees to use alternative transportation to commute.	Massport encourages employees to utilize public transit through a comprehensive employee transportation system. The system includes a 24/7 free shuttle bus service to the Terminals with off-Airport employee parking in Chelsea; shuttle buses connecting Airport Station to Southwest Service Area, South Cargo Area locations, and Terminals; early morning and late-night Logan Express bus trips; the Sunrise Shuttle that offers early morning services from East Boston, Winthrop, and Revere before the commencement of MBTA operations; subsidies for water transportation, transit use, and financial support for the Sunrise Shuttle; and discounted HOV and transit fare options. The MBTA introduced the Route 104 bus in 2024, providing a connection from Malden Center to Airport Station. Massport includes bike racks or posts for securing bikes at all new facilities and at appropriate existing facilities to promote employees biking to work. Bicycle racks or posts for securing bikes are currently provided at the Rental Car Center (RCC), Terminal A, Terminal E, Logan Office Center, MBTA's Airport Station, Economy Parking Garage, Signature General Aviation Facility, and the Green Bus Depot (Bus Maintenance Facility) for authorized personnel.
Minimize emissions from Construction Equipment	Incorporate Clean Air Construction Initiative (CACI) into major earthwork construction projects.	For all large construction projects, heavy construction equipment must continue to be equipped with diesel particulate filters or diesel oxidation catalysts in accordance with CACI.
Reduce emissions from fuel vapor loss	Provide state-of-the-art fuel storage and distribution equipment.	The Fuel Storage and Distribution System continued to be in operation to reduce the use of mobile fueling trucks and associated vapor losses.
	Implement Tank Management Program.	Refer to Chapter 9, Water Quality, which provides details regarding tank management and focuses on proper maintenance.
Reduce emissions from stationary sources	Employ Reasonable Available Control Technologies (RACT) for NO_X at the Central Heating Plant.	RACT policies have been implemented before 2023 and 2024. The focus of Massport's Net Zero by 2031 program is studying options for transitioning the Logan Central Heating Plant from fossil fuel-burning technologies. The Central Heating Plant is the largest single source of stationary emissions at Logan Airport.

Table 8-21 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2023 and 2024 Updates
	Use alternative fuels in snow melters.	At the time of this filing, Massport is piloting the use of renewable diesel, a sustainable fuel alternative to fossil-fuel-based diesel. This will primarily result in GHG emissions benefits; renewable diesel has also been shown to reduce PM, NO_X, CO, total hydrocarbons (THC), polycyclic aromatic hydrocarbons (PAHs), and VOCs.[3] See Section 11.2.3.2 for more details.
Reduce emissions from stationary sources	Incorporate green building technologies and energy use reduction strategies.	Massport continues to pursue LEED® certification, Envision™ Verification, and ParkSmart® Certification for relevant projects. See Section 11.1.2.1. for more details.
	Install diesel particulate filters on large emergency generators.	Since 2011, Massport has voluntarily installed diesel particulate filters on all large (>500 kilowatts) stationary emergency generators.
Reduce aircraft emissions	Use of pre-conditioned air (PCA) at new and renovated terminals and terminal gates.	All contact gates have PCA and/or 400-Hz power. This reduces the time-in-mode (TIM) of auxiliary power units (APUs) and consequently reduces associated emissions. The recent improvements at Terminal B and the Terminal B-C Connector project and the new gates at Terminal E included the installation of PCA at all new/renovated gates.

Table 8-21 Air Quality Management Strategy Status

Air Quality Emissions Reduction Goals	Plan Elements	2023 and 2024 Updates
	Work with FAA to study and implement airfield-improvement concepts and operational changes that may have air quality benefits.	Massport promoted such concepts through the Logan Airside Improvements Planning Project, which recommended physical and operational improvements to Logan Airport. • Massport conducted surveys to understand the extent of single-engine taxiing at Logan Airport and supported a more detailed study by MIT in 2009. The surveys found that single-engine taxiing is an important measure used by airlines to conserve fuel • To better understand single-engine taxiing use, FAA issued a paper in March 2010. In January 2011, MIT published a paper on aircraft pushback control strategies aimed at reducing congestion and taxi delays. • In addition to the MIT study on single-engine taxiing, Massport continues to: • Promote single-engine taxiing directly to chief pilots and airlines when safe. • Collaborate with MIT on national research on reducing departure queues on the airfield. Logan Airport-related work is complete and is now being tested at other airports. • Conduct a runway incursion mitigation study to include the potential for holding pads at appropriate locations to reduce aircraft queues at runway ends (closer to communities). • Manage an engine run-up location at the end of Runway 14-32 away from communities.
Reduce energy intensity and greenhouse gas (GHG) emissions while increasing portion of Logan Airport's energy generated from renewable sources	Increase the portion of Massport's energy generated from renewable sources. Reduce overall GHG emissions from Massport-operated mobile sources and energy consumed in Massport-operated facilities.	This goal was identified as part of the Logan Airport's Sustainability Management Plan (SMP), [2] which was released in April 2015. In the *2018 Annual Sustainability &Resiliency Report*, Massport identified several policies and initiatives it is implementing to achieve this goal, including pursuing LEED® accreditation for new projects and upgrading to energy-efficient heating, ventilation, and air conditioning (HVAC) systems. See section 11.2.3.2

Source: Massport, 2024.

1 U.S. EPA, "National DERA Awarded Grants," https://www.epa.gov/dera/national-dera-awarded-grants.

2 Progress towards goals identified as part of the Logan Airport's SMP will be reported separately, as part of Massport's annual sustainability reporting.

3 State of California Environmental Protection Agency, "Multimedia Evaluation of Renewable Diesel," Renewable_Diesel_Multimedia_Evaluation_5-21-15.pdf (ca.gov).

8.6 Air Quality Studies and Topics

The following sections provide an overview of air quality-related studies during the reporting timeframe as relevant to Logan Airport. These studies and topics include research presented in MEPA's Logan Airport Work Group, as discussed in Chapter 2, *Outreach and Environmental Justice*, Section 2.2.4.2.

User's Guide Section U8.6

In addition to this summary of recent applicable research, the **User's Guide, Section U8.6** discusses air quality studies and their relation to public health around Logan Airport in greater detail. It includes an overview of a Massachusetts Department of Public Health study that evaluated the potential health impacts of airport operations. The User's Guide also covers Massport's cooperation and contributions to these studies, including technical and financial support for research and community health initiatives, such as asthma and COPD prevention programs.

The MassDPH Study findings can be viewed online at:

https://www.mass.gov/doc/logan-airport-health-study-english-0/download.

In addition, the User's Guide presents recent research into the effects of aviation emissions on air quality and public health, highlighting studies from Tufts University, Olin College, the University of Southern California, and the University of Washington. These studies investigate pollutant concentrations in residential areas near airports, monitor air quality in affected communities, and explore the health implications of exposure to ultrafine particles (UFPs), black carbon (BC), and other pollutants. The User's Guide includes summaries of comprehensive research by the National Academies of Science, Engineering, and Medicine's Transportation Research Board (TRB) and Airports Cooperative Research Program (ACRP) as well as a collaborative study led by the University of North Carolina at Chapel Hill and Harvard University's T.H. Chan School of Public Health's Center for Climate, Health, and the Global Environment (Harvard Chan C-CHANGE), both of which address the broader impacts of airport-related emissions and suggest mitigation strategies.

8.6.1 Recent Studies on Impacts of Aviation Emissions on Air Quality

Massport continues to stay apprised of studies regarding the impact of aviation on air quality and public health. Findings from many of the following studies have been discussed as a part of MEPA's Logan Airport Work Group, and lead researchers from several of these studies have presented to the Work Group.

Transportation Research Board (TRB) Studies

In 2023 as part of the TRB Annual and Mid-Year Meetings the following presentations on UFP research studies were given:

- *Changes in Ultrafine Particle Concentrations near a Major Airport Following Reduced Transportation Activity during the COVID-19 Pandemic* by Sean Mueller et al., 2022.

- *Air Quality Impacts of Aviation Activities at a Mid-sized Airport in Central Europe* by Ivonne Trebs et al., 2023.

The Mueller et al. study, an ASCENT supported project, shows the effect of pandemic-related mobility changes on UFP counts in a near-airport community and distinguishes aviation-related and ground transportation source contributions. Additionally, the Trebs et al study concluded that UFP counts at the study airport declined during the daytime, despite significant flight activities during that same time period due to efficient turbulent mixing of air.

The TRB's ACRP Report 135: *Understanding Airport Air Quality and Public Health Studies Related to Airports* provides a comprehensive overview of how airport-related emissions affect air quality and public health. Over the reporting period for this EDR, a second edition released in 2024 expands on climate change, environmental justice, and tools for community risk communication.

Additional Air Quality Research

The following recently published studies were discussed during MEPA's Logan Airport Work Group meetings, which began in 2025 in response to the MEPA Secretary's comments on the *2022 ESPR*. Further information on these studies and findings is provided in the **User's Guide, Section U8.6.2**.

User's Guide Section U8.6.2

- **Aircraft arrival and departure contribution to ultrafine particle size distribution in a near airport community (van Loenen et al, 2025):** This research used flight activity and meteorology data to analyze UFP concentrations and size distributions at an airport monitoring site and determined concentrations were greatest downwind of the airport.[13]
- **Assessing the impact of aircraft arrival on ambient ultrafine particle number concentrations in near-airport communities in Boston, Massachusetts (Chung et al, 2023):** This study found ambient UFP concentrations varied significantly, but were notably elevated during hours with high aircraft activity, particularly downwind from Logan Airport.[14]
- **Aviation-Related Impacts on Ultrafine Particle Number Concentrations Outside and Inside Residences near an Airport (Hudda et al, 2018):** Conducted in Chelsea and Boston residential areas, this research found both outdoor and indoor UFP concentrations increased when winds came from the Airport's direction; however the study emphasized the need for further investigation as these impacts are likely not unique to Logan Airport.[15]

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13 van Loenen, B. D., Black-Ingersoll, F., Durant, J. L., Levy, J. I., Patil, P., Mueller, S. C., Gause, E., Hudda, N., Bermudez, M., & Lane, K. J. (2025). Aircraft arrival and departure contribution to ultrafine particle size distribution in a near airport community. Environmental Science & Technology, 59(25), 12853-12864. https://doi.org/10.1021/acs.est.5c04799

14 Chung, C. S., Lane, K. J., Black-Ingersoll, F., Kolaczyk, E., Schollaert, C., Li, S., Simon, M. C., & Levy, J. I. (2023). Assessing the impact of aircraft arrival on ambient ultrafine particle number concentrations in near-airport communities in Boston, Massachusetts. Environmental research, 225, 115584. https://doi.org/10.1016/j.envres.2023.115584

15 Hudda, N., Simon, M. C., Zamore, W., & Durant, J. L. (2018). Aviation-Related Impacts on Ultrafine Particle Number Concentrations Outside and Inside Residences near an Airport. Environmental science & technology, 52(4), 1765–1772. https://doi.org/10.1021/acs.est.7b05593

- **Aviation Emissions Impact Ambient Ultrafine Particle Concentrations in the Greater Boston Area (Hudda et al 2016):** Notably, this research found UFP concentrations rose with increasing wind speed from the Airport's direction, suggesting aviation emissions were the source, whereas other pollutants such as CO and BC decreased with wind speed, indicating a separate source likely from road traffic.[16]

8.6.2 Engagement in Aviation-Related Environmental Issues

Massport maintains membership and active participation in organizations that address aviation-related environmental issues, including air quality. These include environmental committees for TRB, the American Association of Airport Executives (AAAE), and the Airports Council International-North America (ACI-NA). Massport is also cooperating with Boston University, Tufts University, and other researchers in identifying aircraft-specific related UFPs in an urban environment with non-airport related sources. This research is on-going in the East Boston area and Massport continues to contribute by providing Logan Airport operational and other pertinent data.

16 Hudda, N., Simon, M. C., Zamore, W., Brugge, D., & Durant, J. L. (2016). Aviation Emissions Impact Ambient Ultrafine Particle Concentrations in the Greater Boston Area. Environmental science & technology, 50(16), 8514–8521. https://doi.org/10.1021/acs.est.6b01815