# Airport Emissions Inventory
# Denver International Airport

Prepared for:
**City and County of Denver**
**Department of Aviation**
**Maintenance and Engineering Division**

Prepared by:
**Ricondo & Associates, Inc.**

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FINAL DRAFT

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# ES. Executive Summary

The State of Colorado Air Pollution Control Division (APCD) is currently in the process of updating the carbon monoxide (CO) and particulate matter ($PM_{10}$) maintenance plans covering the Denver metropolitan area. The City and County of Denver Department of Aviation (Department of Aviation) wishes to provide information to the APCD specific to and consistent with current planning efforts and activity at Denver International Airport (DIA) for incorporation into the updated maintenance plans. The Department of Aviation previously submitted airport emissions data to APCD in support of the CO State Implementation Plan (SIP) in 1999, the ozone (O3) SIP in 2000, and the $PM_{10}$ SIP in 2001. For the 2005 revisions to the CO and $PM_{10}$ plans, the Department of Aviation prepared a Protocol Document **[ES-1]** with APCD guidance. This Airport Emissions Inventory follows the methodologies outlined in the Protocol Document.

This document presents the data and estimating approach used to prepare airport emission inventories for Denver International Airport for the following analysis years: 2001, 2009, 2010, 2013, 2015, 2020, 2025, and 2030. The document is organized into four sections and several technical appendices. Section I "Introduction" provides some background information regarding the air quality status of the Denver metropolitan area, pollutants evaluated in the airport emissions inventory study, and sources of emissions at Denver International Airport that were quantified as part of the study. Section II "Operational Emissions" provides information regarding emissions from airport operational sources including aircraft, auxiliary power units, ground support equipment, City support equipment, minor point sources, firefighting training, and unpaved roads. Section III "Construction Emissions" provides information regarding emissions from airport construction sources including land development, asphalt paving, concrete batching, asphalt batching, and construction equipment.

This executive summary provides a summary of total airport-related emissions for each of the analysis years described above. **Tables ES-1 through ES-5** provide estimates of emissions (tons per year and tons per day) for each source and analysis year. The following criteria pollutants were evaluated: CO, $PM_{10}$, sulfur dioxide ($SO_2$), and ozone precursors: volatile organic compounds (VOC) and oxides of nitrogen ($NO_x$). For the purposes of this study oxides of sulfur ($SO_x$) were assumed to be equivalent to $SO_2$.

Tons per day data provided in Tables ES-1 through ES-5 were calculated by dividing the annual emissions data by 365 days; therefore, the tons per day numbers represent an annual average day and not a "winter" day. Nevertheless, seasonality was considered during the development of the Airport Emissions Inventory and, as discussed in the Protocol Document, some airport-related emission sources were excluded from the analysis since APCD is developing a "winter" emissions inventory in support of the updated CO and $PM_{10}$ maintenance plans. Airport-related sources of emissions that were not considered in this study include agricultural operations and oil field construction. In hindsight the City and County of Denver Department of Aviation has decided that the Airport Emissions Inventory would have been more comprehensive if these sources had been addressed, and respectfully requests that these sources be evaluated and added to the Airport Emissions Inventory when the APCD initiates its update to the Ozone maintenance plan.

Appendix G "Grids for Regional Air Quality Modeling" contains the Department of Aviation's recommendations regarding the apportionment of airport-related emissions to APCD's grid cells in support of future regional air quality modeling to be conducted by APCD.

**Table ES-1**

Carbon Monoxide Emissions Summary – Denver International Airport

| Inventory Sub-Category | Carbon Monoxide (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 2,470.74 | 3,555.65 | 3,649.35 | 3,922.99 | 4,101.69 | 4,528.47 | 4,936.28 | 5,393.86 |
| Airport Equipment[2/] | 9,977.79 | 12,394.42 | 12,852.57 | 13,604.77 | 14,195.39 | 15,645.22 | 17,053.79 | 18,624.43 |
| Firefighting Training | 0.44 | 0.86 | 0.94 | 1.22 | 1.22 | 1.22 | 1.22 | 1.22 |
| Minor Point Sources | 40.33 | 54.21 | 55.80 | 60.31 | 62.69 | 71.40 | 79.61 | 87.67 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 19.01 | 19.01 | 19.01 | 19.01 | 19.01 | 19.01 | 19.01 | 19.01 |
| Construction Equipment | 125.78 | 125.78 | 125.78 | 125.78 | 125.78 | 125.78 | 125.78 | 125.78 |
| **Total** | 12,634.09 | 16,149.93 | 16,703.45 | 17,734.08 | 18,505.78 | 20,391.10 | 22,215.69 | 24,251.97 |

| Inventory Sub-Category | Carbon Monoxide (tons/day)[4/] 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| Aircraft[1/] | 6.7692 | 9.7415 | 9.9982 | 10.7479 | 11.2375 | 12.4068 | 13.5241 | 14.7777 |
| Airport Equipment[2/] | 27.3364 | 33.9573 | 35.2125 | 37.2733 | 38.8915 | 42.8636 | 46.7227 | 51.0258 |
| Firefighting Training | 0.0012 | 0.0024 | 0.0026 | 0.0033 | 0.0033 | 0.0033 | 0.0033 | 0.0033 |
| Minor Point Sources | 0.1105 | 0.1485 | 0.1529 | 0.1652 | 0.1718 | 0.1956 | 0.2181 | 0.2402 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 0.0521 | 0.0521 | 0.0521 | 0.0521 | 0.0521 | 0.0521 | 0.0521 | 0.0521 |
| Construction Equipment | 0.3446 | 0.3446 | 0.3446 | 0.3446 | 0.3446 | 0.3446 | 0.3446 | 0.3446 |
| **Total** | 34.6140 | 44.2464 | 45.7629 | 48.5864 | 50.7008 | 55.8660 | 60.8649 | 66.4437 |

Notes:
1/ The "Aircraft" source category includes emissions produced by aircraft operations and auxiliary power units. A detailed description is found in Section II.1.
2/ "Airport equipment" includes emissions produced by ground support equipment and city support equipment. A detailed description is found in Section II.2.
3/ Construction emissions are discussed in Section III.
4/ Tons per day were calculated by dividing the tons per year data by 365 days per year.
n.a. = not applicable

Source: Ricondo & Associates, Inc
Prepared by: Ricondo & Associates, Inc.

**Table ES-2**

$PM_{10}$ Emissions Summary – Denver International Airport

| Inventory Sub-Category | $PM_{10}$ (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 166.69 | 212.06 | 217.66 | 233.65 | 244.05 | 268.68 | 291.95 | 319.00 |
| Airport Equipment[2/] | 27.54 | 31.18 | 34.16 | 32.41 | 45.23 | 53.31 | 58.06 | 63.34 |
| Firefighting Training | 1.47 | 2.90 | 3.16 | 4.10 | 4.10 | 4.10 | 4.10 | 4.10 |
| Minor Point Sources | 7.92 | 8.83 | 9.16 | 10.00 | 10.50 | 11.99 | 13.50 | 15.09 |
| Unpaved Roads | 148.04 | 148.04 | 148.04 | 148.04 | 148.04 | 148.04 | 148.04 | 148.04 |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 97.99 | 97.99 | 97.99 | 97.99 | 97.99 | 97.99 | 97.99 | 97.99 |
| Construction Equipment | 32.66 | 32.66 | 32.66 | 32.66 | 32.66 | 32.66 | 32.66 | 32.66 |
| **Total** | 482.31 | 533.66 | 542.83 | 558.85 | 582.57 | 616.77 | 646.30 | 680.22 |

| Inventory Sub-Category | $PM_{10}$ (tons/day)[4/] 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 0.8212 | 1.1515 | 1.1796 | 1.2599 | 1.3122 | 1.4381 | 1.5583 | 1.7027 |
| Airport Equipment[2/] | 0.0754 | 0.0854 | 0.0936 | 0.0888 | 0.1239 | 0.1460 | 0.1591 | 0.1735 |
| Firefighting Training | 0.0011 | 0.0079 | 0.0087 | 0.0112 | 0.0112 | 0.0112 | 0.0112 | 0.0112 |
| Minor Point Sources | 0.0217 | 0.0242 | 0.0251 | 0.0274 | 0.0288 | 0.0328 | 0.0370 | 0.0413 |
| Unpaved Roads | 0.4056 | 0.4056 | 0.4056 | 0.4056 | 0.4056 | 0.4056 | 0.4056 | 0.4056 |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 0.2685 | 0.2685 | 0.2685 | 0.2685 | 0.2685 | 0.2685 | 0.2685 | 0.2685 |
| Construction Equipment | 0.0895 | 0.0895 | 0.0895 | 0.0895 | 0.0895 | 0.0895 | 0.0895 | 0.0895 |
| **Total** | 1.6830 | 2.0326 | 2.0706 | 2.1509 | 2.2397 | 2.3917 | 2.5292 | 2.6923 |

Notes:
1/ The "Aircraft" source category includes emissions produced by aircraft operations and auxiliary power units. A detailed description is found in Section II.1.
2/ "Airport equipment" includes emissions produced by ground support equipment and city support equipment. A detailed description is found in Section II.2.
3/ Construction emissions are discussed in Section III.
4/ Tons per day were calculated by dividing the tons per year data by 365 days per year.
n.a. = not applicable

Source: Ricondo & Associates, Inc
Prepared by: Ricondo & Associates, Inc.

**Table ES-3**

Oxides of Sulfur Emissions ($SO_x$) Summary – Denver International Airport

| Inventory Sub-Category | $SO_x$ (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 216.05 | 275.54 | 283.13 | 305.69 | 320.47 | 355.97 | 390.20 | 426.36 |
| Airport Equipment[2/] | 48.09 | 52.70 | 67.15 | 58.50 | 55.08 | 59.77 | 65.50 | 71.49 |
| Firefighting Training | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Minor Point Sources | 1.17 | 1.31 | 1.34 | 1.43 | 1.49 | 1.64 | 1.81 | 1.95 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 32.06 | 32.06 | 32.06 | 32.06 | 32.06 | 32.06 | 32.06 | 32.06 |
| Construction Equipment | 35.76 | 5.50 | 2.58 | 0.50 | 0.17 | 0.17 | 0.17 | 0.17 |
| **Total** | 333.13 | 367.11 | 386.26 | 398.18 | 409.27 | 449.61 | 489.74 | 532.03 |

| Inventory Sub-Category | $SO_x$ (tons/day)[4/] 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 0.5919 | 0.7549 | 0.7757 | 0.8375 | 0.8780 | 0.9752 | 1.0690 | 1.1681 |
| Airport Equipment[2/] | 0.1318 | 0.1444 | 0.1840 | 0.1603 | 0.1509 | 0.1637 | 0.1794 | 0.1959 |
| Firefighting Training | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Minor Point Sources | 0.0032 | 0.0036 | 0.0037 | 0.0039 | 0.0041 | 0.0045 | 0.0050 | 0.0053 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 0.0878 | 0.0878 | 0.0878 | 0.0878 | 0.0878 | 0.0878 | 0.0878 | 0.0878 |
| Construction Equipment | 0.0980 | 0.0151 | 0.0071 | 0.0014 | 0.0005 | 0.0005 | 0.0005 | 0.0005 |
| **Total** | 0.9127 | 1.0058 | 1.0583 | 1.0909 | 1.1213 | 1.2317 | 1.3417 | 1.4576 |

Notes:

1/ The "Aircraft" source category includes emissions produced by aircraft operations and auxiliary power units. A detailed description is found in Section II.1.

2/ "Airport equipment" includes emissions produced by ground support equipment and city support equipment. A detailed description is found in Section II.2.

3/ Construction emissions are discussed in Section III.

4/ Tons per day were calculated by dividing the tons per year data by 365 days per year.

n.a. = not applicable

Source: Ricondo & Associates, Inc
Prepared by: Ricondo & Associates, Inc.

**Table ES-4**

Volatile Organic Compounds Emissions Summary – Denver International Airport

| Inventory Sub-Category | VOC (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 299.73 | 420.30 | 430.55 | 459.87 | 478.96 | 524.91 | 568.79 | 621.48 |
| Airport Equipment[2/] | 399.20 | 470.48 | 490.25 | 510.91 | 527.96 | 578.74 | 629.93 | 687.62 |
| Firefighting Training | 0.40 | 0.79 | 0.86 | 1.11 | 1.11 | 1.11 | 1.11 | 1.11 |
| Minor Point Sources | 138.29 | 169.75 | 176.93 | 185.41 | 192.30 | 211.68 | 236.10 | 266.20 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 79.42 | 79.42 | 79.42 | 79.42 | 79.42 | 79.42 | 79.42 | 79.42 |
| Construction Equipment | 38.80 | 38. 80 | 38. 80 | 38. 80 | 38. 80 | 38. 80 | 38. 80 | 38. 80 |
| **Total** | 955.84 | 1,140.74 | 1,178.01 | 1,236.72 | 1,279.75 | 1,395.86 | 1,515.35 | 1,655.83 |

| Inventory Sub-Category | VOC (tons/day)[4/] 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 0.8212 | 1.1515 | 1.1796 | 1.2599 | 1.3122 | 1.4381 | 1.5583 | 1.7027 |
| Airport Equipment[2/] | 1.0937 | 1.2890 | 1.3432 | 1.3998 | 1.4465 | 1.5856 | 1.7258 | 1.8839 |
| Firefighting Training | 0.0011 | 0.0022 | 0.0024 | 0.0030 | 0.0030 | 0.0030 | 0.0030 | 0.0030 |
| Minor Point Sources | 0.3789 | 0.4651 | 0.4847 | 0.5080 | 0.5269 | 0.5799 | 0.6468 | 0.7293 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 0.2176 | 0.2176 | 0.2176 | 0.2176 | 0.2176 | 0.2176 | 0.2176 | 0.2176 |
| Construction Equipment | 0.1063 | 0.1063 | 0.1063 | 0.1063 | 0.1063 | 0.1063 | 0.1063 | 0.1063 |
| **Total** | 2.6188 | 3.2317 | 3.3338 | 3.4946 | 3.6125 | 3.9305 | 4.2578 | 4.6428 |

Notes:
1/ The "Aircraft" source category includes emissions produced by aircraft operations and auxiliary power units. A detailed description is found in Section II.1.
2/ "Airport equipment" includes emissions produced by ground support equipment and city support equipment. A detailed description is found in Section II.2.
3/ Construction emissions are discussed in Section III.
4/ Tons per day were calculated by dividing the tons per year data by 365 days per year.
n.a. = not applicable

Source: Ricondo & Associates, Inc
Prepared by: Ricondo & Associates, Inc.

**Table ES-5**

Oxides of Nitrogen Emissions Summary – Denver International Airport

| Inventory Sub-Category | $NO_x$ (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 2,322.43 | 2,899.20 | 2,979.45 | 3,220.81 | 3,379.03 | 3,760.35 | 4,129.90 | 4,512.77 |
| Airport Equipment[2/] | 771.23 | 637.36 | 732.76 | 599.75 | 528.84 | 504.55 | 530.20 | 569.00 |
| Firefighting Training | 0.08 | 0.16 | 0.17 | 0.22 | 0.22 | 0.22 | 0.22 | 0.22 |
| Minor Point Sources | 41.00 | 52.94 | 54.52 | 59.08 | 61.72 | 69.99 | 78.10 | 86.03 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 62.25 | 62.25 | 62.25 | 62.25 | 62.25 | 62.25 | 62.25 | 62.25 |
| Construction Equipment | 349.27 | 349.27 | 349.27 | 349.27 | 349.27 | 349.27 | 349.27 | 349.27 |
| **Total** | 3,546.26 | 4,001.18 | 4,178.42 | 4,291.38 | 4,381.33 | 4,746.63 | 5,149.94 | 5,579.54 |

| Inventory Sub-Category | $NO_x$ (tons/day)[4/] 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|
| **Operational Emissions** | | | | | | | | |
| Aircraft[1/] | 6.3628 | 7.9430 | 8.1629 | 8.8241 | 9.2576 | 10.3023 | 11.3148 | 12.3637 |
| Airport Equipment[2/] | 2.1130 | 1.7462 | 2.0076 | 1.6431 | 1.4489 | 1.3823 | 1.4526 | 1.5589 |
| Firefighting Training | 0.0002 | 0.0004 | 0.0005 | 0.0006 | 0.0006 | 0.0006 | 0.0006 | 0.0006 |
| Minor Point Sources | 0.1123 | 0.1451 | 0.1494 | 0.1619 | 0.1691 | 0.1918 | 0.2140 | 0.2357 |
| Unpaved Roads | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| **Construction Emissions**[3/] | | | | | | | | |
| Construction | 0.1705 | 0.1705 | 0.1705 | 0.1705 | 0.1705 | 0.1705 | 0.1705 | 0.1705 |
| Construction Equipment | 0.9569 | 0.9569 | 0.9569 | 0.9569 | 0.9569 | 0.9569 | 0.9569 | 0.9569 |
| **Total** | 9.7157 | 10.9621 | 11.4478 | 11.7571 | 12.0036 | 13.0044 | 14.1094 | 15.2863 |

Notes:
1/ The "Aircraft" source category includes emissions produced by aircraft operations and auxiliary power units. A detailed description is found in Section II.1.
2/ "Airport equipment" includes emissions produced by ground support equipment and city support equipment. A detailed description is found in Section II.2.
3/ Construction emissions are discussed in Section III.
4/ Tons per day were calculated by dividing the tons per year data by 365 days per year.
n.a. = not applicable

Source: Ricondo & Associates, Inc
Prepared by: Ricondo & Associates, Inc.

# I. Introduction

The State of Colorado Air Pollution Control Division (APCD) is currently in the process of updating the carbon monoxide (CO) and particulate matter ($PM_{10}$) maintenance plans covering the Denver metropolitan region. The City and County of Denver Department of Aviation (Department of Aviation) wishes to provide information to the APCD specific to and consistent with current planning efforts and activity at Denver International Airport (DIA) to ensure that accurate information regarding sources of emissions at DIA is incorporated into the updated maintenance plans. This document presents the data and modeling approach used to prepare the airport emission inventories for DIA.

## 1.1 Background

The federal *Clean Air Act of 1970* **[I-1]**, as amended, requires that states identify those areas where the National Ambient Air Quality Standards (NAAQS) are not met for specific air pollutants. The U.S. Environmental Protection Agency (USEPA) has designated such areas as nonattainment areas. A State with a nonattainment area must prepare a State Implementation Plan (SIP) that details the programs and requirements that the State will use in order to meet the NAAQS by the deadlines specified in the *Clean Air Act Amendments of 1990* (CAAA) **[I-2]**.

The USEPA, pursuant to mandates of the CAAA, has established primary and secondary NAAQS for seven air contaminants, known as criteria pollutants **[I-3]**. These criteria pollutants are: carbon monoxide (CO), nitrogen dioxide ($NO_2$), ozone ($O_3$), particulate matter ($PM_{10}$ and $PM_{2.5}$), lead (Pb), and sulfur dioxide ($SO_2$). The primary standards were established at levels sufficient to protect public health with an adequate margin of safety. The secondary standards were established to protect public welfare from other adverse effects of air pollution.

Nonattainment areas that are brought into attainment for the NAAQS are reclassified as maintenance areas for criteria pollutants. For these areas, a State must convert its regional plan into a maintenance plan. The USEPA has defined two types of maintenance areas. The first classification is a transport maintenance area, which means that the pollutants found in the region are transported in by trade winds from another region. The second classification is for a non-transport maintenance area, which means that the pollutants are produced in the region. The Denver metropolitan area is considered a non-transport maintenance area.

### 1.1.1 Denver SIP Status

The air quality of the region in which Denver is located is managed via SIPs for three criteria pollutants: carbon monoxide (CO), ozone ($O_3$), and particulate matter with an aerometric diameter less than or equal to a nominal ten micrometers ($PM_{10}$). Historically, the Denver metropolitan area was determined to be a nonattainment area for each of these criteria pollutants; however, Denver's air quality has improved dramatically over the past thirty years. A description of the air quality status for each of the relevant criteria pollutants is given below.

- Effective October 11, 2001, the USEPA redesignated the Denver metropolitan area as attainment for ozone. With this designation, the area is classified as a maintenance area for ozone through 2014 **[I-4]**. In 2003, however, the Denver metropolitan area officially violated the 8-hour ozone standard, the "new" ozone standard promulgated by USEPA in July 1997. In anticipation of violations and to reduce ozone levels, a number of agencies in the Denver

metropolitan area entered into an ozone Early Action Compact (EAC) with USEPA in December 2002. An EAC allows a region to submit an enforceable plan outlining steps the region will take to maintain compliance with the ozone standard. In return, the USEPA will defer any potential nonattainment designation and give the area until 2007 to demonstrate attainment with the standard. Under the EAC, which was amended in early 2004, Denver retains its ozone maintenance area status until at least 2007 despite the violation of the 8-hour ozone standard in 2003.

- Effective January 14, 2002, the USEPA redesignated the Denver metropolitan area as attainment for carbon monoxide. With this designation, the area is classified as a maintenance area for carbon monoxide through the year 2014 **[I-5]**.
- Effective October 16, 2002, the USEPA redesignated the Denver metropolitan area as attainment for $PM_{10}$. With this designation, the area is classified as a maintenance area for $PM_{10}$ through the year 2015 **[I-6]**.

### 1.1.2 Pollutants Studied

The pollutants evaluated in the airport emissions inventories include carbon monoxide; ozone precursors: volatile organic compounds (VOC) and oxides of nitrogen ($NO_x$); and $PM_{10}$. $PM_{10}$ can also be formed from the interaction of $SO_x$ and $NO_x$ emissions, commonly called secondary particulates. These secondary particulates are not emitted as $PM_{10}$ directly, but are formed in the atmosphere through complex chemical reactions and conditions. $SO_x$ emissions from airport operational and construction sources have been included in the Airport Emissions Inventory for information purposes. Denver International Airport is not a significant source of lead; therefore, for purposes of this study, lead emissions were not quantified. In addition, $PM_{2.5}$ was not quantified in this study because the entire state of Colorado is classified as attainment for $PM_{2.5}$.

## 1.2 Estimating Tools

The development of the airport pollutant emissions inventory was conducted using the Emissions and Dispersion Modeling System (EDMS) and other industry-accepted computer models and techniques. EDMS is the Environmental Protection Agency's (USEPA's) preferred guideline model for air quality analyses at airports **[I-7]**. EDMS is a combined emissions and dispersion model developed by the Federal Aviation Administration (FAA) in cooperation with the United States Air Force (USAF) in the mid-1980s. The primary applications of the model are (1) generating an inventory of emissions caused by sources on and around an airport or air base and (2) calculating pollutant concentrations in the surrounding environment. System data tables include emission factors for civilian and military aircraft, civilian ground support equipment, and civilian motor vehicles. Both the emissions inventory and dispersion modeling modules interact with the system database to retrieve and store data.

The EDMS emissions inventory module incorporates USEPA-approved methodologies for calculating aircraft emissions, on- and off-road vehicle emissions, and stationary source emissions. Pollutants currently included in EDMS for emissions inventories are carbon monoxide (CO), hydrocarbons (HC), volatile organic compounds (VOC), oxides of nitrogen ($NO_x$), oxides of sulfur ($SO_x$), and particulate matter less than 10 microns in diameter ($PM_{10}$).

In 2001, the FAA re-engineered EDMS to incorporate new data and algorithms and released EDMS Version 4.0. The FAA subsequently released Versions 4.1, 4.11, 4.12 and 4.2 of the EDMS. EDMS 4.2 is the most current release of the model and was used for the Airport Emissions Inventory study.

EDMS Version 4.2 includes advances in data inputs for aircraft performance and auxiliary power units (APUs) and new data for dispersion.

## 1.3 Airport Emissions Sources

Estimates of emissions generated by Airport-related sources were prepared for the baseline year (2001) and eight future years (2009, 2010, 2013, 2015, 2020, 2025, and 2030). Sources of emissions that were included in this study are identified in **Table I-1.** Onroad vehicle traffic emissions at the Airport, of which, construction employee vehicle trips and construction hauling trips are a part, are accounted for in transportation conformity models developed by the Denver Regional Council of Governments (DRCOG) for the Denver metropolitan area and therefore were excluded from the Airport Emissions Inventory study. For the purposes of the documentation the sources of emissions have been divided into two primary categories: airport operational emissions and construction emissions, which are discussed in Section II and Section III, respectively.

**Table I-1**

Sources of Emissions at Denver International Airport

- Operational Emissions
  - Aircraft
    - Aircraft Operations
    - Auxiliary Power Units
  - Airport Equipment
    - Ground Support Equipment
    - City Support Equipment
  - Minor Point Sources
  - Firefighting Training
  - Unpaved Roads
- Construction Emissions
  - Construction
    - Land Development
    - Asphalt Paving
    - Concrete Batching
    - Asphalt Batching
  - Construction Equipment

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

# II. Operational Emissions

## 2.1 Aircraft

For the purposes of the Airport Emissions Inventory, aircraft emissions include emissions generated by aircraft engines while aircraft are in flight, taxiing, or idling and emissions from on-board auxiliary power units (APUs). These emission sources are described in the sections that follow.

### 2.1.1 Aircraft Operations

Annual aircraft emissions are a function of the number of annual aircraft operations expressed as landing and takeoff (LTO) cycles, the aircraft fleet mix (types of aircraft used), and the length of time aircraft spend in each of the four modes of operation defined in EDMS: takeoff, climbout, approach, and idle. For emissions calculations, the EDMS treats the takeoff mode as the time from the start of the takeoff roll until an aircraft reaches 1,000 feet above the ground. The climbout mode begins at 1,000 feet above the ground and ends when the aircraft reaches the mixing height. The mixing height is set to 3,000 feet above the ground by default. The approach mode begins at the mixing height and ends when the descending aircraft reaches the ground. The idle mode is the sum of the landing roll time, the taxi time, and the time an aircraft spends in queue.

The EDMS database contains an expansive list of aircraft types (airframes) and engine types for use in air quality analyses. Aircraft emissions are estimated using emission factors associated with particular engine types and operating modes. Aircraft emission factors included in the EDMS 4.2 database are based on information from engine manufacturers, information contained in the International Civil Aviation Organization (ICAO) Aircraft Engine Exhaust databank, and data provided in the USEPA's *Procedures for Emission Inventory Preparation. Volume IV: Mobile Sources* **[II-1]**. EDMS is not capable of estimating $PM_{10}$ emissions from aircraft engines. $PM_{10}$ emission factors used in the Airport Emissions Inventory study were derived from the USEPA's *Draft 2002 National Emissions Inventory* **[II-2]** and are specific to DIA. The baseline year (2001) and future year aircraft emissions estimates are discussed in the sections below.

#### 2.1.1.1 Baseline Emissions

The baseline year aircraft emissions inventory was estimated in EDMS 4.2 using aircraft operations data obtained from the Department of Aviation and the FAA's Air Traffic Activity Data System (ATADS) on-line database. EDMS aircraft fleet mix data used in the calculation of the 2001 baseline emissions inventory was developed using electronic data from the Department of Aviation's aircraft noise monitoring system (ANMS) for calendar year 2001 **[II-3]**. Information obtained from the U.S. Bureau of Transportation Statistics **[II-4]** regarding commercial airlines at Denver International Airport in 2001 was used to determine the appropriate engine types for aircraft selected from the EDMS database because the ANMS dataset did not include information regarding engine types. Aircraft and engine fleet mix data contained in the 2000/2001 edition of JP-Airline Fleets International **[II-5]** was also used to define EDMS aircraft/engine pairings for smaller airlines and for general aviation aircraft not covered in the U.S. Bureau of Transportation Statistics dataset. **Table II-1** presents the EDMS aircraft and engine fleet mix used to model baseline year emissions.

**Table II-1 (1 of 3)**

Baseline Year Aircraft Fleet Mix and Engine Type Mix – Denver International Airport

| EDMS Aircraft Type | Aircraft Fleet Mix | EDMS Engine Type | Engine Type Mix |
|---|---|---|---|
| **Majors/Nationals** | | | |
| A319 | 6.56% | CFM56-5A5 | 12.86% |
| | | CFM56-5B5/P | 31.49% |
| | | V2522-A5 | 55.65% |
| A320-200 | 9.67% | CFM56-5A1 | 17.14% |
| | | CFM56-5B4/P | 13.46% |
| | | V2527-A5 | 69.40% |
| A340-300 | 0.17% | CFM56-5C4 | 100.00% |
| B717-200 | 0.03% | BR700-715C1-30 | 100.00% |
| B727-200 | 11.97% | JT8D-15 | 94.46% |
| | | JT8D-17R | 5.54% |
| B737-200 | 3.92% | JT8D-15A | 70.41% |
| | | JT8D-17 | 22.82% |
| | | JT8D-9A | 6.77% |
| B737-300 | 29.21% | CFM56-3B-2 | 24.96% |
| | | CFM56-3C-1 | 75.04% |
| B737-500 | 8.95% | CFM56-3C-1 | 100.00% |
| B737-700 | 0.35% | CFM56-7B24 | 100.00% |
| B737-800 | 1.29% | CFM56-7B26 | 82.64% |
| | | CFM56-7B27 | 17.36% |
| B737-900 | 0.15% | CFM56-7B26 | 100.00% |
| B747-400 | 0.24% | PW4056 | 100.00% |
| B757-200 | 13.60% | PW2037 | 97.92% |
| | | RB211-535E4 | 2.08% |
| B767-200 | 0.39% | CF6-80A (A1) | 83.62% |
| | | JT9D-7R4D | 16.38% |
| B767-300 | 2.22% | CF6-80A2 | 32.60% |
| | | PW4056 | 67.40% |
| B777-200 | 3.12% | PW4077 | 90.04% |
| | | GE90-85B | 7.26% |
| | | TRENT 895 | 2.70% |
| DC9-30 | 0.09% | JT8D-7B | 56.60% |
| | | JT8D-9A | 43.40% |
| MD-80 | 8.06% | JT8D-217C | 70.52% |
| | | JT8D-219 | 29.48% |
| Subtotal | 100.00% | | |
| **Regional/Commuters** | | | |
| BAE146-200 | 17.65% | ALF502R-5 | 100.00% |
| BH-1900 | 47.91% | PT6A-65B | 100.00% |
| Canadair Reg-100 | 0.01% | CF34-3A1 | 100.00% |
| DO 328 | 20.17% | PW119-C | 100.00% |
| EMB-120 | 3.16% | PW118 | 100.00% |
| Navajo | 0.25% | TIO-540-J2B2 | 100.00% |
| REG'L JET 200 | 9.39% | CF34-3B | 100.00% |
| Swearingen Metro 2 | 1.46% | TPE331-3 | 100.00% |
| Subtotal | 100.00% | | |

**Table II-1 (2 of 3)**

Baseline Year Aircraft Fleet Mix and Engine Type Mix – Denver International Airport

| EDMS Aircraft Type | Aircraft Fleet Mix | EDMS Engine Type | Engine Type Mix |
|---|---|---|---|
| **All Cargo** | | | |
| A300-600 | 10.39% | CF6-80C2A5 | 79.80% |
| | | PW4158 | 20.20% |
| A310-200F | 0.27% | CF6-80A3 | 63.27% |
| | | JT9D-7R4E1 | 36.73% |
| B727-200F | 31.00% | JT8D-15 | 30.47% |
| | | JT8D-17 | 31.50% |
| | | JT8D-7B | 20.05% |
| | | JT8D-9A | 17.98% |
| B737-200 | 0.14% | JT8D-15 | 100.00% |
| B747-100 | 0.23% | JT9D-7A | 100.00% |
| B747-200 | 0.10% | JT9D-7Q | 100.00% |
| B757-200 | 6.10% | PW2040 | 46.67% |
| | | RB211-535E4 | 53.33% |
| B767-200 | 4.51% | CF6-80A (A1) | 81.48% |
| | | JT9D-7R4D | 18.52% |
| B767-300 | 5.95% | CF6-80C2B7F | 100.00% |
| BH-1900C | 1.82% | PT6A-65B | 100.00% |
| BH-C99 | 7.91% | PT6A-36 | 100.00% |
| Cessna 208 Caravan | 4.46% | PT6A-114 | 100.00% |
| Cessna T337 | 0.34% | IO-360-B | 100.00% |
| DC10-30F | 6.49% | CF6-50C2 | 100.00% |
| DC8-62F | 0.17% | JT3D-3B | 100.00% |
| DC8-73F | 2.68% | CFM56-2C5 | 100.00% |
| DC9-15F | 1.52% | JT8D-7B | 100.00% |
| DC9-30F | 0.22% | JT8D-7B | 30.23% |
| | | JT8D-9 | 69.77% |
| DC9-40 | 3.66% | JT8D-11 | 55.17% |
| | | JT8D-15 | 44.83% |
| EMB-120 | 0.50% | PW118 | 100.00% |
| Falcon 20 | 1.48% | CF700-2D | 100.00% |
| Learjet 25C | 0.12% | CJ610-6 | 100.00% |
| Learjet 35/36 | 0.43% | TFE 731-2-2B | 100.00% |
| MD-80 | 0.78% | JT8D-219 | 100.00% |
| Navajo | 7.70% | TIO-540-J2B2 | 100.00% |
| Swearingen Metro 2 | 1.02% | TPE331-3 | 100.00% |
| Subtotal | 100.00% | | |
| **Other Air Taxi** | | | |
| B727-200 | 0.92% | JT8D-15 | 20.00% |
| | | JT8D-17 | 80.00% |
| B737-800 | 0.12% | CFM56-7B26 | 100.00% |
| BAE 125-700 | 2.93% | TFE731-3 | 100.00% |
| Beechjet 400 | 3.41% | JT15D-5 (A & B) | 100.00% |
| Cessna 208 Caravan | 3.64% | PT6A-114 | 100.00% |
| Cessna 441 Conquest 2 | 7.11% | TPE331-8 | 100.00% |
| CITATION V | 3.01% | JT15D-5 (A & B) | 100.00% |
| Citation VII | 0.47% | TFE731-3 | 100.00% |
| CITATION X | 1.28% | AE3007C | 100.00% |
| CL600 | 1.51% | CF34-3A | 100.00% |
| DC10-10-F | 0.08% | CF6-6D | 100.00% |
| DC8-63F | 1.16% | JT8D-7 | 100.00% |
| DC8-71F | 2.11% | CFM56-2C5 | 100.00% |

**Table II-1 (3 of 3)**

Baseline Year Aircraft Fleet Mix and Engine Type Mix – Denver International Airport

| EDMS Aircraft Type | Aircraft Fleet Mix | EDMS Engine Type | Engine Type Mix |
|---|---|---|---|
| **Other Air Taxi (cont.)** | | | |
| Falcon 2000EX | 0.55% | PW308C | 100.00% |
| Falcon 50 | 0.45% | TFE731-3 | 100.00% |
| King Air 200 | 1.01% | PT6A-41 | 100.00% |
| Learjet 24D | 0.36% | CJ610-6 | 100.00% |
| Learjet 35/36 | 4.89% | TFE 731-2-2B | 100.00% |
| Navajo | 13.28% | TIO-540-J2B2 | 100.00% |
| Swearingen Metro 2 | 51.71% | TPE331-3 | 100.00% |
| Subtotal | 100.00% | | |
| **General Aviation** | | | |
| Bell 206 | 0.25% | 250B17B | 100.00% |
| CITATION X | 0.84% | AE3007C1 | 100.00% |
| Gulfstream V | 0.30% | BR700-715B1-30 | 100.00% |
| CL600 | 1.84% | CF34-3B | 100.00% |
| Learjet 25C | 1.23% | CJ610-6 | 100.00% |
| Cessna 172 Skyhawk | 1.67% | IO-320-D1AD | 100.00% |
| Piper PA-28 | 1.50% | IO-320-D1AD | 100.00% |
| CITATION I | 2.26% | JT15D-1 | 100.00% |
| Beechjet 400 | 1.18% | JT15D-5 (A & B) | 100.00% |
| CITATION V | 4.82% | JT15D-5 (A & B) | 100.00% |
| Cessna 208 Caravan | 3.67% | PT6A-114 | 100.00% |
| BH-C99 | 1.22% | PT6A-20 | 100.00% |
| Beech King Air 100 | 5.05% | PT6A-28 | 100.00% |
| PA-31T Cheyenne | 6.61% | PT6A-28 | 100.00% |
| Beech King Air 200 | 13.38% | PT6A-41 | 100.00% |
| Beech King Air 300 | 1.77% | PT6A-60, -60A, -60AG | 100.00% |
| BH-1900 | 3.46% | PT6A-67D | 100.00% |
| Falcon 2000EX | 0.37% | PW308C | 100.00% |
| Gulfstream II | 1.31% | SPEY MK511-8 | 100.00% |
| Gulfstream IV | 2.34% | TAY Mk611-8 | 100.00% |
| Citation VII | 2.00% | TFE 731-2-2B | 100.00% |
| Learjet 35/36 | 11.29% | TFE 731-2-2B | 100.00% |
| BAE 125-700 | 4.01% | TFE731-3 | 100.00% |
| Falcon 50 | 3.67% | TFE731-3 | 100.00% |
| Westwind 2 | 2.52% | TFE731-3 | 100.00% |
| Swearingen Metro 2 | 6.19% | TPE331-2 | 100.00% |
| Cessna 441 Conquest2 | 15.25% | TPE331-8 | 100.00% |
| Subtotal | 100.00% | | |
| **Military** | | | |
| C-130 HERCULES | 21.15% | 501D22A | 100.00% |
| F/A-18 HORNET | 23.08% | F404-GE-400 | 100.00% |
| F-16 | 55.77% | F100-PW-100 | 100.00% |
| Subtotal | 100.00% | | |

Source: Ricondo & Associates, Inc. using aircraft operations data obtained from the City and County of Denver Department of Aviation, JP Airline-Fleets International, and the U.S. Bureau of Transportation Statistics.

Prepared by: Ricondo & Associates, Inc.

The baseline year aircraft emissions inventory is presented in **Table II-2**. A detailed breakdown of LTO cycle data for baseline conditions is presented in **Appendix A. Appendix B** contains a detailed summary of aircraft emissions in 2001 by EDMS aircraft type.

**Table II-2**

Baseline Year Aircraft Emissions – Denver International Airport

| | Pollutant (tons/year) | | | | |
|---|---|---|---|---|---|
| Year | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2001 | 2,327.473 | 290.495 | 2,245.267 | 204.471 | 163.214 |

Source: Ricondo & Associates, Inc based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2 and information contained in the USEPA's Draft 2002 National Emissions Inventory (NEI).
Prepared by: Ricondo & Associates, Inc.

### 2.1.1.2 Forecast Emissions

Future year aircraft emissions inventories for DIA were modeled in EDMS 4.2 using aircraft operations data contained in the May 16, 2001 document, *Aviation Activity Forecast* **[II-6],** which is the current FAA-approved aviation activity forecast for the airport. For analysis years not covered in the forecast document, the number of aircraft operations was estimated using linear interpolation. To estimate activity through 2030 (APCD's final analysis year in the CO and $PM_{10}$ maintenance plan revisions), the level of aircraft activity was linearly extrapolated based on growth rates presented in the forecast. A summary of aircraft LTO cycles for the baseline year and each of the future analysis years is provided in **Table II-3**.

**Table II-3**

Landing Takeoff Cycles: Baseline and Future Analysis Years

| | Landing Takeoff (LTO) Cycles by Aircraft Category | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Majors/ Nationals | Regional/ Commuters | All Cargo | Other Air Taxi | General Aviation | Military | Total |
| 2001 | 183,900 | 60,000 | 13,300 | 8,950 | 7,550 | 475 | 274,175 |
| 2009 | 237,200 | 73,450 | 17,612 | 9,350 | 8,213 | 475 | 346,300 |
| 2010 | 243,800 | 75,100 | 18,150 | 9,400 | 8,300 | 475 | 355,225 |
| 2013 | 263,760 | 78,540 | 19,850 | 9,550 | 8,490 | 475 | 380,665 |
| 2015 | 276,920 | 80,580 | 20,950 | 9,650 | 8,630 | 475 | 397,205 |
| 2020 | 308,300 | 84,960 | 23,820 | 9,900 | 8,940 | 475 | 436,395 |
| 2025 | 338,400 | 88,300 | 26,850 | 10,150 | 9,200 | 475 | 473,375 |
| 2030 | 369,765 | 96,484 | 29,338 | 11,091 | 10,053 | 519 | 517,250 |

Notes: One LTO cycle consists of one arrival and one departure.
LTO cycles in 2009, 2013, 2015, and 2020 were determined through linear interpolation.
LTO cycles in 2030 were determined through linear extrapolation.

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

EDMS aircraft and engine fleet mix data used to develop the emission estimates for the future analysis years are presented in **Table II-4**. While the total number of LTO cycles in the future analysis years is different, the EDMS aircraft and engine fleet mix was assumed to be the same. The aircraft and engine fleet mix data for the future analysis years was determined using data obtained from the Department of Aviation's aircraft noise monitoring system (ANMS) for calendar year 2004, information obtained from the U.S. Bureau of Transportation Statistics regarding aircraft operations at Denver International Airport in 2004, and airline equipment and fleet mix data contained in the 2004/2005 edition of JP-Airline Fleets International **[II-7]**.

**Table II-4 (1 of 3)**

Future Year Aircraft Fleet Mix and Engine Type Mix – Denver International Airport

| EDMS Aircraft Type | Aircraft Fleet Mix | EDMS Engine Type | Engine Type Mix |
|---|---|---|---|
| **Majors/Nationals** | | | |
| A318 | 2.93% | CFM56-5B8/P | 100.00% |
| A319 | 21.94% | CFM56-5B5/P | 69.07% |
| | | V2522-A5 | 24.39% |
| | | CFM56-5A5 | 6.54% |
| A320-200 | 15.16% | V2527-A5 | 83.17% |
| | | CFM56-5A1 | 16.83% |
| A321 | 0.51% | CFM56-5B3/2P DAC-II | 100.00% |
| A340-300 | 0.01% | CFM56-5C4 | 100.00% |
| A340-642 | 0.02% | TRENT 556-61 | 100.00% |
| B717-200 | 0.53% | BR700-715C1-30 | 100.00% |
| B737-300 | 33.15% | CFM56-3C-1 | 83.54% |
| | | CFM56-3B-2 | 16.46% |
| B737-800 | 3.44% | CFM56-7B27 | 44.36% |
| | | CFM56-7B26 | 55.64% |
| B747-400 | 0.36% | CF6-80C2B1F | 36.51% |
| | | PW4056 | 63.49% |
| B757-200 | 10.75% | PW2037 | 94.16% |
| | | RB211-535E4B | 5.84% |
| B767-200 | 0.60% | CF6-80A (A1) | 100.00% |
| B767-300 | 1.27% | PW4056 | 100.00% |
| B777-200 | 2.29% | PW4077 | 90.23% |
| | | GE90-85B | 6.10% |
| | | TRENT 895 | 3.66% |
| MD-80 | 6.83% | JT8D-217C | 61.06% |
| | | JT8D-219 | 38.94% |
| MD-90-30 | 0.22% | V2525-D5 | 100.00% |
| Subtotal | 100.00% | | |
| **Regionals/Commuters** | | | |
| BAE 146-200 | 4.94% | ALF502R-5 | 100.00% |
| BH-1900C | 27.73% | PT6A-65B | 100.00% |
| Bombardier CRJ700 | 10.24% | CF34-8C1 | 100.00% |
| Bombardier CRJ900 | 0.05% | CF34-8C5 | 100.00% |
| Canadair Reg-100 | 0.01% | CF34-3B | 100.00% |
| DHC-8-200 | 9.74% | PW123D | 100.00% |
| EMB-120 | 10.57% | PW118A | 67.92% |
| | | PW118B | 32.08% |
| Embraer ERJ 145LR | 2.73% | A3007A1/2 | 66.06% |
| | | AE3007A1/1 | 33.94% |
| REG'L JET 200 | 33.98% | CF34-3B | 100.00% |
| Subtotal | 100.00% | | |

**Table II-4 (2 of 3)**

Future Year Aircraft Fleet Mix and Engine Type Mix – Denver International Airport

| EDMS Aircraft Type | Aircraft Fleet Mix | EDMS Engine Type | Engine Type Mix |
|---|---|---|---|
| **Cargo** | | | |
| A300-600 | 27.66% | CF6-80C2A5 | 43.99% |
| | | PW4158 | 56.01% |
| A310 | 0.66% | CF6-80A3 | 100.00% |
| B727-200F | 30.21% | JT8D-15 | 35.88% |
| | | JT8D-17 | 30.56% |
| | | JT8D-7B | 26.19% |
| | | JT8D-9A | 7.37% |
| B747-100F | 0.87% | JT9D-7A | 62.89% |
| | | JT9D-7Q | 37.11% |
| B757-200 | 4.33% | PW2040 | 46.78% |
| | | RB211-535E4 | 53.22% |
| B767-200 | 8.35% | CF6-80A (A1) | 81.50% |
| | | JT9D-7R4D | 18.50% |
| B767-300ER | 5.81% | CF6-80C2B7F | 100.00% |
| BH-1900C | 0.91% | PT6A-65B | 100.00% |
| BH-C99 | 1.00% | PT6A-36 | 100.00% |
| Cessna 208 Caravan | 1.47% | PT6A-114 | 100.00% |
| DC10-10F | 1.47% | CF6-6D | 100.00% |
| DC10-30F | 10.95% | CF6-50C2 | 100.00% |
| DC8-61 | 0.13% | JT3D-3B | 100.00% |
| DC8-71F | 0.34% | CFM56-2C5 | 100.00% |
| DC9-30F | 0.57% | JT8D-9 | 100.00% |
| DC9-40 | 3.61% | JT8D-11 | 55.17% |
| | | JT8D-15 | 44.83% |
| Learjet 35/36 | 0.31% | TFE 731-2-2B | 100.00% |
| MD-11F | 0.04% | CF6-80C2D1F | 100.00% |
| MD-80 | 1.23% | JT8D-219 | 100.00% |
| Swearingen Metro 2 | 0.07% | TPE331-3 | 100.00% |
| Subtotal | 100.00% | | |
| **Other Air Taxi** | | | |
| B727-200 | 0.08% | JT8D-15 | 100.00% |
| B737-200 | 0.30% | JT8D-17 | 100.00% |
| B737-800 | 0.23% | CFM56-7B26 | 100.00% |
| BAE 125-700 | 3.53% | TFE731-3 | 100.00% |
| Beech King Air 200 | 0.15% | PT6A-41 | 100.00% |
| Beechjet 400A | 2.62% | JT15D-5 (A & B) | 100.00% |
| Cessna 441 Conquest2 | 5.20% | TPE331-8 | 100.00% |
| CITATION V | 4.61% | JT15D-5 (A & B) | 100.00% |
| Citation VII | 0.51% | TFE731-3 | 100.00% |
| CITATION X | 1.69% | AE3007C | 100.00% |
| CL600 | 0.35% | CF34-3B | 100.00% |
| CL601-3A | 0.36% | CF34-3A | 100.00% |
| Embraer Legacy | 0.20% | AE3007A1P (Type 1) | 100.00% |
| Falcon 2000EX | 0.68% | PW308C | 100.00% |
| Falcon 50 | 0.09% | TFE731-3 | 100.00% |
| Galaxy (IAI) G200 | 0.17% | PW306A | 100.00% |
| Gulfstream IV | 0.05% | TAY Mk611-8 | 100.00% |
| Learjet 24D | 0.20% | CJ610-6 | 100.00% |
| Learjet 35/36 | 1.96% | TFE 731-2-2B | 100.00% |
| Navajo | 18.11% | PT6A-28 | 100.00% |
| Swearingen Metro 2 | 58.91% | TPE331-3 | 100.00% |
| Subtotal | 100.00% | | |

**Table II-4 (3 of 3)**

Future Year Aircraft Fleet Mix and Engine Type Mix – Denver International Airport

| EDMS Aircraft Type | Aircraft Fleet Mix | EDMS Engine Type | Engine Type Mix |
|---|---|---|---|
| **General Aviation** | | | |
| Bell 206 | 0.85% | 250B17B | 100.00% |
| CITATION X | 1.06% | AE3007C | 100.00% |
| Gulfstream V | 0.85% | BR700-715B1-30 | 100.00% |
| CL600 | 2.95% | CF34-3B | 100.00% |
| Learjet 25C | 0.85% | CJ610-6 | 100.00% |
| Cessna 172 Skyhawk | 1.85% | IO-320-D1AD | 100.00% |
| Piper PA-28 | 2.51% | IO-320-D1AD | 100.00% |
| CITATION I | 2.37% | JT15D-1 | 100.00% |
| Beechjet 400 | 1.37% | JT15D-5 (A & B) | 100.00% |
| CITATION V | 6.48% | JT15D-5 (A & B) | 100.00% |
| Cessna 208 Caravan | 4.57% | PT6A-114 | 100.00% |
| Beech King Air 100 | 7.79% | PT6A-28 | 100.00% |
| PA-31T Cheyenne | 2.26% | PT6A-28 | 100.00% |
| BH-C99 | 0.21% | PT6A-36 | 100.00% |
| Beech King Air 200 | 13.08% | PT6A-41 | 100.00% |
| Beech King Air 300 | 1.97% | PT6A-60, -60A, -60AG | 100.00% |
| BH-1900 | 3.45% | PT6A-67D | 100.00% |
| Falcon 2000EX | 0.71% | PW308C | 100.00% |
| Gulfstream II | 1.31% | SPEY MK511-8 | 100.00% |
| Gulfstream IV | 3.51% | TAY Mk611-8 | 100.00% |
| Citation VII | 1.74% | TFE 731-2-2B | 100.00% |
| Learjet 35/36 | 11.46% | TFE 731-2-2B | 100.00% |
| BAE 125-700 | 5.11% | TFE731-3 | 100.00% |
| Falcon 50 | 5.46% | TFE731-3 | 100.00% |
| Westwind 2 | 2.33% | TFE731-3 | 100.00% |
| Swearingen Metro 2 | 1.23% | TPE331-3 | 100.00% |
| Cessna 441 Conquest2 | 12.67% | TPE331-8 | 100.00% |
| Subtotal | 100.00% | | |
| **Military** | | | |
| C-130 HERCULES | 20.00% | 501D22A | 100.00% |
| C-17A | 31.43% | F117-PW-100 | 100.00% |
| F-16 | 48.57% | F100-PW-100 | 100.00% |
| Subtotal | 100.00% | | |

Source: Ricondo & Associates, Inc. using aircraft operations data obtained from the City and County of Denver Department of Aviation, JP Airline-Fleets International, and the U.S. Bureau of Transportation Statistics.
Prepared by: Ricondo & Associates, Inc.

A summary of future-year aircraft emissions is presented in **Table II-5**. A detailed breakdown of aircraft LTO cycle data for the future analysis years is presented in **Appendix A. Appendix B** contains a detailed summary of aircraft emissions by EDMS aircraft type for the future analysis years.

**Table II-5**

Future Year Aircraft Emissions – Denver International Airport

| | Pollutant (tons/year) | | | | |
|---|---|---|---|---|---|
| **Year** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| 2009 | 3,401.936 | 409.976 | 2,784.997 | 260.129 | 207.475 |
| 2010 | 3,491.527 | 419.946 | 2,862.095 | 267.280 | 212.950 |
| 2013 | 3,753.382 | 448.461 | 3,094.089 | 288.610 | 228.581 |
| 2015 | 3,924.432 | 467.032 | 3,246.170 | 302.576 | 238.735 |
| 2020 | 4,333.068 | 511.726 | 3,612.786 | 336.141 | 262.799 |
| 2025 | 4,723.732 | 554.432 | 3,968.222 | 368.521 | 285.519 |
| 2030 | 5,161.622 | 605.792 | 4,336.102 | 402.677 | 311.982 |

Source: Ricondo & Associates, Inc based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2 and information contained in the USEPA's Draft 2002 National Emissions Inventory (NEI).
Prepared by: Ricondo & Associates, Inc.

### 2.1.2 Auxiliary Power Units

Many large commercial aircraft are equipped with auxiliary power units (APUs). An APU is basically a small turbine engine that generates electricity and compressed air to operate aircraft instruments, lights, and ventilation when the main aircraft engines are not operational, for instance when aircraft are parked at the gate. APUs can also be used to provide power for starting the main aircraft engines. APUs burn jet fuel and hence create exhaust emissions.

The methodology for calculating emissions from APUs is presented in Appendix E of the report *Air Quality Procedures for Civilian Airports and Air Force Bases* **[II-8]**. This methodology has been incorporated into the EDMS model. Emissions from APUs are tied to the number of LTO cycles performed by aircraft equipped by APUs, and the operating times of the APUs per LTO cycle. Default APU assignments and operating times in EDMS were utilized for this Airport Emissions Inventory study to provide a conservative estimate of emissions. EDMS is not capable of estimating $PM_{10}$ emissions from APUs. Aircraft $PM_{10}$ emission factors from the USEPA's *Draft 2002 National Emissions Inventory* were also used to estimate $PM_{10}$ emissions for APUs; however, the emission factors were scaled down to account for differences in fuel flow rates between aircraft engines and APUs. Default APU assignments for several aircraft are presented in **Table II-6**.

**Table II-6**

APU Assignments and Operating Times – Representative Aircraft at Denver International Airport

| **Aircraft Type** | **APU** | **HP** | **Default Operating Time (Min/LTO Cycle)** |
|---|---|---|---|
| B737-300 | APU GTCP85-129 | 200 | 26 |
| REG'L JET 200 | APU GTCP85 | 200 | 26 |
| B727-200F | APU GTCP85-129 | 200 | 26 |
| Beech King Air 200 | N/A | - | - |
| F-16 | N/A | - | - |

Notes: The Beech King Air 200 and F-16 aircrafts are assumed to have no onboard APU.

Source: Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

### 2.1.2.1 Baseline Emissions

Baseline year emissions from APUs at DIA are presented in **Table II-7**. As discussed above, EDMS default APU assignments were used to develop the emissions estimate for pollutants other than $PM_{10}$.

**Table II-7**

Baseline Year APU Emissions – Denver International Airport

| | Pollutant (tons/year) | | | | |
|---|---|---|---|---|---|
| Year | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2001 | 143.270 | 9.235 | 77.161 | 11.575 | 3.484 |

Source: Ricondo & Associates, Inc based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2 and information contained in the USEPA's Draft 2002 National Emissions Inventory (NEI).
Prepared by: Ricondo & Associates, Inc.

### 2.1.2.2 Forecast Emissions

APU emissions in the future analysis years are presented in **Table II-8**. The emissions estimates prepared for the future analysis years also relied on EDMS default APU assignments for pollutants other than $PM_{10}$.

**Table II-8**

Future Year APU Emissions – Denver International Airport

| | Pollutant (tons/year) | | | | |
|---|---|---|---|---|---|
| Year | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2009 | 153.711 | 10.325 | 114.199 | 15.415 | 4.582 |
| 2010 | 157.827 | 10.606 | 117.352 | 15.845 | 4.707 |
| 2013 | 169.604 | 11.406 | 126.722 | 17.077 | 5.073 |
| 2015 | 177.258 | 11.929 | 132.862 | 17.890 | 5.312 |
| 2020 | 195.397 | 13.180 | 147.561 | 19.825 | 5.883 |
| 2025 | 212.551 | 14.361 | 161.674 | 21.676 | 6.428 |
| 2030 | 232.241 | 15.692 | 176.665 | 23.683 | 7.023 |

Source: Ricondo & Associates, Inc based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2 and information contained in the USEPA's Draft 2002 National Emissions Inventory (NEI).
Prepared by: Ricondo & Associates, Inc.

## 2.2 Airport Equipment

For the purposes of the Airport Emissions Inventory study, airport equipment includes ground support equipment and City support equipment. Emissions from these two sources are described in the following sections.

### 2.2.1 Ground Support Equipment

Ground support equipment (GSE) includes a wide range of vehicles that are used to service aircraft while they are on the ground. Examples of GSE include tugs that haul baggage cars and other equipment, fuel trucks, catering trucks, lavatory trucks, and other service vehicles. Most GSE are powered by gasoline, diesel or propane. Factors that influence the level of emissions from GSE include airport activity levels and the load factor, horsepower, and fuel type of the GSE. GSE emission factors used by EDMS are derived from the USEPA's NONROAD model.

By default, the EDMS assigns a fleet of GSE to each aircraft type. EDMS default assignments in terms of GSE types and operating times were used to develop emission estimates for the baseline year and future analysis years. Default GSE assignments were selected to ensure that the emissions estimates would be conservative. Default GSE assignments for several aircraft types operating at DIA are presented in **Table II-9**, on the following page.

#### 2.2.1.1 Baseline Emissions

Baseline year emissions from GSE operating at DIA are presented in **Table II-10**. As discussed above, the emissions estimate is based on EDMS default GSE assignments.

**Table II-10**

Baseline Year GSE Emissions – Denver International Airport

| | Emissions (tons/year) | | | | |
|---|---|---|---|---|---|
| Year | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2001 | 9,634.922 | 361.096 | 488.828 | 41.734 | 18.915 |

Source: Ricondo & Associates, Inc based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

#### 2.2.1.2 Forecast Emissions

Estimates of emissions from GSE for the future analysis years are presented in **Table II-11**.

**Table II-11**

Future Year GSE Emissions – Denver International Airport

| | Emissions (tons/year) | | | | |
|---|---|---|---|---|---|
| Year | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2009 | 12,113.363 | 444.166 | 459.687 | 50.634 | 26.020 |
| 2010 | 12,591.158 | 465.125 | 452.699 | 66.850 | 29.681 |
| 2013 | 13,372.486 | 485.967 | 442.038 | 52.896 | 32.029 |
| 2015 | 13,988.454 | 507.234 | 442.049 | 54.683 | 42.386 |
| 2020 | 15,459.752 | 558.958 | 457.358 | 59.395 | 51.136 |
| 2025 | 16,868.541 | 609.884 | 499.424 | 65.025 | 55.985 |
| 2030 | 18,432.011 | 666.413 | 545.717 | 71.049 | 61.167 |

Source: Ricondo & Associates, Inc based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table II-9**

Default GSE Assignments and Operating Times – Representative Aircraft at Denver International Airport

| Aircraft Type | Default GSE Assignment | HP | Power | Default Operating Time (Min/LTO Cycle) |
|---|---|---|---|---|
| B737-300 | Air Conditioner | 0 | Electric | 30 |
| | Air Start | 425 | Diesel | 7 |
| | Aircraft Tractor | 88 | Diesel | 8 |
| | Baggage Tractor | 107 | Gasoline | 75 |
| | Belt Loader | 107 | Gasoline | 48 |
| | Cabin Service Truck | 210 | Diesel | 20 |
| | Catering Truck | 210 | Diesel | 15 |
| | Hydrant Truck | 235 | Diesel | 12 |
| | Lavatory Truck | 56 | Diesel | 15 |
| | Service Truck | 235 | Diesel | 15 |
| | Water Service | 0 | Electric | 12 |
| REG'L JET 200 | Aircraft Tractor | 88 | Diesel | 8 |
| | Baggage Tractor | 107 | Gasoline | 35 |
| | Belt Loader | 107 | Gasoline | 30 |
| | Catering Truck | 71 | Diesel | 10 |
| | Hydrant Truck | 235 | Diesel | 12 |
| | Lavatory Truck | 56 | Diesel | 15 |
| | Service Truck | 235 | Diesel | 15 |
| B727-200F | Air Conditioner | 210 | Diesel | 30 |
| | Air Start | 425 | Diesel | 7 |
| | Aircraft Tractor | 88 | Diesel | 8 |
| | Baggage Tractor | 107 | Gasoline | 75 |
| | Belt Loader | 107 | Gasoline | 48 |
| | Cargo Loader | 80 | Diesel | 40 |
| | Hydrant Truck | 235 | Diesel | 12 |
| | Lavatory Truck | 56 | Diesel | 15 |
| | Service Truck | 235 | Diesel | 15 |
| | Water Service | 260 | Gasoline | 12 |
| Swearingen Metro 2 | Aircraft Tractor | 86 | Diesel | 5 |
| | Baggage Tractor | 107 | Gasoline | 35 |
| | Belt Loader | 107 | Gasoline | 30 |
| | Cabin Service Truck | 71 | Diesel | 10 |
| | Fuel Truck | 175 | Diesel | 20 |
| | Ground Power Unit | 71 | Diesel | 40 |
| | Service Truck | 235 | Diesel | 15 |
| Beech King Air 200 | Baggage Tractor | 107 | Gasoline | 35 |
| | Fuel Truck | 175 | Diesel | 10 |
| | Ground Power Unit | 71 | Diesel | 40 |
| F-16 | Cart | 25 | Diesel | 10 |
| | Generator | 158 | Diesel | 120 |
| | Lift | 115 | Diesel | 10 |

Source: Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

### 2.2.2 City Support Equipment

City support equipment includes nonroad equipment, such as airport snow removal equipment, and on-road equipment, such as fleet pick-up trucks, fleet sport utility vehicles, employee shuttle busses and street sweepers, operated in non-public environments such as the air operations area (AOA). As discussed in Section 1.3, it was assumed that emissions from motor vehicle travel outside the AOA are accounted for in the transportation conformity models managed by DRCOG. City support equipment vehicles evaluated in the Airport Emissions Inventory study include diesel-powered and gasoline-powered vehicles.

To calculate the emissions produced by city support equipment, it was necessary to estimate vehicle-miles traveled (VMT) by diesel-powered and gasoline-powered vehicles. The Department of Aviation provided information regarding gallons of gasoline and diesel fuel dispensed at DIA for city support equipment in 2001. Dispensed yearly fuel was assumed to increase in proportion to the number of annual aircraft operations. City support equipment was assumed to have an average fuel efficiency of twenty miles per gallon, an assumption that remained constant through all analysis years. VMT for each year were calculated by multiplying the gallons of fuel dispensed by twenty miles per gallon.

Emissions produced by city support equipment were calculated by multiplying the VMT by fuel specific emission factors. Emission factors for city support equipment were developed by APCD using the USEPA's MOBILE6.2 emission factor model. Emission factors developed by MOBILE6.2 are expressed in grams per vehicle mile, therefore to calculate emissions in tons, it was necessary to use a conversion factor. Emission factors developed by APCD are presented in **Table II-12**.

**Table II-12**

Emission Factors for City Support Equipment

| Year | Diesel (g/veh-mile) | | | | | Gasoline (g/veh-mile) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2001 | 8.8510 | 1.4110 | 17.4130 | 0.3667 | 0.5365 | 30.3579 | 2.3841 | 1.5744 | 0.0939 | 0.0366 |
| 2009 | 4.8370 | 0.8240 | 8.6430 | 0.1007 | 0.2508 | 21.8027 | 1.1817 | 0.8557 | 0.0095 | 0.0255 |
| 2010 | 4.0770 | 0.7680 | 7.7060 | 0.0108 | 0.2106 | 20.4834 | 1.0984 | 0.7868 | 0.0095 | 0.0253 |
| 2013 | 2.5870 | 0.6340 | 4.9040 | 0.1499 | 0.0135 | 17.6388 | 0.8470 | 0.6229 | 0.0249 | 0.0095 |
| 2015 | 1.8930 | 0.5810 | 3.6000 | 0.0135 | 0.1149 | 16.8009 | 0.7765 | 0.5517 | 0.0095 | 0.0249 |
| 2020 | 1.1000 | 0.5220 | 1.7000 | 0.0108 | 0.0767 | 14.7337 | 0.6346 | 0.4623 | 0.0095 | 0.0247 |
| 2025 | 0.7310 | 0.5100 | 0.9520 | 0.0135 | 0.0663 | 14.2189 | 0.5412 | 0.4403 | 0.0095 | 0.0247 |
| 2030 | 0.6250 | 0.5070 | 0.6310 | 0.0108 | 0.0632 | 13.6785 | 0.4936 | 0.3700 | 0.0095 | 0.0247 |

Source: State of Colorado Air Pollution Control Division, May 25, 2005.
Prepared by: Ricondo & Associates, Inc.

### 2.2.2.1 Baseline Emissions

Baseline year emissions from city support equipment at DIA are presented in **Table II-13**.

**Table II-13**

Baseline Year Emissions for City Support Equipment

| Year | Fuel | Gallons dispensed | Average Mileage (mpg) | VMT | Emissions (tons/year) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2001 | Diesel | 707,972 | 20 | 14,159,432 | 138.147 | 22.023 | 271.784 | 5.723 | 8.374 |
| | Gasoline | 305,877 | 20 | 6,117,542 | 204.717 | 16.077 | 10.617 | 0.633 | 0.247 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

### 2.2.2.2 Forecast Emissions

Estimates of emissions from city support equipment in the future analysis years are presented in **Table II-14**.

**Table II-14**

Future Year Emissions for City Support Equipment

| Year | Fuel | Gallons dispensed | Average Mileage (mpg) | VMT | Emissions (tons/year) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| 2009 | Diesel | 707,972 | 20 | 17,884,239 | 95.357 | 16.244 | 170.388 | 1.985 | 4.944 |
| | Gasoline | 305,877 | 20 | 7,726,835 | 185.702 | 10.065 | 7.288 | 0.081 | 0.217 |
| 2010 | Diesel | 894,212 | 20 | 18,345,160 | 82.445 | 15.531 | 155.831 | 0.218 | 4.259 |
| | Gasoline | 386,342 | 20 | 7,925,974 | 178.962 | 9.597 | 6.874 | 0.083 | 0.221 |
| 2013 | Diesel | 917,258 | 20 | 19,658,978 | 56.061 | 13.739 | 106.271 | 3.248 | 0.293 |
| | Gasoline | 396,299 | 20 | 8,493,605 | 165.145 | 7.930 | 5.832 | 0.233 | 0.089 |
| 2015 | Diesel | 982,949 | 20 | 20,513,166 | 42.804 | 13.138 | 81.403 | 0.305 | 2.598 |
| | Gasoline | 424,680 | 20 | 8,862,655 | 164.135 | 7.586 | 5.389 | 0.093 | 0.243 |
| 2020 | Diesel | 1,025,658 | 20 | 22,537,085 | 27.327 | 12.968 | 42.233 | 0.268 | 1.905 |
| | Gasoline | 443,133 | 20 | 9,737,083 | 158.141 | 6.811 | 4.962 | 0.102 | 0.265 |
| 2025 | Diesel | 1,126,854 | 20 | 24,446,872 | 19.699 | 13.744 | 25.655 | 0.364 | 1.787 |
| | Gasoline | 486,854 | 20 | 10,562,201 | 165.549 | 6.301 | 5.126 | 0.110 | 0.288 |
| 2030 | Diesel | 1,222,344 | 20 | 26,712,743 | 18.404 | 14.929 | 18.580 | 0.318 | 1.861 |
| | Gasoline | 528,110 | 20 | 11,541,164 | 174.017 | 6.280 | 4.707 | 0.121 | 0.314 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

## 2.3 Minor Point Sources

Stationary point sources at Denver International Airport include boilers, chiller engines, emergency generators, cooling towers, incinerators, jet fuel storage tanks, gasoline storage tanks, and paint booths. These facilities are operated by the City and County of Denver and by Airport tenants. Baseline year emissions data for minor point sources were provided by APCD. Future year emissions from minor point sources were determined using growth factors provided by APCD, growth factors that were calculated using information in the Airport Activity forecast, or growth factors calculated using other information including building square footage. Growth factors used to estimate future year emissions for each minor point source included in the airport emissions inventory are described in **Tables II-15 and II-16**. Table II-15 includes information about minor point sources that emit criteria pollutants of interest for the CO and $PM_{10}$ maintenance plans. Table II-16 lists minor point sources that emit VOC. Emissions estimates for the Central Plant boilers were adjusted to account for higher fuel useage during the winter months (December through February) using information contained in the Air Pollutant Emission Notice (APEN). Similarly, emission estimates for the Central Plan chiller engines were adjusted to account for lower fuel useage during the winter months. Seasonal variations in fuel useage or load was not factored into the emission estimates for other minor point sources.

**Table II-15**

Minor Point Emission Sources at Denver International Airport and Future Growth Factors

| Company | Emission Point | APCD ID No. | Growth Factor Basis |
|---|---|---|---|
| City and County of Denver | Central Plant boilers | 031/1260/101 | Total enplanements |
| City and County of Denver | Central Plant chiller engines | 031/1260/102 | Total enplanements |
| City and County of Denver | Emergency generators for airfield lighting vaults | 031/1260/104 | APCD methodology |
| City and County of Denver | Incinerators | 031/1260/107 | International passenger enplanements |
| City and County of Denver | Cooling tower | 031/1260/108 | APCD methodology |
| City and County of Denver | Emergency generator for Airport Office Building | 031/1260/109 | APCD methodology |
| United Airlines | Maintenance air start compressor | 031/1814/004 | Aircraft operations |
| United Airlines | Paint booths | 031/1814/018 | Aircraft operations |
| Continental Airlines | Hangar boilers | 031/1815/012 | APCD methodology |
| Continental Airlines | Icehouse boilers | 031/1815/013 | APCD methodology |
| Inland Technologies | Natural gas-fired heater for hot oil | 031/1822/001 | APCD methodology |
| Inland Technologies | Medium boiler | 031/1822/002 | APCD methodology |
| Inland Technologies | Small boiler | 031/1822/003 | APCD methodology |

Source: Ricondo & Associates, Inc. based on information provided by the City and County of Denver Department of Aviation
Prepared by: Ricondo & Associates, Inc.

**Table II-16**

VOC Only Minor Point Emission Sources at Denver International Airport and Future Growth Factors

| Company | Emission Point | AIRS ID No. | Growth Factor Basis |
|---|---|---|---|
| City and County of Denver | O&G E&P condensate tank battery – Box Elder J | 001/1565/001 | APCD methodology |
| City and County of Denver | O&G E&P condensate tank battery – Box Elder K | 001/1566/001 | APCD methodology |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 117 Amoco C | 001/1567/001 | APCD methodology |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 75 Amoco D | 001/1573/001 | APCD methodology |
| City and County of Denver | Maintenance paint booth | 031/1260/105 | Aircraft operations |
| City and County of Denver | Fleet vehicle gasoline tank | 031/1260/106 | Aircraft operations |
| Vanguard Car Rental USA (National Alamo) | Fuel tanks for rental cars | 031/1498/001 | Domestic passenger enplanements |
| Advantage | Fuel tanks for rental cars | 031/1646/001 | Domestic passenger enplanements |
| Dollar Thrifty Automotive Group | Fuel tanks for rental cars | 031/1650/001 | Domestic passenger enplanements |
| Aircraft Service International Group | Jet fuel tank | 031/1811/001 | Tank farm General Manager projection |
| Aircraft Service International Group | Jet fuel tank | 031/1811/002 | Tank farm General Manager projection |
| Aircraft Service International Group | Jet fuel tank | 031/1811/003 | Tank farm General Manager projection |
| Aircraft Service International Group | Jet fuel tank | 031/1811/004 | Tank farm General Manager projection |
| Aircraft Service International Group | Jet fuel tank | 031/1811/005 | Tank farm General Manager projection |
| Aircraft Service International Group | Jet fuel tank | 031/1811/006 | Tank farm General Manager projection |
| Aircraft Service International Group | Concourse A GSE fueling station | 031/1811/007 | Aircraft operations |
| Aircraft Service International Group | Concourse B GSE fueling station | 031/1811/008 | Aircraft operations |
| Aircraft Service International Group | Concourse C GSE fueling station | 031/1811/009 | Aircraft operations |
| Aircraft Service International Group | South Cargo GSE fueling station | 031/1811/010 | Aircraft operations |
| United Airlines | Fuel tanks | 031/1814/006 | Aircraft operations |
| FedEx | Fuel tank | 031/1817/003 | Aircraft operations |
| Avis | Fuel tanks for rental cars | 031/1820/001 | Domestic passenger enplanements |
| Hertz | Fuel tanks for rental cars | 031/1821/001 | Domestic passenger enplanements |
| Enterprise | Fuel tanks for rental cars | 031/1824/001 | Domestic passenger enplanements |
| Hertz | Fuel tanks for rental cars | 031/1825/001 | Domestic passenger enplanements |
| Payless | Fuel tanks for rental cars | 031/1827/001 | Domestic passenger enplanements |
| Budget | Fuel tanks for rental cars | 031/1828/001 | Domestic passenger enplanements |
| ConocoPhillips | Fuel tanks | 031/1829/001 | Total enplanements |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 117 Amoco A | 031/1971/001 | APCD methodology |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 125 Amoco B | 031/1972/001 | APCD methodology |
| City and County of Denver | O&G E&P condensate tank battery – Kallsen | 031/1973/001 | APCD methodology |

Source: Ricondo & Associates, Inc. based on information provided by the City and County of Denver Department of Aviation
Prepared by: Ricondo & Associates, Inc.

### 2.3.1 Baseline Emissions

Baseline year emissions from minor point sources at DIA are presented in **Table II-17**. A detailed summary of emissions from minor point sources is provided in **Appendix C**.

**Table II-17**

Baseline Year Emissions from Minor Point Sources

| | Emissions (tons/year) | | | | |
|---|---|---|---|---|---|
| **Year** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| 2001 | 40.328 | 138.287 | 41.000 | 1.166 | 7.921 |

Source: Air Pollution Control Division and City and County of Denver Department of Aviation
Prepared by: Ricondo & Associates, Inc.

### 2.3.2 Forecast Emissions

Estimates of emissions from minor point sources in the future analysis years are presented in **Table II-18**.

**Table II-18**

Future Year Emissions from Minor Point Sources

| | Emissions (tons/year) | | | | |
|---|---|---|---|---|---|
| **Year** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| 2009 | 54.207 | 169.746 | 52.945 | 1.306 | 8.832 |
| 2010 | 55.801 | 176.934 | 54.522 | 1.338 | 9.162 |
| 2013 | 60.311 | 185.413 | 59.082 | 1.432 | 10.001 |
| 2015 | 62.689 | 192.304 | 61.718 | 1.486 | 10.497 |
| 2025 | 71.403 | 211.681 | 69.991 | 1.642 | 11.990 |
| 2030 | 79.610 | 236.100 | 78.104 | 1.808 | 13.500 |

Source: Air Pollution Control Division and City and County of Denver Department of Aviation
Prepared by: Ricondo & Associates, Inc.

## 2.4 Firefighting Training

Firefighting training operations at the airport's Aircraft Rescue and Firefighting (ARFF) training facility are a source of pollutant emissions. The facility allows firefighters for the airport and fire departments from across the Denver metropolitan area to train in a live-fire environment. Emissions from firefighting training operations vary based on the quantity of the fuel burned in the training fires and the type of fuel burned. Information about firefighting training operations at DIA including annual gallons of fuel burned and type of fuel burned was obtained through conversations with ARFF personnel **[II-9]**. Information regarding quantities of fuel burned and type of fuel were input into EDMS to estimate annual emissions from firefighting activities. Emissions from firefighting training operations are summarized below.

### 2.4.1 Baseline Emissions

Baseline year emissions from firefighting training operations are presented in **Table II-19.**

**Table II-19**

Baseline Year Firefighting Training Emissions – Denver International Airport

| | Pollutant (tons/year) | | | | |
|---|---|---|---|---|---|
| **Year** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| 2001 | 0.435 | 0.398 | 0.080 | 0.000 | 1.465 |

Source: Ricondo & Associates, Inc. based on output from the Emission Dispersion and Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

### 2.4.2 Forecast Emissions

Emissions from firefighting training operations were assumed to grow over time as the number of aircraft operations performed at DIA increases. Emissions from firefighting training operations were assumed to remain constant after 2013 because the ARFF is expected to reach operational capacity in 2013. Emissions from firefighting operations for the future analysis years are presented in **Table II-20**.

**Table II-20**

Future Year Firefighting Training Emissions – Denver International Airport

| | Pollutant (tons/year) | | | | |
|---|---|---|---|---|---|
| **Year** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| 2009 | 0.861 | 0.787 | 0.159 | 0.000 | 2.900 |
| 2010 | 0.939 | 0.858 | 0.173 | 0.000 | 3.163 |
| 2013 | 1.218 | 1.112 | 0.224 | 0.001 | 4.102 |
| 2015 | 1.218 | 1.112 | 0.224 | 0.001 | 4.102 |
| 2020 | 1.218 | 1.112 | 0.224 | 0.001 | 4.102 |
| 2025 | 1.218 | 1.112 | 0.224 | 0.001 | 4.102 |
| 2030 | 1.218 | 1.112 | 0.224 | 0.001 | 4.102 |

Source: Ricondo & Associates, Inc. based on output from the Emission and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

## 2.5 Unpaved Roads

Vehicle travel on unpaved roads can be a source of fugitive dust ($PM_{10}$) emissions. $PM_{10}$ emissions associated with vehicle travel on unpaved roads were calculated using an empirical formula from AP-42, Section 13.2.2 **[II-10]**. Emissions from unpaved roads are a function of the distance traveled on the unpaved road, the weight of the vehicle traveling on the road, and the dust content of the unpaved road. Vehicles traveling on unpaved roads were assumed to be either light-duty trucks or sport utility vehicles (SUVs). The calculation of the emission factor used in the unpaved roads analysis is described in **Appendix D**.

Unpaved roads within the air operations area (AOA) were evaluated in the Airport Emissions Inventory since the APCD has already estimated emissions for unpaved roads that are publicly accessible (e.g., unpaved county roads). Trips made by the Denver Police Department (DPD) and a private security contractor were the only trips considered in the analysis. Information provided by the Department of Aviation, including the Airport Layout Plan, was used to determine the route traveled by the DPD and the private security contractor on unpaved roads and the average trip length. The average trip length was determined to be 24.1 miles. Additional information regarding the route is presented in **Appendix D**.

The number of daily trips on unpaved roads performed by the DPD and the private security contractor were determined through conversations with DIA security personnel **[II-11]**. During each of 3 daily shifts, DPD makes 2 trips and the private security contractor makes 4 trips. The DPD therefore makes 6 daily trips and the private security contractor makes 12 daily. Total annual VMT on unpaved roads were calculated based on the number of daily trips and the trip length. It was assumed that changes to the airport layout in the future would not significantly change the length of the trip or number of trips, thus VMT was assumed to remain constant. Estimates of $PM_{10}$ emissions associated with travel on unpaved roads are presented in **Table II-21.**

**Table II-21**

Summary of $PM_{10}$ Emissions on Unpaved Roads

| | Daily Security Trips | Trip Distance | Yearly VMT | Emission Factor (lb/VMT) | $PM_{10}$ (tons) |
|---|---|---|---|---|---|
| Denver Police Department | 6 | 24.1 miles | 52,774 | 1.8701 | 49.347 |
| Private Security Contractor | 12 | 24.1 miles | 105,547 | 1.8701 | 98.693 |
| **Total** | | | | | 148.040 |

Source: Ricondo & Associates, Inc. based on information provided by the City and County of Denver Department of Aviation.
Prepared by: Ricondo & Associates, Inc.

# III. Construction Emissions

## 3.1 Overview

Construction activity at DIA is a source of pollutant emissions. The level of construction-related emissions at DIA varies year by year according to the number of construction projects that are ongoing at any one time, the size and scale of the construction projects, and the type of construction activity (e.g., land clearing, concrete paving, building demolition). To ensure that the Airport Emissions Inventory did not understate construction-related emissions at DIA, Department of Aviation staff defined a "worst year" construction scenario using historical records and information regarding capital improvement projects that have been proposed for implementation in the next twenty-five years. The "worst year" construction scenario was developed based on the assumption that construction activity for all of the potential construction projects would occur during a single construction season. This assumption is reasonable because airports often implement significant infrastructure expansions over a short time frame, following a comprehensive effort to complete planning and environmental analyses and obtain funding. Furthermore, it was assumed that the same construction emissions estimate would apply to each of the CO and $PM_{10}$ maintenance plan analysis years (i.e., DIA construction emissions are the same for every year presented in this Airport Emissions Inventory study). This was done because the specific year that a worst case construction would occur is currently unknown.

**Table III-1** provides a summary of potential airport capital improvement projects to be constructed at DIA during a worst case year in the next twenty-five years. Construction emissions estimates for certain projects listed in Table III-1 have been prepared in support of previous general conformity evaluations therefore, where appropriate, these estimates were used to develop the "worst year" construction emissions estimate. New construction emissions estimates were prepared for the "Passenger Concourse" and "Terminal Module" projects because existing data were not available for these types of projects. Additional information regarding emissions associated with the projects listed in Table III-1 is presented in **Appendix E**.

The combined emissions from all potential construction projects are presented in **Table III-2**. Based on a request from APCD, the Department of Aviation conducted additional analysis surrounding tailpipe emissions from construction equipment and the introduction of low-sulfur diesel and ultra-low sulfur diesel fuel in the future. **Table III-3** presents estimates of construction equipment emissions for each of the SIP analysis years that reflect the use of low-sulfur and ultra-low sulfur diesel fuel by airport construction equipment. Information contained in the USEPA memorandum *Diesel Fuel Sulfur Inputs for the Draft NONROAD2004 Model Used in the 2004 Nonroad Diesel Engine Final Rule* **[III-1]** was used to determine future-year $SO_x$ emissions for construction equipment.

**Appendix F** presents a detailed discussion of the construction emissions analysis conducted for the "Passenger Concourse" and "Terminal Module" projects. Sources of information used to develop the emissions estimates for the "Passenger Concourse" and "Terminal Module" projects included:

- Section 13.2.3 "Heavy Construction Operations" of AP-42. **[III-2]**
- Section 11.9 "Western Surface Coal Mining" of AP-42. **[III-3]**
- Section 11.12 "Concrete Batching" of AP-42 **[III-4]**

- USEPA Report *Nonroad Engine and Vehicle Emission Study—Report* **[III-5]**
- USEPA Report NR-009c, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition*. **[III-6]**

**Table III-1**

Summary of Airport Capital Improvement Projects for "Worst Year" Construction Scenario

| Project | Description | Source of Emissions data |
|---|---|---|
| Runway | 16,000 foot long runway with associated taxiways and service roads | Based on historical analysis for 6th Runway |
| Taxiway | One mile long and 100 feet wide. 17 inches thick concrete with asphalt shoulders. Designed to aircraft design group (ADG) VI standards. | Based on historical analysis for Taxiway Echo-Alpha (EA). |
| ARFF Station | New ARFF station | Based on historical analysis for replacement ARFF station. |
| Terminal Module | New 300 foot long by 300 foot wide terminal module. Multiple stories. Associated curbside. | Based on new analysis documented in Appendix F. |
| Passenger Concourse | New 24-gate passenger concourse and return loop for automated guideway transit system (AGTS). | Based on new analysis documented in Appendix F. |
| Parking Structure | Parking structure with 2,000 parking spaces | Based on historical analysis for Module 4 West Parking Garage. |
| Parking Lot | Surface parking lot with 2,000 parking spaces | Based on historical analysis for Pikes Peak Lot expansion. |
| Detention Pond | Large detention pond | Based on historical analysis for Detention Pond T-239. |
| Hotel | New on-Airport hotel | Based on historical analysis for the on-Airport Westin hotel. |
| Commercial Development | 50 acres of general commercial development. 75% coverage of site. | Based on historical analysis for Worldport. The historical emissions estimate was scaled up by a factor of 1.5 due to the size of the proposed commercial development. |

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table III-2**

Total Emissions – All Construction Projects

| | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| **Source of Emissions** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 79.575 |
| Asphalt Paving | 0.000 | 73.100 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 3.230 | 0.450 | 14.690 | 0.240 | 13.555 |
| Asphalt Batching | 15.775 | 5.865 | 47.560 | 31.820 | 4.860 |
| Construction Equipment | 125.782 | 38.796 | 349.270 | 35.755 | 32.662 |
| **Total** | 144.787 | 118.211 | 411.520 | 67.815 | 130.652 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table III-3**

Estimates of Construction Equipment Emissions

| | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| **Year** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| 2001[1/] | 125.782 | 38.796 | 349.270 | 35.755 | 32.662 |
| 2009 | 125.782 | 38.796 | 349.270 | 5.495 | 32.662 |
| 2010 | 125.782 | 38.796 | 349.270 | 2.583 | 32.662 |
| 2013 | 125.782 | 38.796 | 349.270 | 0.501 | 32.662 |
| 2015 | 125.782 | 38.796 | 349.270 | 0.172 | 32.662 |
| 2020 | 125.782 | 38.796 | 349.270 | 0.172 | 32.662 |
| 2025 | 125.782 | 38.796 | 349.270 | 0.172 | 32.662 |
| 2030 | 125.782 | 38.796 | 349.270 | 0.172 | 32.662 |

Notes:

1/ Construction equipment emissions for 2001 were derived from Table III-2.

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

# IV. References


ES-1 Ricondo & Associates, Inc. *SIP Airport Emissions Inventories Assumptions and Methodology Protocol Document.* May 2005.

I-1. U.S. Congress. *Clean Air Act of 1970.* Public Law 91-604. December 31, 1970.

I-2. U.S. Congress. *Clean Air Act Amendments of 1990*. Public Law 101-49. November 15, 1990.

I-3. U.S. National Archives and Records Administration. Office of the Federal Register. Code of Federal Regulations. Title 40, Part 50. July 2003, as amended.

I-4. U.S. National Archives and Records Administration. Office of the Federal Register. Federal Register. Vol 66, No. 176, September 11, 2001. pp. 47086-47093.

I-5 U.S. National Archives and Records Administration. Office of the Federal Register. Federal Register. Vol 66, No. 241, December 14, 2001. pp. 64751-64759.

I-6. U.S. National Archives and Records Administration. Office of the Federal Register. Federal Register. Vol 67, No. 179, September 16, 2002. pp. 58335-58339.

I-7 Federal Aviation Administration, Office of Environment and Energy. *Emissions and Dispersion Modeling System Version 4.2.* September 2004.

II-1. U.S. Environmental Protection Agency. *Procedures for Emission Inventory Preparation. Volume IV: Mobile Sources*. Chapter 5: Emissions from Aircraft, 1992.

II-2. U.S. Environmental Protection Agency. *Draft 2002 National Emissions Inventory*.

II-3. City and County of Denver, Aircraft Noise Monitoring System (ANMS) Data, Calendar Years 2001 and 2004.

II-4. U.S. Bureau of Transportation Statistics. Airline On-Time Statistics, Calendar Years 2001 and 2004.

II-5. Bucher & Co. Publication. JP Airline-Fleets International 2000/2001.

II-6. Ricondo & Associates, Inc. *Aviation Activity Forecast.* May 16, 2001.

II-7. Bucher & Co. Publication. JP Airline-Fleets International 2004/2005. 38th Edition, April 2004.

II-8. Federal Aviation Administration. Office of Environment and Energy, AEE-120. *Air Quality Procedures for Civilian Airports and Air Force Bases,* April, 1997, as amended.

II-9. Conversations with Chief Sauls. Tuesday, May 10, 2005.

II-10. U.S. Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, Section 13.2.2 "Unpaved Roads". December 2003.

II-11. Conversations with George Radovich of DIA Security on Monday, June 6, 2005.

III-1. U.S. Environmental Protection Agency. *Diesel Fuel Sulfur Inputs for the Draft NONROAD2004 Model Used in the 2004 Nonroad Diesel Engine Final Rule.* April 27, 2004.

III-2. U.S. Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, Section 13.2.3 "Heavy Construction Operations". January 1995.

III-3. U.S Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, Section 11.9 "Western Surface Coal Mining". October 1998.

III-4. U.S. Environmental Protection Agency. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*, Section 11.12 "Concrete Batching". October 2001.

III-5. U.S. Environmental Protection Agency. *Nonroad Engine and Vehicle Emission Study—Report*. November 1991.

III-6. U.S. Environmental Protection Agency, Office of Mobile Sources. *Exhaust Emission Factors for Nonroad Engine Modeling – Compression-Ignition,* Report No. NR-009c, Table A2 "Steady-State Emission Factors for CI Engines in the NONROAD Model". April 2004.

# Appendix A. Aircraft Landing Takeoff Cycles

This appendix presents aircraft landing takeoff (LTO) cycle data used to develop the aircraft emission inventories presented in Section II. **Tables A-1 and A-2** present aircraft landing takeoff (LTO) cycles data for each of the SIP analysis years.

**Table A-1 (1 of 3)**

Aircraft Landing and Takeoff (LTO) Cycles at Denver International Airport – 2001

| EDMS Aircraft Type | EDMS Engine Type | 2001 LTO cycles |
|---|---|---|
| **Majors/Nationals** | | |
| A319 | CFM56-5A5 | 1,550 |
| | CFM56-5B5/P | 3,796 |
| | V2522-A5 | 6,709 |
| A320-200 | CFM56-5A1 | 3,048 |
| | CFM56-5B4/P | 2,394 |
| | V2527-A5 | 12,342 |
| A340-300 | CFM56-5C4 | 321 |
| B717-200 | BR700-715C1-30 | 64 |
| B727-200 | JT8D-15 | 20,799 |
| | JT8D-17R | 1,220 |
| B737-200 | JT8D-15A | 5,075 |
| | JT8D-17 | 1,644 |
| | JT8D-9A | 488 |
| B737-300 | CFM56-3B-2 | 13,408 |
| | CFM56-3C-1 | 40,306 |
| B737-500 | CFM56-3C-1 | 16,453 |
| B737-700 | CFM56-7B24 | 638 |
| B737-800 | CFM56-7B26 | 1,968 |
| | CFM56-7B27 | 413 |
| B737-900 | CFM56-7B26 | 284 |
| B747-400 | PW4056 | 443 |
| B757-200 | PW2037 | 24,487 |
| | RB211-535E4 | 519 |
| B767-200 | CF6-80A (A1) | 605 |
| | JT9D-7R4D | 119 |
| B767-300 | CF6-80A2 | 1,333 |
| | PW4056 | 2,756 |
| B777-200 | PW4077 | 5,158 |
| | GE90-85B | 416 |
| | TRENT 895 | 155 |
| DC9-30 | JT8D-7B | 94 |
| | JT8D-9A | 72 |
| MD-80 | JT8D-217C | 10,453 |
| | JT8D-219 | 4,370 |
| Subtotal | | 183,900 |
| **Regional/Commuters** | | |
| BAE146-200 | ALF502R-5 | 10,591 |
| BH-1900 | PT6A-65B | 28,748 |
| Canadair Reg-100 | CF34-3A1 | 7 |
| DO 328 | PW119-C | 12,100 |
| EMB-120 | PW118 | 1,895 |
| Navajo | TIO-540-J2B2 | 152 |
| REG'L JET 200 | CF34-3B | 5,632 |
| Swearingen Metro 2 | TPE331-3 | 875 |
| Subtotal | | 60,000 |

**Table A-1 (2 of 3)**

Aircraft Landing and Takeoff (LTO) Cycles at Denver International Airport – 2001

| EDMS Aircraft Type | EDMS Engine Type | 2001 LTO cycles |
|---|---|---|
| **All Cargo** | | |
| A300-600 | CF6-80C2A5 | 1,103 |
| | PW4158 | 279 |
| A310-200F | CF6-80A3 | 22 |
| | JT9D-7R4E1 | 13 |
| B727-200F | JT8D-15 | 1,256 |
| | JT8D-17 | 1,299 |
| | JT8D-7B | 827 |
| | JT8D-9A | 741 |
| B737-200 | JT8D-15 | 19 |
| B747-100 | JT9D-7A | 30 |
| B747-200 | JT9D-7Q | 14 |
| B757-200 | PW2040 | 379 |
| | RB211-535E4 | 433 |
| B767-200 | CF6-80A (A1) | 489 |
| | JT9D-7R4D | 111 |
| B767-300 | CF6-80C2B7F | 791 |
| BH-1900C | PT6A-65B | 242 |
| BH-C99 | PT6A-36 | 1,052 |
| Cessna 208 Caravan | PT6A-114 | 594 |
| Cessna T337 | IO-360-B | 45 |
| DC10-30F | CF6-50C2 | 864 |
| DC8-62F | JT3D-3B | 23 |
| DC8-73F | CFM56-2C5 | 356 |
| DC9-15F | JT8D-7B | 202 |
| DC9-30F | JT8D-7B | 9 |
| | JT8D-9 | 20 |
| DC9-40 | JT8D-11 | 269 |
| | JT8D-15 | 218 |
| EMB-120 | PW118 | 67 |
| Falcon 20 | CF700-2D | 196 |
| Learjet 25C | CJ610-6 | 16 |
| Learjet 35/36 | TFE 731-2-2B | 57 |
| MD-80 | JT8D-219 | 104 |
| Navajo | TIO-540-J2B2 | 1,024 |
| Swearingen Metro 2 | TPE331-3 | 136 |
| Subtotal | | 13,300 |
| **Other Air Taxi** | | |
| B727-200 | JT8D-15 | 16 |
| | JT8D-17 | 66 |
| B737-800 | CFM56-7B26 | 10 |
| BAE 125-700 | TFE731-3 | 262 |
| Beechjet 400 | JT15D-5 (A & B) | 305 |
| Cessna 208 Caravan | PT6A-114 | 326 |
| Cessna 441 Conquest2 | TPE331-8 | 637 |
| CITATION V | JT15D-5 (A & B) | 270 |
| Citation VII | TFE731-3 | 42 |
| CITATION X | AE3007C | 115 |
| CL600 | CF34-3A | 135 |
| DC10-10-F | CF6-6D | 7 |
| DC8-63F | JT8D-7 | 104 |
| DC8-71F | CFM56-2C5 | 189 |
| Falcon 2000EX | PW308C | 49 |
| Falcon 50 | TFE731-3 | 40 |
| King Air 200 | PT6A-41 | 91 |

**Table A-1 (3 of 3)**

Aircraft Landing and Takeoff (LTO) Cycles at Denver International Airport – 2001

| EDMS Aircraft Type | EDMS Engine Type | 2001 LTO cycles |
|---|---|---|
| **Other Air Taxi (cont.)** | | |
| Learjet 24D | CJ610-6 | 32 |
| Learjet 35/36 | TFE 731-2-2B | 438 |
| Navajo | TIO-540-J2B2 | 1,188 |
| Swearingen Metro 2 | TPE331-3 | 4,628 |
| Subtotal | | 8,950 |
| **General Aviation** | | |
| Bell 206 | 250B17B | 303 |
| CITATION X | AE3007C1 | 381 |
| Gulfstream V | BR700-715B1-30 | 1,010 |
| CL600 | CF34-3B | 134 |
| Learjet 25C | CJ610-6 | 89 |
| Cessna 172 Skyhawk | IO-320-D1AD | 19 |
| Piper PA-28 | IO-320-D1AD | 261 |
| CITATION I | JT15D-1 | 92 |
| Beechjet 400 | JT15D-5 (A & B) | 126 |
| CITATION V | JT15D-5 (A & B) | 277 |
| Cessna 208 Caravan | PT6A-114 | 1,152 |
| BH-C99 | PT6A-20 | 171 |
| Beech King Air 100 | PT6A-28 | 364 |
| PA-31T Cheyenne | PT6A-28 | 151 |
| Beech King Air 200 | PT6A-41 | 64 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 139 |
| BH-1900 | PT6A-67D | 28 |
| Falcon 2000EX | PW308C | 277 |
| Gulfstream II | SPEY MK511-8 | 99 |
| Gulfstream IV | TAY Mk611-8 | 177 |
| Citation VII | TFE 731-2-2B | 22 |
| Learjet 35/36 | TFE 731-2-2B | 93 |
| BAE 125-700 | TFE731-3 | 852 |
| Falcon 50 | TFE731-3 | 499 |
| Westwind 2 | TFE731-3 | 113 |
| Swearingen Metro 2 | TPE331-2 | 467 |
| Cessna 441 Conquest2 | TPE331-8 | 190 |
| Subtotal | | 7,550 |
| **Military** | | |
| C-130 HERCULES | 501D22A | 100 |
| F/A-18 HORNET | F404-GE-400 | 110 |
| F-16 | F100-PW-100 | 265 |
| Subtotal | | 475 |
| **Total** | | 274,175 |

Source: Ricondo & Associates, Inc. using aircraft operations data obtained from the City and County of Denver Department of Aviation, JP Airline-Fleets International, and the U.S. Bureau of Transportation Statistics.

Prepared by: Ricondo & Associates, Inc

**Table A-2 (1 of 3)**

Aircraft Landing Takeoff (LTO) Cycles at Denver International Airport – 2009, 2010, 2013, 2015, 2020, 2025, 2030

| | | LTO Cycles by Year | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **EDMS Aircraft Type** | **EDMS Engine Type** | **2009** | **2010** | **2013** | **2015** | **2020** | **2025** | **2030** |
| **Air Carrier** | | | | | | | | |
| A318 | CFM56-5B8/P | 6,959 | 7,153 | 7,738 | 8,124 | 9,045 | 9,928 | 10,848 |
| A319 | CFM56-5B5/P | 35,941 | 36,942 | 39,966 | 41,960 | 46,715 | 51,276 | 56,028 |
| | V2522-A5 | 12,693 | 13,046 | 14,115 | 14,819 | 16,498 | 18,109 | 19,787 |
| | CFM56-5A5 | 3,401 | 3,496 | 3,782 | 3,971 | 4,421 | 4,852 | 5,302 |
| A320-200 | V2527-A5 | 29,904 | 30,736 | 33,252 | 34,911 | 38,867 | 42,662 | 46,616 |
| | CFM56-5A1 | 6,053 | 6,222 | 6,731 | 7,067 | 7,868 | 8,636 | 9,436 |
| A321 | CFM56-5B3/2P DAC-II | 1,212 | 1,246 | 1,348 | 1,415 | 1,576 | 1,729 | 1,890 |
| A340-300 | CFM56-5C4 | 18 | 18 | 20 | 21 | 23 | 26 | 28 |
| A340-642 | TRENT 556-61 | 46 | 47 | 51 | 53 | 59 | 65 | 71 |
| B717-200 | BR700-715C1-30 | 1,256 | 1,291 | 1,397 | 1,467 | 1,633 | 1,792 | 1,958 |
| B737-300 | CFM56-3C-1 | 65,691 | 67,519 | 73,047 | 76,691 | 85,382 | 93,718 | 102,404 |
| | CFM56-3B-2 | 12,943 | 13,303 | 14,392 | 15,110 | 16,822 | 18,465 | 20,176 |
| B737-800 | CFM56-7B27 | 3,616 | 3,717 | 4,021 | 4,222 | 4,700 | 5,159 | 5,637 |
| | CFM56-7B26 | 4,536 | 4,662 | 5,044 | 5,296 | 5,896 | 6,471 | 7,071 |
| B747-400 | CF6-80C2B1F | 313 | 321 | 348 | 365 | 406 | 446 | 488 |
| | PW4056 | 544 | 559 | 605 | 635 | 707 | 776 | 848 |
| B757-200 | PW2037 | 24,005 | 24,673 | 26,693 | 28,025 | 31,201 | 34,247 | 37,421 |
| | RB211-535E4B | 1,490 | 1,531 | 1,656 | 1,739 | 1,936 | 2,125 | 2,322 |
| B767-200 | CF6-80A (A1) | 1,424 | 1,464 | 1,583 | 1,662 | 1,851 | 2,031 | 2,220 |
| B767-300 | PW4056 | 3,003 | 3,086 | 3,339 | 3,506 | 3,903 | 4,284 | 4,681 |
| B777-200 | PW4077 | 4,892 | 5,028 | 5,439 | 5,711 | 6,358 | 6,979 | 7,626 |
| | GE90-85B | 331 | 340 | 368 | 386 | 430 | 472 | 516 |
| | TRENT 895 | 199 | 204 | 221 | 232 | 258 | 283 | 310 |
| MD-80 | JT8D-217C | 9,898 | 10,173 | 11,006 | 11,555 | 12,865 | 14,121 | 15,430 |
| | JT8D-219 | 6,312 | 6,488 | 7,019 | 7,369 | 8,204 | 9,005 | 9,840 |
| MD-90-30 | V2525-D5 | 520 | 535 | 579 | 608 | 676 | 743 | 811 |
| Subtotal | | 237,200 | 243,800 | 263,760 | 276,920 | 308,300 | 338,400 | 369,765 |
| **Regionals/Commuters** | | | | | | | | |
| BAE 146-200 | ALF502R-5 | 3,631 | 3,712 | 3,882 | 3,983 | 4,200 | 4,365 | 4,769 |
| BH-1900C | PT6A-65B | 20,369 | 20,827 | 21,781 | 22,347 | 23,561 | 24,488 | 26,757 |
| Bombardier CRJ700 | CF34-8C1 | 7,523 | 7,692 | 8,044 | 8,253 | 8,702 | 9,044 | 9,882 |
| Bombardier CRJ900 | CF34-8C5 | 39 | 40 | 41 | 43 | 45 | 47 | 51 |
| Canadair Reg-100 | CF34-3B | 7 | 7 | 8 | 8 | 8 | 8 | 9 |
| DHC-8-200 | PW123D | 7,156 | 7,316 | 7,651 | 7,850 | 8,277 | 8,602 | 9,400 |
| EMB-120 | PW118A | 5,273 | 5,392 | 5,639 | 5,785 | 6,099 | 6,339 | 6,927 |
| | PW118B | 2,490 | 2,546 | 2,663 | 2,732 | 2,881 | 2,994 | 3,271 |
| Embraer ERJ 145LR | A3007A1/2 | 1,324 | 1,354 | 1,416 | 1,452 | 1,531 | 1,591 | 1,739 |
| | AE3007A1/1 | 680 | 695 | 727 | 746 | 787 | 818 | 894 |
| REG'L JET 200 | CF34-3B | 24,958 | 25,519 | 26,688 | 27,381 | 28,869 | 30,004 | 32,785 |
| Subtotal | | 73,450 | 75,100 | 78,540 | 80,580 | 84,960 | 88,300 | 96,484 |

**Table A-2 (2 of 3)**

Aircraft Landing Takeoff (LTO) Cycles at Denver International Airport – 2009, 2010, 2013, 2015, 2020, 2025, 2030

| | | LTO Cycles by Year | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **EDMS Aircraft Type** | **EDMS Engine Type** | **2009** | **2010** | **2013** | **2015** | **2020** | **2025** | **2030** |
| **All Cargo** | | | | | | | | |
| A300-600 | CF6-80C2A5 | 2,143 | 2,208 | 2,415 | 2,549 | 2,898 | 3,267 | 3,569 |
| | PW4158 | 2,728 | 2,811 | 3,075 | 3,245 | 3,690 | 4,159 | 4,544 |
| A310 | CF6-80A3 | 117 | 120 | 131 | 139 | 158 | 178 | 194 |
| B727-200F | JT8D-15 | 1,909 | 1,967 | 2,152 | 2,271 | 2,582 | 2,911 | 3,180 |
| | JT8D-17 | 1,626 | 1,676 | 1,833 | 1,934 | 2,199 | 2,479 | 2,709 |
| | JT8D-7B | 1,394 | 1,436 | 1,571 | 1,658 | 1,885 | 2,125 | 2,322 |
| | JT8D-9A | 392 | 404 | 442 | 467 | 531 | 598 | 654 |
| B747-100F | JT9D-7A | 96 | 99 | 108 | 114 | 130 | 147 | 160 |
| | JT9D-7Q | 57 | 59 | 64 | 68 | 77 | 86 | 95 |
| B757-200 | PW2040 | 357 | 368 | 402 | 424 | 482 | 544 | 594 |
| | RB211-535E4 | 406 | 418 | 457 | 483 | 549 | 619 | 676 |
| B767-200 | CF6-80A (A1) | 1,199 | 1,236 | 1,352 | 1,426 | 1,622 | 1,828 | 1,998 |
| | JT9D-7R4D | 272 | 281 | 307 | 324 | 368 | 415 | 453 |
| B767-300ER | CF6-80C2B7F | 1,023 | 1,054 | 1,153 | 1,217 | 1,383 | 1,559 | 1,704 |
| BH-1900C | PT6A-65B | 161 | 166 | 181 | 191 | 217 | 245 | 268 |
| BH-C99 | PT6A-36 | 176 | 182 | 199 | 210 | 239 | 269 | 294 |
| Cessna 208 Caravan | PT6A-114 | 258 | 266 | 291 | 307 | 349 | 394 | 430 |
| DC10-10F | CF6-6D | 258 | 266 | 291 | 307 | 349 | 394 | 430 |
| DC10-30F | CF6-50C2 | 1,929 | 1,988 | 2,174 | 2,294 | 2,609 | 2,940 | 3,213 |
| DC8-61 | JT3D-3B | 22 | 23 | 25 | 26 | 30 | 34 | 37 |
| DC8-71F | CFM56-2C5 | 60 | 62 | 67 | 71 | 81 | 91 | 100 |
| DC9-30F | JT8D-9 | 101 | 104 | 114 | 120 | 136 | 154 | 168 |
| DC9-40 | JT8D-11 | 350 | 361 | 395 | 417 | 474 | 534 | 584 |
| | JT8D-15 | 285 | 293 | 321 | 339 | 385 | 434 | 474 |
| Learjet 35/36 | TFE 731-2-2B | 55 | 57 | 62 | 66 | 75 | 84 | 92 |
| MD-11F | CF6-80C2D1F | 8 | 8 | 9 | 9 | 11 | 12 | 13 |
| MD-80 | JT8D-219 | 217 | 224 | 245 | 259 | 17 | 331 | 362 |
| Swearingen Metro 2 | TPE331-3 | 13 | 13 | 14 | 15 | 294 | 19 | 21 |
| Subtotal | | 17,612 | 18,150 | 19,850 | 20,950 | 23,820 | 26,850 | 29,338 |
| **Other Air Taxi** | | | | | | | | |
| B727-200 | JT8D-15 | 7 | 7 | 7 | 8 | 8 | 8 | 9 |
| B737-200 | JT8D-17 | 28 | 29 | 29 | 29 | 30 | 31 | 34 |
| B737-800 | CFM56-7B26 | 22 | 22 | 22 | 23 | 23 | 24 | 26 |
| BAE 125-700 | TFE731-3 | 330 | 332 | 337 | 340 | 349 | 358 | 391 |
| Beech King Air 200 | PT6A-41 | 14 | 14 | 14 | 14 | 15 | 15 | 16 |
| Beechjet 400A | JT15D-5 (A & B) | 245 | 247 | 251 | 253 | 260 | 266 | 291 |
| Cessna 441 Conquest2 | TPE331-8 | 486 | 489 | 497 | 502 | 515 | 528 | 577 |
| CITATION V | JT15D-5 (A & B) | 431 | 433 | 440 | 444 | 456 | 467 | 511 |
| Citation VII | TFE731-3 | 48 | 48 | 48 | 49 | 50 | 51 | 56 |
| CITATION X | AE3007C | 158 | 159 | 162 | 163 | 168 | 172 | 188 |
| CL600 | CF34-3B | 33 | 33 | 34 | 34 | 35 | 36 | 39 |
| CL601-3A | CF34-3A | 34 | 34 | 34 | 35 | 35 | 36 | 40 |
| Embraer Legacy | AE3007A1P (Type 1) | 18 | 18 | 19 | 19 | 19 | 20 | 22 |
| Falcon 2000EX | PW308C | 64 | 64 | 65 | 65 | 67 | 69 | 75 |
| Falcon 50 | TFE731-3 | 9 | 9 | 9 | 9 | 9 | 10 | 10 |
| Galaxy (IAI) G200 | PW306A | 16 | 16 | 16 | 17 | 17 | 17 | 19 |
| Gulfstream IV | TAY Mk611-8 | 4 | 4 | 4 | 5 | 5 | 5 | 5 |
| Learjet 24D | CJ610-6 | 18 | 18 | 19 | 19 | 19 | 20 | 22 |
| Learjet 35/36 | TFE 731-2-2B | 183 | 184 | 187 | 189 | 194 | 199 | 217 |
| Navajo | PT6A-28 | 1,693 | 1,702 | 1,730 | 1,748 | 1,793 | 1,838 | 2,009 |
| Swearingen Metro 2 | TPE331-3 | 5,509 | 5,538 | 5,626 | 5,685 | 5,833 | 5,980 | 6,534 |
| Subtotal | | 9,350 | 9,400 | 9,550 | 9,650 | 9,900 | 10,150 | 11,091 |

**Table A-2 (3 of 3)**

Aircraft Landing Takeoff (LTO) Cycles at Denver International Airport – 2009, 2010, 2013, 2015, 2020, 2025, 2030

| | | LTO Cycles by Year | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **EDMS Aircraft Type** | **EDMS Engine Type** | **2009** | **2010** | **2013** | **2015** | **2020** | **2025** | **2030** |
| **General Aviation** | | | | | | | | |
| Bell 206 | 250B17B | 420 | 424 | 434 | 441 | 457 | 470 | 514 |
| CITATION X | AE3007C | 640 | 646 | 661 | 672 | 696 | 717 | 783 |
| Gulfstream V | BR700-715B1-30 | 1,075 | 1,086 | 1,111 | 1,129 | 1,170 | 1,204 | 1,315 |
| CL600 | CF34-3B | 162 | 164 | 168 | 170 | 176 | 182 | 198 |
| Learjet 25C | CJ610-6 | 113 | 114 | 116 | 118 | 123 | 126 | 138 |
| Cessna 172 Skyhawk | IO-320-D1AD | 70 | 71 | 72 | 73 | 76 | 78 | 86 |
| Piper PA-28 | IO-320-D1AD | 283 | 286 | 293 | 298 | 308 | 317 | 347 |
| CITATION I | JT15D-1 | 17 | 17 | 18 | 18 | 19 | 19 | 21 |
| Beechjet 400 | JT15D-5 (A & B) | 152 | 153 | 157 | 160 | 165 | 170 | 186 |
| CITATION V | JT15D-5 (A & B) | 375 | 379 | 388 | 394 | 408 | 420 | 459 |
| Cessna 208 Caravan | PT6A-114 | 1,040 | 1,051 | 1,076 | 1,093 | 1,133 | 1,166 | 1,274 |
| Beech King Air 100 | PT6A-28 | 195 | 196 | 201 | 204 | 212 | 218 | 238 |
| PA-31T Cheyenne | PT6A-28 | 532 | 538 | 550 | 559 | 579 | 596 | 651 |
| BH-C99 | PT6A-36 | 143 | 145 | 148 | 151 | 156 | 160 | 175 |
| Beech King Air 200 | PT6A-41 | 87 | 88 | 90 | 91 | 95 | 98 | 106 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 242 | 245 | 250 | 255 | 264 | 271 | 296 |
| BH-1900 | PT6A-67D | 58 | 59 | 60 | 61 | 63 | 65 | 71 |
| Falcon 2000EX | PW308C | 449 | 453 | 464 | 471 | 488 | 503 | 549 |
| Gulfstream II | SPEY MK511-8 | 107 | 109 | 111 | 113 | 117 | 120 | 131 |
| Gulfstream IV | TAY Mk611-8 | 288 | 291 | 298 | 303 | 314 | 323 | 353 |
| Citation VII | TFE 731-2-2B | 70 | 71 | 72 | 74 | 76 | 78 | 86 |
| Learjet 35/36 | TFE 731-2-2B | 70 | 71 | 72 | 74 | 76 | 78 | 86 |
| BAE 125-700 | TFE731-3 | 941 | 951 | 973 | 989 | 1,025 | 1,055 | 1,152 |
| Falcon 50 | TFE731-3 | 186 | 188 | 192 | 195 | 202 | 208 | 228 |
| Westwind 2 | TFE731-3 | 206 | 209 | 213 | 217 | 225 | 231 | 253 |
| Swearingen Metro 2 | TPE331-3 | 101 | 102 | 104 | 106 | 109 | 113 | 123 |
| Cessna 441 Conquest2 | TPE331-8 | 191 | 193 | 198 | 201 | 208 | 214 | 234 |
| Subtotal | | 8,213 | 8,300 | 8,490 | 8,630 | 8,940 | 9,200 | 10,053 |
| **Military** | | | | | | | | |
| C-130 HERCULES | 501D22A | 95 | 95 | 95 | 95 | 95 | 95 | 104 |
| C-17A | F117-PW-100 | 149 | 149 | 149 | 149 | 149 | 149 | 163 |
| F-16 | F100-PW-100 | 231 | 231 | 231 | 231 | 231 | 231 | 252 |
| Subtotal | | 475 | 475 | 475 | 475 | 475 | 475 | 519 |
| **Total** | | 346,300 | 355,225 | 380,665 | 397,205 | 436,395 | 473,375 | 517,250 |

Source: Ricondo & Associates, Inc. using aircraft operations data obtained from the City and County of Denver Department of Aviation, JP Airline-Fleets International, and the U.S. Bureau of Transportation Statistics.

Prepared by: Ricondo & Associates, Inc

# Appendix B. Aircraft Emissions

This appendix presents tables that summarize aircraft emissions by aircraft type and engine type. Detailed aircraft emissions tables were developed for each of the SIP analysis years. This information was taken directly from output files generated by the Emissions and Dispersion Modeling System (EDMS) Version 4.2.

**Table B-1 (1 of 3)**

Baseline (2001) Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A319 | CFM56-5A5 | 9.233 | 0.938 | 11.406 | 0.996 | 0.961 |
| | CFM56-5B5/P | 33.876 | 7.667 | 23.688 | 2.302 | 2.354 |
| | V2522-A5 | 34.864 | 0.399 | 52.964 | 4.839 | 4.160 |
| A320-200 | CFM56-5A1 | 17.777 | 1.777 | 23.618 | 2.103 | 1.890 |
| | CFM56-5B4/P | 18.599 | 4.039 | 23.038 | 1.745 | 1.484 |
| | V2527-A5 | 64.524 | 0.807 | 113.552 | 9.705 | 7.653 |
| A340-300 | CFM56-5C4 | 7.788 | 1.303 | 13.804 | 0.700 | 0.199 |
| B717-200 | BR700-715C1-30 | 0.315 | 0.003 | 0.581 | 0.041 | 0.040 |
| B727-200 | JT8D-15 | 174.117 | 27.719 | 276.017 | 29.799 | 12.896 |
| | JT8D-17R | 9.319 | 1.227 | 20.475 | 1.833 | 0.756 |
| B737-200 | JT8D-15A | 29.837 | 5.063 | 30.906 | 4.017 | 3.147 |
| | JT8D-17 | 8.589 | 1.246 | 12.539 | 1.430 | 1.019 |
| | JT8D-9A | 2.933 | 0.710 | 2.929 | 0.376 | 0.303 |
| B737-300 | CFM56-3B-2 | 149.131 | 9.177 | 83.305 | 9.247 | 8.314 |
| | CFM56-3C-1 | 418.052 | 23.440 | 284.860 | 29.506 | 24.992 |
| B737-500 | CFM56-3C-1 | 171.316 | 9.595 | 125.719 | 12.564 | 10.202 |
| B737-700 | CFM56-7B24 | 4.787 | 0.564 | 5.515 | 0.460 | 0.396 |
| B737-800 | CFM56-7B26 | 12.886 | 1.442 | 21.095 | 1.528 | 1.220 |
| | CFM56-7B27 | 2.633 | 0.280 | 4.857 | 0.332 | 0.256 |
| B737-900 | CFM56-7B26 | 1.860 | 0.208 | 3.045 | 0.220 | 0.176 |
| B747-400 | PW4056 | 12.709 | 1.202 | 23.088 | 1.490 | 0.275 |
| B757-200 | PW2037 | 256.882 | 23.697 | 331.106 | 25.283 | 15.183 |
| | RB211-535E4 | 3.899 | 0.117 | 8.906 | 0.594 | 0.322 |
| B767-200 | CF6-80A (A1) | 8.415 | 2.033 | 13.040 | 0.818 | 0.375 |
| | JT9D-7R4D | 0.722 | 0.114 | 2.932 | 0.180 | 0.074 |
| B767-300 | CF6-80A2 | 18.509 | 4.524 | 30.574 | 1.860 | 0.827 |
| | PW4056 | 38.267 | 9.354 | 63.211 | 3.845 | 1.709 |
| B777-200 | PW4077 | 72.596 | 12.631 | 199.964 | 10.579 | 3.198 |
| | GE90-85B | 5.206 | 0.200 | 20.546 | 0.931 | 0.258 |
| | TRENT 895 | 2.308 | 0.149 | 8.908 | 0.428 | 0.096 |
| DC9-30 | JT8D-7B | 0.558 | 0.160 | 0.571 | 0.073 | 0.058 |
| | JT8D-9A | 0.435 | 0.105 | 0.472 | 0.057 | 0.045 |
| MD-80 | JT8D-217C | 83.395 | 0.000 | 79.913 | 9.340 | 6.481 |
| | JT8D-219 | 32.989 | 0.000 | 37.185 | 3.978 | 2.710 |
| **Regional/Commuters** | | | | | | |
| BAE146-200 | ALF502R-5 | 111.085 | 15.214 | 44.443 | 5.938 | 6.567 |
| BH-1900 | PT6A-65B | 146.804 | 45.641 | 15.018 | 3.683 | 17.825 |
| Canadair Reg-100 | CF34-3A1 | 0.044 | 0.004 | 0.013 | 0.002 | 0.004 |
| DO 328 | PW119-C | 18.801 | 0.000 | 27.924 | 3.020 | 7.503 |
| EMB-120 | PW118 | 4.309 | 0.000 | 2.353 | 0.344 | 1.175 |
| Navajo | TIO-540-J2B2 | 5.724 | 0.130 | 0.003 | 0.000 | 0.094 |
| REG'L JET 200 | CF34-3B | 38.582 | 4.050 | 9.966 | 1.576 | 3.492 |
| Swearingen Metro 2 | TPE331-3 | 2.413 | 3.025 | 0.396 | 0.077 | 0.543 |
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 13.382 | 1.156 | 23.293 | 1.670 | 0.684 |
| | PW4158 | 3.900 | 0.363 | 5.968 | 0.423 | 0.173 |
| A310-200F | CF6-80A3 | 0.304 | 0.074 | 0.407 | 0.028 | 0.014 |
| | JT9D-7R4E1 | 0.078 | 0.012 | 0.302 | 0.019 | 0.008 |
| B727-200F | JT8D-15 | 10.515 | 1.674 | 16.668 | 1.799 | 0.779 |
| | JT8D-17 | 10.311 | 1.506 | 17.191 | 1.808 | 0.805 |
| | JT8D-7B | 7.511 | 2.141 | 9.113 | 1.066 | 0.513 |
| | JT8D-9A | 6.833 | 1.642 | 8.791 | 0.973 | 0.459 |
| B737-200 | JT8D-15 | 0.104 | 0.017 | 0.131 | 0.017 | 0.012 |
| B747-100 | JT9D-7A | 3.240 | 1.497 | 1.680 | 0.098 | 0.019 |

**Table B-1 (2 of 3)**

Baseline (2001) Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo (cont.)** | | | | | | |
| B747-200 | JT9D-7Q | 1.049 | 0.263 | 0.787 | 0.052 | 0.009 |
| B757-200 | PW2040 | 3.697 | 0.331 | 6.357 | 0.421 | 0.235 |
| | RB211-535E4 | 3.253 | 0.098 | 7.431 | 0.496 | 0.268 |
| B767-200 | CF6-80A (A1) | 6.801 | 1.642 | 10.540 | 0.661 | 0.303 |
| | JT9D-7R4D | 0.674 | 0.106 | 2.735 | 0.168 | 0.069 |
| B767-300 | CF6-80C2B7F | 9.160 | 0.796 | 19.652 | 1.310 | 0.490 |
| BH-1900C | PT6A-65B | 1.236 | 0.385 | 0.127 | 0.031 | 0.150 |
| BH-C99 | PT6A-36 | 0.876 | 0.063 | 0.471 | 0.089 | 0.652 |
| Cessna 208 Caravan | PT6A-114 | 0.267 | 0.020 | 0.117 | 0.023 | 0.368 |
| Cessna T337 | IO-360-B | 0.402 | 0.009 | 0.002 | 0.000 | 0.028 |
| DC10-30F | CF6-50C2 | 16.645 | 2.086 | 28.723 | 1.833 | 0.536 |
| DC8-62F | JT3D-3B | 1.993 | 2.310 | 0.261 | 0.042 | 0.014 |
| DC8-73F | CFM56-2C5 | 8.828 | 0.554 | 5.250 | 0.563 | 0.221 |
| DC9-15F | JT8D-7B | 1.194 | 0.341 | 1.015 | 0.144 | 0.125 |
| DC9-30F | JT8D-7B | 0.053 | 0.015 | 0.055 | 0.007 | 0.006 |
| | JT8D-9 | 0.121 | 0.029 | 0.131 | 0.015 | 0.012 |
| DC9-40 | JT8D-11 | 4.519 | 1.350 | 1.879 | 0.236 | 0.167 |
| | JT8D-15 | 1.203 | 0.191 | 1.692 | 0.196 | 0.135 |
| EMB-120 | PW118 | 0.152 | 0.000 | 0.084 | 0.012 | 0.042 |
| Falcon 20 | CF700-2D | 6.273 | 0.648 | 0.138 | 0.063 | 0.122 |
| Learjet 25C | CJ610-6 | 0.573 | 0.056 | 0.008 | 0.002 | 0.010 |
| Learjet 35/36 | TFE 731-2-2B | 0.282 | 0.094 | 0.053 | 0.004 | 0.035 |
| MD-80 | JT8D-219 | 0.785 | 0.000 | 0.885 | 0.095 | 0.064 |
| Navajo | TIO-540-J2B2 | 38.561 | 0.880 | 0.019 | 0.003 | 0.635 |
| Swearingen Metro 2 | TPE331-3 | 0.375 | 0.471 | 0.062 | 0.012 | 0.084 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.134 | 0.021 | 0.213 | 0.023 | 0.005 |
| | JT8D-17 | 0.524 | 0.076 | 0.873 | 0.091 | 0.020 |
| B737-800 | CFM56-7B26 | 0.065 | 0.008 | 0.107 | 0.008 | 0.003 |
| BAE 125-700 | TFE731-3 | 1.095 | 0.212 | 0.321 | 0.021 | 0.079 |
| Beechjet 400 | JT15D-5 (A & B) | 3.544 | 3.450 | 0.216 | 0.026 | 0.092 |
| Cessna 208 Caravan | PT6A-114 | 0.147 | 0.011 | 0.064 | 0.013 | 0.098 |
| Cessna 441 Conquest2 | TPE331-8 | 0.583 | 0.045 | 0.360 | 0.052 | 0.192 |
| CITATION V | JT15D-5 (A & B) | 3.169 | 3.064 | 0.227 | 0.025 | 0.081 |
| Citation VII | TFE731-3 | 0.181 | 0.033 | 0.061 | 0.003 | 0.013 |
| CITATION X | AE3007C | 0.424 | 0.088 | 0.212 | 0.028 | 0.035 |
| CL600 | CF34-3A | 0.925 | 0.097 | 0.235 | 0.037 | 0.041 |
| DC10-10-F | CF6-6D | 0.306 | 0.126 | 0.259 | 0.013 | 0.002 |
| DC8-63F | JT8D-7 | 1.245 | 0.355 | 1.410 | 0.169 | 0.031 |
| DC8-71F | CFM56-2C5 | 4.687 | 0.294 | 2.788 | 0.299 | 0.057 |
| Falcon 2000EX | PW308C | 0.291 | 0.041 | 0.129 | 0.014 | 0.015 |
| Falcon 50 | TFE731-3 | 0.250 | 0.046 | 0.074 | 0.004 | 0.012 |
| King Air 200 | PT6A-41 | 0.682 | 0.606 | 0.036 | 0.006 | 0.027 |
| Learjet 24D | CJ610-6 | 1.146 | 0.114 | 0.017 | 0.006 | 0.010 |
| Learjet 35/36 | TFE 731-2-2B | 2.168 | 0.722 | 0.409 | 0.034 | 0.132 |
| Navajo | TIO-540-J2B2 | 44.737 | 1.021 | 0.022 | 0.003 | 0.358 |
| Swearingen Metro 2 | TPE331-3 | 12.764 | 16.000 | 2.095 | 0.409 | 1.396 |
| **General Aviation** | | | | | | |
| BAE 125-700 | TFE731-3 | 1.265 | 0.245 | 0.371 | 0.024 | 0.036 |
| Beech King Air 100 | PT6A-28 | 0.316 | 0.022 | 0.159 | 0.031 | 0.045 |
| Beech King Air 200 | PT6A-41 | 7.570 | 6.723 | 0.400 | 0.057 | 0.120 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.585 | 0.083 | 0.065 | 0.017 | 0.016 |
| Beechjet 400 | JT15D-5 (A & B) | 1.034 | 1.006 | 0.063 | 0.008 | 0.011 |
| Bell 206 | 250B17B | 0.013 | 0.002 | 0.002 | 0.000 | 0.002 |

**Table B-1 (3 of 3)**

Baseline (2001) Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation (cont.)** | | | | | | |
| BH-1900 | PT6A-67D | 1.573 | 0.496 | 0.153 | 0.037 | 0.031 |
| BH-C99 | PT6A-20 | 0.085 | 0.006 | 0.036 | 0.008 | 0.011 |
| Cessna 172 Skyhawk | IO-320-D1AD | 0.765 | 0.013 | 0.002 | 0.000 | 0.015 |
| Cessna 208 Caravan | PT6A-114 | 0.125 | 0.009 | 0.055 | 0.011 | 0.033 |
| Cessna 441 Conquest2 | TPE331-8 | 1.055 | 0.082 | 0.651 | 0.094 | 0.136 |
| CITATION I | JT15D-1 | 1.742 | 0.637 | 0.087 | 0.013 | 0.020 |
| CITATION V | JT15D-5 (A & B) | 4.273 | 4.131 | 0.306 | 0.034 | 0.043 |
| Citation VII | TFE 731-2-2B | 0.755 | 0.250 | 0.161 | 0.012 | 0.018 |
| CITATION X | AE3007C1 | 0.223 | 0.044 | 0.140 | 0.017 | 0.008 |
| CL600 | CF34-3B | 0.952 | 0.100 | 0.241 | 0.039 | 0.016 |
| Falcon 2000EX | PW308C | 0.166 | 0.023 | 0.074 | 0.008 | 0.003 |
| Falcon 50 | TFE731-3 | 1.735 | 0.323 | 0.509 | 0.033 | 0.033 |
| Gulfstream II | SPEY MK511-8 | 1.195 | 0.148 | 0.670 | 0.072 | 0.012 |
| Gulfstream IV | TAY Mk611-8 | 1.447 | 0.235 | 0.656 | 0.097 | 0.021 |
| Gulfstream V | BR700-715B1-30 | 0.109 | 0.001 | 0.149 | 0.012 | 0.003 |
| Learjet 25C | CJ610-6 | 3.331 | 0.330 | 0.046 | 0.015 | 0.011 |
| Learjet 35/36 | TFE 731-2-2B | 4.216 | 1.405 | 0.795 | 0.066 | 0.101 |
| PA-31T Cheyenne | PT6A-28 | 0.398 | 0.025 | 0.180 | 0.035 | 0.059 |
| Piper PA-28 | IO-320-D1AD | 0.775 | 0.013 | 0.002 | 0.000 | 0.013 |
| Swearingen Metro 2 | TPE331-2 | 1.376 | 1.764 | 0.219 | 0.037 | 0.055 |
| Westwind 2 | TFE731-3 | 0.809 | 0.149 | 0.288 | 0.018 | 0.022 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 0.809 | 0.149 | 0.288 | 0.018 | 0.030 |
| F/A-18 HORNET | F404-GE-400 | 2.068 | 0.916 | 0.438 | 0.078 | 0.033 |
| F-16 | F100-PW-100 | 4.264 | 1.607 | 0.488 | 0.043 | 0.080 |
| **Total** | | 2,326.334 | 290.141 | 2,244.285 | 204.436 | 163.214 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-2 (1 of 3)**

2009 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 80.352 | 17.421 | 40.475 | 4.579 | 4.315 |
| A319 | CFM56-5B5/P | 379.200 | 85.811 | 231.676 | 23.738 | 22.285 |
| | V2522-A5 | 77.552 | 0.853 | 104.091 | 10.02 | 7.870 |
| | CFM56-5A5 | 23.814 | 2.381 | 25.851 | 2.379 | 2.109 |
| A320-200 | V2527-A5 | 183.777 | 2.208 | 285.506 | 25.721 | 18.542 |
| | CFM56-5A1 | 41.515 | 4.070 | 48.315 | 4.528 | 3.753 |
| A321 | CFM56-5B3/2P DAC-II | 24.264 | 2.321 | 14.735 | 1.198 | 0.752 |
| A340-300 | CFM56-5C4 | 0.516 | 0.087 | 0.785 | 0.042 | 0.011 |
| A340-642 | TRENT 556-61 | 0.794 | 0.008 | 3.747 | 0.179 | 0.029 |
| B717-200 | BR700-715C1-30 | 7.277 | 0.068 | 11.810 | 0.873 | 0.779 |
| B737-300 | CFM56-3C-1 | 807.246 | 45.506 | 484.468 | 52.786 | 40.732 |
| | CFM56-3B-2 | 170.696 | 10.56 | 84.058 | 9.814 | 8.025 |
| B737-800 | CFM56-7B27 | 27.383 | 2.906 | 43.681 | 3.149 | 2.242 |
| | CFM56-7B26 | 35.259 | 3.939 | 50.011 | 3.817 | 2.813 |
| B747-400 | CF6-80C2B1F | 8.831 | 0.787 | 15.481 | 1.121 | 0.194 |
| | PW4056 | 18.459 | 1.749 | 28.978 | 1.96 | 0.337 |
| B757-200 | PW2037 | 298.878 | 27.654 | 333.215 | 26.889 | 14.884 |
| | RB211-535E4B | 19.225 | 0.197 | 21.222 | 1.987 | 0.924 |
| B767-200 | CF6-80A (A1) | 23.28 | 5.632 | 31.112 | 2.048 | 0.883 |
| B767-300 | PW4056 | 50.518 | 4.790 | 65.470 | 4.881 | 1.862 |
| B777-200 | PW4077 | 82.074 | 14.129 | 192.401 | 10.688 | 3.033 |
| | GE90-85B | 4.902 | 0.186 | 16.664 | 0.795 | 0.205 |
| | TRENT 895 | 3.521 | 0.227 | 11.63 | 0.586 | 0.123 |
| MD-80 | JT8D-217C | 92.959 | 0.000 | 78.838 | 9.625 | 6.137 |
| | JT8D-219 | 56.06 | 0.000 | 55.745 | 6.236 | 3.914 |
| MD-90-30 | V2525-D5 | 3.139 | 0.037 | 4.632 | 0.425 | 0.322 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 45.078 | 6.225 | 15.883 | 2.207 | 2.251 |
| BH-1900C | PT6A-65B | 120.668 | 38.134 | 11.408 | 2.874 | 12.630 |
| Bombardier CRJ700 | CF34-8C1 | 47.176 | 0.219 | 27.539 | 3.347 | 4.665 |
| Bombardier CRJ900 | CF34-8C5 | 0.176 | 0.001 | 0.148 | 0.018 | 0.024 |
| Canadair Reg-100 | CF34-3B | 0.057 | 0.006 | 0.013 | 0.002 | 0.004 |
| DHC-8-200 | PW123D | 12.660 | 0.000 | 16.692 | 1.868 | 4.437 |
| EMB-120 | PW118A | 10.341 | 0.000 | 8.300 | 1.067 | 3.270 |
| | PW118B | 4.894 | 0.000 | 3.926 | 0.505 | 1.544 |
| Embraer ERJ 145LR | A3007A1/2 | 5.580 | 0.858 | 3.753 | 0.439 | 0.821 |
| | AE3007A1/1 | 2.866 | 0.441 | 1.928 | 0.225 | 0.422 |
| REG'L JET 200 | CF34-3B | 204.472 | 21.458 | 46.781 | 7.690 | 15.475 |

**Table B-2 (2 of 3)**

2009 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 30.785 | 2.657 | 46.461 | 3.498 | 1.329 |
| | PW4158 | 45.099 | 4.192 | 59.951 | 4.467 | 1.692 |
| A310 | CF6-80A3 | 1.903 | 0.463 | 2.200 | 0.155 | 0.073 |
| B727-200F | JT8D-15 | 18.664 | 2.934 | 26.114 | 2.978 | 1.184 |
| | JT8D-17 | 15.075 | 2.168 | 22.182 | 2.471 | 1.008 |
| | JT8D-7B | 14.887 | 4.256 | 15.852 | 1.952 | 0.864 |
| | JT8D-9A | 4.249 | 1.022 | 4.781 | 0.560 | 0.243 |
| B747-100F | JT9D-7A | 12.322 | 5.715 | 5.450 | 0.336 | 0.060 |
| | JT9D-7Q | 5.107 | 1.278 | 3.220 | 0.225 | 0.035 |
| B757-200 | PW2040 | 4.136 | 0.370 | 6.131 | 0.430 | 0.221 |
| | RB211-535E4 | 3.610 | 0.109 | 7.113 | 0.507 | 0.252 |
| B767-200 | CF6-80A (A1) | 19.601 | 4.742 | 26.195 | 1.724 | 0.743 |
| | JT9D-7R4D | 1.937 | 0.303 | 6.834 | 0.444 | 0.169 |
| B767-300ER | CF6-80C2B7F | 14.053 | 1.217 | 25.993 | 1.813 | 0.634 |
| BH-1900C | PT6A-65B | 0.953 | 0.301 | 0.090 | 0.023 | 0.100 |
| BH-C99 | PT6A-36 | 0.172 | 0.012 | 0.085 | 0.017 | 0.109 |
| Cessna 208 Caravan | PT6A-114 | 0.136 | 0.010 | 0.055 | 0.011 | 0.160 |
| DC10-10F | CF6-6D | 13.392 | 5.525 | 9.704 | 0.532 | 0.160 |
| DC10-30F | CF6-50C2 | 43.701 | 5.467 | 65.054 | 4.365 | 1.196 |
| DC8-61 | JT3D-3B | 2.242 | 2.630 | 0.259 | 0.043 | 0.014 |
| DC8-71F | CFM56-2C5 | 1.760 | 0.111 | 0.920 | 0.104 | 0.037 |
| DC9-30F | JT8D-9 | 0.720 | 0.174 | 0.683 | 0.088 | 0.063 |
| DC9-40 | JT8D-11 | 6.908 | 2.079 | 2.525 | 0.336 | 0.217 |
| | JT8D-15 | 1.840 | 0.288 | 2.290 | 0.280 | 0.177 |
| Learjet 35/36 | TFE 731-2-2B | 0.316 | 0.107 | 0.054 | 0.004 | 0.034 |
| MD-11F | CF6-80C2D1F | 0.163 | 0.014 | 0.308 | 0.021 | 0.005 |
| MD-80 | JT8D-219 | 0.042 | 0.054 | 0.007 | 0.001 | 0.008 |
| Swearingen Metro 2 | TPE331-3 | 1.927 | 0.000 | 1.917 | 0.214 | 0.135 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.068 | 0.011 | 0.096 | 0.011 | 0.002 |
| B737-200 | JT8D-17 | 0.171 | 0.024 | 0.222 | 0.026 | 0.008 |
| B737-800 | CFM56-7B26 | 0.171 | 0.019 | 0.243 | 0.019 | 0.007 |
| BAE 125-700 | TFE731-3 | 1.614 | 0.315 | 0.422 | 0.030 | 0.100 |
| Beech King Air 200 | PT6A-41 | 0.122 | 0.109 | 0.006 | 0.001 | 0.004 |
| Beechjet 400A | JT15D-5 (A & B) | 3.344 | 3.301 | 0.181 | 0.023 | 0.074 |
| Cessna 441 Conquest2 | TPE331-8 | 0.521 | 0.041 | 0.291 | 0.043 | 0.147 |
| CITATION V | JT15D-5 (A & B) | 5.936 | 5.824 | 0.375 | 0.044 | 0.130 |
| Citation VII | TFE731-3 | 0.240 | 0.045 | 0.072 | 0.004 | 0.014 |
| CITATION X | AE3007C | 0.689 | 0.144 | 0.302 | 0.041 | 0.048 |
| CL600 | CF34-3B | 0.270 | 0.029 | 0.061 | 0.010 | 0.010 |
| CL601-3A | CF34-3A | 0.254 | 0.025 | 0.067 | 0.006 | 0.010 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.075 | 0.013 | 0.050 | 0.006 | 0.005 |
| Falcon 2000EX | PW308C | 0.451 | 0.064 | 0.175 | 0.021 | 0.019 |
| Falcon 50 | TFE731-3 | 0.066 | 0.012 | 0.018 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.010 | 0.100 | 0.046 | 0.004 | 0.005 |
| Gulfstream IV | TAY Mk611-8 | 0.039 | 0.007 | 0.015 | 0.002 | 0.001 |
| Learjet 24D | CJ610-6 | 0.747 | 0.076 | 0.010 | 0.003 | 0.005 |
| Learjet 35/36 | TFE 731-2-2B | 1.054 | 0.356 | 0.177 | 0.015 | 0.055 |
| Navajo | PT6A-28 | 67.735 | 1.656 | 0.032 | 0.006 | 0.511 |
| Swearingen Metro 2 | TPE331-3 | 17.969 | 22.840 | 2.624 | 0.532 | 1.662 |

**Table B-2 (3 of 3)**

2009 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.055 | 0.401 | 0.538 | 0.037 | 0.050 |
| Beech King Air 100 | PT6A-28 | 0.623 | 0.044 | 0.289 | 0.056 | 0.076 |
| Beech King Air 200 | PT6A-41 | 9.377 | 8.393 | 0.449 | 0.067 | 0.127 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.820 | 0.120 | 0.085 | 0.021 | 0.019 |
| Beechjet 400 | JT15D-5 (A & B) | 1.543 | 1.522 | 0.084 | 0.011 | 0.013 |
| Bell 206 | 250B17B | 0.049 | 0.008 | 0.007 | 0.001 | 0.008 |
| BH-1900 | PT6A-67D | 1.985 | 0.636 | 0.177 | 0.045 | 0.033 |
| BH-C99 | PT6A-36 | 0.017 | 0.001 | 0.008 | 0.001 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 0.949 | 0.018 | 0.003 | 0.000 | 0.018 |
| Cessna 208 Caravan | PT6A-114 | 0.197 | 0.015 | 0.080 | 0.017 | 0.044 |
| Cessna 441 Conquest2 | TPE331-8 | 1.114 | 0.087 | 0.623 | 0.093 | 0.123 |
| CITATION I | JT15D-1 | 2.327 | 0.865 | 0.104 | 0.015 | 0.023 |
| CITATION V | JT15D-5 (A & B) | 7.326 | 7.188 | 0.463 | 0.054 | 0.063 |
| Citation VII | TFE 731-2-2B | 0.831 | 0.279 | 0.158 | 0.013 | 0.017 |
| CITATION X | AE3007C | 0.379 | 0.079 | 0.166 | 0.022 | 0.010 |
| CL600 | CF34-3B | 1.983 | 0.208 | 0.446 | 0.074 | 0.029 |
| Falcon 2000EX | PW308C | 0.408 | 0.058 | 0.159 | 0.019 | 0.007 |
| Falcon 50 | TFE731-3 | 3.295 | 0.619 | 0.862 | 0.060 | 0.053 |
| Gulfstream II | SPEY MK511-8 | 1.540 | 0.190 | 0.752 | 0.085 | 0.013 |
| Gulfstream IV | TAY Mk611-8 | 2.795 | 0.449 | 1.113 | 0.175 | 0.034 |
| Gulfstream V | BR700-715B1-30 | 0.409 | 0.004 | 0.495 | 0.043 | 0.008 |
| Learjet 25C | CJ610-6 | 2.908 | 0.298 | 0.037 | 0.013 | 0.008 |
| Learjet 35/36 | TFE 731-2-2B | 5.420 | 1.830 | 0.915 | 0.079 | 0.111 |
| PA-31T Cheyenne | PT6A-28 | 0.175 | 0.011 | 0.074 | 0.014 | 0.022 |
| Piper PA-28 | IO-320-D1AD | 1.448 | 0.025 | 0.006 | 0.000 | 0.024 |
| Swearingen Metro 2 | TPE331-3 | 0.330 | 0.419 | 0.049 | 0.010 | 0.012 |
| Westwind 2 | TFE731-3 | 0.949 | 0.177 | 0.300 | 0.019 | 0.023 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.332 | 1.034 | 0.445 | 0.083 | 0.029 |
| C-17A | F117-PW-100 | 3.622 | 0.387 | 6.083 | 0.195 | 0.045 |
| F-16 | F100-PW-100 | 2.022 | 0.529 | 1.149 | 0.05 | 0.070 |
| **Total** | | 3,401.933 | 409.972 | 2,785.000 | 260.125 | 207.475 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-3 (1 of 3)**

2010 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 82.592 | 17.907 | 41.602 | 4.706 | 4.435 |
| A319 | CFM56-5B5/P | 389.761 | 88.200 | 238.129 | 24.400 | 22.906 |
| | V2522-A5 | 79.709 | 0.876 | 106.986 | 10.299 | 8.089 |
| | CFM56-5A5 | 24.480 | 2.447 | 26.573 | 2.445 | 2.168 |
| A320-200 | V2527-A5 | 188.891 | 2.270 | 293.451 | 26.437 | 19.058 |
| | CFM56-5A1 | 42.674 | 4.184 | 49.664 | 4.655 | 3.858 |
| A321 | CFM56-5B3/2P DAC-II | 24.944 | 2.387 | 15.148 | 1.231 | 0.773 |
| A340-300 | CFM56-5C4 | 0.516 | 0.087 | 0.785 | 0.042 | 0.011 |
| A340-642 | TRENT 556-61 | 0.811 | 0.009 | 3.828 | 0.182 | 0.029 |
| B717-200 | BR700-715C1-30 | 7.480 | 0.069 | 12.140 | 0.897 | 0.800 |
| B737-300 | CFM56-3C-1 | 829.709 | 46.771 | 497.949 | 54.256 | 41.865 |
| | CFM56-3B-2 | 175.444 | 10.854 | 86.396 | 10.087 | 8.249 |
| B737-800 | CFM56-7B27 | 28.148 | 2.986 | 44.902 | 3.237 | 2.305 |
| | CFM56-7B26 | 36.237 | 4.048 | 51.400 | 3.923 | 2.891 |
| B747-400 | CF6-80C2B1F | 9.057 | 0.808 | 15.877 | 1.150 | 0.199 |
| | PW4056 | 18.967 | 1.798 | 29.777 | 2.014 | 0.347 |
| B757-200 | PW2037 | 307.195 | 28.423 | 342.488 | 27.637 | 15.299 |
| | RB211-535E4B | 19.755 | 0.203 | 21.806 | 2.041 | 0.949 |
| B767-200 | CF6-80A (A1) | 23.933 | 5.790 | 31.986 | 2.105 | 0.908 |
| B767-300 | PW4056 | 51.914 | 4.922 | 67.280 | 5.017 | 1.913 |
| B777-200 | PW4077 | 84.355 | 14.522 | 197.749 | 10.985 | 3.118 |
| | GE90-85B | 5.034 | 0.191 | 17.117 | 0.817 | 0.211 |
| | TRENT 895 | 3.610 | 0.233 | 11.923 | 0.601 | 0.126 |
| MD-80 | JT8D-217C | 95.542 | 0.000 | 81.029 | 9.893 | 6.308 |
| | JT8D-219 | 57.623 | 0.000 | 57.300 | 6.410 | 4.023 |
| MD-90-30 | V2525-D5 | 3.230 | 0.039 | 4.765 | 0.438 | 0.332 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 46.084 | 6.364 | 16.237 | 2.255 | 2.302 |
| BH-1900C | PT6A-65B | 123.381 | 38.991 | 11.664 | 2.939 | 12.914 |
| Bombardier CRJ700 | CF34-8C1 | 48.236 | 0.224 | 28.157 | 3.422 | 4.769 |
| Bombardier CRJ900 | CF34-8C5 | 0.182 | 0.001 | 0.152 | 0.018 | 0.025 |
| Canadair Reg-100 | CF34-3B | 0.057 | 0.006 | 0.013 | 0.002 | 0.004 |
| DHC-8-200 | PW123D | 12.943 | 0.000 | 17.065 | 1.910 | 4.536 |
| EMB-120 | PW118A | 10.574 | 0.000 | 8.488 | 1.091 | 3.343 |
| | PW118B | 5.004 | 0.000 | 4.015 | 0.516 | 1.579 |
| Embraer ERJ 145LR | A3007A1/2 | 5.707 | 0.877 | 3.838 | 0.449 | 0.840 |
| | AE3007A1/1 | 2.929 | 0.451 | 1.970 | 0.230 | 0.431 |
| REG'L JET 200 | CF34-3B | 209.068 | 21.939 | 47.833 | 7.863 | 15.823 |

**Table B-3 (2 of 3)**

2010 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 31.719 | 2.737 | 47.871 | 3.603 | 1.369 |
| | PW4158 | 46.471 | 4.319 | 61.775 | 4.602 | 1.743 |
| A310 | CF6-80A3 | 1.952 | 0.475 | 2.256 | 0.159 | 0.074 |
| B727-200F | JT8D-15 | 19.231 | 3.024 | 26.907 | 3.070 | 1.220 |
| | JT8D-17 | 15.538 | 2.234 | 22.863 | 2.546 | 1.039 |
| | JT8D-7B | 15.335 | 4.385 | 16.330 | 2.012 | 0.890 |
| | JT8D-9A | 4.379 | 1.054 | 4.927 | 0.577 | 0.251 |
| B747-100F | JT9D-7A | 12.706 | 5.894 | 5.620 | 0.346 | 0.061 |
| | JT9D-7Q | 5.287 | 1.323 | 3.332 | 0.233 | 0.037 |
| B757-200 | PW2040 | 4.264 | 0.381 | 6.320 | 0.443 | 0.228 |
| | RB211-535E4 | 3.717 | 0.112 | 7.323 | 0.521 | 0.259 |
| B767-200 | CF6-80A (A1) | 20.206 | 4.889 | 27.004 | 1.777 | 0.766 |
| | JT9D-7R4D | 2.001 | 0.313 | 7.060 | 0.459 | 0.174 |
| B767-300ER | CF6-80C2B7F | 14.479 | 1.253 | 26.780 | 1.868 | 0.654 |
| BH-1900C | PT6A-65B | 0.983 | 0.311 | 0.093 | 0.023 | 0.103 |
| BH-C99 | PT6A-36 | 0.177 | 0.013 | 0.088 | 0.017 | 0.113 |
| Cessna 208 Caravan | PT6A-114 | 0.140 | 0.011 | 0.057 | 0.011 | 0.165 |
| DC10-10F | CF6-6D | 13.808 | 5.696 | 10.005 | 0.549 | 0.165 |
| DC10-30F | CF6-50C2 | 45.037 | 5.634 | 67.044 | 4.499 | 1.233 |
| DC8-61 | JT3D-3B | 2.344 | 2.749 | 0.270 | 0.045 | 0.014 |
| DC8-71F | CFM56-2C5 | 1.819 | 0.115 | 0.951 | 0.107 | 0.038 |
| DC9-30F | JT8D-9 | 0.741 | 0.179 | 0.704 | 0.091 | 0.064 |
| DC9-40 | JT8D-11 | 7.125 | 2.144 | 2.605 | 0.346 | 0.224 |
| | JT8D-15 | 1.892 | 0.295 | 2.353 | 0.288 | 0.182 |
| Learjet 35/36 | TFE 731-2-2B | 0.328 | 0.111 | 0.055 | 0.004 | 0.035 |
| MD-11F | CF6-80C2D1F | 0.163 | 0.014 | 0.308 | 0.021 | 0.005 |
| MD-80 | JT8D-219 | 1.990 | 0.000 | 1.979 | 0.222 | 0.139 |
| Swearingen Metro 2 | TPE331-3 | 0.042 | 0.054 | 0.007 | 0.001 | 0.008 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.068 | 0.011 | 0.096 | 0.011 | 0.002 |
| B737-200 | JT8D-17 | 0.177 | 0.025 | 0.229 | 0.028 | 0.009 |
| B737-800 | CFM56-7B26 | 0.171 | 0.019 | 0.243 | 0.019 | 0.007 |
| BAE 125-700 | TFE731-3 | 1.624 | 0.317 | 0.425 | 0.030 | 0.100 |
| Beech King Air 200 | PT6A-41 | 0.122 | 0.109 | 0.006 | 0.001 | 0.004 |
| Beechjet 400A | JT15D-5 (A & B) | 3.372 | 3.328 | 0.182 | 0.023 | 0.075 |
| Cessna 441 Conquest2 | TPE331-8 | 0.524 | 0.041 | 0.293 | 0.044 | 0.148 |
| CITATION V | JT15D-5 (A & B) | 5.964 | 5.851 | 0.377 | 0.044 | 0.131 |
| Citation VII | TFE731-3 | 0.240 | 0.045 | 0.072 | 0.004 | 0.014 |
| CITATION X | AE3007C | 0.693 | 0.144 | 0.304 | 0.041 | 0.048 |
| CL600 | CF34-3B | 0.270 | 0.029 | 0.061 | 0.010 | 0.010 |
| CL601-3A | CF34-3A | 0.254 | 0.025 | 0.067 | 0.006 | 0.010 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.075 | 0.013 | 0.050 | 0.006 | 0.005 |
| Falcon 2000EX | PW308C | 0.451 | 0.064 | 0.175 | 0.021 | 0.019 |
| Falcon 50 | TFE731-3 | 0.066 | 0.012 | 0.018 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.010 | 0.100 | 0.046 | 0.004 | 0.005 |
| Gulfstream IV | TAY Mk611-8 | 0.039 | 0.007 | 0.015 | 0.002 | 0.001 |
| Learjet 24D | CJ610-6 | 0.747 | 0.076 | 0.010 | 0.003 | 0.005 |
| Learjet 35/36 | TFE 731-2-2B | 1.060 | 0.358 | 0.179 | 0.015 | 0.056 |
| Navajo | PT6A-28 | 68.094 | 1.664 | 0.033 | 0.006 | 0.513 |
| Swearingen Metro 2 | TPE331-3 | 18.064 | 22.960 | 2.637 | 0.536 | 1.671 |

**Table B-3 (3 of 3)**

2010 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.073 | 0.406 | 0.543 | 0.037 | 0.050 |
| Beech King Air 100 | PT6A-28 | 0.629 | 0.044 | 0.292 | 0.057 | 0.076 |
| Beech King Air 200 | PT6A-41 | 9.473 | 8.479 | 0.453 | 0.068 | 0.129 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.831 | 0.121 | 0.085 | 0.022 | 0.019 |
| Beechjet 400 | JT15D-5 (A & B) | 1.556 | 1.537 | 0.084 | 0.011 | 0.013 |
| Bell 206 | 250B17B | 0.050 | 0.008 | 0.007 | 0.001 | 0.008 |
| BH-1900 | PT6A-67D | 2.006 | 0.643 | 0.180 | 0.045 | 0.034 |
| BH-C99 | PT6A-36 | 0.017 | 0.001 | 0.008 | 0.001 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 0.956 | 0.018 | 0.003 | 0.000 | 0.018 |
| Cessna 208 Caravan | PT6A-114 | 0.200 | 0.015 | 0.082 | 0.017 | 0.045 |
| Cessna 441 Conquest2 | TPE331-8 | 1.127 | 0.088 | 0.629 | 0.094 | 0.124 |
| CITATION I | JT15D-1 | 2.339 | 0.870 | 0.105 | 0.015 | 0.023 |
| CITATION V | JT15D-5 (A & B) | 7.409 | 7.270 | 0.468 | 0.055 | 0.064 |
| Citation VII | TFE 731-2-2B | 0.842 | 0.283 | 0.160 | 0.013 | 0.017 |
| CITATION X | AE3007C | 0.384 | 0.080 | 0.169 | 0.023 | 0.010 |
| CL600 | CF34-3B | 2.007 | 0.211 | 0.452 | 0.075 | 0.029 |
| Falcon 2000EX | PW308C | 0.416 | 0.060 | 0.161 | 0.019 | 0.007 |
| Falcon 50 | TFE731-3 | 3.323 | 0.625 | 0.870 | 0.061 | 0.054 |
| Gulfstream II | SPEY MK511-8 | 1.569 | 0.193 | 0.766 | 0.086 | 0.013 |
| Gulfstream IV | TAY Mk611-8 | 2.825 | 0.453 | 1.124 | 0.177 | 0.034 |
| Gulfstream V | BR700-715B1-30 | 0.414 | 0.004 | 0.503 | 0.044 | 0.008 |
| Learjet 25C | CJ610-6 | 2.950 | 0.302 | 0.037 | 0.013 | 0.008 |
| Learjet 35/36 | TFE 731-2-2B | 5.478 | 1.850 | 0.925 | 0.080 | 0.113 |
| PA-31T Cheyenne | PT6A-28 | 0.177 | 0.011 | 0.074 | 0.014 | 0.022 |
| Piper PA-28 | IO-320-D1AD | 1.469 | 0.026 | 0.006 | 0.000 | 0.025 |
| Swearingen Metro 2 | TPE331-3 | 0.333 | 0.423 | 0.049 | 0.010 | 0.012 |
| Westwind 2 | TFE731-3 | 0.959 | 0.180 | 0.303 | 0.019 | 0.023 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.332 | 1.034 | 0.445 | 0.083 | 0.029 |
| C-17A | F117-PW-100 | 3.622 | 0.387 | 6.083 | 0.195 | 0.045 |
| F-16 | F100-PW-100 | 2.022 | 0.529 | 1.149 | 0.050 | 0.070 |
| **Total** | | 3,491.523 | 419.945 | 2,862.102 | 267.280 | 212.950 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-4 (1 of 3)**

2013 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 89.347 | 19.371 | 45.005 | 5.092 | 4.798 |
| A319 | CFM56-5B5/P | 421.666 | 95.420 | 257.621 | 26.397 | 24.781 |
| | V2522-A5 | 86.240 | 0.948 | 115.753 | 11.142 | 8.752 |
| | CFM56-5A5 | 26.482 | 2.648 | 28.747 | 2.646 | 2.345 |
| A320-200 | V2527-A5 | 204.353 | 2.455 | 317.471 | 28.601 | 20.618 |
| | CFM56-5A1 | 46.165 | 4.526 | 53.727 | 5.036 | 4.174 |
| A321 | CFM56-5B3/2P DAC-II | 26.987 | 2.582 | 16.388 | 1.333 | 0.836 |
| A340-300 | CFM56-5C4 | 0.573 | 0.097 | 0.872 | 0.046 | 0.012 |
| A340-642 | TRENT 556-61 | 0.881 | 0.009 | 4.155 | 0.197 | 0.032 |
| B717-200 | BR700-715C1-30 | 8.094 | 0.075 | 13.136 | 0.971 | 0.866 |
| B737-300 | CFM56-3C-1 | 897.640 | 50.600 | 538.718 | 58.698 | 45.293 |
| | CFM56-3B-2 | 189.806 | 11.743 | 93.468 | 10.913 | 8.924 |
| B737-800 | CFM56-7B27 | 30.450 | 3.231 | 48.574 | 3.502 | 2.493 |
| | CFM56-7B26 | 39.207 | 4.379 | 55.612 | 4.245 | 3.128 |
| B747-400 | CF6-80C2B1F | 9.818 | 0.875 | 17.213 | 1.246 | 0.216 |
| | PW4056 | 20.528 | 1.946 | 32.227 | 2.179 | 0.375 |
| B757-200 | PW2037 | 332.346 | 30.751 | 370.529 | 29.900 | 16.551 |
| | RB211-535E4B | 21.367 | 0.219 | 23.586 | 2.208 | 1.027 |
| B767-200 | CF6-80A (A1) | 25.879 | 6.261 | 34.585 | 2.276 | 0.982 |
| B767-300 | PW4056 | 56.170 | 5.325 | 72.796 | 5.428 | 2.070 |
| B777-200 | PW4077 | 91.252 | 15.709 | 213.913 | 11.883 | 3.372 |
| | GE90-85B | 5.450 | 0.207 | 18.527 | 0.884 | 0.228 |
| | TRENT 895 | 3.911 | 0.252 | 12.916 | 0.651 | 0.137 |
| MD-80 | JT8D-217C | 103.365 | 0.000 | 87.664 | 10.703 | 6.824 |
| | JT8D-219 | 62.339 | 0.000 | 61.990 | 6.935 | 4.352 |
| MD-90-30 | V2525-D5 | 3.495 | 0.041 | 5.158 | 0.474 | 0.359 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 48.194 | 6.655 | 16.981 | 2.359 | 2.407 |
| BH-1900C | PT6A-65B | 129.032 | 40.778 | 12.198 | 3.073 | 13.505 |
| Bombardier CRJ700 | CF34-8C1 | 50.443 | 0.235 | 29.446 | 3.578 | 4.988 |
| Bombardier CRJ900 | CF34-8C5 | 0.186 | 0.002 | 0.155 | 0.018 | 0.025 |
| Canadair Reg-100 | CF34-3B | 0.065 | 0.007 | 0.015 | 0.002 | 0.005 |
| DHC-8-200 | PW123D | 13.535 | 0.000 | 17.846 | 1.998 | 4.744 |
| EMB-120 | PW118A | 11.059 | 0.000 | 8.876 | 1.141 | 3.496 |
| | PW118B | 5.235 | 0.000 | 4.199 | 0.540 | 1.651 |
| Embraer ERJ 145LR | A3007A1/2 | 5.968 | 0.917 | 4.015 | 0.468 | 0.878 |
| | AE3007A1/1 | 3.063 | 0.471 | 2.061 | 0.240 | 0.451 |
| REG'L JET 200 | CF34-3B | 218.646 | 22.945 | 50.024 | 8.223 | 16.548 |

**Table B-4 (2 of 3)**

2013 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 34.693 | 2.993 | 52.359 | 3.942 | 1.497 |
| | PW4158 | 50.835 | 4.725 | 67.577 | 5.034 | 1.907 |
| A310 | CF6-80A3 | 2.131 | 0.518 | 2.464 | 0.173 | 0.081 |
| B727-200F | JT8D-15 | 21.040 | 3.307 | 29.438 | 3.358 | 1.334 |
| | JT8D-17 | 16.994 | 2.444 | 25.005 | 2.786 | 1.137 |
| | JT8D-7B | 16.777 | 4.797 | 17.865 | 2.200 | 0.974 |
| | JT8D-9A | 4.791 | 1.153 | 5.390 | 0.632 | 0.274 |
| B747-100F | JT9D-7A | 13.862 | 6.430 | 6.131 | 0.378 | 0.067 |
| | JT9D-7Q | 5.734 | 1.435 | 3.616 | 0.252 | 0.040 |
| B757-200 | PW2040 | 4.657 | 0.417 | 6.904 | 0.484 | 0.249 |
| | RB211-535E4 | 4.064 | 0.122 | 8.006 | 0.570 | 0.283 |
| B767-200 | CF6-80A (A1) | 22.102 | 5.347 | 29.539 | 1.944 | 0.838 |
| | JT9D-7R4D | 2.186 | 0.342 | 7.714 | 0.500 | 0.190 |
| B767-300ER | CF6-80C2B7F | 15.839 | 1.371 | 29.295 | 2.044 | 0.715 |
| BH-1900C | PT6A-65B | 1.073 | 0.338 | 0.101 | 0.025 | 0.112 |
| BH-C99 | PT6A-36 | 0.194 | 0.014 | 0.097 | 0.019 | 0.123 |
| Cessna 208 Caravan | PT6A-114 | 0.153 | 0.011 | 0.062 | 0.012 | 0.180 |
| DC10-10F | CF6-6D | 15.105 | 6.231 | 10.945 | 0.601 | 0.180 |
| DC10-30F | CF6-50C2 | 49.251 | 6.162 | 73.316 | 4.920 | 1.348 |
| DC8-61 | JT3D-3B | 2.547 | 2.988 | 0.294 | 0.050 | 0.016 |
| DC8-71F | CFM56-2C5 | 1.965 | 0.125 | 1.027 | 0.116 | 0.042 |
| DC9-30F | JT8D-9 | 0.812 | 0.196 | 0.772 | 0.099 | 0.071 |
| DC9-40 | JT8D-11 | 7.797 | 2.346 | 2.851 | 0.379 | 0.245 |
| | JT8D-15 | 2.072 | 0.324 | 2.579 | 0.315 | 0.199 |
| Learjet 35/36 | TFE 731-2-2B | 0.357 | 0.120 | 0.061 | 0.006 | 0.038 |
| MD-11F | CF6-80C2D1F | 0.184 | 0.015 | 0.346 | 0.023 | 0.006 |
| MD-80 | JT8D-219 | 2.176 | 0.000 | 2.164 | 0.243 | 0.152 |
| Swearingen Metro 2 | TPE331-3 | 0.045 | 0.058 | 0.007 | 0.001 | 0.009 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.068 | 0.011 | 0.096 | 0.011 | 0.002 |
| B737-200 | JT8D-17 | 0.177 | 0.025 | 0.229 | 0.028 | 0.009 |
| B737-800 | CFM56-7B26 | 0.171 | 0.019 | 0.243 | 0.019 | 0.007 |
| BAE 125-700 | TFE731-3 | 1.648 | 0.322 | 0.432 | 0.030 | 0.102 |
| Beech King Air 200 | PT6A-41 | 0.122 | 0.109 | 0.006 | 0.001 | 0.004 |
| Beechjet 400A | JT15D-5 (A & B) | 3.427 | 3.382 | 0.185 | 0.024 | 0.076 |
| Cessna 441 Conquest2 | TPE331-8 | 0.532 | 0.042 | 0.298 | 0.044 | 0.150 |
| CITATION V | JT15D-5 (A & B) | 6.059 | 5.946 | 0.383 | 0.045 | 0.133 |
| Citation VII | TFE731-3 | 0.240 | 0.045 | 0.072 | 0.004 | 0.014 |
| CITATION X | AE3007C | 0.707 | 0.148 | 0.310 | 0.042 | 0.049 |
| CL600 | CF34-3B | 0.279 | 0.030 | 0.063 | 0.010 | 0.010 |
| CL601-3A | CF34-3A | 0.254 | 0.025 | 0.067 | 0.006 | 0.010 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.078 | 0.013 | 0.053 | 0.007 | 0.006 |
| Falcon 2000EX | PW308C | 0.457 | 0.065 | 0.177 | 0.021 | 0.020 |
| Falcon 50 | TFE731-3 | 0.066 | 0.012 | 0.018 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.010 | 0.100 | 0.046 | 0.004 | 0.005 |
| Gulfstream IV | TAY Mk611-8 | 0.039 | 0.007 | 0.015 | 0.002 | 0.001 |
| Learjet 24D | CJ610-6 | 0.789 | 0.080 | 0.010 | 0.003 | 0.006 |
| Learjet 35/36 | TFE 731-2-2B | 1.077 | 0.364 | 0.182 | 0.015 | 0.056 |
| Navajo | PT6A-28 | 69.215 | 1.692 | 0.033 | 0.006 | 0.522 |
| Swearingen Metro 2 | TPE331-3 | 18.350 | 23.325 | 2.679 | 0.543 | 1.697 |

**Table B-4 (3 of 3)**

2013 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.123 | 0.414 | 0.556 | 0.039 | 0.051 |
| Beech King Air 100 | PT6A-28 | 0.644 | 0.045 | 0.299 | 0.058 | 0.078 |
| Beech King Air 200 | PT6A-41 | 9.692 | 8.674 | 0.464 | 0.069 | 0.131 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.851 | 0.125 | 0.087 | 0.022 | 0.020 |
| Beechjet 400 | JT15D-5 (A & B) | 1.584 | 1.563 | 0.086 | 0.011 | 0.014 |
| Bell 206 | 250B17B | 0.050 | 0.008 | 0.007 | 0.001 | 0.009 |
| BH-1900 | PT6A-67D | 2.056 | 0.658 | 0.184 | 0.046 | 0.035 |
| BH-C99 | PT6A-36 | 0.018 | 0.001 | 0.009 | 0.002 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 0.981 | 0.018 | 0.003 | 0.000 | 0.019 |
| Cessna 208 Caravan | PT6A-114 | 0.204 | 0.015 | 0.083 | 0.017 | 0.046 |
| Cessna 441 Conquest2 | TPE331-8 | 1.153 | 0.090 | 0.645 | 0.096 | 0.127 |
| CITATION I | JT15D-1 | 2.399 | 0.892 | 0.107 | 0.017 | 0.024 |
| CITATION V | JT15D-5 (A & B) | 7.574 | 7.432 | 0.478 | 0.056 | 0.065 |
| Citation VII | TFE 731-2-2B | 0.860 | 0.289 | 0.163 | 0.013 | 0.018 |
| CITATION X | AE3007C | 0.392 | 0.082 | 0.172 | 0.023 | 0.011 |
| CL600 | CF34-3B | 2.048 | 0.215 | 0.461 | 0.077 | 0.030 |
| Falcon 2000EX | PW308C | 0.422 | 0.061 | 0.164 | 0.019 | 0.007 |
| Falcon 50 | TFE731-3 | 3.404 | 0.640 | 0.892 | 0.062 | 0.055 |
| Gulfstream II | SPEY MK511-8 | 1.597 | 0.197 | 0.780 | 0.088 | 0.013 |
| Gulfstream IV | TAY Mk611-8 | 2.892 | 0.464 | 1.152 | 0.182 | 0.035 |
| Gulfstream V | BR700-715B1-30 | 0.420 | 0.004 | 0.509 | 0.044 | 0.009 |
| Learjet 25C | CJ610-6 | 2.992 | 0.305 | 0.039 | 0.013 | 0.009 |
| Learjet 35/36 | TFE 731-2-2B | 5.605 | 1.892 | 0.946 | 0.083 | 0.115 |
| PA-31T Cheyenne | PT6A-28 | 0.181 | 0.012 | 0.076 | 0.015 | 0.023 |
| Piper PA-28 | IO-320-D1AD | 1.497 | 0.026 | 0.006 | 0.000 | 0.025 |
| Swearingen Metro 2 | TPE331-3 | 0.340 | 0.431 | 0.050 | 0.010 | 0.012 |
| Westwind 2 | TFE731-3 | 0.984 | 0.184 | 0.311 | 0.020 | 0.023 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.332 | 1.034 | 0.445 | 0.083 | 0.029 |
| C-17A | F117-PW-100 | 3.622 | 0.387 | 6.083 | 0.195 | 0.045 |
| F-16 | F100-PW-100 | 2.022 | 0.529 | 1.149 | 0.050 | 0.070 |
| **Total** | | 3,753.377 | 448.458 | 3,094.095 | 288.609 | 228.581 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-5 (1 of 3)**

2015 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 93.803 | 20.338 | 47.251 | 5.345 | 5.037 |
| A319 | CFM56-5B5/P | 442.704 | 100.181 | 270.475 | 27.714 | 26.017 |
| | V2522-A5 | 90.542 | 0.995 | 121.527 | 11.699 | 9.189 |
| | CFM56-5A5 | 27.806 | 2.780 | 30.185 | 2.778 | 2.462 |
| A320-200 | V2527-A5 | 214.548 | 2.577 | 333.310 | 30.028 | 21.647 |
| | CFM56-5A1 | 48.470 | 4.752 | 56.409 | 5.288 | 4.382 |
| A321 | CFM56-5B3/2P DAC-II | 28.328 | 2.711 | 17.203 | 1.399 | 0.877 |
| A340-300 | CFM56-5C4 | 0.602 | 0.101 | 0.916 | 0.049 | 0.013 |
| A340-642 | TRENT 556-61 | 0.915 | 0.010 | 4.317 | 0.205 | 0.033 |
| B717-200 | BR700-715C1-30 | 8.500 | 0.079 | 13.794 | 1.020 | 0.910 |
| B737-300 | CFM56-3C-1 | 942.419 | 53.125 | 565.593 | 61.626 | 47.552 |
| | CFM56-3B-2 | 199.276 | 12.328 | 98.132 | 11.457 | 9.369 |
| B737-800 | CFM56-7B27 | 31.973 | 3.393 | 51.003 | 3.677 | 2.618 |
| | CFM56-7B26 | 41.166 | 4.598 | 58.389 | 4.457 | 3.284 |
| B747-400 | CF6-80C2B1F | 10.298 | 0.918 | 18.053 | 1.306 | 0.226 |
| | PW4056 | 21.547 | 2.043 | 33.826 | 2.288 | 0.394 |
| B757-200 | PW2037 | 348.930 | 32.286 | 389.018 | 31.392 | 17.377 |
| | RB211-535E4B | 22.439 | 0.230 | 24.769 | 2.319 | 1.078 |
| B767-200 | CF6-80A (A1) | 27.170 | 6.573 | 36.311 | 2.390 | 1.031 |
| B767-300 | PW4056 | 58.979 | 5.592 | 76.436 | 5.699 | 2.174 |
| B777-200 | PW4077 | 95.814 | 16.495 | 224.611 | 12.477 | 3.541 |
| | GE90-85B | 5.715 | 0.217 | 19.433 | 0.927 | 0.239 |
| | TRENT 895 | 4.105 | 0.265 | 13.558 | 0.683 | 0.144 |
| MD-80 | JT8D-217C | 108.520 | 0.000 | 92.036 | 11.237 | 7.165 |
| | JT8D-219 | 65.448 | 0.000 | 65.080 | 7.280 | 4.569 |
| MD-90-30 | V2525-D5 | 3.670 | 0.043 | 5.416 | 0.498 | 0.377 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 49.449 | 6.828 | 17.422 | 2.421 | 2.470 |
| BH-1900C | PT6A-65B | 132.385 | 41.837 | 12.516 | 3.153 | 13.856 |
| Bombardier CRJ700 | CF34-8C1 | 51.754 | 0.240 | 30.211 | 3.672 | 5.117 |
| Bombardier CRJ900 | CF34-8C5 | 0.195 | 0.002 | 0.163 | 0.019 | 0.027 |
| Canadair Reg-100 | CF34-3B | 0.065 | 0.007 | 0.015 | 0.002 | 0.005 |
| DHC-8-200 | PW123D | 13.888 | 0.000 | 18.310 | 2.050 | 4.867 |
| EMB-120 | PW118A | 11.345 | 0.000 | 9.106 | 1.171 | 3.587 |
| | PW118B | 5.370 | 0.000 | 4.308 | 0.554 | 1.694 |
| Embraer ERJ 145LR | A3007A1/2 | 6.119 | 0.940 | 4.116 | 0.481 | 0.900 |
| | AE3007A1/1 | 3.144 | 0.483 | 2.115 | 0.247 | 0.463 |
| REG'L JET 200 | CF34-3B | 224.323 | 23.540 | 51.323 | 8.436 | 16.978 |

**Table B-5 (2 of 3)**

2015 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 36.618 | 3.159 | 55.263 | 4.160 | 1.581 |
| | PW4158 | 53.646 | 4.986 | 71.313 | 5.312 | 2.012 |
| A310 | CF6-80A3 | 2.261 | 0.550 | 2.614 | 0.184 | 0.086 |
| B727-200F | JT8D-15 | 22.204 | 3.490 | 31.066 | 3.544 | 1.408 |
| | JT8D-17 | 17.930 | 2.578 | 26.383 | 2.939 | 1.199 |
| | JT8D-7B | 17.706 | 5.063 | 18.854 | 2.323 | 1.028 |
| | JT8D-9A | 5.062 | 1.218 | 5.696 | 0.667 | 0.290 |
| B747-100F | JT9D-7A | 14.632 | 6.787 | 6.472 | 0.399 | 0.071 |
| | JT9D-7Q | 6.092 | 1.524 | 3.842 | 0.268 | 0.042 |
| B757-200 | PW2040 | 4.912 | 0.440 | 7.281 | 0.510 | 0.263 |
| | RB211-535E4 | 4.296 | 0.130 | 8.461 | 0.603 | 0.299 |
| B767-200 | CF6-80A (A1) | 23.312 | 5.639 | 31.155 | 2.050 | 0.884 |
| | JT9D-7R4D | 2.306 | 0.362 | 8.141 | 0.529 | 0.201 |
| B767-300ER | CF6-80C2B7F | 16.719 | 1.447 | 30.921 | 2.157 | 0.755 |
| BH-1900C | PT6A-65B | 1.131 | 0.357 | 0.107 | 0.026 | 0.118 |
| BH-C99 | PT6A-36 | 0.205 | 0.015 | 0.101 | 0.020 | 0.130 |
| Cessna 208 Caravan | PT6A-114 | 0.161 | 0.012 | 0.066 | 0.013 | 0.190 |
| DC10-10F | CF6-6D | 15.935 | 6.573 | 11.547 | 0.634 | 0.190 |
| DC10-30F | CF6-50C2 | 51.970 | 6.501 | 77.364 | 5.191 | 1.422 |
| DC8-61 | JT3D-3B | 2.650 | 3.107 | 0.305 | 0.052 | 0.016 |
| DC8-71F | CFM56-2C5 | 2.082 | 0.131 | 1.089 | 0.122 | 0.044 |
| DC9-30F | JT8D-9 | 0.855 | 0.206 | 0.812 | 0.105 | 0.074 |
| DC9-40 | JT8D-11 | 8.231 | 2.477 | 3.009 | 0.400 | 0.259 |
| | JT8D-15 | 2.188 | 0.342 | 2.724 | 0.333 | 0.210 |
| Learjet 35/36 | TFE 731-2-2B | 0.380 | 0.128 | 0.064 | 0.006 | 0.041 |
| MD-11F | CF6-80C2D1F | 0.184 | 0.015 | 0.346 | 0.023 | 0.006 |
| MD-80 | JT8D-219 | 2.301 | 0.000 | 2.287 | 0.256 | 0.161 |
| Swearingen Metro 2 | TPE331-3 | 0.049 | 0.062 | 0.007 | 0.001 | 0.009 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.078 | 0.012 | 0.109 | 0.012 | 0.002 |
| B737-200 | JT8D-17 | 0.177 | 0.025 | 0.229 | 0.028 | 0.009 |
| B737-800 | CFM56-7B26 | 0.179 | 0.020 | 0.254 | 0.020 | 0.007 |
| BAE 125-700 | TFE731-3 | 1.663 | 0.325 | 0.435 | 0.030 | 0.103 |
| Beech King Air 200 | PT6A-41 | 0.122 | 0.109 | 0.006 | 0.001 | 0.004 |
| Beechjet 400A | JT15D-5 (A & B) | 3.455 | 3.409 | 0.186 | 0.024 | 0.076 |
| Cessna 441 Conquest2 | TPE331-8 | 0.538 | 0.042 | 0.301 | 0.045 | 0.151 |
| CITATION V | JT15D-5 (A & B) | 6.115 | 6.000 | 0.387 | 0.045 | 0.134 |
| Citation VII | TFE731-3 | 0.246 | 0.045 | 0.073 | 0.004 | 0.015 |
| CITATION X | AE3007C | 0.711 | 0.149 | 0.312 | 0.042 | 0.049 |
| CL600 | CF34-3B | 0.279 | 0.030 | 0.063 | 0.010 | 0.010 |
| CL601-3A | CF34-3A | 0.261 | 0.025 | 0.069 | 0.006 | 0.011 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.078 | 0.013 | 0.053 | 0.007 | 0.006 |
| Falcon 2000EX | PW308C | 0.457 | 0.065 | 0.177 | 0.021 | 0.020 |
| Falcon 50 | TFE731-3 | 0.066 | 0.012 | 0.018 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.011 | 0.107 | 0.049 | 0.004 | 0.005 |
| Gulfstream IV | TAY Mk611-8 | 0.049 | 0.008 | 0.020 | 0.003 | 0.002 |
| Learjet 24D | CJ610-6 | 0.789 | 0.080 | 0.010 | 0.003 | 0.006 |
| Learjet 35/36 | TFE 731-2-2B | 1.089 | 0.367 | 0.184 | 0.015 | 0.057 |
| Navajo | PT6A-28 | 69.935 | 1.710 | 0.033 | 0.006 | 0.527 |
| Swearingen Metro 2 | TPE331-3 | 18.542 | 23.570 | 2.707 | 0.549 | 1.715 |

**Table B-5 (3 of 3)**

2015 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation (cont.)** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.157 | 0.422 | 0.564 | 0.040 | 0.052 |
| Beech King Air 100 | PT6A-28 | 0.654 | 0.046 | 0.303 | 0.060 | 0.080 |
| Beech King Air 200 | PT6A-41 | 9.848 | 8.814 | 0.471 | 0.071 | 0.134 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.861 | 0.126 | 0.088 | 0.022 | 0.020 |
| Beechjet 400 | JT15D-5 (A & B) | 1.610 | 1.590 | 0.087 | 0.011 | 0.014 |
| Bell 206 | 250B17B | 0.051 | 0.008 | 0.008 | 0.001 | 0.009 |
| BH-1900 | PT6A-67D | 2.091 | 0.670 | 0.187 | 0.047 | 0.035 |
| BH-C99 | PT6A-36 | 0.018 | 0.001 | 0.009 | 0.002 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 1.000 | 0.019 | 0.003 | 0.000 | 0.019 |
| Cessna 208 Caravan | PT6A-114 | 0.207 | 0.015 | 0.084 | 0.017 | 0.047 |
| Cessna 441 Conquest2 | TPE331-8 | 1.172 | 0.093 | 0.655 | 0.098 | 0.129 |
| CITATION I | JT15D-1 | 2.434 | 0.905 | 0.109 | 0.017 | 0.024 |
| CITATION V | JT15D-5 (A & B) | 7.699 | 7.553 | 0.486 | 0.057 | 0.066 |
| Citation VII | TFE 731-2-2B | 0.877 | 0.294 | 0.166 | 0.013 | 0.018 |
| CITATION X | AE3007C | 0.397 | 0.083 | 0.174 | 0.023 | 0.011 |
| CL600 | CF34-3B | 2.090 | 0.219 | 0.471 | 0.078 | 0.030 |
| Falcon 2000EX | PW308C | 0.430 | 0.061 | 0.166 | 0.020 | 0.007 |
| Falcon 50 | TFE731-3 | 3.456 | 0.650 | 0.905 | 0.063 | 0.056 |
| Gulfstream II | SPEY MK511-8 | 1.626 | 0.201 | 0.794 | 0.089 | 0.013 |
| Gulfstream IV | TAY Mk611-8 | 2.941 | 0.472 | 1.171 | 0.184 | 0.036 |
| Gulfstream V | BR700-715B1-30 | 0.432 | 0.004 | 0.524 | 0.046 | 0.009 |
| Learjet 25C | CJ610-6 | 3.074 | 0.314 | 0.040 | 0.014 | 0.009 |
| Learjet 35/36 | TFE 731-2-2B | 5.697 | 1.924 | 0.961 | 0.084 | 0.117 |
| PA-31T Cheyenne | PT6A-28 | 0.184 | 0.012 | 0.077 | 0.015 | 0.023 |
| Piper PA-28 | IO-320-D1AD | 1.526 | 0.028 | 0.006 | 0.000 | 0.026 |
| Swearingen Metro 2 | TPE331-3 | 0.346 | 0.440 | 0.051 | 0.010 | 0.013 |
| Westwind 2 | TFE731-3 | 1.000 | 0.186 | 0.315 | 0.020 | 0.024 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.332 | 1.034 | 0.445 | 0.083 | 0.029 |
| C-17A | F117-PW-100 | 3.622 | 0.387 | 6.083 | 0.195 | 0.045 |
| F-16 | F100-PW-100 | 2.022 | 0.529 | 1.149 | 0.050 | 0.070 |
| **Total** | | 3,924.436 | 467.029 | 3,246.173 | 302.577 | 238.735 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-6 (1 of 3)**

2020 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 104.438 | 22.644 | 52.607 | 5.951 | 5.608 |
| A319 | CFM56-5B5/P | 492.872 | 111.534 | 301.126 | 30.855 | 28.966 |
| | V2522-A5 | 100.800 | 1.109 | 135.295 | 13.024 | 10.230 |
| | CFM56-5A5 | 30.956 | 3.094 | 33.605 | 3.092 | 2.741 |
| A320-200 | V2527-A5 | 238.861 | 2.869 | 371.080 | 33.430 | 24.100 |
| | CFM56-5A1 | 53.963 | 5.291 | 62.802 | 5.886 | 4.879 |
| A321 | CFM56-5B3/2P DAC-II | 31.551 | 3.018 | 19.159 | 1.558 | 0.977 |
| A340-300 | CFM56-5C4 | 0.660 | 0.111 | 1.003 | 0.054 | 0.014 |
| A340-642 | TRENT 556-61 | 1.019 | 0.011 | 4.806 | 0.229 | 0.037 |
| B717-200 | BR700-715C1-30 | 9.461 | 0.088 | 15.355 | 1.135 | 1.013 |
| B737-300 | CFM56-3C-1 | 1049.218 | 59.146 | 629.688 | 68.610 | 52.941 |
| | CFM56-3B-2 | 221.854 | 13.726 | 109.250 | 12.756 | 10.431 |
| B737-800 | CFM56-7B27 | 35.591 | 3.777 | 56.777 | 4.094 | 2.914 |
| | CFM56-7B26 | 45.830 | 5.119 | 65.004 | 4.962 | 3.656 |
| B747-400 | CF6-80C2B1F | 11.454 | 1.022 | 20.081 | 1.454 | 0.252 |
| | PW4056 | 23.990 | 2.274 | 37.660 | 2.547 | 0.438 |
| B757-200 | PW2037 | 388.473 | 35.944 | 433.105 | 34.950 | 19.346 |
| | RB211-535E4B | 24.981 | 0.256 | 27.574 | 2.582 | 1.200 |
| B767-200 | CF6-80A (A1) | 30.260 | 7.320 | 40.440 | 2.662 | 1.148 |
| B767-300 | PW4056 | 65.658 | 6.225 | 85.092 | 6.345 | 2.420 |
| B777-200 | PW4077 | 106.670 | 18.363 | 250.058 | 13.890 | 3.942 |
| | GE90-85B | 6.367 | 0.241 | 21.647 | 1.033 | 0.267 |
| | TRENT 895 | 4.566 | 0.294 | 15.079 | 0.761 | 0.160 |
| MD-80 | JT8D-217C | 120.823 | 0.000 | 102.471 | 12.511 | 7.977 |
| | JT8D-219 | 72.864 | 0.000 | 72.455 | 8.105 | 5.087 |
| MD-90-30 | V2525-D5 | 4.081 | 0.049 | 6.022 | 0.553 | 0.419 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 52.143 | 7.199 | 18.372 | 2.552 | 2.604 |
| BH-1900C | PT6A-65B | 139.578 | 44.110 | 13.195 | 3.325 | 14.609 |
| Bombardier CRJ700 | CF34-8C1 | 54.570 | 0.254 | 31.855 | 3.871 | 5.396 |
| Bombardier CRJ900 | CF34-8C5 | 0.204 | 0.002 | 0.171 | 0.020 | 0.028 |
| Canadair Reg-100 | CF34-3B | 0.065 | 0.007 | 0.015 | 0.002 | 0.005 |
| DHC-8-200 | PW123D | 14.643 | 0.000 | 19.307 | 2.162 | 5.132 |
| EMB-120 | PW118A | 11.961 | 0.000 | 9.600 | 1.235 | 3.782 |
| | PW118B | 5.664 | 0.000 | 4.543 | 0.584 | 1.786 |
| Embraer ERJ 145LR | A3007A1/2 | 6.452 | 0.992 | 4.340 | 0.507 | 0.949 |
| | AE3007A1/1 | 3.317 | 0.510 | 2.231 | 0.260 | 0.488 |
| REG'L JET 200 | CF34-3B | 236.513 | 24.820 | 54.111 | 8.895 | 17.900 |

**Table B-6 (2 of 3)**

2020 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 41.631 | 3.591 | 62.831 | 4.730 | 1.797 |
| | PW4158 | 61.003 | 5.670 | 81.092 | 6.041 | 2.288 |
| A310 | CF6-80A3 | 2.569 | 0.625 | 2.971 | 0.209 | 0.098 |
| B727-200F | JT8D-15 | 25.244 | 3.968 | 35.320 | 4.029 | 1.601 |
| | JT8D-17 | 20.387 | 2.932 | 29.998 | 3.341 | 1.363 |
| | JT8D-7B | 20.130 | 5.755 | 21.436 | 2.640 | 1.169 |
| | JT8D-9A | 5.756 | 1.385 | 6.476 | 0.758 | 0.329 |
| B747-100F | JT9D-7A | 16.686 | 7.739 | 7.380 | 0.455 | 0.081 |
| | JT9D-7Q | 6.899 | 1.726 | 4.350 | 0.303 | 0.048 |
| B757-200 | PW2040 | 5.584 | 0.500 | 8.277 | 0.580 | 0.299 |
| | RB211-535E4 | 4.882 | 0.148 | 9.618 | 0.686 | 0.340 |
| B767-200 | CF6-80A (A1) | 26.516 | 6.414 | 35.437 | 2.332 | 1.006 |
| | JT9D-7R4D | 2.620 | 0.410 | 9.246 | 0.601 | 0.228 |
| B767-300ER | CF6-80C2B7F | 18.998 | 1.645 | 35.138 | 2.452 | 0.858 |
| BH-1900C | PT6A-65B | 1.285 | 0.407 | 0.121 | 0.031 | 0.135 |
| BH-C99 | PT6A-36 | 0.234 | 0.017 | 0.116 | 0.022 | 0.148 |
| Cessna 208 Caravan | PT6A-114 | 0.183 | 0.014 | 0.075 | 0.015 | 0.216 |
| DC10-10F | CF6-6D | 18.115 | 7.473 | 13.126 | 0.720 | 0.216 |
| DC10-30F | CF6-50C2 | 59.106 | 7.394 | 87.986 | 5.904 | 1.618 |
| DC8-61 | JT3D-3B | 3.057 | 3.586 | 0.353 | 0.060 | 0.019 |
| DC8-71F | CFM56-2C5 | 2.375 | 0.150 | 1.242 | 0.140 | 0.050 |
| DC9-30F | JT8D-9 | 0.969 | 0.234 | 0.920 | 0.119 | 0.084 |
| DC9-40 | JT8D-11 | 9.355 | 2.815 | 3.420 | 0.455 | 0.294 |
| | JT8D-15 | 2.485 | 0.388 | 3.093 | 0.378 | 0.239 |
| Learjet 35/36 | TFE 731-2-2B | 0.432 | 0.146 | 0.073 | 0.007 | 0.047 |
| MD-11F | CF6-80C2D1F | 0.225 | 0.019 | 0.423 | 0.029 | 0.007 |
| MD-80 | JT8D-219 | 2.611 | 0.000 | 2.597 | 0.290 | 0.182 |
| Swearingen Metro 2 | TPE331-3 | 0.055 | 0.071 | 0.008 | 0.001 | 0.011 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.078 | 0.012 | 0.109 | 0.012 | 0.002 |
| B737-200 | JT8D-17 | 0.183 | 0.026 | 0.237 | 0.029 | 0.009 |
| B737-800 | CFM56-7B26 | 0.179 | 0.020 | 0.254 | 0.020 | 0.007 |
| BAE 125-700 | TFE731-3 | 1.707 | 0.334 | 0.446 | 0.031 | 0.105 |
| Beech King Air 200 | PT6A-41 | 0.131 | 0.117 | 0.007 | 0.001 | 0.005 |
| Beechjet 400A | JT15D-5 (A & B) | 3.549 | 3.503 | 0.192 | 0.024 | 0.078 |
| Cessna 441 Conquest2 | TPE331-8 | 0.552 | 0.043 | 0.309 | 0.046 | 0.155 |
| CITATION V | JT15D-5 (A & B) | 6.280 | 6.162 | 0.397 | 0.046 | 0.138 |
| Citation VII | TFE731-3 | 0.250 | 0.046 | 0.075 | 0.004 | 0.015 |
| CITATION X | AE3007C | 0.733 | 0.153 | 0.322 | 0.044 | 0.051 |
| CL600 | CF34-3B | 0.287 | 0.030 | 0.065 | 0.011 | 0.011 |
| CL601-3A | CF34-3A | 0.261 | 0.025 | 0.069 | 0.006 | 0.011 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.078 | 0.013 | 0.053 | 0.007 | 0.006 |
| Falcon 2000EX | PW308C | 0.472 | 0.067 | 0.183 | 0.022 | 0.020 |
| Falcon 50 | TFE731-3 | 0.066 | 0.012 | 0.018 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.011 | 0.107 | 0.049 | 0.004 | 0.005 |
| Gulfstream IV | TAY Mk611-8 | 0.049 | 0.008 | 0.020 | 0.003 | 0.002 |
| Learjet 24D | CJ610-6 | 0.789 | 0.080 | 0.010 | 0.003 | 0.006 |
| Learjet 35/36 | TFE 731-2-2B | 1.118 | 0.377 | 0.188 | 0.017 | 0.059 |
| Navajo | PT6A-28 | 71.735 | 1.754 | 0.034 | 0.006 | 0.541 |
| Swearingen Metro 2 | TPE331-3 | 19.025 | 24.184 | 2.778 | 0.563 | 1.760 |

**Table B-6 (3 of 3)**

2020 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.235 | 0.437 | 0.585 | 0.041 | 0.054 |
| Beech King Air 100 | PT6A-28 | 0.678 | 0.049 | 0.314 | 0.062 | 0.082 |
| Beech King Air 200 | PT6A-41 | 10.206 | 9.135 | 0.488 | 0.074 | 0.138 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.892 | 0.130 | 0.091 | 0.023 | 0.021 |
| Beechjet 400 | JT15D-5 (A & B) | 1.679 | 1.658 | 0.090 | 0.012 | 0.015 |
| Bell 206 | 250B17B | 0.053 | 0.009 | 0.008 | 0.001 | 0.009 |
| BH-1900 | PT6A-67D | 2.161 | 0.692 | 0.193 | 0.049 | 0.036 |
| BH-C99 | PT6A-36 | 0.019 | 0.001 | 0.009 | 0.002 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 1.031 | 0.019 | 0.003 | 0.000 | 0.020 |
| Cessna 208 Caravan | PT6A-114 | 0.214 | 0.017 | 0.087 | 0.018 | 0.048 |
| Cessna 441 Conquest2 | TPE331-8 | 1.215 | 0.096 | 0.679 | 0.101 | 0.134 |
| CITATION I | JT15D-1 | 2.530 | 0.940 | 0.114 | 0.018 | 0.025 |
| CITATION V | JT15D-5 (A & B) | 7.974 | 7.823 | 0.504 | 0.060 | 0.069 |
| Citation VII | TFE 731-2-2B | 0.906 | 0.304 | 0.172 | 0.014 | 0.018 |
| CITATION X | AE3007C | 0.414 | 0.086 | 0.182 | 0.024 | 0.011 |
| CL600 | CF34-3B | 2.164 | 0.227 | 0.487 | 0.082 | 0.031 |
| Falcon 2000EX | PW308C | 0.443 | 0.063 | 0.172 | 0.020 | 0.007 |
| Falcon 50 | TFE731-3 | 3.580 | 0.674 | 0.937 | 0.065 | 0.058 |
| Gulfstream II | SPEY MK511-8 | 1.684 | 0.207 | 0.822 | 0.093 | 0.014 |
| Gulfstream IV | TAY Mk611-8 | 3.048 | 0.489 | 1.214 | 0.191 | 0.037 |
| Gulfstream V | BR700-715B1-30 | 0.443 | 0.004 | 0.538 | 0.047 | 0.009 |
| Learjet 25C | CJ610-6 | 3.157 | 0.323 | 0.041 | 0.014 | 0.009 |
| Learjet 35/36 | TFE 731-2-2B | 5.904 | 1.993 | 0.996 | 0.087 | 0.121 |
| PA-31T Cheyenne | PT6A-28 | 0.191 | 0.012 | 0.079 | 0.015 | 0.024 |
| Piper PA-28 | IO-320-D1AD | 1.582 | 0.029 | 0.006 | 0.000 | 0.027 |
| Swearingen Metro 2 | TPE331-3 | 0.356 | 0.452 | 0.052 | 0.011 | 0.013 |
| Westwind 2 | TFE731-3 | 1.034 | 0.193 | 0.326 | 0.021 | 0.025 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.332 | 1.034 | 0.445 | 0.083 | 0.029 |
| C-17A | F117-PW-100 | 3.622 | 0.387 | 6.083 | 0.195 | 0.045 |
| F-16 | F100-PW-100 | 2.022 | 0.529 | 1.149 | 0.050 | 0.070 |
| **Total** | | 4,333.065 | 511.726 | 3,612.785 | 336.143 | 262.799 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-7 (1 of 3)**

2025 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 114.634 | 24.854 | 57.742 | 6.532 | 6.156 |
| A319 | CFM56-5B5/P | 540.993 | 122.424 | 330.526 | 33.866 | 31.794 |
| | V2522-A5 | 110.643 | 1.217 | 148.507 | 14.296 | 11.229 |
| | CFM56-5A5 | 33.974 | 3.396 | 36.881 | 3.394 | 3.008 |
| A320-200 | V2527-A5 | 262.184 | 3.149 | 407.313 | 36.695 | 26.453 |
| | CFM56-5A1 | 59.230 | 5.807 | 68.932 | 6.462 | 5.355 |
| A321 | CFM56-5B3/2P DAC-II | 34.614 | 3.311 | 21.020 | 1.709 | 1.072 |
| A340-300 | CFM56-5C4 | 0.746 | 0.126 | 1.134 | 0.061 | 0.016 |
| A340-642 | TRENT 556-61 | 1.122 | 0.012 | 5.294 | 0.252 | 0.040 |
| B717-200 | BR700-715C1-30 | 10.383 | 0.097 | 16.851 | 1.246 | 1.111 |
| B737-300 | CFM56-3C-1 | 1151.655 | 64.920 | 691.166 | 75.308 | 58.110 |
| | CFM56-3B-2 | 243.523 | 15.066 | 119.920 | 14.002 | 11.449 |
| B737-800 | CFM56-7B27 | 39.068 | 4.146 | 62.321 | 4.494 | 3.199 |
| | CFM56-7B26 | 50.298 | 5.618 | 71.344 | 5.445 | 4.012 |
| B747-400 | CF6-80C2B1F | 12.583 | 1.122 | 22.059 | 1.597 | 0.277 |
| | PW4056 | 26.331 | 2.496 | 41.336 | 2.795 | 0.481 |
| B757-200 | PW2037 | 426.398 | 39.453 | 475.386 | 38.362 | 21.235 |
| | RB211-535E4B | 27.419 | 0.281 | 30.266 | 2.834 | 1.318 |
| B767-200 | CF6-80A (A1) | 33.203 | 8.033 | 44.374 | 2.921 | 1.259 |
| B767-300 | PW4056 | 72.068 | 6.833 | 93.398 | 6.963 | 2.656 |
| B777-200 | PW4077 | 117.088 | 20.157 | 274.482 | 15.247 | 4.327 |
| | GE90-85B | 6.990 | 0.266 | 23.761 | 1.133 | 0.293 |
| | TRENT 895 | 5.008 | 0.323 | 16.539 | 0.834 | 0.175 |
| MD-80 | JT8D-217C | 132.619 | 0.000 | 112.474 | 13.733 | 8.756 |
| | JT8D-219 | 79.978 | 0.000 | 79.530 | 8.896 | 5.584 |
| MD-90-30 | V2525-D5 | 4.485 | 0.053 | 6.618 | 0.608 | 0.461 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 54.191 | 7.482 | 19.093 | 2.652 | 2.707 |
| BH-1900C | PT6A-65B | 145.070 | 45.845 | 13.714 | 3.455 | 15.184 |
| Bombardier CRJ700 | CF34-8C1 | 56.714 | 0.263 | 33.107 | 4.023 | 5.608 |
| Bombardier CRJ900 | CF34-8C5 | 0.213 | 0.002 | 0.179 | 0.021 | 0.029 |
| Canadair Reg-100 | CF34-3B | 0.065 | 0.007 | 0.015 | 0.002 | 0.005 |
| DHC-8-200 | PW123D | 15.219 | 0.000 | 20.065 | 2.247 | 5.334 |
| EMB-120 | PW118A | 12.432 | 0.000 | 9.978 | 1.283 | 3.931 |
| | PW118B | 5.885 | 0.000 | 4.721 | 0.607 | 1.856 |
| Embraer ERJ 145LR | A3007A1/2 | 6.705 | 1.031 | 4.511 | 0.527 | 0.987 |
| | AE3007A1/1 | 3.447 | 0.530 | 2.319 | 0.271 | 0.507 |
| REG'L JET 200 | CF34-3B | 245.812 | 25.795 | 56.239 | 9.245 | 18.604 |

**Table B-7 (2 of 3)**

2025 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 46.932 | 4.049 | 70.830 | 5.333 | 2.026 |
| | PW4158 | 68.757 | 6.390 | 91.399 | 6.809 | 2.579 |
| A310 | CF6-80A3 | 2.895 | 0.704 | 3.347 | 0.236 | 0.110 |
| B727-200F | JT8D-15 | 28.461 | 4.474 | 39.821 | 4.543 | 1.805 |
| | JT8D-17 | 22.983 | 3.306 | 33.818 | 3.767 | 1.537 |
| | JT8D-7B | 22.693 | 6.488 | 24.165 | 2.976 | 1.318 |
| | JT8D-9A | 6.482 | 1.560 | 7.293 | 0.854 | 0.371 |
| B747-100F | JT9D-7A | 18.867 | 8.751 | 8.344 | 0.515 | 0.091 |
| | JT9D-7Q | 7.706 | 1.928 | 4.858 | 0.340 | 0.053 |
| B757-200 | PW2040 | 6.303 | 0.564 | 9.342 | 0.655 | 0.337 |
| | RB211-535E4 | 5.505 | 0.166 | 10.845 | 0.773 | 0.384 |
| B767-200 | CF6-80A (A1) | 29.884 | 7.230 | 39.938 | 2.629 | 1.133 |
| | JT9D-7R4D | 2.954 | 0.463 | 10.427 | 0.677 | 0.257 |
| B767-300ER | CF6-80C2B7F | 21.417 | 1.854 | 39.610 | 2.763 | 0.967 |
| BH-1900C | PT6A-65B | 1.452 | 0.459 | 0.137 | 0.034 | 0.152 |
| BH-C99 | PT6A-36 | 0.262 | 0.019 | 0.130 | 0.025 | 0.167 |
| Cessna 208 Caravan | PT6A-114 | 0.207 | 0.015 | 0.084 | 0.017 | 0.244 |
| DC10-10F | CF6-6D | 20.451 | 8.436 | 14.818 | 0.814 | 0.244 |
| DC10-30F | CF6-50C2 | 66.605 | 8.332 | 99.150 | 6.652 | 1.823 |
| DC8-61 | JT3D-3B | 3.465 | 4.064 | 0.400 | 0.067 | 0.021 |
| DC8-71F | CFM56-2C5 | 2.670 | 0.169 | 1.396 | 0.158 | 0.056 |
| DC9-30F | JT8D-9 | 1.097 | 0.265 | 1.043 | 0.134 | 0.095 |
| DC9-40 | JT8D-11 | 10.539 | 3.171 | 3.854 | 0.513 | 0.331 |
| | JT8D-15 | 2.801 | 0.438 | 3.487 | 0.427 | 0.269 |
| Learjet 35/36 | TFE 731-2-2B | 0.484 | 0.163 | 0.082 | 0.007 | 0.052 |
| MD-11F | CF6-80C2D1F | 0.245 | 0.021 | 0.461 | 0.032 | 0.007 |
| MD-80 | JT8D-219 | 2.940 | 0.000 | 2.923 | 0.327 | 0.205 |
| Swearingen Metro 2 | TPE331-3 | 0.062 | 0.078 | 0.009 | 0.002 | 0.012 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.078 | 0.012 | 0.109 | 0.012 | 0.002 |
| B737-200 | JT8D-17 | 0.190 | 0.028 | 0.245 | 0.030 | 0.009 |
| B737-800 | CFM56-7B26 | 0.186 | 0.021 | 0.265 | 0.020 | 0.007 |
| BAE 125-700 | TFE731-3 | 1.752 | 0.343 | 0.459 | 0.032 | 0.108 |
| Beech King Air 200 | PT6A-41 | 0.131 | 0.117 | 0.007 | 0.001 | 0.005 |
| Beechjet 400A | JT15D-5 (A & B) | 3.632 | 3.585 | 0.196 | 0.025 | 0.080 |
| Cessna 441 Conquest2 | TPE331-8 | 0.565 | 0.044 | 0.316 | 0.047 | 0.159 |
| CITATION V | JT15D-5 (A & B) | 6.431 | 6.310 | 0.407 | 0.047 | 0.141 |
| Citation VII | TFE731-3 | 0.256 | 0.047 | 0.076 | 0.006 | 0.015 |
| CITATION X | AE3007C | 0.750 | 0.157 | 0.328 | 0.045 | 0.052 |
| CL600 | CF34-3B | 0.295 | 0.031 | 0.066 | 0.011 | 0.011 |
| CL601-3A | CF34-3A | 0.268 | 0.026 | 0.071 | 0.007 | 0.011 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.083 | 0.014 | 0.056 | 0.007 | 0.006 |
| Falcon 2000EX | PW308C | 0.486 | 0.069 | 0.188 | 0.022 | 0.021 |
| Falcon 50 | TFE731-3 | 0.074 | 0.014 | 0.019 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.011 | 0.107 | 0.049 | 0.004 | 0.005 |
| Gulfstream IV | TAY Mk611-8 | 0.049 | 0.008 | 0.020 | 0.003 | 0.002 |
| Learjet 24D | CJ610-6 | 0.831 | 0.085 | 0.011 | 0.003 | 0.006 |
| Learjet 35/36 | TFE 731-2-2B | 1.146 | 0.387 | 0.194 | 0.017 | 0.060 |
| Navajo | PT6A-28 | 73.536 | 1.798 | 0.035 | 0.006 | 0.554 |
| Swearingen Metro 2 | TPE331-3 | 19.504 | 24.793 | 2.847 | 0.578 | 1.804 |

**Table B-7 (3 of 3)**

2025 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation (cont.)** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.299 | 0.450 | 0.602 | 0.042 | 0.056 |
| Beech King Air 100 | PT6A-28 | 0.698 | 0.050 | 0.324 | 0.063 | 0.085 |
| Beech King Air 200 | PT6A-41 | 10.503 | 9.399 | 0.503 | 0.076 | 0.142 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 0.922 | 0.134 | 0.095 | 0.024 | 0.022 |
| Beechjet 400 | JT15D-5 (A & B) | 1.721 | 1.698 | 0.093 | 0.012 | 0.015 |
| Bell 206 | 250B17B | 0.054 | 0.009 | 0.008 | 0.001 | 0.009 |
| BH-1900 | PT6A-67D | 2.224 | 0.712 | 0.198 | 0.051 | 0.038 |
| BH-C99 | PT6A-36 | 0.019 | 0.001 | 0.009 | 0.002 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 1.062 | 0.020 | 0.003 | 0.000 | 0.020 |
| Cessna 208 Caravan | PT6A-114 | 0.220 | 0.017 | 0.089 | 0.018 | 0.050 |
| Cessna 441 Conquest2 | TPE331-8 | 1.250 | 0.098 | 0.699 | 0.105 | 0.138 |
| CITATION I | JT15D-1 | 2.601 | 0.967 | 0.117 | 0.018 | 0.026 |
| CITATION V | JT15D-5 (A & B) | 8.208 | 8.053 | 0.519 | 0.061 | 0.071 |
| Citation VII | TFE 731-2-2B | 0.930 | 0.312 | 0.176 | 0.014 | 0.019 |
| CITATION X | AE3007C | 0.428 | 0.089 | 0.187 | 0.025 | 0.012 |
| CL600 | CF34-3B | 2.221 | 0.233 | 0.500 | 0.083 | 0.032 |
| Falcon 2000EX | PW308C | 0.457 | 0.065 | 0.177 | 0.021 | 0.008 |
| Falcon 50 | TFE731-3 | 3.691 | 0.694 | 0.967 | 0.067 | 0.060 |
| Gulfstream II | SPEY MK511-8 | 1.727 | 0.213 | 0.843 | 0.095 | 0.014 |
| Gulfstream IV | TAY Mk611-8 | 3.135 | 0.503 | 1.248 | 0.196 | 0.038 |
| Gulfstream V | BR700-715B1-30 | 0.455 | 0.004 | 0.552 | 0.049 | 0.009 |
| Learjet 25C | CJ610-6 | 3.241 | 0.332 | 0.042 | 0.014 | 0.009 |
| Learjet 35/36 | TFE 731-2-2B | 6.077 | 2.051 | 1.026 | 0.089 | 0.125 |
| PA-31T Cheyenne | PT6A-28 | 0.196 | 0.013 | 0.083 | 0.017 | 0.025 |
| Piper PA-28 | IO-320-D1AD | 1.624 | 0.029 | 0.006 | 0.000 | 0.027 |
| Swearingen Metro 2 | TPE331-3 | 0.368 | 0.468 | 0.054 | 0.011 | 0.013 |
| Westwind 2 | TFE731-3 | 1.064 | 0.198 | 0.336 | 0.021 | 0.025 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.332 | 1.034 | 0.445 | 0.083 | 0.029 |
| C-17A | F117-PW-100 | 3.622 | 0.387 | 6.083 | 0.195 | 0.045 |
| F-16 | F100-PW-100 | 2.022 | 0.529 | 1.149 | 0.050 | 0.070 |
| **Total** | | 4,723.734 | 554.430 | 3,968.223 | 368.524 | 285.519 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

**Table B-8 (1 of 3)**

2030 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **Majors/Nationals** | | | | | | |
| A318 | CFM56-5B8/P | 125.257 | 27.157 | 63.093 | 7.137 | 6.726 |
| A319 | CFM56-5B5/P | 591.130 | 133.769 | 361.157 | 37.006 | 34.740 |
| | V2522-A5 | 120.896 | 1.329 | 162.268 | 15.620 | 12.269 |
| | CFM56-5A5 | 37.126 | 3.711 | 40.302 | 3.708 | 3.288 |
| A320-200 | V2527-A5 | 286.483 | 3.441 | 445.064 | 40.095 | 28.904 |
| | CFM56-5A1 | 64.717 | 6.345 | 75.318 | 7.060 | 5.851 |
| A321 | CFM56-5B3/2P DAC-II | 37.837 | 3.620 | 22.977 | 1.868 | 1.172 |
| A340-300 | CFM56-5C4 | 0.804 | 0.136 | 1.221 | 0.065 | 0.017 |
| A340-642 | TRENT 556-61 | 1.226 | 0.012 | 5.784 | 0.276 | 0.044 |
| B717-200 | BR700-715C1-30 | 11.344 | 0.106 | 18.412 | 1.361 | 1.214 |
| B737-300 | CFM56-3C-1 | 1258.394 | 70.937 | 755.224 | 82.288 | 63.496 |
| | CFM56-3B-2 | 266.088 | 16.462 | 131.033 | 15.299 | 12.510 |
| B737-800 | CFM56-7B27 | 42.687 | 4.529 | 68.095 | 4.910 | 3.495 |
| | CFM56-7B26 | 54.962 | 6.139 | 77.959 | 5.950 | 4.384 |
| B747-400 | CF6-80C2B1F | 13.768 | 1.228 | 24.136 | 1.747 | 0.303 |
| | PW4056 | 28.775 | 2.727 | 45.172 | 3.056 | 0.526 |
| B757-200 | PW2037 | 465.917 | 43.109 | 519.445 | 41.916 | 23.203 |
| | RB211-535E4B | 29.961 | 0.308 | 33.073 | 3.096 | 1.440 |
| B767-200 | CF6-80A (A1) | 36.292 | 8.780 | 48.503 | 3.192 | 1.377 |
| B767-300 | PW4056 | 78.746 | 7.466 | 102.053 | 7.609 | 2.902 |
| B777-200 | PW4077 | 127.943 | 22.025 | 299.928 | 16.660 | 4.729 |
| | GE90-85B | 7.641 | 0.290 | 25.977 | 1.239 | 0.320 |
| | TRENT 895 | 5.485 | 0.354 | 18.118 | 0.914 | 0.192 |
| MD-80 | JT8D-217C | 144.913 | 0.000 | 122.901 | 15.006 | 9.567 |
| | JT8D-219 | 87.393 | 0.000 | 86.904 | 9.721 | 6.101 |
| MD-90-30 | V2525-D5 | 4.895 | 0.058 | 7.223 | 0.664 | 0.503 |
| **Regionals/Commuters** | | | | | | |
| BAE 146-200 | ALF502R-5 | 59.206 | 8.175 | 20.861 | 2.898 | 2.957 |
| BH-1900C | PT6A-65B | 158.511 | 50.093 | 14.985 | 3.775 | 16.591 |
| Bombardier CRJ700 | CF34-8C1 | 61.969 | 0.288 | 36.175 | 4.396 | 6.127 |
| Bombardier CRJ900 | CF34-8C5 | 0.231 | 0.002 | 0.194 | 0.022 | 0.032 |
| Canadair Reg-100 | CF34-3B | 0.074 | 0.008 | 0.017 | 0.003 | 0.006 |
| DHC-8-200 | PW123D | 16.629 | 0.000 | 21.926 | 2.455 | 5.828 |
| EMB-120 | PW118A | 13.585 | 0.000 | 10.904 | 1.402 | 4.295 |
| | PW118B | 6.430 | 0.000 | 5.158 | 0.664 | 2.028 |
| Embraer ERJ 145LR | A3007A1/2 | 7.328 | 1.127 | 4.930 | 0.575 | 1.078 |
| | AE3007A1/1 | 3.768 | 0.579 | 2.534 | 0.297 | 0.554 |
| REG'L JET 200 | CF34-3B | 268.596 | 28.186 | 61.452 | 10.102 | 20.328 |

**Table B-8 (2 of 3)**

2030 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **All Cargo** | | | | | | |
| A300-600 | CF6-80C2A5 | 51.271 | 4.424 | 77.378 | 5.826 | 2.213 |
| | PW4158 | 75.121 | 6.982 | 99.859 | 7.439 | 2.818 |
| A310 | CF6-80A3 | 3.155 | 0.767 | 3.648 | 0.257 | 0.120 |
| B727-200F | JT8D-15 | 31.091 | 4.888 | 43.501 | 4.963 | 1.972 |
| | JT8D-17 | 25.115 | 3.612 | 36.955 | 4.116 | 1.680 |
| | JT8D-7B | 24.798 | 7.090 | 26.405 | 3.252 | 1.440 |
| | JT8D-9A | 7.089 | 1.705 | 7.976 | 0.934 | 0.406 |
| B747-100F | JT9D-7A | 20.536 | 9.525 | 9.083 | 0.560 | 0.099 |
| | JT9D-7Q | 8.512 | 2.130 | 5.366 | 0.375 | 0.059 |
| B757-200 | PW2040 | 6.882 | 0.616 | 10.201 | 0.714 | 0.368 |
| | RB211-535E4 | 6.012 | 0.181 | 11.843 | 0.843 | 0.419 |
| B767-200 | CF6-80A (A1) | 32.663 | 7.901 | 43.653 | 2.874 | 1.239 |
| | JT9D-7R4D | 3.225 | 0.505 | 11.382 | 0.739 | 0.281 |
| B767-300ER | CF6-80C2B7F | 23.409 | 2.027 | 43.294 | 3.021 | 1.057 |
| BH-1900C | PT6A-65B | 1.587 | 0.502 | 0.150 | 0.037 | 0.166 |
| BH-C99 | PT6A-36 | 0.288 | 0.021 | 0.142 | 0.028 | 0.182 |
| Cessna 208 Caravan | PT6A-114 | 0.226 | 0.017 | 0.091 | 0.019 | 0.267 |
| DC10-10F | CF6-6D | 22.320 | 9.208 | 16.173 | 0.887 | 0.267 |
| DC10-30F | CF6-50C2 | 72.790 | 9.106 | 108.356 | 7.270 | 1.992 |
| DC8-61 | JT3D-3B | 3.771 | 4.422 | 0.435 | 0.073 | 0.023 |
| DC8-71F | CFM56-2C5 | 2.933 | 0.185 | 1.534 | 0.173 | 0.062 |
| DC9-30F | JT8D-9 | 1.197 | 0.289 | 1.138 | 0.147 | 0.104 |
| DC9-40 | JT8D-11 | 11.527 | 3.469 | 4.214 | 0.561 | 0.362 |
| | JT8D-15 | 3.060 | 0.478 | 3.808 | 0.466 | 0.294 |
| Learjet 35/36 | TFE 731-2-2B | 0.530 | 0.179 | 0.089 | 0.008 | 0.057 |
| MD-11F | CF6-80C2D1F | 0.266 | 0.023 | 0.499 | 0.034 | 0.008 |
| MD-80 | JT8D-219 | 3.215 | 0.000 | 3.197 | 0.357 | 0.224 |
| Swearingen Metro 2 | TPE331-3 | 0.068 | 0.087 | 0.010 | 0.002 | 0.013 |
| **Other Air Taxi** | | | | | | |
| B727-200 | JT8D-15 | 0.088 | 0.014 | 0.123 | 0.014 | 0.003 |
| B737-200 | JT8D-17 | 0.208 | 0.030 | 0.269 | 0.032 | 0.010 |
| B737-800 | CFM56-7B26 | 0.202 | 0.022 | 0.287 | 0.022 | 0.008 |
| BAE 125-700 | TFE731-3 | 1.913 | 0.374 | 0.500 | 0.034 | 0.118 |
| Beech King Air 200 | PT6A-41 | 0.140 | 0.125 | 0.007 | 0.001 | 0.005 |
| Beechjet 400A | JT15D-5 (A & B) | 3.973 | 3.921 | 0.215 | 0.028 | 0.088 |
| Cessna 441 Conquest2 | TPE331-8 | 0.618 | 0.049 | 0.346 | 0.052 | 0.174 |
| CITATION V | JT15D-5 (A & B) | 7.037 | 6.905 | 0.445 | 0.052 | 0.154 |
| Citation VII | TFE731-3 | 0.280 | 0.052 | 0.084 | 0.006 | 0.017 |
| CITATION X | AE3007C | 0.820 | 0.171 | 0.359 | 0.049 | 0.057 |
| CL600 | CF34-3B | 0.320 | 0.033 | 0.072 | 0.012 | 0.012 |
| CL601-3A | CF34-3A | 0.298 | 0.030 | 0.079 | 0.007 | 0.012 |
| Embraer Legacy | AE3007A1P (Type 1) | 0.091 | 0.015 | 0.062 | 0.007 | 0.007 |
| Falcon 2000EX | PW308C | 0.528 | 0.075 | 0.205 | 0.024 | 0.023 |
| Falcon 50 | TFE731-3 | 0.074 | 0.014 | 0.019 | 0.001 | 0.003 |
| Galaxy (IAI) G200 | PW306A | 0.012 | 0.120 | 0.055 | 0.006 | 0.006 |
| Gulfstream IV | TAY Mk611-8 | 0.049 | 0.008 | 0.020 | 0.003 | 0.002 |
| Learjet 24D | CJ610-6 | 0.914 | 0.094 | 0.012 | 0.004 | 0.007 |
| Learjet 35/36 | TFE 731-2-2B | 1.250 | 0.422 | 0.211 | 0.019 | 0.065 |
| Navajo | PT6A-28 | 80.377 | 1.965 | 0.039 | 0.007 | 0.606 |
| Swearingen Metro 2 | TPE331-3 | 21.312 | 27.089 | 3.112 | 0.632 | 1.971 |

**Table B-8 (3 of 3)**

2030 Aircraft Emissions – Denver International Airport

| EDMS Aircraft Type | EDMS Engine Type | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|
| **General Aviation** | | | | | | |
| BAE 125-700 | TFE731-3 | 2.514 | 0.492 | 0.658 | 0.045 | 0.061 |
| Beech King Air 100 | PT6A-28 | 0.762 | 0.054 | 0.354 | 0.069 | 0.093 |
| Beech King Air 200 | PT6A-41 | 11.471 | 10.267 | 0.549 | 0.083 | 0.156 |
| Beech King Air 300 | PT6A-60, -60A, -60AG | 1.003 | 0.147 | 0.104 | 0.026 | 0.023 |
| Beechjet 400 | JT15D-5 (A & B) | 1.884 | 1.860 | 0.101 | 0.013 | 0.016 |
| Bell 206 | 250B17B | 0.060 | 0.010 | 0.009 | 0.001 | 0.010 |
| BH-1900 | PT6A-67D | 2.435 | 0.779 | 0.217 | 0.055 | 0.041 |
| BH-C99 | PT6A-36 | 0.021 | 0.001 | 0.010 | 0.002 | 0.002 |
| Cessna 172 Skyhawk | IO-320-D1AD | 1.162 | 0.022 | 0.004 | 0.000 | 0.022 |
| Cessna 208 Caravan | PT6A-114 | 0.241 | 0.019 | 0.098 | 0.020 | 0.054 |
| Cessna 441 Conquest2 | TPE331-8 | 1.366 | 0.107 | 0.764 | 0.114 | 0.151 |
| CITATION I | JT15D-1 | 2.840 | 1.056 | 0.127 | 0.020 | 0.028 |
| CITATION V | JT15D-5 (A & B) | 8.965 | 8.796 | 0.567 | 0.066 | 0.077 |
| Citation VII | TFE 731-2-2B | 1.017 | 0.342 | 0.193 | 0.015 | 0.021 |
| CITATION X | AE3007C | 0.462 | 0.097 | 0.203 | 0.028 | 0.013 |
| CL600 | CF34-3B | 2.425 | 0.255 | 0.546 | 0.090 | 0.035 |
| Falcon 2000EX | PW308C | 0.499 | 0.071 | 0.194 | 0.023 | 0.008 |
| Falcon 50 | TFE731-3 | 4.028 | 0.757 | 1.055 | 0.073 | 0.065 |
| Gulfstream II | SPEY MK511-8 | 1.886 | 0.233 | 0.920 | 0.104 | 0.016 |
| Gulfstream IV | TAY Mk611-8 | 3.427 | 0.550 | 1.364 | 0.215 | 0.042 |
| Gulfstream V | BR700-715B1-30 | 0.502 | 0.006 | 0.608 | 0.053 | 0.010 |
| Learjet 25C | CJ610-6 | 3.573 | 0.365 | 0.046 | 0.017 | 0.010 |
| Learjet 35/36 | TFE 731-2-2B | 6.636 | 2.240 | 1.120 | 0.097 | 0.136 |
| PA-31T Cheyenne | PT6A-28 | 0.215 | 0.014 | 0.090 | 0.018 | 0.027 |
| Piper PA-28 | IO-320-D1AD | 1.778 | 0.032 | 0.007 | 0.000 | 0.030 |
| Swearingen Metro 2 | TPE331-3 | 0.401 | 0.510 | 0.058 | 0.012 | 0.015 |
| Westwind 2 | TFE731-3 | 1.163 | 0.217 | 0.367 | 0.023 | 0.028 |
| **Military** | | | | | | |
| C-130 HERCULES | 501D22A | 2.553 | 1.132 | 0.487 | 0.090 | 0.031 |
| C-17A | F117-PW-100 | 3.963 | 0.423 | 6.654 | 0.213 | 0.049 |
| F-16 | F100-PW-100 | 2.205 | 0.578 | 1.253 | 0.054 | 0.076 |
| **Total** | | 5,161.625 | 605.795 | 4,336.104 | 402.678 | 311.982 |

Source: Ricondo & Associates, Inc. based on output from the Emissions and Dispersion Modeling System (EDMS) Version 4.2.
Prepared by: Ricondo & Associates, Inc.

# Appendix C. Minor Point Source Emissions

This Appendix provides Baseline year and future year emissions data for minor point sources at Denver International Airport. The data provided herein was compiled from various sources including databases maintained by the Air Pollution Control Division (APCD) and information maintained by the City and County of Denver Department of Aviation. As discussed in Section 2.3, a variety of statistics from the Airport's activity forecast and information provided by the APCD and the City and County of Denver formed the basis for growth factors used in estimation of future-year emissions from minor point sources. **Table C-1** presents data regarding aircraft operations, domestic enplanements, international enplanements, and total enplanements at Denver International Airport for each of the SIP analysis years. **Table C-2** provides a summary of emissions from non-VOC emitting minor point sources considered in the Airport Emissions Inventory. **Table C-3** contains information about minor point sources that emit VOC.

**Table C-1**

Airport Activity Statistics – Denver International Airport

| Year | Aircraft Operations | Enplanements (Domestic) | Enplanements (International) | Total Enplanements |
|---|---|---|---|---|
| 2001 | 548,350 | 19,327,600 | 691,400 | 20,019,000 |
| 2009 | 692,600 | 26,152,500 | 1,145,760 | 27,298,260 |
| 2010 | 710,450 | 27,029,400 | 1,207,680 | 28,237,080 |
| 2013 | 761,330 | 29,751,980 | 1,370,000 | 31,121,980 |
| 2015 | 794,410 | 31,597,660 | 1,470,400 | 33,068,060 |
| 2020 | 872,790 | 36,198,900 | 1,738,280 | 37,937,180 |
| 2025 | 946,750 | 40,832,200 | 2,011,200 | 42,843,400 |
| 2030 | 1,034,500 | 45,811,980 | 2,307,861 | 48,119,841 |

Source: Ricondo & Associates, Inc. *Aviation Activity Forecast*. May 16, 2001.
Prepared by: Ricondo & Associates, Inc.

**Table C-2 (1 of 2)**

Summary of Emissions from Minor Point Sources

| Facility Name | Name of Source | APCD ID No. | Pollutant | Emissions (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| City and County of Denver | Central Plant boilers [1/] | 031/1260/101 | CO | 14.7953 | 20.1752 | 20.8690 | 23.0011 | 24.4394 | 28.0380 | 31.6640 | 35.5636 |
| | | | VOC | 0.9685 | 1.3206 | 1.3660 | 1.5056 | 1.5997 | 1.8353 | 2.0726 | 2.3279 |
| | | | $NO_X$ | 17.5520 | 23.9342 | 24.7574 | 27.2868 | 28.9930 | 33.2621 | 37.5637 | 42.1899 |
| | | | $SO_x$ | 0.1053 | 0.1436 | 0.1485 | 0.1637 | 0.1740 | 0.1996 | 0.2254 | 0.2531 |
| | | | $PM_{10}$ | 1.3381 | 1.8246 | 1.8874 | 2.0802 | 2.2103 | 2.5357 | 2.8637 | 3.2164 |
| City and County of Denver | Central Plant chiller engines [2/] | 031/1260/102 | CO | 5.9205 | 8.0733 | 8.3509 | 9.2041 | 9.7797 | 11.2197 | 12.6707 | 14.2311 |
| | | | VOC | 2.6311 | 3.5878 | 3.7112 | 4.0903 | 4.3461 | 4.9860 | 5.6308 | 6.3243 |
| | | | $NO_X$ | 2.6311 | 3.5878 | 3.7112 | 4.0903 | 4.3461 | 4.9860 | 5.6308 | 6.3243 |
| | | | $SO_x$ | 0.0070 | 0.0096 | 0.0099 | 0.0109 | 0.0116 | 0.0133 | 0.0151 | 0.0169 |
| | | | $PM_{10}$ | 0.1174 | 0.1600 | 0.1655 | 0.1824 | 0.1938 | 0.2224 | 0.2512 | 0.2821 |
| City and County of Denver | Emergency generators for airfield lighting vaults | 031/1260/104 | CO | 0.6232 | 0.6072 | 0.6168 | 0.6480 | 0.6671 | 0.7125 | 0.7682 | 0.8002 |
| | | | VOC | 0.0600 | 0.0585 | 0.0594 | 0.0624 | 0.0643 | 0.0687 | 0.0740 | 0.0771 |
| | | | $NO_X$ | 2.3462 | 2.2859 | 2.3220 | 2.4396 | 2.5113 | 2.6824 | 2.8919 | 3.0126 |
| | | | $SO_x$ | 0.0019 | 0.0018 | 0.0018 | 0.0019 | 0.0020 | 0.0021 | 0.0023 | 0.0024 |
| | | | $PM_{10}$ | 0.0733 | 0.0714 | 0.0726 | 0.0762 | 0.0785 | 0.0838 | 0.0904 | 0.0941 |
| City and County of Denver | Incinerators | 031/1260/107 | CO | 1.6120 | 2.6713 | 2.8157 | 3.1942 | 3.4282 | 4.0528 | 4.6891 | 5.3808 |
| | | | VOC | 0.1050 | 0.1740 | 0.1834 | 0.2081 | 0.2233 | 0.2640 | 0.3054 | 0.3505 |
| | | | $NO_X$ | 2.3850 | 3.9523 | 4.1659 | 4.7258 | 5.0722 | 5.9962 | 6.9377 | 7.9610 |
| | | | $SO_x$ | 0.1150 | 0.1906 | 0.2009 | 0.2279 | 0.2446 | 0.2891 | 0.3345 | 0.3839 |
| | | | $PM_{10}$ | 0.1460 | 0.2419 | 0.2550 | 0.2893 | 0.3105 | 0.3671 | 0.4247 | 0.4873 |
| City and County of Denver | Cooling tower | 031/1260/108 | CO | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | VOC | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | $NO_X$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | $SO_x$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | $PM_{10}$ | 4.6000 | 4.3960 | 4.5979 | 5.0816 | 5.3986 | 6.1881 | 7.0429 | 7.9965 |
| City and County of Denver | Emergency generator for Airport Office Building | 031/1260/109 | CO | 1.4000 | 1.3640 | 1.3855 | 1.4557 | 1.4985 | 1.6006 | 1.7256 | 1.7976 |
| | | | VOC | 0.2000 | 0.1949 | 0.1979 | 0.2080 | 0.2141 | 0.2287 | 0.2465 | 0.2568 |
| | | | $NO_X$ | 6.0000 | 5.8456 | 5.9379 | 6.2386 | 6.4220 | 6.8596 | 7.3954 | 7.7041 |
| | | | $SO_x$ | 0.8000 | 0.7794 | 0.7917 | 0.8318 | 0.8563 | 0.9146 | 0.9860 | 1.0272 |
| | | | $PM_{10}$ | 0.1100 | 0.1072 | 0.1089 | 0.1144 | 0.1177 | 0.1258 | 0.1356 | 0.1412 |
| United Airlines | Maintenance air start compressor | 031/1814/004 | CO | 0.0495 | 0.0670 | 0.0692 | 0.0762 | 0.0809 | 0.0927 | 0.1046 | 0.1173 |
| | | | VOC | 0.0031 | 0.0042 | 0.0044 | 0.0048 | 0.0051 | 0.0058 | 0.0066 | 0.0074 |
| | | | $NO_X$ | 0.1038 | 0.1405 | 0.1452 | 0.1598 | 0.1697 | 0.1944 | 0.2193 | 0.2460 |
| | | | $SO_x$ | 0.0141 | 0.0191 | 0.0197 | 0.0217 | 0.0231 | 0.0264 | 0.0298 | 0.0334 |
| | | | $PM_{10}$ | 0.0084 | 0.0114 | 0.0117 | 0.0129 | 0.0137 | 0.0157 | 0.0177 | 0.0199 |
| United Airlines | Paint booths | 031/1814/018 | CO | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | VOC | 0.4071 | 0.5509 | 0.5694 | 0.6267 | 0.6656 | 0.7625 | 0.8601 | 0.9650 |
| | | | $NO_X$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | $SO_x$ | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| | | | $PM_{10}$ | 0.0054 | 0.0073 | 0.0076 | 0.0083 | 0.0088 | 0.0101 | 0.0114 | 0.0128 |
| Continental Airlines | Hangar boilers | 031/1815/012 | CO | 0.0500 | 0.0549 | 0.0568 | 0.0609 | 0.0634 | 0.0719 | 0.0804 | 0.0868 |
| | | | VOC | 0.7000 | 0.7484 | 0.7741 | 0.8296 | 0.8634 | 0.9803 | 1.0955 | 1.1830 |
| | | | $NO_X$ | 0.5000 | 0.5492 | 0.5681 | 0.6088 | 0.6336 | 0.7194 | 0.8040 | 0.8681 |
| | | | $SO_x$ | 0.0100 | 0.0110 | 0.0114 | 0.0122 | 0.0127 | 0.0144 | 0.0161 | 0.0174 |
| | | | $PM_{10}$ | 0.0400 | 0.0439 | 0.0454 | 0.0487 | 0.0507 | 0.0576 | 0.0643 | 0.0695 |
| Continental Airlines | Icehouse boilers | 031/1815/013 | CO | 0.0513 | 0.0563 | 0.0583 | 0.0624 | 0.0650 | 0.0738 | 0.0824 | 0.0890 |
| | | | VOC | 0.0034 | 0.0036 | 0.0037 | 0.0040 | 0.0041 | 0.0047 | 0.0053 | 0.0057 |
| | | | $NO_X$ | 0.0610 | 0.0670 | 0.0693 | 0.0743 | 0.0774 | 0.0878 | 0.0981 | 0.1060 |
| | | | $SO_x$ | 0.0004 | 0.0004 | 0.0004 | 0.0004 | 0.0005 | 0.0005 | 0.0006 | 0.0006 |
| | | | $PM_{10}$ | 0.0046 | 0.0051 | 0.0053 | 0.0056 | 0.0059 | 0.0067 | 0.0075 | 0.0081 |
| Inland Technologies | Natural gas-fired heater for hot oil | 031/1822/001 | CO | 3.4213 | 3.7582 | 3.8869 | 4.1660 | 4.3357 | 4.9225 | 5.5012 | 5.9403 |
| | | | VOC | 0.2239 | 0.2460 | 0.2544 | 0.2727 | 0.2838 | 0.3222 | 0.3601 | 0.3888 |
| | | | $NO_X$ | 2.0365 | 2.2371 | 2.3137 | 2.4799 | 2.5809 | 2.9301 | 3.2746 | 3.5360 |
| | | | $SO_x$ | 0.0244 | 0.0268 | 0.0277 | 0.0297 | 0.0309 | 0.0350 | 0.0392 | 0.0423 |
| | | | $PM_{10}$ | 0.3557 | 0.3908 | 0.4042 | 0.4332 | 0.4508 | 0.5118 | 0.5720 | 0.6177 |

**Table C-2 (2 of 2)**

Summary of Emissions from Minor Point Sources

| Facility Name | Name of Source | APCD ID No. | Pollutant | Emissions (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Inland Technologies | Medium boiler | 031/1822/002 | CO | 9.9235 | 14.3828 | 14.6415 | 15.2620 | 15.1700 | 17.0630 | 18.4747 | 19.5795 |
| | | | VOC | 0.6496 | 0.7845 | 0.7987 | 0.8325 | 0.8275 | 0.9307 | 1.0078 | 1.0680 |
| | | | $NO_X$ | 5.9070 | 8.5614 | 8.7154 | 9.0848 | 9.0300 | 10.1568 | 10.9972 | 11.6548 |
| | | | $SO_x$ | 0.0706 | 0.1024 | 0.1042 | 0.1086 | 0.1080 | 0.1215 | 0.1315 | 0.1394 |
| | | | $PM_{10}$ | 0.8975 | 1.3008 | 1.3242 | 1.3803 | 1.3720 | 1.5432 | 1.6708 | 1.7708 |
| Inland Technologies | Small boiler | 031/1822/003 | CO | 2.4812 | 2.9969 | 3.0508 | 3.1801 | 3.1609 | 3.5553 | 3.8495 | 4.0796 |
| | | | VOC | 0.1624 | 0.1962 | 0.1997 | 0.2082 | 0.2069 | 0.2327 | 0.2520 | 0.2670 |
| | | | $NO_X$ | 1.4770 | 1.7839 | 1.8160 | 1.8929 | 1.8815 | 2.1163 | 2.2914 | 2.4284 |
| | | | $SO_x$ | 0.0177 | 0.0213 | 0.0217 | 0.0226 | 0.0225 | 0.0253 | 0.0274 | 0.0290 |
| | | | $PM_{10}$ | 0.2244 | 0.2710 | 0.2759 | 0.2876 | 0.2859 | 0.3215 | 0.3481 | 0.3690 |

Note: 1/ Annual emissions estimates for the Central Plant boilers were adjusted to account for higher fuel useage during the winter months as reported on Air Pollution Emission Notice (APEN) 031/1260/101.
2/ Annual emissions estimates for the Central Plant chiller engines were adjusted to account for lower fuel useage during the winter months as reported on the Air Pollution Emission Notice (APEN) 031/1260/102.
Pollutants not emitted from a particular source are denoted as n.a. (not applicable)

Source: Air Pollution Control Division and City and County of Denver Department of Aviation
Prepared by: Ricondo & Associates, Inc.

**Table C-3**

Summary of Emissions from Minor Point Sources – VOC Only

| Facility Name | Name of Source | APCD ID No. | VOC Emissions (tons/year) 2001 | 2009 | 2010 | 2013 | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| City and County of Denver | O&G E&P condensate tank battery – Box Elder J | 001/1565/001 | 7.3200 | 8.5594 | 8.9664 | 9.1292 | 9.3327 | 9.9875 | 11.0198 | 12.4127 |
| City and County of Denver | O&G E&P condensate tank battery – Box Elder K | 001/1566/001 | 9.6700 | 11.3073 | 11.8450 | 12.0600 | 12.3288 | 13.1939 | 14.5575 | 16.3977 |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 117 Amoco C | 001/1567/001 | 15.3900 | 17.9958 | 18.8515 | 19.1937 | 19.6216 | 20.9984 | 23.1686 | 26.0973 |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 75 Amoco D | 001/1573/001 | 6.8800 | 8.0449 | 8.4274 | 8.5804 | 8.7717 | 9.3872 | 10.3574 | 11.6666 |
| City and County of Denver | Maintenance paint booth | 031/1260/105 | 0.1025 | 0.1295 | 0.1328 | 0.1423 | 0.1485 | 0.1631 | 0.1770 | 0.1934 |
| City and County of Denver | Fleet vehicle gasoline tank | 031/1260/106 | 1.6168 | 2.0421 | 2.0947 | 2.2447 | 2.3422 | 2.5733 | 2.7914 | 3.0501 |
| Vanguard Car Rental USA (National/Alamo) | Fuel tanks for rental cars | 031/1498/001 | 4.5342 | 6.1353 | 6.3410 | 6.9797 | 7.4127 | 8.4922 | 9.5791 | 10.7474 |
| Advantage | Fuel tanks for rental cars | 031/1646/001 | 4.7917 | 6.4837 | 6.7011 | 7.3760 | 7.8336 | 8.9743 | 10.1230 | 11.3576 |
| Dollar Thrifty Automotive Group | Fuel tanks for rental cars | 031/1650/001 | 0.1663 | 0.2251 | 0.2326 | 0.2560 | 0.2719 | 0.3115 | 0.3514 | 0.3942 |
| Aircraft Service International Group | Jet fuel tank | 031/1811/001 | 0.3730 | 0.5512 | 0.5787 | 0.6699 | 0.7386 | 0.9427 | 1.2031 | 1.5355 |
| Aircraft Service International Group | Jet fuel tank | 031/1811/002 | 0.3730 | 0.5512 | 0.5787 | 0.6699 | 0.7386 | 0.9427 | 1.2031 | 1.5355 |
| Aircraft Service International Group | Jet fuel tank | 031/1811/003 | 0.3730 | 0.5512 | 0.5787 | 0.6699 | 0.7386 | 0.9427 | 1.2031 | 1.5355 |
| Aircraft Service International Group | Jet fuel tank | 031/1811/004 | 0.3730 | 0.5512 | 0.5787 | 0.6699 | 0.7386 | 0.9427 | 1.2031 | 1.5355 |
| Aircraft Service International Group | Jet fuel tank | 031/1811/005 | 0.3730 | 0.5512 | 0.5787 | 0.6699 | 0.7386 | 0.9427 | 1.2031 | 1.5355 |
| Aircraft Service International Group | Jet fuel tank | 031/1811/006 | 0.3730 | 0.5512 | 0.5787 | 0.6699 | 0.7386 | 0.9427 | 1.2031 | 1.5355 |
| Aircraft Service International Group | Concourse A GSE fueling station | 031/1811/007 | 0.6038 | 0.7626 | 0.7823 | 0.8383 | 0.8748 | 0.9611 | 1.0425 | 1.1391 |
| Aircraft Service International Group | Concourse B GSE fueling station | 031/1811/008 | 0.6038 | 0.7626 | 0.7823 | 0.8383 | 0.8748 | 0.9611 | 1.0425 | 1.1391 |
| Aircraft Service International Group | Concourse C GSE fueling station | 031/1811/009 | 0.6038 | 0.7626 | 0.7823 | 0.8383 | 0.8748 | 0.9611 | 1.0425 | 1.1391 |
| Aircraft Service International Group | South Cargo GSE fueling station | 031/1811/010 | 0.1684 | 0.2127 | 0.2182 | 0.2338 | 0.2439 | 0.2680 | 0.2907 | 0.3177 |
| United Airlines | Fuel tanks | 031/1814/006 | 1.7156 | 2.1669 | 2.2227 | 2.3819 | 2.4854 | 2.7306 | 2.9620 | 3.2366 |
| FedEx | Fuel tank | 031/1817/003 | 0.3014 | 0.3806 | 0.3905 | 0.4184 | 0.4366 | 0.4797 | 0.5203 | 0.5685 |
| Avis | Fuel tanks for rental cars | 031/1820/001 | 1.7905 | 2.4228 | 2.5040 | 2.7562 | 2.9272 | 3.3535 | 3.7827 | 4.2440 |
| Hertz | Fuel tanks for rental cars | 031/1821/001 | 11.7142 | 15.8506 | 16.3821 | 18.0322 | 19.1509 | 21.9396 | 24.7478 | 27.7660 |
| Enterprise | Fuel tanks for rental cars | 031/1824/001 | 0.2640 | 0.3573 | 0.3693 | 0.4065 | 0.4317 | 0.4945 | 0.5578 | 0.6259 |
| Hertz | Fuel tanks for rental cars | 031/1825/001 | 0.1521 | 0.2058 | 0.2127 | 0.2342 | 0.2487 | 0.2849 | 0.3214 | 0.3605 |
| Payless | Fuel tanks for rental cars | 031/1827/001 | 0.7782 | 1.0530 | 1.0883 | 1.1979 | 1.2722 | 1.4575 | 1.6441 | 1.8446 |
| Budget | Fuel tanks for rental cars | 031/1828/001 | 0.7975 | 1.0791 | 1.1153 | 1.2276 | 1.3038 | 1.4936 | 1.6848 | 1.8903 |
| ConocoPhillips | Fuel tanks | 031/1829/001 | 7.7500 | 10.5680 | 10.9315 | 12.0483 | 12.8017 | 14.6867 | 16.5861 | 18.6287 |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 117 Amoco A | 031/1971/001 | 5.4900 | 6.4196 | 6.7248 | 6.8469 | 6.9995 | 7.4907 | 8.2648 | 9.3096 |
| City and County of Denver | O&G E&P condensate tank battery – Champlin 125 Amoco B | 031/1972/001 | 12.8500 | 15.0258 | 15.7402 | 16.0260 | 16.3832 | 17.5328 | 19.3448 | 21.7901 |
| City and County of Denver | O&G E&P condensate tank battery – Kallsen | 031/1973/001 | 33.8800 | 39.6166 | 41.5002 | 42.2537 | 43.1955 | 46.2265 | 51.0041 | 57.4513 |

Source: Air Pollution Control Division and City and County of Denver Department of Aviation
Prepared by: Ricondo & Associates, Inc.

# Appendix D. Unpaved Road Emissions

This appendix provides additional information regarding the development of the estimate of $PM_{10}$ emissions produced by vehicle travel on unpaved roads. $PM_{10}$ emissions associated with vehicle travel on unpaved roads were calculated using an empirical formula from AP-42, Section 13.2.2. This equation is specific to vehicles traveling on unpaved surfaces at industrial sites (no public access to roads). The equation is shown below in **Equation D-1**.

**Equation D-1**

Unpaved Surfaces at Industrial Sites

$$E = k \cdot (s/12)^a \cdot (W/3)^b$$

where:

| | | |
|---|---|---|
| $E$ | = | size-specific emission factor (lb/VMT) |
| $k$ | = | empirical constant (2.6) |
| $s$ | = | surface material silt content (8.5 %) |
| $a$ | = | empirical constant (0.9) |
| $W$ | = | mean vehicle weight (tons) |
| $b$ | = | empirical constant (0.45) |

Source: U.S. Environmental Protection Agency. Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: *Stationary Point and Area Sources*, Section 13.2.2 "Unpaved Roads". December 2003.
Prepared by: Ricondo & Associates, Inc.

For these emissions calculations, the variable ***W*** was assumed to equal 5,750 pounds (2.875 tons). This assumption was based on manufacturer specified gross vehicle weight for a sample of light-duty trucks and SUVs. Empirical values for the variables ***k***, ***a***, and ***b*** were developed from tests of traffic on unpaved surfaces. The value for the variable ***s*** was obtained from samples of the dirt found on the unpaved surfaces.

The route traveled on unpaved roads was determined by Burlestone, Inc. and the Department of Aviation based on a review of the Airport Layout Plan. The route follows the path shown below:

> Gate P42 → 70th Avenue → Hardwrick Street → 98th Avenue → Uriah Street → 101st Avenue → 99th Avenue → Newbern Street → 114th Avenue → Grandbay Street → west, then south to 88th Avenue → south to 81st Avenue → 79th Avenue → Newbern Street.

Portions of this route may be disconnected due to paved stretches of roadway. Emissions from paved roadways are not included in the emissions estimates presented in Section 2.5, "Unpaved Roads."

# Appendix E. Worst Year Construction Scenario

This appendix provides additional information regarding the development of the emissions estimate for the "worst year" construction scenario. Construction sources documented in the Airport Emissions Inventory include emissions associated with land development, asphalt paving, and on-site concrete and asphalt batch plants. Emissions from heavy duty construction equipment were also estimated. **Tables E-1 through E-10** document emissions estimates for each of the projects included in the "worst year" construction scenario. **Table E-11** presents total construction-related emissions for the "worst year" construction scenario. Additional information regarding the estimation of construction emissions for the Terminal Module and the Passenger Concourse is presented in **Appendix E**.

**Table E-1**

Runway Project

| | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| **Source of Emissions** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 48.860 |
| Asphalt Paving | 0.000 | 1.320 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 4.380 |
| Asphalt Batching | 9.770 | 4.210 | 23.470 | 26.130 | 3.120 |
| Construction Equipment | 40.930 | 11.270 | 90.410 | 8.450 | 9.780 |
| **Total** | 50.700 | 16.800 | 113.880 | 34.580 | 66.140 |

Source: HNTB Corporation. *Sixth Runway Environmental Review*. July 20, 2000
Prepared by: Ricondo & Associates, Inc.

**Table E-2**

Taxiway Project

| | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| **Source of Emissions** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 3.920 |
| Asphalt Paving | 0.000 | 10.560 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.120 |
| Asphalt Batching | 2.420 | 0.740 | 9.420 | 2.780 | 0.810 |
| Construction Equipment | 14.310 | 4.770 | 40.450 | 3.750 | 3.810 |
| **Total** | 16.730 | 16.070 | 49.870 | 6.530 | 8.660 |

Source: URS Corporation. *Emission Estimates and Conformity Determination for 2000 Projects*. Final Report – Second Revision August 2000.
Prepared by: Ricondo & Associates, Inc.

**Table E-3**

ARFF Station

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 0.210 |
| Asphalt Paving | 0.000 | 0.020 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 0.600 | 0.160 | 2.140 | 0.000 | 0.160 |
| **Total** | 0.600 | 0.180 | 2.140 | 0.000 | 0.370 |

Source: City and County of Denver, Department of Aviation. *Revised General Conformity Evaluation for the Replacement ARFF Station*. October 15, 2003.
Prepared by: Ricondo & Associates, Inc.

**Table E-4**

Terminal Module

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 1.020 |
| Asphalt Paving | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 1.250 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 1.984 | 0.639 | 11.765 | 1.810 | 0.458 |
| **Total** | 1.984 | 0.639 | 11.765 | 1.810 | 2.728 |

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table E-5**

Passenger Concourse

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 9.810 |
| Asphalt Paving | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 4.880 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 7.048 | 2.647 | 44.290 | 6.805 | 1.829 |
| **Total** | 7.048 | 2.647 | 44.290 | 6.805 | 16.519 |

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table E-6**

Parking Structure

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 0.270 |
| Asphalt Paving | 0.000 | 2.070 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 2.310 | 0.320 | 10.490 | 0.170 | 0.470 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 11.670 | 4.190 | 34.800 | 3.220 | 3.460 |
| **Total** | 13.980 | 6.580 | 45.290 | 3.390 | 4.200 |

Source: URS Corporation. *Emission Estimates and Conformity Determination for 2001 Projects*. Final Draft December 20, 2000.
Prepared by: Ricondo & Associates, Inc.

**Table E-7**

Parking Lot

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 3.360 |
| Asphalt Paving | 0.000 | 37.200 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 8.520 | 2.620 | 22.710 | 2.160 | 2.250 |
| **Total** | 8.520 | 39.820 | 22.710 | 2.160 | 5.610 |

Source: URS Corporation. *Emission Estimates and Conformity Determination for 2000 Projects*. Final Report – Second Revision August 2000
Prepared by: Ricondo & Associates, Inc.

**Table E-8**

Detention Pond

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 7.610 |
| Asphalt Paving | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 9.550 | 2.450 | 20.610 | 1.970 | 2.410 |
| **Total** | 9.550 | 2.450 | 20.610 | 1.970 | 10.020 |

Source: URS Corporation. *Emission Estimates and Conformity Determination for 2000 Projects*. Final Report – Second Revision August 2000.
Prepared by: Ricondo & Associates, Inc.

**Table E-9**

Hotel

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 0.360 |
| Asphalt Paving | 0.000 | 3.990 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.920 | 0.130 | 4.200 | 0.070 | 0.490 |
| Asphalt Batching | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Construction Equipment | 6.540 | 2.250 | 18.210 | 1.680 | 1.890 |
| **Total** | 7.460 | 6.370 | 22.410 | 1.750 | 2.740 |

Source: URS Corporation. *Emission Estimates and Conformity Determination for 2001 Projects*. December 20, 2000
Prepared by: Ricondo & Associates, Inc.

**Table E-10**

Commercial Development

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 4.155 |
| Asphalt Paving | 0.000 | 17.940 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 0.000 | 0.000 | 0.000 | 0.000 | 1.965 |
| Asphalt Batching | 3.585 | 0.915 | 14.670 | 2.910 | 0.930 |
| Construction Equipment | 24.630 | 7.800 | 63.885 | 5.910 | 6.615 |
| **Total** | 28.215 | 26.655 | 78.555 | 8.820 | 13.665 |

Note: Emissions estimates prepared by URS Corporation for the Worldport development were scaled up by a factor of 1.5 to account for the size of the proposed commercial development.

Source: URS Corporation. *Emission Estimates and Conformity Determination for 2000 Projects*. Final Report – Second Revision August 2000.
Prepared by: Ricondo & Associates, Inc.

**Table E-11**

Total – All Construction Projects

| Source of Emissions | Emissions in Tons per Year | | | | |
|---|---|---|---|---|---|
| | CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
| Construction | | | | | |
| Land Development | 0.000 | 0.000 | 0.000 | 0.000 | 79.575 |
| Asphalt Paving | 0.000 | 73.100 | 0.000 | 0.000 | 0.000 |
| Concrete Batching | 3.230 | 0.450 | 14.690 | 0.240 | 13.555 |
| Asphalt Batching | 15.775 | 5.865 | 47.560 | 31.820 | 4.860 |
| Construction Equipment | 125.782 | 38.796 | 349.270 | 35.755 | 32.662 |
| **Total** | 144.787 | 118.211 | 411.520 | 67.815 | 130.652 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

# Appendix F. Construction Emissions Terminal and Concourse

Construction emissions estimates for a proposed Terminal Module and a Passenger Concourse were developed by Ricondo & Associates in association with Burlstone, Inc. and are documented in this appendix. Construction of both the Terminal Module and the Passenger Concourse is expected to occur over a period of two years. Emissions for each construction year of the projects were calculated separately, and for each project, the year with the highest emissions was identified. The emissions produced during this year were included in the total construction emissions estimate presented in Section III and Appendix D.

## F.1 Land Development

Earth moving activities during construction and wind erosion are sources of $PM_{10}$ emissions. $PM_{10}$ emissions caused by earth moving and wind erosion were calculated using the methodologies outlined in Section 13.2.3 "Heavy Construction Operations" of AP-42. Land development emissions associated with the Terminal Module and the Passenger Concourse are presented in **Tables F-1 and F-2**, respectively. Assumptions used in the estimation of land development emissions are described below.

**Table F-1**

Land Development Emissions for Terminal Module

| Year | Activity | Total Acres | Months | Acres on a Monthly Basis | Acres on a Daily Basis | PM Emission Factor | EF Units | $PM_{10}$ Fraction | $PM_{10}$ Emissions (tons/year) |
|---|---|---|---|---|---|---|---|---|---|
| | Wind Erosion | 5.33 | - | - | - | 0.38 | tpay | 0.5 | 1.013 |
| 1 | Earthmoving | 5.33 | 12 | 0.4 | 0.01 | 0.04 | tpad | 0.5 | 0.009 |
| | Wind Erosion | 4.80 | - | - | - | 0.38 | tpay | 0.5 | 0.911 |
| 2 | Earthmoving | 4.80 | 12 | 0.4 | 0.01 | 0.04 | tpad | 0.5 | 0.008 |

Notes: Tons per acre-year and tons per acre-day are denoted tpay and tpad, respectively.
No control factor was assumed.

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table F-2**

Land Development Emissions for Passenger Concourse

| Year | Activity | Total Acres | Months | Acres on a Monthly Basis | Acres on a Daily Basis | PM Emission Factor | EF Units | $PM_{10}$ Fraction | $PM_{10}$ Emissions (tons/year) |
|---|---|---|---|---|---|---|---|---|---|
| | Wind Erosion | 51.16 | - | - | - | 0.38 | tpay | 0.5 | 9.720 |
| 1 | Earthmoving | 51.16 | 12 | 4.3 | 0.14 | 0.04 | tpad | 0.5 | 0.085 |
| | Wind Erosion | 37.56 | - | - | - | 0.38 | tpay | 0.5 | 7.137 |
| 2 | Earthmoving | 37.56 | 12 | 3.1 | 0.10 | 0.04 | tpad | 0.5 | 0.063 |

Notes: Tons per acre-year and tons per acre-day are denoted tpay and tpad, respectively.
No control factor was assumed.

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc

### F.1.1 Earth Moving Emissions

The excavation, grading, and general disturbance of soil on a construction site results in $PM_{10}$ emissions. Emission factors for earth moving activity are found in Section 13.2.3 "Heavy Construction Operations" of AP-42. According to the Colorado Department of Public Health and Environment's Air Pollution Control Division Adequate watering of the construction site as a control efficiency would be expected to reduce $PM_{10}$ emissions by 50%. For the purposes of the Denver International Airport Emissions Inventory study, no control efficiency was assumed.

### F.1.2 Wind Erosion Emissions

Dirt piles, areas of bare soils, and newly paved portions of a construction site can be source of windblown $PM_{10}$. Emission factors for wind erosion were derived from Section 11.9 "Western Surface Coal Mining" of AP-42. No control efficiencies were assumed for the Airport Emissions Inventory study; however the State of Colorado typically assigns control factors for techniques that reduce wind erosion emissions including watering, soil stabilizers, and revegetation among others.

## F.2 Concrete Batching

Concrete is composed of water, cement, sand and coarse aggregate. During the process of manufacturing concrete (concrete batching) these raw materials can be the source of $PM_{10}$ emissions. Fugitive sources of $PM_{10}$ emissions during concrete batching include the transfer of sand and aggregate, truck loading, mixer loading, and wind erosion from sand and aggregate storage piles.

The process of estimating particulate emissions associated with concrete batch plant operations is described in Section 11.12 "Concrete Batching" of AP-42. Concrete batch plant emissions (excluding wind erosion emissions) were calculated by multiplying the number of cubic yards of concrete necessary for each construction project by a particulate emission factor. $PM_{10}$ emission factors per cubic yard of concrete for an average batch formulation at a typical concrete batch plant using the central mix method are presented in Table 11.12-4 "Plant Wide Emission Factors Per Yard of Central Mix Concrete" in Section 11.12 of AP-42. $PM_{10}$ emissions associated with wind erosion from sand and aggregate storage piles were calculated using methodologies presented in Section 11.9 "Western Surface Coal Mining" of AP-42 because wind erosion factors are not included in Section 11.12.

An estimate of concrete batch plant emissions for the Terminal Module and Passenger Concourse are presented in **Table F-3** and **Table F-4,** respectively**.**

**Table F-3**

Concrete Batch Plant Emissions for Terminal Module

| Year | Source | Cubic yards of concrete | $PM_{10}$ ($lb/yd^3$) | $PM_{10}$ (tons/year) |
|---|---|---|---|---|
| 1 | Concrete Batch Plant | 67,360 | 0.037 | 1.246 |
| 2 | Concrete Batch Plant | 10,800 | 0.037 | 0.200 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table F-4**

Concrete Batch Plant Emissions for Passenger Concourse

| Year | Source | Cubic yards of concrete | $PM_{10}$ ($lb/yd^3$) | $PM_{10}$ (tons/year) |
|---|---|---|---|---|
| 1 | Concrete Batch Plant | 263,760 | 0.037 | 4.880 |
| 2 | Concrete Batch Plant | 147,500 | 0.037 | 2.729 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc

## F.3 Construction Equipment

Construction equipment emissions estimates are generally developed using two basic methodologies (Nonroad and Onroad) depending on the type of construction equipment. Nonroad construction equipment (e.g., bulldozers, backhoes, front end loaders, etc.) are generally operated off road and on the construction site. Onroad construction equipment (e.g., semi-trucks for material hauling), in contrast can be operated on public roads. Nonroad estimation methods which are described in the USEPA report, *Nonroad Engine and Vehicle Emission Study—Report* were used for the airport emissions inventory study since most of the construction activities would require heavy duty construction equipment.

Emissions from diesel-powered engines are regulated under *40 CFR, Part 89.112*. Emission factors associated with diesel engines vary by engine year and horsepower according to Tier 1, Tier 2 Tier 3, and Tier 4 standards as defined in Table 1 of the USEPA Report NR-009c, *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression-Ignition.* These factors were used with data and methodologies described in the USEPA report, *Nonroad Engine and Vehicle Emission Study—Report* to estimate diesel equipment emissions for each construction year. Emissions were calculated based on the type of fuel, engine horsepower, equipment use in hours, and the average age of the construction equipment.

The USEPA recommended technique for calculating emissions from nonroad construction equipment is presented in **Equation F-1**.

**Equation F-1**

Nonroad Construction Equipment Emissions Calculation Equation

$$M_i = (N)(HRS)(HP)(LF/100)(EF_i)$$

where:

$M_i$ = mass of emissions of $i^{th}$ pollutants during inventory period
$N$ = source population (units)
$HRS$ = annual hours of use
$HP$ = average rated horsepower
$LF$ = typical load factor
$EF_i$ = average emissions of $i^{th}$ pollutant per unit of use (e.g., pounds per horsepower-hour)

Source: U.S. Environmental Protection Agency. *Nonroad Engine and Vehicle Emission Study—Report*. November 1991.
Prepared by: Ricondo & Associates, Inc.

The fleet age of the diesel construction equipment used for the proposed project was estimated to be an eight (8) year spread – for the 2005 construction year it was assumed that the oldest piece of equipment was manufactured in 1998. Through the use of the vehicle age spread a weighted average of Tier 1 and Tier 2 emissions standards were developed for each equipment horsepower range. This methodology is the most representative process of calculating pollutant emissions for nonroad construction equipment equipped with diesel engines.

Hourly estimates of construction equipment utilization for the Terminal Module and Passenger Concourse were prepared by Burlstone, Inc. A summary of the major assumptions used to develop construction equipment utilization estimates are provided below:

- The projects would occur at accelerated schedules and construction of the Passenger Concourse and the Terminal Module would each be completed within two years.
- In general, "light equipment" (i.e., pavement cutters, skid steer loaders, hand compactors, etc.) have been excluded from the equipment estimates.
- Equipment types, load capacity rates, and horsepower information are based on information in the *Caterpillar Performance Handbook, Edition 30*.
- The dump location for excavated materials (soil, concrete, etc.) is located in close proximity to the site, and the round trip time for loading is approximately 30 minutes.
- The Passenger Concourse will be constructed to match the footprint of an existing concourse.
- All caissons are 36" diameter and 30 feet in depth.
- All concrete pavement is 17" thick.
- A 25% reduction in production rates was applied to all phases of construction as a contingency.
- Pickup truck time for a site superintendent has been added to each phase of work.
- Detention systems for storm runoff have been excluded.
- Six bridges would be constructed to accommodate the terminal expansion. Existing bridges would be removed.

- The total length for each of the AGTS loops (east and west) is 13,617 feet of which 4,243 is elevated.
- The relocated glycol ponds and AGTS maintenance facility are the same size as the existing facilities.

Estimates of construction equipment emissions for the Terminal Module are presented in **Tables F-5** and **F-6**. Estimates of construction equipment emissions for the Passenger Concourse are presented in **Tables F-7** and **F-8**.

**Table F-5 (1 of 2)**

Terminal Module Construction Emissions for Year 1

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building | | | | | | | | | | | | | | | | | |
| Excavation | Bulldozer | Cat D7 | Diesel | 230 | 32 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.003 | 0.001 | 0.023 | 0.004 | 0.001 |
| | Grader | Cat 16H | Diesel | 275 | 48 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.006 | 0.002 | 0.039 | 0.006 | 0.002 |
| | Backhoe | Cat 426 | Diesel | 195 | 32 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.013 | 0.002 | 0.001 |
| | Loader | Cat 950 | Diesel | 430 | 159 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.029 | 0.005 | 0.142 | 0.022 | 0.005 |
| | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 48 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.017 | 0.002 | 0.001 |
| | Dump Truck | Cat D20D | Diesel | 180 | 2,667 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.150 | 0.062 | 1.003 | 0.154 | 0.042 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 159 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.012 | 0.005 | 0.072 | 0.011 | 0.003 |
| Foundation | Crane | 45 Ton | Diesel | 300 | 780 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.113 | 0.020 | 0.551 | 0.085 | 0.017 |
| | Caisson Driller | n.a. | Diesel | 300 | 417 | 75% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.105 | 0.019 | 0.513 | 0.079 | 0.016 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 2,500 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.329 | 0.136 | 2.193 | 0.337 | 0.091 |
| | Concrete Pumper | n.a. | Diesel | 250 | 63 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.007 | 0.003 | 0.049 | 0.007 | 0.002 |
| | Loader | Cat 950 | Diesel | 430 | 250 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.046 | 0.008 | 0.224 | 0.035 | 0.007 |
| | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 78 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.005 | 0.002 | 0.027 | 0.004 | 0.001 |
| | Backhoe | Cat 426 | Diesel | 195 | 89 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.005 | 0.002 | 0.036 | 0.006 | 0.002 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 780 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.060 | 0.023 | 0.351 | 0.053 | 0.017 |
| Concrete Paving | | | | | | | | | | | | | | | | | |
| Adjoining Roadways | Bulldozer | Dat D7 | Diesel | 230 | 16 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.012 | 0.002 | 0.000 |
| | Scraper | Cat 631 | Diesel | 250 | 105 | 60% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.013 | 0.005 | 0.086 | 0.013 | 0.004 |
| | Grader | Cat 16H | Diesel | 275 | 16 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.013 | 0.002 | 0.001 |
| | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 37 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.002 | 0.001 | 0.013 | 0.002 | 0.001 |
| | Finisher | Cat 12H | Diesel | 250 | 28 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.004 | 0.001 | 0.024 | 0.004 | 0.001 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 212 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.028 | 0.011 | 0.186 | 0.029 | 0.008 |
| | Paver | Cat BG 260 | Diesel | 174 | 28 | 56% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 157 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.012 | 0.005 | 0.071 | 0.011 | 0.003 |
| Structures | Caisson Driller | n.a. | Diesel | 250 | 104 | 75% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.016 | 0.007 | 0.107 | 0.017 | 0.004 |
| | Crane | 45 Ton | Diesel | 300 | 44 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.006 | 0.001 | 0.031 | 0.005 | 0.001 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 239 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.031 | 0.013 | 0.210 | 0.032 | 0.009 |
| | Concrete Pumper | n.a. | Diesel | 250 | 28 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.003 | 0.001 | 0.021 | 0.003 | 0.001 |
| | Backhoe | Cat 426 | Diesel | 195 | 6 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 66 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.008 | 0.003 | 0.056 | 0.009 | 0.002 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 99 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.008 | 0.003 | 0.045 | 0.007 | 0.002 |

**Table F-5 (2 of 2)**

Terminal Module Construction Emissions for Year 1

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Service areas | | | | | | | | | | | | | | | | | |
| Level 4 – Passenger Pick-up | Caisson Driller | n.a. | Diesel | 250 | 197 | 75% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.030 | 0.013 | 0.203 | 0.031 | 0.008 |
| | Crane | 45 Ton | Diesel | 300 | 83 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.012 | 0.002 | 0.059 | 0.009 | 0.002 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 385 | 1662 | 56% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.401 | 0.071 | 1.961 | 0.303 | 0.062 |
| | Concrete Pumper | n.a. | Diesel | 250 | 191 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.022 | 0.009 | 0.147 | 0.023 | 0.006 |
| | Backhoe | Cat 426 | Diesel | 195 | 38 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.016 | 0.002 | 0.001 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 125 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.016 | 0.007 | 0.107 | 0.016 | 0.004 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 291 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.022 | 0.009 | 0.131 | 0.020 | 0.006 |
| Level 5 – Transportation | Crane | 45 Ton | Diesel | 300 | 227 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.033 | 0.006 | 0.160 | 0.025 | 0.005 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 2308 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.304 | 0.125 | 2.025 | 0.311 | 0.084 |
| | Concrete Pumper | n.a. | Diesel | 250 | 265 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.031 | 0.013 | 0.204 | 0.031 | 0.008 |
| | Backhoe | Cat 426 | Diesel | 195 | 53 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.003 | 0.001 | 0.022 | 0.003 | 0.001 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 340 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.043 | 0.018 | 0.290 | 0.045 | 0.012 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 369 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.028 | 0.011 | 0.166 | 0.025 | 0.008 |
| Site Clearing | Bulldozer | Cat D7 | Diesel | 230 | 66 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.007 | 0.003 | 0.047 | 0.007 | 0.002 |
| | Pavement breaker | Cat 315 | Diesel | 100 | 16 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.001 | 0.000 | 0.006 | 0.001 | 0.000 |
| | Grader | Cat 16H | Diesel | 275 | 33 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.004 | 0.002 | 0.027 | 0.004 | 0.001 |
| | Loader | Cat 950 | Diesel | 430 | 16 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.003 | 0.001 | 0.015 | 0.002 | 0.000 |
| | Dump Truck | Cat D20D | Diesel | 180 | 46 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.003 | 0.001 | 0.017 | 0.003 | 0.001 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 33 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Backhoe | Cat 426 | Diesel | 195 | 10 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.001 | 0.000 | 0.004 | 0.001 | 0.000 |
| **Total** | | | | | | | | | | | | | 1.984 | 0.639 | 11.765 | 1.810 | 0.458 |

Notes:

n.a. = not available.

1. Data provided by Burlstone, Inc.
2. The Load Factor reference is the listing of the vehicle type of equipment as stated in Table 2-05 “Inventory A and B Typical Operating Load Factor Estimates” of the *Nonroad Engine and Vehicle Emission Study-Report*, November 1991. The load factors utilized for diesel vehicles were from Inventory B.
3. Emission factors were derived from Tier 1 and Tier 2 standards and an 8 year spread of construction equipment was utilized to create a weighted average emission factor.
4. The conversion factor is the number of pounds (lbs) per ton – 1 ton/ 2000 lbs = 0.0005.
5. Total annual emissions are calculated by multiplying the annual hours, load factor, horsepower, emission factor, and conversion factor to create a value of tons per year for each piece of equipment.

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table F-6**

Terminal Module Construction Emissions for Year 2

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Building | | | | | | | | | | | | | | | | | |
| Exterior Walls/Enclosure | Crane - Tower | | Diesel | 350 | 2,340 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.395 | 0.070 | 1.928 | 0.298 | 0.061 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 6,750 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.888 | 0.366 | 5.922 | 0.911 | 0.246 |
| | Concrete Pumper | | Diesel | 250 | 675 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.078 | 0.032 | 0.519 | 0.080 | 0.022 |
| | Flat-bed Tractor/Trailer | | Diesel | 250 | 659 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.084 | 0.035 | 0.561 | 0.086 | 0.023 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 2,340 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.180 | 0.070 | 1.054 | 0.160 | 0.050 |
| Exterior Fixtures | Crane | 45 Ton | Diesel | 300 | 10 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.001 | 0.000 | 0.007 | 0.001 | 0.000 |
| | Flat-bed Tractor/Trailer | | Diesel | 250 | 18 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 2,340 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.180 | 0.070 | 1.054 | 0.160 | 0.050 |
| Concrete Paving | | | | | | | | | | | | | | | | | |
| Level 6 - Passenger Drop-off | Crane | 45 Ton | Diesel | 300 | 83 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.012 | 0.002 | 0.059 | 0.009 | 0.002 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 831 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.109 | 0.045 | 0.729 | 0.112 | 0.030 |
| | Concrete Pumper | | Diesel | 250 | 96 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.011 | 0.005 | 0.074 | 0.011 | 0.003 |
| | Backhoe | Cat 426 | Diesel | 195 | 19 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.001 | 0.000 | 0.008 | 0.001 | 0.000 |
| | Flat-bed Tractor/Trailer | | Diesel | 250 | 125 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.016 | 0.007 | 0.107 | 0.016 | 0.004 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 134 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.010 | 0.004 | 0.060 | 0.009 | 0.003 |
| **Total** | | | | | | | | | | | | | 1.968 | 0.708 | 12.097 | 1.857 | 0.496 |

Notes:

n.a. = not available.

1. Data provided by Burlstone, Inc.
2. The Load Factor reference is the listing of the vehicle type of equipment as stated in Table 2-05 “Inventory A and B Typical Operating Load Factor Estimates” of the *Nonroad Engine and Vehicle Emission Study-Report*, November 1991. The load factors utilized for diesel vehicles were from Inventory B.
3. Emission factors were derived from Tier 1 and Tier 2 standards and an 8 year spread of construction equipment was utilized to create a weighted average emission factor.
4. The conversion factor is the number of pounds (lbs) per ton – 1 ton/ 2000 lbs = 0.0005.
5. Total annual emissions are calculated by multiplying the annual hours, load factor, horsepower, emission factor, and conversion factor to create a value of tons per year for each piece of equipment.

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table F-7 (1 of 3)**

Passenger Concourse Construction Emissions for Year 1

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Concrete Removal | Bulldozer | Cat D7 | Diesel | 230 | 62 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.007 | 0.003 | 0.044 | 0.007 | 0.002 |
| | Pavement breaker | Cat 315 | Diesel | 100 | 164 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.010 | 0.004 | 0.057 | 0.009 | 0.003 |
| | Loader | Cat 950 | Diesel | 430 | 205 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.038 | 0.007 | 0.183 | 0.028 | 0.006 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 205 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.016 | 0.006 | 0.092 | 0.014 | 0.004 |
| | Dump Truck | Cat D20D | Diesel | 180 | 577 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.033 | 0.013 | 0.217 | 0.033 | 0.009 |
| Asphalt Removal | Bulldozer | Cat D7 | Diesel | 230 | 18 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.013 | 0.002 | 0.001 |
| | Pavement breaker | Cat 315 | Diesel | 100 | 29 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.002 | 0.001 | 0.010 | 0.002 | 0.000 |
| | Loader | Cat 950 | Diesel | 430 | 36 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.007 | 0.001 | 0.032 | 0.005 | 0.001 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 36 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.016 | 0.002 | 0.001 |
| | Dump Truck | Cat D20D | Diesel | 180 | 76 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.004 | 0.002 | 0.028 | 0.004 | 0.001 |
| Building | | | | | | | | | | | | | | | | | |
| Excavation – Building | Backhoe | Cat 235 | Diesel | 195 | 128 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.008 | 0.003 | 0.052 | 0.008 | 0.002 |
| | Loader | Cat 988 | Diesel | 625 | 427 | 38% | 0.0029265 | 0.0003464 | 0.0109385 | 0.0016915 | 0.0003877 | 0.0005 | 0.148 | 0.018 | 0.555 | 0.086 | 0.020 |
| | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 43 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Dump Truck | Cat D20D | Diesel | 180 | 2002 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.113 | 0.047 | 0.753 | 0.116 | 0.031 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 107 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.008 | 0.003 | 0.048 | 0.007 | 0.002 |
| Excavation – Train | Backhoe | Cat 235 | Diesel | 195 | 131 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.008 | 0.003 | 0.053 | 0.008 | 0.002 |
| | Loader | Cat 988 | Diesel | 430 | 436 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.080 | 0.014 | 0.390 | 0.060 | 0.012 |
| | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 44 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Dump Truck | Cat D20D | Diesel | 180 | 1953 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.110 | 0.045 | 0.734 | 0.113 | 0.030 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 109 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.008 | 0.003 | 0.049 | 0.007 | 0.002 |
| Foundation | Caisson Driller | n.a. | Diesel | 250 | 900 | 75% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.139 | 0.057 | 0.928 | 0.143 | 0.038 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 692 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.091 | 0.038 | 0.607 | 0.093 | 0.025 |
| | Concrete Pumper | n.a. | Diesel | 250 | 80 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.009 | 0.004 | 0.061 | 0.009 | 0.003 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 450 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.035 | 0.014 | 0.203 | 0.031 | 0.010 |
| Compaction – Foundation | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 5 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 3 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Concrete – Basement Slab | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 992 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.131 | 0.054 | 0.871 | 0.134 | 0.036 |
| | Concrete Pumper | n.a. | Diesel | 250 | 114 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.013 | 0.005 | 0.088 | 0.014 | 0.004 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 86 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.007 | 0.003 | 0.039 | 0.006 | 0.002 |
| Basement Walls | Crane – Mobile | 45 Ton | Diesel | 300 | 27 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.004 | 0.001 | 0.019 | 0.003 | 0.001 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 231 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.030 | 0.013 | 0.202 | 0.031 | 0.008 |
| | Concrete Pumper | n.a. | Diesel | 250 | 27 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.003 | 0.001 | 0.020 | 0.003 | 0.001 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 20 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.002 | 0.001 | 0.009 | 0.001 | 0.000 |

**Table F-7 (2 of 3)**

Passenger Concourse Construction Emissions for Year 1

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | Emissions (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Paving | Grader | Cat 16H | Diesel | 275 | 213 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.026 | 0.011 | 0.174 | 0.027 | 0.007 |
| Taxiway - Concrete 17" | Finisher | Cat 12H | Diesel | 140 | 426 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.035 | 0.014 | 0.207 | 0.031 | 0.010 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 2906 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.382 | 0.158 | 2.549 | 0.392 | 0.106 |
| | Paver | BG 260 | Diesel | 174 | 504 | 56% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.047 | 0.018 | 0.275 | 0.042 | 0.013 |
| | Cure Truck | n.a. | Diesel | 130 | 504 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.039 | 0.015 | 0.227 | 0.034 | 0.011 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 126 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.010 | 0.004 | 0.057 | 0.009 | 0.003 |
| Apron - Concrete 17" | Grader | Cat 16H | Diesel | 275 | 520 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.064 | 0.026 | 0.424 | 0.065 | 0.018 |
| | Finisher | Cat 12H | Diesel | 140 | 1037 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.086 | 0.034 | 0.503 | 0.076 | 0.024 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 7083 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.932 | 0.384 | 6.214 | 0.956 | 0.258 |
| | Paver | BG 260 | Diesel | 174 | 1228 | 56% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.114 | 0.045 | 0.669 | 0.101 | 0.032 |
| | Cure Truck | n.a. | Diesel | 130 | 1228 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.095 | 0.037 | 0.553 | 0.084 | 0.026 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 307 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.024 | 0.009 | 0.138 | 0.021 | 0.007 |
| Utilities | | | | | | | | | | | | | | | | | |
| Power & Communications | Trencher | n.a. | Diesel | 75 | 240 | 75% | 0.0052159 | 0.0010645 | 0.0118499 | 0.0016915 | 0.0009145 | 0.0005 | 0.035 | 0.007 | 0.080 | 0.011 | 0.006 |
| | Loader | Cat 950 | Diesel | 430 | 240 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.044 | 0.008 | 0.215 | 0.033 | 0.007 |
| | Dump Truck | Cat D20D | Diesel | 180 | 120 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.007 | 0.003 | 0.045 | 0.007 | 0.002 |
| RCP Storm Sewer Pipe | Backhoe | CAT 426 | Diesel | 195 | 1000 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.061 | 0.025 | 0.407 | 0.063 | 0.017 |
| | Loader | Cat 950 | Diesel | 430 | 800 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.146 | 0.026 | 0.716 | 0.111 | 0.023 |
| | Sheep's-Foot Vibratory Roller | Cat CP433 | Diesel | 105 | 200 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.012 | 0.005 | 0.069 | 0.010 | 0.003 |
| | Dump Truck | Cat D20D | Diesel | 180 | 500 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.028 | 0.012 | 0.188 | 0.029 | 0.008 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 200 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.026 | 0.011 | 0.170 | 0.026 | 0.007 |
| | Pick-up | 4x43/4 ton | Diesel | 130 | 250 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.019 | 0.008 | 0.113 | 0.017 | 0.005 |

**Table F-7 (3 of 3)**

Passenger Concourse Construction Emissions for Year 1

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | Emissions (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Relocated Facilities | | | | | | | | | | | | | | | | | |
| AGTS Maintenance Facility | Bulldozer | Cat D7 | Diesel | 230 | 2 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Building Demolition | Pavement breaker | Cat 315 | Diesel | 100 | 5 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | Loader | Cat 950 | Diesel | 430 | 6 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.001 | 0.000 | 0.005 | 0.001 | 0.000 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 6 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| | Dump Truck | Cat D20D | Diesel | 180 | 17 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.001 | 0.000 | 0.006 | 0.001 | 0.000 |
| Relocation of Retention Pond | Loader | Cat 988 | Diesel | 625 | 62 | 38% | 0.0029265 | 0.0003464 | 0.0109385 | 0.0016915 | 0.0003877 | 0.0005 | 0.022 | 0.003 | 0.081 | 0.012 | 0.003 |
| | Dump Truck | Cat D20D | Diesel | 180 | 292 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.016 | 0.007 | 0.110 | 0.017 | 0.005 |
| Site Clearing | Dump Truck | Cat D20D | Diesel | 180 | 67 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.004 | 0.002 | 0.025 | 0.004 | 0.001 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 33 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.003 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Backhoe | n.a. | Diesel | 195 | 67 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.004 | 0.002 | 0.027 | 0.004 | 0.001 |
| Excavation | Bulldozer | Cat D7 | Diesel | 230 | 344 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.037 | 0.015 | 0.248 | 0.038 | 0.010 |
| | Grader | Cat 16H | Diesel | 275 | 517 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.063 | 0.026 | 0.422 | 0.065 | 0.018 |
| | Backhoe | Cat 426 | Diesel | 195 | 344 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.021 | 0.009 | 0.140 | 0.022 | 0.006 |
| | Loader | Cat 950 | Diesel | 430 | 1722 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.315 | 0.056 | 1.540 | 0.238 | 0.049 |
| | Sheep's-Foot Vibratory Roller | Cat CP433 | Diesel | 105 | 517 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.031 | 0.012 | 0.179 | 0.027 | 0.009 |
| | Dump Truck | Cat D20D | Diesel | 180 | 28933 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 1.631 | 0.673 | 10.878 | 1.674 | 0.451 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 1722 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.133 | 0.052 | 0.776 | 0.117 | 0.037 |
| **Total** | | | | | | | | | | | | | 7.048 | 2.647 | 44.290 | 6.805 | 1.829 |

Notes:

n.a. = not available.

1. Data provided by Burlstone, Inc.
2. The Load Factor reference is the listing of the vehicle type of equipment as stated in Table 2-05 “Inventory A and B Typical Operating Load Factor Estimates” of the *Nonroad Engine and Vehicle Emission Study-Report*, November 1991. The load factors utilized for diesel vehicles were from Inventory B.
3. Emission factors were derived from Tier 1 and Tier 2 standards and an 8 year spread of construction equipment was utilized to create a weighted average emission factor.
4. The conversion factor is the number of pounds (lbs) per ton – 1 ton/ 2000 lbs = 0.0005.
5. Total annual emissions are calculated by multiplying the annual hours, load factor, horsepower, emission factor, and conversion factor to create a value of tons per year for each piece of equipment.

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table F-8 (1 of 2)**

Passenger Concourse Construction Emissions for Year 2

| | | | | | | | Emission Factor (lb-hp/hr) | | | | | | Emissions (Tons/Year) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Activity** | **Equipment** | **Type** | **Fuel** | **Hp** | **(Hours/Year)** | **Load Factor** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** | **Conversion Factor** | **CO** | **VOC** | **$NO_x$** | **$SO_x$** | **$PM_{10}$** |
| Extension of Train Tunnels | Crane – Mobile | 45 Ton | Diesel | 300 | 332 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.048 | 0.009 | 0.234 | 0.036 | 0.007 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 2885 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.379 | 0.157 | 2.531 | 0.389 | 0.105 |
| | Concrete Pumper | n.a. | Diesel | 250 | 332 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.038 | 0.016 | 0.255 | 0.039 | 0.011 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 249 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.019 | 0.007 | 0.112 | 0.017 | 0.005 |
| Exterior Walls | Crane – Tower | | Diesel | 350 | 2394 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.404 | 0.072 | 1.973 | 0.305 | 0.063 |
| | Crane – Mobile | 45 Ton | Diesel | 300 | 1197 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.173 | 0.031 | 0.845 | 0.131 | 0.027 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 955 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.122 | 0.050 | 0.814 | 0.125 | 0.034 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 2394 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.184 | 0.072 | 1.079 | 0.163 | 0.052 |
| Roof | Crane – Tower | n.a. | Diesel | 350 | 3091 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.521 | 0.092 | 2.546 | 0.393 | 0.081 |
| | Crane – Mobile | 45 Ton | Diesel | 300 | 1545 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.223 | 0.040 | 1.091 | 0.169 | 0.035 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 1233 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.157 | 0.065 | 1.051 | 0.162 | 0.044 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 3091 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.238 | 0.093 | 1.392 | 0.211 | 0.067 |
| New AGTS Maintenance Facility | Crane – Mobile | 45 Ton | Diesel | 300 | 9 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.001 | 0.000 | 0.006 | 0.001 | 0.000 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 77 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.010 | 0.004 | 0.067 | 0.010 | 0.003 |
| | Concrete Pumper | n.a. | Diesel | 250 | 9 | 53% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.001 | 0.000 | 0.006 | 0.001 | 0.000 |
| | Backhoe | Cat 235 | Diesel | 195 | 23 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.001 | 0.001 | 0.010 | 0.001 | 0.000 |
| | Loader | Cat 988 | Diesel | 625 | 78 | 38% | 0.0029265 | 0.0003464 | 0.0109385 | 0.0016915 | 0.0003877 | 0.0005 | 0.027 | 0.003 | 0.101 | 0.016 | 0.004 |
| | Sheep's-Foot Vibratory Roller | Cat Cp 433 | Diesel | 105 | 8 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| | Dump Truck | Cat D20D | Diesel | 180 | 365 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.021 | 0.008 | 0.137 | 0.021 | 0.006 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 18 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.002 | 0.001 | 0.015 | 0.002 | 0.001 |
| | Pick-up | 4x4 ¾ ton | Diesel | 130 | 19 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.001 | 0.001 | 0.009 | 0.001 | 0.000 |

**Table F-8 (2 of 2)**

Passenger Concourse Construction Emissions for Year 2

| Activity | Equipment | Type | Fuel | Hp | (Hours/Year) | Load Factor | Emission Factor (lb-hp/hr) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ | Conversion Factor | Emissions (Tons/Year) CO | VOC | $NO_x$ | $SO_x$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AGTS Return Loop | | | | | | | | | | | | | | | | | |
| Excavation | Bulldozer | Cat D7 | Diesel | 230 | 344 | 57% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.037 | 0.015 | 0.248 | 0.038 | 0.010 |
| | Grader | Cat 16H | Diesel | 275 | 517 | 54% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.063 | 0.026 | 0.422 | 0.065 | 0.018 |
| | Backhoe | Cat 426 | Diesel | 195 | 344 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.021 | 0.009 | 0.140 | 0.022 | 0.006 |
| | Loader | Cat 950 | Diesel | 430 | 1722 | 38% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.315 | 0.056 | 1.540 | 0.238 | 0.049 |
| | Sheep's-Foot Vibratory Roller | Cat CP 433 | Diesel | 105 | 517 | 59% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.031 | 0.012 | 0.179 | 0.027 | 0.009 |
| | Dump Truck | Cat D20D | Diesel | 180 | 28933 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 1.631 | 0.673 | 10.878 | 1.674 | 0.451 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 1722 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.133 | 0.052 | 0.776 | 0.117 | 0.037 |
| Underground Construction | Concrete Truck/Mixer | 10 CY | Diesel | 285 | 8000 | 56% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 1.052 | 0.434 | 7.018 | 1.080 | 0.291 |
| | Concrete Pumper | n.a. | Diesel | 250 | 920 | 53% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.100 | 0.041 | 0.670 | 0.103 | 0.028 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 690 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.053 | 0.021 | 0.311 | 0.047 | 0.015 |
| Aboveground Construction | Caisson Driller | | Diesel | 250 | 36 | 75% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.005 | 0.002 | 0.037 | 0.006 | 0.002 |
| | Crane | 45 Ton | Diesel | 300 | 450 | 43% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.065 | 0.012 | 0.318 | 0.049 | 0.010 |
| | Concrete Truck/Mixer | 10 CY | Diesel | 385 | 385 | 56% | 0.0022410 | 0.0003975 | 0.0109482 | 0.0016915 | 0.0003474 | 0.0005 | 0.093 | 0.016 | 0.454 | 0.070 | 0.014 |
| | Concrete Pumper | n.a. | Diesel | 250 | 44 | 53% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.005 | 0.002 | 0.032 | 0.005 | 0.001 |
| | Backhoe | Cat 426 | Diesel | 195 | 9 | 38% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.001 | 0.000 | 0.004 | 0.001 | 0.000 |
| | Flat-bed Tractor/Trailer | n.a. | Diesel | 250 | 675 | 62% | 0.0016482 | 0.0006802 | 0.0109936 | 0.0016915 | 0.0004562 | 0.0005 | 0.086 | 0.036 | 0.575 | 0.088 | 0.024 |
| | Pick-up | 4x4 3/4 ton | Diesel | 130 | 30 | 62% | 0.0019111 | 0.0007462 | 0.0111798 | 0.0016915 | 0.0005346 | 0.0005 | 0.002 | 0.001 | 0.013 | 0.002 | 0.001 |
| **Total** | | | | | | | | | | | | | 6.268 | 2.130 | 37.894 | 5.826 | 1.508 |

Notes:
n.a. = not available.

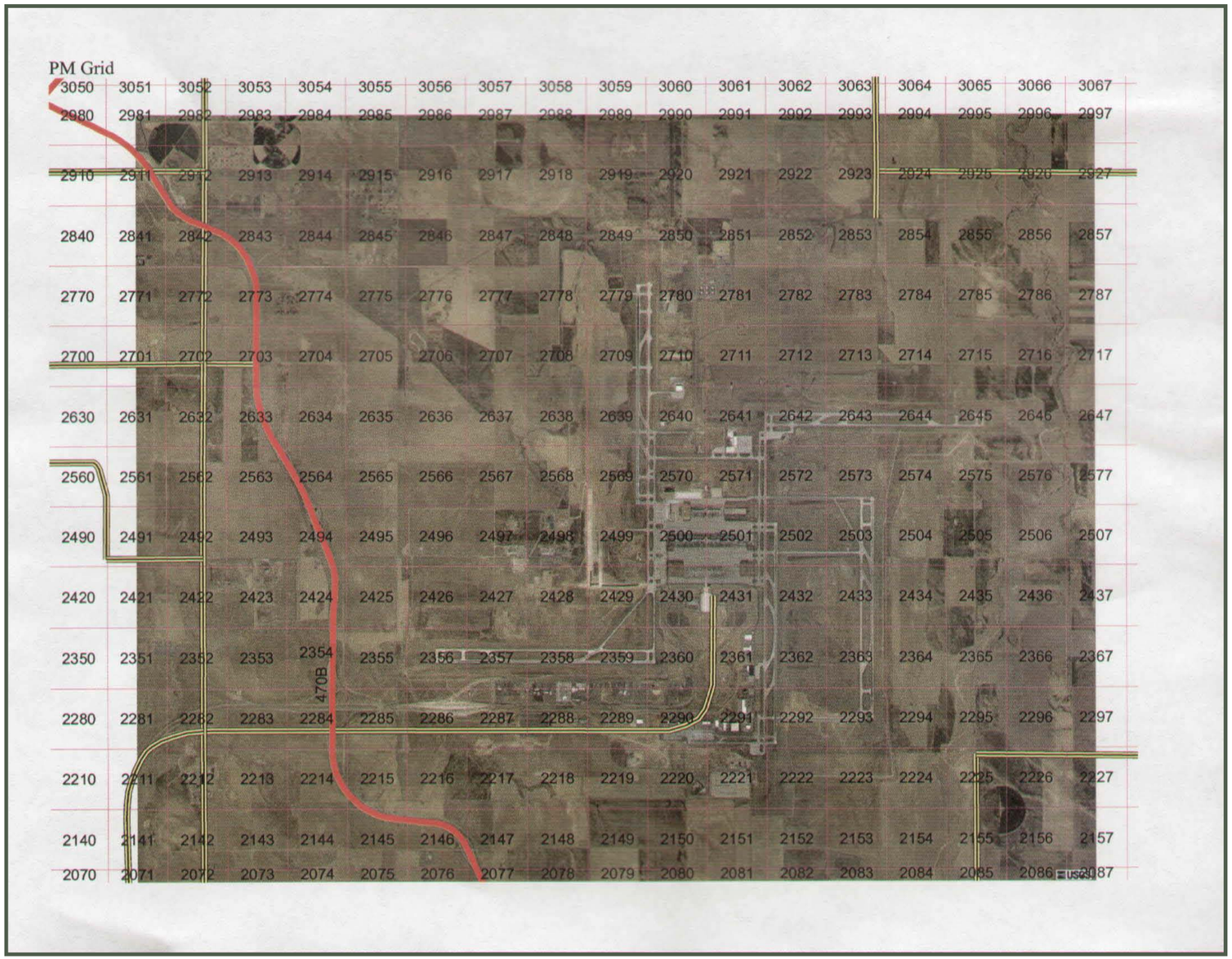
1. Data provided by Burlstone, Inc.
2. The Load Factor reference is the listing of the vehicle type of equipment as stated in Table 2-05 “Inventory A and B Typical Operating Load Factor Estimates” of the *Nonroad Engine and Vehicle Emission Study-Report*, November 1991. The load factors utilized for diesel vehicles were from Inventory B.
3. Emission factors were derived from Tier 1 and Tier 2 standards and an 8 year spread of construction equipment was utilized to create a weighted average emission factor.
4. The conversion factor is the number of pounds (lbs) per ton – 1 ton/ 2000 lbs = 0.0005.
5. Total annual emissions are calculated by multiplying the annual hours, load factor, horsepower, emission factor, and conversion factor to create a value of tons per year for each piece of equipment.

Source: Burlstone, Inc. and Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

# Appendix G: Grids for Regional Air Quality Modeling

The State of Colorado Air Pollution Control Division (APCD) has divided the Denver metropolitan region into a finite number of grid cells for the purposes of regional air quality modeling/air dispersion analyses. The APCD recently developed two grid cell maps for the area covering Denver International Airport: one for particulate matter ($PM_{10}$) and the other for carbon monoxide (CO). The grid cell maps are presented on **Exhibits G-1 and G-2** and were provided to the City and County of Denver Department of Aviation for use in the Airport Emissions Inventory study.

This memorandum presents recommendations regarding the apportionment of airport-related emissions to APCD's grid cells in support of future regional air quality modeling to be conducted by APCD. **Tables G-1 and G-2**, respectively, present a list of $PM_{10}$ and CO grid cells where there could be emissions (either now or in the future) from airport-related sources of emissions. The tables present grid cell information for each emission source described in the Executive Summary of the Airport Emissions Inventory. It is assumed that APCD will evenly distribute the annual inventory of $PM_{10}$ and CO emissions over all grid cells relevant to a particular source category as identified in Tables G-1 and G-2.

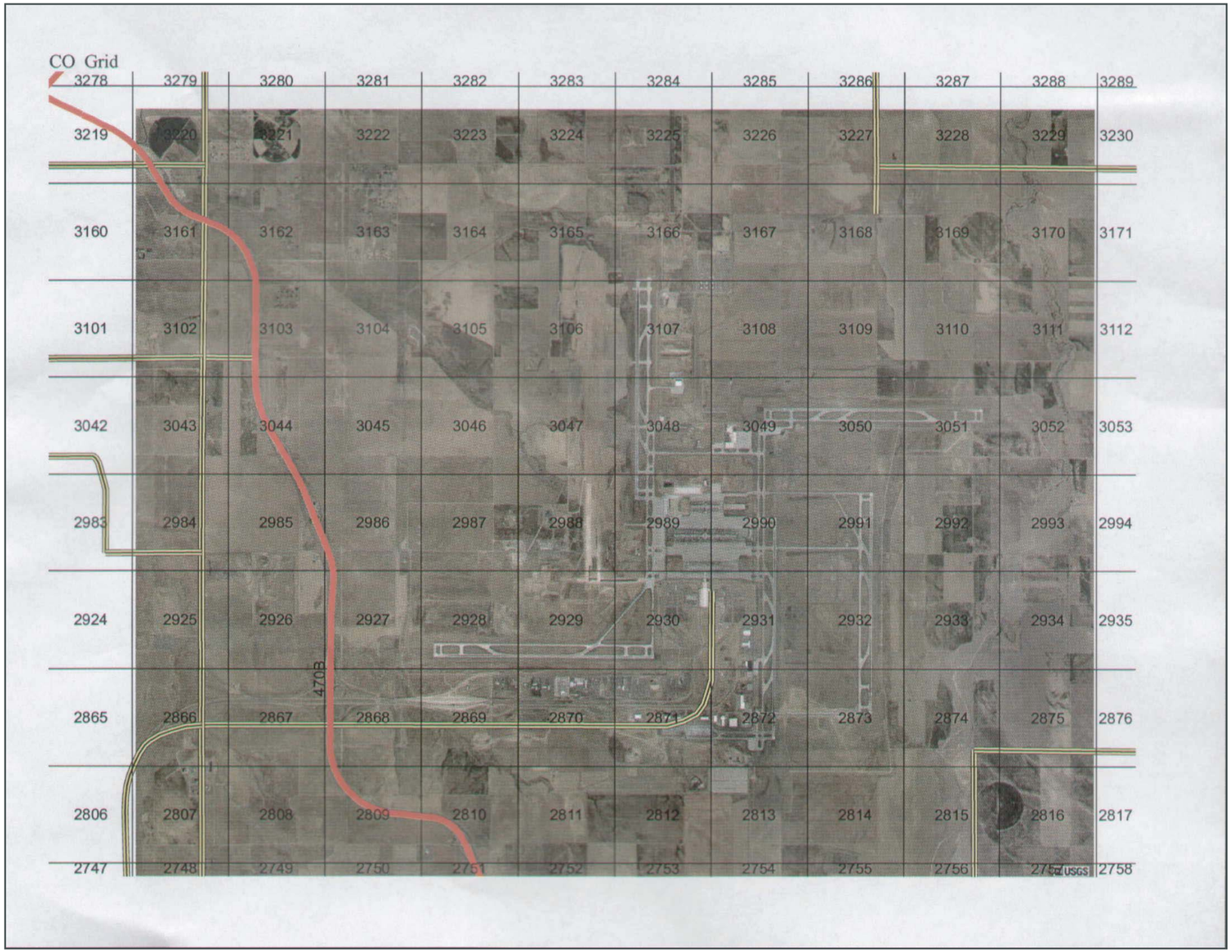



Source: State of Colorado Air Pollution Control Division (APCD)
Prepared by: Ricondo & Associates, Inc.

Exhibit G-1

north

**Grid for Regional Air Quality Modeling - Particulate Matter**




Source: State of Colorado Air Pollution Control Division (APCD)
Prepared by: Ricondo & Associates, Inc.

Exhibit G-2

north

**Grid for Regional Air Quality Modeling - Carbon Monoxide**

**Table G-1**

Airport Emission Sources and Grid Cells for Regional Air Quality Modeling - $PM_{10}$

| | **Air Pollution Control Division's $PM_{10}$ Grid Cells** |
|---|---|
| **Operational Emissions** | |
| Aircraft[1/] | 2356, 2357, 2358, 2359, 2778, 2708, 2638, 2568, 2498, 2428, 2779, 2709, 2639, 2569, 2499, 2429, 2570, 2571, 2500, 2501, 2430, 2431, 2640, 2641, 2642, 2643, 2644, 2645, 2572, 2573, 2502, 2503, 2432, 2433, 2362, 2363, 2292, 2293, 2290, 2291, 2361 |
| Airport Equipment[2/] | 2500, 2501, 2570, 2571, 2640, 2641, 2430, 2431, 2361, 2290, 2291 |
| | |
| Firefighting Training | 2851 |
| | |
| Minor Point Sources | 2500, 2501, 2780, 2640, 2641, 2431, 2361, 2287, 2288, 2289, 2290, 2291 |
| | |
| Unpaved Roads | 2848, 2849, 2850, 2780, 2710, 2642, 2643, 2644, 2645, 2646 2223, 2222, 2360, 2359, 2358, 2357, 2356, 2355, 2426, 2496, 2568, 2638, 2497, 2498, 2574, 2504, 2434, 2364, 2294, 2708, 2778, 2224 |
| **Construction Emissions**[3/] | |
| Construction | 2774, 2775, 2776, 2777, 2778, 2779, 2780, 2781, 2782, 2783, 2784, 2785, 2786, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2712, 2713, 2714, 2715, 2716, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2644, 2645, 2646, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2285, 2286, 2287, 2288, 2289, 2290, 2294, 2292, 2293, 2294, 2295, 2296, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2281, 2282, 2283, 2284, 2211, 2141, 2071 |
| Construction Equipment | 2774, 2775, 2776, 2777, 2778, 2779, 2780, 2781, 2782, 2783, 2784, 2785, 2786, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2712, 2713, 2714, 2715, 2716, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2644, 2645, 2646, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2285, 2286, 2287, 2288, 2289, 2290, 2294, 2292, 2293, 2294, 2295, 2296, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2281, 2282, 2283, 2284, 2211, 2141, 2071 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.

**Table G-2**

Airport Emission Sources and Grid Cells for Regional Air Quality Modeling – Carbon Monoxide (CO)

| | **Air Pollution Control Division's CO Grid Cells** |
|---|---|
| **Operational Emissions** | |
| Aircraft[1/] | 3106, 3107, 3047, 3048, 3049, 3050, 3051, 2988, 2989, 2990, 2991, 2928, 2929, 2930, 2931, 2932, 2871, 2872, 2873 |
| Airport Equipment[2/] | 2989, 2990, 3048, 3049, 2930, 2931, 2871, 2872 |
| | |
| Firefighting Training | 3167 |
| Minor Point Sources | 2989, 2990, 2869, 2870, 2871, 2872, 2931, 3049, 3048, 3107 |
| Unpaved Roads | Not applicable |
| **Construction Emissions**[3/] | |
| Construction | 3104, 3105, 3106, 3107, 3108, 3109, 3110, 3111, 3045, 3046, 3047, 3048, 3049, 3050, 3051, 3052, 2986, 2987, 2988, 2989, 2990, 2991, 2992, 2993, 2927, 2928, 2929, 2930, 2931, 2932, 2933, 2934, 2868, 2869, 2870, 2871, 2872, 2873, 2874, 2875, 2811, 2812, 2813, 2814, 2815, 2816, 2866, 2867, 2806, 2747 |
| Construction Equipment | 3104, 3105, 3106, 3107, 3108, 3109, 3110, 3111, 3045, 3046, 3047, 3048, 3049, 3050, 3051, 3052, 2986, 2987, 2988, 2989, 2990, 2991, 2992, 2993, 2927, 2928, 2929, 2930, 2931, 2932, 2933, 2934, 2868, 2869, 2870, 2871, 2872, 2873, 2874, 2875, 2811, 2812, 2813, 2814, 2815, 2816, 2866, 2867, 2806, 2747 |

Source: Ricondo & Associates, Inc.
Prepared by: Ricondo & Associates, Inc.