TECHNICAL SUPPORT DOCUMENT
NON-ROAD MOBILE SOURCE:
OZONE INVENTORY
For 2017 BASE YEAR,
FEBRUARY and JULY

APRIL 2020

Utah Division of Air Quality
Planning Branch/Mobile Sources

Table of Contents

List of Figures

List of Tables

1.0 Overview

This section of the Technical Support Documentation (TSD) gives information describing how the Nonroad Mobile Source Inventory is developed.

Non-road mobile sources include 1) Non-road engines and motorized equipment from MOVES2014b Model, 2) aircraft and airport ground support equipment (GSE) and 3) diesel locomotives. This inventory includes emissions

- Ammonia (NH3)
- Carbon Monoxide (CO)
- Oxides of Nitrogen (NOx)
- PM2.5 Exhaust (PM2.5)
- Volatile Organic Compounds (VOC)

The modeling domain for this SIP includes the entire state of Utah including the following ozone nonattainment areas and seasons.

Uintah, UT Nonattainment area (NA) for February 2017 and Northern Wasatch Front and Southern Wasatch Front for July 2017. Units were converted to tons per year for SMOKE.

2.0 Nonroad Equipment – Diesel, Gasoline and others

2.1 Nonroad Description

Nonroad equipment include all mobile sources that are not on-highway exclude locomotives, aircraft, or commercial marine vessels. Locomotive emissions from railyards and aircraft and associated ground support equipment are described in Section 3 and Section 4.

EPA's most current MOVES model (MOVES2014b-Nonroad) was used to obtain emission inventories for nonroad mobile vehicles and equipment that operate on unpaved roads or other areas but not on paved roads. They include nonroad engines and equipment, such as lawn and garden equipment, construction equipment, engines used in recreational activities, portable industrial, commercial, and agricultural engines.

MOVES-Nonroad estimates emissions from a diverse collection of equipment from lawn mowers to locomotive support using a variety of fuel types, as shown in Table 2-1.

Table 2- 1 MOVES-Nonroad Equipment and Fuel Types

Equipment Types	Fuel Types
Agriculture	Gasoline Diesel Compressed Natural Gas (CNG) Liquified Petroleum Gas (LPG)
Airport Ground Support Equipment (GSE; excludes aircraft)	
Commercial	
Construction	
Industrial	
Lawn and Garden	
Logging	
Oil Field	
Pleasure Craft (recreational marine; excludes commercial marine vessels)	
Railroad (excludes locomotives)	
Recreational	
Underground Mining	

2.2 MOVES Model

The nonroad runs were executed using MOVES2014b, the most current publicly-released version of EPA's Motor Vehicle Emissions Simulator (MOVES) Model. The default database is movesdb20181022.

For 2017 base year, February and July scenarios, emissions were computed for a weekday and a weekend day. Output units were grams per weekday or grams per weekend day. Then emissions were converted from daily to annually ton-per-year using the following equation:

(5*Wkdy + 2*Wknd)/7 = Daily Emissions * 365.25 = Tons per Year

Output was organized into "SMOKE" format and transferred to the air dispersion model for analysis of pollutant concentrations.

2.3 MOVES Input Data

MOVES uses county database managers (CDBs) to provide detailed local information for developing nonroad emissions. Each CDB contains the non-road mobile data tables for each county in the state for fuel and meteorology.

2.3.1 Fuel Value

Fuels values were developed based on the extensive refinery gate batch dataset. An adjustment was made for 2017 to account for gasoline sulfur level in Utah since small volume refiners are not required to comply with federal Tier 3 gasoline (10 ppm sulfur) requirements until January 1, 2020. EPA Office of Transportation and Air Quality

(OTAQ) provided 2017 local gasoline sulfur values of 20.9 ppm. MOVES 2014b default fuel parameters were used for diesel and CNG.

2.3.2 Meteorological Data

The UDAQ Technical Analysis Section provided metrological conditions from multiple meteorological sites located throughout the state of Utah from MesoWest data archives. MesoWest (mesowest.utah.edu) is a database of current and archived meteorological data from weather stations in the United States maintained by the University of Utah.

Meteorology Inputs for February for the Uintah NA:

The meteorological data is an hourly average temperature and relative humidity collected from the Vernal, UT airport February 1-10, 2013.

Meteorology Inputs for July for Northern Wasatch and Southern Wasatch NA:

The meteorological data is an hourly average temperature and relative humidity collected from the Salt Lake City International airport (SLC) covering the month of July in 2017.

2.4 Airport Ground Support Equipment (GSE), Rail yard and Oil Field equipment

Commercial marine equipment, locomotive emissions from rail yards and aircraft GSE are not modeled by MOVES. Although MOVES-Nonroad estimates emissions from Airport GSE, the results are not used in the Nonroad emission. Airport GSE are calculated via the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT).

Railway maintenance emissions (SCC 2285002015) are included in the nonroad emission. Rail yard emissions are associated with the operation of switcher engines at each yard. It is compiled by the Eastern Regional Technical Advisory Committee (ERTAC).

Non-road Oil field pieces of equipment are accounted by MOVES for every county within the State of Utah except for Duchesne and Uintah counties. The inventories for these counties have separate inventories that account for oil and gas construction and development processes and off road mobile source operating within the oil fields.

2.5 Snowmobiles

Snowmobiles are run separately within MOVES to take advantage of winter time activity data within the State of Utah. In order to take advantage of the activity data two runs will need to be created within MOVES. Both runs will be created to construct an emission factor per vehicle by SCC for July and February which is shown at Table 2-2.

Table 2- 2 Snowmobile Emission Factor in 2017 July and February

2017 Utah July and February Emission Factors (EF) grams per vehicle per day			
Day	Pollutant	July EF	February EF
Weekend	Total Gas HC	20.86	1,124.96
Weekend	CO	0.00	2,636.26
Weekend	NOx	0.00	76.52
Weekend	NH3	0.00	0.49
Weekend	NMHC	20.86	1,100.43
Weekend	VOC	20.86	1,161.15
Weekend	PM2.5 Total Exh	0.00	31.82
Weekday	Total Gas HC	20.86	562.77
Weekday	CO	0.00	1,318.12
Weekday	NOx	0.00	38.26
Weekday	NH3	0.00	0.25
Weekday	NMHC	20.86	550.51
Weekday	VOC	20.86	580.87
Weekday	PM2.5 Total Exh	0.00	15.91

The activity being used for each month will be different. DMV registration counts by county were used to account for parked snowmobiles during the summer time. State total DMV registration counts were apportioned according to the 2012 snowmobile activity survey accounting for activity for snowmobiles during the winter time.

The DMV data used will account for snowmobiles from the year 2017 covering model years 2016-1969. Snowmobile counts in summer and winter 2017 are shown at Table 2-3.

Table 2- 3 Snowmobile count in July and February 2017

July Activty	
2017 DMV Snowmobile Count MY 2016-1969	
FIPS	Snowmobile Count
49001	41
49003	870
49005	1577
49007	210
49009	21
49011	2751
49013	377
49015	120
49017	43
49019	55
49021	340
49023	170
49025	129
49027	96
49029	445
49031	10
49033	130
49035	4932
49037	46
49039	617
49041	292
49043	1137
49045	406
49047	499
49049	3704
49051	1130
49053	291
49055	46
49057	2460
Total	22945

February Activity	
2017 DMV Snowmobile Count MY 2016-1969	
FIPS	Snowmobile Count
49005	2741
49007	1163
49009	579
49013	200
49015	664
49017	230
49021	774
49023	289
49031	221
49033	2741
49039	1214
49041	221
49043	4008
49047	579
49049	346
49051	4234
49057	2741
Total	22945

MOVES Non-Road is run only for Recreational Equipment for the whole state with the output set to a 24-hour day. Two separate runs were conducted for February and July with two separate databases to avoid confusion. The only output selection included is SCC. The Manage data sets tab is set to use the appropriate meteorology and fuel parameters. A default MOVES script was run to produce emission factors by SCC. After the script is run, the output database was reduced to only cover snowmobiles.

3.0 Aircraft

The EPA estimated emissions related to aircraft activity for all known U.S. airports. Aircraft inventory 2017ERTAC_Rail was downloaded from EPA EIS Gateway.

3.1 Aircraft Type

The aircraft source category includes all aircraft types used for public, private, and military purposes. The aircraft emissions inventories are grouped by type of operation rather than aircraft type. This includes four types of aircraft:

(1) Commercial air carriers (AC)
(2) Air taxis (AT)
(3) General aviation (GA)
(4) Military aircraft (MIL)

Commercial air carriers (AC) transport passengers, freight, or both and tend to be larger aircraft that are driven with jet engines. Air taxis (AT), which are also considered to be commercial aircraft, are usually smaller aircraft (less than 60 passengers) that operate on a limited basis compared to larger commercial aircraft that carry between 60 and 800 passengers. General aviation (GA) includes most other aircraft used for recreational flying and personal transportation. Smaller aircraft that support business travel, usually on an unscheduled basis, are also included in the GA category. Military aircraft (MIL) comprise a wide range of aircraft types such as training aircraft, fighter jets, helicopters, and jet- and propeller-driven cargo planes of varying sizes.

Aircraft tend to emit significant amounts of air pollutants. The national AT and GA fleet includes both jet and propeller-driven aircraft. Most of the AT and GA fleet are comprised of piston- (or propeller-) driven aircraft, though these aircraft types also include smaller business jets and turboprops and helicopters equipped with piston or turboshaft engines.

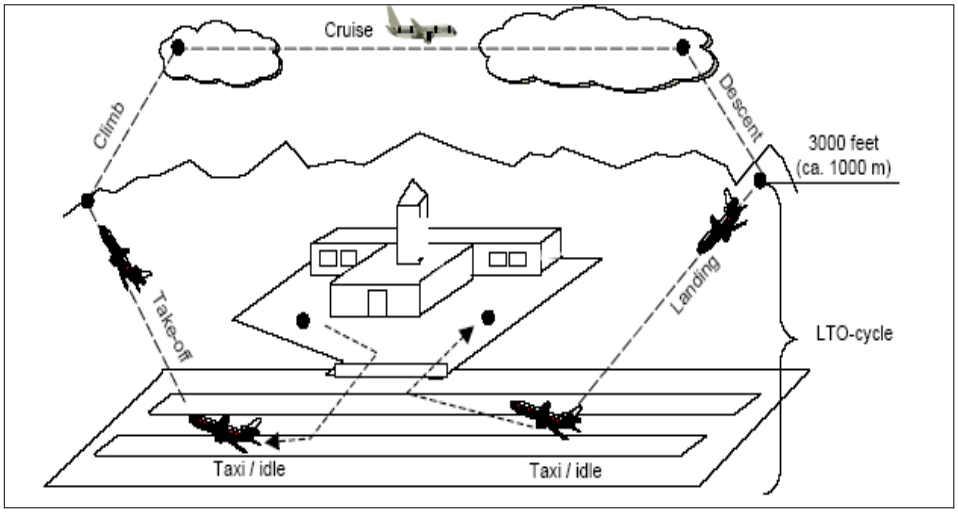
The emissions associated with airport activities are attributed to the following sources with associated SCC:

- Commercial aviation (SCC: 2275020000)
- Air taxis
    - Piston driven (SCC: 2275060011)
    - Turbine driven (SCC: 2275060012)
- General aviation
    - Piston driven (SCC: 2275050011)
    - Turbine driven (SCC: 2275050012)
- Military (SCC: 2275001000)
- Auxiliary Power Units (SCC: 2275070000)
- Ground Support Equipment
    - Diesel-fueled (SCC: 2270008005)
    - Gasoline-fueled (SCC: 2265008005)

3.2 Sources Aircraft Emissions Estimates

Aircraft exhaust, GSE, and Auxiliary Power Unit (APU) emissions estimates are associated with aircrafts' landing and takeoff (LTO) cycle. Figure 1 shows six specific operating modes in an LTO cycle: Approach, Taxi/idle-in, Taxi/idle-out, Idling, Takeoff, Climb out.

Figure 3. 1 LTO cycle



Federal Aviation Administration's (FAA) Aviation Environmental Design Tool (AEDT) was used to estimate emissions. This is the first NEI to use this model. 2008 and 2011 used the FAA's previous model, Emissions and Dispersion Modeling System (EDMS).

3.3 Data Sources for Activity Data

Aircraft landing and takeoff (LTO) data from several Federal Aviation Administration's (FAA) data sources including the following: 2017 T-100 dataset[1], 2014 Terminal Area Forecast (TAF) data[2], 2014 Air Traffic Activity Data Systems (ATADS) data[3], and 2014 Airport Master Record (form 5010) data[4].

The T-100 data is derived from commercial aviation operations, reported directly by the airlines and specifically includes very detailed information about large commercial air carriers and air taxis which could be identified by typical passenger capacity. All non-air taxi data in the T-100 data are assumed to be larger commercial aircraft. ATADS includes actual operations at FAA controlled facilities, while TAF includes the ATADS data and also modeled operations for other non-FAA control facilities. T-100, TAF and ATADS data are provided as operations (separate operation counts for each landing and takeoff leg), such that their operations need to be divided by 2 to get LTOs.

$$(\text{Arrival} + \text{Departure})/2 = \text{LTO}$$

3.4 Monthly Activity Data

T-100 provides the monthly number of aircraft operations by county and aircraft type. From this, UDAQ would apportion the aircraft inventory by monthly activity. For air taxi, general aviation and military aircraft, the FAA's TAF and ATADS datasets do not provide operations data at the aircraft manufacturer and model level of detail that the T-100 data does; instead, annual operations are provided for general aircraft types. UDAQ

would apportion this activity using the apportionment for the commercial aircraft LTO from Salt Lake City airport (SLC).

Table 3- 1 Summarizes LTO from SLC Airport from 2017 T-100 Dataset

Month	Departure SLC	Arrival SLC	Average LTO	Percentage
1	9,728	9,727	9,728	8.05%
2	8,915	8,921	8,918	7.38%
3	10,652	10,655	10,654	8.82%
4	9,792	9,787	9,790	8.10%
5	10,213	10,217	10,215	8.46%
6	10,544	10,546	10,545	8.73%
7	10,890	10,896	10,893	9.02%
8	10,952	10,947	10,950	9.06%
9	9,801	9,797	9,799	8.11%
10	9,999	10,011	10,005	8.28%
11	9,398	9,396	9,397	7.78%
12	9,917	9,926	9,922	8.21%
Grand Total	120,801	120,826	120,814	

3.5 Aircraft APUs and GSE

The NEI also includes emission estimates for aircraft auxiliary power units (APUs) and aircraft ground support equipment (GSE) typically found at airports, such as aircraft refueling vehicles, baggage handling vehicles and equipment, aircraft towing vehicles, and passenger buses. These APUs and GSE are located at the airport facilities as point sources along with the aircraft exhaust emissions.

GSE for Davis County and Tooele County were reported in point sources under Hill Air Force Base and Dugway Proving Ground.

4.0 Diesel Railroad Locomotives

2017 NEI rail yard estimates are compiled by the Eastern Regional Technical Advisory Committee (ERTAC) for most rail yards in the US. Yard emissions are associated with the operation of switcher engines at each yard. Commuter rail emissions from UTA FrontRunner are also included in the inventory. The inventory 2017ERTAC_Rail was downloaded from EPA EIS Gateway.

4.1 Data Sources for Activity Data

The rail sector includes all locomotives in the NEI nonpoint data category. There are five distinct components of the Rail Inventory: Class I line-haul and Class I yard switching, Non-Class I yard switching, Class II/III railroads and Commuter railroads This sector excludes railway maintenance activities. Railway maintenance emissions are included in the nonroad sector. The rail sector SCCs are shown in Table 4-1.

Table 4- 1 2017 NEI SCCs for Rail Sector

SCC	Sector	SCC Sector Description: Mobile Sources prefix for all
2285002006	rail	Railroad Equipment; Diesel; Line Haul Locomotives: Class I Operations
2285002007	rail	Railroad Equipment; Diesel; Line Haul Locomotives: Class II / III Operations
2285002008	rail	Railroad Equipment; Diesel; Line Haul Locomotives: Passenger Trains (Amtrak)
2285002009	rail	Railroad Equipment; Diesel; Line Haul Locomotives: Commuter Lines
228500201	rail	Railroad Equipment; Diesel; Yard Locomotives

4.2 Monthly Activity Data

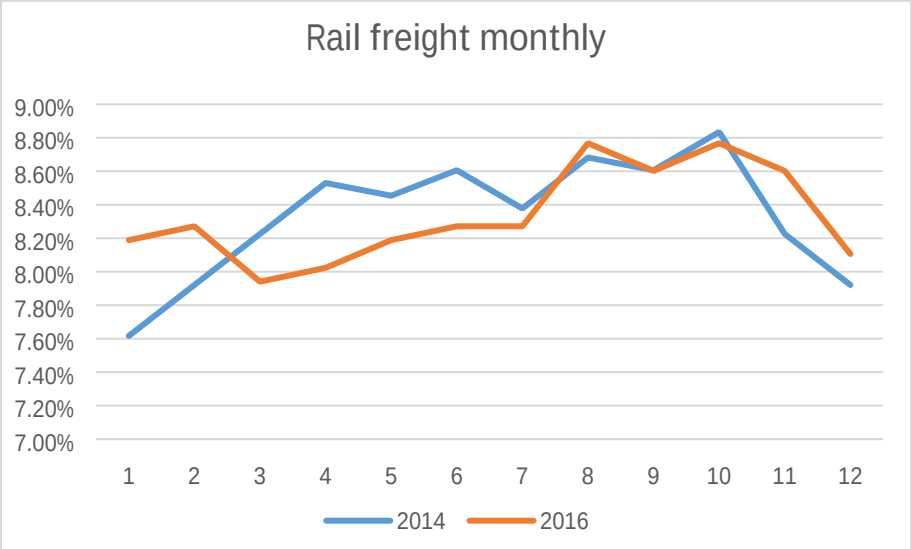
EPA recommended use of the rail traffic data from Association of American Railroads (AAR) website (https://www.aar.org/data-center/rail-traffic-data/). Alison Eyth's group[5] put 2014 and 2016 data together to allocate them to monthly profiles for freight and passenger rail. The passenger rail numbers are very misleading. UDAQ chose not to use passenger rail figures and just use freight rail to develop the average monthly activity which is shown in Table 4-2.

Table 4- 2 Monthly Freight Profiles in 2014 and 2016

Month	2014	2016	Average
Jan	7.62%	8.19%	7.90%
Feb	7.92%	8.27%	8.10%
Mar	8.23%	7.94%	8.08%
Apr	8.53%	8.02%	8.28%
May	8.45%	8.19%	8.32%
Jun	8.61%	8.27%	8.44%
Jul	8.38%	8.27%	8.32%
Aug	8.68%	8.77%	8.72%
Sep	8.61%	8.60%	8.60%
Oct	8.83%	8.77%	8.80%
Nov	8.23%	8.60%	8.41%
Dec	7.92%	8.11%	8.01%

It's clear rail activity on a monthly or seasonal basis is low during the 1st-2nd quarter and high during the 3rd-4th quarter pattern.

Figure 4. 1 Monthly Freight Pattern in 2014 and 2016



5.0 References

1. T-100 Segment (All Carriers) database - Published Online by Bureau of Transportation Statistics. https://www.transtats.bts.gov/DataIndex.asp. Accessed April 21, 2020.

2. Federal Aviation Administration. Terminal Area Forecast (TAF). http://aspm.faa.gov/main/taf.asp.

3. Federal Aviation Administration. ATADS: Airport Operations: Standard Report. http://aspm.faa.gov/opsnet/sys/Airport.asp.

4. Federal Aviation Administration. *Airport Master Record Form 5010*. Published by GCR & Associates. http://www.gcr1.com/5010WEB/.

5. Recommended by Matthew Harrell, U.S. EPA Illinois, April 6, 2020.

Appendix A. Summary of Nonroad Equipment Emissions

Table A- 1 2017 February Nonroad Equipment Emissions (tons per day)

County ID	CO	NH3	NMHC	NOx	PM2.5 Total Exh	Total Gas HC	VOC	Grand Total
49001	0.33	0.00	0.03	0.03	0.00	0.03	0.03	0.45
49003	5.42	0.00	0.77	0.62	0.04	0.83	0.81	8.49
49005	5.55	0.00	0.43	0.73	0.06	0.48	0.45	7.69
49007	1.61	0.00	0.13	0.37	0.03	0.14	0.14	2.43
49009	0.21	0.00	0.04	0.01	0.00	0.05	0.05	0.37
49011	14.21	0.00	1.22	1.55	0.14	1.32	1.28	19.72
49013	1.13	0.00	0.12	0.08	0.01	0.13	0.13	1.60
49015	0.55	0.00	0.06	0.29	0.02	0.07	0.07	1.06
49017	1.00	0.00	0.20	0.09	0.01	0.21	0.21	1.72
49019	2.07	0.00	0.31	0.18	0.02	0.33	0.32	3.22
49021	1.90	0.00	0.14	0.29	0.02	0.16	0.15	2.65
49023	0.90	0.00	0.08	0.13	0.01	0.09	0.08	1.28
49025	1.13	0.00	0.22	0.08	0.01	0.23	0.23	1.89
49027	1.26	0.00	0.18	0.15	0.01	0.19	0.19	1.99
49029	0.48	0.00	0.02	0.06	0.00	0.03	0.02	0.62
49031	0.05	0.00	0.01	0.01	0.00	0.01	0.01	0.08
49033	0.86	0.00	0.13	0.06	0.01	0.14	0.14	1.33
49035	77.41	0.01	5.55	5.55	0.55	6.10	5.81	100.99
49037	1.16	0.00	0.18	0.09	0.01	0.19	0.19	1.82
49039	0.90	0.00	0.10	0.09	0.01	0.10	0.10	1.30
49041	1.77	0.00	0.22	0.39	0.04	0.23	0.24	2.89
49043	3.00	0.00	0.28	0.34	0.03	0.30	0.29	4.25
49045	2.18	0.00	0.30	0.29	0.02	0.32	0.31	3.42
49047	1.70	0.00	0.13	0.15	0.01	0.15	0.14	2.28
49049	21.21	0.00	1.82	2.23	0.21	1.97	1.91	29.37
49051	0.80	0.00	0.08	0.17	0.01	0.08	0.08	1.22
49053	9.35	0.00	0.96	0.94	0.10	1.03	1.01	13.39
49055	0.40	0.00	0.07	0.02	0.00	0.07	0.07	0.65
49057	12.19	0.00	0.98	1.12	0.10	1.07	1.03	16.49
Grand Total	170.74	0.03	14.75	16.12	1.50	16.03	15.48	234.65

Table A- 2 2017 July Nonroad Equipment Emissions (tons per day)

County ID	CO	NH3	NMHC	NOx	PM2.5 Total Exh	Total Gas HC	VOC	Grand Total
49001	0.85	0.00	0.05	0.10	0.01	0.06	0.06	1.12
49003	23.88	0.00	5.02	2.08	0.12	5.22	5.19	41.51
49005	10.15	0.00	0.96	1.01	0.09	1.03	1.00	14.25
49007	2.29	0.00	0.17	0.43	0.04	0.19	0.19	3.31
49009	1.12	0.00	0.25	0.06	0.01	0.26	0.26	1.95
49011	31.84	0.01	3.06	2.20	0.20	3.23	3.17	43.71
49013	3.05	0.00	0.46	0.21	0.03	0.48	0.48	4.70
49015	0.98	0.00	0.11	0.37	0.03	0.12	0.12	1.74
49017	4.70	0.00	1.07	0.18	0.03	1.11	1.11	8.21
49019	7.37	0.00	1.50	0.26	0.05	1.56	1.55	12.29
49021	3.68	0.00	0.33	0.44	0.04	0.35	0.34	5.19
49023	2.04	0.00	0.27	0.21	0.02	0.28	0.28	3.09
49025	5.60	0.00	1.26	0.25	0.03	1.30	1.30	9.74
49027	5.66	0.00	1.24	0.59	0.04	1.28	1.28	10.09
49029	0.77	0.00	0.04	0.09	0.01	0.05	0.04	1.00
49031	0.22	0.00	0.04	0.04	0.00	0.04	0.04	0.38
49033	4.34	0.00	0.63	0.22	0.03	0.65	0.65	6.52
49035	141.71	0.02	8.46	6.26	0.75	9.12	8.75	175.07
49037	4.73	0.00	0.94	0.30	0.03	0.98	0.98	7.95
49039	2.17	0.00	0.28	0.21	0.02	0.30	0.30	3.28
49041	5.09	0.00	0.69	0.56	0.06	0.73	0.73	7.86
49043	6.86	0.00	0.62	0.47	0.05	0.65	0.64	9.30
49045	9.12	0.00	1.75	0.75	0.05	1.82	1.81	15.30
49047	3.13	0.00	0.36	0.25	0.02	0.38	0.38	4.52
49049	44.60	0.01	3.63	2.94	0.32	3.85	3.76	59.09
49051	1.74	0.00	0.20	0.24	0.02	0.21	0.20	2.61
49053	23.39	0.00	2.36	1.20	0.16	2.47	2.44	32.04
49055	1.86	0.00	0.33	0.07	0.01	0.35	0.35	2.97
49057	26.08	0.00	2.15	1.42	0.15	2.28	2.22	34.30
Grand Total	379.00	0.05	38.22	23.40	2.43	40.35	39.63	523.08

Table A- 3 2017 February Snowmobile Emissions (tons per day)

County ID	CO	NH3	NMHC	NOx	PM2.5 Total Exh	Total Gas HC	VOC	Grand Total
49001	0	0	0	0	0	0	0	0.00
49003	0	0	0	0	0	0	0	0.00
49005	5.12	0.00	2.14	0.15	0.06	2.19	2.26	11.91
49007	2.17	0.00	0.91	0.06	0.03	0.93	0.96	5.05
49009	1.08	0.00	0.45	0.03	0.01	0.46	0.48	2.51
49011	0	0	0	0	0	0	0	0.00
49013	0.37	0.00	0.16	0.01	0.00	0.16	0.16	0.87
49015	1.24	0.00	0.52	0.04	0.01	0.53	0.55	2.88
49017	0.43	0.00	0.18	0.01	0.01	0.18	0.19	1.00
49019	0	0	0	0	0	0	0	0.00
49021	1.45	0.00	0.60	0.04	0.02	0.62	0.64	3.37
49023	0.54	0.00	0.23	0.02	0.01	0.23	0.24	1.26
49025	0	0	0	0	0	0	0	0.00
49027	0	0	0	0	0	0	0	0.00
49029	0	0	0	0	0	0	0	0.00
49031	0.41	0.00	0.17	0.01	0.00	0.18	0.18	0.96
49033	5.12	0.00	2.14	0.15	0.06	2.19	2.26	11.91
49035	0	0	0	0	0	0	0	0.00
49037	0	0	0	0	0	0	0	0.00
49039	2.27	0.00	0.95	0.07	0.03	0.97	1.00	5.28
49041	0.41	0.00	0.17	0.01	0.00	0.18	0.18	0.96
49043	7.49	0.00	3.13	0.22	0.09	3.20	3.30	17.42
49045	0	0	0	0	0	0	0	0.00
49047	1.08	0.00	0.45	0.03	0.01	0.46	0.48	2.51
49049	0.65	0.00	0.27	0.02	0.01	0.28	0.28	1.50
49051	7.91	0.00	3.30	0.23	0.10	3.38	3.48	18.40
49053	0	0	0	0	0	0	0	0.00
49055	0	0	0	0	0	0	0	0.00
49057	5.12	0.00	2.14	0.15	0.06	2.19	2.26	11.91
Grand Total	42.86	0.01	17.90	1.24	0.52	18.30	18.88	99.71

Table A- 4 2017 July Snowmobile Emissions (tons per day)

County ID	CO	NH3	NMHC	NOx	PM2.5 Total Exh	Total Gas HC	VOC	Grand Total
49001	0	0	0.00	0	0	0.00	0.00	0.00
49003	0	0	0.02	0	0	0.02	0.02	0.06
49005	0	0	0.04	0	0	0.04	0.04	0.11
49007	0	0	0.00	0	0	0.00	0.00	0.01
49009	0	0	0.00	0	0	0.00	0.00	0.00
49011	0	0	0.06	0	0	0.06	0.06	0.19
49013	0	0	0.01	0	0	0.01	0.01	0.03
49015	0	0	0.00	0	0	0.00	0.00	0.01
49017	0	0	0.00	0	0	0.00	0.00	0.00
49019	0	0	0.00	0	0	0.00	0.00	0.00
49021	0	0	0.01	0	0	0.01	0.01	0.02
49023	0	0	0.00	0	0	0.00	0.00	0.01
49025	0	0	0.00	0	0	0.00	0.00	0.01
49027	0	0	0.00	0	0	0.00	0.00	0.01
49029	0	0	0.01	0	0	0.01	0.01	0.03
49031	0	0	0.00	0	0	0.00	0.00	0.00
49033	0	0	0.00	0	0	0.00	0.00	0.01
49035	0	0	0.11	0	0	0.11	0.11	0.34
49037	0	0	0.00	0	0	0.00	0.00	0.00
49039	0	0	0.01	0	0	0.01	0.01	0.04
49041	0	0	0.01	0	0	0.01	0.01	0.02
49043	0	0	0.03	0	0	0.03	0.03	0.08
49045	0	0	0.01	0	0	0.01	0.01	0.03
49047	0	0	0.01	0	0	0.01	0.01	0.03
49049	0	0	0.09	0	0	0.09	0.09	0.26
49051	0	0	0.03	0	0	0.03	0.03	0.08
49053	0	0	0.01	0	0	0.01	0.01	0.02
49055	0	0	0.00	0	0	0.00	0.00	0.00
49057	0	0	0.06	0	0	0.06	0.06	0.17
Grand Total	0	0	0.53	0	0	0.53	0.53	1.58

Appendix B. Summary of Airport Emissions

Table B- 1 2017 February Airport Emissions (tons per year)

FIPS	CO	NOX	PM10-PRI	PM25-PRI	SO2	VOC
49001	0.82	0.01	0.02	0.01	0.00	0.01
49003	4.42	0.03	0.09	0.06	0.00	0.06
49005	16.10	0.15	0.33	0.23	0.02	0.26
49007	0.95	0.02	0.03	0.02	0.00	0.03
49009	0.35	0.01	0.01	0.01	0.00	0.02
49011	13.37	4.58	0.44	0.39	0.44	2.31
49013	1.62	0.01	0.03	0.02	0.00	0.02
49015	1.22	0.01	0.03	0.02	0.00	0.02
49017	1.51	0.02	0.03	0.03	0.00	0.04
49019	4.33	0.23	0.10	0.08	0.04	0.26
49021	19.64	0.47	0.41	0.30	0.07	0.52
49023	0.81	0.01	0.02	0.01	0.00	0.01
49025	1.12	0.01	0.02	0.02	0.00	0.02
49027	0.92	0.01	0.02	0.01	0.00	0.01
49029	0.94	0.01	0.02	0.01	0.00	0.01
49031	0.17	0.00	0.00	0.00	0.00	0.01
49035	422.78	136.23	3.46	3.26	20.24	51.33
49037	1.86	0.01	0.04	0.03	0.00	0.03
49039	0.30	0.00	0.01	0.00	0.00	0.00
49041	2.26	0.01	0.05	0.03	0.00	0.03
49043	0.03	0.00	0.00	0.00	0.00	0.00
49045	36.00	15.87	1.30	1.18	1.54	7.81
49047	2.83	0.11	0.05	0.04	0.03	0.29
49049	27.29	1.07	0.52	0.38	0.16	1.00
49051	4.35	0.05	0.10	0.08	0.01	0.10
49053	13.58	0.19	0.31	0.23	0.03	0.28
49055	0.61	0.00	0.01	0.01	0.00	0.01
49057	16.96	0.58	0.37	0.27	0.08	0.52
Grand Total	597.14	159.69	7.81	6.75	22.69	65.03

Table B- 2 2017 July Airport Emissions (tons per year)

FIPS	CO	NOX	PM10-PRI	PM25-PRI	SO2	VOC
49001	1.00	0.01	0.02	0.01	0.00	0.01
49003	5.40	0.03	0.11	0.08	0.01	0.07
49005	19.67	0.18	0.40	0.29	0.03	0.32
49007	1.16	0.02	0.03	0.03	0.00	0.03
49009	0.43	0.01	0.01	0.01	0.00	0.02
49011	16.33	5.60	0.54	0.47	0.53	2.82
49013	1.98	0.01	0.04	0.03	0.00	0.03
49015	1.49	0.02	0.04	0.03	0.00	0.03
49017	1.84	0.03	0.04	0.03	0.01	0.05
49019	5.29	0.29	0.12	0.10	0.05	0.32
49021	23.99	0.57	0.50	0.37	0.09	0.63
49023	0.98	0.01	0.02	0.01	0.00	0.01
49025	1.37	0.02	0.03	0.02	0.00	0.03
49027	1.13	0.01	0.02	0.02	0.00	0.02
49029	1.14	0.01	0.02	0.02	0.00	0.01
49031	0.20	0.01	0.00	0.00	0.00	0.01
49035	516.41	166.40	4.22	3.99	24.73	62.70
49037	2.27	0.02	0.05	0.03	0.00	0.04
49039	0.37	0.00	0.01	0.01	0.00	0.01
49041	2.77	0.02	0.06	0.04	0.00	0.04
49043	0.04	0.00	0.00	0.00	0.00	0.00
49045	43.97	19.39	1.58	1.44	1.88	9.54
49047	3.45	0.13	0.06	0.05	0.03	0.36
49049	33.34	1.31	0.64	0.46	0.19	1.22
49051	5.32	0.06	0.12	0.09	0.01	0.12
49053	16.58	0.23	0.38	0.28	0.04	0.35
49055	0.74	0.00	0.02	0.01	0.00	0.01
49057	20.71	0.70	0.45	0.33	0.09	0.63
Grand Total	729.38	195.06	9.54	8.24	27.71	79.43

Appendix C. Summary of Rail Emissions

Table C- 1 2017 February Rail Annual Emissions (tons per year)

County	FIPs	CO	NOx	PM10	PM2.5	SO2	VOC	NH3
Beaver	49001	3.57	18.97	0.54	0.53	0.01	0.96	0.01
Box Elder	49003	9.98	51.86	1.50	1.45	0.04	2.52	0.03
Cache	49005	0.39	1.99	0.06	0.06	0.00	0.09	0.00
Carbon	49007	1.64	9.87	0.30	0.29	0.01	0.47	0.01
Daggett	49009	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Davis	49011	7.67	49.06	1.44	1.39	0.03	2.27	0.02
Duchesne	49013	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emery	49015	1.98	11.79	0.36	0.35	0.01	0.57	0.01
Garfield	49017	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grand	49019	2.42	14.29	0.44	0.42	0.01	0.69	0.01
Iron	49021	4.33	22.21	0.65	0.63	0.02	1.02	0.01
Juab	49023	4.03	20.41	0.60	0.58	0.01	0.94	0.01
Kane	49025	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Millard	49027	6.89	34.88	1.02	0.99	0.02	1.61	0.02
Morgan	49029	3.65	18.47	0.54	0.52	0.01	0.85	0.01
Piute	49031	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rich	49033	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salt Lake	49035	10.79	64.12	1.81	1.76	0.04	3.46	0.03
San Juan	49037	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sanpete	49039	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sevier	49041	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Summit	49043	6.42	32.48	0.95	0.92	0.02	1.50	0.02
Tooele	49045	9.99	52.24	1.55	1.50	0.04	2.50	0.03
Uintah	49047	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utah	49049	5.18	29.74	0.88	0.86	0.02	1.47	0.02
Wasatch	49051	0.20	1.40	0.04	0.04	0.00	0.07	0.00
Washington	49053	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wayne	49055	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weber	49057	8.04	46.55	1.33	1.29	0.03	2.36	0.02
	SUM	87.15	480.32	14.01	13.59	0.31	23.34	0.27

Table C- 2 2017 July Rail Annual Emissions (tons per year)

County	FIPs	CO	NOx	PM10	PM2.5	SO2	VOC	NH3
Beaver	49001	3.67	19.51	0.56	0.54	0.01	0.99	0.01
Box Elder	49003	10.26	53.33	1.54	1.49	0.04	2.59	0.03
Cache	49005	0.40	2.04	0.06	0.06	0.00	0.09	0.00
Carbon	49007	1.69	10.15	0.31	0.30	0.01	0.48	0.01
Daggett	49009	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Davis	49011	7.89	50.45	1.48	1.43	0.03	2.33	0.02
Duchesne	49013	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emery	49015	2.04	12.12	0.37	0.36	0.01	0.58	0.01
Garfield	49017	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grand	49019	2.48	14.69	0.45	0.43	0.01	0.71	0.01
Iron	49021	4.45	22.84	0.67	0.65	0.02	1.05	0.01
Juab	49023	4.14	20.98	0.61	0.60	0.01	0.97	0.01
Kane	49025	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Millard	49027	7.09	35.87	1.05	1.02	0.02	1.65	0.02
Morgan	49029	3.75	18.99	0.56	0.54	0.01	0.88	0.01
Piute	49031	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rich	49033	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Salt Lake	49035	11.09	65.93	1.86	1.81	0.04	3.56	0.03
San Juan	49037	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sanpete	49039	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sevier	49041	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Summit	49043	6.60	33.39	0.98	0.95	0.02	1.54	0.02
Tooele	49045	10.27	53.72	1.59	1.55	0.04	2.57	0.03
Uintah	49047	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utah	49049	5.33	30.58	0.91	0.88	0.02	1.51	0.02
Wasatch	49051	0.21	1.44	0.04	0.04	0.00	0.07	0.00
Washington	49053	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wayne	49055	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Weber	49057	8.27	47.86	1.37	1.33	0.03	2.42	0.03
	SUM	89.61	493.88	14.40	13.97	0.31	23.99	0.28