UTAH DIVISION OF AIR QUALITY

$PM_{2.5}$ Inventory Preparation Plan

SALT LAKE CITY, UT
PROVO, UT
LOGAN, UT-ID
SEPTEMBER, 2019

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
AIR QUALITY

UTAH DIVISION OF AIR QUALITY $PM_{2.5}$ INVENTORY PREPARATION PLAN (IPP) 4
I. INTRODUCTION 4
II. SCOPE OF WORK 5
A. A. Geographic Area; Non-Attainment Areas and Modeling Domain 5
i. Pollutants to be Inventoried 6
ii. Episode Days, Base Year and Projection Years for Inventories 6
a. 2011 Episode Inventories 6
b. Base Year Inventory: 7
c. Projection Year Inventories: 8
d. Time Averaging Periods 9
III. POINT SOURCE EMISSION INVENTORY DATA 10
A. Threshold Values for Point Sources in Tons per Year – Base Year 10
i. Data Collection Method 11
a. Episodic Inventories 11
b. Base Year Inventory 11
c. Projection to Future Years 12
d. Depiction of Control Technologies 12
e. The Smoke Emissions Model and Processor 12
f. Correction for Potential Double Counting of Emissions 13
IV. AREA SOURCE INVENTORY DATA COLLECTION 13
A. Area Emission Inventory Source Categories 13
ii. Combustion Sources 13
iii. Evaporative Loss 13
B. Method of Calculation of Area Source Categories 14
C. Sources of Activity Level Information 18
D. Emission Apportionment for Partial Counties within the Domain 18
E. Projection of Area Source Emissions 19
V. ON-ROAD MOBILE INVENTORY DATA COLLECTION 20
A. Agency Responsibilities 21
B. MOVES Methodology 21
i. Baseline and Projection 22
C. AP-42 Road Dust Methodology 23

D. Idaho Methodology 24
VI. NON-ROAD MOBILE INVENTORY DATA COLLECTION 24
A. Non-road Mobile Source Categories 24

UTAH DIVISION OF AIR QUALITY $PM_{2.5}$ INVENTORY PREPARATION PLAN (IPP)

I. INTRODUCTION

On September 21, 2006, EPA promulgated revisions to the National Ambient Air Quality Standards (NAAQS) for $PM_{2.5}$. It retained the primary annual standard at 15 micrograms per cubic meter ($\mu g/m^3$), but lowered the 24-hour standard from the 1997 level of 65$\mu g/m^3$ to 35.

On December 14, 2009, EPA effectively designated three nonattainment areas (NAAs) which collectively included Davis, Salt Lake, and portions of Box Elder, Cache, Tooele, Utah and Weber counties in Utah. Additionally, the Logan UT-ID area includes a portion of Franklin County in Idaho.

A map of the three NAAs is shown in Figure 1 below (see Federal Register, "Air Quality Designations for the 2006 24-Hour Fine Particle ($PM_{2.5}$) National Ambient Air Quality Standards"; Final Rule, November 13, 2009).

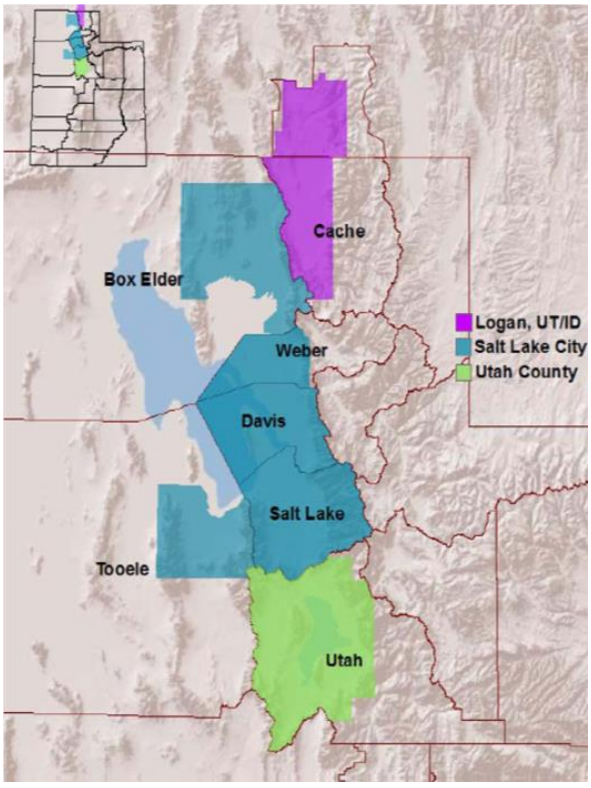

Figure 1: Utah's PM2.5 Nonattainment Areas

The Salt Lake City non-attainment area (SLC NAA) and Provo NAA were reclassified to serious, with statutory attainment dates of December 31, 2019. A serious SIP for the SLC NAA was submitted to the EPA in February 2019. The 3-year average of the 24-hr 98th percentile values for 2016, 2017, and 2018 show that the SLC NAA has attained the NAAQS.

The Provo NAA attained the standard prior to the statutory attainment date and a clean data determination will suspend many of the moderate and serious SIP elements. The remaining required serious SIP elements have been submitted to the EPA.

The Logan, UT-ID NAA attained the standard by the statutory attainment date and has an approved clean data determination that suspends some moderate SIP elements. All three NAAs have attained the NAAQS and maintenance plans have been prepared to fulfill redesignation requirements detailed in the Clean Air Act.

For the maintenance plans, UDAQ will perform a photochemical grid modeling analysis using the "Comprehensive Air Quality Model with Extensions" (v. 6.3, http://www.camx.com/) modeling system. The purpose of this Inventory Preparation Plan is to outline, in sufficient detail, the procedures that will be used to compile a suite of reasonably accurate, representative, and complete emissions inventories for the modeling process for all three $PM_{2.5}$ maintenance plans.

II. SCOPE OF WORK

A. Geographic Area; Non-Attainment Areas and Modeling Domain

The inventories will support maintenance plans in the three NAAs, and will be developed to a high degree of accuracy in these areas. In addition, the modeling domain will encompass a much greater area, including the remaining 22 counties in Utah and some additional areas in Nevada, Arizona, New Mexico, Colorado, Wyoming, and Idaho. See Figure 2 below.

The domain includes areas outside the current non-attainment areas in order to ensure that all pollutants, including short-range transported pollutants, are included in the modeling process. These outlying areas will be inventoried at a lesser level of detail than the NAAs. The inventories will address all air pollution sources throughout the entire modeling domain as well as within the $PM_{2.5}$ NAAs.

UDAQ will compile information directly for all areas of the state. By source category, this includes Point Sources, Area Sources, and Mobile Sources (both on-road and non-road). For outlying areas in other states, the UDAQ will import National Emissions Inventory (NEI) data from the EPA's website, with the exception of Franklin County in the Logan, UT-ID NAA which will have more detailed inventories supplied by Idaho DEQ.

Within each NAA greater attention will be given to the accuracy of the inventories. For example, Point Sources will be included at a threshold of 70 tons per year inside the SLC and Provo NAAs, while outside the threshold will be 100 tpy. On-road Mobile Source emissions will make use of Travel Demand Models in the NAAs to make projections of Vehicle Miles Traveled. This is not possible in the outlying areas. More detail is provided in the sections of this document specific to each of these source categories.

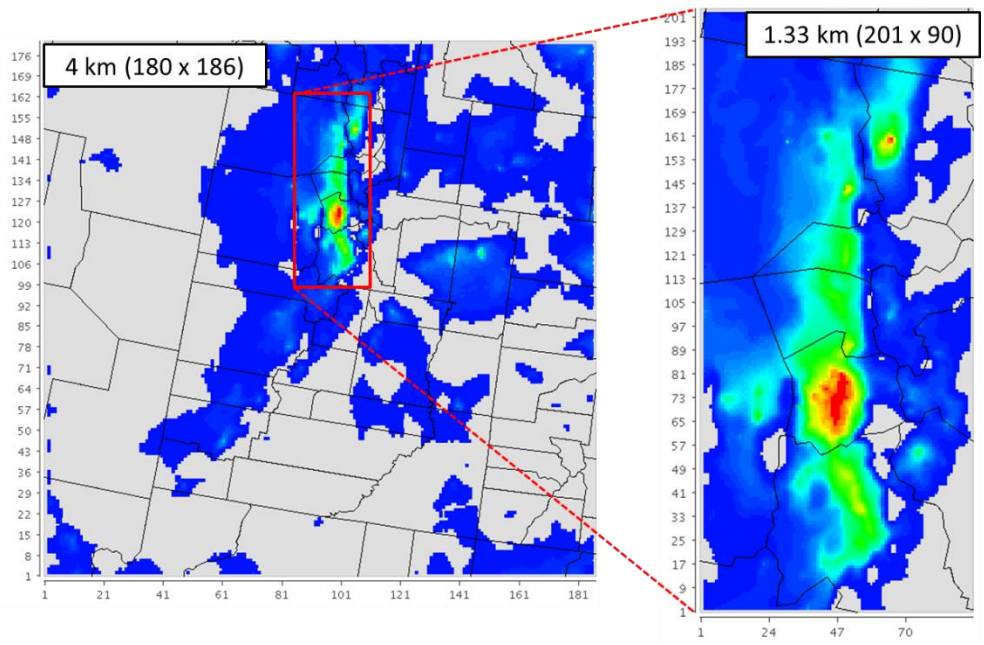

Figure 2: PM2.5 Modeling Domain

i. Pollutants to be Inventoried

The pollutants to be inventoried will include $PM_{2.5}$, to include both filterable and condensable fractions where appropriate. It will also include all $PM_{2.5}$ precursors, including: SOx, NOx, VOC, and ammonia. Each of these pollutants has importance from a regulatory standpoint.

In addition, the inventories will include CO, chlorine, HCl, benzene, toluene and xylene (wherever emission factors are available). Information concerning these pollutants is of value to the modeling process.

ii. Episode Days, Base Year and Projection Years for Inventories

Model validation for the SLC NAA serious SIP was performed and it was determined that the episode from Friday, December 31 through Tuesday, January 11, 2011 performed the best when compared to two other possible episodes. Therefore, the 2011 episode will be used for validation again for these maintenance plans. The timeframe and meteorological conditions of this episode will be used for modeling the baseline year of 2017, as well as the projection years 2026 and 2035. Projection year inventories will be modeled following EPA guidance.

Temporal allocation of the annual point source inventories, to other time scales, will be made while preprocessing the inventories for modeling. These adjustments are based on profiles contained in the SMOKE emissions preprocessor. Reports generated by SMOKE for 24-hr averaging periods will be made available for review. In addition, on- and non-road emissions will be reported in SMOKE format by SCC.

a. 2011 Episode Inventories

- Point source emissions will be represented as the actual emissions from the 2011 Tri-annual inventory. For a Serious $PM_{2.5}$ NAA, the BACT threshold for point sources is 70 tpy, and this is the definition that will be applied to "point sources" within the three NAAs. This characterization will apply to all inventories used in the SIP. Outside of these areas, UDAQ will continue to use a 100 tpy threshold for distinguishing between point and area sources. Again, this will apply to all inventories used in the maintenance plans.

- Area sources, emissions will be back-casted from the 2014 Tri-annual inventory. For this source category there are some significant updates in certain calculation methods (e.g. residential woodburning and commercial cooking) and sources of activity data to warrant a replacement of the 2011 inventory.

- On-road Mobile source emissions will use the following: UDOT 2011 data for Average Speed Distribution, VMT, and Road Type Distribution; I\M programs in consultation with the counties; Meteorological profiles from MesoWest.

- Non-road mobile source emissions (non-road motorized vehicles and equipment) were calculated for Jan1 – Jan 11, 2011 using MOVES 2014a:

  Aircraft and airport ground support equipment emissions were modeled for the month of January 2011. (Commercial aircraft activity can only be downloaded by month or year from the U.S. Bureau of Transportation Statistics "Transtats" website.) Smaller aircraft activity is only available in annual units.

  Diesel locomotive emissions were modeled by calendar year. Railroad companies report annual activity (annual locomotive diesel fuel consumption in gallons per year) only.

  Each of the 29 counties was inventoried separately. UDAQ inventory staff completed the non-road inventories. Emissions data from the bordering states will be obtained from the 2011 NEI.

- 2011 NEI emissions data was used for the bordering states.

b. Base Year Inventory:

2017 has been selected to represent the base year emissions inventory (EI) for the maintenance plans. This inventory will represent the actual emissions for one of the three years used for clean data determinations and is central to the years selected to calculate the monitored design values for each of the ambient monitors referenced in the air quality modeling. In addition, 2017 coincides with the most recent tri-annual inventory that has been compiled by the UDAQ.

This inventory of actual emissions will be the basis for any projections made to represent future years. The subset of this EI that pertains to the geographic area within the NAAs will be consistent with the definition of the required "*Base year inventory for the nonattainment area*" (see 51.1000 and 51.1008(b)(1)).

Utah typically tabulates emissions from area and mobile sources on a county-by-county basis. The boundaries of Utah's three $PM_{2.5}$ NAAs bisect five different counties. The raw data is entered into the air model such that it is assigned a geographic location (grid cell). To report emissions specific to the NAAs, Utah will use a GIS description for each area to retrieve the respective emissions data after it has been gridded into the model.

The county-by-county data will be included in the SIP submittal as part of the Technical Support Document. Compilation of the base year inventory throughout the modeling domain may be summarized as follows:

- Point source emissions will be represented as the actual emissions from the 2017 tri-annual inventory. Within the SLC and Provo NAAs, "point sources" will be those with actual emissions of 70 tpy or more for $PM_{2.5}$ or any of its scientific precursors (or having the potential to emit 70 tpy). Outside of these areas, UDAQ will continue to use a 100 tpy threshold for distinguishing between Point and Area sources.

- Area source emissions will be represented by forecasting to base year 2017 from the 2014 tri-annual inventory. Area source emissions had not been certified for the 2017 tri-annual inventory at the time this work was necessary.

- On-road mobile source emissions will be prepared by the metropolitan planning organizations (MPOs) for the urban NAAs and UDAQ will provide rural attainment area inventories for 22 counties. The Cache County MPO will provide inventories for Cache County. Mountainland Association of Governments will provide inventories for Utah County. Wasatch Front Regional Council will provide inventories for Box Elder, Davis, Salt Lake, Tooele, and Weber counties. Each MPO is responsible for developing the latest planning assumptions for the MOVES 2014b model. The Technical Support Documentation will explain what specific local planning assumptions were used. Inventories will be developed for tons per day for an average winter weekday, Saturday, and Sunday.

- Non-road mobile source emissions will be calculated for the entire state by county using the average of temperatures and relative humidity values from the three episodes mentioned above. UDAQ inventory staff will prepare the non-road inventories. Emissions will be modeled for a January 2017 day (MOVES). Commercial aircraft and airport commercial GSE will be modeled in units of January monthly emissions. Air taxi, general aviation and military aircraft can only be modeled in annual units. Diesel locomotives will be modeled in annual units as well. Final units for the non-road inventory will be tons per year as discussed with Technical Analysis.

- 2014 NEI emissions data was used for the bordering states.

c. Projection Year Inventories:

The following is a list of all the years for which a projection year emissions inventory will be prepared, as well as the role each year will play in the maintenance plans. Each will be a projection of emissions reflecting changes due to growth and control.

2026 The base year inventory will be projected to 2026 as an attainment "spot check" between the base year and the final year.

2035 According to CAA section 175(a), a maintenance plan must show maintenance of the NAAQS for at least 10 years after redesignation. Based on this, 2035 will be the final year modelled for these maintenance plans.

The subset of this EI that pertains to the geographic area within the Nonattainment Areas will be consistent with the definition of the required "*Attainment projected inventory for the nonattainment area*" (see 51.1000 and 51.1008(b)(2)).

In the case of each of these projections, emissions will be compiled as follows:

- Point source emissions will be forecasted from the 2017 tri-annual inventory. Individual sources will be adjusted based on projected growth as well as BACT phase-in from the serious SIP.

- Area sources will be forecasted from the 2014 Tri-annual EI using the appropriate growth factors from various projection sources (see section IV. E. Projection of Area Source Emissions) and factoring in controls identified during previous SIP iterations at the appropriate points in time.

- Non-road mobile source emissions will be calculated for the entire state by county using MOVES 2014b (non-road motorized vehicles and equipment). Meteorological data to be used will be the average of all days in the three episodes mentioned above. The appropriate growth factors for aircraft, airport ground support equipment and diesel locomotive activity will be used.

- On-road mobile source emissions will be prepared by the metropolitan planning organizations (MPOs) for the urban NAAs and UDAQ will provide rural attainment area inventories for 22 counties. The Cache County MPO will provide inventories for Cache County. Mountainland Association of Governments will provide inventories for Utah County. Wasatch Front Regional Council will provide inventories for Box Elder, Davis, Salt Lake, Tooele, and Weber counties. Each MPO is responsible for developing the latest planning assumptions for the MOVES 2014b model. The Technical Support Documentation will explain what specific local planning assumptions were used. Inventories will be developed for tons per day for an average winter weekday, Saturday, and Sunday.

- 2014 NEI emissions data was used for the bordering states.

d. Time Averaging Periods

Emissions will be calculated as annual emissions with the exception of:

1. On-road mobile source inventories will be calculated as Tons Per Day for an average winter weekday, Saturday or Sunday.

2. Non-road mobile source emissions of miscellaneous NONROAD vehicles and equipment from MOVES2014b will be calculated as January daily * 365.25 = "annual ton-per year" emissions. Commercial aircraft will be calculated as January monthly emissions * (365.25/31) = "annual ton-per-year" emissions. Air taxi, general aviation and military aircraft will be calculated in TPY. Diesel locomotive activity is submitted by railroad companies in units of locomotive diesel fuel consumption (gallons per year) by county.

3. Point and Area Source emissions are adjusted to reflect activity during the winter periods common with Utah's elevated $PM_{2.5}$ concentrations. For example, each point source reports a level of operation corresponding to each month of the year. Some sources, such as aggregate producers, typically operate at much lower levels during winter months. The same is true of certain area source categories. Wild land fires, for instance, are not relevant for a winter-time depiction of emissions.

The new implementation rule requires that emissions values shall be either annual total emissions, average-season-day emissions, or both, as appropriate for the relevant (24-hour) $PM_{2.5}$ NAAQS. Also, that the state shall include as part of the plan a rationale for providing annual or seasonal emissions, and the justification for the period used for any seasonal emissions calculations.

Utah's long-running difficulties with fine PM may be characterized as a short-term (24-hour NAAQS) problem belonging to the winter months when meteorological conditions are conducive to both the trapping of air in the valleys due to temperature inversions and to the secondary formation of $PM_{2.5}$. Thus, in addressing the problem through quantitative SIP analyses, emissions inventories have historically been adjusted to reflect this seasonality.

"Average-season-day emissions" are defined, in 40 CFR 51.1000, as the sum of all emissions during the applicable season divided by the number of days in that season. Again, Utah's inventory is compiled using a variety of different averaging periods, and is then gridded into the air model along with an hourly temporal component for each 24 hour period.

Emissions will be extracted from SMOKE and reported in time averaged units of "tons-per-day". Each projection of the emissions inventory will be modeled with meteorology reflecting the actual episode used to validate the air quality model (this episode spans 12 days from Friday, December 31 through Tuesday, January 11, 2011). Therefore, average-season-day emissions in the maintenance plans refers to tons-per-day typical of a Utah "inversion episode".

The maintenance plan submittal will include the original EI calculations as part of the Technical Support Document (TSD).

III. POINT SOURCE EMISSION INVENTORY DATA

A. Threshold Values for Point Sources in Tons per Year – Base Year

The 2016 PM Implementation Rule requires that areas reclassified as Serious shall use the Serious area definition of a major source listed under 40 CFR 51.165(a)(1)(iv)(A) and (a)(1)(vii) and (viii). To paraphrase, this equates to any stationary source that emits (or has the potential to emit) 100 tons per year or more, except that lower thresholds shall apply in areas subject to subpart 4 of part D, title I of the Clean Air Act.

In the case of the maintenance plans, the threshold is 70 tons per year for $PM_{2.5}$ or any individual precursor to $PM_{2.5}$ (SO_2, NOx, VOC, and NH_3) in the serious nonattainment areas (Provo and Salt Lake City). There are no point sources in the Logan, UT-ID NAA. To assess point sources, UDAQ will evaluate the 2017 actual emissions inventory, and additionally will review its permits to identify those sources with the potential to emit any of these pollutants in the amount of 70 tpy or greater.

Excepting the two serious NAAs, point sources throughout the remainder of the modeling domain will be identified using the standard threshold of 100 tons per year, or more, for $PM_{2.5}$ or any $PM_{2.5}$ precursor.

i. Data Collection Method

UDAQ has recently improved emissions inventory data management with the development and implementation of the State and Local Emissions Inventory System (SLEIS). This new system has established an online emissions inventory system, whereby point sources can submit their air emissions inventories to UDAQ. SLEIS includes extensive built-in calculation capabilities which simplify the process and reduce the workload for point sources required to submit an emissions inventory. SLEIS also contains extensive QA/QC which guides point sources as they submit their data, thereby greatly reducing oversight required by UDAQ staff. The 2017 triannual emissions inventory was submitted to UDAQ by point sources using the SLEIS online system. The submitted emissions inventories were thoroughly reviewed using additional QA/QC by UDAQ staff before being finalized. The extensive QA/QC contained in the SLEIS online system along with the review performed by UDAQ staff greatly surpasses EPA guidance requiring 10% QA/QC as the minimum criteria necessary for a SIP inventory.

a. Episodic Inventories

1. 2011 Episode - Point source emissions will be represented as the actual emissions from the 2011 triannual inventory.

b. Base Year Inventory

The 2017 point source emissions inventory will be used to represent the base year emissions inventory for the maintenance plans. Point source emissions will be represented as the actual emissions from the 2017 triannual emissions inventory which coincides with the most recent triannual inventory that has been compiled by UDAQ. This inventory will be the basis for the intermediate and final year projections.

In order to streamline the process, PM2.5 maintenance SIP workbooks will be constructed for each point source using 2017 emissions data from SLEIS for the base year. These workbooks will provide a depiction of the required emissions and data for each source. They will also be used for projecting emissions to future years and to represent any control technologies that will be applied.

c. Projection to Future Years

Point source emissions in the PM2.5 NAAs will be grown on a case by case basis for each source and represented in the PM2.5 maintenance SIP workbooks for the future years of 2026 and 2035. A thorough description of the growth for each source in the PM2.5 NAAs will be given in the technical support document of the maintenance plan.

Growth data from REMI will be used to project the point source emissions in the surrounding areas for the future years of 2026 and 2035. Data from Kem C. Gardner Policy Institute County Projections will be used for projecting emissions at military bases in the surrounding areas.

d. Depiction of Control Technologies

After the point source emissions have been projected to future years, control measures resulting from reasonable and best available control technologies will be applied to each source and resulting emissions represented in the PM2.5 maintenance SIP workbooks.

e. The Smoke Emissions Model and Processor

The emissions processing model, SMOKE, takes the annual, county wide emissions inventory prepared by UDAQ and reformulates it for use in the air quality model. There are three aspects to this reformulation of the inventory that, in the end, produces a refined version of the inventory. These include temporal processing, spatial processing, and speciation. Temporal processing converts emissions from annual to daily and hourly values. Spatial processing locates emissions from the county to specific grid cells within the modeling domain. Speciation breaks PM and VOC emissions into their component subspecies.

The emissions processing for air quality modeling is done with sets of activity profiles based on various Source Classification Codes (SCCs) and associated cross reference files developed using source provided temporal data. This feature essentially establishes the level of detail required of the point source inventories, wherein each “source component” has with it an associated SCC. These SCCs and the cross-reference files are also created for area sources and mobile sources.

Once developed, these activity profiles serve to establish the temporal allocation of emissions within the model (e.g. 8-hour workdays), and also determine the speciation of PM and VOC emissions.

f. Correction for Potential Double Counting of Emissions

Double counting occurs when emissions from a source are included in both the area source and point source emissions. To avoid this, known point source emissions will be subtracted from area emissions. For example, after the total natural gas consumption is calculated from utility records, the known point source consumption will be subtracted from the area source natural gas use total. The difference is the area source contribution and the contribution of missed or unidentified point sources.

IV. AREA SOURCE INVENTORY DATA COLLECTION

A. Area Emission Inventory Source Categories

The following area source categories have been identified in Utah and Idaho and will be inventoried. Stationary sources of emissions not included in the point source inventory will be included in the 2014 area source inventory. Seasonal adjustments, such as allocating fewer wildfire emissions to winter months, will be made to various area source categories to reflect operations during cold pool meteorological conditions.

ii. Combustion Sources

.

a. Stationary sources using fossil fuel, e.g., wood, natural gas, fuel oil, kerosene, LPG, and coal

- Residential
- Commercial and institutional (excluding point source overlap)
- Industrial (excluding point source overlap)

b. Other combustion sources

- Forest fires (including wild and prescribed burning)
- Agricultural burning
- Open burning (including yard waste, brush, and household waste)
- Cremation (animal and human)
- Non-road aircraft maintenance
- Structural fires
- Vehicle fires
- Commercial cooking
- Backyard Barbecues

iii. Evaporative Loss

a. Fuel distribution (gasoline and aviation fuel)

- Fuel truck at bulk terminal

- Fuel trucks in transit
- Underground tank breathing
- Refueling
- Portable fuel containers

b. Stationary source solvent and other chemicals

- Dry cleaning
- Solvent cleaning and degreasing
- Household and commercial consumer products
- Graphic arts
- Cutback/Emulsified asphalt paving
- Tank cleanings
- Surface coating
  - Architectural
  - Automobile refinishing
  - Traffic markings
  - Other small industrial
- Pesticides
  - Agricultural
  - Non-agricultural, residential & commercial

c. Waste management practices

- Treated and untreated sewage waste
- Municipal and other non-hazardous waste landfill
- Livestock wastes
- Wild animal wastes
- Domestic animal wastes
- Human respiration, perspiration & cigarettes
- Industrial point source (ammonia only)
- Bakery yeast

d. Fugitive dust sources

- Agricultural tilling
- Agricultural harvesting
- Mining and quarrying
- Unpaved road dust
- Construction, roads and buildings

Oil & Gas sources

B. Method of Calculation of Area Source Categories

The calculation methods for the above area source categories have been identified and are listed in Table 1.

AREA SOURCE EMISSION CALCULATION METHODS	
CATEGORY	**METHOD**
Agricultural Burning	"Documentation for the Final 2002 Nonpoint Sector (Feb 2006 version) National Emission Inventory for Criteria and Hazardous Air Pollutants," Appendix A-111, Utah State University survey, "Inventory of Agriculture Burning in Utah."
Agricultural Harvesting	Chapter 10, Agricultural Harvesting of the "WRAP Fugitive Dust Handbook," dated September 7, 2006.
Agricultural, Livestock	Emissions were taken from the 2011 NEI v2 (EPA/ERTAC calculations based on CMU Ammonia Model v. 3.6).
Agricultural Tilling	Emission Factors and calculation are in EPA/NOMAD Agricultural Tilling estimates for the 2014 NEI.
Animals, Domestic	"Development of the Ammonia Emission Inventory for the Southern California Air Quality Study," Radian Corp
Animals, Wild	"Technical Support Study 15: Evaluation and Improvement of Methods for Determining Ammonia Emissions in the San Joaquin Valley."
Asphalt Paving	Emission Factors and calculation are in EPA/NOMAD Asphalt Paving estimates for the 2014 NEI and adjusted by using State-level, UDOT VMT data rather than US Highway Administration data.
Auto Body Refinishing	EIIP, Vol. III, Chapter 13, "Auto Body Refinishing"
Backyard Barbecues	Emission Factors and calculation are in the EPA/NOMAD Residential Charcoal Grilling Tool (for the 2014 NEI).
Bakery Yeast	EIIP, Vol. III, "Area Source Category Method Abstract – Bakeries"
Biogenic Decay in Soils	BEIS3 software model
Commercial Cooking	Emissions were taken from the 2014 EPA/NOMAD estimates.
Combustion, Coal	Emission factors and methodology are from the EPA/NOMAD 2014 ICI Combustion Tool and residential non-wood combustion calculation.

Combustion, Kerosene	Commercial emission factors and methodology are from the EPA/NOMAD 2014 ICI Combustion Tool. It is assumed that industrial fuel combustion is included in the point source inventory as 2014 data indicated this to be the case. Residential calculation method adapted from ERTAC Residential Combustion calculations (see: ftp://ftp.epa.gov/EmisInventory/2011nei/doc/residential_consumption_kerosene.zip).
Combustion, LPG	Industrial/Commercial emission factors are from the EPA/NOMAD 2014 ICI Combustion Tool. Residential emission factors and methods are from EPA/NOMAD 2014 residential non-wood heating calculations.
Combustion, Natural Gas	Commercial and industrial emission factors and emission calculation methodology are based on NOMAD (formerly ERTAC) for the 2014 ICI Combustion Tool. Residential emission factors are from EPA's "2008 National Emissions Inventory Data & Documentation." Calculation methodology employs local gas distributor data rather than EIA fuel use and US Census housing distribution data.
Combustion, Oil	Industrial and commercial emission factors and adjustment methods are from the EPA/NOMAD 2014 ICI Combustion Tool. Residential emission factors and methods are from EPA/NOMAD 2014 residential non-wood heating calculations.
Combustion, Wood	Industrial and commercial emission factors and calculation methodology were taken from the 2014 EPA/NOMAD ICI Combustion Tool. Residential wood combustion estimates are from the 2014 EPA/NOMAD Residential Wood Combustion Tool.
Construction, Buildings	Calculation methods and emission factors are from 2014 EPA/NOMAD methodology.
Construction, Roads	Calculation methods and emission factors are from 2014 EPA/NOMAD methodology.
Fertilizer Application	Calculation methods and emission factors are from 2014 EPA/NOMAD methodology.
Fires - Forest, Wild, and Prescribed	Fire emissions were calculated by EPA based on 2014 activity data submitted by Utah.
Fires, Structural	EIIP, Vol. III, (1/27/99 edition), Chapter 18, “Structure Fires”
Fires, Vehicle	EIIP, Vol. III, (5/15/00 edition), “Area Source Category Method Abstract - Vehicle Fires”

Fuel Distribution	For portable fuel container, bulk plant, and pipeline emissions, calculation methods and emission factors are from 2014 EPA/NOMAD methodology. All other categories are calculated using EIIP, Vol. III, Chapter 11, "Gasoline Marketing (Stage I and Stage II);" AP-42, Chapter 5.2, "Transportation and Marketing Of Petroleum Liquids;" and "Procedures For The Preparation Of Emission Inventories For Carbon Dioxide and Precursors Of Ozone"
Human Perspiration, Human Respiration, and Cigarette Smoking	"Development of the Ammonia Emission Inventory for the Southern California Air Quality Study," Radian Corp, Appendix G
Landfills	Landfill emission factors were calculated based on inventoried point source landfills emissions per ton of waste accepted in 2014, then projected to other landfills based on the waste accepted by the landfills in each county.
Leaking Underground Storage Tanks	EIIP, Vol. III, "Area Source Category Method Abstract-Remediation of Leaking Underground Storage Tanks"
Mining & Quarrying	Overall emission calculation methodology and emission factors are from EPA/NOMAD but adjusted for local factors based on consultation with UDAQ compliance inspectors.
Non-road Aircraft Maintenance	UDAQ's 1992 phone survey of aircraft maintenance staff in Salt Lake County
Oil and Gas	Data is based on the 2014 NEI v2 which contains a combination of 2014 emissions inventories submitted to UDAQ by various sources in the Uintah Basin, 2006 WRAP Inventory projected based on the change in drilling and production activity data, and estimates from the 2014 EPA/NOMAD oil and gas tool.
Open Burning	Calculation method and emission factors are from 2014 EPA/NOMAD calculations.
Pesticide Applications	Calculation method and emission factors are from 2014 EPA/NOMAD calculations.
Sewer Treatment Plants & etc.	Calculation method and emission factors are from 2014 EPA/NOMAD calculations.
Solvent, Cleaning & Degreasing	Emission factors and methodology are from the EPA/NOMAD Solvent Tool
Solvent, Consumer Use	Emission factors and methodology are from the EPA/NOMAD Solvent Tool

Solvent, Dry Cleaning	Emission factors and overall methodology are from the 2014 EPA/NOMAD Solvent Tool.
Solvent, Graphic Arts	Overall methodology is from the EPA/NOMAD Solvent Tool. VOC emission factor was changed to 201 lb/employee on 3/7/12 as result of ERTAC/Utah/Industry collaboration.
Surface Coatings, Architectural	Emission factors and methodology are from the EPA/NOMAD Solvent Tool
Surface Coatings, Industrial	Emission factors and methodology are from the EPA/NOMAD Solvent Tool
Surface Coatings, Traffic Markings	Emission factors and methodology are from the EPA/NOMAD Solvent Tool
Tank Cleaning	AP42, Chapter 4.8, "Tank and Drum Cleaning," (2/80 ed.)
Unpaved Roads	Emission factors and overall methodology are from the 2014 EPA/NOMAD calculations.

Table 1: Area Source Emissions Calculation Methods

C. Sources of Activity Level Information

Sources of activity level information will be identified for each area source category. The EIIP guidance documents will be used to identify the appropriate source of information for each category, whenever possible. Activity level information will be requested from sources such as Departments of Transportation, State Tax Commissions, State Data Centers, State Offices of Planning and Budget, State Energy Commissions, federal agencies such as the U.S. Census Bureau, county and local government agencies, airports, natural gas suppliers, and local trade associations.

D. Emission Apportionment for Partial Counties within the Domain

The perimeter of the modeling domain will bisect many counties in a total of six states. Emissions data from these counties will be obtained from the NEI. Since the domain is so large and its boundaries so far removed from the actual areas of nonattainment, there will be no effort made to parse these emissions into the representative portions of each county.

Within the modeling domain, the boundaries of Utah's three $PM_{2.5}$ nonattainment areas bisect five different counties. Utah typically tabulates emissions from area sources on a county-by-county basis. All of the county-wide data will be entered into the air model where it will then be associated with a geographic location (grid cell). Utah will use a GIS description for the nonattainment areas in order to retrieve the emissions data belonging to each area after it has been gridded into the model. Utah will include the original county-by-county information in the Technical Support Document.

E. Projection of Area Source Emissions

The growth factors that will be used for the area source projections are contained in Table 2.

TABLE 2
GROWTH FACTORS FOR PROJECTING EMISSIONS OF AREA SOURCE CATEGORIES

Source Category	Growth Factors	Information Sources
Agricultural Burning, Harvesting, Tilling, Livestock, Fertilizer Application, Pesticide Application (Agricultural)	Agricultural employment growth rate	Utah Governor's Office of Management & Budget; National Agricultural Statistics Service (NASS); and local agriculture extension offices
Solvent Cleaning and Degreasing, Industrial Surface Coatings, Wood Furniture Surface Coatings	Manufacturing employment growth rate	Utah Governor's Office of Management & Budget
Solvent Graphic Arts	Graphic arts employment growth rate with adjustments based on manufacturing employment	Utah Governor's Office of Management & Budget
Domestic Animals, Backyard Barbecues, Commercial Cooking, Building Construction, Cremation, Structure and Vehicle Fires, Human Respiration and etc., Landfills, Open Burning, Pesticide Application (consumer), Sewer Treatment, Solvent Consumer Use, Solvent Dry Cleaning, Architectural Coatings, Auto Body Refinishing, High Performance Maintenance Coatings, Other Industrial Surface Coatings, Tank Cleaning	Human population growth rate; Forecast based on all resources available to the state's primary growth planning agency	Utah Governor's Office of Management & Budget
Coal, Kerosene, LPG, Natural Gas, Oil, and Wood Combustion and Fuel Distribution	Energy consumption forcasts	EIA and ITD

Asphalt Paving, Road Construction, Traffic Markings	Growth in VMTs	UDOT, CMPOs UDAQ,
Wild Animals	Forecast of historic trends combined with Department of Natural Resources goals and state-level data allocated to counties based on surrogates	Utah Department of Natural Resources, Division of Wildlife Resources website; and the Carnegie Mellon University NH3 model (Strader, et al., 2004)
Biogenic Decay in Soils	No growth; Fixed to total land area and current natural distribution of foliage	Land area mapping, Global Information Systems (GIS)
Forest and Range Fires	Forecast of average acres burned during previous years	Utah Department of Natural Resources, Division of Forestry, Fire & State Lands; US Bureau of Land Management
Leaking Underground Storage Tanks	Forecast of average projects from previous years	Utah Department of Environmental Quality, Division of Environmental Response and Remediation
Mining and Quarrying	Mining employment growth rates	Utah Governor's Office of Planning & Budget website
Non-road Aircraft Engine Maintenance	Estimates of projected aircraft operations used in conjunction with the UDAQ aircraft maintenance survey information	FAA Aerospace Forecast
Oil and Gas	Production growth rates	EIA
Unpaved Roads	No growth	VMT per functional length from a 2008 NMIM run. Unpaved road VMT estimates were derived from FHWA Table HM-67 (last published in 1996).

V. ON-ROAD MOBILE INVENTORY DATA COLLECTION

The following acronyms are used throughout the following section:

- AADT – Average Annual Daily Traffic
- CMPO - Cache Metropolitan Planning Organization
- EPA – Environmental Protection Agency
- FHWA - Federal Highway Administration
- FTA - Federal Transit Administration
- HPMS – Highway Performance Monitoring System
- IDEQ – Idaho Department of Environmental Quality
- MAG - Mountainland Association of Government
- MOVEs - Motor Vehicle Emissions Simulator
- MPO - Metropolitan Planning Organization
- NEI - National Emissions Inventory
- OTAQ – EPA's Office of Transportation and Air Quality
- TSD – Technical Support Document
- UDAQ - Utah Division of Air Quality
- UDMV – Utah Department of Motor Vehicles
- UDOT - Utah Department of Transportation
- UTA - Utah Transit Authority
- WFRC - Wasatch Front Regional Council

On-road mobile source emissions include vehicles that travel on paved roads that produce exhaust, evaporative, and road dust emissions. The Motor Vehicle Emissions Simulator (MOVES2014b) is the EPA designated model for on-road mobile exhaust and evaporative emissions. The on-road mobile inventory will be compiled using MOVES according to the document "MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity" (November 2015). EPA AP-42 Chapter 13, "Miscellaneous Sources", Section 13.2.1, "Paved Roads" (January 2011) will be used to calculate on-road PM_{10} and $PM_{2.5}$ dust emissions.

The pollutants to be inventoried include Ammonia (NH3), Benzene, Carbon Monoxide(CO), Chloride, Methane, Nitrogen Oxide(NO), Oxides of Nitrogen (NOx), $PM_{2.5}$ (Elemental Carbon, Organic Carbon, Sulfate Particulate), $PM_{2.5}$ & PM_{10} (Primary Exhaust, Brake, & Tire), Sulfur Dioxide (SO2), Toluene, Non-methane Hydrocarbons, Total Gaseous Hydrocarbons, Total Organic Gases, Volatile Organic Compounds, Xylene, and $PM_{2.5}$ & PM_{10} road dust.

A. Agency Responsibilities

The following agencies are responsible for on-road mobile source emissions

- Cache MPO (CMPO): Cache County
- Wasatch Front Regional Council (WFRC): Box Elder, Davis, Salt Lake, Tooele, and Weber Counties
- Mountainland Association of Governments (MAG): Utah County
- Utah Division of Air Quality: 22 rural attainment counties within Utah
- Idaho Department of Environmental Quality: Franklin County

B. MOVES Methodology

The state of Utah will adjust the MOVES2014b to allow for separate local road facilities. The EPA Office of Transportation and Air Quality has approved this modification (OTAQ email dated 5/10/10 Local Road

Question). A demonstration of this method was shared with EPA Region 8 (EPA R8 email date 5/10/17 Modified MOVES DB). This method has been employed in Utah for air quality analysis, SIP, and transportation conformity purposes since 2008. Utah Division of Air Quality (UDAQ) has worked closely with OTAQ to make adjustments to MOVES beginning with the draft release of MOVES in 2009.

i. Baseline and Projection

The baseline year and projection year inventories for the seven non-attainment counties will be compiled through the Interagency Consultation Team following consultation procedures detailed in Section XII of the Utah Transportation Conformity Consultation SIP. The interagency consultation team is primarily used to discuss and decide what MOVES modeling inputs should be used with the SIP modeling domain. The interagency consultation team includes representatives from EPA, Federal Highway Administration \Federal Transit Authority, Utah Department of Transportation, Utah Transit Authority, Wasatch Front Regional Council (WFRC), Mountainland Association of Governments (MAG), Cache MPO, and Utah Division of Air Quality.

On-road mobile source baseline and projection emission inventories will be prepared for an average winter weekday, Saturday, Sunday based on average hourly temperatures and relative humidity from the three episodes: 2011 January 1-12, 2013 December 7-19, and 2016 February 1-17. Vehicle Miles Traveled (VMT) will be measured as an average winter weekday, Saturday, and Sunday. This baseline and projection modeling process will involve over 261 hours of runtime (11 days).

The MPOs will be providing urban maintenance area on-road mobile source inventories and UDAQ will provide inventories for the remaining 22 rural attainment counties in Utah. The baseline and projection TSD will indicate what specific local planning assumptions were used.

Age Distribution, AVFT, and sourcetype population – The MPOs and UDAQ will use UDMV data to construct county specific age distribution values, AVFT fraction, and sourcetype population counts for light duty vehicle types.

Average Speeds, VMT, and Ramp Fractions – MPOs will use county specific projected average speeds, VMT distributions, and ramp fractions based on their federally approved Travel Demand Models. UDAQ for the rural areas will project county specific historical HPMS AADT VMT from 1996-2017 utilizing linear regression and curvilinear fit methods. Speed data will be calculated using 2017 UDOT lane miles using the Highway Capacity Manual method. UDAQ will use default ramp fractions.

Fuel Data –EPA Office of Transportation and Air Quality (OTAQ) will provide gasoline sulfur levels for 2017 at 20.9 parts per million. The gasoline sulfur data reflects more accurate gasoline produced by the five refineries along the Wasatch Front and the Sinclair, Wyoming refinery. MOVES 2014b default fuel parameters will be used for projection years 2026 and 2035. The default gasoline sulfur level for 2026 and 2035 will be set at 10 parts per million.

Inspection and Maintenance (I/M) Programs – UDAQ will construct and provide the MPOs with county specific I/M program details. The compliance factor will be calculated utilizing 2017 EPA I/M reports from the Counties Health Departments (Davis,Cache, Salt Lake, Utah, Weber). Inputs will include detailed program test procedures, model year coverage, failure rate, waiver rate, and regulatory class coverage .

Meteorology – The average of all the hourly temperatures and relative humidity readings over the three episodes for each representative weather station was used to reflect the atmospheric conditions that represent the $PM_{2.5}$ season: 2011 January 1-12, 2013 December 7-19, and 2016 February 1-17. The

UDAQ Technical Analysis Section provided meteorological conditions from Meso West University of Utah from weather stations in Box Elder, Cache, Davis, Salt Lake, Tooele, Utah, and Weber counties. The rural counties will be utilizing the temperature profile from Salt Lake County.

Road Type Distribution – MPOs and UDAQ will construct county specific VMT travel fractions for FHWA vehicle classes grouped by Gross Vehicle Weight Rating (GVWR) ranges provided by the UDOT Division of Systems and Planning and Programming.

Conformity Budgets – The motor vehicle emissions budget (MVEB) will be established for the last year of each maintenance plan for the year 2035 for Direct PM2.5, NOx, and VOC emissions. EPA's conformity regulation (40 CFR 93.118(b)(2)) requires that the last year of the maintenance plan to be used as a MVEB. Intermediate MVEB years can be established within the maintenance plans but are not required. The 2026 analysis years will not be a MVEB year but will consist of a qualitative finding that there are no factors which would cause or contribute to a new violation or exacerbate an existing violation in the years before the last year of the maintenance plan.

MPOs will be constructing a transportation conformity budget for 2035 and UDAQ will be adding a safety margin that will quantify explicitly the amount by which motor vehicle emissions could be higher while demonstrating compliance with the maintenance plan requirements. EPA's conformity regulation (40 CFR 93.124(a)) allows the implementation plan to quantify explicitly the amount by which motor vehicle emissions could be higher while still demonstrating compliance with the maintenance requirement. These additional emissions that can be allocated to the applicable MVEB are considered the "safety margin." As defined in 40 CFR 93.101, safety margin represents the amount of emissions by which the total projected emissions from all sources of a given pollutant are less than the total emissions that would satisfy the applicable requirement for demonstrating maintenance. The implementation plan can then allocate some or all of this "safety margin" to the applicable MVEBs for transportation conformity purposes.

UDAQ will establish a trading ratio mechanism to be established for the MVEBs defined within the SIP. The trading ratio logic would be constructed to allow for future increases in on-road direct PM2.5 emissions to be offset by future decreases in plan precursor emissions from on-road mobile sources at appropriate ratios established by the air quality model and documented within the TSD. EPA's conformity regulation (40 CFR 93.124(b)) allows for the trading among budgets allocated to the MVEBs as long as the SIP includes the trading mechanism for such trades. The trading ratio logic would allow future increases in onroad direct PM2.5 emissions to be offset with future decreases in NOx\VOC emissions from on-road mobile sources.

WFRC will prepare a MVEB adjustment in 2035 that will exclude portions of Box Elder and Tooele Counties that extend beyond the Salt Lake PM2.5 maintenance area boundary. WFRC will include a section in the TSD that covers how the MVEBs were derived with annotations appropriately documented within the SIP.

C. AP-42 Road Dust Methodology

EPA's MOVES2014b was used to calculate mobile source emissions, and road dust projections were calculated using the January 2011 update to AP-42 Method for Estimating Re-Entrained Road Dust from Paved Roads (Chapter 13, released 76 FR 6329 February 4, 2011), where a 93% reduction was applied to the emission factor. This reduction was based on a comparison of modeled and measured crustal material, which indicated an overestimation in paved road dust emissions. The latter account for most of crustal material emissions. UDAQ will prepare the paved road dust inventory for all 29 counties for the episodic, baseline, and projection inventories.

Baseline and Projection
On-road mobile source baseline and projection emission inventories will be prepared for an average winter weekday, Saturday, Sunday.

VMT – MPOs will use county specific projected VMT distributions based on their federally approved Travel Demand Models. UDAQ for the rural areas will project county specific historical HPMS AADT VMT utilizing linear regression and curvilinear fit methods.

Meteorological – Include all hours per day with precipitation greater than or equal to 0.01 inch by county from all episode days from a representative weather station in each county.

D. Idaho Methodology

Because the northern portion of the Logan, UT-ID $PM_{2.5}$ nonattainment area overlays part of Franklin County, Idaho, the Idaho Department of Environmental Quality will contribute its own emissions calculations and Motor Vehicle Emissions Budgets for the on-road mobile source portion of the inventory for Franklin County and the surrounding area.

TABLE 3
DATA SOURCES

MOVES Input Parameter	Data Source
Meteorology	MesoWest
Ramp Fractions	MPO, MOVES Default
Road Type Distribution	MPO, UDOT
Vehicle Type VMT	MPO, UDOT, UDAQ
I/M Programs	Cache, Davis, Salt Lake, Utah, and Weber County Health Departments; Currently no I/M programs in other counties.
Age Distribution/Source Type Population/AVFT	UDMV
Average Speed Distribution	MPO, UDOT, FHWA EMIT Model
Fuel Supply/Fuel Formulation	MOVES Fuel Database

VI. NON-ROAD MOBILE INVENTORY DATA COLLECTION

A. Non-road Mobile Source Categories

Non-road mobile sources include emissions from a) non-road motorized vehicles and equipment (MOVES2014b), b) aircraft, c) airport ground support equipment and d) diesel locomotives.

The modeling domain in Utah for the base year and projection year inventories will be the entire state. Data will be collected for each county.

MOVES2014b
EPA updated the entire database of non-road vehicle and equipment base year populations and growth rates in MOVES2014b.

Source categories in MOVES2014b include the following:

- Agricultural
- Airport Ground Support Equipment
- Commercial
- Construction
- Industrial
- Lawn and garden
- Logging
- Marine
- Oil Field (misc. equipment)
- Railroad (misc. equipment)
- Recreational
- Underground Mining

Aircraft
Aircraft operational groups include:

Air Carriers or Commercial Aircraft
Air Taxi Aircraft
General Aviation Aircraft
Military Aircraft

Air carrier or commercial aircraft include the large, well-known airlines and aircraft such as American, Delta, United, etc. These operate on jet fuel (Jet A or Jet A-1).

Air taxi aircraft are mostly small private or corporate and operate on jet fuel or aviation gas.
General aviation aircraft are located at all municipal airports and use small aircraft as well, operating on jet fuel or aviation gas. The aircraft used at these airports are called "based" aircraft. Some of these airports also have helicopter operations.

Military aircraft are located at some municipal airports. These are made up of a variety of specialized aircraft and operate mostly on JP-8 jet fuel (and less commonly, aviation gas).

There are about 50 major municipal airports in Utah. Only about 10 of these have commercial operations.

In addition, there are 96 very small airports which are mostly "heliports". However, inventory staff could not find any data about the specific makes and models of aircraft or helicopters for these. (Neither the Federal Aviation Administration (FAA) "Total Area Forecast" (TAF) database nor the FAA "Airport Master Records" include any information about this (see C.2 below, "Sources of Aircraft Activity").

Airport Ground Support Equipment (GSE)

Airport GSE emissions are automatically calculated as emissions separate from aircraft emissions when the Federal Aviation Administration (FAA) software model "Emissions and Dispersion Modeling System" (EDMS 5.1.4.1) is run.

EDMS has been replaced by the new FAA "Aviation Environmental Design Tool (AEDT) model (see. https://aedt.faa.gov/. Inventory staff could not find anything on-line that requires AEDT to be used for SIP inventories. This document does not discuss the use of AEDT. The AEDT website includes free training (videos, presentations and exercises).

Railroad Diesel Locomotives

Diesel locomotives are grouped into three classes: line-haul (freight locomotives covering long distances), commuter locomotives, and yard or switch locomotives operating in railroad yards.

Railroad companies should report line-haul separately from yard or switch locomotives because emission factors (EF) for these are different.

B. Time Scale of Non-road Inventories

For these SIP inventories, staff must capture emissions for a January winter day if possible. However, final units for the non-road mobile inventory must be **tons per year**. This has been discussed with the Technical Analysis Section.

NONROAD motorized vehicles and equipment (MOVES2014b):

Base and projection year non-road emissions (MOVES) will be run for a weekday and a weekend day. See "Calculations" (D) below.

Aircraft: Commercial aircraft activity will be modeled for the month of January 2017. It is not possible to obtain daily aircraft activity. For the smaller aircraft (air taxi, general aviation and military), activity data is available for annual activity only. See "Calculations" (D) below.

Airport Ground Support Equipment: When each aircraft make and model is entered into the FAA EDMS model, output includes not only aircraft emissions but associated aircraft ground support equipment emissions.

Diesel Locomotives: Locomotive activity will be modeled on an annual time scale because data from railroad companies only reports annual activity (annual diesel locomotive fuel consumption by county).

C. Sources of Non-road Emission Inventory Data

1. Non-road Motorized Vehicles & Equipment: EPA MOVES2014b Emissions Model

Pollutants

In addition to the usual pollutants, the following will be modeled:

CH4, CO2, NH3, non-methane hydrocarbons (NMHC), total gaseous hydrocarbons (TGH), total organic gases (TOG), benzene, toluene and xylenes.

MOVES includes a national database with over 200 tables. The data in these tables are called "default" values. The user should use local data--not defaults--as much as possible to improve accuracy. The

following tables of default data were replaced with local data:

Fuel Formulation and Fuel Supply: In 2017, gasoline sulfur content will be set to 30 ppm because most gasoline serving Utah will still be Tier II. In 2026 and 2035, (Tier III) gasoline sulfur content will be set to 10 ppm. Virtually all gasoline used in Utah comes from local refiners. Governor Herbert has received commitments from all local refiners to produce Tier III gasoline--if not by 2020, then certainly by 2026. For all other fuels (non-road diesel, marine diesel, CNG (compressed natural gas) and LPG (liquid petroleum gas--a mixture of propane and butane), MOVES default values were used. Diesel sulfur content is generally 15 ppm or lower for all modeled years with the exception of marine diesel, whose sulfur content is 56 ppm in 2017, and 15 ppm in 2026 and 2035.

Meteorological Data (Zonemonthour table): Default temperature and relative humidity data were replaced with local data. Specifically, local data was input for Box Elder, Cache, Davis, Salt Lake, Tooele, Utah and Weber Counties, which was decided by the Technical Analysis Section.

Snowmobiles
The MOVES2014b database includes snowmobiles. There are base year (1990) snowmobile populations and annual growth rates.

The UT Tax Commission posts snowmobile populations by county on its website at https://tax.utah.gov/. Click on Useful Information\Economics & Statistics\Motor Vehicle Statistics\Vehicle Registrations - Recent\.

However, snowmobile populations in MOVES disagree with Tax Commission data. Snowmobile default data has been replaced with local data obtained from surveys. Survey data showed marked differences from default data for the following parameters:

a) Allocation of snowmobiles by county;
b) Base year and projection year populations:
c) Months of activity

Refer to the Technical Support Document for details on changing the snowmobile profiles in MOVES.

Other Non-road Vehicles & Equipment (MOVES)
In-depth nonroad source surveys are not planned. If, as the inventory is compiled, it appears that a given non-road source is significant, additional research may be warranted to refine activity data for that source.

2. Sources of Aircraft Activity (Number of Landing and Takeoff Cycles--LTOs)

Definitions
Aircraft *activity* means either 1) number of separate landings and takeoffs or 2) number of landing/takeoff cycles (LTO).

One *operation* = one landing = one takeoff

One *LTO* = one landing and takeoff pair (one cycle)

1 LTO = one landing and takeoff cycle = 2 operations

Aircraft group means any of the following:

Commercial
Air Taxi
General Aviation
Military

Aircraft type means the specific make and model of aircraft, e.g., Boeing 737-400.

In the aircraft emissions model, the Federal Aviation Administration (FAA) "Emissions Dispersion and Modeling System" (EDMS v. 5.1.4.1), the user enters activity in units of LTOs--number of landing and takeoff cycles.

All aircraft activity, regardless of source of data, is given in units of number of operations (either per month or per year).

Therefore, the number of operations reported must be divided by two to obtain the number of LTOs.

(If the new aviation model, the FAA "Aviation Environmental Design Tool" (AEDT) is used, the user should enter aircraft activity in units of operations.)

Pollutants
The usual pollutants were modeled. No emission factors (EF) could be found for aircraft NH3.

Commercial Aircraft Activity
Commercial aircraft activity (number of operations) is found on the U.S. DOT Bureau of Transportation Statistics (BTS) "Transtats" website at (http://www.transtats.bts.gov/). Choose "Aviation". International flights should be included. Download and save the file in .csv or EXCEL. The user should download the activity--the number of operations--for the winter month being modeled. For this SIP, this would be January 2017.

The downloaded file contains the following key information:

Aircraft type (specific make and model), designated by a unique 2- or 3-digit code;
Origin and destination city names;
Departures performed (the number of operations during the given month)

NOTE: All commercial aircraft operations--separate landings and takeoffs--are found under the heading "Departures Performed". These include arrivals as well (i.e., there is not a separate column for arrivals). The total number of departures equals the total number of operations.

Air Taxi, General Aviation and Military Aircraft Activity
Sources of activity for these aircraft groups are 1) Federal Aviation Administration (FAA) "Terminal Area Forecast" (TAF) and/or 2) FAA "Airport Master Records".

Activity from these sources is reported in units of annual operations.

FAA Terminal Area Forecast Database
For most airports, small aircraft (air taxi, general aviation and military aircraft) activity is found on the following website: FAA Terminal Area Forecast (TAF) at ttps://www.faa.gov/data_research/aviation/taf/.

Units of activity are aircraft operations per year.

On this web page, download the zip file under the menu item "Current TAF Data". The zip file contains 5 workbooks, but only 2 of them are needed: 1) Aircraft Operations.xlsx and 2) Airports.xlsx.

FAA Airport Master Records

Several municipal airports are not listed in the FAA Terminal Area Forecast (TAF) database. For example, Bountiful (Skypark), Dutch John, Fillmore, Huntington, Morgan and others are not listed.

If the airport is not listed in the FAA TAF database, there is an "Airport Master Record" for the airport. These records are found on the "Airport IQ 5010: Airport Master Records" URL at http://www.gcr1.com/5010web/.

Some airports are found in the TAF database AND the Airport IQ 5010 database (FAA Airport Master Records). If an airport has *both* a TAF and an Airport Master Record, use the TAF data.

Some of the Airport Master Records are not kept current. For example, the record for Bountiful Airport shows, under "Operations for 12 Months Ending", a date (in this case, the date is 01/01/2012). If the airport is not in the TAF database and the Airport Master Record is not current to the base year, a *scaling factor* must be applied to adjust the number of operations to the base year.

FAA Scaling Factors

The U.S. DOT FAA website "FAA Aerospace Forecasts" shows "FY 2018 - 2038 Forecast Tables". Choose "Operations, Tables 32 - 34" (EXCEL) and save. Table 32, "Total Combined Aircraft Operations", shows numbers of operations in thousands for commercial, air taxi, general aviation and military aircraft for a number of historical and projection years. Using these data, one can adjust the number of operations to the base year. See https://www.faa.gov/data_research/aviation/aerospace_forecasts/.

Aircraft Types for Air Taxi, General Aviation and Military Operations

Commercial: Commercial *aircraft types* operated during the base year 2017 are found in the downloaded file from the Bureau of Transportation Statistics "Transtats" website.

Air Taxi, General Aviation and Military: Neither the TAF db nor the FAA Airport Master Records contains information about the specific *aircraft type*s used in air taxi, general aviation or military operations. Instead, the UDOT Division of Aeronautics tracks aircraft types used for these operations. Discussion with Jared Esselman, Director of Aeronautics (jesselman@utah.gov or 801-715-2262), directed UDAQ to model specific aircraft makes and models for each aircraft group.

Refer to the aircraft workbooks (EXCEL) for details.

In addition, Utah has two military airports that submit their emissions inventories to UDAQ each year: Hill Air Force Base (Davis County) and Michael Army Air Field (Dugway Proving Ground)--Tooele County. Aircraft operations and emissions are reported in these inventories.

3. Airport Ground Support Equipment

Pollutants

The usual pollutants were modeled. No EFs could be found for NH3.

Airport ground support equipment (GSE) emissions can be calculated by both MOVES/NR and EDMS. Inventory staff believes that EDMS is more accurate than MOVES/NR in computing these emissions because EDMS takes into account the exact aircraft make, model and engine type and *automatically computes associated emissions from GSE for each aircraft*, whereas MOVES/NR uses default data.

When the EDMS model is run, output is produced separately for each aircraft and its associated GSE. Emissions units are tons per 1,000 LTOs (separately) for aircraft and GSE.

4. Diesel Locomotives

Pollutants
The usual pollutants were modeled including NH3.

Diesel locomotive activity is reported by railroad companies. Activity must be reported *separately* for line-haul and yard (switch) locomotives because emission factors (EF) are different for these. For each railroad, data must include, at a minimum, diesel locomotive fuel consumption by county and sulfur content.

Reporting of additional data such as ton-miles, tier level and/or model year of locomotives and number of line-haul and yard locomotives is helpful to serve as a check on fuel consumption.

D. Methods of Calculation

The methods of calculating the non-road mobile source categories have been identified and are listed in Table 4.

TABLE 4
NON-ROAD EMISSION CALCULATION METHODS

CATEGORY	METHOD
Non-road Motorized Vehicles & Equipment (MOVES2014b)	In the MOVES GUI, the user must set the scale of inputs. INPUTS Under "Scale", choose "nonroad" and "national". Under "Time Spans", choose year or projection year, month (January), and "weekday" and "weekend day". Under "Output Emissions", output units are "24-Hour Day" and CANNOT be changed when user is in non-road national scale. Output will be one large file. In the column "dayID", the first group of rows will display a "5" under "dayID", which indicates a weekday with units of Grams per Weekday. The second group of rows will, under "dayID", display a "2", which denotes a weekend day with units of Grams per Weekend Day. The user must convert the output units to "daily" by writing a script in MySQL which encodes the following equation: Grams per Day (daily) = [(5*weekday) + (2*weekend day)]/7

	Final units for a SIP inventory should be TPY, as agreed upon with the Technical Analysis Section. To convert from "Grams per Day" to TPY, use the following equation (can be done in MySQL or EXCEL): (Gm/Day)*(Days per Month)*{(365.25 Da/Yr)/(31 Days/Month of January)} = Gm/Yr TPY = (Gm/Yr)*(1 lb/453.59 Gm)*(1 Ton/2000 lb)
Aircraft and Airport GSE	The FAA EDMS 5.1.4.1 software model is used to obtain both aircraft and airport ground support equipment (GSE) emissions. The user should set up both the INPUT and OUTPUT units as follows: Always enter "1,000" in the field "Number of LTOs". REMEMBER: One landing and takeoff cycle (one LTO) equals two operations. Thus one takeoff is one operation, one landing is one operation, and one landing and takeoff equals one LTO. OUTPUT units will be tons per 1,0000 LTO. In the EXCEL workbook, the emission factor is entered for each pollutant in units of tons per 1,000 LTOs. A separate worksheet has been created for each aircraft operational type: Commercial, Air Taxi, General Aviation, and Military. <u>Commercial Aircraft</u> The user should have already downloaded the commercial aircraft activity for the month of January 2017 only --not the entire year. LTOs/Year = (January number of LTOs)*(365.25/31) $TPY = \{\frac{(LTOs/Year)*(Tons/1{,}000\ LTOs)}{1{,}000}\}$ <u>Air Taxi, General Aviation and Military Aircraft</u> Activity for these come from the FAA "Terminal Area Forecast" (TAF) database. Units are operations per year. If an airport is not listed in the TAF db, go to the FAA "Airport Master Record" for that airport. Activity will be shown in units of operations per year. $LTOs/Year = \frac{(Operations/Year)}{2}$ $TPY = \{\frac{(LTOs/Year)*(Tons/1{,}000\ LTOs)}{1{,}000}\}$ <u>Airport Ground Support Equipment</u>

	When the user chooses a particular make and model of aircraft (e.g., Boeing 737-400) and enters "1,000" in the field "Number of LTOs", separate output will automatically be displayed for both the aircraft and the associated airport GSE. Output units for each are Tons/1,000 LTOs. Note that the magnitude of emissions from GSE is much smaller than from the aircraft. Hill Air Force Base and Michael Air Army Field (Dugway Proving Ground) each submit their military aircraft inventories in units of tons per year.
Diesel Locomotives Diesel Locomotives (cont.)	Use the EPA document below to obtain emission factors (EF) for CO, NOx, PM10 and PM2.5 exhaust, SO2 and VOC. Use, for NOx, PM10 and HC, the tables by applying the EF for the calendar year being modeled. EPA Office of Transportation and Air Quality, Emission Factors for Locomotives", EPA-420-F-09-025, April 2009, https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100500B.pdf Read document CAREFULLY: for example, the EF for PM2.5 exhaust is 0.97 * PM10 EF. Also, use the conversion factor in the doc to obtain VOC from HC. For ammonia, see the document "Locomotive Emission Inventories for the United States from ERTAC Rail" (mbergin.pdf), p. 5 of 23. The EF is 0.0833 gm/gal. https://www3.epa.gov/ttnchie1/conference/ei20/session8/mbergin.pdf

EXCEL Workbooks

Separate workbooks exist for aircraft and airport ground support equipment (GSE) emissions, each containing the emission factors for the most commonly found aircraft and associated GSE in units of tons per 1,000 LTOs. The user merely needs to enter the annualized number of LTOs, and the workbook automatically calculates emissions in units of TPY.

E. Spatial Allocation of Non-road Emissions

1. Non-road Mobile Sources from MOVES2014b Model

Spatial allocation of non-road mobile sources from MOVES within partial counties will be determined using county FIPs codes. Each source category is spatially allocated more precisely by the Technical Analysis Section.

2. Aircraft and Airport Ground Support Equipment Activity

The activity and emissions at each airport are assigned to the GIS grid square(s) that contain(s) the location of the airport. Airport ground support equipment emissions will be presumed to occur on or very near the airport property so these emissions are effectively located at the airport itself. Precise spatial allocation is handled by Technical Analysis.

SCC Code for Airport GSE: The SCC code used for this in the SMOKE formats is 2270-00-8005. Strictly speaking, airport GSE emissions may come from gasoline, diesel, CNG or LPG-fueled equipment, but EDMS does not specify the fuel type. The majority of GSE is diesel-fueled, so the SCC code above (2270) denotes diesel.

3. Diesel Locomotive Activity

Locomotive diesel activity is spatially allocated along the railroad network by Technical Analysis.

The CAMx model converts ton-per-year emissions into moles per hour for gaseous components and grams per hour for solid components.

F. Projection of Non-road Mobile Source Emissions

Table 5 indicates the growth factors and other factors that will be included in the non-road mobile source projection inventories.

TABLE 5
GROWTH INDICATORS FOR PROJECTING EMISSIONS OF NON-ROAD SOURCE CATEGORIES

Source Category	Growth Indicators	Information Sources
Diesel Locomotives	Diesel fuel consumption projections obtained from: Commuter Railroads (AMTRAK, UTA Front Runner): AMTRAK, "AMTRAK Fleet Strategy, version 3.1", March 2012, http://www.amtrak.com/ccurl/36/921/2012-Amtrak-Fleet-Strategy-v3.1-%2003-29-12.pdf Annual growth rate is 2.00%. Growth from 2017 to 2026: 1.195 Growth from 2017 to 2035: 1.428 Freight Railroads (Burlington Northern Santa Fe, Utah Railway, Salt Lake Garfield & Western, Union Pacific): National Petroleum Council: "Topic Paper #2: Rail Transportation Demand", https://www.npc.org/FTF_Topic_papers/2-Rail_Transportation_Demand.pdf Growth from 2017 to 2026: 1.089 Growth from 2017 to 2035: 1.178	AMTRAK and National Petroleum Council documents
Aircraft flights (Aircraft GSE emissions are generated from the EDMS model along	Federal Aviation Administration, http://www.faa.gov, Data and Research\Aviation Forecasts\Aerospace Forecasts\Additional Forecast Data\FY 2018 - 2038 Forecast Tables\Operations\Tables 32 - 34 (save	Federal Aviation Administration http://www.faa.gov/data_research/aviation/aerospace_forecasts/

with aircraft emissions.)	in EXCEL); Table 32: "Total Combined Aircraft Operations". Commercial Aircraft Growth (LTOs) from 2017 - 2026: 1.308 Growth (LTOs) from 2017 - 2035: 1.537 Air Taxi Aircraft Growth from 2017 - 2026: 0.7743 Growth from 2017 - 2035: 0.8490 General Aviation Aircraft Growth from 2017 - 2026: 1.033 Growth from 2017 - 2035: 1.060 Military Aircraft Growth from 2017 - 2026: 1.000 Growth from 2017 - 2035: 1.000	
MOVES2014b Miscellaneous NR Vehicles & Equipment	User enters the calendar year to be modeled via GUI.	MOVES2014b default database (movesdb20180517)

G. Double-Counting Issues

1. Aircraft and airport ground support equipment emissions are part of the Non-Road Mobile Source inventory with the following exceptions:

For the military bases Hill Air Force Base (HAFB) and Michael Army Air Field (aka Dugway Proving Ground), airport ground support equipment (GSE) emissions, if any, will be reported in the Point Source inventory. GSE from HAFB is labeled "Aerospace Ground Equipment" (AGE) in its point source inventory.

2. Point Sources that Report Mobile Source Emissions

a. Several point source inventories include emissions from non-road mobile sources. For example, Rio Tinto (Kennecott Utah Copper) reports emissions from large mobile source equipment operating in the Bingham Mine. These mobile source emissions will be reported in the Point Source inventories.

b. Inventory staff recognizes that there may be very minor double-counting between point sources that report emissions from non-road mobile sources and emissions from MOVES/NR. However, there is no way for staff to determine the extent of this double-counting. Therefore, no adjustment will be made for this in emissions from MOVES/NR.