UTAH DIVISION OF AIR QUALITY

$PM_{2.5}$ EMISSION

INVENTORY PREPARATION

PLAN

June 22, 2017

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

I. INTRODUCTION

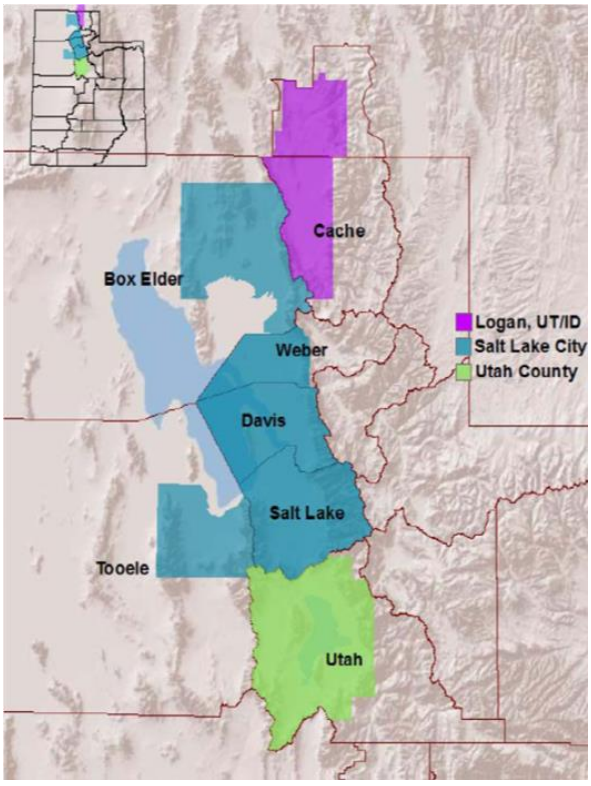
A. Purpose of Inventory

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 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 nonattainment areas is shown in Figure 1 below.

Figure 1



Utah's $PM_{2.5}$ Nonattainment Areas

(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).

$PM_{2.5}$ Nonattainment Areas are classified as either Moderate or Serious areas. All areas are initially classified as Moderate. Areas will be reclassified as Serious if, as of their attainment date, they are unable to monitor attainment using the three most recent years of air quality data.

All three of Utah's Moderate $PM_{2.5}$ nonattainment areas were found to be exceeding the 24-hour health standard as of their moderate area attainment date (December 31, 2015), and the EPA has proposed to reclassify each of the areas to Serious. Once reclassified, the Clean Air Act will require a new State Implementation Plan (SIP) for each area.

For this new State Implementation Plan, 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 the $PM_{2.5}$ SIPs.

II. SCOPE OF WORK

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

The inventories will support SIPs in the three nonattainment areas, 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. See the $PM_{2.5}$ SIP modeling protocol for information on how the domain was determined.

In some ways, these outlying areas will be inventoried at a lesser level of detail than the non-attainment areas.

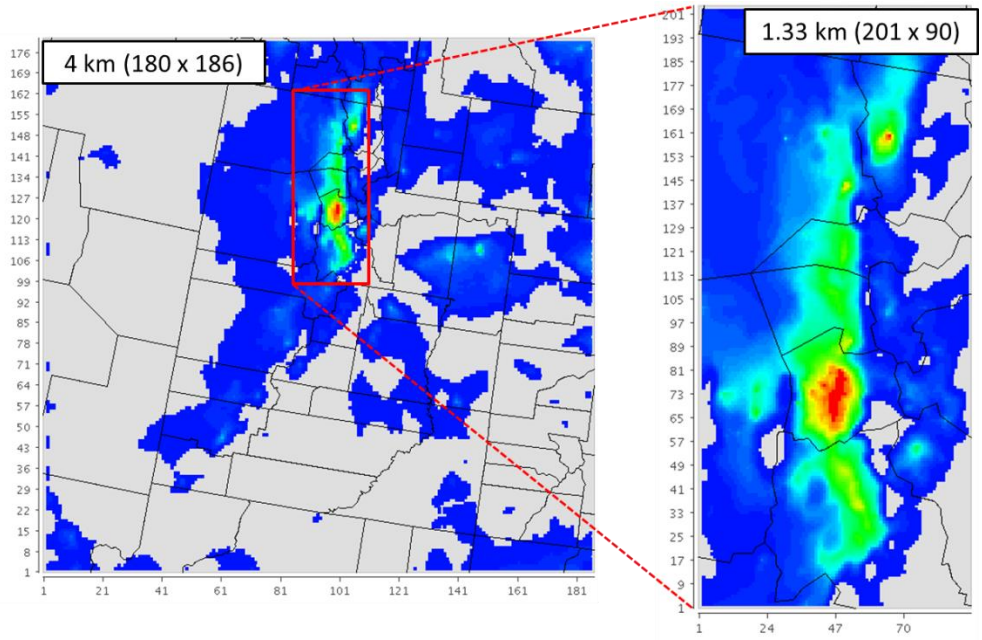
UDAQ will compile information directly for all areas of the state. By source category, this includes Point Sources, Area Sources, and Mobile Sources (both on-road and off).

By contrast, UDAQ will import National Emissions Inventory (NEI) data from the EPA's website to fill in the outlying areas in other states. .

Within each nonattainment area 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 these areas, while outside the threshold will be 100 tpy. On-road Mobile Source emissions will make use of Travel Demand Models in the nonattainment areas 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

$PM_{2.5}$ MODELING DOMAIN



The emission inventory will address all air pollution sources throughout the entire modeling domain as well as within the $PM_{2.5}$ non-attainment areas.

The broader modeling domain includes all three nonattainment areas, but includes the entire state of Utah and portions of Colorado, New Mexico, Arizona, Nevada, Idaho and Wyoming. A map of the area is shown in Figure 2.

Portions of Franklin County, Idaho, are included in the Logan UT/ID nonattainment area, and Idaho DEQ may provide portions of the inventory for areas in and around Franklin County. UDAQ will obtain emissions data for the bordering states from the NEI.

B. 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.

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

At least two episodes will be used to validate the model, each of which contains a number of consecutive days during which $PM_{2.5}$ emissions were the highest. For this SIP, emissions inventories for the following candidate episodes will be prepared:

Friday, December 31 through Tuesday, January 11, 2011

Saturday, December 7 through Thursday, December 19, 2013

Monday, February 1 through Tuesday, February 16, 2016

The base year for the inventory will be 2014. The episode that gives the best performance of the CAMX air model will determine the month and meteorological conditions that will be modeled in the base year inventory.

Projection year inventories will be modeled following EPA guidance. Projection years will include 2017, 2019 and 2020, and depending on the assignment of an attainment year, could also include 2023, 2024, and 2026. The month and meteorological conditions to be modeled for the projection year inventories will be identical those modeled in the base year.

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.

Emissions for the 2011 episode will be compiled as follows:

- Point source emissions will be represented as the actual emissions from the 2011 Tri-annual inventory. For a Serious $PM_{2.5}$ nonattainment area, the BACT threshold for point sources is 70 tpy, and this is the definition that will be applied to "point sources" within the three nonattainment areas. 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 SIP.

- 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.

- Non-road Mobile source emissions will be recalculated for the entire state, using MOVES 2014a, to account for episodic temperatures (etc.) that were not represented in the tri-annual 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.

- Emissions data from the bordering states will be obtained from the 2011 NEI.

Emissions for the 2016 episode will be compiled as follows:

- Point and Area sources will all be forecasted from the 2014 Tri-annual EI using the appropriate growth factors from the REMI model.

- Non-road Mobile source emissions will be recalculated for the entire state, using MOVES 2014a, to account for the actual episodic temperatures (etc.)

- On-road Mobile source emissions will use the following: UDOT 2011-2014 data grown out to 2016: Average Speed Distribution, VMT, and Road Type Distribution; I\M programs in consultation with the counties; Meteorological profiles from MesoWest.

- Emissions data from the bordering states will be obtained from the NEI, likely using the 2011~~2014~~ NEI data for each of the three epsodes.

Emissions for the 2013 episode will be compiled as follows:

- Larger point Sources will have submitted their actual emissions in an inventory for 2013, but emissions for the smaller Point Sources will be back-casted from the 2014 Tri-annual EI using the appropriate growth factors from the REMI model .

- Area sources will back-cast one year from the 2014 Tri-annual EI.

- Non-road Mobile source emissions will be recalculated for the entire state, using MOVES 2014a, to account for the actual episodic temperatures (etc.)

- On-road Mobile source emissions will use the following: UDOT 2013 data for Average Speed Distribution, VMT, and Road Type Distribution; I\M programs in consultation with the counties; Meteorological profiles from MesoWest.

- Again, the emissions data from the bordering states will be obtained from the NEI using the 2011 NEI data.

Base Year Inventory:

2014 has been selected to represent the Base year EI for the Serious Area SIPs. This inventory will represent the actual emissions for one of the three years used for re-classification (2013-2015) and will be central to the years ultimately selected to calculate the monitored design values for each of the ambient monitors referenced in the air quality modeling (potentially 2013-2017). In addition, 2014 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 Nonattainment Areas 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 $PM_{2.5}$ nonattainment areas 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 nonattainment areas, 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 and Area Source emissions will be represented as the actual emissions from the 2014 Tri-annual inventory. Within the three nonattainment areas, "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.

- On-road Mobile source emissions will be prepared by the MPOs for the urban non-attainment areas 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 model. The Technical Support Documentation will explain what specific local planning assumptions were used.

- Non-road Mobile source emissions will be recalculated for the entire state using the same episodic temperatures (etc.) described above.

- Again, the modelers (and possibly the Idaho DEQ) will fill in the surrounding regions with data from the NEI, however the base year and subsequent projection year inventories will utilize data for 2014.

Projection Year Inventories:

The following is a list of all the years for which a projection year emissions inventory will be prepared, ~~A~~as well as the role each year would play in the SIP. Each will be a projection of emissions reflecting changes due to growth and control, including those control measures required by the SIP. Note that some of these years may prove unnecessary depending on the assignment of the attainment year.

2017 1st Quantitative Milestone Year for the attainment plan submissions of these areas that were designated nonattainment for the 2006 NAAQS prior to January 15, 2015 (see 51.1013(a)(4))

2019 Year containing the statutory attainment date for the Serious Area SIPs Note that the attainment projected inventory for the nonattainment area shall be the most expeditious year for which projected emissions show modeled concentrations beneath the NAAQS.

Guidance presented in Section VI.E.5. of the new rule, "Future Year(s) To Be Modeled in Attainment Demonstrations," recommends looking at the year containing the statutory due date first and working backwards. It is actually quite possible in Utah's case that an extension of the attainment date would be needed. In either case, the guidance indicates that it is not necessary or reasonable to require states to model each and every year to determine the appropriate attainment date given the resource demands associated with modeling.

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)).

2020 2nd Quantitative Milestone Year for the attainment plan submissions of these areas that were designated nonattainment for the 2006 NAAQS prior to January 15, 2015 (see 51.1013(a)(4)) In addition, 2020 would represent an intermediate year within the 5-year span of a possible extension of the attainment date.

2023 Potentially the 3rd Quantitative Milestone Year for the attainment plan submissions of these areas that were designated nonattainment for the 2006 NAAQS prior to January 15, 2015 (see 51.1013(a)(4)) In addition, 2023 would represent an intermediate year within the 5-year span of a possible extension of the attainment date.

2024 The year preceding the maximum allowable extension of the attainment date Again, this would project changes in emissions due to growth and control, including those control measures required by the SIP. The subset of this EI that pertains to the geographic area within the Nonattainment Areas would represent the latest permissible "*Attainment projected inventory for the nonattainment area*" (see 51.1000 and 51.1008(b)(2)).

2026 Potentially the 4th Quantitative Milestone Year for the attainment plan submissions of these areas that were designated nonattainment for the 2006 NAAQS prior to January 15, 2015 (see 51.1013(a)(4)) This would represent the first milestone date that falls within the three year period following the latest permissible attainment date. As such it would be the final milestone date.

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

- Point and Area sources will all be forecasted from the 2014 Tri-annual EI using the appropriate growth factors from the REMI model and factoring in controls identified in the SIP (or otherwise required) at the appropriate points in time.

- On-road Mobile source emissions will be prepared by the MPOs for the urban non-attainment areas 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 model. The Technical Support Documentation will explain what specific local planning assumptions were used.

- Non-road Mobile source emissions will be recalculated for the entire state using the same episodic temperatures (etc.) described above.

- Again, the modelers (and possibly the Idaho DEQ) will fill in the surrounding regions with data from the NEI.

D. Time Averaging Periods

The amounts will be calculated as annual emissions with the exception of:

1. On-road mobile source inventories will be calculated as weekday, Saturday or Sunday emissions.

2. Non-road mobile source emissions of miscellaneous NONROAD equipment and engines from MOVES2014a (formerly EPA NONROAD Model) will be calculated as weekday or weekend day emissions.

3. Point and Area Source emissions are initially calculated as annual emissions, but are then 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 the 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 spanning 12 days was incurred from Friday, December 31 through Tuesday, January 11, 2011

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Thus, Utah's SIP will report, in its narrative, average-season-day emissions, with the definition of season spanning the 2011 episode. This "definition" should not be

confused with the actual span of time used to delineate any of the resulting emission limitations that may be seasonal.

The SIP 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 these Serious $PM_{2.5}$ nonattainment areas, the threshold is 70 tons per year for $PM_{2.5}$ or any individual precursor to $PM_{2.5}$ (SO2, NOx, VOC, and ammonia).

To make this assessment, UDAQ will evaluate the 2014 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 three nonattainment areas, 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.

B. Data Collection Method

UDAQ has constructed detailed Microsoft Excel inventory workbooks for most of the larger point sources. These workbooks provide an interactive interface with sources, a high level of accuracy, and allow for a seamless upload of emissions data to the UDAQ database. Construction of these workbooks required a very careful evaluation of the emissions calculations and their representativeness of each particular facility. After receiving completed workbooks from the sources they are individually inspected and updated to reflect any necessary changes requested by the sources before being uploaded into the database. UDAQ utilizes detailed inventory workbooks for the majority of the larger point sources. For the remainder of the sources including those with the potential to emit 70 to 100 tons per year, submitted hard copy emissions inventories are used. Exceptions include sources for which no inventory is available. For any such sources UDAQ will assume the emissions are 90% of their PTE.

C. Episodic Inventories

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

2. 2016 Episode - Point source emissions will be represented by projecting the 2014 actual triannual emissions inventory using the most current growth data from the Regional Economic Models, Inc. (REMI). However, since REMI data does not exist

for military installations, data from the Bureau of Economic Analysis (BEA) along with data from the Governor's Office of Management and Budget (GOMB) will be used for projecting emissions at military bases.

3. 2013 Episode – Larger point sources will have submitted an actual annual emissions inventory for 2013. However, since 2013 is not a triannual year, the smaller point sources are not required and will not have submitted an inventory. Therefore the emissions for the smaller point sources will be represented by back casting the 2014 actual triannual emissions inventory using the most current growth data from REMI. Data from BEA along with data from GOMB will be used for projecting emissions at military bases.

D. Base Year Inventory

The 2014 point source emissions inventory will be used to represent the Base Year Emissions Inventory for the Serious Area SIPs. Point Source emissions will be represented as the actual emissions from the 2014 triannual emissions inventory which coincides with the most recent triannual inventory that has been compiled by UDAQ. This inventory will be the basis for any projections made to represent future years.

In order to streamline the process, abbreviated workbooks will be constructed for each point source. These abbreviated workbooks will provide a mathematical 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.

E. Projection to Future Years

Growth data from REMI will be used to project the point source emissions in the abbreviated workbooks to the future years of 2017, 2019, 2020, 2023, 2024, and 2026. Data from BEA along with data from GOMB will be used for projecting emissions at military bases.

An exception to this is refineries which will be held constant through the projection years and not grown using projection data. Reasons for this are discussed below.

1. Refineries - It was determined that emissions for refineries in the modeling domain will be held constant and not grown using projection data. Reasons for this include the fact that four refineries have each submitted a notice of intent (NOI) and been issued an approval order (AO) that includes projected actual emissions. Because these four refineries represent the majority of the refinery related emissions in the modeling domain, and in order to prevent these four refineries from violating the premise of their AO's, all refineries as a group will be kept at zero percent projected growth.

F. Depiction of Control Technologies

After the point source emissions in the abbreviated workbooks have been projected to future years, control measures resulting from best available control technologies will be applied to each. These emissions will then be compared to the business as usual (BAU) emissions to assess reductions resulting from the applied control technologies.

G. The Smoke Emissions Model and Processor

The emissions processing model 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 $PM_{2.5}$ and VOC emissions into their component subspecies.

The point source emissions processing for air quality modeling will be done with sets of activity profiles based on component level activity data including hours per day, days per week, and monthly operating percentages. This process will establish the level of detail required of the point source inventories, wherein each "source component" has an associated SCC.

Once developed, these activity profiles will serve to establish the temporal allocation of emissions within the model (e.g. 8-hour workdays). In the case of spatial processing, the emissions from point sources will be placed in the location of the source itself.

H. 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.

1. Combustion Sources

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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

2. 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
- Paved road dust

e. 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.

For inventories compiled for years between 2011 (a year for which there is a triannual inventory) and 2013 UDAQ determined it would be better to use 2014 as the area source inventory base year and back cast to 2011 and 2013 for three reasons:

1. Many calculations and methods have changed since the 2011 area source inventory. The new methodologies, activity sources and projection sources were incorporated into UDAQ's 2014 area source NEI workbook. Calculation refinements include UDAQ's current WRAP oil & gas inventory projection method.

2. When back casting to 2011, most of the activity data that feeds the 2011 area source calculations are based on 2011 activity inputs which should result in comparable figures to the 2011 NEI or more accurate figures due to updated, actual activity data rather than projected activity data (as some actual values were not available during the 2011 NEI submission and estimated values based on growth rates etc. were used instead). Even if back casting is based on a projection rather than activity data, the projection would be based on actual observed values/growth rates rather than estimated growth rates.

3. As calculations and data inputs have changed, it is doubtful that the data from the 2011 NEI and 2014 NEI would be compatible. Thus only one NEI should be selected for area source data to ensure continuity in the data across the various years to be modeled. As noted above, the 2014 area source NEI would be preferred.

The only exception to the above is agricultural livestock emissions. At the time of writing, EPA/NOMAD livestock emissions estimates for 2014 were not completed, and therefore 2011 figures were used for the baseline and projections.

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 take from the 2011 NEI v2 (EPA/ERTAC calculations based on CMU Ammonia Model v. 3.6). 2014 estimates were not finalized at the time when data was required for modeling.
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 DAQ compliance inspectors.
Non-road Aircraft Maintenance	DAQ's 1992 phone survey of aircraft maintenance staff in Salt Lake County
Oil and Gas	2006 WRAP Inventory projected based on the change in drilling and production activity data. For categories not included in the WRAP inventory, categories calculated as part of the 2011 and 2014 NEIs are employed.
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,	Overall methodology is from the EPA/NOMAD Solvent Tool. VOC emission factor

Graphic Arts	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.

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 and non-road mobile 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 (MOVES2014a) 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 Department 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 MOVES2014a 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.

Episodic

UDAQ will prepare the on-road mobile source inventories for all 29 counties in Utah. UDAQ will use a National Emissions Inventory (NEI) approach for the episodic modeling effort. This method is similar to how Utah submits inventories to EPA for the triannual NEI but is more specific to the actual $PM_{2.5}$ episodes. On-road mobile source episodic emission inventories will be prepared for each episode day based on hourly temperatures and absolute humidity. Vehicle Miles Traveled (VMT) will be measured as an average winter weekday, Saturday, and Sunday. This episodic modeling process will involve over 1100 hours of runtime (45 days). Utah Department of Transportation (UDOT) provided travel data covering the years 2011-2014. UDOT travel data from the year 2016 was not available at the time when the episodic inventories were constructed. The episodic Technical Support Document (TSD) will indicate what local planning assumptions were utilized within the modeling effort.

Age Distribution, Alternative Vehicle Fuel and Technology(AVFT/Diesel and Gas fractions), Source Type Population, Fuels data, Hour VMT Fractions, Ramp Fractions – UDAQ will use the default MOVES data for these inputs. This was the best available data at the time.

Average Speeds – UDAQ will use UDOT lane miles data and the Highway Capacity Method built within the Federal Highway Administration (FHWA) "Easy Mobile Inventory Tool", or "EMIT" model to construct speed profiles. UDOT Highway Performance Monitoring System (HPMS) AADT (Average Annual Daily Traffic) VMT will be used to calculate VMT and road type distribution. Both urban and rural areas will use VMT factors provided by UDOT to adjust for month, weekday, Saturday and Sunday.

Inspection and Maintenance (I/M) Programs – UDAQ will use program details provided by the county I/M program managers. Cache, Davis, Salt Lake, Utah, and Weber I/M programs essentially offer Two Speed Idle (TSI) testing for 1995 and older vehicles and On Board Diagnostic (OBD) testing for 1996 and newer vehicles.

Meteorology – Episodic inventories will include hourly temperature and relative humidity data by county for each episode day from a representative weather station in each county. UDAQ selected weather stations that had the most complete data sets and were located near UDAQ PM2.5 monitors.

VMT and Road Type Distribution – UDAQ will utilize HPMS AADT VMT to calculate VMT and road type distribution. 2011 and 2013 VMT will be constructed to represent an average winter weekday, Saturday, and Sunday. UDAQ will project county specific historical HPMS AADT VMT utilizing linear regression and curvilinear fit methods for

2016. UDAQ will use VMT travel fractions for FHWA vehicle classes grouped and adjusted by Gross Vehicle Weight Rating (GVWR) ranges.

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. Vehicle Miles Traveled (VMT) will be measured as an average winter weekday, Saturday, and Sunday. This baseline and projection modeling process will involve over 510 hours of runtime (21 days).
The MPOs will be providing urban non-attainment on-road mobile source inventories and UDAQ will provide inventories for the remaining 22 rural attainment counties in Utah. Utah Department of Transportation (UDOT) provided travel data covering the years 2011-2015. The baseline and projection TSD will indicate what specific local planning assumptions were used.

Age Distribution and AVFT – The MPOs will use UDMV data to construct county specific age distribution values and AVFT fractions for light duty vehicle types. UDAQ for the rural areas will use the default MOVES data for these inputs for the rural areas. This was the best available data at the time.

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 1996-2015 utilizing linear regression and curvilinear fit methods. Speed profiles from the 2014 episode will be used since the rural areas have no TDM. UDAQ will use default ramp fractions.

Fuel Data – UDAQ and the MPOs will use the following fuel data inputs. MOVES2014a default fuel parameter values will be used for the baseline year of 2014. MOVES 2014a default fuel parameters for diesel and CNG will be used for projection years 2017-2026. MOVES2014a default fuel parameter values for tier 2 gasoline from the year 2016 will be used for 2017-2026. This adjustment was made for the following reasons:

1. For the years 2017-2019 small volume refiners that serve Utah are not required to comply with federal Tier 3 gasoline requirements.
2. For the years from 2020 forward there are no current federal or state requirements guaranteeing that Tier 3 fuel will be available in the marketplace as refiners can use the averaging, banking and trading program to meet federal Tier 3 gasoline requirements.

However if the state of Utah receives a guarantee from the local refineries that tier 3 fuel sales will be guaranteed in the marketplace the MOVES2014a default value for Tier 3 gasoline value will be utilized.

Inspection and Maintenance (I/M) Programs – UDAQ will construct and provide the MPOs with county specific I/M program details similar to those used in the episodic inventories.

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.

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.

Source Type Population – UDAQ and CMPO will use the default MOVES data for these inputs. MAG and the WFRC will develop source type population data.

C. AP-42 Road Dust Methodology

PM_{10} and $PM_{2.5}$ road dust from paved roads is calculated according to EPA AP-42 Chapter 13, "Miscellaneous Sources", Section 13.2.1, "Paved Roads" (January 2011). UDAQ will prepare the paved road dust inventory for all 29 counties for the episodic, baseline, and projection inventories.

Episodic

On-road mobile source episodic emission inventories for PM_{10} and $PM_{2.5}$ road dust will be prepared for each episode day.

VMT – UDAQ will utilize HPMS AADT VMT to calculate VMT and road type distribution. VMT will be constructed to represent an average winter weekday, Saturday, and Sunday.

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

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 likely 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. Should this be the case, IDEQ's methodology may differ somewhat from UDAQ's. More specific documentation will be provided for inclusion in Utah's TSD.

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	MOVES Defaults, 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) miscellaneous non-road equipment b) aircraft, c) airport ground support equipment and d) locomotives.

The modeling domain in Utah for the episode inventories will be the entire state--all 29 counties.

MOVES2014a

MOVES2014a produces the same emissions as the EPA NONROAD Model, except that ammonia emissions are included. Since ammonia is a $PM_{2.5}$ precursor, these emissions must be included in the air quality model. Therefore the sources listed below will be modeled using MOVES2014a instead of the EPA NONROAD Model:

- Agricultural
- Airport
- Commercial
- Construction and mining
- Industrial
- Lawn and garden
- Marine
- Logging
- Pleasure craft
- Recreational

The MOVES2014a model (October 2015) will be run using EPA defaults for each county in the domain with the exception of temperature data, which will be input into the model. In-depth nonroad source surveys are not planned. If, as the inventory is compiled, it appears that a given nonroad source is significant, additional research may be warranted to refine activity data for the emissions inventory.

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

Aircraft

Aircraft groups include air carriers or commercial aircraft, air taxi, general aviation and military.

Aircraft activity is expressed in units of landing and takeoff (LTO) pairs. One LTO cycle consists of a landing and takeoff pair.

Commercial Aircraft

Commercial aircraft activity is found on the U.S. DOT Transtats website at (http://www.transtats.bts.gov/).

The purpose of the file of aircraft types is to identify the aircraft names and enter them into the Federal Aviation Administration Emissions and Dispersion Modeling System (EDMS 5.1.4.1) model to calculate emissions.

Air Taxi, General Aviation and Military Aircraft Operations

Air taxi,general aviation and military aircraft operations are found at the following website: FAA Airport Master Records, http://www.gcr1.com/5010web/.

A separate Airport Master Record exists for each airport in Utah. Each record indicates the number of aircraft operations (air taxi, general aviation and military) current to the given date shown under "Operations for 12 Months Ending". For example, the record for Logan-Cache Airport is current to December 31, 2012.

If the airport record is not current to the year being modeled, scaling factors are applied to adjust the number of operations to the year being modeled. Scaling factors are found at the following website: Federal Aviation Administration, http://www.faa.gov, Data and Research\Aviation Forecasts\Aerospace Forecasts\Additional Forecast Data\FY 2016 - 2036 Forecast Tables\Operations\Table 32, "Total Combined Aircraft Operations at Airports".

The EXCEL Table 32 includes forecasts (in thousands of operations) for air carriers, air taxi, general aviation and military aircraft for calendar years 2015 - 2035.

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

Airport Ground Support Equipment

When the EDMS model is run, output includes not only emissions by aircraft type, but emissions from ground support equipment associated with each aircraft. Emissions units

are tons per 1,000 LTOs (separately) for aircraft and GSE. Emissions are then scaled to the actual number of LTOs for each aircraft. The same scaling factor applies to GSE.

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 operating in Utah submit reports to UDAQ every three years for the EPA National Emissions Inventory. Diesel locomotive annual fuel consumption by county is reported.

Using annual fuel consumption, emission factors are obtained from the EPA guidance document "Emission Factors for Locomotives", EPA-420-F-09-025 (April 2009), https://www3.epa.gov/nonroad/locomotv/420f09025.pdf.

B. Time Scale of Non-road Inventories

The following PM2.5 episodes were identified for inventory modeling by the UDAQ Technical Analysis section:

Saturday, January 1 through Wednesday, January 12, 2011 inclusive
Monday, February 1 through Wednesday, February 17, 2016 inclusive
Saturday, December 7 through Thursday, December 19, 2013 inclusive

All non-road emissions will be reported in tons per year (TPY) for easy comparison to emissions in the statewide National Emissions Inventory (NEI).

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

Miscellaneous NONROAD engines and equipment (MOVES2014a): Each episode day will be modeled for each of the 29 counties in Utah. Episode days will be modeled as either a weekday or weekend day according to the calendar. The Technical Analysis section will convert weekday and weekend emissions into TPY.

Base and projection year non-road emissions (MOVES) will be run as daily emissions and will be converted to tons per year by multiplying daily by 365.25.

Aircraft: Commercial aircraft activity will be modeled for the month of January 2011. 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. All aircraft emissions will be converted to tons per year for the CAMx model.

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, which will also be reported in TPY.

Diesel Locomotives: Locomotive activity will be modeled on an annual time scale only because data from railroad companies only reports annual activity. Locomotive emissions will be reported in TPY.

C. Sources of Non-road Emission Inventory Data

The following list includes some of the activity-level information sources identified for estimation of the nonroad mobile source categories:

1. State UDOT Division of Aeronautics
2. Federal agencies (Bureau of Transportation Statistics, Federal Aviation Administration)
3. County and local government agencies
4. Airports
5. Railroad companies
6. EPA MOVES2014a model
7. Emissions and Dispersion Modeling System (EDMS 5.1.4.1)

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
*Nonroad, Aircraft Engines and Ground Support Equipment	Emissions and Dispersion Modeling System (EDMS 5.1.4.1, August 2013) software model; EPA guidance for aircraft emissions inventories: "Federal Aviation Administration: Airport Operations and Ranking Reports Using the Air Traffic Activity Data System (ATADS)". Note that, to determine the number of flights (landing and takeoff cycles, or LTOs), divide the number of operations in half (see "To Generate an Operations (Take-Offs and Landings) Report for and Airport", step 12). http://www.faa/gov/news/media_resources/atadsguide/.
*Nonroad, Aircraft Maintenance	EDMS 5.1.4.1 software model
*Nonroad, Railroad Engines	EPA Office of Transportation and Air Quality, Emission Factors for Locomotives", EPA-420-F-09-025, April 2009, https://www3.epa.gov/nonroad/locomotv/420f09025.pdf.
Other Non-road Mobile Sources	Run the EPA MOVES2014a model and make appropriate adjustments to the output (for month of year modeled).

*Category not included in EIIP.

E. Spatial Allocation of Non-road Emissions

1. Airport Activity

The activity and emissions from each incoming and outgoing airplane will be assigned to the GIS grid square(s) that contain(s) the location of the airport. All aircraft maintenance emissions will be presumed to occur on or very near the airport property so these emissions are effectively located at the airport itself.

2. Railroad Activity

Locomotive diesel fuel consumption is reported to UDAQ from railroad companies and must show fuel consumption by county. Emissions will be calculated by UDAQ using EPA guidance. Emissions will be spatially allocated in the air quality model.

3. Other non-road mobile sources

Spatial allocation of other non-road mobile sources within partial counties will be determined using population data (see Section VI.F of this document).

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
Railroad	Railroad 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 Freight Railroads (Burlington Northern Santa Fe, Utah Railway, Salt Lake Garfield & Western, Union Pacific): U.S. DOE, Energy Efficiency & Renewable Energy (EERE), "Freight Transportation Demand: Energy-Efficient Scenarios for a Low-Carbon Future", March 2013, http://www.nrel.gov/docs/fy13osti/55641.pdf	AMTRAK and U.S. DOE Energy Efficiency & Renewable Energy (EERE) documents
Aircraft flights (Aircraft GSE emissions are generated from the EDMS model along with aircraft emissions.)	FAA/Data & Research/Aviation Forecasts/Forecast Tables/Total TRACON Operations (Table 32)	Federal Aviation Administration http://www.faa.gov/data_research/aviation/aerospace_forecasts/ General Aviation (Tables 28 – 32), M.S. EXCEL
Miscellaneous Nonroad Engines	EPA MOVES2014a model; every year run separately	EPA MOVES2014a model

VII. SIP DEMONSTRATION MODELING

UDAQ will perform a photochemical grid modeling analysis using CAMX modeling system for the purpose of the $PM_{2.5}$ attainment demonstration. This will involve the entire domain, including portions of Utah, Colorado, New Mexico, Arizona, Nevada, Idaho, and Wyoming. See Figure 2 for a map of the domain area.

A. Temporal and Spatial Allocation and Speciation of the Annual Inventory

The software model, SMOKE modeling system, will be used for the following functions:

1. Import the inventory
2. Spatially allocate emissions to a photochemical or aerosol modeling grid
3. Temporally allocate emissions from the annual emissions inventories
4. Speciate emissions for some chemical mechanism
5. Output emissions for an air quality model

A more detailed discussion concerning the spatial and temporal allocations of annual emissions data is provided in the "Emissions Inputs" section of the modeling protocol.

B. Seasonal Temperature Adjustments

The model makes the temperature adjustments based on National Weather Service (NWS) data from appropriate meteorological sites.

C. Typical Operating Day Emission Rates

SMOKE will be used to calculate peak $PM_{2.5}$ season typical operating day emission rates.

1. Point sources

   SCC profiles will be used to adjust the actual annual emission rates to actual daily or hourly emission rates.

2. Area sources

   SCC profiles will be used to adjust the annual emission rates to actual daily or hourly emission rates.

3. On-road mobile sources

   On-road mobile source emissions inventories will be created for each $PM_{2.5}$ episode week-day, Saturday and Sunday. Each daily inventory will be broken down using the following hierarchy of parameters (in order): calendar year, county, road type, pollutant type, and vehicle type. The daily inventories will then be converted into a compatible format for the SMOKE pre-processor. SMOKE will be used to allocate the emissions spatially and temporally and to speciate the emissions.