

September 30, 2013

## TECHNICAL MEMORANDUM No. 13: PARAMETERS

To: Tom Moore, Western Governors' Association (WGA) (WRAP)

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Subject: Emissions Modeling Parameters, Ancillary Data and Summary Results for the WestJumpAQMS 2008 Photochemical Modeling

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### INTRODUCTION

ENVIRON International Corporation (ENVIRON), Alpine Geophysics, LLC (Alpine) and the University of North Carolina (UNC) at Chapel Hill Institute for Environment are performing the West-wide Jump Start Air Quality Modeling Study (WestJumpAQMS) managed by the Western Governors' Association (WGA) Air Quality Program. WestJumpAQMS is setting up the CAMx photochemical grid model for the 2008 calendar year (plus spin up days for the end of December 2007) on a 36 km CONUS, 12 km WESTUS and several 4 km Inter-Mountain West domains. The WestJumpAQMS Team has compiled emissions to be used for the 2008 base case modeling, with the 2008 National Emissions Inventory (NEI) being a major data source, and prepared 13 Technical Memorandums discussing the sources of the 2008 emissions by major source sector:

1. Point Sources including Electrical Generating Units (EGUs) and Non-EGUs;
  2. Area plus Non-Road Mobile Sources;
  3. On-Road Mobile Sources that will be based on MOVES;
  4. Oil and Gas Sources (5 installments a-e);
  5. Fires Emissions including wildfire, prescribed burns and agricultural burning;
  6. Fugitive Dust Sources;
  7. Off-Shore Shipping Sources;
  8. Ammonia Emissions;
  9. Biogenic Emissions;
  10. Eastern USA Emissions (eliminated since emissions were covered by other memorandums);
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11. Mexico/Canada;
12. Sea Salt and Lightening Emissions; and
13. Emissions Modeling Parameters including spatial surrogates, temporal adjustment parameters and chemical (VOC and PM) speciation profiles.

This is Technical Memorandum #13. We discuss the approach to be used for developing the emissions modeling parameters that will be used to simulate air pollutant emissions for the WestJumpAQMS project. After a brief description of the different types of emissions modeling parameters, this memo includes detailed descriptions of the sources of the data that will be used for the WestJumpAQMS project.

We will summarize WestJumpAQMS 2008 emissions data after the emissions modeling is complete so that it is comparable on a source category and state/county basis to the WRAP Regional Modeling Center's "Base02b" 2002 emissions modeling results displayed on the WRAP Technical Support System's "[Emissions Review Tool](#)", found under "Emissions & Source Apportionment" at: <http://vista.cira.colostate.edu/tss/Results/HazePlanning.aspx>.

Emissions modeling parameters refer to the non-inventory data used to prepare emissions for input to an air quality model (AQM), including:

- ***Spatial data.*** All anthropogenic non-point inventory data, including on-road and non-road mobile sources, are estimated at the county level. Data files called spatial surrogates are used to map the county-level emission inventories to the model grid cells. Spatial surrogates are generated from Geographic Information System (GIS) Shapefiles using software that calculates the fractions of county-level different geospatial attributes in a model grid cell. For example, a Shapefile of the housing distribution in Los Angeles County is combined with a description of a modeling grid to calculate the percentage of L.A. County housing assigned to each grid cell. This information is then used to allocate county-level emission inventory sources that are associated with housing (e.g. residential wood combustion) to the modeling grids.

Spatial surrogates require cross-referencing data that assign a spatial surrogate to specific categories of inventory sources. Spatial cross-reference files assign surrogates to inventory sources using country/state/county codes (FIPS) and source classification codes (SCCs).

- ***Temporal data.*** Air quality modeling systems, such as CMAQ and CAMx, require hourly emissions input data. With the exception of a few source types (e.g. Continuous Emissions Monitoring data, biogenic emissions and some fire inventories), most inventory data include annual or daily emission estimates. Temporal profiles are used to compute hourly emissions from the annual or daily inventory estimates. The SMOKE model, which is being used to process emissions for the WestJumpAQMS study, uses three types of temporal profiles:

1. Monthly profiles: Convert annual inventory to monthly emissions accounting for seasonal and other effects.
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2. Daily profiles: Convert monthly emissions to daily emissions accounting for day-of-week and other effects.
3. Hourly profiles: Convert daily emissions to hourly emissions accounting for the diurnal variation in emissions (e.g., work schedules and commute times).

Temporal profiles are assigned to inventory sources using cross-referencing data that match the profiles and inventory sources using country/state/county (FIPS) and source classification codes (SCCs).

- **Chemical speciation data.** Emissions inventories have limited chemical composition information. The emissions inventories for WestJumpAQMS include 6 criteria pollutants: carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOC), ammonia (NH<sub>3</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter with a mean diameter < 10 µg/m<sup>3</sup> (PM<sub>10</sub>), and particulate matter with a mean diameter < 2.5 µg/m<sup>3</sup> (PM<sub>2.5</sub>). Chemical speciation profiles are used to describe the chemical compositions of the effluent from particular emissions sources. The exact specification of the source-specific emissions species is determined by the chemistry mechanism selected for the AQM simulation. Speciation profiles convert the inventory pollutants to more detailed source-specific species in terms required by the AQM chemistry mechanism. For example, there is a speciation profile that converts the inventory pollutant NO<sub>x</sub> to the AQM input species NO, NO<sub>2</sub>, and HONO. Speciation profiles are required to convert inventory NO<sub>x</sub>, VOC, SO<sub>2</sub>, and PM<sub>2.5</sub> into AQM species. For the WestJumpAQMS SMOKE emissions modeling the CB6 chemical mechanism will be utilized and VOC will be speciated using source specific speciation profiles developed using the SPECIATE 4.3 database<sup>1</sup>. Note that because the CB6 has more explicit VOC species than CB05 it can be easily converted to CB05, however not vice versa. In fact, during the course of WestJumpAQMS photochemical model sensitivity tests found that better ozone model performance was obtained using CB05 than the versions of CB6 available at the time of the modeling. Thus, all of the model-ready CB6 emission inputs were converted to CB05 for the final WestJumpAQMS model simulations. Since then, CB6 has been revised to reduce the ozone overestimation tendency.

Chemical speciation profiles are assigned to inventory sources using cross-referencing data that match the profiles and inventory sources using country/state/county (FIPS) and source classification codes (SCCs).

## EMISSIONS MODELING PARAMETERS AND QUALITY ASSURANCE

There are three types of emissions modeling parameters required for converting emissions inventories into AQM inputs. Details of the sources of these parameters used for WestJumpAQMS are provided below.

### Spatial Surrogates and Cross-Reference Data

#### Spatial Surrogate Data

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<sup>1</sup> <http://www.epa.gov/ttnchie1/software/speciate/>

Team member UNC has recently developed new spatial surrogates for the U.S. EPA Office of Air Quality Planning and Standards (OAQPS). These new surrogates are replacing the spatial data used by OAQPS for modeling studies completed over the past 10 years. As they represented the best available geospatial information for the U.S., the OAQPS data were also used to support regulatory and research air quality modeling studies conducted by other modeling groups during the same period, including all modeling conducted by the WRAP RMC. The data collected and processed by UNC for OAQPS will be used to create spatial surrogates for WestJumpAQMS.

This section describes the processing, collection, and development of geospatial data for calculating spatial surrogates. All of the surrogates described here were generated with the Surrogate Tool of the Spatial Allocator (SA)<sup>2</sup>. The SA is open-source Java software that manipulates and generates data files related to emissions, air quality, and meteorology modeling. The tools perform functions similar to a GIS and are targeted specifically toward processing data for atmospheric modeling. The Surrogate Tool is a component of the SA that uses the PROJ.4 library<sup>3</sup> to compute spatial surrogates on different map projections for use in emissions processing.

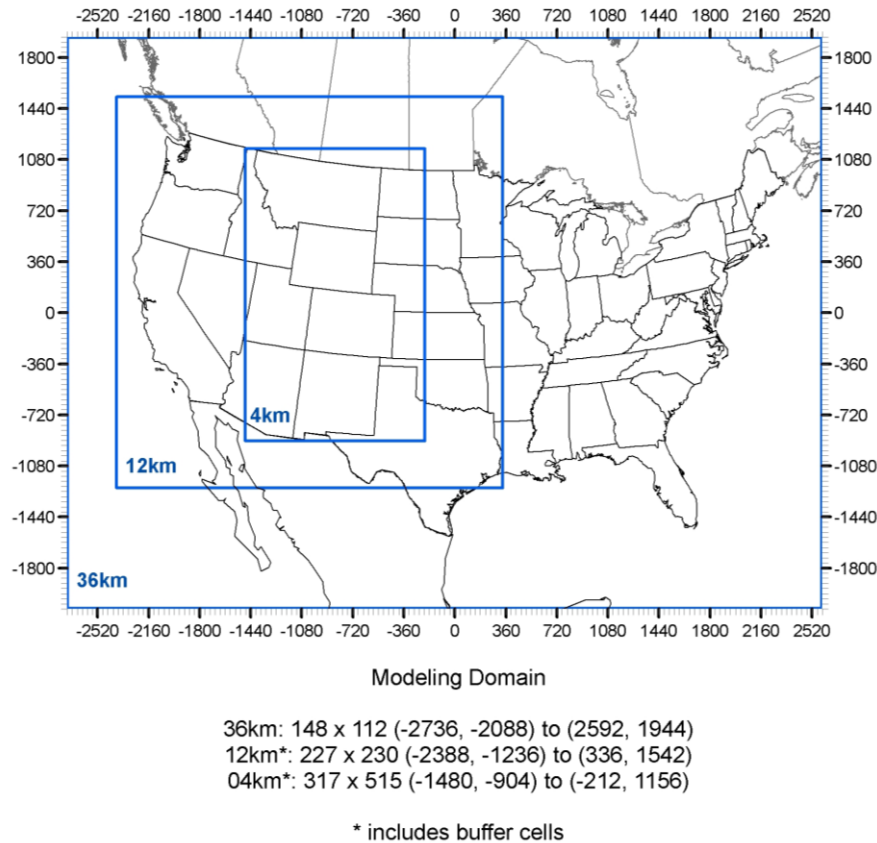
The Spatial Allocator was used for the WestJumpAQMS project to compute spatial surrogates for the U.S., Canada, and Mexico on a North American modeling domain at three grid resolutions: 36, 12, and 4 km. The grid definitions of the Lambert Conformal Conic modeling domains covered by the spatial surrogates are shown in Table 1. Spatial surrogates for the 12 km and 4 km grids will be generated on the continental U.S. (CONUS) domain to support flexibility in the placement of nested modeling domains for the WestJumpAQMS project. Figure 1 is a graphic of the candidate modeling domains for the WestJumpAQMS project.

**Table 1. WestJumpAQMS study spatial surrogate and modeling grid definitions**

Projection	Lat Centroid	Lon Centroid	Std. Parallel 1	Std. Parallel 2	Central Meridian
Lambert Conformal Conic	40N	97W	33N	45N	97W
Grid	dx x dy (km)	Columns	Rows	Lat Origin Offset (km)	Lon Origin Offset (km)
CONUS36	36x36	148	112	-2,736	-2,088
CONUS12	12x12	444	336	-2,736	-2,088
CONUS4	4x4	1332	1008	-2,736	-2,088
WestJump36	36x36	148	112	-2,736	-2,088
WestJump12	12x12	227	230	-2,388	-1,236
WestJump4	4x4	317	515	-1,480	-904

<sup>2</sup> Available from <http://www.cmascenter.org>

<sup>3</sup> <http://trac.osgeo.org/proj/>



**Figure 1. 36 km CONUS, 12 km WESTUS and 4 km Inter-Mountain West processing modeling domains for the WestJumpAQMS project.**

UNC updated most of the OAQPS U.S. Shapefile database with the latest available geospatial datasets. The timing of the Shapefile database update was due in part to the recent release of a few key datasets. The 2010 U.S. Census population and housing data, American Community Survey home heating data, year 2010 roadway data from TIGER, rail/port data from the National Transportation Atlas, and Federal Emergency Management Agency (FEMA) HAZUS-MH v2 building square footage data all became available in 2011 and 2012. Analysis of the 2005 U.S. National Emission Inventory showed that the spatial surrogates derived from these datasets were used to allocate the following proportion of the nonpoint inventory to modeling grids<sup>4</sup>:

- CO: 61%
- NO<sub>x</sub>: 94%
- VOC: 88%
- NH<sub>3</sub>: 69%
- SO<sub>2</sub>: 98%
- PM<sub>2.5</sub>: 61%

The roadway surrogates derived from the TIGER data are used to allocate 100% of the on-road mobile emissions to the modeling grid.

<sup>4</sup> Adelman, Z. and L. Ran, 2010: Proposal: Updating U.S. Non-mobile Spatial Surrogates, prepared for M. Houyoux, U.S. EPA OAQPS under contract No. EP-D-07-102, Assignment 3-07, September 2010.

In addition to using the new Shapefiles to update existing spatial surrogates, three entirely new surrogates were created to support the processing of new off-network mobile source emissions generated by EPA's MOtor Vehicle Emissions Simulator (MOVES) on-road mobile source emissions model. Of the 77 U.S. spatial surrogates developed from the OAQPS Shapefile database, 66 of them were updated with data that became available in 2011 and 2012. The remaining 11 surrogates were generated using Shapefiles in the existing OAQPS database. Details of the Shapefiles used to create the surrogates, including the sources of the data, are included in at the end of this memo in Table 3. Descriptions of the Shapefiles are included below. Table 4, also at the end of this memo, includes the specifications for all spatial surrogates used for WestJumpAQMS.

Population and Housing: The 2010 TIGER/Line database contains U.S. Census population and housing unit counts at the Census block level for each state. UNC downloaded the entire database, merged the state-level data into a national Shapefile, and projected the data to a U.S. national Lambert Conformal Conic projection. Urban and rural areas were calculated using Census block groups. Urban was defined as Census block groups that have a population density of at least 1,000 people per square mile and everything else was defined as rural.

Roadways: State-level 2010 TIGER/Line Shapefile data were merged to create a national file with urban and rural roadways. The TIGER/Line MTFCC codes S1100 and S1200 were used to define primary and secondary roads, respectively. Urban and rural roadway classifications were calculated using Census block group population densities (see Section 2.1) overlaid onto TIGER roads.

Rail and Waterways: State-level 2010 TIGER/Line Shapefile data were merged to create a national railway network file. The TIGER/Line MTFCC codes R1052, R1051, and R1011 were used to define the different classes of rail lines. The National Transportation Atlas Database (NTAD) 2011 was used to get waterway length information.

Highway Exits, Major Roads, and Transportation Terminals: Data from the ESRI Data and Maps 2010 database were used to create surrogates for the MOVES off-network (rate-per-profile and rate-per-vehicle) emissions sectors. The Off-Network HD/MD surrogate was designed for MOVES rate per profile (RPP) and rate per vehicle (RPV) medium and heavy-duty vehicle sources. It is computed from a combination of industrial building square footage data and highway exit ramps. The rationale behind this surrogate is that idling and starting/stopping medium and heavy-duty vehicles occur mainly while loading freight in industrial areas and at rest areas and along highway exits ramps. As a national Shapefile of highway rest areas is not available, highway exit ramps were used to represent the locations of idling tractor-trailers. The Off-Network LD surrogate is designed for MOVES RPP and RPV light-duty vehicles, including motorcycles. It is computed from a combination of commercial building square footage data, residential building square footage data, and local roads. The rationale behind this surrogate is that idling and starting/stopping light duty vehicles and motorcycles occur mostly in driveways/residential parking areas, parking lots of shopping centers, and along non-residential roadways with street parking. The Off-Network Buses surrogate is designed for MOVES RPP and RPV buses. It is computed from a combination of bus terminal locations and local roads,

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with the concept behind this surrogate being that bus terminals and local roads represent the majority of locations that buses are loading/unloading passengers.

FEMA Building Footprints: The Federal Emergency Management Agency HAZUS-MH version 2 was released in September 2011 and contains square footage data for different types of buildings throughout the U.S. The building square footage data are used to identify building classifications (i.e. commercial, residential, industrial, and institutional) for allocating non-point inventory sources to modeling grids. Census-block level data by state were merged into a national Shapefile for the database attributes required for generated spatial surrogates.

Home Heating: The American Community Survey (ACS) is U.S. Census project that collects yearly demographic and housing information from randomly selected households throughout the U.S. The data are aggregated in 5 and 10-year increments to provide Census tract estimates for the statistics collected during the survey. Home heating fuel type is used to develop spatial surrogates for home heating sources (i.e. residential wood combustion) in the nonpoint inventory. The ACS 5-year 2010 survey results that were released in 2011 represent data collected from 2006-2010. These data were used to create home heating surrogates.

As a review of the 5-year ACS data for 2010 showed that the number of housing units per Census tract in the ACS are always lower than the number of housing units reported in the 2010 Census. This trend indicates that the ACS only estimates demographic and housing statistics for a random sampling of households in each Census tract and does not represent the entire distribution of households. In order to represent the spatial distribution of home heating sources accurately, the ACS was used to calculate a distribution of heating sources for each Census tract and then these distributions were applied to the 2010 Census Housing Unit Shapefile to construct a home heating Shapefile that is consistent with the number of census tract housing units in the 2010 Census database. For example, if the ACS reports that in Census tract X 75% of the households use coal for heating and 25% of the households use heating fuel, the 2010 U.S. Census estimate of the total number of households in tract X were multiplied by 0.75 and 0.25 to estimate the distribution of coal and heating fuel use, respectively, for tract X.

Oil and Gas Development: EPA's new spatial surrogates for oil and gas development project inventories in the states of Colorado, Wyoming, and Utah include accompanying GIS Shapefiles with the locations of well pads and drill rigs by project, BLM field office, or development basin. These Shapefiles would typically be used to create spatial surrogates to allocate the non-point inventories for the associated development project to the modeling grids. However, for these four states we are using 2008 oil and gas emissions projected from the WRAP Phase III oil and gas emissions development study that have their own spatial surrogates that will be used in the SMOKE emissions modeling.

### **Spatial Cross-Referencing Data**

Spatial cross-reference tables relate inventory sources to spatial surrogates. Each surrogate has a numeric code that can be associated to inventory sources using location and source identifiers in the inventory. Country/state/county (FIPS) and source classification codes (SCC) are used to identify locations and source types, respectively in the non-point and mobile inventories. SMOKE support hierarchical cross-referencing of the spatial surrogates to inventory sources. The most specific cross-referencing takes precedence over less-specific

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matches. The example spatial cross-reference table below shows a case where two surrogates are assigned to FIPS 01005:

Surrogate ID	SCC	FIPS
1	2210010000	01005
2	-	01005

In this example, sources with SCC 2210010000 in FIPS 01005 would be allocated to the modeling grid with surrogate 1 and all other sources in FIPS 01005 would be allocated using surrogate 2 (because the SCC field is blank).

The spatial cross-referencing table used for WestJumpAQMS will originate from the data distributed with the U.S. EPA NEI2008v2 (filename: amgref\_us\_can\_mex\_revised\_28nov2011\_v17.txt). A key assumption in using the EPA data is that there will be consistency in the encoding of inventory sources with SCCs between WestJumpAQMS and NEI 2008. This is a good assumption because (1) many of the inventory components for WestJumpAQMS are being taken directly from the NEI and (2) the SCC coding convention is standardized in the U.S. The spatial cross-referencing files used by the EPA have been in use for over a decade and through this period have undergone many rounds of quality control.

One task of the WestJumpAQMS will be to verify the spatial surrogate assignments for the largest sources in each inventory category. We will generate reports by state, SCC, and surrogate code and use these reports to verify the surrogate assignments for the top 95% of the sources in each state by inventory pollutant mass. The surrogate code and the SCC descriptions will be used to determine the validity of the surrogate assignments to inventory sources. Discrepancies in these assignments will be corrected by changing the spatial cross-reference entry for the state and SCC in question.

## Temporal Profiles and Cross-Reference Data

### Temporal Profiles

Temporal profiles are available from the U.S. EPA for a wide range of emissions sources. While the majority of the temporal profiles available from the EPA represent nationally averaged emissions sources, state-specific monthly profiles exist for prescribed fires, wildfires, livestock, and some mobile sources. For most sources we will base the WestJumpAQMS emissions modeling on the U.S. EPA temporal profiles distributed with the NEI2008v2 (filename: amptpro\_2008aa\_us\_can\_revised\_06oct2011\_v0.txt). The WestJumpAQMS modeling process we will evaluate the quality and appropriateness of the EPA temporal profiles. While it is unlikely that new profiles will be added, there is a possibility of changing the assignments of existing profiles to inventory sources through updates to the temporal cross-reference file. For episodic emissions, such as biogenics, prescribed burns and wildfires, we will use day-specific emissions.

### Temporal Cross-referencing Data

Temporal cross-reference tables relate inventory sources to temporal profiles. A temporal cross-reference entry includes six elements:

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- 10-digit or 7-digit SCC
- Monthly temporal profile code
- Weekly temporal profile code
- Daily temporal profile code
- Pollutant name
- FIPS (country/state/county) code

At a minimum, entries in the temporal cross-reference files must include an SCC and three profile codes that exist in the temporal profile file. Including a pollutant and/or FIPS code in the cross-reference file entries supports more specific assignments of temporal profiles to inventory sources.

The temporal cross-reference table used for the WestJumpAQMS will originate from the data distributed with the U.S. EPA NEI2008v2 (filename: `amptref_v3_3_revised_03nov2011_v14.txt`). The same assumption about consistency noted for the spatial cross-referencing table also applies to the temporal cross-reference file. One task of the WestJumpAQMS will be to verify the temporal profiles assignments for the largest sources in each inventory category. We will generate reports by state, SCC, and temporal profile code and use these reports to verify the temporal profile assignments for the top 95% of the sources in each state by inventory pollutant mass. As metadata describing the source of the temporal profiles in the EPA database are limited, assessing the validity of the temporal profile assignments will require review of the assignments by WestJumpAQMS participants and stakeholders. If requested, we will produce a spreadsheet of the temporal profile assignments for the top emissions sources that includes graphical representations of the temporal profiles assigned to these sources. Comparisons of the SCC descriptions to the qualitative graphics of the temporal profiles may be used to determine the validity of the profile assignments and inform corrections to these assignments as needed.

## Chemical Speciation Profiles and Cross-Reference Data

### Speciation Profiles

The U.S. EPA develops speciation profiles from information stored in the SPECIATE database (<http://www.epa.gov/ttnchie1/software/speciate/>). The current SPECIATE database (version 4.3) is the official repository of volatile organic compound (VOC) and particulate matter (PM) emissions source profiles for different categories of emissions sources. SPECIATE contains 5,592 profiles of chemical mass fractions from source testing conducted by EPA, state agencies, or published in the literature since the 1970's. Of the current profiles in SPECIATE, 3,570 are for PM sources, 1,775 are for VOC sources, and 247 are for other gases, such as mercury. The most recent update to the SPECIATE database occurred with the release of version 4.3 in September 2011. SPECIATE 4.3 include 405 new profiles obtained from a combination of recommendations for EPA Office of Transportation and Air Quality, EPA and state-sponsored studies of various industrial processes, and literature reviews conducted by the SPECIATE workgroup.

Part of the speciation process for VOCs includes converting inventory reactive organic gases (ROG) to total organic gases (TOG). This step is required because inventoried VOC excludes methane in the mass of total VOC while the speciation profiles include methane. Before the

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speciation profiles can be applied to the inventory, the inventory VOC must be scaled up to account for the missing methane mass. SCC-specific ROG-to-TOG conversion factors are included with the speciation profiles to prepare the inventories for speciation.

We will base the WestJumpAQMS emissions modeling on Carbon Bond version 6 (CB6) speciation profiles and ROG-to-TOG conversion factors recently developed by ENVIRON. Note that CB6 has several explicit VOC species not included in CB05 so that it is easy to convert CB6 emissions to CB05 if needed, however the reverse is not true. ENVIRON developed an interface to the SPECIATE database called the Speciation Tool. If new speciation information for sources in the WestJumpAQMS modeling domain become available during the project we will use the Speciation Tool to generate SMOKE-ready speciation profiles. For example, we may receive VOC speciation data for oil and gas wells in a specific development basin in the WestJumpAQMS 4-km modeling domain. We could use the Speciation Tool to convert the mass fractions for these wells to a speciation profile for use in simulating VOC emissions from these sources. The latest version of the Speciation Tool developed by ENVIRON creates both ROG-to-TOG conversion factors and SMOKE-ready speciation profiles for multiple photochemical mechanisms, including Carbon Bond 05 and SAPRC07.

Note that for the WRAP Phase III Basins we have Basin-specific VOC speciation profiles for the O&G emissions that will be used in the SMOKE emissions modeling instead of the default oil and gas VOC speciation profiles in SMOKE from the SPECIATE database. The oil and gas VOC speciation profiles for the WRAP Phase III Basins were obtained from the Operators as part of the surveys. Details on the WRAP Phase III oil and gas VOC speciation profiles are provide in Appendix A.

The latest EPA profiles contain a single profile for inventory  $\text{NO}_x$ . Inventory  $\text{NO}_x$  is converted to 9.2%  $\text{NO}_2$ , 90%  $\text{NO}$ , and 0.8%  $\text{HONO}$  using the profile “HONO”. There are several profiles for inventory  $\text{SO}_2$ , which differ in the amount of gas-phase sulfuric acid produced from the profile. All of the  $\text{SO}_2$  profiles directly pass through the  $\text{SO}_2$  mass from the inventory on a 1:1 basis.

Early on in the WestJumpAQMS, photochemical model sensitivity tests were conducted that found CB6 produced an ozone overestimation bias that was quite large in the eastern U.S. by also affected the western U.S. somewhat. Thus, the model-ready emissions were converted from CB6 to CB05 and the final WestJumpAQMS photochemical model simulations were performed using CB05.

### **Speciation Cross-referencing Data**

Speciation cross-reference tables relate inventory sources to speciation profiles. A speciation cross-reference entry includes four elements:

- 10-digit or 7-digit SCC
- Speciation profile code
- Pollutant name
- FIPS (country/state/county) code

At a minimum, entries in the speciation cross-reference files must include an SCC, pollutant name, and a profile code that exists in the speciation profiles file. Including a FIPS code in the cross-reference file entries supports location-specific assignments of speciation profiles inventory sources.

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The speciation cross-reference table used for the WestJumpAQMS will originate from the data distributed with the U.S. EPA NEI2008v2 (source specific profiles tagged as version cmaq\_cb05\_soa\_2007ea\_v5\_07c\_12nov2009). The same assumption about consistency noted for the spatial cross-referencing table also applies to the speciation cross-reference file. One task of the WestJumpAQMS will be to verify the chemical profiles assignments for the largest sources in each inventory category. We will generate reports by state, SCC, VOC speciation profile code, and PM speciation profile code and use these reports to verify the speciation profile assignments for the top 95% of the sources in each state by inventory pollutant mass. We will qualitatively compare descriptions of the profile codes in the SPECIATE database to the descriptions of the SCCs to which they are assigned in order to evaluate the validity of the cross-reference entries. In particular we will look for sources that are assigned the default VOC and PM profiles, which are based on a vast mixture of combustion sources, and update these assignments with profiles that more closely match the emission process described by the SCC.

## Emissions Processing

The majority of the emissions processing for WestJumpAQMS will be conducted with the Sparse Matrix Operator Kernel Emissions (SMOKE) model version 3.1 beta (<http://www.smoke-model.org>). SMOKE is an open-source software for converting emissions inventories into the formats required for regional-scale chemistry and transport modeling. We will base the WestJumpAQMS SMOKE configuration settings on recent simulations using the NEI08v2, including the EPA OAQPS 2008 modeling platform and the SESARM Southeast Modeling, Analysis, and Planning (SEMAP) project (modeling protocol available at <http://www.airqualitymodeling.org/semawiki>). Specifics about the SMOKE settings or configurations used for each WestJumpAQMS inventory category are available in the sector-specific memoranda referenced in the introduction of this memo.

We will define a series of emissions processing categories for the WestJumpAQMS project to facilitate the modeling and quality assurance of the inventory data. While there are four main types of inventory data (point, nonpoint, mobile, and biogenic), it is necessary to refine these categories to support special emissions modeling approaches or to provide flexibility for tagging emissions categories in source apportionment air quality modeling.

Efficiencies in the emissions modeling process are gained through consideration of the temporal variability in the emissions sources. If a processing category includes only sources that use a flat temporal profile throughout the year, meaning that the emissions are the same on every hour of every day of the year, it is possible to process a single day for that category and recycle the emissions on each day of the air quality modeling simulation. Both processing time and disk space are conserved by not producing 365 files that all contain the exact same information. Other types of temporal processing configurations that may be used for the WestJumpAQMS project include:

- Single day per year (aveday\_yr)
  - Single day per month (aveday\_mon)
  - Typical Monday, Weekday, Saturday, Sunday per year (mwdss\_yr)
  - Typical Monday, Weekday, Saturday, Sunday per month (mwdss\_mon)
  - Emissions estimated for each model simulation day (daily)
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- Emissions estimated for each model simulation day with temporal profiles generated with average daily meteorology (daily met)
- Emissions estimated for each model simulation day with temporal profiles generated with hourly meteorology (hourly met)

Table 2 defines the emissions categories that we will define for the WestJumpAQMS project. The “Temporal” column in Table 2 refers to the temporal configuration that will be used for each category.

### Treatment of Point Sources

There were five types of point sources treated in the WestJumpAQMS emissions modeling:

- Oil and Gas Point Sources (PTO&G): Point sources related to upstream oil and gas emissions were processed separately from the other point sources. These include O&G point sources from the WRAP Phase III 2008 O&G emissions updates as well as O&G point sources from the 2008 NEIv2.0 for locations outside of the WRAP Phase III Basins.
- Commercial Marine Vessels (CMV): Because large Commercial Marine Vessels (CMVs) can be several stories high and emissions can be release above the top of layer 1 in the photochemical model (~24 m high), their emissions were treated as point sources.
- Fire Emissions: Fire emissions in the final WestJumpAQMS photochemical model simulations were based on a 2008 inventory developed by the Deterministic and Empirical Assessment of Smoke’s Contribution to Ozone (DEASCO<sup>5</sup>) study. DEASCO3 generated 2008 emissions for three types of fires: Wild Fires (WF), Prescribed Burns (Rx) and Agricultural Burning (Ag). The plume rise for DEASCO3 fire emissions was calculated outside of the CAMx photochemical grid model with each fire having a plume top (Ptop) and plume bottom (Pbot). CAMx internally figures out which vertical layers in a horizontal grid cell containing the fire were between Pbot and Ptop and injected the fire emissions into the appropriate vertical layers using a mass conservative approach.
- Point Sources with CEMs (PTCEM): Point sources with Continuous Emissions Monitoring (CEM) devices used hourly SO<sub>2</sub> and NO<sub>x</sub> emissions from EPA’s Clean Air Market Division (CAMD) website<sup>6</sup>. Stack locations, parameters and other emissions (e.g., PM) were obtained from the 2008 NEIv2.0 whose 2008 annual emissions were allocated to hour of day using the CEM hourly heat input from CAMD. All PTCEM point sources were treated as elevated point sources with plume rise calculated by CAMx internally. Note that data filling was used for hours with missing CEM data (see Emissions Technical Memorandum No. 1).
- Point Sources with No CEMs (PTNCEM): Emissions and stack parameters for 2008 NEIv2.0 point sources within CEMs were processed with SMOKE to determine temporal allocation and chemical speciation and whether they should be treated as elevated point sources or merged with the low-level two-dimensional emission inputs and

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<sup>5</sup> <http://deasco3.wraptools.org/>

<sup>6</sup> <http://www.epa.gov/airmarkt/>

injected into layer 1 of the CAMx photochemical model. SMOKE used a plume rise cut-off value of 20 m AGL. If the SMOKE calculated plume rise for a PTNCM point source was below 20 m, then it was treated as a low-level source and merged with the surface layer emissions. If the SMOKE calculated plume rise was above 20 m, then it was treated as an elevated point source in CAMx that calculated plume rise each hour using hourly meteorological data and determined which vertical layer the point source emissions should be injected into.

CAMx includes an optional Plume-in-Grid (PiG) treatment for point sources that treats the near-source dispersions and chemistry of point source plumes using a non-steady-state Lagrangian puff model. When the PiG plume size is commensurate with a grid cell size the concentrations from the PiG module are released to the CAMx photochemical grid model with the effects of the emissions from the point source is tracked further downwind. PiG applications to date have shown that it doesn't have a big enough effect to alter the model performance evaluation, but can affect a point source's contribution to ozone and PM concentrations. The original intent

**Table 2. WestJumpAQMS Emissions Processing Categories**

No.	Emissions Processing Category (Abbr)	Inventory Year	Inventory Source	Temporal	Processing Comments
1	Nonpoint/Area (nonpt)	2008	NEI08v2	mwdss_mon	Remove oil & gas, agricultural NH3, and dust;; includes commercial marine and rail
2	Livestock NH3 (lv)	2008	NEI08v2	mwdss_mon	Do not apply met-based temporal profiles; separate out for possible sensitivity later
	Fertilizer NH3 (ft)	2008	NEI08v2	mwdss_mon	Group with lv as a full agricultural NH3 sector (ag)
3	Fugitive and Road Dust (fd)	2008	NEI08v2	mwdss_mon	Includes paved and unpaved road dust; apply transport factors but not met factors
4	Residential Wood Combustion (rwc)	2008	NEI08v2	mwdss_mon	Do not apply met-based temporal profiles; separate out for possible sensitivity later
5	Area Oil & Gas (og)		IPAMS	mwdss_mon	Basin specific speciation profiles and spatial surrogates
6	Nonroad mobile (nr)	2008	NEI08v2	mwdss_mon	Includes NMIM commercial marine and rail
7	MOVES RPD (rpd)	2008	MOVES2010a	hourly met	Representative weekday and weekends for each year; process as hourly area sources
8	MOVES RPP (rpp)	2008	MOVES2010a	hourly met	Representative weekday and weekends



					for each year; process as hourly area sources
9	MOVES RPV (rpv)	2008	MOVES2010a	hourly met	Representative weekday and weekends for each year; process as hourly area sources
10	CEM Point (ptcem)	2008	NEI08v2/CAMD	daily	Anomalies removed from 2008 CAMD data
11	Non-CEM Point (ptncem)	2008	NEI08v2	mwdss_mon	Removed oil & gas sources and transferred to ptog sector; includes point aircraft and ports
12	Point Oil & Gas (ptog)		IPAMS	mwdss_mon	Combination of WRAP Phase III inventory and NEI08v2 for areas not covered by WRAP EI
13	Point Fires (ptfire)	2008		daily	
14	Commercial Marine (ptseca)	2008	NEI08v2	aveday_mon	
15	Canada/Mexico Area (nusar)	Can2006/Mex2008	Canada NPRI Mexico NEI	mwdss_mon	Mexico inventory projected from 1999 to 2008
16	Canada/Mexico Point (nuspt)	Can2006/Mex2008	Canada NPRI Mexico NEI	mwdss_mon	Mexico inventory projected from 1999 to 2008
17	Canada/Mexico Mobile (nusmb)	Can006/Mex2008	Canada NPRI Mexico NEI	mwdss_mon	Mexico inventory projected from 1999 to 2008
18	Lightning NOx (Inox)	N/A		hourly met	Gridded monthly NLCD lightning flash counts converted to hourly, gridded NO emissions with WRF convective rainfall
19	Sea salt (ss)	N/A		hourly met	Surfzone and open ocean PM emissions
20	Windblown Dust (wbd)	N/A	WRAP WBD Model	hourly met	
21	MEGAN Biogenic (bg)	N/A	MEGAN2.1	hourly met	Use new versions of MEGAN V2.10 updated by WRAP for the western U.S.

## Quality Assurance

Quality assurance (QA) of the emissions modeling parameters used for the WestJumpAQMS project will be accomplished through scrutiny of the profile assignments made to specific inventory sources and analysis of the profiles applied to the largest inventory sources.

Descriptions of how we will tabulate and analyze the profiles and assignments are provided in each subsection on the different types of profiles used for emissions processing. The general approach to QA of the parameters for WestJumpAQMS includes:

1. Focus on the profiles assigned to the top 95% of the emissions sources by mass. A large amount of emissions are typically associated with a relatively small number of SCCs.
  2. Where possible, minimize the application of default temporal, speciation, and spatial profiles
  3. Replace default profile applications with profiles that are more appropriate for the source in question. What is considered appropriate for a profile application may be somewhat subjective and will require review by WestJumpAQMS participants and stakeholders
  4. Use the best available inventories and ancillary data, including information that may not be packaged with the EPA NEI2008v2. A good example here is spatial surrogates for oil and gas sources in Colorado, Utah, and Wyoming. Basin-specific Shapefiles should be used to generate the spatial surrogates for the WRAP Phase III oil and gas inventories used for WestJumpAQMS.
  5. Document all changes made to the WestJumpAQMS modeling parameters in a central location to facilitate compiling these changes into a final report on the modeling conducted for this project.
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**Table 3. Descriptions of the Shapefiles used to generate spatial surrogates for WestJumpAQMS\***

Shapefile	Description	Type	Year	Source	URL
cty_pophu2k_revised	U.S. County Boundaries	Polygon	2005	U.S. Census Bureau	<a href="ftp://ftp.epa.gov/EmisInventory/emiss_shp2006/us/">ftp://ftp.epa.gov/EmisInventory/emiss_shp2006/us/</a>
pophu_bg2010	Population/Housing	Polygon	2010	U.S. Census Bureau	<a href="http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html">http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html</a>
rd_ps_tiger2010	Roadways	Line	2010	U.S. Census Bureau	<a href="http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html">http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html</a>
waterway_ntad2011	Waterways	Line	2010	U.S. Bureau of Transport Statistics	<a href="#">NTAD</a>
rail_tiger2010	Railways	Line	2010	U.S. Census Bureau	<a href="http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html">http://www.census.gov/geo/www/tiger/tgrshp2010/tgrshp2010.html</a>
exits**	Highway Exits	Point	2010	ESRI	Only available through ESRI Data and Maps
mjrds**	Major Roads	Line	2010	ESRI	Only available through ESRI Data and Maps
transterm**	Transportation Terminals	Point	2010	ESRI	Only available through ESRI Data and Maps
fema_bsf_2002bnd	Building footprints	Polygon	2010	FEMA	<a href="http://www.fema.gov/plan/prevent/hazus/">http://www.fema.gov/plan/prevent/hazus/</a>
heating_fuels_acs0510_c2010	Home heating fuels	Polygon	2010	U.S. Census Bureau	<a href="http://www.census.gov/acs/www/">http://www.census.gov/acs/www/</a>

\*All projections = Lambert Conformal Conic (X0=-97,Y1=33,Y2=45,Y0=40), Datum: NAD83, unless otherwise specified

\*\*Projection = Geographic, Datum: WGS84

Table 4. Spatial surrogate specifications

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Population	100	pophu_bg2010, POP2010	cty_pophu2k_revised, FIPSSTCO	N/A	Y	Land Area, None, None	Total population from 2010 Census blocks
Population by State	105	pophu_bg2010, POP2010	state_pophu2010, FIRST_STAT		Y	Land Area, None, None	
Housing	110	pophu_bg2010, HU2010	cty_pophu2k_revised, FIPSSTCO	N/A	Y	Population, Land Area, None	Total housing units from 2010 Census blocks
Urban Population	120	pophu_bg2010, URBAN	cty_pophu2k_revised, FIPSSTCO	N/A	Y	Population, Land Area, None	Total urban population from 2010 Census blocks
Rural Population	130	pophu_bg2010, RURAL	cty_pophu2k_revised, FIPSSTCO	N/A	Y	Population, Land Area, None	Total rural population from 2010 Census blocks
Housing Change	137	pophu_bg2010, HUCH1000	cty_pophu2k_revised, FIPSSTCO	N/A	Y	Population, Land Area, None	Total housing change from 2000 to 2010 Census blocks
Housing Change and Population	140	N/A	cty_pophu2k_revised, FIPSSTCO	0.5*Housing Change+ 0.5*Population	Y	Population, Land Area, None	Weighted combination of 2000-to-2010 housing unit change and 2010 population from 2010 Census
Residential Heating – Natural Gas	150	heating_fuels_acs0510_c2010, UTIL_GAS	cty_pophu2k_revised, FIPSSTCO		Y	Housing, Population, Land Area,	Number of Housing Units using Utility Gas for primary heating: ACS 5-year 2010 survey data
Residential Heating - Wood	160	heating_fuels_acs0510_c2010, WOOD	cty_pophu2k_revised, FIPSSTCO		Y	Housing, Population, Land Area,	Number of Housing Units using Wood for primary heating: ACS 5-year 2010 survey data
0.5 Residential Heating – Wood plus 0.5 Low Intensity Residential	165	N/A	cty_pophu2k_revised, FIPSSTCO	0.5*Residential Heating - Wood+0.5*Low Intensity Residential	Y	Housing, Population, Land Area,	
Residential	170	heating_fuels_acs	cty_pophu2k_revised		Y	Housing,	Number of Housing Units using Fuel

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Heating – Distillate Oil		0510_c2010, FUEL_OIL	d, FIPSSTCO			Population, Land Area,	Oil for primary heating: ACS 5-year 2010 survey data
Residential Heating – Coal	180	heating_fuels_acs 0510_c2010, COAL	cty_popthu2k_revise d, FIPSSTCO		Y	Housing, Population, Land Area,	Number of Housing Units using Coal for primary heating: ACS 5-year 2010 survey data
Residential Heating – LP Gas	190	heating_fuels_acs 0510_c2010, LP_GAS	cty_popthu2k_revise d, FIPSSTCO		Y	Housing, Population, Land Area,	Number of Housing Units using LP Gas for primary heating: ACS 5-year 2010 survey data
Urban Primary Road Miles	200	rd_ps_tiger2010	cty_popthu2k_revise d, FIPSSTCO	RDTYPE=1	Y	Total Road Miles, Population, Land Area	Primary road miles from TIGER 2010 overlaid with Census block-level urban population
Highway Exit Ramps	201	exits	cty_popthu2k_revise d, FIPSSTCO	N/A	NEW	Total Road Miles, Population, Land Area	Exit ramps on U.S. highways from ESRI DM2010; proxy to rest stops for tractor trailers
Local Roads	202	mjrds	cty_popthu2k_revise d, FIPSSTCO	FRC=4,5	NEW	Housing, Population, Land Area	Major local roads and feeders (does not include surface streets) from ESRI DM2010
Bus Stops	203	transterm	cty_popthu2k_revise d, FIPSSTCO	FCC=D53	NEW	Local Roads, Total Road Miles, Land Area	Bus terminals from ESRI DM2010
Rural Primary Road Miles	210	rd_ps_tiger2010	cty_popthu2k_revise d, FIPSSTCO	RDTYPE=2	Y	Total Road Miles, Population, Land Area	Primary road miles from TIGER 2010 overlaid with Census block-level rural population
Urban Secondary Road Miles	220	rd_ps_tiger2010	cty_popthu2k_revise d, FIPSSTCO	RDTYPE=3	Y	Total Road Miles, Population, Land Area	Secondary road miles from TIGER 2010 overlaid with Census block-level urban population
Rural Secondary Road Miles	230	rd_ps_tiger2010	cty_popthu2k_revise d, FIPSSTCO	RDTYPE=4	Y	Total Road Miles, Population,	Secondary road miles from TIGER 2010 overlaid with Census block-level rural population

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
						Land Area	
Total Road Miles	240	rd_ps_tiger2010	cty_popthu2k_revised, FIPSSTCO	RDTYPE=1,2,3,4	Y	Population, Land Area, None	Total road miles from TIGER 2010
Urban Primary plus Rural Primary	250	rd_ps_tiger2010	cty_popthu2k_revised, FIPSSTCO	RDTYPE=1,2	Y	Total Road Miles, Population, Land Area	Total primary road miles from TIGER 2010
Off-Network MD/HD	251	N/A	cty_popthu2k_revised, FIPSSTCO	0.5*Industrial Land+ 0.5*Highway Exit Ramps	NEW	Total Road Miles, Population, Land Area	Off-network MOVES medium and heavy-duty vehicles; freight loading at industrial facilities and rest areas/highway exits
Off-Network LD	252	N/A	cty_popthu2k_revised, FIPSSTCO	0.75*Commercial plus Residential+ 0.25*Local Roads	NEW	Population, Housing, Land Area	Off-network MOVES light-duty vehicles; shopping centers, residential areas, and street parking
Off-Network Buses	253	N/A	cty_popthu2k_revised, FIPSSTCO	0.5*Bus Stops+ 0.5*Local Roads	NEW	Housing, Urban Secondary Road Miles, Land Area	Off-network MOVES buses; bus stations and local streets
0.75*Total Roadway Miles plus 0.25*Population	255	N/A	cty_popthu2k_revised, FIPSSTCO	0.75*Total Road Miles+ 0.25*Population	Y	Population, Land Area, None	Combination of ¾ total road miles and ¼ population
Total Railroad Miles	260	rail_tiger2010	cty_popthu2k_revised, FIPSSTCO	RRTYPE=1,2	Y	Total Road Miles, Population, Land Area	MTFCC codes from TIGER2010 data used to identify rail lines



Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Class 1 Railroad Miles	270	rail_tiger2010	cty_pophu2k_revised, FIPSSTCO	RRTYPE=1	Y	Total Railroad Miles, Total Road Miles, Population	Railroad miles of class 1 railroads
Class 2 and 3 Railroad Miles	280	rail_tiger2010	cty_pophu2k_revised, FIPSSTCO	RRTYPE=2,3	Y	Total Railroad Miles, Total Road Miles, Population	Railroad miles of class 2 and 3 railroads
Low Intensity Residential	300	us_lowres	cty_pophu2k_revised, FIPSSTCO	GRID_CODE=21	N	Single Family Residential, Population, Land Area	Includes areas with a mixture of constructed materials and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20 to 70 percent of the cover. These areas most commonly include single-family housing units.
Total Agriculture	310	us_ag2k	cty_pophu2k_revised, FIPSSTCO	GRID_CODE=61,81,82,83,84	N	Rural Land Area, Land Area, None	Sum of the following NLCD areas: Pasture/Hay, Grains, Row Crops, Fallow Land and Orchards/Vineyards
Total Agriculture without Orchards/Vineyards	311	us_ag2k	cty_pophu2k_revised, FIPSSTCO	GRID_CODE=81,82,83,84	N	Rural Land Area, Land Area, None	Sum of the following NLCD areas: Pasture/Hay, Grains, Row Crops and Fallow

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
							Land
Orchards/Vine yards	312	us_ag2k	cty_popthu2k_revised, FIPSSSTCO	GRID_CODE=61	N	Total Agriculture, Rural Land Area, Land Area	Orchards, vineyards, and other areas planted or maintained for the production of fruits, nuts, berries, or ornamentals.
Forest Land	320	us_for2k	cty_popthu2k_revised, FIPSSSTCO	GRID_CODE=41,42,43,91	N	Rural Land Area, Land Area, None	Sum of the following NLCD areas: Evergreen Forest, Mixed Forest, Woody Wetland, Deciduous Forest
Strip Mines/Quarries	330	mines_nlcd, AREA	cty_popthu2k_revised, FIPSSSTCO		N	Mines, Rural Land Area, Land Area	Area of Mines
Land	340	us_lw2k, AREA	cty_popthu2k_revised, FIPSSSTCO	H2O_CODE=2	N	None, None, None	
State Land	345	us_lw2k, AREA	state_popthu02, STATE	H2O_CODE=2	N	None, None, None	
Water	350	us_lw2k, AREA	cty_popthu2k_revised, FIPSSSTCO	H2O_CODE!=2	N	Navigable Waterway Miles, Land Area, None	Water Area
Rural Land Area	400	rural_land, AREA	cty_popthu2k_revised, FIPSSSTCO	RL_FLAG=Rural Land	N	Land Area, None, None	Land Area that is not within an area designated as an Urbanized Area or an Urban Cluster. Determined by intersecting NLCD land area with US Census spatial information representing areas not classified as Urbanized Area or as Urban Clusters
Commercial Land	500	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSSTCO	COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9	Y	Population, Land Area, None	Sum of building square footage from the following FEMA categories: COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Industrial Land	505	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	IND1+IND2+IND3+IND4+IND5+IND6	Y	Population, Land Area, None	Sum of building square footage from the following FEMA categories: IND1 + IND2 + IND3 + IND4 + IND5 + IND6
Commercial plus Industrial	510	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+IND1+IND2+IND3+IND4+IND5+IND6	Y	Population, Land Area, None	Sum of building square footage from the following FEMA categories: COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9 + IND1 + IND2 + IND3 + IND4 + IND5 + IND6
Commercial plus Residential	512	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+RES1+RES2+RES3+RES4	Y	Population, Land Area, None	
Commercial plus Institutional Land	515	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	COM1+COM2+COM3+COM4+COM5+COM6+COM7+COM8+COM9+RES5+RES6+EDU1+EDU2+REL1	Y	Population, Land Area, None	Sum of building square footage from the following FEMA categories: COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9 + RES5 + RES6 + EDU1 + EDU2 + REL1
Commercial plus Industrial plus Institutional	520	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9 + IND1 + IND2 + IND3 + IND4 + IND5 + IND6 + RES5 + RES6 + EDU1 +	Y	Population, Land Area, None	

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
				EDU2 + REL1			
Golf Courses plus Institutional plus Industrial plus Commercial	525	N/A	cty_popthu2k_revised, FIPSSTCO	0.5*Commercial plus Industrial plus Institutional+0.5*Golf Courses	Y	Golf Courses, Commercial plus Industrial plus Institutional, Land Area	Combination of the golf courses ratio with the following FEMA categories: COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9 + IND1 + IND2 + IND3 + IND4 + IND5 + IND6 + RES5 + RES6 + EDU1 + EDU2 + REL1
Single Family Residential	527	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	RES1	Y	Housing, Population, Land Area	building square footage from single family dwellings (RES1)
Residential - High Density	530	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	RES3+RES4+RES5+RES6	Y	Housing, Population, Land Area	sum of building square footage from the following FEMA residential categories: RES3 + RES4 + RES5 + RES6
Residential + Commercial + Industrial + Institutional + Government	535	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9 + IND1 + IND2 + IND3 + IND4 + IND5 + IND6 + EDU1 + EDU2 + REL1 + GOV1 + GOV2 + RES1 + RES2 + RES3 + RES4	Y	Population, Land Area, None	sum of building square footage from the following FEMA categories: COM1 + COM2 + COM3 + COM4 + COM5 + COM6 + COM7 + COM8 + COM9 + IND1 + IND2 + IND3 + IND4 + IND5 + IND6 + EDU1 + EDU2 + REL1 + GOV1 + GOV2 + RES1 + RES2 + RES3 + RES4
Retail Trade (COM1)	540	fema_bsf_2002bnd	cty_popthu2k_revised, FIPSSTCO	COM1	Y	Commercial Land, Population, Land Area	building square footage from Retail Trade: SIC Codes: 52,53,54,55,56,57,59
Personal	545	fema_bsf_2002bnd	cty_popthu2k_revised	COM3	Y	Commercial	building square footage from

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Repair (COM3)		d	d, FIPSSTCO			Land, Population, Land Area	Personal/Repair Services: SIC Codes: 72,75,76,83,88
Retail Trade (COM1) plus Personal Repair (COM3)	550	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	COM1+COM3	Y	Commercial Land, Population, Land Area	sum of building square footage from the following FEMA categories: COM1 + COM3
Professional/Technical (COM4) plus General Government (GOV1)	555	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	COMV4+GOV1	Y	Commercial Land, Population, Land Area	sum of building square footage from the following FEMA categories: COM4 + GOV1
Hospital (COM6)	560	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	COM6	Y	Commercial Land, Population, Land Area	building square footage from Hospitals: SIC Codes: 8062,8063,8069
Medical Office/Clinic (COM7)	565	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	COM7	Y	Commercial Land, Population, Land Area	building square footage from Medical Office/Clinics: SIC Codes: 80 (except 8051,8052,8059,8062,8063,8069)
Heavy and High Tech Industrial (IND1 + IND5)	570	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	IND1+IND5	Y	Industrial Land, Population, Land Area	sum of building square footage from the following FEMA categories: IND1 + IND5
Light and High Tech Industrial (IND2 + IND5)	575	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	IND2+IND5	Y	Industrial Land, Population, Land Area	sum of building square footage from the following FEMA categories: IND2 + IND5
"Food, Drug, Chemical Industrial (IND3)"	580	fema_bsf_2002bnd	cty_popphu2k_revised, FIPSSTCO	IND3	Y	Industrial Land, Population, Land Area	building square footage from Food/Drugs/Chemical Factories: SIC Codes: 20,21,28,29

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Metals and Minerals Industrial (IND4)	585	fema_bsf_2002bnd	cty_pophu2k_revised, FIPSSTCO	IND4	Y	Industrial Land, Population, Land Area	building square footage from Metals/Minerals Processing Factories: SIC Codes: 10,12,13,14,33
Heavy Industrial (IND1)	590	fema_bsf_2002bnd	cty_pophu2k_revised, FIPSSTCO	IND1	Y	Industrial Land, Population, Land Area	building square footage from Heavy Industrial Factories - SIC Codes: 22,24,26,32,34,35 (except 3571,3572), 37
Light Industrial (IND2)	595	fema_bsf_2002bnd	cty_pophu2k_revised, FIPSSTCO	IND2	Y	Industrial Land, Population, Land Area	building square footage from Light Industrial Factories: SIC Codes: 23,25,27,30,31,36 (except 3671,3672,3674), 38,39
Industrial plus Institutional plus Hospitals	596	fema_bsf_2002bnd	cty_pophu2k_revised, FIPSSTCO	IND1+IND2+IND3+IND4+IND5+IND6+COM6+EDU1+EDU2+REL1+RES5+RES6	Y	Population, Land Area, None	sum of building square footage from IND1, IND2, IND3, IND4, IND5, IND6, COM6, EDU1, EDU2, REL1, RES5, RES6
Gas Stations	600	us_gas_sta, NUM_OF_GAS	cty_pophu2k_revised, FIPSSTCO		N	Commercial Land, Population, Land Area	Number of Gas Stations
Refineries and Tank Farms	650	us_oil	cty_pophu2k_revised, FIPSSTCO	TANKFARM,REFINERY	N	Industrial Land, Population, Land Area	Number of Oil Refineries and Tank Farms
Refineries and Tank Farms and Gas Stations	675	us_oilgas, NUM_OILGAS	cty_pophu2k_revised, FIPSSTCO		N	Commercial plus Industrial, Population, Land Area	Number of Oil Refineries, Tank Farms and Gas Stations
Airport Points	710	airport_point,	cty_pophu2k_revised, FIPSSTCO		N	Population, Land Area, None	Number of Airports
Airport Areas	700	airport-area,	cty_pophu2k_revised		N	Airport	Area of Commercial Airports



Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
		AREA	d, FIPSSTCO			Points, Population, Land Area	
Military Airports	720	military_air	cty_pophu2k_revised, FIPSSTCO		N	Airport Points, Population, Land Area	Number of Military Airports
Marine Ports	800	ports_ntad2010	cty_pophu2k_revised, FIPSSTCO e	N/A	Y	Navigable Waterway Miles, Water, Land Area	NTAD 2010 dataset of number of ports, not just marine, but also inland lakes and rivers
Navigable Waterway Miles	807	waterway_ntad2010, LENGTH	cty_pophu2k_revised, FIPSSTCO		Y	Marine Ports, Water, Land Area	NTAD 2010 dataset of navigable inland and intracoastal waterways, used for gapfilling
Navigable Waterway Activity	810	nav_water_activity, CTY_ACTIV	cty_pophu2k_revised, FIPSSTCO		N	Navigable Waterway Miles, Marine Ports, Water	Miles of waterways - navigable inland and intracoastal waterways
Golf Courses	850	us_golf	cty_pophu2k_revised, FIPSSTCO		N	Housing, Population, Land Area	Number of Golf Courses
Mines	860	mines_usgs	cty_pophu2k_revised, FIPSSTCO		N	Strip Mines/Quarries, Rural Land Area, Land Area	Number of mines
Construction and Mining	861		cty_pophu2k_revised, FIPSSTCO	0.5*Housing Change and Population+0.5*Mines	NEW	Population, Land Area, None	

Surrogate	Code	Weight Shapefile, Attribute	Data Shapefile, Attribute	Filter or Merge Function	Updated or New?	2ry, 3ry, 4ry Surrogate	Description
Wastewater Treatment Facilities	870	us_wwtp	cty_pophu2k_revised, FIPSSTCO		N	Commercial Plus Industrial, Population, Land Area	Number of Wastewater Treatment Plants (WWTP)
Drycleaners	880	us_dryclean, NO_EST	cty_pophu2k_revised, FIPSSTCO		N	Commercial Land, Population, Land Area	Number of Dry Cleaners
Commercial Timber	890		cty_pophu2k_revised, FIPSSTCO		N	Forest Land, Rural Land Area, Population	Number of Possible Timber Removal Locations

## Summary of Results

Tables 4 through 8 summarize the WestJumpAQMS 2008 emissions for NO<sub>x</sub>, VOC, NH<sub>3</sub>, SO<sub>2</sub> and PM<sub>2.5</sub>, respectively. The emissions are presented by state and then the total across all states in the contiguous U.S. The emission summaries are broken down by the following major source categories:

- Area: Represents Area Sources that are called Non-Point Sources in the 2008 NEI inventory (Discussed in Technical Memorandums #2 and #4e).
- Area-O&G: Area source oil and gas that is just from the WRAP Phase III Basins. Oil and gas area source emissions outside of the WRAP Phase III Basins are under the Area category (Discussed in Technical Memorandums #4a-4d).
- Dust: Fugitive dust emissions from the 2008 NEI (e.g., road dust and mechanically generated dust; Discussed in Technical Memorandum #6).
- Biogenic: Annual biogenic emissions from MEGAN using grid cell definitions of states (Discussed in Technical Memorandum #9).
- Off-Road: Off-road mobile source emissions from 2008 NEI (EPA NONROAD; Discussed in Technical Memorandum #2).
- On-Road: On-road mobile sources emissions using MOVES and EMFAC2011 (California) (Discussed in Technical Memorandum #3).
- Fires: Fire emissions from the DEASCO3 study<sup>7</sup>.
- WBD: Wind Blown Dust (WBD) emissions from the WRAP WBD model (Discussed in Technical Memorandum #6).
- PT-O&G: Point source oil and gas that is just from the WRAP Phase III Basins. Oil and gas point source emissions outside of the WRAP Phase III Basins (from NEI) are under the PTNCEM category (Discussed in Technical Memorandums #4a-4d).
- PTCEM: Point sources with Continuous Emissions Monitoring (CEM) devices whose hourly emissions are from the EPA CAMD website (Discussed in Technical Memorandum #1).
- PTNCEM: Non-CEM point sources from the 2008 NEI (Discussed in Technical Memorandum #1 and #4e).

The state and county total emissions for most source categories given above were taken from the SMOKE state- and county-level emission summary reports. The exceptions to this are for three source categories that used process-based information (e.g., hourly gridded WRF meteorological data) to develop the gridded hourly emission inputs: biogenic, WBD and fires. For these three categories we used grid cell definitions of states and counties to calculate the

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<sup>7</sup> <http://deasco3.wraptools.org/>

summary emissions. This was done by gridding the emissions using a 4 km resolution across the entire CONUS domain and then associating each 4 km grid cell with a state or county that has the largest areal coverage of the grid cell. The 4 km emissions gridding for the CONUS domain kept the highest resolution available which would be 4 km for the Intermountain West Processing Domain (IMWD), 12 km for the WESTUS domain outside of the IMWD and 36 km everywhere else (see Figure1).

Across the contiguous U.S. in 2008 there was 18.1 million (18.1M) tons per year of NO<sub>x</sub> emissions (Table 4a). The five largest emitting states were Texas (1.6M), California (1.1M), Florida (1.6M), Ohio (0.8M) and Georgia (0.7M) whose emissions represent 29% of the total U.S. NO<sub>x</sub> emissions in 2008. Table 4b displays the percent contribution of each major source category to the total NO<sub>x</sub> emissions by state and then for all states combined. Across the U.S., on-road mobile (42%) is the largest contributor to total NO<sub>x</sub> emissions followed by PTCEM (17%), area (12%), off-road (11%) and PTNCEM (11%). The dominant source category contribution by state depends on the population and amount of coal-fired electrical generation. For most states, on-road mobile is the largest contributor, although West Virginia has more PTCEM (43%) than on-road mobile NO<sub>x</sub> (25%). California, on the other hand, has essentially no PTCEM NO<sub>x</sub> (0.3%) with almost half the NO<sub>x</sub> being from on-road mobile (46%). At the other extreme are Tribal lands whose NO<sub>x</sub> is dominated by PTCEM (90%), presumably due to the inclusion of the Navajo power plant and the exclusion of on-road and non-road mobile and WRAP Phase III O&G that are assigned to counties in the states where they reside, rather than to tribal lands.

There is 44.4M tons per year of VOC emissions in the contiguous U.S. of which two thirds (29.5M) is from biogenic sources (Table 5a). Texas has the highest total VOC emissions (6.3M) that is nearly three times higher than the next highest state (Georgia with 2.2M). This is due in part to Texas having high biogenic VOC emissions (4.1M) that is over double what the next highest state has (again Georgia with 1.8M). When just looking at anthropogenic VOC emissions, the five highest VOC emitting states in 2008 were Texas (2.3M), California (1.1M), Florida (0.8M), New York (0.6M) and Georgia (0.5M). These five states emit 35% of the total U.S. anthropogenic VOC emissions (Table 5b). As noted previously, across the U.S. biogenic VOC contribute 67% of the total VOCs. Biogenic emissions are a larger percentage of a state's total VOC emissions for sparsely populated states and states in the south and lowest relative contribution for more populated states in the northeast. Biogenic emissions of VOC also have a strong seasonal signal with most of the emissions occurring in the late spring through early fall and peaking in the summer. Just looking at anthropogenic VOC emissions across the contiguous U.S., area sources are the largest contributor (34%), followed by on-road (23%), off-road (17%), and area source O&G (13%). Note that for states within the WRAP Phase III O&G Basins, the O&G VOC is a significant contributor to the state-wide anthropogenic VOC emissions: Colorado (44%), New Mexico (69%), Utah (43%), and Wyoming (66%). Texas and Oklahoma, which had O&G area and point source updates in the NEI, also have significant O&G VOC contributions (58% and 50%, respectively). Note that some other states with large O&G emissions may also have significant O&G VOC emissions, but since the emissions are below the reporting threshold their emissions are not included in the 2008 NEI (see Technical Memorandum#4e).

There is 4.2M tons per year of ammonia (NH<sub>3</sub>) emissions across the contiguous U.S. (Table 6) with a vast majority (3.8M or 89%) coming from the Area Source sector with most of that (6%)

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being from agricultural livestock and fertilizer categories (see Technical Memorandum#8). Across the U.S. there are small amounts of ammonia emissions from fires (5.2%), on-road mobile (3.3%) and point sources (2.2% for PTCCEM plus PTNCEM). For states in the Northeast Corridor that have large amounts of mobile sources and not as much livestock and fertilizer application, on-road mobile tends to be the largest contributor. However, these Northeast States tend to have the lowest amounts of ammonia emissions. The five states with the highest amounts of ammonia emissions are California (0.3M), Texas (0.3M), Iowa (0.3M), Minnesota (0.2M) and Nebraska (0.2M), which are all states known for having large amounts of livestock and agriculture.

There is approximately 10M tons per year of SO<sub>2</sub> emissions across the contiguous U.S. of which 7.7M (77%) is due to the PTCCEM electrical generation sector (Table 7). The ten highest emitting SO<sub>2</sub> states are known for having the highest number of coal-fire electricity generating units and contribute 58% of the U.S. SO<sub>2</sub> emissions with each state have total SO<sub>2</sub> emissions ranging from 1.0M to 0.4M tons per year (from highest to lowest the top ten SO<sub>2</sub> emission states are: PA, OH, IN, TX, GA, AL, MO, MI, IL and KY).

Table 8 summarizes the primary PM<sub>2.5</sub> emissions by state. Total contiguous U.S. PM<sub>2.5</sub> emissions are 4.8M tons per year that are spread out across several source categories: Fugitive Dust (24%), Fires (21%), Area (15%), Windblown Dust (10%), PTNCEM (8%) and PTCCEM (6%). The five highest emitting primary PM<sub>2.5</sub> states are California (0.6M), Texas (0.4M), Kansas (0.1M), Ohio (0.1M) and Florida (0.1M) who together emit ~30% of the U.S. PM<sub>2.5</sub> emissions. However, the source category with the highest PM<sub>2.5</sub> contribution varies by state. For example, for California it is Fires (68%), for Texas it is Fugitive Dust (42%), for Florida it is on-road mobile (26%), for Kansas it is Fugitive Dust (45%) and for Ohio it is PTCCEM (27%).

**Table 4a. Summary of 2008 NO<sub>x</sub> emissions (tons per year) by state and major source category (not shown are 678,716 TPY near-shore and 475,000 TPY off-shore commercial marine vessel and Mexico/Canada emissions).**

State	Area	A-O&G	Bio	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF	Total
Alabama	38,509		11,746	25,981	251,996	567	112,812	66,738	100	4,783	583	513,813
Arizona	39,403	0	15,256	33,857	137,555	0	42,769	18,107	8	4,705	1,319	292,980
Arkansas	27,030	6,183	12,677	24,867	81,057	178	37,269	37,399	584	2,473	580	230,298
California	153,233	2,221	18,218	233,142	513,028	967	3,725	90,049	429	1,183	121,138	1,137,331
Colorado	22,852	27,048	9,542	31,360	129,591	21,310	61,560	25,218	17	218	932	329,647
Connecticut	14,884		347	15,921	134,539	0	3,789	4,696	0	4		174,180
Delaware	4,709		523	4,980	35,937	0	9,197	4,702	2	9	2	60,062
District of Columbia	1,730		10	2,693	12,649	0	0	597				17,679
Florida	40,057		41,393	108,275	561,917	120	160,297	56,304	1,299	3,113	8,099	980,875
Georgia	40,657	0	16,095	50,662	444,346	30	105,556	45,358	195	7,324	730	710,952
Idaho	19,869		4,806	14,129	44,554	0	0	12,671	391	10,879	3,782	111,081
Illinois	101,752		15,864	90,120	268,604	907	123,594	80,911	97	133	39	682,020
Indiana	53,493		8,991	56,127	207,414	2	196,119	69,376	39	69	27	591,657
Iowa	31,431		13,704	57,103	83,250	0	48,886	40,834	355	56	4	275,623
Kansas	53,041		28,199	42,020	77,939	113	52,716	53,114	4,893	235	251	312,522
Kentucky	39,461		8,918	27,971	239,040	415	157,246	39,965	48	657	462	514,183
Louisiana	175,628	0	12,782	25,880	97,757	3,271	49,270	140,400	841	2,842	633	509,304
Maine	14,395		1,430	7,356	40,206	0	585	16,168	1	30		80,171
Maryland	28,439		1,928	25,261	114,574	0	36,608	21,782	8	75	15	228,690
Massachusetts	30,409		407	26,309	121,138	0	9,489	13,785	0	7	5	201,551
Michigan	68,061	0	5,715	65,730	264,786	543	103,217	78,021	8	54	53	586,188
Minnesota	53,516		8,957	60,928	144,617	0	59,774	59,046	120	571	9,299	396,828
Mississippi	29,130		12,969	19,489	99,171	89	40,993	53,265	248	2,303	1,099	258,755
Missouri	64,829		18,535	47,642	182,342	0	88,246	45,373	376	1,018	357	448,717
Montana	25,777	332	12,953	16,910	29,931	395	28,354	14,195	64	7,951	2,293	139,155
Nebraska	74,124		17,994	36,062	52,451	173	43,052	14,003	340	247	19	238,465
Nevada	11,321		7,364	17,081	50,068	0	16,002	14,088	1	12	3,575	119,513
New Hampshire	6,426		411	7,156	26,275	0	4,635	2,328		3		47,234
New Jersey	84,584		852	36,687	155,562	8	11,890	16,915	2	100	111	306,712
New Mexico	27,754	35,838	15,983	8,566	72,074	31,243	26,930	4,329	122	4,275	1,085	228,199
New York	100,561		3,546	71,841	307,553	3	31,595	47,429	2	33	95	562,658
North Carolina	30,033		10,803	52,900	235,470	0	55,878	40,760	114	1,565	13,588	441,112
North Dakota	16,719		9,133	34,572	22,879	164	66,849	11,239	552	302	47	162,455
Ohio	91,078		6,646	74,636	288,475	3	235,229	66,202	15	43	9	762,336
Oklahoma	34,757	68,744	26,325	27,736	117,681	342	79,716	64,956	1,015	2,412	731	424,415
Oregon	24,121		5,560	23,463	98,399	0	9,463	14,085	296	9,627	8,521	193,534
Pennsylvania	80,021		5,149	53,635	244,630	1	185,496	70,492	5	175	16	639,620
Rhode Island	4,931		38	4,086	18,869	0	199	1,319				29,441
South Carolina	19,225		8,580	25,776	124,855	0	43,929	29,039	440	17,988	1,440	271,273
South Dakota	5,904		14,758	24,699	26,865	0	13,852	2,532	136	242	827	89,815
Tennessee	53,817		9,299	35,879	182,233	0	84,204	47,686	57	927	316	414,417
Texas	135,207	248,358	86,105	163,763	519,964	40,814	157,388	195,689	1,132	3,177	5,561	1,557,159
Utah	17,269	12,521	6,144	13,249	64,186	3,082	61,308	23,233	3	63	650	201,707
Vermont	4,539		524	3,656	20,658	0	296	206	0	6	2	29,887
Virginia	51,231		6,465	39,017	181,383	0	42,655	53,015	37	992	955	375,751
Washington	50,287		3,845	38,096	139,989	0	10,804	27,614	92	10,177	2,236	283,140
West Virginia	31,383		2,091	7,339	57,757	3	99,344	34,627	3	549	58	233,154
Wisconsin	43,994		6,500	47,302	160,748	0	48,261	40,814	21	162	52	347,854
Wyoming	37,685	22,526	6,928	4,848	27,211	23,505	74,762	23,901	5	1,877	7,429	230,678
Tribal Data	251					1,051	82,241	7,782				91,325
Grand Total	2,209,516	423,772	543,008	1,966,761	7,514,176	129,298	3,018,047	1,942,355	14,515	105,645	199,027	18,066,118



**Table 4b. Percent contribution of source categories to NO<sub>x</sub> emissions by state.**

State	Area	A-O&G	Bio	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF
Alabama	7.5%	0.0%	2.3%	5.1%	49.0%	0.1%	22.0%	13.0%	0.0%	0.9%	0.1%
Arizona	13.4%	0.0%	5.2%	11.6%	47.0%	0.0%	14.6%	6.2%	0.0%	1.6%	0.5%
Arkansas	11.7%	2.7%	5.5%	10.8%	35.2%	0.1%	16.2%	16.2%	0.3%	1.1%	0.3%
California	13.5%	0.2%	1.6%	20.5%	45.1%	0.1%	0.3%	7.9%	0.0%	0.1%	10.7%
Colorado	6.9%	8.2%	2.9%	9.5%	39.3%	6.5%	18.7%	7.7%	0.0%	0.1%	0.3%
Connecticut	8.5%	0.0%	0.2%	9.1%	77.2%	0.0%	2.2%	2.7%	0.0%	0.0%	0.0%
Delaware	7.8%	0.0%	0.9%	8.3%	59.8%	0.0%	15.3%	7.8%	0.0%	0.0%	0.0%
District of Columbia	9.8%	0.0%	0.1%	15.2%	71.5%	0.0%	0.0%	3.4%	0.0%	0.0%	0.0%
Florida	4.1%	0.0%	4.2%	11.0%	57.3%	0.0%	16.3%	5.7%	0.1%	0.3%	0.8%
Georgia	5.7%	0.0%	2.3%	7.1%	62.5%	0.0%	14.8%	6.4%	0.0%	1.0%	0.1%
Idaho	17.9%	0.0%	4.3%	12.7%	40.1%	0.0%	0.0%	11.4%	0.4%	9.8%	3.4%
Illinois	14.9%	0.0%	2.3%	13.2%	39.4%	0.1%	18.1%	11.9%	0.0%	0.0%	0.0%
Indiana	9.0%	0.0%	1.5%	9.5%	35.1%	0.0%	33.1%	11.7%	0.0%	0.0%	0.0%
Iowa	11.4%	0.0%	5.0%	20.7%	30.2%	0.0%	17.7%	14.8%	0.1%	0.0%	0.0%
Kansas	17.0%	0.0%	9.0%	13.4%	24.9%	0.0%	16.9%	17.0%	1.6%	0.1%	0.1%
Kentucky	7.7%	0.0%	1.7%	5.4%	46.5%	0.1%	30.6%	7.8%	0.0%	0.1%	0.1%
Louisiana	34.5%	0.0%	2.5%	5.1%	19.2%	0.6%	9.7%	27.6%	0.2%	0.6%	0.1%
Maine	18.0%	0.0%	1.8%	9.2%	50.2%	0.0%	0.7%	20.2%	0.0%	0.0%	0.0%
Maryland	12.4%	0.0%	0.8%	11.0%	50.1%	0.0%	16.0%	9.5%	0.0%	0.0%	0.0%
Massachusetts	15.1%	0.0%	0.2%	13.1%	60.1%	0.0%	4.7%	6.8%	0.0%	0.0%	0.0%
Michigan	11.6%	0.0%	1.0%	11.2%	45.2%	0.1%	17.6%	13.3%	0.0%	0.0%	0.0%
Minnesota	13.5%	0.0%	2.3%	15.4%	36.4%	0.0%	15.1%	14.9%	0.0%	0.1%	2.3%
Mississippi	11.3%	0.0%	5.0%	7.5%	38.3%	0.0%	15.8%	20.6%	0.1%	0.9%	0.4%
Missouri	14.4%	0.0%	4.1%	10.6%	40.6%	0.0%	19.7%	10.1%	0.1%	0.2%	0.1%
Montana	18.5%	0.2%	9.3%	12.2%	21.5%	0.3%	20.4%	10.2%	0.0%	5.7%	1.6%
Nebraska	31.1%	0.0%	7.5%	15.1%	22.0%	0.1%	18.1%	5.9%	0.1%	0.1%	0.0%
Nevada	9.5%	0.0%	6.2%	14.3%	41.9%	0.0%	13.4%	11.8%	0.0%	0.0%	3.0%
New Hampshire	13.6%	0.0%	0.9%	15.2%	55.6%	0.0%	9.8%	4.9%	0.0%	0.0%	0.0%
New Jersey	27.6%	0.0%	0.3%	12.0%	50.7%	0.0%	3.9%	5.5%	0.0%	0.0%	0.0%
New Mexico	12.2%	15.7%	7.0%	3.8%	31.6%	13.7%	11.8%	1.9%	0.1%	1.9%	0.5%
New York	17.9%	0.0%	0.6%	12.8%	54.7%	0.0%	5.6%	8.4%	0.0%	0.0%	0.0%
North Carolina	6.8%	0.0%	2.4%	12.0%	53.4%	0.0%	12.7%	9.2%	0.0%	0.4%	3.1%
North Dakota	10.3%	0.0%	5.6%	21.3%	14.1%	0.1%	41.1%	6.9%	0.3%	0.2%	0.0%
Ohio	11.9%	0.0%	0.9%	9.8%	37.8%	0.0%	30.9%	8.7%	0.0%	0.0%	0.0%
Oklahoma	8.2%	16.2%	6.2%	6.5%	27.7%	0.1%	18.8%	15.3%	0.2%	0.6%	0.2%
Oregon	12.5%	0.0%	2.9%	12.1%	50.8%	0.0%	4.9%	7.3%	0.2%	5.0%	4.4%
Pennsylvania	12.5%	0.0%	0.8%	8.4%	38.2%	0.0%	29.0%	11.0%	0.0%	0.0%	0.0%
Rhode Island	16.7%	0.0%	0.1%	13.9%	64.1%	0.0%	0.7%	4.5%	0.0%	0.0%	0.0%
South Carolina	7.1%	0.0%	3.2%	9.5%	46.0%	0.0%	16.2%	10.7%	0.2%	6.6%	0.5%
South Dakota	6.6%	0.0%	16.4%	27.5%	29.9%	0.0%	15.4%	2.8%	0.2%	0.3%	0.9%
Tennessee	13.0%	0.0%	2.2%	8.7%	44.0%	0.0%	20.3%	11.5%	0.0%	0.2%	0.1%
Texas	8.7%	15.9%	5.5%	10.5%	33.4%	2.6%	10.1%	12.6%	0.1%	0.2%	0.4%
Utah	8.6%	6.2%	3.0%	6.6%	31.8%	1.5%	30.4%	11.5%	0.0%	0.0%	0.3%
Vermont	15.2%	0.0%	1.8%	12.2%	69.1%	0.0%	1.0%	0.7%	0.0%	0.0%	0.0%
Virginia	13.6%	0.0%	1.7%	10.4%	48.3%	0.0%	11.4%	14.1%	0.0%	0.3%	0.3%
Washington	17.8%	0.0%	1.4%	13.5%	49.4%	0.0%	3.8%	9.8%	0.0%	3.6%	0.8%
West Virginia	13.5%	0.0%	0.9%	3.1%	24.8%	0.0%	42.6%	14.9%	0.0%	0.2%	0.0%
Wisconsin	12.6%	0.0%	1.9%	13.6%	46.2%	0.0%	13.9%	11.7%	0.0%	0.0%	0.0%
Wyoming	16.3%	9.8%	3.0%	2.1%	11.8%	10.2%	32.4%	10.4%	0.0%	0.8%	3.2%
Tribal Data	0.3%	0.0%	0.0%	0.0%	0.0%	1.2%	90.1%	8.5%	0.0%	0.0%	0.0%
Grand Total	12.2%	2.3%	3.0%	10.9%	41.6%	0.7%	16.7%	10.8%	0.1%	0.6%	1.1%

**Table 5a. Summary of 2008 VOC emissions (tons per year) by state and major source category (not shown are 25,259 TPY near-shore and 17,165 TPY off-shore commercial marine vessel and Mexico/Canada emissions).**

State	Area	Area-O&G	Dust	Biogenic	Off-Road	On-Road	Fires	WBD	PT-O&G	PTCEM	PTNCEM	Total
Alabama	76,980	-	-	1,762,020	47,313	115,402	30,208	-	-	1,037	31,249	2,064,208
Arizona	100,256	12	-	686,255	42,297	54,589	4,989	-	-	492	3,006	891,897
Arkansas	78,116	1,250	-	1,527,879	32,580	35,817	46,272	-	-	488	27,552	1,749,953
California	297,201	15,149	-	1,230,279	164,441	198,383	331,443	-	-	428	41,989	2,279,313
Colorado	67,133	68,895	-	275,328	34,301	55,953	3,732	-	79,847	508	29,160	614,856
Connecticut	34,918	-	-	80,798	24,291	57,602	13	-	-	151	1,099	198,871
Delaware	10,126	-	-	23,155	8,343	15,416	139	-	-	80	3,060	60,318
District of Columbia	5,926	-	-	1,277	1,461	5,748	0	-	-	-	70	14,482
Florida	271,935	-	-	1,300,657	184,173	271,441	71,868	-	-	1,909	31,442	2,133,426
Georgia	193,060	2	-	1,812,923	65,986	191,315	37,034	-	-	1,563	24,257	2,326,140
Idaho	89,706	-	-	240,280	21,971	18,852	35,143	-	-	-	1,168	407,120
Illinois	220,505	-	-	340,743	86,268	121,532	6,502	-	-	1,611	49,787	826,948
Indiana	157,552	-	-	246,726	47,016	94,503	4,003	-	-	1,954	37,688	589,442
Iowa	72,253	-	-	205,546	37,382	40,382	4,948	-	-	642	21,854	383,007
Kansas	74,796	-	-	303,333	19,675	35,329	35,743	-	-	743	18,017	487,636
Kentucky	65,753	-	-	607,945	34,537	102,156	4,506	-	-	1,598	44,025	860,519
Louisiana	142,759	1,627	-	1,366,208	52,974	49,730	45,123	-	-	1,089	67,684	1,727,193
Maine	27,547	-	-	235,236	29,353	17,703	65	-	-	34	4,150	314,086
Maryland	69,461	-	-	185,604	38,551	51,039	484	-	-	330	2,873	348,343
Massachusetts	86,801	-	-	95,444	41,113	52,645	235	-	-	331	4,012	280,582
Michigan	191,730	10,505	-	373,995	138,301	132,274	934	-	-	1,127	28,008	876,873
Minnesota	117,043	-	-	449,437	86,508	72,627	7,962	-	-	637	22,448	756,663
Mississippi	62,248	-	-	1,611,910	32,271	44,474	29,856	-	-	551	32,378	1,813,687
Missouri	124,875	-	-	1,262,144	51,348	81,169	13,759	-	-	1,571	16,512	1,551,376
Montana	18,512	204	-	305,432	12,449	13,231	13,434	-	136	395	4,150	367,944
Nebraska	45,187	-	-	167,093	15,104	24,272	6,281	-	-	436	3,563	261,936
Nevada	40,973	-	-	262,912	18,783	21,302	1,127	-	-	159	2,801	348,056
New Hampshire	22,282	-	-	91,432	19,528	13,952	15	-	-	93	692	147,993
New Jersey	104,950	-	-	104,571	60,061	68,286	761	-	-	135	9,642	348,407
New Mexico	37,395	174,990	-	468,258	11,383	29,629	2,677	-	7,573	281	2,006	734,193
New York	276,502	-	-	341,530	159,616	134,192	487	-	-	747	6,996	920,069
North Carolina	179,251	-	-	1,118,947	72,837	103,811	22,312	-	-	969	38,171	1,536,298
North Dakota	21,194	-	-	118,195	11,892	10,928	13,873	-	-	744	3,142	179,968
Ohio	179,500	-	-	322,698	80,466	129,332	2,443	-	-	1,305	31,308	747,052
Oklahoma	60,527	190,550	-	949,937	30,881	54,459	15,942	-	-	1,044	24,655	1,327,994
Oregon	63,741	-	-	339,630	33,308	39,649	41,271	-	-	226	8,351	526,176
Pennsylvania	200,885	-	-	428,612	94,997	116,818	2,487	-	-	724	28,592	873,115
Rhode Island	10,258	-	-	8,317	6,332	8,163	68	-	-	8	1,191	34,337
South Carolina	97,066	-	-	910,898	39,523	52,834	11,748	-	-	546	24,539	1,137,153
South Dakota	27,164	-	-	151,342	10,827	11,521	2,833	-	-	126	2,430	206,244
Tennessee	110,817	-	-	852,463	50,671	79,157	7,754	-	-	886	37,110	1,138,859
Texas	409,731	1,299,083	-	4,094,242	152,377	229,629	39,683	-	4,118	3,601	108,514	6,340,979
Utah	72,811	96,412	-	237,799	23,213	27,138	1,977	-	2,619	275	6,409	468,653
Vermont	11,303	-	-	66,394	10,152	8,469	37	-	-	33	458	96,845
Virginia	140,761	-	-	823,308	52,186	83,170	9,501	-	-	548	27,386	1,136,860
Washington	102,173	-	-	224,471	52,264	59,343	16,533	-	-	15	12,726	467,525
West Virginia	27,945	-	-	411,187	16,711	23,538	2,455	-	-	1,191	10,926	493,951
Wisconsin	135,333	-	-	338,335	97,471	75,111	1,828	-	-	1,032	30,522	679,632
Wyoming	11,719	103,208	-	177,044	9,081	10,760	14,792	-	9,441	827	10,526	347,397
Tribal Data	1,448	-	-	-	-	-	-	-	-	572	880	2,900
Grand Total	5,048,106	1,961,886	-	29,540,164	2,464,564	3,344,778	947,278	-	103,734	35,791	981,174	44,427,474

**Table 5b. Percent contribution of source categories to VOC emissions by state.**

State	Area	A-O&G	BIO4km	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF
Alabama	3.8%	0.0%	86.4%	2.3%	5.7%	0.1%	0.1%	1.5%	0.0%	0.2%	0.0%
Arizona	11.2%	0.0%	76.8%	4.7%	6.1%	0.0%	0.1%	0.3%	0.0%	0.6%	0.1%
Arkansas	4.6%	0.1%	89.5%	1.9%	2.1%	0.0%	0.0%	1.6%	0.0%	0.1%	0.0%
California	14.3%	0.7%	59.2%	7.9%	9.5%	0.1%	0.0%	1.9%	0.0%	0.1%	6.2%
Colorado	11.0%	11.3%	45.0%	5.6%	9.1%	13.4%	0.1%	4.4%	0.0%	0.1%	0.1%
Connecticut	17.6%	0.0%	40.6%	12.2%	29.0%	0.0%	0.1%	0.6%	0.0%	0.0%	0.0%
Delaware	16.8%	0.0%	38.5%	13.9%	25.6%	0.0%	0.1%	5.1%	0.0%	0.0%	0.0%
District of Columbia	40.9%	0.0%	8.8%	10.1%	39.7%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%
Florida	13.1%	0.0%	62.8%	8.9%	13.1%	0.0%	0.1%	1.5%	0.0%	0.1%	0.2%
Georgia	8.4%	0.0%	79.0%	2.9%	8.3%	0.0%	0.1%	1.1%	0.0%	0.3%	0.0%
Idaho	23.1%	0.0%	61.9%	5.7%	4.9%	0.0%	0.0%	0.3%	0.1%	3.1%	0.9%
Illionis	26.9%	0.0%	41.5%	10.5%	14.8%	0.1%	0.2%	6.0%	0.0%	0.0%	0.0%
Indiana	26.9%	0.0%	42.1%	8.0%	16.1%	0.0%	0.3%	6.4%	0.0%	0.0%	0.0%
Iowa	19.1%	0.0%	54.3%	9.9%	10.7%	0.0%	0.2%	5.8%	0.1%	0.0%	0.0%
Kansas	16.2%	0.0%	65.9%	4.3%	7.7%	0.6%	0.2%	3.3%	1.7%	0.1%	0.1%
Kentucky	7.7%	0.0%	70.9%	4.0%	11.9%	0.0%	0.2%	5.1%	0.0%	0.1%	0.1%
Louisiana	8.5%	0.1%	81.1%	3.1%	3.0%	0.4%	0.1%	3.6%	0.0%	0.1%	0.0%
Maine	8.8%	0.0%	74.9%	9.3%	5.6%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%
Maryland	20.0%	0.0%	53.3%	11.1%	14.7%	0.0%	0.1%	0.8%	0.0%	0.0%	0.0%
Massachusetts	31.0%	0.0%	34.0%	14.7%	18.8%	0.0%	0.1%	1.4%	0.0%	0.0%	0.0%
Michigan	21.9%	1.2%	42.7%	15.8%	15.1%	0.1%	0.1%	3.1%	0.0%	0.0%	0.0%
Minnesota	15.4%	0.0%	59.1%	11.4%	9.6%	0.0%	0.1%	2.9%	0.0%	0.1%	1.4%
Mississippi	3.5%	0.0%	90.2%	1.8%	2.5%	0.1%	0.0%	1.7%	0.0%	0.1%	0.1%
Missouri	8.1%	0.0%	82.0%	3.3%	5.3%	0.0%	0.1%	1.1%	0.0%	0.1%	0.0%
Montana	5.1%	0.1%	84.0%	3.4%	3.6%	0.1%	0.1%	1.1%	0.0%	2.1%	0.4%
Nebraska	17.6%	0.0%	65.1%	5.9%	9.5%	0.0%	0.2%	1.4%	0.2%	0.2%	0.0%
Nevada	11.7%	0.0%	74.9%	5.3%	6.1%	0.0%	0.0%	0.8%	0.0%	0.0%	1.2%
New Hampshire	15.1%	0.0%	61.8%	13.2%	9.4%	0.0%	0.1%	0.5%	0.0%	0.0%	0.0%
New Jersey	30.2%	0.0%	30.1%	17.3%	19.6%	0.0%	0.0%	2.8%	0.0%	0.0%	0.0%
New Mexico	5.1%	23.7%	63.4%	1.5%	4.0%	1.0%	0.0%	0.3%	0.0%	0.7%	0.1%
New York	30.1%	0.0%	37.1%	17.4%	14.6%	0.0%	0.1%	0.8%	0.0%	0.0%	0.0%
North Carolina	11.7%	0.0%	73.1%	4.8%	6.8%	0.0%	0.1%	2.5%	0.0%	0.1%	0.9%
North Dakota	12.6%	0.0%	70.4%	7.1%	6.5%	0.0%	0.4%	1.8%	0.4%	0.6%	0.0%
Ohio	24.1%	0.0%	43.3%	10.8%	17.4%	0.0%	0.2%	4.2%	0.0%	0.0%	0.0%
Oklahoma	4.6%	14.5%	72.1%	2.3%	4.1%	0.4%	0.1%	1.5%	0.1%	0.2%	0.0%
Oregon	12.7%	0.0%	67.4%	6.6%	7.9%	0.0%	0.0%	1.7%	0.1%	1.8%	1.8%
Pennsylvania	23.1%	0.0%	49.2%	10.9%	13.4%	0.0%	0.1%	3.2%	0.0%	0.0%	0.0%
Rhode Island	29.9%	0.0%	24.3%	18.5%	23.8%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%
South Carolina	8.5%	0.0%	79.9%	3.5%	4.6%	0.0%	0.0%	2.1%	0.0%	1.2%	0.1%
South Dakota	13.3%	0.0%	74.0%	5.3%	5.6%	0.0%	0.1%	1.2%	0.1%	0.1%	0.4%
Tennessee	9.8%	0.0%	75.3%	4.5%	7.0%	0.0%	0.1%	3.3%	0.0%	0.1%	0.0%
Texas	6.5%	20.6%	64.9%	2.4%	3.6%	0.2%	0.1%	1.6%	0.0%	0.0%	0.1%
Utah	15.6%	20.6%	50.9%	5.0%	5.8%	0.6%	0.1%	1.4%	0.0%	0.0%	0.2%
Vermont	11.7%	0.0%	68.6%	10.5%	8.7%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%
Virginia	12.5%	0.0%	72.9%	4.6%	7.4%	0.0%	0.0%	2.4%	0.0%	0.1%	0.1%
Washington	22.0%	0.0%	48.4%	11.3%	12.8%	0.0%	0.0%	2.7%	0.0%	2.2%	0.5%
West Virginia	5.7%	0.0%	83.6%	3.4%	4.8%	0.2%	0.2%	2.0%	0.0%	0.1%	0.0%
Wisconsin	20.0%	0.0%	49.9%	14.4%	11.1%	0.0%	0.2%	4.5%	0.0%	0.0%	0.0%
Wyoming	3.5%	30.4%	52.1%	2.7%	3.2%	2.9%	0.2%	2.9%	0.0%	0.5%	1.6%
Tribal Data	50.1%	0.0%	0.0%	0.0%	0.0%	5.2%	19.8%	24.9%	0.0%	0.0%	0.0%
Grand Total	11.5%	4.5%	67.4%	5.6%	7.6%	0.3%	0.1%	2.2%	0.0%	0.2%	0.5%

**Table 6a. Summary of 2008 NH<sub>3</sub> emissions (tons per year) by state and major source category (not shown are Mexico and Canada emissions).**

State	Area	A-O&G	BIO4km	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF	Grand Tot:
Alabama	62,464			30	4,514	0	551	1,595	66	3,321	357	72,899
Arizona	34,878			40	2,377	0	923	51	5	3,274	912	42,457
Arkansas	120,628			26	1,388	0	256	932	405	1,702	357	125,694
California	322,270			192	8,729	20	745	10,824	297	736	84,489	428,302
Colorado	70,451			35	2,201	0	468	1	12	142	648	73,958
Connecticut	3,471			18	2,572	0	283	0	0	3	0	6,346
Delaware	13,294			6	729	0	142	128	2	6	1	14,307
District of Columbi	180			3	299	0	0	0	0	0	0	482
Florida	33,829			137	12,069	0	3,618	1,756	902	2,120	5,516	59,946
Georgia	85,923			58	8,506	0	1,058	4,898	135	5,098	494	106,169
Idaho	104,060			16	689	0	0	1,042	271	7,566	2,608	116,252
Illionis	122,497			100	5,089	7	193	1,286	67	80	19	129,338
Indiana	103,870			54	3,533	0	346	841	27	46	19	108,737
Iowa	296,453			52	1,416	0	22	3,397	248	35	3	301,626
Kansas	152,679			37	1,317	0	358	1,576	2,337	156	146	158,606
Kentucky	52,417			29	4,125	0	795	177	34	458	321	58,355
Louisiana	61,866			32	2,006	0	1,477	6,233	584	1,940	397	74,534
Maine	5,888			13	672	0	29	582	1	21	0	7,206
Maryland	28,295			31	2,416	0	202	0	5	52	11	31,012
Massachusetts	4,238			31	2,570	0	196	326	0	5	4	7,369
Michigan	66,125			85	4,745	0	141	766	5	33	37	71,938
Minnesota	186,073			65	2,466	0	200	1,804	84	393	6,488	197,573
Mississippi	59,473			21	1,723	0	481	1,482	168	1,584	686	65,617
Missouri	126,012			48	3,228	0	143	1,514	257	701	230	132,132
Montana	55,254			16	458	0	6	48	45	5,462	1,599	62,888
Nebraska	176,682			31	852	0	192	1,021	227	150	9	179,163
Nevada	5,717			20	849	0	225	77	1	5	2,490	9,382
New Hampshire	1,530			10	580	0	153	47	0	2	0	2,323
New Jersey	6,406			45	3,328	0	118	1,002	1	70	78	11,047
New Mexico	39,399			10	1,090	0	274	0	85	2,981	754	44,594
New York	42,019			88	6,262	0	1,596	1,437	2	22	65	51,491
North Carolina	169,574			59	4,366	0	149	1,372	78	1,085	9,457	186,141
North Dakota	78,857			29	345	0	369	6,002	386	143	33	86,164
Ohio	88,035			79	5,177	0	66	3,011	11	30	5	96,414
Oklahoma	98,039			29	2,063	0	718	2,340	613	1,608	492	105,902
Oregon	43,814			27	1,668	0	252	3	204	6,697	5,907	58,571
Pennsylvania	72,491			61	4,976	0	413	1,628	3	121	6	79,698
Rhode Island	589			5	404	0	4	115	0	0	0	1,117
South Carolina	30,367			30	2,121	0	283	1,840	307	12,540	999	48,486
South Dakota	131,616			21	386	0	34	228	95	169	577	133,126
Tennessee	34,903			39	3,197	0	207	986	39	640	207	40,218
Texas	290,794			1,125	10,151	35	4,404	2,201	785	2,095	3,719	315,308
Utah	37,639			16	1,048	0	23	533	1	35	449	39,744
Vermont	8,019			5	341	0	15	0	0	4	2	8,386
Virginia	43,188			46	3,619	0	269	1,285	23	679	630	49,739
Washington	44,368			43	2,543	0	92	349	64	7,088	1,556	56,104
West Virginia	12,857			9	904	0	33	273	2	382	36	14,495
Wisconsin	118,588			57	2,796	0	426	497	14	99	35	122,513
Wyoming	19,446			6	374	0	440	277	3	1,302	5,177	27,024
Tribal Data	1,452					0	286	30				1,768
Grand Total	3,768,976			3,060	139,275	62	23,674	67,812	8,901	72,880	138,022	4,222,661

**Table 6b. Percent contribution of source categories to NH<sub>3</sub> emissions by state.**

State	Area	A-O&G	BIO4km	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF
Alabama	85.7%	0.0%	0.0%	0.0%	6.2%	0.0%	0.8%	2.2%	0.1%	4.6%	0.5%
Arizona	82.1%	0.0%	0.0%	0.1%	5.6%	0.0%	2.2%	0.1%	0.0%	7.7%	2.1%
Arkansas	96.0%	0.0%	0.0%	0.0%	1.1%	0.0%	0.2%	0.7%	0.3%	1.4%	0.3%
California	75.2%	0.0%	0.0%	0.0%	2.0%	0.0%	0.2%	2.5%	0.1%	0.2%	19.7%
Colorado	95.3%	0.0%	0.0%	0.0%	3.0%	0.0%	0.6%	0.0%	0.0%	0.2%	0.9%
Connecticut	54.7%	0.0%	0.0%	0.3%	40.5%	0.0%	4.5%	0.0%	0.0%	0.0%	0.0%
Delaware	92.9%	0.0%	0.0%	0.0%	5.1%	0.0%	1.0%	0.9%	0.0%	0.0%	0.0%
District of Columbia	37.4%	0.0%	0.0%	0.6%	62.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Florida	56.4%	0.0%	0.0%	0.2%	20.1%	0.0%	6.0%	2.9%	1.5%	3.5%	9.2%
Georgia	80.9%	0.0%	0.0%	0.1%	8.0%	0.0%	1.0%	4.6%	0.1%	4.8%	0.5%
Idaho	89.5%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.9%	0.2%	6.5%	2.2%
Illinois	94.7%	0.0%	0.0%	0.1%	3.9%	0.0%	0.1%	1.0%	0.1%	0.1%	0.0%
Indiana	95.5%	0.0%	0.0%	0.0%	3.2%	0.0%	0.3%	0.8%	0.0%	0.0%	0.0%
Iowa	98.3%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	1.1%	0.1%	0.0%	0.0%
Kansas	96.3%	0.0%	0.0%	0.0%	0.8%	0.0%	0.2%	1.0%	1.5%	0.1%	0.1%
Kentucky	89.8%	0.0%	0.0%	0.0%	7.1%	0.0%	1.4%	0.3%	0.1%	0.8%	0.6%
Louisiana	83.0%	0.0%	0.0%	0.0%	2.7%	0.0%	2.0%	8.4%	0.8%	2.6%	0.5%
Maine	81.7%	0.0%	0.0%	0.2%	9.3%	0.0%	0.4%	8.1%	0.0%	0.3%	0.0%
Maryland	91.2%	0.0%	0.0%	0.1%	7.8%	0.0%	0.7%	0.0%	0.0%	0.2%	0.0%
Massachusetts	57.5%	0.0%	0.0%	0.4%	34.9%	0.0%	2.7%	4.4%	0.0%	0.1%	0.1%
Michigan	91.9%	0.0%	0.0%	0.1%	6.6%	0.0%	0.2%	1.1%	0.0%	0.0%	0.1%
Minnesota	94.2%	0.0%	0.0%	0.0%	1.2%	0.0%	0.1%	0.9%	0.0%	0.2%	3.3%
Mississippi	90.6%	0.0%	0.0%	0.0%	2.6%	0.0%	0.7%	2.3%	0.3%	2.4%	1.0%
Missouri	95.4%	0.0%	0.0%	0.0%	2.4%	0.0%	0.1%	1.1%	0.2%	0.5%	0.2%
Montana	87.9%	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.1%	0.1%	8.7%	2.5%
Nebraska	98.6%	0.0%	0.0%	0.0%	0.5%	0.0%	0.1%	0.6%	0.1%	0.1%	0.0%
Nevada	60.9%	0.0%	0.0%	0.2%	9.0%	0.0%	2.4%	0.8%	0.0%	0.1%	26.5%
New Hampshire	65.9%	0.0%	0.0%	0.4%	25.0%	0.0%	6.6%	2.0%	0.0%	0.1%	0.0%
New Jersey	58.0%	0.0%	0.0%	0.4%	30.1%	0.0%	1.1%	9.1%	0.0%	0.6%	0.7%
New Mexico	88.4%	0.0%	0.0%	0.0%	2.4%	0.0%	0.6%	0.0%	0.2%	6.7%	1.7%
New York	81.6%	0.0%	0.0%	0.2%	12.2%	0.0%	3.1%	2.8%	0.0%	0.0%	0.1%
North Carolina	91.1%	0.0%	0.0%	0.0%	2.3%	0.0%	0.1%	0.7%	0.0%	0.6%	5.1%
North Dakota	91.5%	0.0%	0.0%	0.0%	0.4%	0.0%	0.4%	7.0%	0.4%	0.2%	0.0%
Ohio	91.3%	0.0%	0.0%	0.1%	5.4%	0.0%	0.1%	3.1%	0.0%	0.0%	0.0%
Oklahoma	92.6%	0.0%	0.0%	0.0%	1.9%	0.0%	0.7%	2.2%	0.6%	1.5%	0.5%
Oregon	74.8%	0.0%	0.0%	0.0%	2.8%	0.0%	0.4%	0.0%	0.3%	11.4%	10.1%
Pennsylvania	91.0%	0.0%	0.0%	0.1%	6.2%	0.0%	0.5%	2.0%	0.0%	0.2%	0.0%
Rhode Island	52.7%	0.0%	0.0%	0.4%	36.2%	0.0%	0.4%	10.3%	0.0%	0.0%	0.0%
South Carolina	62.6%	0.0%	0.0%	0.1%	4.4%	0.0%	0.6%	3.8%	0.6%	25.9%	2.1%
South Dakota	98.9%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.2%	0.1%	0.1%	0.4%
Tennessee	86.8%	0.0%	0.0%	0.1%	7.9%	0.0%	0.5%	2.5%	0.1%	1.6%	0.5%
Texas	92.2%	0.0%	0.0%	0.4%	3.2%	0.0%	1.4%	0.7%	0.2%	0.7%	1.2%
Utah	94.7%	0.0%	0.0%	0.0%	2.6%	0.0%	0.1%	1.3%	0.0%	0.1%	1.1%
Vermont	95.6%	0.0%	0.0%	0.1%	4.1%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
Virginia	86.8%	0.0%	0.0%	0.1%	7.3%	0.0%	0.5%	2.6%	0.0%	1.4%	1.3%
Washington	79.1%	0.0%	0.0%	0.1%	4.5%	0.0%	0.2%	0.6%	0.1%	12.6%	2.8%
West Virginia	88.7%	0.0%	0.0%	0.1%	6.2%	0.0%	0.2%	1.9%	0.0%	2.6%	0.2%
Wisconsin	96.8%	0.0%	0.0%	0.0%	2.3%	0.0%	0.3%	0.4%	0.0%	0.1%	0.0%
Wyoming	72.0%	0.0%	0.0%	0.0%	1.4%	0.0%	1.6%	1.0%	0.0%	4.8%	19.2%
Tribal Data	82.1%	0.0%	0.0%	0.0%	0.0%	0.0%	16.2%	1.7%	0.0%	0.0%	0.0%
Grand Total	89.3%	0.0%	0.0%	0.1%	3.3%	0.0%	0.6%	1.6%	0.2%	1.7%	3.3%

**Table 7a. Summary of 2008 SO<sub>2</sub> emissions (tons per year) by state and major source category (not shown are 305,580 TPY near-shore and 300,238 TPY off-shore commercial marine vessel and Mexico/Canada emissions).**

State	Area	A-O&G	BIO4km	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF	Grand Total
Alabama	1,686			465	1,866	18,182	365,285	47,698	15	681	93	435,970
Arizona	3,678	0		673	812	0	44,226	34,911	1	667	187	85,154
Arkansas	688	380		464	589	325	73,296	13,711	83	356	86	89,977
California	9,562	0		428	1,936	814	196	26,315	62	181	17,151	56,645
Colorado	493	555		609	959	118	56,713	7,685	2	29	132	67,295
Connecticut	12,190			247	926	0	5,000	520	0	1		18,884
Delaware	919			267	277	0	33,669	7,444	0	1	0	42,578
District of Columbia	818			59	107	0	0	343				1,327
Florida	1,971			2,114	4,975	13	269,734	44,934	184	437	1,139	325,501
Georgia	1,110	0		962	2,974	0	514,496	39,193	28	1,039	106	559,909
Idaho	8,929			276	332	0	0	7,490	56	1,538	544	19,166
Illinois	7,730			137	2,037	397	277,649	99,119	13	17	4	387,103
Indiana	16,100			1,031	1,514	81	598,510	81,451	5	10	4	698,705
Iowa	2,527			1,051	628	0	109,277	51,635	50	7	1	165,176
Kansas	7,527			816	578	13	95,683	7,301	615	32	30	112,594
Kentucky	2,140			507	1,673	28	343,756	30,879	7	93	65	379,148
Louisiana	10,223	0		474	853	273	82,221	137,683	119	412	97	232,355
Maine	8,935			136	298	0	1,035	12,544	0	4		22,951
Maryland	5,646			455	967	0	228,351	27,253	1	11	2	262,685
Massachusetts	19,259			424	821	0	46,517	6,414	0	1	1	73,437
Michigan	15,338	0		1,156	2,236	6	327,282	59,594	1	7	8	405,628
Minnesota	9,448			1,104	956	0	74,039	25,192	17	80	1,316	112,152
Mississippi	1,199			355	729	5,914	65,082	12,910	35	326	157	86,707
Missouri	45,425			881	1,453	0	258,118	109,315	52	144	47	415,434
Montana	584	21		336	229	133	19,506	7,763	9	1,112	324	30,019
Nebraska	927			701	378	0	75,695	2,571	46	30	2	80,350
Nevada	4,863			322	298	0	9,328	1,827	0	2	506	17,146
New Hampshire	5,996			120	214	0	36,889	2,044		0		45,263
New Jersey	10,459			604	1,162	18	24,685	3,381	0	14	16	40,339
New Mexico	347	1,076		167	498	12,803	11,326	553	17	605	154	27,545
New York	71,087			3,404	2,410	0	65,779	48,125	0	5	13	190,824
North Carolina	12,268			989	1,861	0	227,880	46,376	16	223	1,927	291,540
North Dakota	729			683	156	1,620	132,584	7,917	78	29	7	143,803
Ohio	14,915			1,338	2,324	0	709,286	133,960	2	6	1	861,832
Oklahoma	4,623	10		519	904	616	101,316	35,301	139	339	103	143,870
Oregon	1,528			431	654	0	11,344	4,574	42	1,362	1,207	21,140
Pennsylvania	72,063			1,285	2,033	0	859,470	42,646	1	25	3	977,527
Rhode Island	2,801			63	131	0	5	914				3,913
South Carolina	1,760			483	953	0	160,915	30,538	62	2,550	204	197,466
South Dakota	339			484	179	0	13,535	1,192	19	34	117	15,901
Tennessee	65,626			642	1,390	0	209,981	45,299	8	132	43	323,123
Texas	7,853	4,487		3,495	3,939	9,549	484,207	105,465	160	456	786	620,397
Utah	1,988	425		286	497	7	20,075	8,123	0	8	92	31,501
Vermont	3,738			65	150	0	2	165	0	1	0	4,120
Virginia	14,509			739	1,477	0	124,100	50,158	6	147	153	191,290
Washington	3,220			703	994	0	2,015	13,451	13	1,437	315	22,149
West Virginia	5,716			130	405	0	312,097	31,699	1	78	11	350,138
Wisconsin	7,164			811	1,147	0	133,461	59,819	3	22	7	202,434
Wyoming	501	1,822		95	190	8,616	81,911	18,202	1	265	1,051	112,655
Tribal Data	389					6	15,139	37				15,570
Grand Total	509,534	8,777		33,984	55,072	59,534	7,712,661	1,593,635	1,971	14,958	28,210	10,018,336

**Table 7b. Percent contribution of source categories to SO<sub>2</sub> emissions by state.**

State	Area	A-O&G	BIO4km	OFFROAD	ONROAD	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF
Alabama	0.4%	0.0%	0.0%	0.1%	0.4%	4.2%	83.8%	10.9%	0.0%	0.2%	0.0%
Arizona	4.3%	0.0%	0.0%	0.8%	1.0%	0.0%	51.9%	41.0%	0.0%	0.8%	0.2%
Arkansas	0.8%	0.4%	0.0%	0.5%	0.7%	0.4%	81.5%	15.2%	0.1%	0.4%	0.1%
California	16.9%	0.0%	0.0%	0.8%	3.4%	1.4%	0.3%	46.5%	0.1%	0.3%	30.3%
Colorado	0.7%	0.8%	0.0%	0.9%	1.4%	0.2%	84.3%	11.4%	0.0%	0.0%	0.2%
Connecticut	64.6%	0.0%	0.0%	1.3%	4.9%	0.0%	26.5%	2.8%	0.0%	0.0%	0.0%
Delaware	2.2%	0.0%	0.0%	0.6%	0.7%	0.0%	79.1%	17.5%	0.0%	0.0%	0.0%
District of Columbia	61.7%	0.0%	0.0%	4.4%	8.1%	0.0%	0.0%	25.8%	0.0%	0.0%	0.0%
Florida	0.6%	0.0%	0.0%	0.6%	1.5%	0.0%	82.9%	13.8%	0.1%	0.1%	0.3%
Georgia	0.2%	0.0%	0.0%	0.2%	0.5%	0.0%	91.9%	7.0%	0.0%	0.2%	0.0%
Idaho	46.6%	0.0%	0.0%	1.4%	1.7%	0.0%	0.0%	39.1%	0.3%	8.0%	2.8%
Illionis	2.0%	0.0%	0.0%	0.0%	0.5%	0.1%	71.7%	25.6%	0.0%	0.0%	0.0%
Indiana	2.3%	0.0%	0.0%	0.1%	0.2%	0.0%	85.7%	11.7%	0.0%	0.0%	0.0%
Iowa	1.5%	0.0%	0.0%	0.6%	0.4%	0.0%	66.2%	31.3%	0.0%	0.0%	0.0%
Kansas	6.7%	0.0%	0.0%	0.7%	0.5%	0.0%	85.0%	6.5%	0.5%	0.0%	0.0%
Kentucky	0.6%	0.0%	0.0%	0.1%	0.4%	0.0%	90.7%	8.1%	0.0%	0.0%	0.0%
Louisiana	4.4%	0.0%	0.0%	0.2%	0.4%	0.1%	35.4%	59.3%	0.1%	0.2%	0.0%
Maine	38.9%	0.0%	0.0%	0.6%	1.3%	0.0%	4.5%	54.7%	0.0%	0.0%	0.0%
Maryland	2.1%	0.0%	0.0%	0.2%	0.4%	0.0%	86.9%	10.4%	0.0%	0.0%	0.0%
Massachusetts	26.2%	0.0%	0.0%	0.6%	1.1%	0.0%	63.3%	8.7%	0.0%	0.0%	0.0%
Michigan	3.8%	0.0%	0.0%	0.3%	0.6%	0.0%	80.7%	14.7%	0.0%	0.0%	0.0%
Minnesota	8.4%	0.0%	0.0%	1.0%	0.9%	0.0%	66.0%	22.5%	0.0%	0.1%	1.2%
Mississippi	1.4%	0.0%	0.0%	0.4%	0.8%	6.8%	75.1%	14.9%	0.0%	0.4%	0.2%
Missouri	10.9%	0.0%	0.0%	0.2%	0.3%	0.0%	62.1%	26.3%	0.0%	0.0%	0.0%
Montana	1.9%	0.1%	0.0%	1.1%	0.8%	0.4%	65.0%	25.9%	0.0%	3.7%	1.1%
Nebraska	1.2%	0.0%	0.0%	0.9%	0.5%	0.0%	94.2%	3.2%	0.1%	0.0%	0.0%
Nevada	28.4%	0.0%	0.0%	1.9%	1.7%	0.0%	54.4%	10.7%	0.0%	0.0%	2.9%
New Hampshire	13.2%	0.0%	0.0%	0.3%	0.5%	0.0%	81.5%	4.5%	0.0%	0.0%	0.0%
New Jersey	25.9%	0.0%	0.0%	1.5%	2.9%	0.0%	61.2%	8.4%	0.0%	0.0%	0.0%
New Mexico	1.3%	3.9%	0.0%	0.6%	1.8%	46.5%	41.1%	2.0%	0.1%	2.2%	0.6%
New York	37.3%	0.0%	0.0%	1.8%	1.3%	0.0%	34.5%	25.2%	0.0%	0.0%	0.0%
North Carolina	4.2%	0.0%	0.0%	0.3%	0.6%	0.0%	78.2%	15.9%	0.0%	0.1%	0.7%
North Dakota	0.5%	0.0%	0.0%	0.5%	0.1%	1.1%	92.2%	5.5%	0.1%	0.0%	0.0%
Ohio	1.7%	0.0%	0.0%	0.2%	0.3%	0.0%	82.3%	15.5%	0.0%	0.0%	0.0%
Oklahoma	3.2%	0.0%	0.0%	0.4%	0.6%	0.4%	70.4%	24.5%	0.1%	0.2%	0.1%
Oregon	7.2%	0.0%	0.0%	2.0%	3.1%	0.0%	53.7%	21.6%	0.2%	6.4%	5.7%
Pennsylvania	7.4%	0.0%	0.0%	0.1%	0.2%	0.0%	87.9%	4.4%	0.0%	0.0%	0.0%
Rhode Island	71.6%	0.0%	0.0%	1.6%	3.3%	0.0%	0.1%	23.4%	0.0%	0.0%	0.0%
South Carolina	0.9%	0.0%	0.0%	0.2%	0.5%	0.0%	81.5%	15.5%	0.0%	1.3%	0.1%
South Dakota	2.1%	0.0%	0.0%	3.0%	1.1%	0.0%	85.1%	7.5%	0.1%	0.2%	0.7%
Tennessee	20.3%	0.0%	0.0%	0.2%	0.4%	0.0%	65.0%	14.0%	0.0%	0.0%	0.0%
Texas	1.3%	0.7%	0.0%	0.6%	0.6%	1.5%	78.0%	17.0%	0.0%	0.1%	0.1%
Utah	6.3%	1.3%	0.0%	0.9%	1.6%	0.0%	63.7%	25.8%	0.0%	0.0%	0.3%
Vermont	90.7%	0.0%	0.0%	1.6%	3.6%	0.0%	0.0%	4.0%	0.0%	0.0%	0.0%
Virginia	7.6%	0.0%	0.0%	0.4%	0.8%	0.0%	64.9%	26.2%	0.0%	0.1%	0.1%
Washington	14.5%	0.0%	0.0%	3.2%	4.5%	0.0%	9.1%	60.7%	0.1%	6.5%	1.4%
West Virginia	1.6%	0.0%	0.0%	0.0%	0.1%	0.0%	89.1%	9.1%	0.0%	0.0%	0.0%
Wisconsin	3.5%	0.0%	0.0%	0.4%	0.6%	0.0%	65.9%	29.5%	0.0%	0.0%	0.0%
Wyoming	0.4%	1.6%	0.0%	0.1%	0.2%	7.6%	72.7%	16.2%	0.0%	0.2%	0.9%
Tribal Data	2.5%	0.0%	0.0%	0.0%	0.0%	0.0%	97.2%	0.2%	0.0%	0.0%	0.0%
Grand Total	5.1%	0.1%	0.0%	0.3%	0.5%	0.6%	77.0%	15.9%	0.0%	0.1%	0.3%



**Table 8a. Summary of 2008 PM<sub>2.5</sub> emissions (tons per year) by state and major source category (not shown are 38,019 TPY near-shore and 37,227 TPY off-shore commercial marine vessel and Mexico/Canada emissions).**

State	Area	A-O&G	DUST	OFFROAD	ONROAD	WBD24km	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF	Grand Total
Alabama	7,761		8,953	2,544	15,806	957	45	2,786	22,076	370	15,820	1,375	78,492
Arizona	16,114	0	26,124	3,311	8,756	9,307	0	1,904	3,720	24	15,692	3,395	88,345
Arkansas	7,214	0	23,607	2,474	5,416	5,397	3	1,236	6,432	1,145	8,563	1,564	63,050
California	83,888	7	39,371	14,681	18,437	12,133	766	965	21,913	847	3,419	398,430	594,858
Colorado	14,940	2,106	24,330	3,071	9,096	13,138	438	527	7,475	48	689	2,815	78,673
Connecticut	8,285		913	1,355	9,107	1	0	121	220	0	11		20,013
Delaware	1,143		716	455	2,265	11	0	1,875	1,077	5	27	2	7,577
District of Columbia	814		35	222	788	0	0	0	45				1,904
Florida	15,772		16,662	10,508	35,438	768	18	13,160	16,388	2,294	9,447	16,906	137,360
Georgia	22,019	0	17,096	4,864	29,351	562	0	5,999	6,549	456	24,198	1,602	112,697
Idaho	7,103		13,387	1,545	3,106	5,286	0	0	2,363	841	35,763	12,189	81,583
Illinois	27,875		64,780	8,397	18,873	8,083	7	5,474	11,998	226	371	70	146,154
Indiana	19,589		36,082	4,494	13,803	2,988	3	30,115	27,398	97	220	81	134,870
Iowa	7,787		51,972	5,025	6,166	27,674	0	5,657	5,780	807	152	5	111,024
Kansas	6,400		77,675	3,792	5,191	64,378	7	1,747	3,617	10,216	593	328	173,943
Kentucky	11,745		9,442	2,612	16,114	3,742	7	6,459	17,419	137	2,019	1,386	71,080
Louisiana	15,194	0	10,039	2,572	7,284	3,557	293	3,506	45,459	1,599	9,037	1,113	99,655
Maine	9,104		1,374	1,062	3,064	55	0	50	2,773	4	90		17,576
Maryland	10,694		3,773	2,447	8,389	137	0	5,945	2,666	17	223	16	34,307
Massachusetts	11,736		4,269	2,286	8,617	4	0	600	1,292	0	23	16	28,845
Michigan	36,601	0	21,668	6,539	17,931	1,628	23	1,602	13,341	26	168	187	99,716
Minnesota	24,606		47,934	6,025	10,909	10,661	0	3,470	12,873	289	1,748	33,755	152,269
Mississippi	10,035		13,082	1,917	6,410	3,597	6	1,007	7,028	676	7,843	2,344	53,945
Missouri	13,580		40,722	4,432	12,319	15,762	0	5,252	6,223	1,076	3,341	1,007	103,712
Montana	3,593	23	25,220	1,692	2,382	26,475	10	221	1,948	136	27,687	7,630	97,016
Nebraska	5,433		45,950	3,263	3,691	29,728	11	1,871	2,039	667	493	41	93,186
Nevada	3,760		20,186	1,700	3,142	17,051	0	360	3,073	5	32	10,939	60,248
New Hampshire	6,678		442	796	2,479	6	0	592	3,093		8		14,095
New Jersey	10,318		1,607	3,307	11,986	35	1	4,333	2,757	4	335	418	35,101
New Mexico	5,374	750	59,604	835	4,774	28,151	351	686	539	203	13,918	2,764	117,949
New York	35,271		10,198	7,154	22,203	904	0	1,867	4,411	7	103	238	82,358
North Carolina	21,750		8,537	4,954	15,132	664	0	16,969	8,688	238	4,910	67,037	148,879
North Dakota	1,808		44,139	3,199	1,777	15,784	19	306	2,249	1,233	368	132	71,015
Ohio	37,916		28,074	6,245	19,732	2,854	1	43,349	21,610	43	134	24	159,982
Oklahoma	9,666	397	52,850	2,596	7,516	26,462	24	3,328	5,625	2,532	6,487	1,277	118,760
Oregon	17,175		10,030	2,289	6,767	8,499	0	706	8,371	936	29,602	27,960	112,334
Pennsylvania	30,841		8,054	5,026	19,078	319	0	53,923	13,953	14	532	43	131,782
Rhode Island	2,367		304	331	1,329	1	0	5	128				4,464
South Carolina	8,718		7,207	2,414	8,408	466	0	14,524	5,604	989	58,792	3,626	110,747
South Dakota	1,957		26,458	2,295	1,987	34,242	0	229	653	377	679	2,790	71,666
Tennessee	21,053		8,628	3,323	11,796	2,434	0	5,284	9,911	139	2,818	722	66,109
Texas	26,077	4,842	171,368	14,531	32,677	85,509	997	11,599	29,123	3,914	9,319	10,649	400,606
Utah	5,220	664	15,122	1,436	4,435	10,810	45	883	3,121	8	165	1,871	43,781
Vermont	8,051		616	443	1,550	12	0	43	94	1	20	7	10,836
Virginia	19,633		4,374	3,771	12,847	578	7	1,618	7,223	93	3,237	2,272	55,652
Washington	20,579		16,042	3,638	9,883	4,520	0	459	3,951	204	32,559	7,044	98,878
West Virginia	7,771		1,186	873	3,958	66	0	25,969	4,276	9	1,705	174	45,986
Wisconsin	34,858		19,855	4,694	11,848	2,422	0	606	3,028	58	490	151	78,010
Wyoming	2,587	1,105	37,636	551	2,032	5,631	229	7,371	15,854	15	7,010	26,165	106,186
Tribal Data	137						19	5,659	927				6,742
Grand Total	738,591	9,894	1,177,689	177,987	496,045	493,451	3,329	302,214	408,375	33,027	340,856	652,559	4,834,016

**Table 8b. Percent contribution of source categories to PM<sub>2.5</sub> emissions by state.**

State	Area	A-O&G	DUST	OFFROAD	ONROAD	WBD24km	PTO&G	PTCEM	PTNCEM	Ag	Rx	WF
Alabama	9.9%	0.0%	11.4%	3.2%	20.1%	1.2%	0.1%	3.5%	28.1%	0.5%	20.2%	1.8%
Arizona	18.2%	0.0%	29.6%	3.7%	9.9%	10.5%	0.0%	2.2%	4.2%	0.0%	17.8%	3.8%
Arkansas	11.4%	0.0%	37.4%	3.9%	8.6%	8.6%	0.0%	2.0%	10.2%	1.8%	13.6%	2.5%
California	14.1%	0.0%	6.6%	2.5%	3.1%	2.0%	0.1%	0.2%	3.7%	0.1%	0.6%	67.0%
Colorado	19.0%	2.7%	30.9%	3.9%	11.6%	16.7%	0.6%	0.7%	9.5%	0.1%	0.9%	3.6%
Connecticut	41.4%	0.0%	4.6%	6.8%	45.5%	0.0%	0.0%	0.6%	1.1%	0.0%	0.1%	0.0%
Delaware	15.1%	0.0%	9.4%	6.0%	29.9%	0.1%	0.0%	24.8%	14.2%	0.1%	0.4%	0.0%
District of Columbia	42.7%	0.0%	1.8%	11.6%	41.4%	0.0%	0.0%	0.0%	2.4%	0.0%	0.0%	0.0%
Florida	11.5%	0.0%	12.1%	7.7%	25.8%	0.6%	0.0%	9.6%	11.9%	1.7%	6.9%	12.3%
Georgia	19.5%	0.0%	15.2%	4.3%	26.0%	0.5%	0.0%	5.3%	5.8%	0.4%	21.5%	1.4%
Idaho	8.7%	0.0%	16.4%	1.9%	3.8%	6.5%	0.0%	0.0%	2.9%	1.0%	43.8%	14.9%
Illinois	19.1%	0.0%	44.3%	5.7%	12.9%	5.5%	0.0%	3.7%	8.2%	0.2%	0.3%	0.0%
Indiana	14.5%	0.0%	26.8%	3.3%	10.2%	2.2%	0.0%	22.3%	20.3%	0.1%	0.2%	0.1%
Iowa	7.0%	0.0%	46.8%	4.5%	5.6%	24.9%	0.0%	5.1%	5.2%	0.7%	0.1%	0.0%
Kansas	3.7%	0.0%	44.7%	2.2%	3.0%	37.0%	0.0%	1.0%	2.1%	5.9%	0.3%	0.2%
Kentucky	16.5%	0.0%	13.3%	3.7%	22.7%	5.3%	0.0%	9.1%	24.5%	0.2%	2.8%	1.9%
Louisiana	15.2%	0.0%	10.1%	2.6%	7.3%	3.6%	0.3%	3.5%	45.6%	1.6%	9.1%	1.1%
Maine	51.8%	0.0%	7.8%	6.0%	17.4%	0.3%	0.0%	0.3%	15.8%	0.0%	0.5%	0.0%
Maryland	31.2%	0.0%	11.0%	7.1%	24.5%	0.4%	0.0%	17.3%	7.8%	0.0%	0.7%	0.0%
Massachusetts	40.7%	0.0%	14.8%	7.9%	29.9%	0.0%	0.0%	2.1%	4.5%	0.0%	0.1%	0.1%
Michigan	36.7%	0.0%	21.7%	6.6%	18.0%	1.6%	0.0%	1.6%	13.4%	0.0%	0.2%	0.2%
Minnesota	16.2%	0.0%	31.5%	4.0%	7.2%	7.0%	0.0%	2.3%	8.5%	0.2%	1.1%	22.2%
Mississippi	18.6%	0.0%	24.2%	3.6%	11.9%	6.7%	0.0%	1.9%	13.0%	1.3%	14.5%	4.3%
Missouri	13.1%	0.0%	39.3%	4.3%	11.9%	15.2%	0.0%	5.1%	6.0%	1.0%	3.2%	1.0%
Montana	3.7%	0.0%	26.0%	1.7%	2.5%	27.3%	0.0%	0.2%	2.0%	0.1%	28.5%	7.9%
Nebraska	5.8%	0.0%	49.3%	3.5%	4.0%	31.9%	0.0%	2.0%	2.2%	0.7%	0.5%	0.0%
Nevada	6.2%	0.0%	33.5%	2.8%	5.2%	28.3%	0.0%	0.6%	5.1%	0.0%	0.1%	18.2%
New Hampshire	47.4%	0.0%	3.1%	5.6%	17.6%	0.0%	0.0%	4.2%	21.9%	0.0%	0.1%	0.0%
New Jersey	29.4%	0.0%	4.6%	9.4%	34.1%	0.1%	0.0%	12.3%	7.9%	0.0%	1.0%	1.2%
New Mexico	4.6%	0.6%	50.5%	0.7%	4.0%	23.9%	0.3%	0.6%	0.5%	0.2%	11.8%	2.3%
New York	42.8%	0.0%	12.4%	8.7%	27.0%	1.1%	0.0%	2.3%	5.4%	0.0%	0.1%	0.3%
North Carolina	14.6%	0.0%	5.7%	3.3%	10.2%	0.4%	0.0%	11.4%	5.8%	0.2%	3.3%	45.0%
North Dakota	2.5%	0.0%	62.2%	4.5%	2.5%	22.2%	0.0%	0.4%	3.2%	1.7%	0.5%	0.2%
Ohio	23.7%	0.0%	17.5%	3.9%	12.3%	1.8%	0.0%	27.1%	13.5%	0.0%	0.1%	0.0%
Oklahoma	8.1%	0.3%	44.5%	2.2%	6.3%	22.3%	0.0%	2.8%	4.7%	2.1%	5.5%	1.1%
Oregon	15.3%	0.0%	8.9%	2.0%	6.0%	7.6%	0.0%	0.6%	7.5%	0.8%	26.4%	24.9%
Pennsylvania	23.4%	0.0%	6.1%	3.8%	14.5%	0.2%	0.0%	40.9%	10.6%	0.0%	0.4%	0.0%
Rhode Island	53.0%	0.0%	6.8%	7.4%	29.8%	0.0%	0.0%	0.1%	2.9%	0.0%	0.0%	0.0%
South Carolina	7.9%	0.0%	6.5%	2.2%	7.6%	0.4%	0.0%	13.1%	5.1%	0.9%	53.1%	3.3%
South Dakota	2.7%	0.0%	36.9%	3.2%	2.8%	47.8%	0.0%	0.3%	0.9%	0.5%	0.9%	3.9%
Tennessee	31.8%	0.0%	13.1%	5.0%	17.8%	3.7%	0.0%	8.0%	15.0%	0.2%	4.3%	1.1%
Texas	6.5%	1.2%	42.8%	3.6%	8.2%	21.3%	0.2%	2.9%	7.3%	1.0%	2.3%	2.7%
Utah	11.9%	1.5%	34.5%	3.3%	10.1%	24.7%	0.1%	2.0%	7.1%	0.0%	0.4%	4.3%
Vermont	74.3%	0.0%	5.7%	4.1%	14.3%	0.1%	0.0%	0.4%	0.9%	0.0%	0.2%	0.1%
Virginia	35.3%	0.0%	7.9%	6.8%	23.1%	1.0%	0.0%	2.9%	13.0%	0.2%	5.8%	4.1%
Washington	20.8%	0.0%	16.2%	3.7%	10.0%	4.6%	0.0%	0.5%	4.0%	0.2%	32.9%	7.1%
West Virginia	16.9%	0.0%	2.6%	1.9%	8.6%	0.1%	0.0%	56.5%	9.3%	0.0%	3.7%	0.4%
Wisconsin	44.7%	0.0%	25.5%	6.0%	15.2%	3.1%	0.0%	0.8%	3.9%	0.1%	0.6%	0.2%
Wyoming	2.4%	1.0%	35.4%	0.5%	1.9%	5.3%	0.2%	6.9%	14.9%	0.0%	6.6%	24.6%
Tribal Data	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	83.9%	13.7%	0.0%	0.0%	0.0%
Grand Total	15.3%	0.2%	24.4%	3.7%	10.3%	10.2%	0.1%	6.3%	8.4%	0.7%	7.1%	13.5%

**Appendix A.**  
**O&G VOC speciation**

## Appendix A. O&G VOC speciation

The WRAP Phase III 2006 baseline oil and gas (O&G) emissions inventory is the product of a multiyear effort and represents the most comprehensive and complete current O&G inventory for the Rocky Mountain States. For the WestJumpAQMS modeling, we projected the WRAP Phase III 2006 O&G emissions inventory to a 2008 base year using production statistics as surrogates to scale emissions from the various source categories considered in Phase III. In developing reductions in the scaled 2008 emissions, we considered controls required by on-the-books federal and state regulations. In the WestJumpAQMS O&G emissions processing, we used basin-specific speciation profiles where possible, rather than the default NEI VOC speciation profiles. We developed the basin-specific VOC profiles using gas composition analysis of produced gas, condensate and flashing gas obtained from operator surveys as part of the WRAP Phase III study. We used the Speciation Tool to convert these gas composition analyses to CB05 speciation profiles ready for use in SMOKE. We used the basin-specific VOC profiles for those source categories that relied on estimates of the volume of gas vented or leaked, such as blowdowns, completions, and fugitive emissions sources. For all other categories, such as combustion sources and flaring, we used profiles from EPA's SPECIATE database.

Table A-1 presents the CB05 speciation profiles used to process the WestJumpAQMS O&G VOC inventory. It includes both SPECIATE profiles and basin-specific profiles from the WRAP Phase III study. Tables A-2 through A-10 provides the linkages (cross-walk) between the inventory source classification codes (SCCs) and the speciation profiles for each Phase III basin for the basin-specific sources. Table A-11 provides the SCC-profile linkage for the basin-independent categories.

We developed the O&G emissions for the Permian Basin as part of the WestJumpAQMS. As it was not part of the WRAP Phase III work, there were no operator surveys of in the Permian Basin. The Permian Basin 2008 O&G emissions were based on a study by Applied EnviroSolutions, Inc. (AES) on 2007 O&G emissions in the New Mexico portion of the Permian Basin. These emissions estimate relied largely on a study conducted by ENVIRON for the Central States Regional Air Partnership (CENRAP) on improving O&G emissions inventories for the central states region. We developed a comprehensive O&G inventory for the Permian Basin using data from the AES/CENRAP studies, updates to O&G activity through recent work with the Central States Air Resources Agencies (CenSARA), and with 2008 production statistics. We generated the produced gas speciation profile (PRM01) from gas composition data provided by operators in the Permian Basin. Since we were unable to obtain condensate flashing gas composition, which is an important category in the Permian Basin, we investigated several available flashing speciation profiles from the SPECIATE4 database and the WRAP Phase III work to find a representative speciation profile. A comparison of profiles is presented in Table A-12. As expected, oil flashing profiles are clearly different from condensate flashing profiles and have predominantly PAR emissions whereas the condensate flashing profile has more CH<sub>4</sub>/ETHA and relatively less PAR. There is no condensate flashing profile available in the

SPECIATE database. As a result, we used the D-J Basin flashing profile for condensate storage tank and truck loading flashing emissions because it is a reasonable and comprehensive speciation profile through averaging 16 individual site-specific liquid compositions and use of the E&P TANK model. This profile was considered the most representative and comprehensive condensate tank flashing speciation profile available.

**Table A-1. VOC CB05 Speciation Profiles used for oil and gas emissions.**

Profile	Profile Name	ALD2	ALDX	CH4	ETH	ETHA	ETOH	FORM	IOLE	ISOP	MEOH	NR	NVOL	OLE	PAR	TERP	TOL	UNK	UNR	XYL	VOC-to-TOG
DJFLA	D-J Basin Flashing Gas Composition for Condensate			0.1492		0.2286									0.4790		0.0017		0.1411	0.0005	1.6070
DJVNT	D-J Basin Produced Gas Composition			0.6272		0.1688									0.1559		0.0006		0.0472	0.0002	4.9035
PNC01	Piceance Basin Gas Composition at Conventional Wells			0.8103		0.1007									0.0671		0.0009		0.0208	0.0002	11.2357
PNC02	Piceance Basin Gas Composition at Oil Wells			0.2590		0.0887									0.5493		0.0004		0.1025	0.0001	1.5331
PNC03	Piceance Basin Flashing Gas Composition for Condensate			0.1315		0.1630									0.5644		0.0056		0.1342	0.0013	1.4176
PRBCB	Powder River Basin Produced Gas Composition for CBM Wells			0.9987		0.0012									0.0001				0.0001		5632.8508
PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells			0.7534		0.1036									0.1079		0.0001		0.0346	0.0004	6.9927
PRM01	Permian Basin Produced Gas Composition			0.8230		0.1017									0.0510				0.0244		13.2734
SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells			0.9887		0.0091									0.0016				0.0007		448.9902
SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells			0.6965		0.1186									0.1454				0.0395		5.4102
SWED1	Sweetwater - East Flash Gas Composition			0.1397		0.1025									0.6374		0.0090		0.1066	0.0048	1.3197
SWFLA	SW Wyoming Basin Flash Gas Composition			0.1533		0.1821									0.5040		0.0057		0.1526	0.0022	1.5048
SWVNT	SW Wyoming Basin Vented Gas Composition			0.7576		0.0901									0.1176		0.0008		0.0337	0.0002	6.5675
UNT01	Uinta Basin Gas Composition at CBM Wells			0.9812		0.0112									0.0053				0.0024		130.0667
UNT02	Uinta Basin Gas Composition at Conventional Wells			0.5470		0.1192					0.0002				0.2714		0.0035		0.0570	0.0017	2.9958
UNT03	Uinta Basin Flashing Gas Composition for Oil			0.0001		0.0006									0.8574		0.0689		0.0300	0.0430	1.0007
UNT04	Uinta Basin Flashing Gas Composition for Condensate			0.0318		0.0285									0.8920		0.0003		0.0473	0.0001	1.0641
WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells			0.8106		0.0769									0.0869		0.0011		0.0237	0.0007	8.8950
0001	External Combustion Boiler - Residual Oil (SPECIATE Profile)			0.1100				0.4200							0.4700						1.6393
0002	External Combustion Boiler - Distillate Oil (SPECIATE Profile)						0.4870								0.5034				0.0096		1.0000
0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)			0.5600				0.0800							0.2864		0.0200		0.0536		2.2727
0004	External Combustion Boiler - Refinery Gas (SPECIATE Profile)			0.0760		0.2090		0.0760						0.1167	0.4278				0.0945		1.3986
0007	Natural Gas Turbine (SPECIATE Profile)			0.7000				0.3000													3.3333
0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)			0.1160	0.2870	0.0280								0.2523	0.1943				0.1223		1.1682
0051	Flares - Natural Gas (SPECIATE Profile)			0.2000		0.3000		0.2000							0.1500				0.1500		2.0000
0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)			0.0880		0.0270									0.7676		0.0140		0.1034		1.1299
1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)	0.0003	0.0001	0.7669	0.0063	0.1400		0.0082	0.0031					0.0121	0.0443		0.0006		0.0171	0.0010	10.7411
1010	Oil and Gas Production - Fugitives - Unclassified (SPECIATE Profile)			0.4630		0.0699									0.4115				0.0556		2.1409
1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)			0.3760		0.0640									0.4996				0.0604		1.7857
1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)			0.6130		0.0790									0.2674				0.0406		3.2468
1101	Light Duty Gasoline Vehicles - 46 Car Study (SPECIATE Profile)	0.0081	0.0027	0.1007	0.0394	0.0141		0.0074	0.0251	0.0007		0.0328		0.0344	0.5204	0.0040	0.0751			0.1351	1.1297
0031	Refinery Fugitive Emissions - Covered Drainage / Separation Pits (SPECIATE Profile)			0.0290		0.0170						0.0578			0.8962						1.0482
0008	Reciprocating Diesel Engine (SPECIATE Profile)			0.1160	0.2870	0.0280						0.1223		0.2523	0.1943						1.1682
0079	Chemical Manufacturing - Flares (SPECIATE Profile)	0.0070	0.0043		0.2220		0.0140	0.0170	0.0445		0.0540	0.2352		0.1305	0.1855	0.0006	0.0747			0.0107	1.0000
0000	Over All Average (SPECIATE Profile)	0.0177	0.0208	0.0732	0.0369	0.0138	0.0138	0.0156	0.0066	0.0040	0.0139	0.1849	0.0039	0.0554	0.4239	0.0068	0.0620	0.0002		0.0467	1.1566
3003	Wastewater Treatment Plants (SPECIATE Profile)	0.0014	0.0097		0.0111			0.0072	0.0008			0.4253	0.0003	0.0133	0.3243	0.0236	0.1030			0.0800	1.3959
2546	Automotive Painting - Downwind Ground Based Compositions (SPECIATE Profile)		0.0031					0.0000	0.0001		0.0756	0.0368		0.0025	0.4475	0.0045	0.3137			0.1161	1.1797
0100	Fixed Roof Tank - Commercial Jet Fuel (Jet A) (SPECIATE Profile)														1.0000						1.0000
0219	Surface Coating Paint Solvent - Acetone (SPECIATE Profile)														1.0000						0.0000
0282	Surface Coating Primer - Naptha (SPECIATE Profile)						0.0148		0.0069		0.0017			0.0000	0.8279		0.0541		0.0050	0.0896	1.0000
0291	Surface Coating Solvent - Methyl Alcohol (SPECIATE Profile)									1.0000											1.0000
0296	Fixed Roof Tank - Crude Oil Production (SPECIATE Profile)			0.0620		0.0560									0.7928				0.0892		1.1338
1078	Railcar Cleaning - Low Vapor Pressure, High Viscosity Cargo (Ethylene Glycol) (SPECIATE Profile)														1.0000						1.0000
1122	Cresol (SPECIATE Profile)																1.0000				1.0000
1132	Ethanolamines (SPECIATE Profile)	1.0000																			1.0000
2406	Metal Furniture Coating (SPECIATE Profile)		0.0084				0.0232	0.0000	0.0015		0.0004			0.0002	0.5400	0.0004	0.1721		0.0205	0.2334	1.0119
2420	Degreasing - All Processes/All Industries (SPECIATE Profile)	0.0984	0.0147		0.0828			0.0048	0.0000	0.0023		0.0005		0.0011	0.3135	0.0019	0.0209		0.4270	0.0321	1.7262
2443	Geogenic Natural Gas from Los Angeles, 1972/1973 (SPECIATE Profile)		0.0009			0.1576		0.0000	0.0001					0.0012	0.6995	0.0021	0.0036		0.1320	0.0031	1.1871
2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)		0.0056		0.0011	0.0239		0.0000	0.0004					0.0445	0.6151	0.0136	0.1139		0.1526	0.0292	1.0245
2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)		0.0034			0.0417		0.0000	0.0003					0.0072	0.7900	0.0082	0.0231		0.1135	0.0127	1.0435
2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)		0.0048			0.0088		0.0000	0.0004					0.0688	0.5579	0.0116	0.0744		0.2366	0.0368	1.0089
8737	Composite Profile - Non-xxygenated Gasoline Headspace Vapor (SPECIATE Profile)	0.0121				0.0005	0.0011	0.0042	0.0494	0.0007			0.0004	0.0080	0.8541		0.0294		0.0196	0.0204	1.0005
8745	Composite Profile - Degreasing: Cold Cleaning (Batch, Conveyor, Spray Gun) (SPECIATE Profile)	0.0040	0.0032		0.0210		0.0593	0.0000	0.0013		0.0353		0.0026	0.0008	0.4586	0.0898	0.0785		0.1796	0.0656	1.4301

**Table A-2. D-J Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030400	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Water Tank Losses	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310010300	Industrial Processes; Oil and Gas Production; Crude Petroleum; Pneumatic devices	DJVNT	D-J Basin Produced Gas Composition
2310010400	Industrial Processes; Oil and Gas Production; Crude Petroleum; Fugitives	DJVNT	D-J Basin Produced Gas Composition
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	DJVNT	D-J Basin Produced Gas Composition
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	DJVNT	D-J Basin Produced Gas Composition
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	DJVNT	D-J Basin Produced Gas Composition
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	DJVNT	D-J Basin Produced Gas Composition
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	DJVNT	D-J Basin Produced Gas Composition
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	DJVNT	D-J Basin Produced Gas Composition
2310020700	Industrial Processes; Oil and Gas Production; Natural Gas; Fugitives	DJVNT	D-J Basin Produced Gas Composition
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	DJVNT	D-J Basin Produced Gas Composition
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	DJVNT	D-J Basin Produced Gas Composition
2310020110	Industrial Processes; Oil and Gas Production; Natural Gas; Amine Units	DJVNT	D-J Basin Produced Gas Composition
2310023100	Industrial Processes; Oil and Gas Production; CBM; Dehydrators	DJVNT	D-J Basin Produced Gas Composition
2310023200	Industrial Processes; Oil and Gas Production; CBM; Venting - Initial Completions	DJVNT	D-J Basin Produced Gas Composition
2310023300	Industrial Processes; Oil and Gas Production; CBM; Venting - Recompletions	DJVNT	D-J Basin Produced Gas Composition
2310023400	Industrial Processes; Oil and Gas Production; CBM; Venting - Blowdowns	DJVNT	D-J Basin Produced Gas Composition
2310023500	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Startup	DJVNT	D-J Basin Produced Gas Composition
2310023600	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Shutdown	DJVNT	D-J Basin Produced Gas Composition
2310023700	Industrial Processes; Oil and Gas Production; CBM; Fugitives	DJVNT	D-J Basin Produced Gas Composition
2310023800	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Devices	DJVNT	D-J Basin Produced Gas Composition
2310023900	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Pumps	DJVNT	D-J Basin Produced Gas Composition
2310023110	Industrial Processes; Oil and Gas Production; CBM; Amine Units	DJVNT	D-J Basin Produced Gas Composition



**Table A-3.Piceance Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020700	Industrial Processes, Oil and Gas Production, Natural Gas, Fugitives	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310020110	Industrial Processes; Oil and Gas Production; Natural Gas; Amine Units	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023100	Industrial Processes; Oil and Gas Production; CBM; Dehydrators	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023200	Industrial Processes; Oil and Gas Production; CBM; Venting - Initial Completions	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023300	Industrial Processes; Oil and Gas Production; CBM; Venting - Recompletions	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023400	Industrial Processes; Oil and Gas Production; CBM; Venting - Blowdowns	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023500	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Startup	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023600	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Shutdown	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023700	Industrial Processes; Oil and Gas Production; CBM; Fugitives	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023800	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Devices	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023900	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Pumps	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310023110	Industrial Processes; Oil and Gas Production; CBM; Amine Units	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000101	Crude Oil Production /Complete Well: Fugitive Emissions	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000201	Natural Gas Production /Gas Sweetening: Amine Process	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000207	Natural Gas Production /Valves: Fugitive Emissions	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000220	Natural Gas Production /All Equipmt Leak Fugitives (Valves, Flanges, Connections, Seals, Drains	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000222	Natural Gas Production /Drilling and Well Completion	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000223	Natural Gas Production /Relief Valves	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000224	Natural Gas Production /Pump Seals	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000225	Natural Gas Production /Compressor Seals	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000226	Natural Gas Production /Flanges and Connections	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000227	Natural Gas Production /Glycol Dehydrator Reboiler Still Stack	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000301	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Still Vent: Triethylene Glycol	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000302	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Burner Stack: Triethylene Glycol	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000303	Natural Gas Proc Facilities /Glycol Dehydrators: Phase Separator Vent: Triethylene Glycol	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000304	Natural Gas Proc Facilities /Glycol Dehydrators: Ethylene Glycol: General	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000305	Natural Gas Proc Facilities /Gas Sweetening: Amine Process	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000306	Natural Gas Proc Facilities /Process Valves	PNC01	Piceance Basin Gas Composition at Conventional Wells

SCC	SCC Description	Profile	Profile Name
31000307	Natural Gas Proc Facilities /Relief Valves	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000310	Natural Gas Proc Facilities /Pump Seals	PNC01	Piceance Basin Gas Composition at Conventional Wells
31000311	Natural Gas Proc Facilities /Flanges and Connections	PNC01	Piceance Basin Gas Composition at Conventional Wells
31088801	Oil&Gas Prod /Fugitive Emissions /Specify in Comments Field	PNC01	Piceance Basin Gas Composition at Conventional Wells
31088804	Oil&Gas Prod /Fugitive Emissions /Specify in Comments Field	PNC01	Piceance Basin Gas Composition at Conventional Wells
31088811	Oil&Gas Prod /Fugitive Emissions /Fugitive Emissions	PNC01	Piceance Basin Gas Composition at Conventional Wells
2310010300	Industrial Processes; Oil and Gas Production; Crude Petroleum; Pneumatic devices	PNC02	Piceance Basin Gas Composition at Oil Wells
2310010400	Industrial Processes; Oil and Gas Production; Crude Petroleum; Fugitives	PNC02	Piceance Basin Gas Composition at Oil Wells
31000124	Crude Oil Production /Valves: General	PNC02	Piceance Basin Gas Composition at Oil Wells
31000125	Crude Oil Production /Relief Valves	PNC02	Piceance Basin Gas Composition at Oil Wells
31000126	Crude Oil Production /Pump Seals	PNC02	Piceance Basin Gas Composition at Oil Wells
31000127	Crude Oil Production /Flanges and Connections	PNC02	Piceance Basin Gas Composition at Oil Wells
31000130	Crude Oil Production /Fugitives: Compressor Seals	PNC02	Piceance Basin Gas Composition at Oil Wells
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	PNC03	Piceance Basin Flashing Gas Composition for Condensate
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	PNC03	Piceance Basin Flashing Gas Composition for Condensate
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	PNC03	Piceance Basin Flashing Gas Composition for Condensate
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	PNC03	Piceance Basin Flashing Gas Composition for Condensate
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	PNC03	Piceance Basin Flashing Gas Composition for Condensate
2310030400	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Water Tank Losses	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400301	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank: Breathing Loss	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400302	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank: Working Loss	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400304	Oil&Gas Field Stor&Workg Tanks /External Floating Roof Tank with Secondary Seals: Standing Loss	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400305	Oil&Gas Field Stor&Workg Tanks /Internal Floating Roof Tank: Standing Loss	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400306	Oil&Gas Field Stor&Workg Tanks /External Floating Roof Tank: Withdrawal Loss	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400307	Oil&Gas Field Stor&Workg Tanks /Internal Floating Roof Tank: Withdrawal Loss	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400311	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Condensate, working+breathing+flashing losses	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400312	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Crude Oil, working+breathing+flashing losses	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400313	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Lube Oil, working+breathing+flashing losses	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400314	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Specialty Chem-working+breathing+flashing	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400315	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Produced Water, working+breathing+flashing	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400322	Oil&Gas Field Stor&Workg Tanks /External Floating Roof Tank, Crude Oil, working+breathing+flashing	PNC03	Piceance Basin Flashing Gas Composition for Condensate
40400332	Oil&Gas Field Stor&Workg Tanks /Internal Floating Roof Tank, Crude Oil, working+breathing+flashing	PNC03	Piceance Basin Flashing Gas Composition for Condensate

**Table A-4. South San Juan Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310023400	Industrial Processes; Oil and Gas Production; CBM; Venting - Blowdowns	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023200	Industrial Processes; Oil and Gas Production; CBM; Venting - Initial Completions	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023300	Industrial Processes; Oil and Gas Production; CBM; Venting - Recompletions	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023700	Industrial Processes; Oil and Gas Production; CBM; Fugitives	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023800	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Devices	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023500	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Startup	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023600	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Shutdown	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310023100	Industrial Processes; Oil and Gas Production; CBM; Dehydrators	SSJCB	South San Juan Basin Produced Gas Composition for CBM Wells
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020700	Industrial Processes; Oil and Gas Production; Natural Gas; Fugitives	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells

**Table A-5. North San Juan Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020700	Industrial Processes, Oil and Gas Production, Natural Gas, Fugitives	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
2310025300	Industrial Processes; Oil and Gas Production; Natural Gas; Artificial Lift	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
31000301	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Still Vent: Triethylene Glycol	SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells

**Table A-6. Uinta Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310023100	Industrial Processes; Oil and Gas Production; CBM; Dehydrators	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023200	Industrial Processes; Oil and Gas Production; CBM; Venting - Initial Completions	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023300	Industrial Processes; Oil and Gas Production; CBM; Venting - Recompletions	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023400	Industrial Processes; Oil and Gas Production; CBM; Venting - Blowdowns	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023500	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Startup	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023600	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Shutdown	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023700	Industrial Processes; Oil and Gas Production; CBM; Fugitives	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023800	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Devices	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023900	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Pumps	UNT01	Uinta Basin Gas Composition at CBM Wells
2310023110	Industrial Processes; Oil and Gas Production; CBM; Amine Units	UNT01	Uinta Basin Gas Composition at CBM Wells
2310010300	Industrial Processes; Oil and Gas Production; Crude Petroleum; Pneumatic devices	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310010400	Industrial Processes; Oil and Gas Production; Crude Petroleum; Fugitives	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020700	Industrial Processes; Oil and Gas Production; Natural Gas; Fugitives	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310020110	Industrial Processes; Oil and Gas Production; Natural Gas; Amine Units	UNT02	Uinta Basin Gas Composition at Conventional Wells
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	UNT03	Uinta Basin Flashing Gas Composition for Oil
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	UNT03	Uinta Basin Flashing Gas Composition for Oil
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	UNT04	Uinta Basin Flashing Gas Composition for Condensate
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	UNT04	Uinta Basin Flashing Gas Composition for Condensate
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	UNT04	Uinta Basin Flashing Gas Composition for Condensate
2310030400	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Water Tank Losses	UNT04	Uinta Basin Flashing Gas Composition for Condensate

**Table A-7. SW Wyoming Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	SWFLA	SW Wyoming Basin Flash Gas Composition
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	SWFLA	SW Wyoming Basin Flash Gas Composition
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	SWFLA	SW Wyoming Basin Flash Gas Composition
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	SWFLA	SW Wyoming Basin Flash Gas Composition
2501050030	Petrol & Petrol Product Storage /Bulk Terminals: All Evaporative Losses /Crude Oil	SWFLA	SW Wyoming Basin Flash Gas Composition
40400302	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank: Working Loss	SWFLA	SW Wyoming Basin Flash Gas Composition
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020700	Industrial Processes, Oil and Gas Production, Natural Gas, Fugitives	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	SWVNT	SW Wyoming Basin Vented Gas Composition
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	SWVNT	SW Wyoming Basin Vented Gas Composition
31000220	Natural Gas Production /All Equipt Leak Fugitives (Valves, Flanges, Connections, Seals, Drains	SWVNT	SW Wyoming Basin Vented Gas Composition
31000301	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Still Vent: Triethylene Glycol	SWVNT	SW Wyoming Basin Vented Gas Composition
31000302	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Burner Stack: Triethylene Glycol	SWVNT	SW Wyoming Basin Vented Gas Composition
31000201	Natural Gas Production /Gas Sweetening: Amine Process	SWVNT	SW Wyoming Basin Vented Gas Composition
31000228	Natural Gas Production /Glycol Dehydrator Reboiler Burner	SWVNT	SW Wyoming Basin Vented Gas Composition
31000227	Natural Gas Production /Glycol Dehydrator Reboiler Still Stack	SWVNT	SW Wyoming Basin Vented Gas Composition

**Table A-8. Wind River Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	SWE01	Sweetwater - East Flash Gas Composition
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	SWE01	Sweetwater - East Flash Gas Composition
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	SWE01	Sweetwater - East Flash Gas Composition
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	SWE01	Sweetwater - East Flash Gas Composition
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	SWE01	Sweetwater - East Flash Gas Composition
40400301	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank: Breathing Loss	SWE01	Sweetwater - East Flash Gas Composition
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020700	Industrial Processes; Oil and Gas Production; Natural Gas; Fugitives	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
2310020110	Industrial Processes; Oil and Gas Production; Natural Gas; Amine Units	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
31000301	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Still Vent: Triethylene Glycol	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
31000302	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Burner Stack: Triethylene Glycol	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
31000201	Natural Gas Production /Gas Sweetening: Amine Process	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
20101020	Int Comb /Electric Gen /Geysers/Geothermal /Well Pad Fugitives: Blowdown	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
31000227	Natural Gas Production /Glycol Dehydrator Reboiler Still Stack	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells
31000220	Natural Gas Production /All Equipt Leak Fugitives (Valves, Flanges, Connections, Seals, Drains	WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells



**Table A-9. Powder River Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310023100	Industrial Processes; Oil and Gas Production; CBM; Dehydrators	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023200	Industrial Processes; Oil and Gas Production; CBM; Venting - Initial Completions	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023300	Industrial Processes; Oil and Gas Production; CBM; Venting - Recompletions	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023400	Industrial Processes; Oil and Gas Production; CBM; Venting - Blowdowns	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023500	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Startup	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023600	Industrial Processes; Oil and Gas Production; CBM; Venting - Compressor Shutdown	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023700	Industrial Processes; Oil and Gas Production; CBM; Fugitives	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310023800	Industrial Processes; Oil and Gas Production; CBM; Pneumatic Devices	PRBCB	Powder River Basin Produced Gas Composition for CBM Wells
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020200	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Initial Completions	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020300	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Recompletions	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020500	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Startup	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020600	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Compressor Shutdown	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020700	Industrial Processes; Oil and Gas Production; Natural Gas; Fugitives	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
31000300	Natural Gas Proc Facilities/Fugitive Emissions/Other	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
31088800	Oil&Gas Prod /Fugitive Emissions /Specify in Comments Field	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
31000302	Natural Gas Proc Facilities /Glycol Dehydrators: Reboiler Burner Stack: Triethylene Glycol	PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	SWE01	Sweetwater - East Flash Gas Composition
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	SWE01	Sweetwater - East Flash Gas Composition
2310030100	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Gas Plant Truck Loading	SWE01	Sweetwater - East Flash Gas Composition
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	SWE01	Sweetwater - East Flash Gas Composition
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	SWE01	Sweetwater - East Flash Gas Composition
40400300	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank: Flashing Loss	SWE01	Sweetwater - East Flash Gas Composition

**Table A-10. Permian Basin VOC Profiles mappings to SCCs.**

SCC	SCC Description	Profile	Profile Name
2310010100	Industrial Processes; Oil and Gas Production; Crude Petroleum; Truck Loading	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
2310010200	Industrial Processes; Oil and Gas Production; Crude Petroleum; Tanks - Flashing & Standing/Working/Breathing	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
2310030200	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Truck Loading	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310030300	Industrial Processes; Oil and Gas Production; Natural Gas Liquids; Tanks - Flashing & Standing/Working/Breathing	DJFLA	D-J Basin Flashing Gas Composition for Condensate
2310020100	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrators	PRM01	Permian Basin Produced Gas Composition
2310020400	Industrial Processes; Oil and Gas Production; Natural Gas; Venting - Blowdowns	PRM01	Permian Basin Produced Gas Composition
2310020700	Industrial Processes, Oil and Gas Production, Natural Gas, Fugitives	PRM01	Permian Basin Produced Gas Composition
2310020800	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Devices	PRM01	Permian Basin Produced Gas Composition
2310020900	Industrial Processes; Oil and Gas Production; Natural Gas; Pneumatic Pumps	PRM01	Permian Basin Produced Gas Composition

**Table A-11. Cross-reference entries independent of basin.**

SCC	SCC Description	Profile	Profile Name
38500101	Industrial Process Cooling Tower /Mechanical Draft	0000	Over All Average (SPECIATE Profile)
50410310	Waste Disp /Site Remed /In Situ Venting/Venting of Soils /Active Aeration	0000	Over All Average (SPECIATE Profile)
30101011	Chem Manuf /Explosives TNT /Batch Process: Nitration Reactors Fume Recovery	0000	Over All Average (SPECIATE Profile)
30188599	Chem Manuf /Inorganic Chem Stor (Pressure Tanks) /Specify Gas: Withdrawal Loss	0000	Over All Average (SPECIATE Profile)
38500102	Industrial Process Cooling Tower /Natural Draft	0000	Over All Average (SPECIATE Profile)
40703297	Organic Chem Storage - Fixed Roof Tanks - Specify Amine: Breathing Loss	0000	Over All Average (SPECIATE Profile)
40703298	Organic Chem Storage - Fixed Roof Tanks - Specify Amine: Working Loss	0000	Over All Average (SPECIATE Profile)
40705297	Organic Chem Storage - Fixed Roof Tanks - Specify Glycol Ether: Breathing Loss	0000	Over All Average (SPECIATE Profile)
40705697	Organic Chem Storage - Fixed Roof Tanks - Specify Glycol: Breathing Loss	0000	Over All Average (SPECIATE Profile)
40714697	Organic Chem Storage - Fixed Roof Tanks - Specify In Comments: Breathing Loss	0000	Over All Average (SPECIATE Profile)
40714698	Organic Chem Storage - Fixed Roof Tanks - Specify In Comments: Working Loss	0000	Over All Average (SPECIATE Profile)
40781604	Organic Chem Storage - Pressure Tanks - Natural Gas: Withdrawal Loss	0000	Over All Average (SPECIATE Profile)
50410310	Waste Disp /Site Remed /In Situ Venting/Venting of Soils /Active Aeration	0000	Over All Average (SPECIATE Profile)
31000403	Oil&Gas Prod /Process Heaters /Crude Oil	0001	External Combustion Boiler - Residual Oil (SPECIATE Profile)
31000413	Oil&Gas Prod /Process Heaters /Crude Oil: Steam Generators	0001	External Combustion Boiler - Residual Oil (SPECIATE Profile)
31000402	Oil&Gas Prod /Process Heaters /Residual Oil	0001	External Combustion Boiler - Residual Oil (SPECIATE Profile)
31000128	Crude Oil Production /Oil Heating	0002	External Combustion Boiler - Distillate Oil (SPECIATE Profile)
31000400	Oil&Gas Prod /Process Heaters /Other	0002	External Combustion Boiler - Distillate Oil (SPECIATE Profile)
31000401	Oil&Gas Prod /Process Heaters /Distillate Oil (No. 2)	0002	External Combustion Boiler - Distillate Oil (SPECIATE Profile)
2310024100	Industrial Processes; Oil and Gas Production; Natural Gas; Heaters	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
31000228	Natural Gas Production /Glycol Dehydrator Reboiler Burner	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
31000404	Oil&Gas Prod /Process Heaters /Natural Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
31000414	Oil&Gas Prod /Process Heaters /Natural Gas: Steam Generators	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10200602	Ext Comb /Industrial /Natural Gas /10-100 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
30990013	Fabricated Metal /Fuel Fired Equipment /Natural Gas: Incinerators	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10500110	Ext Comb /Space Heater /Industrial /Liquified Petroleum Gas (LPG)	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10500210	Ext Comb /Space Heater /Comm-Inst /Liquified Petroleum Gas (LPG)	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10201701	Ext Comb /Industrial /Gasoline	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10200603	Ext Comb /Industrial /Natural Gas /< 10 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10500106	Ext Comb /Space Heater /Industrial /Natural Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
39900601	Misc Manuf /Process Heater-Furnace /Natural Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10300603	Ext Comb /Comm-Inst /Natural Gas /< 10 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
30600105	Petrol Indus /Process Heaters /Natural Gas-fired	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10201002	Ext Comb /Industrial /LPG /Propane	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10200601	Ext Comb /Industrial /Natural Gas /> 100 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10200602	Ext Comb /Industrial /Natural Gas /10-100 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10200603	Ext Comb /Industrial /Natural Gas /< 10 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10201002	Ext Comb /Industrial /LPG /Propane	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10300603	Ext Comb /Comm-Inst /Natural Gas /< 10 Million Btu/hr	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
10500106	Ext Comb /Space Heater /Industrial /Natural Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
30600104	Petrol Indus /Process Heaters /Gas-fired	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
30600105	Petrol Indus /Process Heaters /Natural Gas-fired	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
30600905	Petrol Indus /Flares /Liquified Petroleum Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
30609903	Petrol Indus /Incinerators /Natural Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
39900601	Misc Manuf /Process Heater-Furnace /Natural Gas	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
39990013	Misc Manuf Indus /Natural Gas: Incinerators	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
40290013	Surface Coating /Fuel Fired Equipment /Natural Gas: Incinerator/Afterburner	0003	External Combustion Boiler - Natural Gas (SPECIATE Profile)
31000405	Oil&Gas Prod /Process Heaters /Process Gas	0004	External Combustion Boiler - Refinery Gas (SPECIATE Profile)
31000415	Oil&Gas Prod /Process Heaters /Process Gas: Steam Generators	0004	External Combustion Boiler - Refinery Gas (SPECIATE Profile)
30609904	Petrol Indus /Incinerators /Process Gas	0004	External Combustion Boiler - Refinery Gas (SPECIATE Profile)

SCC	SCC Description	Profile	Profile Name
20200201	Int Comb /Industrial /Natural Gas /Turbine	0007	Natural Gas Turbine (SPECIATE Profile)
20200203	Int Comb /Industrial /Natural Gas /Turbine: Cogeneration	0007	Natural Gas Turbine (SPECIATE Profile)
20200209	Int Comb /Industrial /Natural Gas /Turbine: Exhaust	0007	Natural Gas Turbine (SPECIATE Profile)
20100201	Int Comb /Electric Gen /Natural Gas /Turbine	0007	Natural Gas Turbine (SPECIATE Profile)
20200255	Int Comb /Industrial /Natural Gas /2-cycle Clean Burn	0007	Natural Gas Turbine (SPECIATE Profile)
20300202	Int Comb /Comm-Inst /Natural Gas /Turbine	0007	Natural Gas Turbine (SPECIATE Profile)
20200401	Int Comb /Industrial /Large Bore Engine /Diesel	0008	Reciprocating Diesel Engine (SPECIATE Profile)
2310000110	Industrial Processes; Oil and Gas Production; All Processes; Drill Rigs	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
2310000120	Industrial Processes; Oil and Gas Production; All Processes; Workover Rigs	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
2310026100	Industrial Processes; Oil and Gas Production; CBM; Miscellaneous Engines	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
20100102	Int Comb /Electric Gen /Distillate Oil (Diesel) /Reciprocating	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
20200102	Int Comb /Industrial /Distillate Oil (Diesel) /Reciprocating	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
20200107	Int Comb /Industrial /Distillate Oil (Diesel) /Reciprocating: Exhaust	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
20300101	Int Comb /Comm-Inst /Distillate Oil (Diesel) /Reciprocating	0009	Reciprocating Distillate Oil Engine (SPECIATE Profile)
30600508	Petrol Indus /Wastewater Treatment /Oil/Water Separator	0031	Refinery Fugitive Emissions - Covered Drainage / Separation Pits (SPECIATE Profile)
2310024200	Industrial Processes; Oil and Gas Production; Natural Gas; Initial Completion Flaring	0051	Flares - Natural Gas (SPECIATE Profile)
2310024300	Industrial Processes; Oil and Gas Production; Natural Gas; Condensate Tank Flaring	0051	Flares - Natural Gas (SPECIATE Profile)
2310024400	Industrial Processes; Oil and Gas Production; Natural Gas; Dehydrator Flaring	0051	Flares - Natural Gas (SPECIATE Profile)
31000205	Natural Gas Production /Flares	0051	Flares - Natural Gas (SPECIATE Profile)
31000215	Natural Gas Production /Flares Combusting Gases :1000 BTU/scf	0051	Flares - Natural Gas (SPECIATE Profile)
31000216	Natural Gas Production /Flares Combusting Gases <1000 BTU/scf	0051	Flares - Natural Gas (SPECIATE Profile)
30990023	Fabricated Metal /Fuel Fired Equipment /Natural Gas: Flares	0051	Flares - Natural Gas (SPECIATE Profile)
30600903	Petrol Indus /Flares /Natural Gas	0051	Flares - Natural Gas (SPECIATE Profile)
20190099	Int Comb /Electric Gen /Flares /Heavy Water	0051	Flares - Natural Gas (SPECIATE Profile)
30600904	Petrol Indus /Flares /Process Gas	0079	Chemical Manufacturing - Flares (SPECIATE Profile)
30190099	Chem Manuf /Fuel Fired Equipment /Specify in Comments Field	0079	Chemical Manufacturing - Flares (SPECIATE Profile)
40301015	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Jet Naphtha (JP-4): Working Loss	0100	Fixed Roof Tank - Commercial Jet Fuel (Jet A) (SPECIATE Profile)
40301018	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Jet Kerosene: Working Loss	0100	Fixed Roof Tank - Commercial Jet Fuel (Jet A) (SPECIATE Profile)
40301204	Petrol Prod Stor-Refinery /Variable Vapor Space /Jet Naphtha (JP-4): Filling Loss	0100	Fixed Roof Tank - Commercial Jet Fuel (Jet A) (SPECIATE Profile)
40100311	Solvent Evap /Cold Solvent Cleaning/Stripping /Glycol Ethers	0219	Surface Coating Paint Solvent - Acetone (SPECIATE Profile)
40701613	Organic Chem Storage - Fixed Roof Tanks - Petroleum Distillate: Breathing Loss	0282	Surface Coating Primer - Naptha (SPECIATE Profile)
40700815	Organic Chem Storage - Fixed Roof Tanks - Methyl Alcohol: Breathing Loss	0291	Surface Coating Solvent - Methyl Alcohol (SPECIATE Profile)
40700816	Organic Chem Storage - Fixed Roof Tanks - Methyl Alcohol: Working Loss	0291	Surface Coating Solvent - Methyl Alcohol (SPECIATE Profile)
40400303	Oil&Gas Field Stor&Workg Tanks /External Floating Roof Tank with Primary Seals: Standing Loss	0296	Fixed Roof Tank - Crude Oil Production (SPECIATE Profile)
40400316	Oil&Gas Field Stor&Workg Tanks /Fixed Roof Tank, Diesel, working+breathing+flashing losses	0296	Fixed Roof Tank - Crude Oil Production (SPECIATE Profile)
40301206	Petrol Prod Stor-Refinery /Variable Vapor Space /Distillate Fuel #2: Filling Loss	0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)
40600130	Petrol Trans & Marketg /Tank Cars & Trucks /Distillate Oil: Submerged Loading **	0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)
40600132	Petrol Trans & Marketg /Tank Cars & Trucks /Crude Oil: Submerged Loading (Normal Service)	0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)
40600135	Petrol Trans & Marketg /Tank Cars & Trucks /Distillate Oil: Submerged Loading (Normal Service)	0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)
40600140	Petrol Trans & Marketg /Tank Cars & Trucks /Distillate Oil: Splash Loading (Normal Service)	0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)
40600142	Petrol Trans & Marketg /Tank Cars & Trucks /Crude Oil: Submerged Loading (Balanced Service)	0297	Fixed Roof Tank - Crude Oil Refinery (SPECIATE Profile)
31000000	unclassified oil and gas midstream sources	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
2310025100	Industrial Processes; Oil and Gas Production; Natural Gas; Compressor Engines	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
2310025200	Industrial Processes; Oil and Gas Production; Natural Gas; Miscellaneous Engines	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
2310025300	Industrial Processes; Oil and Gas Production; Natural Gas; Artificial Lift	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20200200	Int Comb /Industrial /Natural Gas /Other	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20200202	Int Comb /Industrial /Natural Gas /Reciprocating	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20200204	Int Comb /Industrial /Natural Gas /Reciprocating: Cogeneration	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20200252	Int Comb /Industrial /Natural Gas /2-cycle Lean Burn	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20200253	Int Comb /Industrial /Natural Gas /4-cycle Rich Burn	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20200254	Int Comb /Industrial /Natural Gas /4-cycle Lean Burn	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)

SCC	SCC Description	Profile	Profile Name
20200256	Int Comb /Industrial /Natural Gas /4-cycle Clean Burn	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
31000203	Natural Gas Production /Compressors	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
31000206	Natural Gas Production /Gas Lift	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20100202	Int Comb /Electric Gen /Natural Gas /Reciprocating	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
20300201	Int Comb /Comm-Inst /Natural Gas /Reciprocating	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
28888801	Int Comb /Fugitive Emissions /Other Not Classified /Specify in Comments	1001	Internal Combustion Engine - Natural Gas (SPECIATE Profile)
31000102	Crude Oil Production /Miscellaneous Well: General	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000103	Crude Oil Production /Wells: Rod Pumps	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000104	Crude Oil Production /Crude Oil Sumps	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000105	Crude Oil Production /Crude Oil Pits	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000107	Crude Oil Production /Oil/Gas/Water/Separation	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000108	Crude Oil Production /Evaporation from Liquid Leaks into Oil Well Cellars	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000123	Crude Oil Production /Well Casing Vents	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000129	Crude Oil Production /Gas/Liquid Separation	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000132	Crude Oil Production /Atmospheric Wash Tank (2nd Stage of Gas-Oil Separation): Flashing Loss	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000160	Crude Oil Production /Flares	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000199	Crude Oil Production /Processing Operations: Not Classified	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000501	Oil&Gas Prod /Liquid Waste Treatment /Floatation Units	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000502	Oil&Gas Prod /Liquid Waste Treatment /Liquid - Liquid Separator	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000506	Oil&Gas Prod /Liquid Waste Treatment /Oil-Water Separation Wastewater Holding Tanks	1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service (SPECIATE Profile)
31000202	Natural Gas Production /Gas Stripping Operations	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
31000204	Natural Gas Production /Wells	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
31000208	Natural Gas Production /Sulfur Recovery Unit	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
31000209	Natural Gas Production /Incinerators Burning Waste Gas or Augmented Waste Gas	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
31000229	Natural Gas Production /Gathering Lines	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
31000231	Natural Gas Production /Fugitives: Drains	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
31000299	Natural Gas Production /Other Not Classified	1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service (SPECIATE Profile)
40705603	Organic Chem Storage - Fixed Roof Tanks - Ethylene Glycol: Breathing Loss	1078	Railcar Cleaning - Low Vapor Pressure, High Viscosity Cargo (Ethylene Glycol) (SPECIATE Profile)
40705604	Organic Chem Storage - Fixed Roof Tanks - Ethylene Glycol: Working Loss	1078	Railcar Cleaning - Low Vapor Pressure, High Viscosity Cargo (Ethylene Glycol) (SPECIATE Profile)
20200305	Int Comb /Industrial /Gasoline /Reciprocating: Crankcase Blowby	1101	Light Duty Gasoline Vehicles - 46 Car Study (SPECIATE Profile)
20200301	Int Comb /Industrial /Gasoline /Reciprocating Engine	1101	Light Duty Gasoline Vehicles - 46 Car Study (SPECIATE Profile)
40703604	Organic Chem Storage - Fixed Roof Tanks - Cresol: Working Loss	1122	Cresol (SPECIATE Profile)
40703203	Organic Chem Storage - Fixed Roof Tanks - Ethanolamines: Breathing Loss	1132	Ethanolamines (SPECIATE Profile)
40703204	Organic Chem Storage - Fixed Roof Tanks - Ethanolamines: Working Loss	1132	Ethanolamines (SPECIATE Profile)
40202505	Surface Coating /Misc Metal Parts /Equipment Cleanup	2406	Metal Furniture Coating (SPECIATE Profile)
40100296	Degreasing : Other Not Classified: General Degreasing Units	2420	Degreasing - All Processes/All Industries (SPECIATE Profile)

SCC	SCC Description	Profile	Profile Name
20101001	Int Comb /Electric Gen /Geysers/Geothermal /Steam Turbine	2443	Geogenic Natural Gas from Los Angeles, 1972/1973 (SPECIATE Profile)
30600401	Petrol Indus /Blowdown Systems /Blowdown System with Vapor Recovery System with Flaring	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30600402	Petrol Indus /Blowdown Systems /Blowdown System w/o Controls	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30600503	Petrol Indus /Wastewater Treatment /Process Drains and Wastewater Separators	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30600701	Petrol Indus /Cooling Towers /Cooling Towers	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30600805	Petrol Indus /Fugitive Emissions /Miscellaneous: Sampling/Non-Asphalt Blowing/Purging/etc.	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30600815	Petrol Indus /Fugitive Emissions /Open-ended Valves: All Streams	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30603301	Petrol Indus /Desulfurization /Sulfur Recovery Unit	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30688801	Petrol Indus /Fugitive Emissions /Specify in Comments Field	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
30699999	Petrol Indus /Petrol Products - Not Classified **	2485	Composite of 21 Fugitive Emission Profiles from Petroleum Industry Facilities - 1993 (SPECIATE Profile)
40301010	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Crude Oil RVP 5: Breathing Loss (67000 Bbl Tank)	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301012	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Crude Oil RVP 5: Working Loss	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301109	Petrol Prod Stor-Refinery /Floating Roof Tanks /Crude Oil RVP 5: Standing Loss (67000 Bbl Tank)	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301110	Petrol Prod Stor-Refinery /Floating Roof Tanks /Crude Oil RVP 5: Standing Loss (250000 Bbl Tank)	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301117	Petrol Prod Stor-Refinery /Floating Roof Tanks /Crude Oil RVP 5: Withdrawal Loss	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301132	Petrol Prod Stor-Refinery /Floating Roof Tanks /Crude Oil: Standing Loss - External - Primary Seal	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301142	Petrol Prod Stor-Refinery /Floating Roof Tanks /Crude Oil: Standing Loss - External - Secondary Seal	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301152	Petrol Prod Stor-Refinery /Floating Roof Tanks /Crude Oil: Standing Loss - Internal	2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993 (SPECIATE Profile)
40301097	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Specify Liquid: Breathing Loss (67000 Bbl Tank)	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40301098	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Specify Liquid: Breathing Loss (250000 Bbl Tank)	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40301099	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Specify Liquid: Working Loss	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40388801	Petrol Prod Stor-Refinery /Fugitive Emissions /Specify in Comments Field	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40400150	Petrol Prod Stor-Bulk Terminals /Miscellaneous Losses/Leaks: Loading Racks	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40400154	Petrol Prod Stor-Bulk Terminals /Tank Truck Vapor Leaks	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40400251	Petrol Prod Stor-Bulk Plants /Valves, Flanges, and Pumps	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40400254	Petrol Prod Stor-Bulk Plants /Tank Truck Vapor Losses	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40799997	Organic Chem Storage - Miscellaneous /Specify in Comments	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)



SCC	SCC Description	Profile	Profile Name
40899995	Organic Chem Transport /Specific Liquid /Cars/Trucks: Loading Rack	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
40899999	Organic Chem Transport /Specific Liquid /Loading Rack	2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993 (SPECIATE Profile)
39999989	Misc Manuf / Indus Processes /Other Not Classified	2546	Automotive Painting - Downwind Ground Based Compositions (SPECIATE Profile)
39999989	Misc Manuf / Indus Processes /Other Not Classified	2546	Automotive Painting - Downwind Ground Based Compositions (SPECIATE Profile)
2630010000	Wastewater Treatment /Industrial /Total Processed	3003	Wastewater Treatment Plants (SPECIATE Profile)
2630010000	Wastewater Treatment /Industrial /Total Processed	3003	Wastewater Treatment Plants (SPECIATE Profile)
40301001	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 13: Breathing Loss (67000 Bbl Tank)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301002	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 10: Breathing Loss (67000 Bbl Tank)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301004	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 13: Breathing Loss (250000 Bbl Tank)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301005	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 10: Breathing Loss (250000 Bbl Tank)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301007	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 13: Working Loss	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301008	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 10: Working Loss	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301009	Petrol Prod Stor-Refinery /Fixed Roof Tanks /Gasoline RVP 7: Working Loss	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301103	Petrol Prod Stor-Refinery /Floating Roof Tanks /Gasoline RVP 7: Standing Loss (67000 Bbl Tank)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301104	Petrol Prod Stor-Refinery /Floating Roof Tanks /Gasoline RVP 13: Standing Loss (250000 Bbl Tank)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40301201	Petrol Prod Stor-Refinery /Variable Vapor Space /Gasoline RVP 13: Filling Loss	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40400199	Petrol Prod Stor-Bulk Terminals /See Comment **	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40400230	Petrol Prod Stor-Bulk Plants /Specify Liquid: Standing Loss - External Floating Roof w/ Primary Seal	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40400260	Petrol Prod Stor-Bulk Plants /Specify Liquid: Standing Loss - Internal Floating Roof w/ Primary Seal	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40600101	Petrol Trans & Marketg /Tank Cars & Trucks /Gasoline: Splash Loading **	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40600126	Petrol Trans & Marketg /Tank Cars & Trucks /Gasoline: Submerged Loading **	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40600131	Petrol Trans & Marketg /Tank Cars & Trucks /Gasoline: Submerged Loading (Normal Service)	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40600199	Petrol Trans & Marketg /Tank Cars & Trucks /Not Classified **	8737	Composite Profile - Non-xygenated Gasoline Headspace Vapor (SPECIATE Profile)
40100399	Solvent Evap /Cold Solvent Cleaning/Stripping /Other Not Classified	8745	Composite Profile - Degreasing: Cold Cleaning (Batch, Conveyor, Spray Gun) (SPECIATE Profile)

**Table A-12. Side-by-side comparison of condensate tank flashing VOC CB05 profiles including defaults in SMOKE modeling system from SPECIATE database (8737 and 2387) and D-J and Uinta Basin-specific profiles from the WRAP Phase III study..**

Profile	Profile_code	ALD2	CH4	ETHA	ETOH	FORM	IOLE	ISOP	NVOL	OLE	PAR	TOL	UNR	XYL	ALDX	TERP	Grand Total
SMOKE profile for 40600101 (Tankcars and Truck loading)	8737	0.0121	0.0000	0.0005	0.0011	0.0042	0.0494	0.0007	0.0004	0.0080	0.8541	0.0294	0.0196	0.0204	0.0000	0.0000	0.9999
SMOKE Profiles for Crude Oil Storage Tanks	2487	0.0000	0.0000	0.0417	0.0000	0.0000	0.0003	0.0000	0.0000	0.0072	0.7900	0.0231	0.1135	0.0127	0.0034	0.0082	1.0000
D-J Basin Flashing Gas Composition for Condensate	DJFLA	0.0000	0.1492	0.2286	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.4790	0.0017	0.1411	0.0005	0.0000	0.0000	1.0001
Uinta Basin Flashing Gas Composition for Oil	UNT03	0.0000	0.0001	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8574	0.0689	0.0300	0.0430	0.0000	0.0000	1.0000