ENVIRON ALPINE GEOPHYSICS UNC INSTITUTE FOR THE ENVIRONMENT

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TECHNICAL MEMORANDUM No. 1: POINT SOURCE EMISSIONS

To: Tom Moore, Western Regional Air Partnership (WRAP)

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Subject: Point Source emissions, including Electricity Generating Units (EGUs) and non-EGUs, 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) for the Western Regional Air Partnership (WRAP). 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 are currently compiling emissions to be used for the 2008 base case modeling, with the 2008 National Emissions Inventory (NEI) being a major data source, and are preparing 13 Technical Memorandums discussing the sources of the 2008 emissions by major source sector:

1. Point Sources including Electricity 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);
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 (dropped);

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 document is Technical Memorandum Number 1 that discusses the approach and data sources to be used for developing 2008 emissions for the Point Source sector.

2008 NEI V2.0 OVERVIEW

The U.S. Environmental Protection Agency (EPA) develops and maintains the National Emissions Inventory (NEI). The NEI is a comprehensive and detailed estimate of air emissions of both Criteria and Hazardous air pollutants from all air emissions sources in the United States. The NEI is prepared every three years by the EPA based primarily upon emission estimates and emission model inputs provided by State, Local, and Tribal air agencies for sources in their jurisdictions, and supplemented by data developed by the EPA. The most current version of the NEI is Version 2 of the 2008 NEI (2008 NEIv2) that we obtained from EPA at the end of February 2012[1]. Table 5 at the end of this Memorandum contains a list of the agencies that have submitted data for the point source categories in the 2008 NEIv2.

Point Source Emissions

The **NEI Point Source** data category contains emission estimates for sources that are inventoried at specific geographic locations using latitude and longitude coordinates. While point emissions data are typically inventories of sources that emit from a stack, other discrete emissions sources, such as airports and landfills, can also be characterized as point sources. In general, point sources can be characterized as **elevated** or **low-level** sources. Elevated point sources produce emissions at elevations above the surface and are typically emitted from a smoke stack. Elevated point source inventories include stack parameters for each source (stack height, stack diameter, exit gas velocity, exit gas temperature) that are used with the hourly meteorological conditions to calculate an hourly vertical plume distribution (i.e., plume rise) for the emissions from the source. Examples of elevated point sources include power plants, smelters, and cement kilns. Low-level point sources produce emissions at the surface and as such low level point inventories include stack parameters that do not result in significant plume rise for the emissions from these sources, such as stack heights of 0. Examples of low-level point sources include wastewater treatment facilities, quarries, and landfills. For emissions modeling purposes, point sources are defined by an administrative unit (state and county [or tribal] codes), release point (plant, stack, and unit identifier), release location (latitude and longitude coordinate), Source Classification Code (SCC) numbers and Standard Industrial Classification (SIC) codes.

1 http://www.epa.gov/ttnchie1/net/2008inventory.html

Other ways to separate the point source inventory include by electric generating unit (EGU) versus non-EGU sources and point sources with Continuous Emission Monitoring (CEM) vs. non-CEM sources. For the WestJumpAQMS we have defined two point sectors based on whether the sources have records in the EPA Clean Air Markets Division (CAMD2) CEM database (CEM Point Sources) or not (non-CEM Point Sources). Details of CEM data and how these data are prepared for emissions modeling are included in the next section.

Continuous Emissions Monitoring Data

For the WestJumpAQMS, the annual NEI point source inventory was supplemented with hourly monitored point emissions for electric generating unit (EGU) and other large point sources. We used year 2008 hourly CEM data to replace the annual NEI emissions for sources that report emissions to the CAMD. Part of the reason EPA requires reporting of the actual SO_2 and NO_X emissions from these large point sources is to satisfy the requires of the Acid Rain cap and trade program. We have identified several potential issues with the raw CEM data that must be considered when using the hourly CEM data in air quality modeling. These issues are summarized below.

Anomalous Data Points

Under Part 75 of Volume 40 in the Code of Federal Regulations[3], continuous emissions monitoring and reporting is required for large EGUs and industrial facilities. The U.S. EPA CAMD collects and distributes hourly CEM data for NO_X and SO_2 emissions (lbs/hr), heat input (mmBTU), gross load (MW), and steam load (1000 lbs/hr) for thousands of U.S. sources from the year 1995 to the present[4]. To satisfy the Part 75 requirement that CEM data are reported for every operating hour for designated CEM units, a complex process for reporting and filling in missing data has been defined. Many times, missing emissions are substituted with values that are much larger than the actual emissions that were emitted.

In some cases, the Part 75 data substitution methodology results in hourly emission spikes in the NO_X and/or SO_2 CEM data that are clearly anomalous relative to the surrounding hourly data. Figure 1 shows an example of anomalous SO_2 emissions in the actual CEM database. We developed a method to identify and replace anomalous data points in SMOKE-formatted CEM files that was used to prepare the 2008 CEM data for use in the WestJumpAQMS.

2 http://www.epa.gov/airmarkets/
3 http://www.epa.gov/airmarkt/emissions/intro.html
4 http://ampd.epa.gov/ampd/

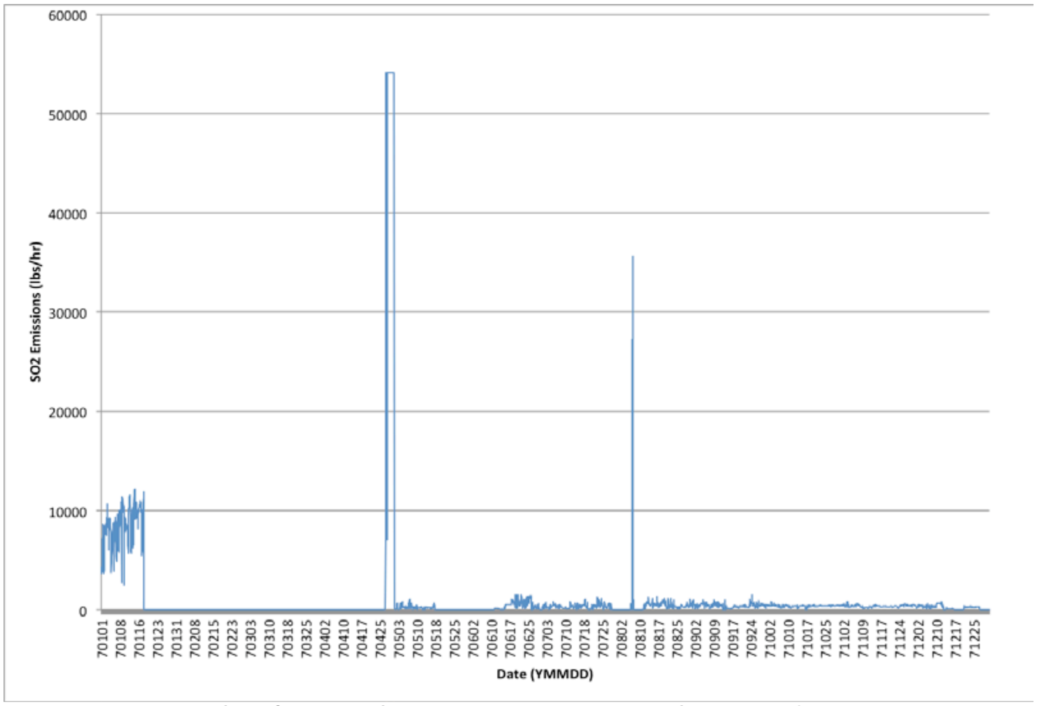

Figure 1. Example of anomalous SO_2 emissions in the CEM data

The approach for eliminating anomalous hourly CEM data was developed for the Southeastern States Air Resource Managers, Inc. (SESARM[5]) and has been reviewed by EPA OAQPS and CAMD. The SMOKE-formatted CEM data files contain flags that identify the origin of the hourly data points. There are a set of fields for each hourly emissions record that contain flags to indicate if the records are either (1) measured, (2) calculated, (3) substituted, or (4) measured and substituted. The four fields that are classified with these flags are heat input, SO_2 mass, NO_X mass, and NO_X rate.

First, we compute calendar year (CY2008) annual mean hourly Heat Input (HI) values for each unique CEM source. For each source, a CY2008 mean HI value for hour 0100 will be calculated using hour 0100 CEM records that are identified as measured (1) and calculated (2); the substituted (3) and measured/substituted (4) entries will be ignored in the annual mean hourly calculation. Similarly we will calculate hour 0200 through hour 2300 mean HI values for every unique CEM source and use these mean values to replace anomalous hourly HI records in the CEM files.

Anomalous hourly HI CEM records are defined as those records flagged as calculated (2), substituted (3), or measured/substituted (4) *and* have a HI value that is 2 times (2x) greater than the CY2008 mean HI value for that hour. Including the 2x variability factor in identifying which data points to replace ensures that “good” substitutions, or substituted values that are not anomalous relative to the surrounding data points, are retained. Also, “null” HI records will be identified as anomalous. This will insure that we have a valid HI value for every hour in the CEM record.

5 http://www.metro4-sesarm.org/

We deliberately include sources flagged as calculated (2) in both the mean HI calculation AND in the grouping of anomalous sources because of specific trends that we observed in the CEM data. Sources flagged as calculated must be included in the mean calculation because many units only have emissions flagged as calculated; by not including calculated emissions it would not be possible to compute mean hourly HI and emissions values to use in the replacement of anomalous data. Similarly, there are examples of sources in the CEM database that are flagged as calculated emissions that clearly have anomalous hourly emissions values. We recognize that by including anomalous records in the mean calculation, the mean hourly values for some sources will have a positive bias.

We use the CEM data origin fields to determine when to replace each hourly CEM heat input record:

> If the heat input field (HEATINPUTMEASURE) is flagged as calculated (2), substituted (3), or measured/substituted (4)
>
> AND
>
> The hourly HI (HTINPUT) is anomalous; the HTINPUT will be replaced with the CY2008 average hourly HI value for that source/hour.

Next, we use the corrected hourly HI fields to compute annual mean SO_2 emissions rates (lbs/mmBTU), non-ozone season (Jan-Apr and Oct-Dec) mean NO_X emission rates (lbs/mmBTU), and ozone season (May-Sep) mean NO_X emissions rates (lbs/mmBTU) for each unique CEM source. For each source, the mean emission rates will be calculated using records that are identified as measured (1) and calculated (2); the substituted (3), and measured/substituted (4) entries will be ignored in the annual mean calculation. The mean emission rate values will be multiplied by the hourly heat input (mmBTU) to give “typical” hourly emission values (lbs). These “typical” hourly emissions values will be used to replace anomalous records in the CEM files.

Anomalous hourly SO_2 and NO_X CEM records are defined as those records flagged as calculated (2), substituted (3), or measured/substituted (4) *and* have an emission value (lbs) that is 2x greater than the “typical” hourly emissions value (lbs) for that hour. The “typical” hourly emissions value is calculated differently for NO_X and SO_2. For NO_X, there will be two “typical” hourly values: one for the ozone season months and another for the non-ozone season months. For SO_2, the “typical” hourly value is an annual mean. Including the 2x variability factor in identifying which data points to replace ensures that “good” substitutions, or substituted values that are not anomalous relative to the surrounding data points, are retained.

We use the CEM data origin fields to determine when to replace each hourly CEM emission record:

- If neither the SO_2 (SO2MEASURE) nor the Heat Input (HEATINPUTMEASURE) fields are flagged as measured (1) AND the hourly SO_2 emission (SO2MASS) is anomalous, the SO2MASS will be replaced with the CY2007 "typical" hourly value for that source/hour.

- If neither the NOXMMEASURE nor NOXRMEASURE fields are flagged as measured (1) AND the hourly NO_X emission (NOXMASS) is anomalous, the NOXMASS will be replaced with either the ozone season or non-ozone season "typical" hourly value for that source/hour. The ozone season months are May-Sep.; the non-ozone season is the rest of the months in the year.

Figures 2 and 3 illustrate the CEM emissions for two sources that were impacted by the anomaly correction procedure. Two CEM datasets are plotted in these figures. The black line shows the original CEM data and the red line shows the corrected data after removal of the anomalous emissions. Figure 2 is a time series plot of the hourly CEM NO_X emissions for Dominion-Hopewell Power #2 in Virginia. The black lines seen early April in this plot are substituted data that are present in the original CEM data from CAMD. The red lines during the same period in early April are the corrected data.

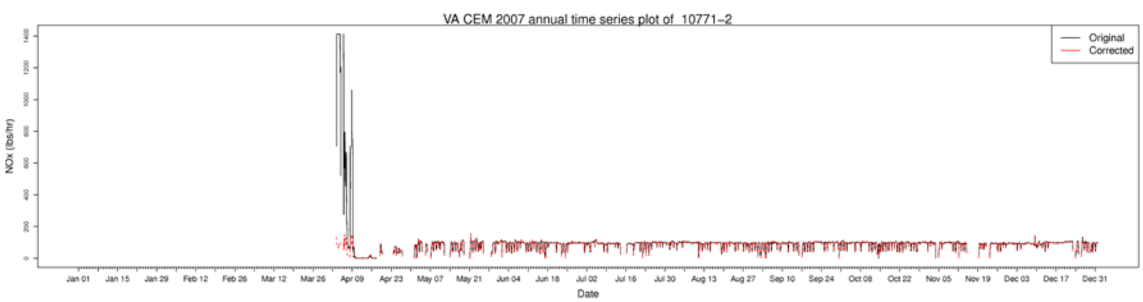

Figure 2. Virginia Dominion-Hopewell #2 2007 CEM NO_X emissions; illustration of anomalous data correction approach

Figure 3 is a time series plot of the hourly CEM SO_2 emissions for Mountaineer #1 in West Virginia. This plot shows a similar trend with the correction of anomalous emissions data in mid-February. These plots illustrate that the corrected data used to replace the anomalous emissions records for these two units is consistent with the overall magnitude of the CEM emissions during the rest of the year.

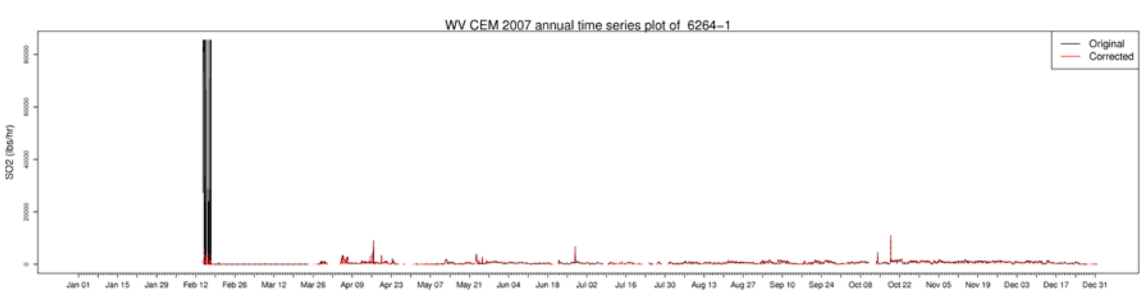

Figure 3. West Virginia Mountaineer #1 2007 CEM SO_2 emissions; illustration of anomalous data correction approach

Partial Year Reporters

We are also aware of another issue with the CEM data for units that are only required to report to CAMD for part of their annual operating cycle. For these units, the NEI08 annual inventory will be higher than the annual total of the CEM data. These "partial year" reporting units can be handled in two different ways. In one approach the non-reporting period emissions, calculated as the difference between the NEI08 annual emission and the CEM annual total, are temporally allocated using SCC-based temporal profiles available from the EPA. In the second approach, the non-reporting period emissions are temporally allocated using profiles derived from hourly CEM data for similar "full year" reporting units. In both cases, preprocessing of the point inventory is required to identify the partial reporting units and to separate these data from the full year reporters. If no action is taken to preprocess the inventories for partial year reporters, the excess or non-reporting period emissions will be dropped. Table 1 summarizes the emissions for the CEM partial year reporting units in the WRAP states. For this cursory analysis we've defined partial year reporters as boilers that contain less than 10 months of valid hourly CEM data. There are 42 boilers in the WRAP states that qualify as partial year reporters and they emit 854 tons/year (TPY) of NO_X and 125 TPY of SO_2 in the non-reporting period. *If no action is taken to preprocess the 2008 CEM inventory, these excess emissions will be dropped in the SMOKE modeling*.

Table 1. 2008 CEM partial year reporters in the WRAP states, emissions in tons/year (TPY)

State	# Boilers	NO_X			SO_2		
		NEI08	CEM	NEI08-CEM	NEI08	CEM	NEI08-CEM
AZ	5	370.2	205.9	164.2	1.3	0.8	0.5
CA	15	243.0	159.6	83.4	7.9	8.4	-0.5
CO	7	60.1	36.0	24.1	0.8	0.6	0.2
ID	0	0.0	0.0	0.0	0.0	0.0	0.0
MT	1	6.0	2.2	3.8	0.1	0.1	0.0
ND	0	0.0	0.0	0.0	0.0	0.0	0.0
NM	3	99.2	97.1	2.1	0.3	0.3	0.0
NV	4	900.2	376.0	524.2	364.9	241.7	123.2
OR	0	0.0	0.0	0.0	0.0	0.0	0.0
SD	0	0.0	0.0	0.0	0.0	0.0	0.0
UT	3	209.2	162.8	46.5	1.3	1.0	0.3
WA	4	31.7	26.4	5.3	3.7	2.9	0.8
WY	0	0.0	0.0	0.0	0.0	0.0	0.0
WRAP Total	42	1919.5	1065.9	853.6	380.3	255.7	124.6

Inconsistencies between the NEI08 and CEM 2008 Inventories

The SMOKE modeling convention for simulating CEM sources is to replace the NO_X and SO_2 emissions in the annual point inventory (PTINV) with the hourly emissions in the CEM inventory. In other words, if there is a difference between the annual NO_X emissions in the NEI08v2 PTINV and the annual total of the hourly NO_X emissions in the 2008 CEM data for a particular unit, the 2008 CEM NO_X will be used by SMOKE to prepare air quality modeling-ready emissions files. A comparison of the NEI08v2 and 2008 CEM data reveals very large differences for all states in the WRAP region except Idaho, which doesn't appear to have any CEM sources in the 2008 inventory. Table 2 summarizes the annual state total NO_X and SO_2 emissions for the NEI08v2 and the 2008 CEM inventories for the full year reporting sources in each state. The table shows the number of full year reporting boilers (i.e. boilers with > 10 months of valid hourly emissions), the annual NEI08v2 emissions, the annual 2008 CEM emissions, and differences between the inventories for both NO_X and SO_2. As WRAP domain totals, there are 60,174 TPY (15%) more NO_X and 50,775 TPY (13%) more SO_2 in the NEI08v2 than reported in the 2008 CEM inventory. Table 6 includes a more detailed summary of this issue by showing similar information by source in each WRAP state. Only units with differences between the NEI08v2 and the CEM data greater than 100 TPY are listed in Table 6. *If no action is taken to reconcile the NEI08v2 and 2008 CEM inventory prior to SMOKE modeling, the CEM emissions will be used to produce the point emission for the WestJumpAQMS air quality modeling.*

Table 2. 2008 CEM full year reporters in the WRAP states, emissions in TPY

State	# Boilers	NO_X			SO_2		
		NEI08	CEM	NEI08-CEM	NEI08	CEM	NEI08-CEM
AZ	31	70887.9	42440.6	28447.3	78189.0	44071.5	34117.6
CA	78	6027.0	3555.0	2471.9	199.4	188.4	11.0
CO	36	64635.7	61335.6	3300.1	61068.8	56537.6	4531.1
ID	0	0.0	0.0	0.0	0.0	0.0	0.0
MT	7	40753.5	28258.2	12495.3	22028.3	19445.3	2583.0
ND	12	70163.7	66654.8	3508.9	136263.3	132228.8	4034.4
NM	18	30127.8	26787.4	3340.4	16425.4	11299.1	5126.4
NV	20	17688.9	15578.9	2110.0	8533.3	9070.8	-537.5
OR	9	11303.9	9426.0	1877.9	14063.2	11306.0	2757.1
SD	1	10029.4	13807.3	-3777.9	9042.8	13497.5	-4454.7
UT	12	61662.7	60986.4	676.3	22298.3	20020.7	2277.6
WA	3	12225.5	10723.9	1501.6	2132.6	2003.0	129.6
WY	20	78754.3	74531.6	4222.7	81889.4	81689.6	199.7
WRAP Total	247	474260.3	414085.8	60174.5	452133.6	401358.2	50775.4

Missing Fields in the NEI08v2 Needed for Simulating CEM Sources

Another potential issue with the CEM data is related to missing fields in the NEI08v2 annual inventory. The CEM inventory files include ORIS and boiler codes that identify unique emissions sources. These files must be combined with a point inventory file, such as the NEI08v2 inventory, containing stack parameters, latitude/longitude coordinates, and emissions for the pollutants other than NO_X and SO_2. The NEI08v2 file must contain ORIS and boiler codes to allow cross-referencing with the CEM inventory. If these fields are missing from the NEI08v2 file it is not possible to simulate the emissions from the CEM sources. For the 2008 inventories that we will use for the WestJumpAQMS, there are CEM inventory records that do not have matches in the NEI08v2 file, either due to blank ORIS and boiler ID fields or completely missing records for these sources in the NEI08v2 file. Table 3 summarizes the extent of this issue on a national scale and for just the WRAP states. This table shows that there are 894 CEM sources in the US that have matching records between the 2008 NEI08v2 and CEM inventories. These sources emit 3,022,324 tons/year of NO_X and 7,597,373 tons/year of SO_2. There are 578 CEM sources that don't have matching records in the NEI08v2 and thus can't be simulated using the hourly CEM emissions data. These sources emit 58,527 tons/year of NO_X and 3,375 tons/year of SO_2. Similar numbers for the WRAP states and tribes are also presented in Table 3. Although 39% of the 2008 CEM sources in the U.S. had no corresponding source with the same ORIS code in the NEI08 they represented only 1.9% and 0.04% of the SO_2 and NO_X emissions, respectively, in the CEM database. Note that just because a CEM source had no corresponding source with the same ORIS code in the NEI08 database does not necessarily mean that the source emissions are dropped as the source may still be in the NEI08 without the correct ORIS code so the NEI08 annual emissions will be used. Table 4 lists the 2008 CEM sources in the WRAP region that do not have complete entries in the NEI08v2 to support simulation of the CEM data for these sources.

Table 3. ORIS-level summary of CEM sources in the NEI08v2

Region	US	WRAP
Sources with both NEI08+CEM Data		
# ORIS Facilities	894	116
NO_X (tons/yr)	3,022,324	283,978
SO_2 (tons/yr)	7,597,374	593,801
Sources with CEM only Data		
# ORIS Facilities	578	81
NO_X (tons/yr)	58,527	2,432
SO_2 (tons/yr)	3,377	134
Comparisons		
# Facility Ratio (CEM/NEI08+CEM)	0.65	0.70
NO_X Ratio (CEM/NEI08+CEM)	0.019	0.009
SO_2 Ratio (CEM/NEI08+CEM)	0.0004	0.0002

While there are a large number of CEM facilities that are missing entries in the NEI08 inventory, the contribution of these sources to the total NO_X and SO_2 emissions is small. The comparisons shown in Table 3 illustrate this point. One important point about the analysis in Table 3 is that there are several CEM sources that are not readily matched to a state and county code and as such cannot be attributed to being in a particular region of the country. The EPA maintains an ORIS description file that cross-references ORIS IDs with the coordinates and FIPS codes of the corresponding facility. We used this ORIS description file to identify the locations of the CEM sources that don't have entries in the NEI08. There are 138 CEM sources in the 2008 CAMD database that do not have entries in this ORIS description file. The implication of the missing sources in the ORIS description file is that we can identify that the sources are missing from the US in general, but we may be underestimating the number of missing sources in the WRAP region.

Summaries of the NEI08v2 point inventories that we will use for the WestJumpAQMS are contained in Tables 7 through 10 near the end of this Memorandum. Table 7 summarizes the 2008 CEM point source emissions by state. Table 8 summarizes the 2008 CEM point source emissions by SCC for the U.S. part of the 36 km CONUS modeling domain. Table 9 summarizes the 2008 non-CEM point source emissions by state. Table 10 summarizes the 2008 non-CEM point source emissions by SCC for the U.S. part of the 36-km modeling domain.

Non-CEM Point Sources

For point sources without CEM measurements, the annual emissions in the 2008 NEIv2.0 are used. Details on the development of the non-CEM Point Source emissions are given in the 2008 NEI documentation[6]. These sources include traditional point sources related to fuel combustion and industrial processes that have stacks and plume rise, but also stationary source that have surface releases (e.g., mining). The non-CEM point source category includes two sub-categories that merit special attention: airports and offshore sources. The airport inventory includes ground support equipment and aircraft in their landing and takeoff cycles (< 3000 feet). Although the inventory for the aircraft sources represents emissions fluxes from the surface up to 3,000 feet, the NEI08 does not include emissions heights. Without emissions height information in the inventory, the emissions from aircraft are all placed in the surface layer for air quality modeling. Offshore sources include oil and gas drilling platforms. The inventory for these sources does include stack parameters, including release heights, and most will have their emissions placed above the model surface layer.

6 http://www.epa.gov/ttnchie1/net/2008inventory.html

Emissions Processing

The CEM and non-CEM point source emissions were processed for the WestJumpAQMS using the Sparse Matrix Operator Kernel Emissions (SMOKE[7]) modeling system. For the CEM sources, emissions are input to SMOKE as a combination of the NEI08v2 annual inventory and the 2008 hourly CEM inventory. Emissions for NO_X and SO_2 from the CEM inventory override the NO_X and SO_2 data in the NEI08v2 annual inventory for the CEM point sources. For the non-CEM point sources, emissions are input to SMOKE as the NEI08v2 annual inventory. Explicit sources are characterized in the point source inventory with a state/county code, plant identification code, source identification code, stack identification code, and latitude/longitude coordinates. As described above, sources in the CEM inventory are matched to sources in the annual NEI08v2 inventory using a combination of ORIS and boiler identification codes.

Spatial Allocation

Spatial allocation of point sources is accomplished by locating the latitude and longitude coordinate of each source location in the NEI08v2 into the corresponding grid cell in the WestJumpAQMS modeling domains.

Temporal Allocation

EPA provided temporal allocation factors for use with the NEI08v2 datasets. Details of the development and application of the temporal allocation profiles are included in Technical Memorandum No. 13. As hourly inventories, CEM data do not require the application of temporal profiles. CEM inventories contain hourly NO_X and SO_2 emissions and hourly heat input, steam load, and gross load. All pollutants other than NO_X and SO_2 for CEM units (i.e., CO, NH_3, VOC, PM_{10}, and $PM_{2.5}$) are converted from annual to hourly emissions using the temporal profiles of the hourly heat input data at each CEM unit.

Chemical Speciation

Speciation profiles for the Carbon Bond version 6 (CB6) chemical mechanism are based on recent work by ENVIRON to update the SPECIATE 4.3 database. Speciation profiles are assigned to inventory sources by a combination of FIPS code, SCC code, pollutant, and plant identification code. EPA updated the speciation profile assignments for use with the NEI08v2. Details of the development of the chemical speciation profiles will be included in Technical Memorandum No. 13.

Quality Assurance

Quality assurance (QA) will be performed following the emissions quality assurance protocol developed for the WRAP Regional Modeling Center (Adelman, 2004[8]). These procedures include systematic procedures for:

7 http://www.smoke-model.org/index.cfm
8 http://www.epa.gov/ttnchie1/conference/ei13/qaqc/adelman_pres.pdf

- Modeling QA – accuracy assurance and problem identification.
- System QA – software and data tracking.
- Documentation – tracking QA issues, recording the QA process and report writing.

An emissions QA checklist is developed that delineates each step of the QA process and allows a systematic approach to the QA process to assure critical steps are not overlooked. The completed QA checklists and templates include:

- Model configuration settings.
- Inventory file log.
- Ancillary input file log.
- Model execution log.

A series of QA products are produced that are compared to other studies and the expected outcomes:

- Spatial plots of emissions by source category.
- Annual time series plots of emissions for subregions.
- Diurnal time series plots.
- Daily vertical profile plots.

EMISSIONS MODELING RESULTS

Table 7 and 8 summarize the CEM point source emissions by state and by process, respectively. Ohio has the most CEM point source NO_X emissions followed by Indiana, Pennsylvania, Kentucky, Florida and Texas. Whereas the five highest CEM point source SO_2 emitting states are Pennsylvania, Ohio, Indiana, Georgia and Texas. External combustion engines for electricity generation is by far the largest CEM point source category for both NO_X (95%) and SO_2 (98%) and contribute 88% or more for all other species except for NH_3 where external and internal combustion electricity generation contribute 57% and 33% of the emissions in the CEM point source Category.

A summary of the non-CEM point source emissions by state and process are given in Tables 9 and 10, respectively. Texas, Louisiana, California, Illinois and Michigan are the highest non-CEM point source NO_X emitting states. Louisiana, Ohio, Texas, Missouri and Illinois are the highest non-CEM point source SO_2 emitting states. The Non-CEM Point source emissions are spread across more categories than the CEM Point Sources.

Table 11 compares the CEM and Non-CEM Point Sources by state and presents the percent of the total point sources that are non-CEM Point Sources. Across the U.S., 58% and 82% of the total point source NO_X and SO_2 emissions come from CEM point sources. Whereas a majority of the VOC (97%), NH_3 (74%) and primary $PM_{2.5}$ (58%) total point source emissions come from non-CEM point sources.

Figures 4 and 5 display the spatial distribution of the monthly average CEM point and non-CEM point source NO_X emissions across the Inter-Mountain West 4 km domain for January and July 2008. Not surprisingly, there are many more non-CEM point sources than CEM point sources, but the NO_X emission rates of the CEM point sources are greater than the non-CEM point sources. There are clusters of non-CEM point sources in the major urban areas (e.g., Denver, Salt Lake City and Albuquerque) but no such clustering is seen with the CEM point sources. There are also clusters of non-CEM point sources in the Texas and Oklahoma panhandles and southwest Kansas that are likely due to the 2008 NEI oil and gas emission point sources. Similar non-CEM point source clusters for the oil and gas development regions in New Mexico, Colorado, Utah and Wyoming are not seen because they are in the point source oil and gas emissions category from the WRAP Phase III study, rather than in the 2008 non-CEM point source category. From the NEI

Figure 6 displays the daily variation in NO and SO_2 emissions for the CEM point source in the 4 km domain and July 2008. The day-to-day variation in daily NO_X and SO_2 emissions for CEM point sources is less than ±10%. These day-to-day variations are mostly due to electricity demand. During the first part of July 2008, the lower CEM point NO_X and SO_2 emissions tend to occur on weekend days as expected (i.e., July 5 and 6 and July 12 and 13). However, such is not the case during the last two weekends in July 2008 (July 19 and 20 and July 26 and 27).

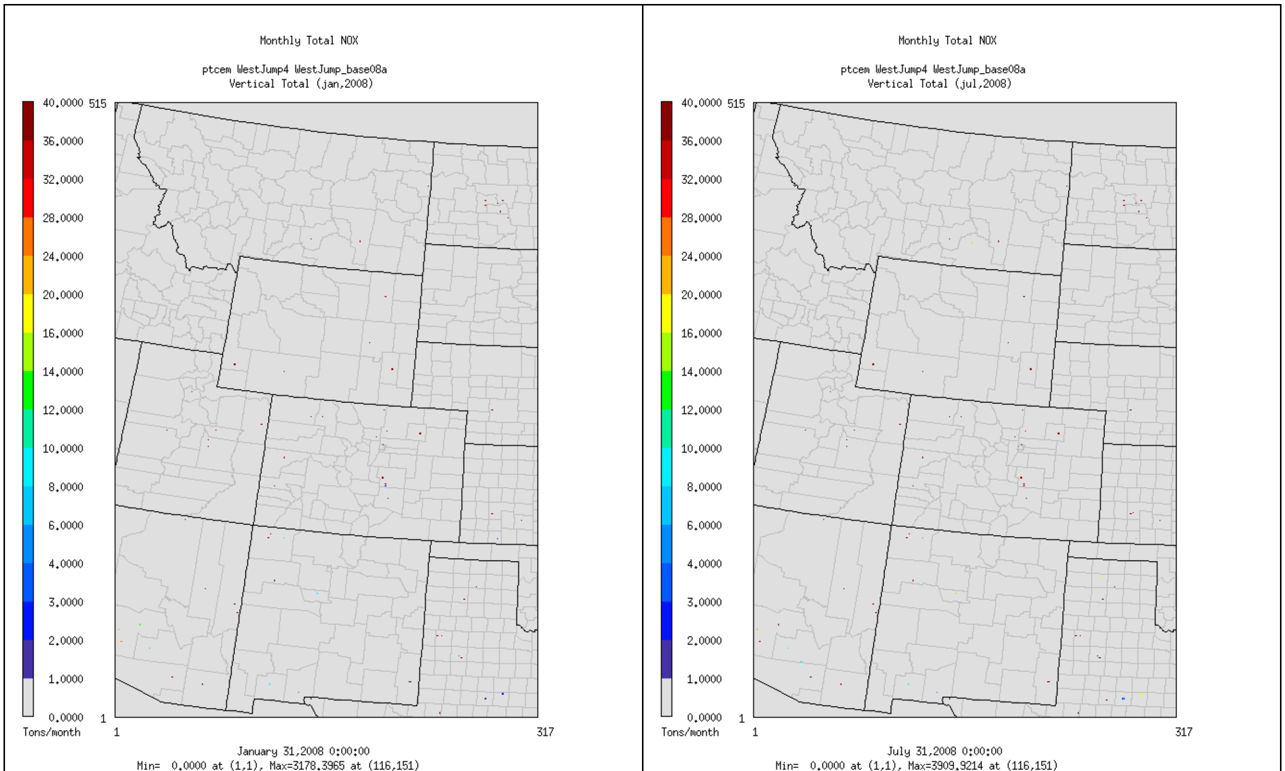

Figure 4. Monthly CEM Point Source NO_X emissions for January (left) and July (right).

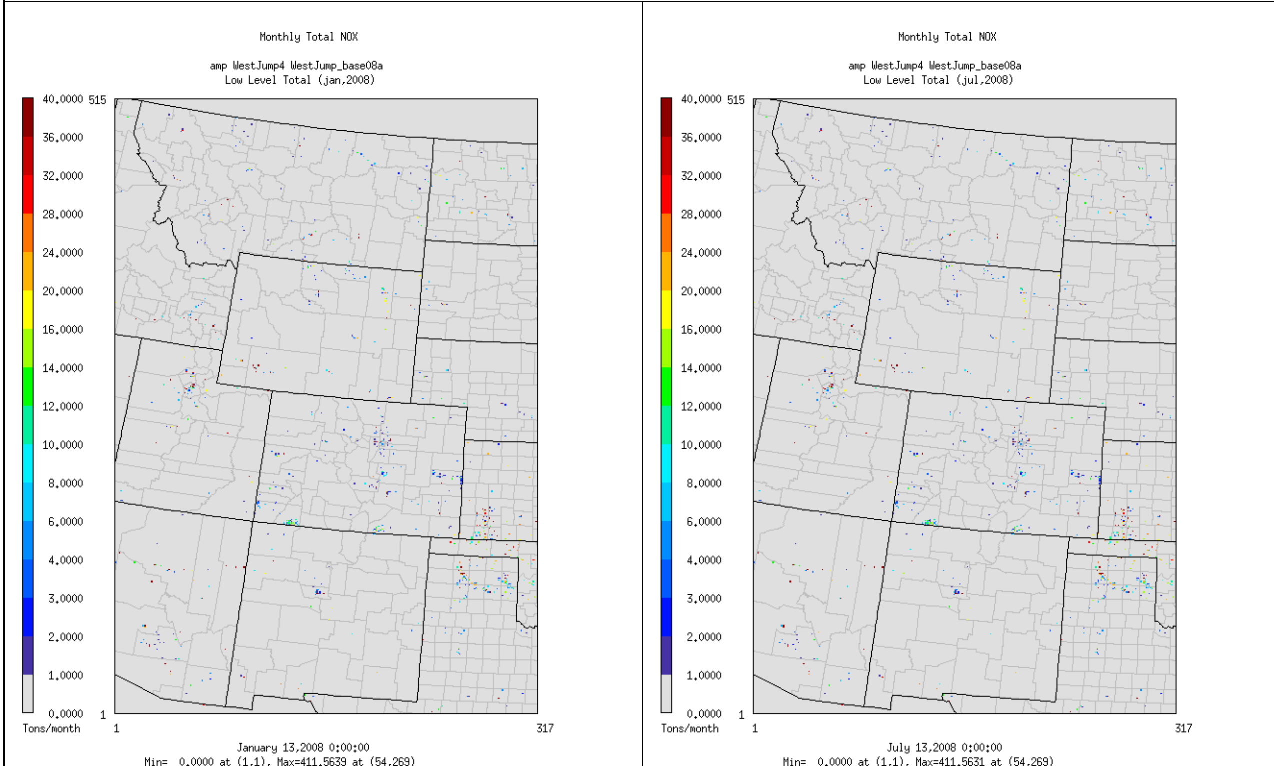

Figure 5. Monthly Non-CEM Point Source NO_X emissions for January (left) and July (right).

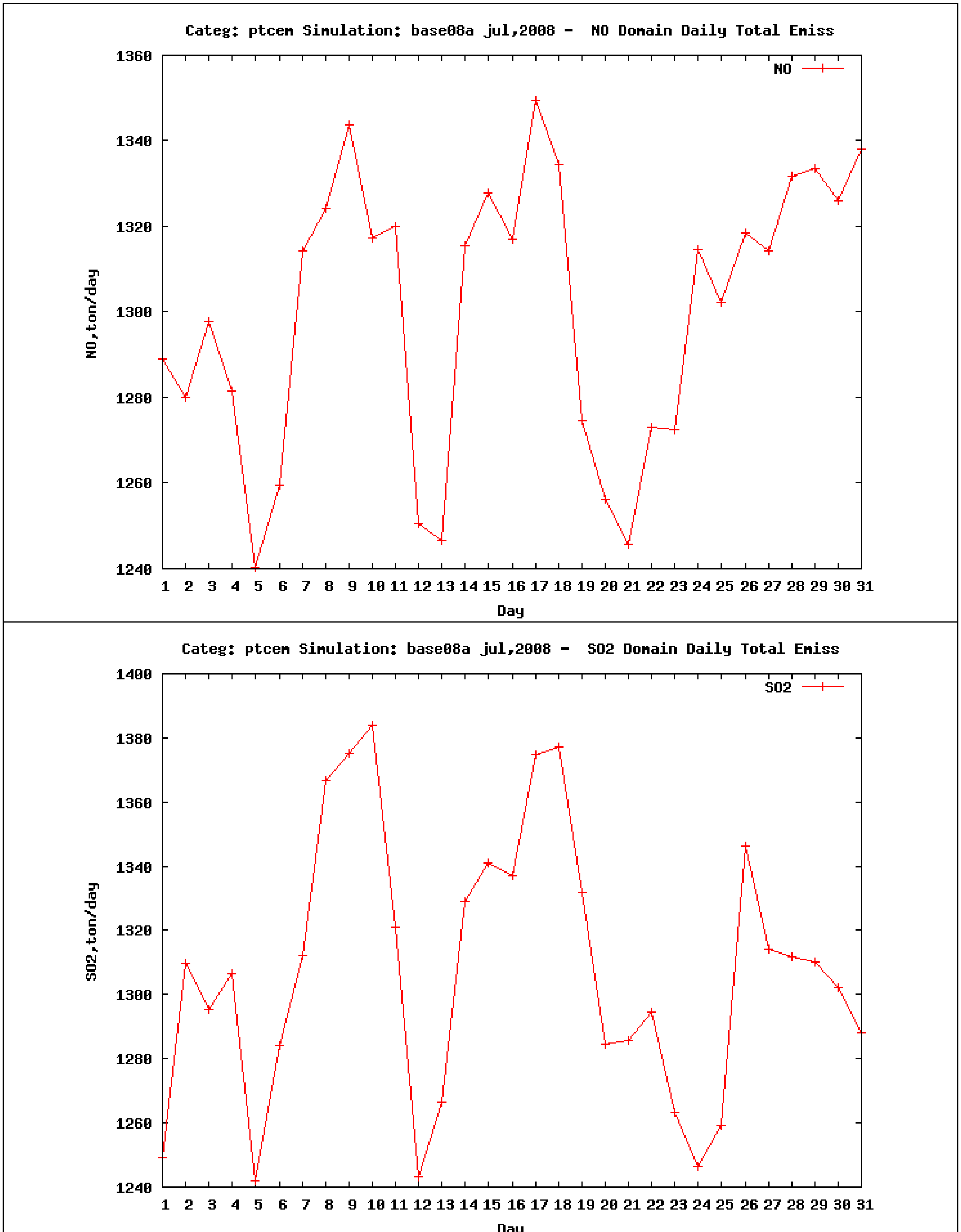

Figure 6. Daily variation in CEM Point Source NO_X (top) and SO_2 (bottom) emissions across the 4 km Inter-Mountain West Modeling Domain for July 2008.

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Table 4. CEM sources in the WRAP states that are missing from the NEI08v2; emissions in TPY

ORIS ID	FIPS	ORIS Plant Description	NO_X	SO_2
116	4013	OCOTILLO POWER PLANT	57.2	0.3
117	4013	APS WEST PHX POWER PLANT	118.5	3.7
147	4013	SRP KYRENE STEAM PLANT	53.5	2.2
8068	4013	SANTAN GENERATING PLANT	136.3	9.3
55282	4013	Duke Energy Arlington Valley	34.7	2.1
55372	4013	New Harquahala Generating Company, LLC	85.2	6.4
55455	4013	Redhawk Generating Facility	178.8	9.2
55124	4015	Griffith Energy LLC	62.2	3.5
124	4019	TUCSON ELECTRIC POWER COMPANY (TEP)	1.7	0.0
55522	4021	Sundance Power Plant	24.1	0.6
55963	6013	Riverview Energy Center	2.2	0.1
10156	6019	FRESNO COGENERATION PARTNERS	2.7	0.2
50131	6019	COALINGA COGENERATION CO	24.6	1.0
55508	6019	Cal Peak Power - Panoche LLC	0.4	0.0
55875	6019	Wellhead Power Gates, LLC	0.6	0.0
356	6037	SO CAL EDISON CO	17.6	1.1
399	6037	LA CITY, DWP HARBOR GENERATING	32.9	0.9
408	6037	LA CITY, DWP VALLEY GENERATING	72.0	8.4
420	6037	PASADENA CITY, DWP (EIS USE)	10.6	0.3
422	6037	Glenarm	4.1	0.1
6013	6037	BURBANK CITY, PUB SERV DEPT	0.4	0.0
7987	6037	Lake	1.7	0.1
10169	6037	CARSON COGENERATION CO, CALIF	12.2	0.9
10294	6053	CALPINE KING CITY COGEN, LLC	1.4	0.1
50864	6053	SARGENT CANYON COGENERATION C	15.6	1.2
50865	6053	SALINAS RIVER COGENERATION COM	18.4	1.2
7693	6059	Anaheim Combustion Turbine	5.9	0.2
55295	6065	Blythe Energy	77.3	3.1
55541	6065	Indigo Energy Facility	14.0	0.4
7551	6067	SACRAMENTO COGENERATION AUTHOY	44.4	2.0
7552	6067	SACRAMENTO POWER AUTHORITY	40.0	2.6
358	6071	SO CAL EDISON CO	113.8	14.5
55510	6073	Cal Peak Power - Border LLC	0.9	0.0
55512	6073	Cal Peak Power - El Cajon LLC	0.8	0.0
55513	6073	Cal Peak Power - Enterprise LLC	0.8	0.0
55538	6073	Escondido Power Plant	2.0	0.0
55540	6073	Chula Vista Power Plant	0.6	0.0
55542	6073	Larkspur Energy Facility	7.3	0.2
7449	6077	NCPA Combustion Turbine Project #2	3.6	0.2

55933	6077	Tracy Peaker	12.9	0.0
10034	6085	CALPINE GILROY COGEN, L P	39.6	0.3
55748	6085	Los Esteros Critical Energy Fac	10.9	0.3
55810	6085	Gilroy Energy Center, LLC	11.7	0.3
55499	6095	Cal Peak Power - Vaca Dixon LLC	0.4	0.0
55625	6095	Creed Energy Center	1.3	0.1
55626	6095	Lambie Energy Center	1.5	0.1
55627	6095	Goose Haven Energy Center	1.5	0.0
55855	6095	Wolfskill Energy Center	1.9	0.1
7266	6099	MODESTO IRRIGATION DISTRICT	14.7	1.1
7315	6099	TURLOCK IRRIGATION DISTRICT	8.4	0.2
10349	6101	CALPINE GREENLEAF II	3.2	0.1
55847	6101	Feather River Energy Center	2.4	0.1
55505	8001	Frank Knutson Station	10.4	0.4
55645	8001	Blue Spruce Energy Center	90.1	2.4
55207	8013	Valmont Combustion Turbine Facility	2.4	0.0
55200	8031	Arapahoe Combustion Turbine	26.4	0.7
55504	8073	Limon Generating Station	4.2	0.3
10682	8087	Brush 3	12.5	0.1
55127	8087	Manchief Station	65.6	0.7
7953	16039	Mountain Home Generation Station	30.2	0.5
7456	16055	Avista Corporation	4.6	0.0
55179	16055	Rathdrum Power, LLC	69.7	2.9
2322	32003	CLARK STATION	39.8	0.3
7082	32003	Harry Allen	6.9	0.1
10761	32003	Las Vegas Cogeneration II, LLC	37.3	2.0
55077	32003	El Dorado Energy	160.4	7.8
55687	32003	REI Bighorn	18.2	1.2
55494	32029	Tri-Center Naniwa Energy	0.3	0.0
55039	35001	Person Generating Project	7.0	0.0
7967	35023	Lordsburg Generating Station	27.8	0.1
7975	35023	Pyramid Generating Station	21.9	1.8
55544	41035	Klamath Energy LLC	39.8	0.5
3344	46005	Huron	8.0	0.0
7237	46099	Angus Anson	45.3	1.3
55478	46103	Lange	7.3	0.1
55622	49035	West Valley Generation Project	45.0	1.4
55482	53039	Goldendale Energy Project	36.1	2.8
55662	53041	Chehalis Generation Facility	86.7	19.0
55818	53053	Frederickson Power LP	43.5	2.3
607	53057	PSE FREDONIA	1.5	0.3
55177	88604	Calpine South Point Energy Center, LLC	91.5	5.9
		Total	2431.9	134.0

Table 5. Agencies supplying point source emissions data for the 2008 NEIv2.

Alabama Department of Environmental Management
Alaska Department of Environmental Conservation
Allegheny County Health Department
Arizona Department of Environmental Quality
Arkansas Department of Environmental Quality
California Air Resources Board
Chattanooga Air Pollution Control Bureau (CHCAPCB)
City of Albuquerque
City of Huntsville Division of Natural Resources and Environmental Mgmt
Clark County Department of Air Quality and Environmental Management
Colorado Department of Public Health and Environment
Confederated Tribes of the Colville Reservation, Washington
Connecticut Department Of Environmental Protection
DC Department of Health Air Quality Division
Delaware Department of Natural Resources and Environmental Control
Florida Department of Environmental Protection
Forsyth County Environmental Affairs Department
Georgia Department of Natural Resources
Hawaii Department of Health Clean Air Branch
Idaho Department of Environmental Quality
Illinois Environmental Protection Agency
Indiana Department of Environmental Management
Iowa Department of Natural Resources
Jefferson County (AL) Department of Health
Kansas Department of Health and Environment
Kentucky Division for Air Quality
Knox County Department of Air Quality Management
Lane Regional Air Pollution Authority
Leech Lake Band of Ojibwe Reservation
Lincoln/Lancaster County Health Department
Louisiana Department of Environmental Quality
Louisville Metro Air Pollution Control District
Maine Department of Environmental Protection
Makah Indian Tribe of the Makah Indian Reservation
Maricopa County Air Quality Department
Maryland Department of the Environment
Massachusetts Department of Environmental Protection
Mecklenburg County Air Quality
Memphis and Shelby County Health Department - Pollution Control
Metro Public Health of Nashville/Davidson County
Michigan Department of Environmental Quality
Minnesota Pollution Control Agency

Mississippi Department of Environmental Quality
Missouri Department of Natural Resources
Montana Department of Environmental Quality
Navajo Nation
Nebraska Environmental Quality
Nevada Division of Environmental Protection
New Hampshire Department of Environmental Services
New Jersey Department of Environment Protection
New Mexico Environment Department Air Quality Bureau
New York State Department of Environmental Conservation
Nez Perce Tribe
North Carolina Department of Environment and Natural Resources
North Dakota Department of Health
Northern Cheyenne Tribe
Ohio Environmental Protection Agency
Oklahoma Department of Environmental Quality
Olympic Region Clean Air Agency
Omaha Air Quality Control Division
Omaha Tribe of Nebraska
Oregon Department of Environmental Quality
Pennsylvania Department of Environmental Protection
Philadelphia Air Management Services
Pinal County
Prairie Band of Potawatomi Indians
Pueblo of Pojoaque
Puget Sound Clean Air Agency
Rhode Island Department of Environmental Management
Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho
South Carolina Department of Health and Environmental Control
Southern Ute Indian Tribe
Tennessee Department of Environmental Conservation
Texas Commission on Environmental Quality
Utah Division of Air Quality
Vermont Department of Environmental Conservation
Virginia Department of Environmental Quality
Washington State Department of Ecology
Washoe County Health District
West Virginia Division of Air Quality
Western North Carolina Regional Air Quality Agency (Buncombe Co.)
Wisconsin Department of Natural Resources
Wyoming Department of Environmental Quality

Table 6. 2008 CEM full year reporter comparisons by WRAP state for sources with |NEI08-CEM| > 100 TPY; emissions in TPY

ORIS	BLRID	NO_X NEI08	NO_X CEM	NO_X NEI08-CEM	SO_2 NEI08	SO_2 CEM	SO_2 NEI08-CEM	Plant Name
AZ								
113	1	3266.7	866.2	2400.4	1582.3	521.0	1061.3	CHOLLA
113	2	8381.3	3282.2	5099.1	3197.6	1528.0	1669.7	CHOLLA
113	3	7983.1	3992.1	3991.0	20229.6	10295.4	9934.1	CHOLLA
113	4	10780.4	2988.4	7791.9	22035.3	3977.7	18057.6	CHOLLA
160	2	8227.9	2922.9	5305.0	3110.2	987.2	2122.9	AZ ELECTRIC POWER COOPERATIVE INC
160	3	7472.6	3775.9	3696.6	2213.4	1457.9	755.5	AZ ELECTRIC POWER COOPERATIVE INC
55306	4CTGB	353.3	55.9	297.4	2.7	2.5	0.2	Gila River Power Station
6177	U1B	7305.5	7294.7	10.8	9442.0	7955.5	1486.5	SALT RIVER PROJECT
6177	U2B	6784.1	7668.7	-884.6	7438.8	7895.3	-456.5	SALT RIVER PROJECT
8223	1	3033.6	2532.6	501.0	2289.9	2590.3	-300.4	TUCSON ELECTRIC POWER CO-SPRINGERVILLE
8223	2	2662.4	2826.2	-163.8	2175.1	2655.1	-480.0	TUCSON ELECTRIC POWER CO-SPRINGERVILLE
8223	TS3	1242.4	1142.4	100.0	1528.4	1294.7	233.6	TUCSON ELECTRIC POWER CO-SPRINGERVILLE
CA								
55217	X724	2690.6	48.2	2642.4	3.9	3.4	0.5	Los Medanos Energy Center, LLC
CO								
465	3	1729.2	1871.8	-142.6	1025.7	867.8	157.9	PUBLIC SERVICE CO - ARAPAHOE
465	4	1249.8	1032.2	217.6	1936.7	1736.2	200.5	PUBLIC SERVICE CO - ARAPAHOE
468	2	590.6	593.1	-2.5	1638.6	1789.9	-151.3	PUBLIC SERVICE CO CAMEO PLT
469	1	1282.4	1546.9	-264.5	1941.4	2526.8	-585.4	PUBLIC SERVICE CO CHEROKEE PLT
469	2	2716.7	3148.4	-431.7	1924.4	1900.4	24.0	PUBLIC SERVICE CO CHEROKEE PLT
469	3	1795.4	1924.5	-129.1	786.5	662.7	123.7	PUBLIC SERVICE CO CHEROKEE PLT
469	4	4499.8	4209.3	290.5	2429.9	1660.1	769.8	PUBLIC SERVICE CO CHEROKEE PLT
470	1	4138.2	2819.8	1318.4	6413.0	4915.2	1497.9	PUBLIC SERVICE CO COMANCHE PLT

470	2	3332.2	2512.0	820.2	6192.0	5675.4	516.5	PUBLIC SERVICE CO COMANCHE PLT
492	5	696.1	805.2	-109.1	1149.4	1296.3	-146.9	COLORADO SPRINGS UTILITIES-DRAKE PLT
492	6	1516.6	1389.7	126.9	2992.0	2681.2	310.8	COLORADO SPRINGS UTILITIES-DRAKE PLT
492	7	2350.1	2071.3	278.7	4988.5	3887.2	1101.3	COLORADO SPRINGS UTILITIES-DRAKE PLT
525	H1	4081.5	3623.3	458.1	1248.4	1206.2	42.2	PUBLIC SERVICE CO HAYDEN PLT
525	H2	3692.0	3371.7	320.3	1470.1	1331.8	138.2	PUBLIC SERVICE CO HAYDEN PLT
6021	C1	5763.0	5020.5	742.5	1053.1	987.5	65.6	TRI STATE GENERATION CRAIG
6021	C2	4987.5	5481.1	-493.6	797.1	1146.3	-349.2	TRI STATE GENERATION CRAIG
6021	C3	6624.5	6066.5	558.0	1948.5	1776.4	172.1	TRI STATE GENERATION CRAIG
6248	1	4415.3	4581.5	-166.3	14126.5	13183.1	943.4	PUBLIC SERVICE CO PAWNEE PLT
6761	101	1863.3	1739.0	124.3	927.5	866.5	61.0	PLATTE RIVER POWER AUTHORITY - RAWHIDE
8219	1	2137.0	2535.9	-398.9	4043.1	4428.8	-385.7	COLORADO SPRINGS UTILITIES - NIXON PLT
MT								
2187	2	1814.4	1652.5	162.0	3476.4	2807.6	668.8	PPL, MONTANA - J.E. CORETTE PLANT
55749	U1	6466.3	361.8	6104.4	385.2	399.3	-14.1	Plant Name
6076	1	4427.8	4302.1	125.7	5794.5	5058.6	735.9	MPC - COLSTRIP UNITS #3 & #4 & #1 & #2
6076	2	4362.7	3732.2	630.5	5777.7	4227.1	1550.5	Plant Name
6076	3	8542.4	5611.8	2930.6	2491.3	2802.6	-311.4	MPC - COLSTRIP UNITS #3 & #4 & #1 & #2
6076	4	14250.9	11731.0	2519.9	2928.5	2970.3	-41.8	Plant Name
ND								
2790	B2	1183.1	983.6	199.5	2976.9	2394.1	582.8	R M HESKETT
2817	1	2177.2	2845.1	-668.0	14562.4	17871.1	-3308.7	LELAND OLDS
2817	2	8451.6	8184.6	267.0	33450.1	29930.6	3519.5	LELAND OLDS
2823	B1	8704.4	8193.4	511.0	20542.8	19607.9	935.0	MILTON R YOUNG
2823	B2	12169.9	8565.1	3604.8	7660.4	9270.4	-1610.1	MILTON R YOUNG
2824	1	1168.6	1169.9	-1.2	2455.8	2720.7	-264.9	STANTON
2824	10	744.5	856.9	-112.3	131.6	146.3	-14.7	STANTON
6030	1	6202.5	5312.5	890.1	15845.1	10685.7	5159.5	COAL CREEK
6030	2	4260.1	4126.0	134.2	12461.5	12407.6	53.9	COAL CREEK

6469	B1	7418.9	6118.5	1300.3	7054.4	6480.9	573.5	ANTELOPE VALLEY
6469	B2	5466.4	7076.9	-1610.5	6617.9	7763.1	-1145.3	ANTELOPE VALLEY
8222	B1	12216.4	13222.4	-1005.9	12504.4	12950.5	-446.0	COYOTE
NM								
2444	8	463.7	568.3	-104.6	1.3	1.7	-0.3	RIO GRANDE GENERATING STATION
2451	1	5554.7	4484.8	1069.9	2637.0	2566.5	70.5	SAN JUAN GENERATING STATION
2451	2	4951.7	4957.5	-5.8	2038.6	1869.8	168.8	SAN JUAN GENERATING STATION
2451	3	7953.0	4847.3	3105.7	5400.6	1897.6	3503.0	SAN JUAN GENERATING STATION
2451	4	5623.6	6156.9	-533.3	5208.3	3745.7	1462.6	SAN JUAN GENERATING STATION
2454	122B	805.3	1153.8	-348.5	2.2	2.9	-0.7	CUNNINGHAM
87	1	3384.8	3228.7	156.2	1124.0	1201.5	-77.6	ESCALANTE
NV								
2324	2	1952.3	1606.0	346.3	189.0	120.7	68.3	REID GARDNER STATION
2324	3	1176.9	1028.9	147.9	141.6	160.6	-19.0	REID GARDNER STATION
2324	4	2829.0	1684.7	1144.3	689.9	520.5	169.4	REID GARDNER STATION
2330	1	1114.8	979.6	135.3	4.0	1.4	2.6	SIERRA PACIFIC POWER COMPANY
2330	2	774.5	626.2	148.3	1.6	1.1	0.5	SIERRA PACIFIC POWER COMPANY
2336	1	150.5	9.9	140.6	0.3	0.0	0.3	SIERRA PACIFIC POWER
2336	2	281.5	60.1	221.4	0.7	0.2	0.6	SIERRA PACIFIC POWER
56224	1	382.2	249.2	132.9	363.6	241.4	122.2	#N/A
8224	1	2990.0	2647.2	342.8	5988.7	6668.5	-679.8	VALMY GENERATING STATION
8224	2	3867.8	4073.3	-205.5	1352.7	1429.7	-77.0	VALMY GENERATING STATION
OR								
6106	1SG	10656.6	8701.3	1955.3	14037.2	11277.0	2760.1	PORTLAND GENERAL ELECTRIC COMPANY
SD								
6098	1	10029.4	13807.3	-3777.9	9042.8	13497.5	-4454.7	BIG STONE
UT								
3644	1	1477.9	1460.3	17.6	2446.7	2129.2	317.5	CARBON POWER PLANT
3644	2	2343.0	1872.5	470.5	4064.5	2909.3	1155.2	CARBON POWER PLANT
6165	1	6710.2	7021.6	-311.4	2989.7	2799.0	190.7	HUNTER POWER PLANT

6165	2	6797.0	6997.6	-200.6	2747.6	2210.0	537.6	HUNTER POWER PLANT
6165	3	5184.0	6353.6	-1169.6	933.9	984.4	-50.5	HUNTER POWER PLANT
6481	1SGA	13968.8	14802.8	-834.0	2234.5	3010.5	-776.1	INTERMOUNTAIN GENERATION STATION
6481	2SGA	14778.1	12325.3	2452.8	2529.5	2668.5	-139.0	INTERMOUNTAIN GENERATION STATION
8069	1	5973.9	6040.2	-66.3	2900.9	2279.4	621.5	HUNTINGTON POWER PLANT
8069	2	4400.6	4088.6	312.0	1449.9	1029.4	420.5	HUNTINGTON POWER PLANT
WA								
3845	BW21	6821.9	5631.1	1190.8	934.3	1326.5	-392.2	TRANSALTA CENTRALIA GENERATION
3845	BW22	5336.5	5021.4	315.0	1193.1	673.2	519.9	TRANSALTA CENTRALIA GENERATION
WY								
4158	BW41	2273.7	1977.0	296.7	3831.6	3431.8	399.8	PACIFICORP_DAVE JOHNSTON
4158	BW42	2064.9	2016.9	48.0	3637.2	3390.9	246.3	PACIFICORP_DAVE JOHNSTON
4158	BW43	5171.6	5286.0	-114.4	7893.7	7453.3	440.3	PACIFICORP_DAVE JOHNSTON
4158	BW44	4068.3	3283.1	785.3	5993.0	5196.2	796.8	PACIFICORP_DAVE JOHNSTON
4162	1	3376.2	3598.2	-222.1	6688.4	7251.0	-562.6	PACIFICORP_NAUGHTON POWER PLANT
4162	2	4606.6	4439.2	167.3	9135.5	9149.6	-14.1	PACIFICORP_NAUGHTON POWER PLANT
4162	3	5814.6	5905.1	-90.5	5764.4	5645.7	118.7	PACIFICORP_NAUGHTON POWER PLANT
55479	1	590.2	589.4	0.8	832.7	650.6	182.2	Wygen
6101	BW91	4603.8	5010.1	-406.3	7835.2	8193.3	-358.1	PACIFICORP_WYODAK
6204	1	6363.9	6395.2	-31.4	3119.3	3722.1	-602.8	BASIN ELECTRIC_LARAMIE RIVER STATION
6204	2	6019.1	6526.5	-507.4	2778.5	3135.4	-356.8	BASIN ELECTRIC_LARAMIE RIVER STATION
6204	3	7227.7	6300.6	927.0	4489.3	3854.3	635.0	BASIN ELECTRIC_LARAMIE RIVER STATION
7504	1	644.8	1310.4	-665.7	616.5	777.0	-160.5	BLACK HILLS POWER & LGT_SIMPSON 2
8066	BW71	8670.7	8190.0	480.7	5907.8	5303.1	604.7	PACIFICORP_JIM BRIDGER
8066	BW72	4681.7	4657.7	24.0	5516.7	5813.8	-297.1	PACIFICORP_JIM BRIDGER
8066	BW73	4689.5	4474.1	215.3	5122.9	6106.4	-983.6	PACIFICORP_JIM BRIDGER
8066	BW74	7577.8	4288.8	3289.0	2505.5	2395.3	110.1	PACIFICORP_JIM BRIDGER

Table 7. 2008 NEIv2 total CEM point source emissions by state, annual emissions (Tons per Year, TPY)

FIPS CODE	State	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
1000	Alabama	11384.39	113477.73	1033.70	549.08	368183.97	5178.50	2777.72
4000	Arizona	8581.47	41768.56	490.91	919.79	43571.27	2755.63	1901.76
5000	Arkansas	3849.08	37386.22	486.40	255.85	73109.84	2039.38	1233.06
6000	California	5736.35	3319.40	430.47	746.83	188.81	967.16	965.96
8000	Colorado	5161.26	61663.70	506.06	466.81	56508.05	1623.07	524.94
9000	Connecticut	8925.65	3872.44	150.08	281.91	5015.84	375.89	120.69
0000	Delaware	753.80	9120.70	79.30	142.00	33566.12	2139.34	1869.42
11000	DC	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12000	Florida	32627.24	157599.27	1903.59	3606.90	266591.78	16531.92	13117.58
13000	Georgia	11663.57	107151.98	1558.14	1054.37	514424.81	12707.06	5981.31
17000	Illinois	16667.34	123596.52	1606.22	192.18	276900.91	7227.51	5458.63
18000	Indiana	15611.94	194258.89	1948.18	345.55	589158.25	35912.00	30029.13
19000	Iowa	26826.56	48754.18	640.53	22.23	108952.91	8050.69	5640.63
20000	Kansas	8189.70	52383.30	741.39	357.44	95629.55	3174.67	1742.35
21000	Kentucky	15546.12	158434.69	1593.12	792.02	347471.22	8368.13	6439.93
22000	Louisiana	34917.73	45476.49	1085.67	1474.90	88068.37	6187.17	3497.12
23000	Maine	394.54	577.91	33.68	28.63	1028.73	72.89	49.86
24000	Maryland	3735.81	35956.06	329.49	201.29	227225.12	7641.60	5929.19
25000	Massachusetts	3621.71	9482.67	330.58	195.84	46377.80	757.61	598.27
26000	Michigan	11013.62	104497.91	1123.35	141.01	328983.78	2933.92	1597.42
27000	Minnesota	6126.58	59638.21	634.74	199.06	73837.75	8319.00	3459.77
28000	Mississippi	8019.80	41668.57	548.91	479.62	65107.60	1761.53	1003.53
29000	Missouri	20685.42	88171.57	1566.39	142.33	257539.75	8435.58	5237.55
30000	Montana	2849.14	27032.59	394.18	5.67	18746.30	704.27	220.31
31000	Nebraska	3420.01	42732.04	434.55	191.13	75470.52	2287.48	1865.32
32000	Nevada	1291.46	15770.43	158.80	224.53	9440.72	912.89	359.56
33000	New Hampshire	982.01	4627.05	92.35	152.53	36782.77	832.61	590.39

FIPS CODE	State	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
34000	New Jersey	1689.57	11762.36	134.74	117.67	24562.44	4347.47	4323.97
35000	New Mexico	16032.57	28663.65	280.22	273.28	11807.30	693.69	684.26
36000	New York	8160.84	31909.35	744.98	1591.73	66268.06	3602.30	1862.61
37000	North Carolina	18633.67	56958.43	966.02	149.01	227468.94	19970.64	16922.5
38000	North Dakota	7127.09	67124.16	741.41	368.22	132140.64	1542.28	304.99
39000	Ohio	15075.29	237371.42	1301.48	65.86	722904.81	48106.16	43226.70
40000	Oklahoma	10579.88	77379.41	1041.16	716.08	100911.35	5663.10	3318.72
41000	Oregon	958.65	9387.84	225.71	251.55	11321.93	1108.94	703.40
42000	Pennsylvania	20294.85	185353.16	722.72	411.63	865070.44	59279.29	53762.19
44000	Rhode Island	169.00	199.81	7.89	4.48	4.65	4.67	4.67
45000	South Carolina	11179.42	45416.58	544.41	281.66	160472.92	18185.37	14477.73
46000	South Dakota	570.69	13807.85	125.55	34.24	13494.56	241.46	227.93
47000	Tennessee	6778.71	86039.52	883.54	205.99	211984.05	7113.14	5266.44
48000	Texas	220600.27	154644.97	3591.75	4394.19	480946.41	21321.77	11568.57
49000	Utah	3725.74	59926.50	273.79	22.59	20120.14	1938.91	880.04
50000	Vermont	1190.29	294.59	33.26	15.05	1.89	43.49	42.48
51000	Virginia	5600.1	51633.10	546.39	267.82	131686.05	3017.22	1613.18
53000	Washington	2634.02	10891.13	14.96	91.90	2315.87	487.69	457.78
54000	West Virginia	9895.23	100043.91	1187.17	32.76	311329.75	28031.65	25891.86
55000	Wisconsin	12025.03	48470.36	1028.57	425.06	133093.31	3282.50	604.15
56000	Wyoming	13048.29	72280.77	826.20	439.34	80636.75	14779.43	7363.89
88000	Tribal Data	4752.37	81962.91	570.30	285.14	15157.75	8464.71	5639.83

Table 8. 2008 NEIv2 total CEM point source emissions by Tier 2 SCC in the WestJumpAQMS 36-km domain, annual emissions (Tons per Year, TPY)

SCC Tier 2	Description	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
101	External Combustion Boilers; Electric Generation	598164.27	2881385.42	31447.68	13520.74	7558982.17	364644.92	274391.59
102	External Combustion Boilers; Industrial	20751.74	79492.79	948.76	468.84	162522.04	21947.40	15132.86
103	External Combustion Boilers; Commercial/Institutional	357.59	1833.50	12.61	0.26	6357.75	376.80	261.26
201	Internal Combustion Engines; Electric Generation	32094.02	46335.54	2747.88	7740.75	3343.97	8807.94	8478.49
202	Internal Combustion Engines; Industrial	6124.03	8958.89	477.78	1737.00	340.21	1649.56	1575.04
203	Internal Combustion Engines; Commercial/Institutional	1497.60	1179.62	29.28	135.85	32.24	111.48	110.80
305	Industrial Processes; Mineral Products	0.00	0.00	0.00	0.00	0.00	70.60	50.43
311	Industrial Processes; Building Construction	22.34	55.58	1.36	0.83	0.16	0.57	0.57
385	Industrial Processes; Cooling Tower	0.00	0.00	0.00	0.00	0.00	1433.98	1276.37
390	Industrial Processes; In-process Fuel Use	0.00	0.00	0.03	5.73	3.50	0.14	0.14
399	Industrial Processes; Miscellaneous Manufacturing Industries	14.49	395.30	21.25	0.00	2.70	26.65	26.65
407	Petroleum and Solvent Evaporation; Organic Chemical Storage	277.60	301.60	6.53	4.85	4.61	53.88	53.88

Table 9. 2008 NEIv2 total non-CEM point source emissions by state, annual emissions (Tons per Year, TPY)

FIPS CODE	State	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
1000	Alabama	108452.22	67321.91	31310.94	1594.64	65885.73	27333.60	22149.74
4000	Arizona	26494.53	18107.27	2998.05	50.69	34910.42	8125.50	3719.62
5000	Arkansas	40485.10	37577.01	27477.25	932.43	14035.69	9015.27	6434.31
6000	California	118909.57	91018.70	41873.41	10844.12	27128.72	38611.44	22678.26
8000	Colorado	45822.17	51380.13	71684.95	0.55	8356.38	19076.58	8521.81
9000	Connecticut	4300.60	4696.06	1096.13	0.00	520.13	290.95	219.83
10000	Delaware	6803.49	4701.55	3052.90	127.67	7443.81	1229.24	1077.31
11000	DC	438.51	596.65	69.40	0.01	343.00	48.64	45.47
12000	Florida	116147.80	56424.52	31356.09	1756.19	44946.53	19931.38	16405.27
13000	Georgia	70662.12	52244.87	27946.61	5550.80	45874.47	8285.82	6936.28
16000	Idaho	25499.05	12680.73	1189.11	1099.84	7499.53	3094.13	2366.78
17000	Illinois	78210.27	81817.74	49650.63	1292.99	99516.09	20019.94	12004.06
18000	Indiana	336717.00	69377.80	37584.64	840.91	81531.62	37356.03	27400.98
19000	Iowa	29362.96	40834.38	21794	3396.84	51635.30	9004.78	5779.88
20000	Kansas	24372.83	53227.88	17967.87	1576.59	7313.73	5018.31	3623.41
21000	Kentucky	67111.59	40379.54	43904.20	176.63	30907.54	23428.47	17424.98
22000	Louisiana	101842.32	143670.70	67501.23	6233.15	137955.98	51868.55	45753.62
23000	Maine	16847.04	16167.72	4337.36	582.29	12543.56	3757.41	2773.51
24000	Maryland	75040.47	21781.36	2865.16	0.40	27252.44	4192.41	2666.31
25000	Massachusetts	16066.76	13786.34	4061.94	325.66	6414.92	1854.59	1292.42
26000	Michigan	79581.97	79006.84	27959.91	779.03	59604.48	20979.80	13389.09
27000	Minnesota	30298.54	59337.12	22446.85	1855.83	25199.29	20563.36	12900.36
28000	Mississippi	35344.08	53354.78	32289.30	1482.32	18824.84	9047.37	7033.78
29000	Missouri	79207.83	45381.39	16473.71	1513.55	109316.04	10225.58	6225.57
30000	Montana	27806.42	15474.71	4296.48	49.16	7895.41	5149.24	1995.39
31000	Nebraska	10413.41	14177.00	3780.42	1020.64	2571.79	3177.81	2077.32
32000	Nevada	11131.46	14088.41	2793.39	77.06	1827.07	4834.64	3073.32

FIPS CODE	State	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
33000	New Hampshire	4505.98	2327.81	690.58	47.01	2043.68	3203.94	3092.73
34000	New Jersey	17037.76	16950.03	9643.24	1005.40	3399.52	3366.07	2773.74
35000	New Mexico	20857.86	28709.28	8860.18	0.13	11023.91	2258.05	1068.19
36000	New York	76858.06	47431.74	6976.68	1437.01	48125.13	6076.30	4411.34
37000	North Carolina	57937.85	40760.16	38067.54	1371.87	46375.54	10771.24	8688.34
38000	North Dakota	10338.26	11402.54	3133.29	6002.25	9537.10	2929.27	2278.41
39000	Ohio	248125.58	66204.55	31226.91	3011.26	133959.44	25753.14	21610.61
40000	Oklahoma	43635.11	65468.24	24784.81	2340.35	35916.61	8861.71	5651.69
41000	Oregon	35420.51	14085.11	8327.67	2.94	4573.71	10437.96	8371.34
42000	Pennsylvania	96708.29	70495.37	28513.74	1627.65	42647.05	19984.71	13952.83
44000	Rhode Island	3834.58	1430.30	1210.42	115.00	1017.20	172.77	135.07
45000	South Carolina	90522.45	29038.81	24471.95	1840.15	30538.51	7722.40	5604.06
46000	South Dakota	2284.66	165.43	98.19	0.00	21.01	50.36	10.33
47000	Tennessee	53300.20	47972.86	37326.49	985.95	45429.59	13626.66	10275.17
48000	Texas	262203.47	238585.69	119379.14	2240.82	121641.79	38581.54	31176.73
49000	Utah	18143.75	25854.55	6942.92	545.78	8135.35	7395.84	3160.28
50000	Vermont	1167.21	205.78	456.36	0.00	164.72	157.90	94.24
51000	Virginia	71074.61	53014.52	27310.98	1285.32	50158.31	9200.73	7229.95
53000	Washington	65856.07	27613.12	12691.45	350.17	13450.40	4816.90	3950.70
54000	West Virginia	55816.85	34629.97	10896.08	272.94	31699.71	7043.37	4276.58
55000	Wisconsin	63519.25	40813.82	30438.07	496.68	59818.99	9384.44	3028.2
56000	Wyoming	33358.75	42310.35	17477.82	281.41	26213.33	29735.53	16833.78
85000	Offshore	82145.84	74285.60	60823.05	0.00	1021.11	779.97	769.26
88000	Tribal Data	6807.51	13603.47	3132.21	29.59	46.22	2790.88	977.76

Table 10. 2008 NEIv2 total non-CEM point source emissions by Tier 2 SCC in the WestJumpAQMS 36-km domain, annual emissions (Tons per Year, TPY)

SCC Tier 2	Description	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
101	External Combustion Boilers; Electric Generation	38698.71	86367.52	2518.82	1940.04	161270.69	11955.68	8981.33
102	External Combustion Boilers; Industrial	337709.24	358207.08	19604.94	3329.29	535170.73	81946.07	67504.58
103	External Combustion Boilers; Commercial/Institutional	28851.62	36709.50	1840.04	383.63	58858.47	5188.13	3976.26
105	External Combustion Boilers; Space Heaters	1595.32	2927.77	217.27	32.23	385.65	328.88	305.20
201	Internal Combustion Engines; Electric Generation	41386.52	44019.34	4938.15	3110.49	3377.54	6183.91	5589.16
202	Internal Combustion Engines; Industrial	293489.60	616998.64	49089.30	987.87	5339.62	16566.42	14723.32
203	Internal Combustion Engines; Commercial/Institutional	18000.95	31028.97	3586.54	340.94	1069.07	1698.52	1541.91
204	Internal Combustion Engines; Engine Testing	13429.25	6309.92	1332.42	3.16	369.79	510.12	310.30
275	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust	63.24	9.45	22.65	0.00	0.62	7.99	7.91
276	Internal Combustion Engines; Rotary Wing Aircraft L & TO Exhaust	497.43	345.64	102.30	0.00	1.65	13.78	13.84
280	Internal Combustion Engines; Diesel Marine Vessels	456.08	3322.28	106.77	0.00	155.21	151.54	139.41
285	Internal Combustion Engines; Railroad Equipment	7766.06	62788.32	4114.01	23.19	531.41	1777.04	1723.93
288	Internal Combustion Engines; Fugitive Emissions	200.70	386.44	234.53	58.50	106.99	41.39	37.56
301	Industrial Processes; Chemical Manufacturing	212299.28	77206.68	95383.88	19373.79	199617.35	29905.67	24335.27
302	Industrial Processes; Food and Agriculture	40102.95	6251.15	84045.00	2819.23	6053.60	28840.79	14562.10
303	Industrial Processes; Primary Metal Production	788508.67	81228.72	15407.07	1776.04	170047.12	57873.85	42208.57
304	Industrial Processes; Secondary Metal Production	74692.80	12549.40	23118.70	341.85	24510.72	28333.80	24783.89
305	Industrial Processes; Mineral Products	213888.02	315744.03	26012.62	8193.49	199154.49	160477.90	81490.00
306	Industrial Processes; Petroleum Industry	82574.67	90568.17	63702.87	2987.59	141969.02	26451.36	23509.41
307	Industrial Processes; Pulp and Paper and Wood Products	132123.47	74552.29	133046.75	5962.30	39616.39	51962.20	42293.35
308	Industrial Processes; Rubber and Miscellaneous Plastics Products	727.75	622.04	34598.91	130.74	9.89	1982.43	1443.67
309	Industrial Processes; Fabricated Metal Products	1879.91	2508.81	5580.81	115.84	138.88	4741.32	3274.74
310	Industrial Processes; Oil and Gas Production	19103.05	24198.70	97515.51	27.10	58577.59	1794.84	1758.15
311	Industrial Processes; Building Construction	145.16	17.63	15.26	0.00	0.84	305.93	208.93
312	Industrial Processes; Machinery, Miscellaneous	39.55	68.40	358.30	7.83	10.02	237.55	197.79

SCC Tier 2	Description	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
313	Industrial Processes; Electrical Equipment	2064.04	109.80	1310.51	31.37	244.98	147.68	144.11
314	Industrial Processes; Transportation Equipment	286.18	62.86	2884.60	0.84	3.51	661.01	391.81
315	Industrial Processes; Photo Equip/Health Care/Labs/Air Condit/SwimPools	172.80	154.38	202.91	66.34	18.43	66.44	64.94
316	Industrial Processes; Photographic Film Manufacturing	10.37	31.01	145.40	0.17	0.07	79.70	78.57
317	Industrial Processes; NGTS	0.00	0.00	61.38	0.00	0.00	0.00	0.00
320	Industrial Processes; Leather and Leather Products	0.00	0.45	523.90	0.40	0.00	98.70	81.89
330	Industrial Processes; Textile Products	36.67	60.09	1851.00	63.73	1.64	326.70	285.46
360	Industrial Processes; Printing and Publishing	6.83	8.14	133.11	0.00	0.05	0.62	0.34
385	Industrial Processes; Cooling Tower	52.32	66.54	3252.42	7868.76	0.61	19699.83	16653.46
390	Industrial Processes; In-process Fuel Use	46035.61	22072.54	3848.20	261.87	13388.84	4591.95	3791.27
399	Industrial Processes; Miscellaneous Manufacturing Industries	12997.10	15725.75	31576.67	1742.72	16158.97	14946.47	11893.93
401	Petroleum and Solvent Evaporation; Organic Solvent Evaporation	162.70	337.44	11478.40	5.24	338.70	76.55	70.73
402	Petroleum and Solvent Evaporation; Surface Coating Operations	2962.22	2458.42	148329.44	185.57	94.56	3671.32	3251.31
403	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries	46.69	75.14	31594.15	76.61	33.19	41.30	40.01
404	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery)	1515.16	726.89	67295.21	0.70	14.74	104.32	91.34
405	Petroleum and Solvent Evaporation; Printing/Publishing	3197.32	3852.52	28800.48	81.33	26.71	258.76	234.21
406	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products	1509.87	329.54	30873.08	1.07	64.56	83.05	66.51
407	Petroleum and Solvent Evaporation; Organic Chemical Storage	91.74	241.88	8145.49	83.69	72.95	119.23	117.20
408	Petroleum and Solvent Evaporation; Organic Chemical Transportation	32.39	24.22	1913.32	0.61	0.67	16.59	14.80
410	Petroleum and Solvent Evaporation; Dry Cleaning	0.00	0.00	475.72	0.00	0.00	0.00	0.00
425	Petroleum and Solvent Evaporation;	0.00	0.00	584.33	1.14	0.00	0.00	0.00
490	Petroleum and Solvent Evaporation; Organic Solvent Evaporation	388.86	293.34	18140.03	50.55	226.72	209.14	161.55
501	Waste Disposal; Solid Waste Disposal - Government	24027.44	27927.97	6392.03	3462.57	7290.34	10169.68	5321.46

SCC Tier 2	Description	CO (TPY)	NO_X (TPY)	VOC (TPY)	NH_3 (TPY)	SO_2 (TPY)	PM_{10} (TPY)	$PM_{2.5}$ (TPY)
502	Waste Disposal; Solid Waste Disposal - Commercial/Institutional	6237.69	6528.91	2034.43	12.83	2792.57	2737.17	1129.17
503	Waste Disposal; Solid Waste Disposal - Industrial	6847.18	6964.48	3604.21	2417.60	4120.26	2259.40	1571.85
504	Waste Disposal; Site Remediation	72.20	424.78	1961.05	14.12	19.28	189.27	72.72
625	MACT Source Categories; Food and Agricultural Processes	0.00	0.00	168.23	0.00	200.27	0.02	0.02
631	MACT Source Categories; Agricultural Chemicals Production	0.00	0.00	12.35	0.00	0.00	0.42	0.42
641	MACT Source Categories; Styrene or Methacrylate Based Resins	0.00	0.00	130.16	0.00	0.00	36.76	36.63
644	MACT Source Categories; Cellulose-based Resins	0.00	0.00	4.62	0.00	0.00	0.00	0.00
645	MACT Source Categories; Miscellaneous Resins	0.00	0.00	47.86	0.00	0.00	16.32	16.06
646	MACT Source Categories; Vinyl-based Resins	9.56	19.14	399.92	0.37	0.06	114.64	90.25
648	MACT Source Categories; Miscellaneous Polymers	0.78	0.92	39.32	0.00	0.00	0.21	0.20
649	MACT Source Categories; Fibers Production Processes	1.80	0.00	8.03	0.00	0.00	5.25	5.25
651	MACT Source Categories; Inorganic Chemicals Manufacturing	156.80	0.00	24.14	60.44	0.00	10.79	6.52
681	MACT Source Categories; Consumer Product Manufacturing Facilities	0.00	0.00	255.51	0.00	0.00	0.00	0.00
682	MACT Source Categories; Miscellaneous Processes	0.00	0.00	118.32	13.48	0.00	5.48	5.48
684	MACT Source Categories; Miscellaneous Processes (Chemicals)	19.27	17.88	45.06	0.23	0.27	21.98	14.49
685	MACT Source Categories; Miscellaneous Processes (Chemicals)	5.83	0.00	167.52	0.00	0.00	0.04	0.04

Table 11. CEM and Non-CEM Point sources and percent total point sources are non-CEM points.

	CEM Point Sources					Non-CEM Point Sources					Percent CEM Point Sources				
	NO_X	VOC	NH_3	SO_2	$PM_{2.5}$	NO_X	VOC	NH_3	SO_2	$PM_{2.5}$	NO_X	VOC	NH_3	SO_2	$PM_{2.5}$
State	(TPY)	(TPY)	(TPY)	(TPY)	(TPY)	(TPY)	(TPY)	(TPY)	(TPY)	(TPY)	(%)	(%)	(%)	(%)	(%)
Alabama	67,322	31,311	1,595	65,886	22,150	113,478	1,034	549	368,184	2,778	37%	97%	74%	15%	89%
Arizona	18,107	2,998	51	34,910	3,720	41,769	491	920	43,571	1,902	30%	86%	5%	44%	66%
Arkansas	37,577	27,477	932	14,036	6,434	37,386	486	256	73,110	1,233	50%	98%	78%	16%	84%
California	91,019	41,873	10,844	27,129	22,678	3,319	430	747	189	966	96%	99%	94%	99%	96%
Colorado	51,380	71,685	1	8,356	8,522	61,664	506	467	56,508	525	45%	99%	0%	13%	94%
Connecticut	4,696	1,096	0	520	220	3,872	150	282	5,016	121	55%	88%	0%	9%	65%
Delaware	4,702	3,053	128	7,444	1,077	9,121	79	142	33,566	1,869	34%	97%	47%	18%	37%
DC	597	69	0	343	45	0	0	0	0	0	100%	100%	100%	100%	100%
Florida	56,425	31,356	1,756	44,947	16,405	157,599	1,904	3,607	266,592	13,118	26%	94%	33%	14%	56%
Georgia	52,245	27,947	5,551	45,874	6,936	107,152	1,558	1,054	514,425	5,981	33%	95%	84%	8%	54%
Idaho	12,681	1,189	1,100	7,500	2,367	0	0	0	0	0	100%	100%	100%	100%	100%
Illinois	81,818	49,651	1,293	99,516	12,004	123,597	1,606	192	276,901	5,459	40%	97%	87%	26%	69%
Indiana	69,378	37,585	841	81,532	27,401	194,259	1,948	346	589,158	30,029	26%	95%	71%	12%	48%
Iowa	40,834	21,794	3,397	51,635	5,780	48,754	641	22	108,953	5,641	46%	97%	99%	32%	51%
Kansas	53,228	17,968	1,577	7,314	3,623	52,383	741	357	95,630	1,742	50%	96%	82%	7%	68%
Kentucky	40,380	43,904	177	30,908	17,425	158,435	1,593	792	347,471	6,440	20%	96%	18%	8%	73%
Louisiana	143,671	67,501	6,233	137,956	45,754	45,476	1,086	1,475	88,068	3,497	76%	98%	81%	61%	93%
Maine	16,168	4,337	582	12,544	2,774	578	34	29	1,029	50	97%	99%	95%	92%	98%
Maryland	21,781	2,865	0	27,252	2,666	35,956	329	201	227,225	5,929	38%	90%	0%	11%	31%
Massachusetts	13,786	4,062	326	6,415	1,292	9,483	331	196	46,378	598	59%	92%	62%	12%	68%
Michigan	79,007	27,960	779	59,604	13,389	104,498	1,123	141	328,984	1,597	43%	96%	85%	15%	89%
Minnesota	59,337	22,447	1,856	25,199	12,900	59,638	635	199	73,838	3,460	50%	97%	90%	25%	79%
Mississippi	53,355	32,289	1,482	18,825	7,034	41,669	549	480	65,108	1,004	56%	98%	76%	22%	88%

Missouri	45,381	16,474	1,514	109,316	6,226	88,172	1,566	142	257,540	5,238	34%	91%	91%	30%	54%
Montana	15,475	4,296	49	7,895	1,995	27,033	394	6	18,746	220	36%	92%	90%	30%	90%
Nebraska	14,177	3,780	1,021	2,572	2,077	42,732	435	191	75,471	1,865	25%	90%	84%	3%	53%
Nevada	14,088	2,793	77	1,827	3,073	15,770	159	225	9,441	360	47%	95%	26%	16%	90%
New Hampshire	2,328	691	47	2,044	3,093	4,627	92	153	36,783	590	33%	88%	24%	5%	84%
New Jersey	16,950	9,643	1,005	3,400	2,774	11,762	135	118	24,562	4,324	59%	99%	90%	12%	39%
New Mexico	28,709	8,860	0	11,024	1,068	28,664	280	273	11,807	684	50%	97%	0%	48%	61%
New York	47,432	6,977	1,437	48,125	4,411	31,909	745	1,592	66,268	1,863	60%	90%	47%	42%	70%
North Carolina	40,760	38,068	1,372	46,376	8,688	56,958	966	149	227,469	16,923	42%	98%	90%	17%	34%
North Dakota	11,403	3,133	6,002	9,537	2,278	67,124	741	368	132,141	305	15%	81%	94%	7%	88%
Ohio	66,205	31,227	3,011	133,959	21,611	237,371	1,301	66	722,905	43,227	22%	96%	98%	16%	33%
Oklahoma	65,468	24,785	2,340	35,917	5,652	77,379	1,041	716	100,911	3,319	46%	96%	77%	26%	63%
Oregon	14,085	8,328	3	4,574	8,371	9,388	226	252	11,322	703	60%	97%	1%	29%	92%
Pennsylvania	70,495	28,514	1,628	42,647	13,953	185,353	723	412	865,070	53,762	28%	98%	80%	5%	21%
Rhode Island	1,430	1,210	115	1,017	135	200	8	4	5	5	88%	99%	96%	100%	97%
South Carolina	29,039	24,472	1,840	30,539	5,604	45,417	544	282	160,473	14,478	39%	98%	87%	16%	28%
South Dakota	165	98	0	21	10	13,808	126	34	13,495	228	1%	44%	0%	0%	4%
Tennessee	47,973	37,326	986	45,430	10,275	86,040	884	206	211,984	5,266	36%	98%	83%	18%	66%
Texas	238,586	119,379	2,241	121,642	31,177	154,645	3,592	4,394	480,946	11,569	61%	97%	34%	20%	73%
Utah	25,855	6,943	546	8,135	3,160	59,927	274	23	20,120	880	30%	96%	96%	29%	78%
Vermont	206	456	0	165	94	295	33	15	2	42	41%	93%	0%	99%	69%
Virginia	53,015	27,311	1,285	50,158	7,230	51,633	546	268	131,686	1,613	51%	98%	83%	28%	82%
Washington	27,613	12,691	350	13,450	3,951	10,891	15	92	2,316	458	72%	100%	79%	85%	90%
West Virginia	34,630	10,896	273	31,700	4,277	100,044	1,187	33	311,330	25,892	26%	90%	89%	9%	14%
Wisconsin	40,814	30,438	497	59,819	3,028	48,470	1,029	425	133,093	604	46%	97%	54%	31%	83%
Wyoming	42,310	17,478	281	26,213	16,834	72,281	826	439	80,637	7,364	37%	95%	39%	25%	70%
Offshore	74,286	60,823	0	1,021	769	0	0	0	0	0	100%	100%		100%	100%

Tribal Data	13,603	3,132	30	46	978	81,963	570	285	15,158	5,640	14%	85%	9%	0%	15%
Total	2,151,972	1,112,642	68,450	1,664,212	415,390	3,019,941	35,693	23,615	7,731,583	301,359	42%	97%	74%	18%	58%

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