Pinal County, Arizona

Area Designation for the 2006 24-hour Fine Particle National Ambient Air Quality Standard

Technical Support Document

May 5, 2010

US Environmental Protection Agency
Region 9

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PINAL COUNTY, ARIZONA
AREA DESIGNATION FOR THE 2006 24-HOUR FINE PARTICLE NAAQS

EPA intends to designate a portion of Pinal County as not attaining the 2006 24-hour $PM_{2.5}$ national ambient air quality standards (NAAQS).[1] A county or portion of a county will be designated as nonattainment if it has an air quality monitor that is violating the standard or if the county or portion of a county is determined to be contributing to the violation of the standard.

EPA intends to designate the remainder of Pinal County, Cochise, Gila, Graham, La Paz, Maricopa, Pima, Yavapai, and Yuma counties, and, as noted below, Indian country[2] located within those areas, as "unclassifiable/attainment." EPA is deferring designation of the Gila River Indian Community and Ak-Chin Indian Community reservations, which are located in this portion of Pinal County.

EPA Technical Analysis for Pinal County

Introduction

Pursuant to section 107(d) of the Clean Air Act, EPA must designate as nonattainment those areas that violate the national ambient air quality standards (NAAQS) and those nearby areas that contribute to the violations. This technical analysis identifies the monitor that violates the 24-hour $PM_{2.5}$ standard and evaluates surrounding counties for contributions to fine particle concentrations in the area. EPA has evaluated these counties based on the weight of evidence of the following nine factors recommended in EPA guidance and any other relevant information:

- pollutant emissions
- air quality data
- population density and degree of urbanization
- traffic and commuting patterns
- growth

[1] EPA designated nonattainment areas for the 1997 fine particle standards in 2005. In 2006, the 24-hour $PM_{2.5}$ standard was revised from 65 micrograms per cubic meter (average of 98th percentile values for 3 consecutive years) to 35 micrograms per cubic meter; the level of the 1997 annual standard for $PM_{2.5}$ remained unchanged at 15 micrograms per cubic meter (average of annual averages for 3 consecutive years).

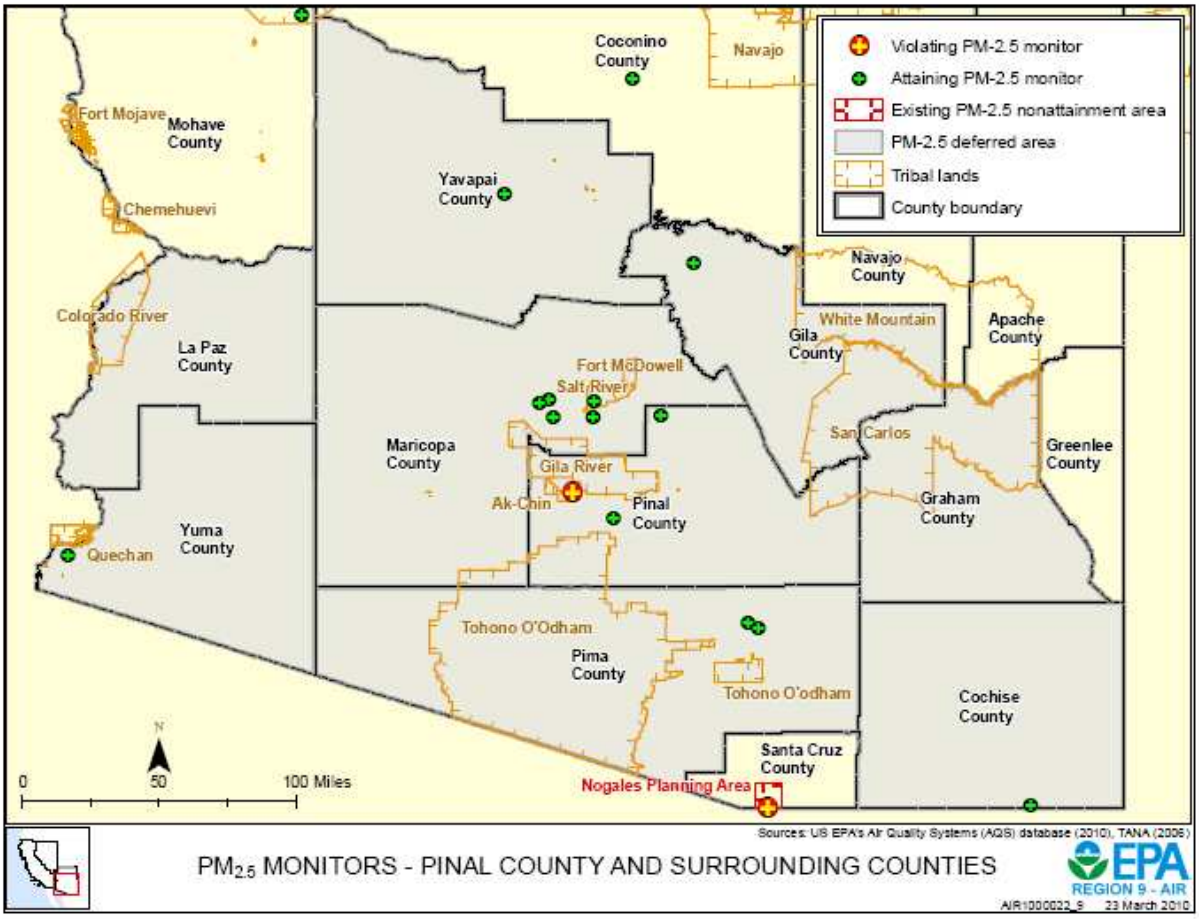
[2] "Indian country" as defined at 18 U.S.C. 1151 refers to: "(a) all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation, (b) all dependent Indian communities within the borders of the United States whether within the original or subsequently acquired territory thereof, and whether within or without the limits of a state, and (c) all Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same." The lands of the Fort McDowell Yavapai, Salt River Pima-Maricopa, San Carlos Apache and Tohono O'odham tribes will be designated "unclassifiable/attainment."

- meteorology
- geography and topography
- jurisdictional boundaries
- level of control of emissions sources

We also used analytical tools and data such as pollution roses, coarse particle composition monitoring data, and the correlation between meteorological data and composition data to evaluate these areas.

Figure 1 is a map of the counties in the area and other relevant information such as the locations of air quality monitors. Pinal County and Maricopa County comprise the Phoenix-Mesa-Scottsdale Core-Based Statistical Area (CBSA).

Figure 1. $PM_{2.5}$ Monitors – Pinal County and Surrounding Counties



In response to EPA's promulgation of the revised 24-hour $PM_{2.5}$ NAAQS in 2006, the Governor of Arizona, by letter dated December 19, 2007, recommended that all portions of the state, with the exception of the Nogales area, be designated as "attainment" for the 2006 24-hour $PM_{2.5}$ standard based on air quality data from 2004-2006. These data are from Federal Reference

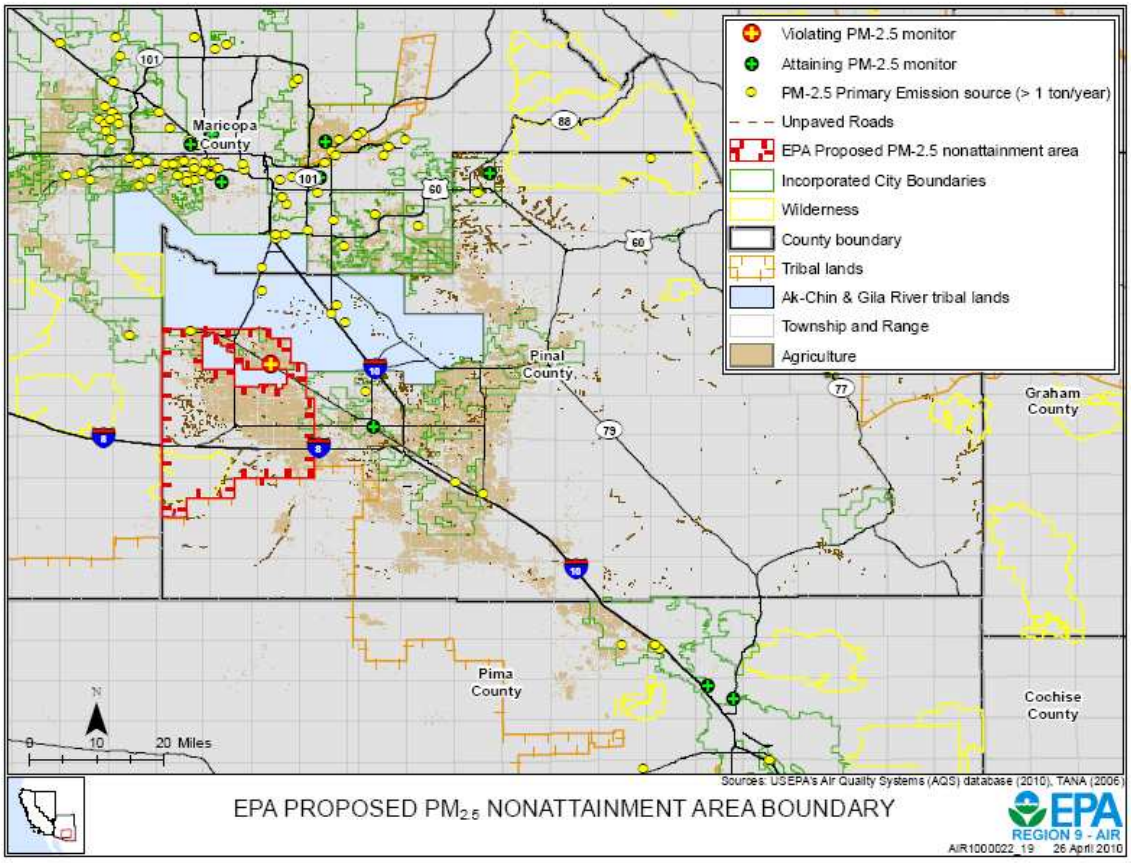
Method (FRM) monitors located in the state. The State of Arizona does not have jurisdiction over Indian country.

In October of 2009, EPA notified the Governor of Arizona and Tribal leaders of tribes with lands located in Pinal and Maricopa counties that a monitor in Pinal County was violating the 24-hour $PM_{2.5}$ standard based on the most recent (2006-2008) air quality monitoring data. Due to this new violation, and due to the need for additional time to collect data and evaluate the area to determine an appropriate nonattainment area boundary, EPA decided to defer the area designation of Pinal County, Maricopa County (i.e., the other county comprising the Phoenix-Mesa-Scottsdale CBSA), and the seven counties (i.e., Cochise, Gila, Graham, La Paz, Pima, Yavapai, and Yuma Counties) surrounding the Phoenix-Mesa-Scottsdale CBSA, for the 2006 24-hour $PM_{2.5}$ standard.[3]

Based on EPA's technical analysis, EPA believes the central-western portion of Pinal County, Arizona, should be designated as "nonattainment" for the 24-hour $PM_{2.5}$ NAAQS as shown in Figure 2. Emission inventory data, combined with speciation and source apportionment data, point to agricultural activities and cattle feedlots, as well as other nearby sources of $PM_{2.5}$, as primary sources contributing to $PM_{2.5}$ levels at the Cowtown monitor on days with exceedances of the 24-hour $PM_{2.5}$ NAAQS. In addition, EPA assessed air quality and meteorological data, including data on monthly exceedances of the 24-hour $PM_{2.5}$ standards; wind direction and speed for hourly and daily $PM_{2.5}$ levels; correlation of $PM_{2.5}$ with PM_{10} at the Cowtown monitoring site; and, the diurnal pattern of PM_{10}, wind speed, and temperature for $PM_{2.5}$ exceedance days. Results of these assessments indicate that agricultural lands and cattle feedlots, and activities associated with these operations, particularly those to the south and southwest of the monitor, are contributing to $PM_{2.5}$ levels at the monitoring site.

[3] Unless otherwise specified, references to "counties" or to "Arizona" include all lands within the geographic boundary and do not differentiate between lands under state or tribal jurisdiction.

Figure 2. EPA Proposed Nonattainment Area Boundary



Except as noted below, EPA intends to designate the remaining portion of Pinal County, including those lands of the Tohono O'odham Nation, and the San Carlos Apache Tribe that are located in Pinal County, Arizona, as "unclassifiable/attainment" for the 2006 24-hour $PM_{2.5}$ NAAQS.

The population density on the lands of the Tohono O'odham Nation, which lie to the south and west of EPA's intended nonattainment area is very low at approximately 3 people per square mile, and the types of sources that data indicate are the primary contributors to exceedances of the 24-hour $PM_{2.5}$ NAAQS in Pinal County (e.g., cattle feedlots and unpaved roads) either are not present on Tohono O'odham tribal lands or are present in small amounts. EPA has therefore concluded that any emissions activities occurring there are not contributing to nonattainment at the violating monitor in Pinal County.

The lands of the San Carlos Apache Tribe are located at a considerable distance from the proposed nonattainment area and are separated from it by mountainous terrain. Therefore, EPA concludes that any emissions activity there is not contributing to the violation at the monitor in Pinal County. Accordingly, EPA intends to designate the lands of the San Carlos Apache Tribe as "unclassifiable/attainment."

EPA is deferring designation of the lands of the Ak-Chin Indian Community and the Gila River Indian Community[4] in order to consider unique issues involving these tribal lands and to complete formal consultation with these tribal governments.

EPA intends to designate the eight counties surrounding Pinal County, including Indian country that lies within those counties, as "unclassifiable/attainment" for the 24-hour $PM_{2.5}$ NAAQS. These counties are: Cochise County, Gila County, Graham County, La Paz County, Maricopa County, Pima County, Yavapai County, and Yuma County. As stated above and described in more detail below, there are no violating monitors in these counties, and evaluation of the nine factors supports a finding that emissions within the eight subject counties do not contribute to the $PM_{2.5}$ violations recorded at the Cowtown monitor for the purposes of section 107(d) of the Clean Air Act. With respect to Cochise, Gila, Graham, and Yavapai counties, this conclusion is supported by, among other factors, the speciation and source apportionment data for the Cowtown monitor (which point to the predominance of local sources), the distance between sources in these counties and the proposed nonattainment area, the presence of topographical features inhibiting emissions transport to the Cowtown monitor location, and the low direct $PM_{2.5}$ emissions and population densities characteristic of these counties. For La Paz and Yuma counties, topography plays a lesser role, but the other factors, the speciation and source apportionment data for the Cowtown monitor (which point to the predominance of local sources), the distance between sources in these counties and the proposed nonattainment area, as well as the low direct $PM_{2.5}$ emissions and population densities characteristic of these counties, support a finding of little or no contribution from La Paz and Yuma counties.

For Maricopa County, the closest county with significant population, the meteorological evaluation along with the speciation and source apportionment data lends support to a finding of little or no contribution. For Pima County, the finding of little or no contribution relies upon the speciation and source apportionment data, the correlation between $PM_{2.5}$ and PM_{10} concentrations, and the review of contemporaneous ambient concentration, wind speed and wind direction data at the Cowtown monitor during periods when exceedances have been recorded.

The following is a summary of EPA's technical analysis, which supports the boundaries of the nonattainment designation for the Pinal County 2006 24-hour $PM_{2.5}$ nonattainment area and the attainment/unclassifiable designation for the remainder of Pinal County, Cochise, Gila, Graham, La Paz, Maricopa, Pima, Yavapai, and Yuma counties, and, except as noted above, Indian country located within those areas.

Factor 1: Emissions data

For this factor, EPA evaluated county-level emission data for the following $PM_{2.5}$ components and precursor pollutants: "Primary $PM_{2.5}$," "SO_2," "NO_x," "VOCs," and "NH_3." "Primary $PM_{2.5}$" represents direct emissions of $PM_{2.5}$ and includes: "$PM_{2.5}$ emissions carbon," "$PM_{2.5}$ emissions other," primary sulfate (SO_4), and primary nitrate. (Although primary sulfate and primary nitrate, which are emitted directly from stacks rather than forming in atmospheric reactions with SO_2 and NO_x, are part of "$PM_{2.5}$ emissions total," they are not shown in Table 1 as

[4] Gila River Indian Community reservation straddles the border between Pinal and Maricopa counties. Designation for the entire reservation, including the portion located within Maricopa County, is deferred.

separate items.) "$PM_{2.5}$ emissions carbon" represents the sum of organic carbon (OC) and elemental carbon (EC) emissions, and "$PM_{2.5}$ emissions other" represents other inorganic particles (crustal). Emissions of SO_2 and NO_x, which are precursors of the secondary $PM_{2.5}$ components sulfate and nitrate, are also considered. VOCs (volatile organic compounds) and NH_3 (ammonia) are also potential $PM_{2.5}$ precursors and are included for consideration.

Table 1 shows emissions of $PM_{2.5}$ and precursor pollutants (given in tons per year) for counties with violating monitors and potentially contributing counties surrounding Pinal County. The emissions data were derived from the most current version of the national emissions inventory, the 2005 National Emissions Inventory, version 2 (NEIv2).[5]

Table 1. Emission Totals Per County (tons per year). 2005 NEI version 2.

County	Primary $PM_{2.5}$ Emissions	NO_x	NH_3	SO_2	VOC
Pinal	4,210	12,545	5,646	757	9,217
Maricopa	14,836	99,947	19,318	5,276	108,548
Cochise	2,939	16,137	3,531	3,826	8,838
Gila	2,316	2,098	553	20,342	7,592
Graham	903	1,010	494	61	1,894
La Paz	573	3,017	597	148	2,604
Pima	4,827	30,412	1,878	6,157	31,169
Yavapai	4,717	14,640	1,300	1,912	11,552
Yuma	1,748	9,219	4,370	555	7,138

While many of the surrounding counties generate substantial emissions of primary $PM_{2.5}$ and $PM_{2.5}$ precursors relative to Pinal County, as explained further below, the composition of the particles measured at the Cowtown monitor on high $PM_{2.5}$ days, combined with meteorological data and the presence of topographic barriers, indicate that there is a negligible contribution from the surrounding counties to the total $PM_{2.5}$ levels at the violating monitor.

[5] http://www.epa.gov/ttn/chief/net/2005inventory.html#inventorydata. Retrieved February 3, 2010.

To determine what nearby sources exist, EPA considered additional emissions data for the county containing the violating monitor. Table 2 lists source categories in Pinal County that emit direct (primary) $PM_{2.5}$ according to the 2005 NEIv2. Open burning, agriculture (including crop tilling and livestock dust), unpaved roads and construction account for 67% of the primary $PM_{2.5}$ emissions in Pinal County. Additional tables showing source categories in Pinal County that emit nitrogen oxides, ammonia, sulfur dioxide, and volatile organic compound emissions may be found in Appendix A.

Table 2. Primary $PM_{2.5}$ Sources in Pinal County* (includes filterables + condensables). 2005 NEI version2.**

Source Category	Emissions (tpy)	% of Total Primary $PM_{2.5}$ Emissions, Pinal County
Nonpoint		
Waste Disposal - Open Burning	886	21%
Agriculture - Crop Tilling & Livestock Dust	751	18%
Unpaved Roads	626	15%
Construction	547	13%
Wildfires	395	9%
Industrial Process – not elsewhere classified	220	5%
Paved Roads	152	4%
Other Nonpoint	105	2%
Nonroad		
Non-Road Equipment – Diesel	166	4%
Planes, Trains, & Ships	64	2%
Non-Road Equipment – Gasoline	38	1%
Onroad		
On-Road Vehicles – Diesel	116	3%
On-Road Vehicles – Gasoline	42	1%
Point		
Misc. Point	102	2%
TOTAL:	**4,210**	**100%**

*Emissions from tribal lands are not included because tribes are not required to submit information to the NEI.

** Filterable PM consists of particles that are directly emitted as a solid or liquid at stack or release conditions and are captured on the filter of a stack test train. Condensable PM is material that is in the vapor phase at stack conditions but condenses and/or reacts upon cooling and dilution in the ambient air to form a solid or a liquid particulate immediately after discharge from the stack.

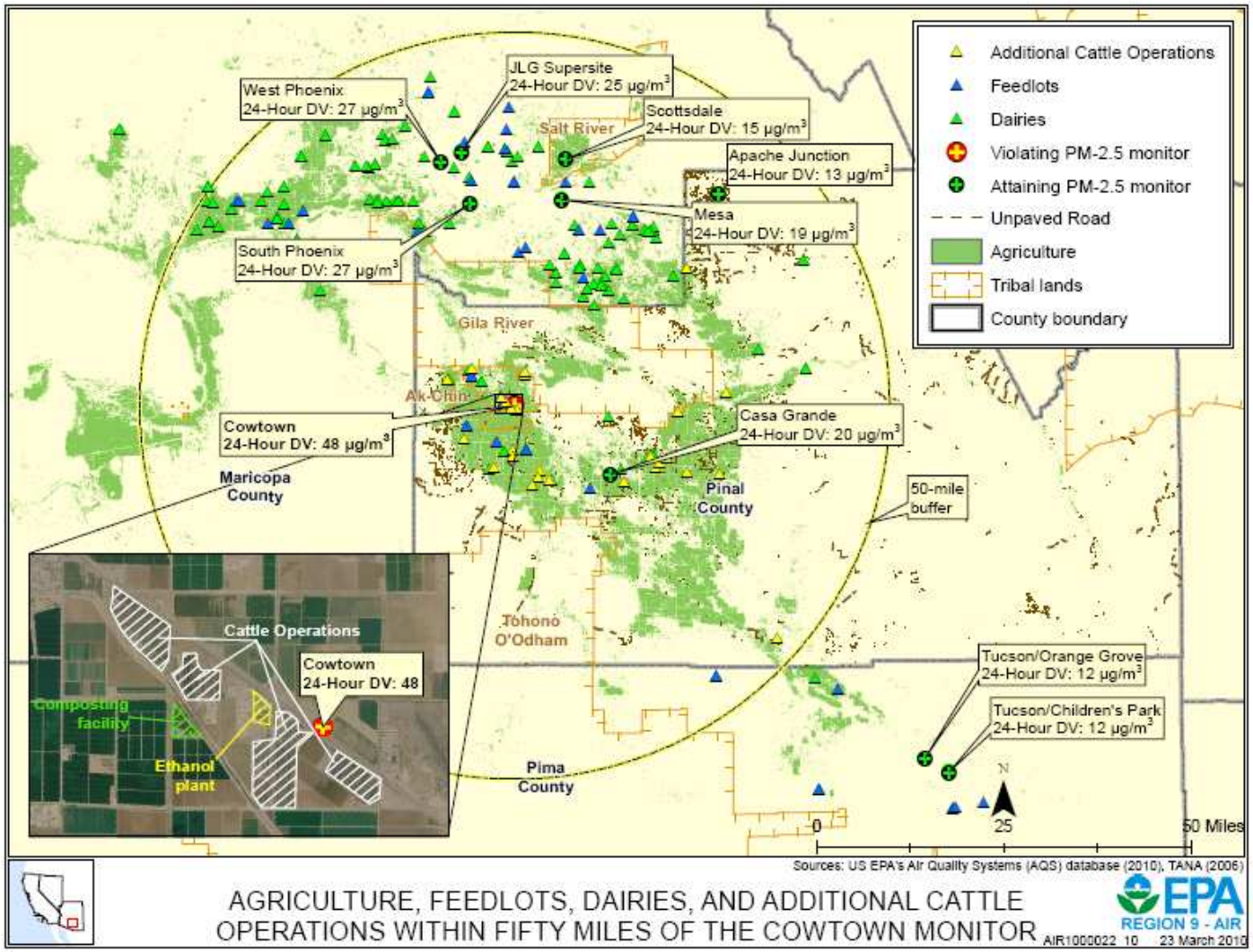
Sources in the immediate vicinity of the Cowtown monitor include cattle feedlots, an ethanol plant, agricultural fields, and a commercial composting facility. The monitor is approximately 300 yards from the closest feedlot. Four different cattle operations (Sawyer Cattle Company, OK Cattle Co., Maricopa Feedyard LLC, and Pinal Feeding Co.) are located immediately

northwest, west, south, and southeast of the monitor and account for approximately 424 acres of feedlot.[6] As shown by Figure 3, active and fallow agricultural fields surround the area. Figure 4 shows issued construction permits, and point sources emitting direct $PM_{2.5}$ near the Cowtown monitor. Also shown is a close-up of the Cowtown monitor and surrounding operations. Figure 5 shows paved and unpaved roads within fifty miles of the Cowtown monitor.

Figures 3, 4, and 5 reflect information for both tribal and non-tribal lands. Figure 3 contains agriculture information from the USDA (2006), and feedlot, dairy and additional cattle operations information from the Dun and Bradstreet business database (2007) and Google Earth (retrieved February 3, 2010). Figure 4 shows construction permits issued according to ADEQ (2010) and point sources from EPA's 2005 NEI version 2. Figure 5's paved and unpaved roads information originates from Teledyne Atlas of North America (2006) and U.S. Department of Commerce, U.S. Census Bureau, Geography Division (2008), respectively.

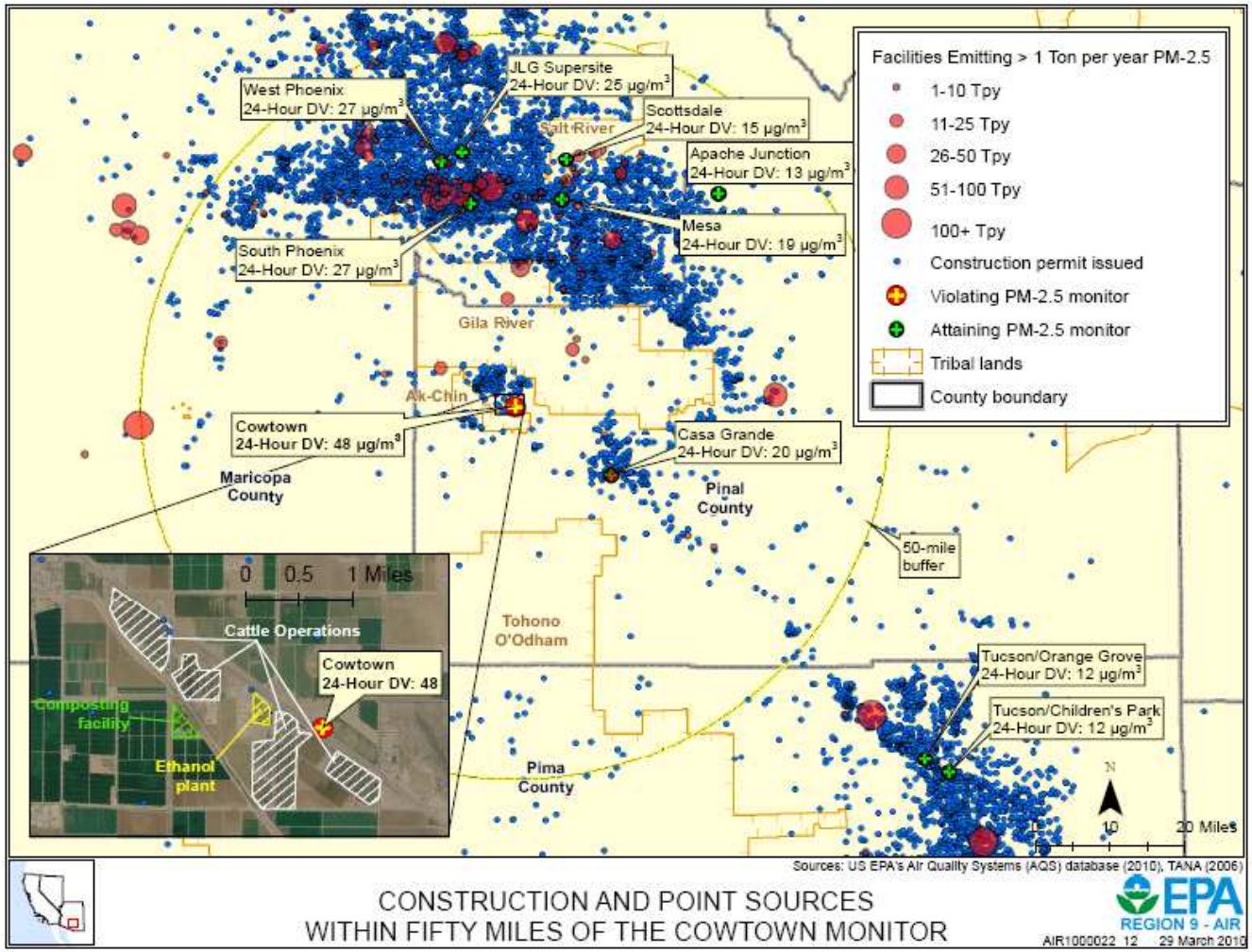
[6] Dun & Bradstreet Agricultural Data

Figure 3. Agriculture, Feedlots, Dairies, and Additional Cattle Operations.[7]



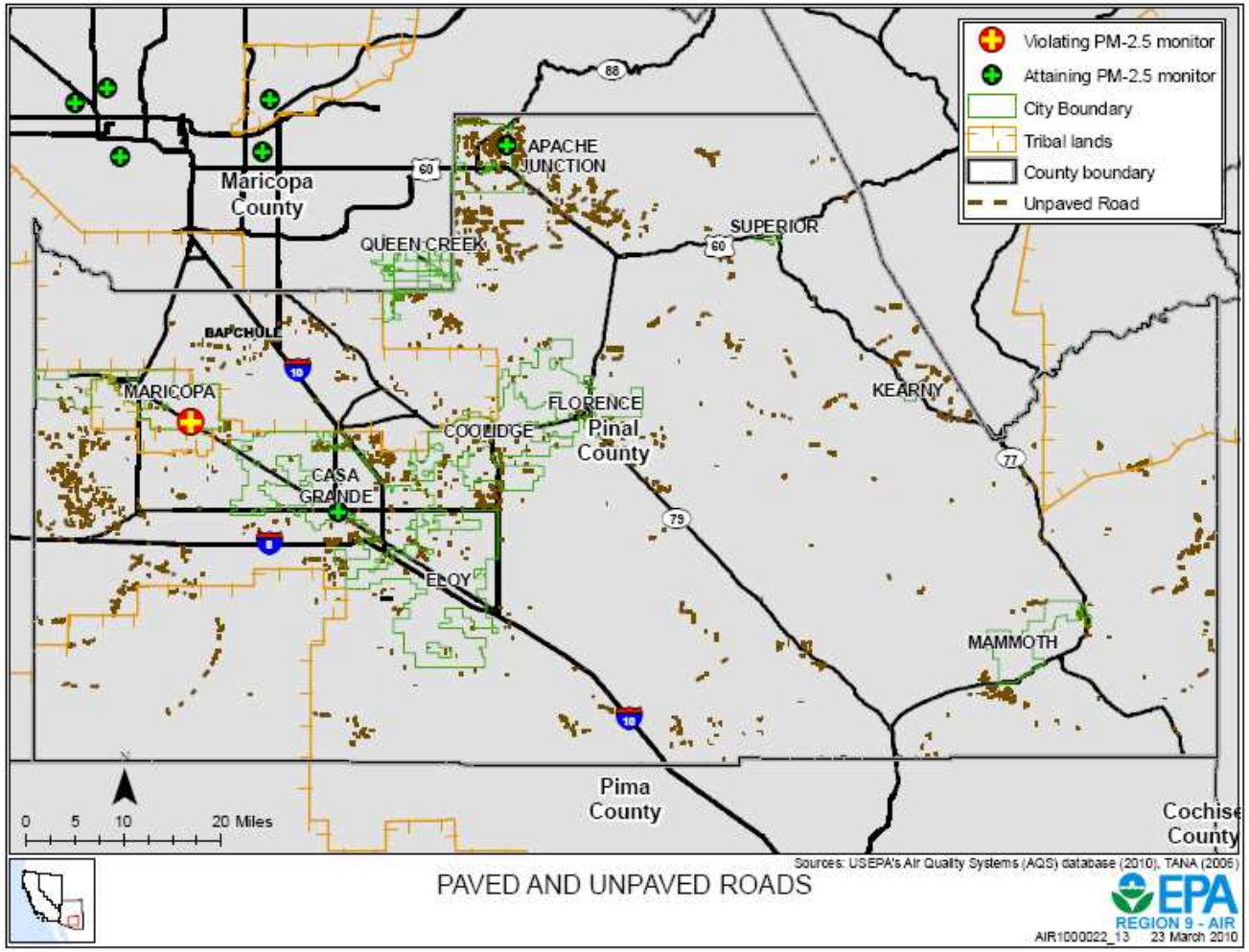
[7] USDA 2006; Dun and Bradstreet business database 2007; Google Earth February 3, 2010.

Figure 4. Construction and Point Sources within Fifty Miles of the Cowtown $PM_{2.5}$ Monitor.[8]



[8] ADEQ 2010; 2005 NEI version 2.

Figure 5. Paved and Unpaved Roads within Fifty Miles of the Cowtown $PM_{2.5}$ Monitor.[9]



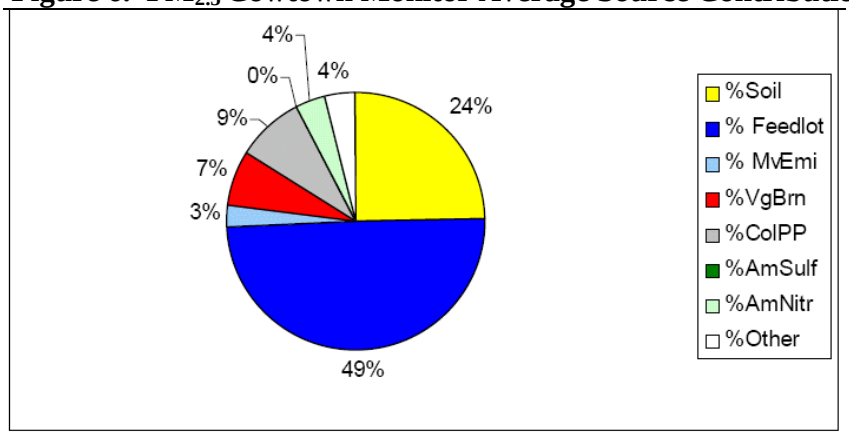
[9] Teledyne Atlas of North America 2006; U.S. Department of Commerce, U.S. Census Bureau, Geography Division 2008.

In 2003, Pinal County Air Quality Control District (PCAQCD) undertook a source apportionment study to determine what sources were contributing to elevated PM levels.[10] Chemical fingerprints were developed for feedlot soil emissions, agricultural soil emissions, and dirt road soil emissions. The feedlot emissions contained a substantial amount of total carbon (particularly OC3), making it a distinguishable signature. The chemical analysis was not able to distinguish between agricultural and dirt road emissions. The report notes that a high total carbon signature may not only be associated with feedlots, but possibly with agricultural fields recently covered with manure. The report does not mention the composting facility near the Cowtown monitor; however, emissions from this source could also show high total carbon.

Open burning, agricultural fields, livestock, unpaved roads and construction are the source categories with the highest direct $PM_{2.5}$ emissions in Pinal County according to the 2005 NEIv2. One would expect significant geological soil and feedlot/manure signatures from the majority of these source types, which is consistent with the Pinal County source apportionment study findings.

As shown in Figure 6, 24-hour $PM_{2.5}$ data collected at Cowtown in October and November 2003 showed an average contribution of 49% from the feedlot soil category and 24% from geological soil. The average concentration was 67 micrograms per cubic meter ($\mu g/m^{3)}$, with three samples over 100$\mu g/m^3$. Each of these three sample days showed inversion conditions with light winds throughout the day.

Figure 6. $PM_{2.5}$ Cowtown Monitor Average Source Contributions.[11]



Soil	Geological soil	ColPP	Coal fired power plant
Feedlot	Feedlot soil	AmSulf	Ammonium sulfate
MV Emi	Motor vehicle combustion emissions	AmNitr	Ammonium nitrate
VgBr	Vegetative burning	Other	Unclassified sources

[10] Pinal County Air Quality Control District Source Apportionment Study: July 29, 2005
[11] Pinal County Air Quality Control District Source Apportionment Study: July 29, 2005, p 35.

Figure 7 (Table 9 and Figure 7 from the Pinal County Source Apportionment Study) illustrates the correlation between higher levels of $PM_{2.5}$ and increased levels of feedlot and soil emissions. The feedlot contribution ranged from 1.41 $\mu g/m^3$ on October 12, 2003, when the total measured $PM_{2.5}$ was 15.7 $\mu g/m^3$ (9% of the total), to 146.29 $\mu g/m^3$ on October 27, 2003, when the total measured $PM_{2.5}$ was 183.38 ug/m3 (79.8% of the total). The soil component also varied significantly, with the highest measured levels occurring on days when the overall $PM_{2.5}$ levels were highest. On days when measured $PM_{2.5}$ levels were at or above 35 $\mu g/m^3$, the combined feedlot and soil emissions contribution to total $PM_{2.5}$ mass ranged from 68% to 96% of the total.

In contrast, the contribution of other sources (e.g., vegetation burning and coal-fired power plant) was relatively constant and low. For example, for days that data were collected, the contribution from coal-fired power plants ranged from 1.73 to 5.05 $\mu g/m^3$ and averaged 3.53 $\mu g/m^3$.

Figure 7. $PM_{2.5}$ Source Attributions from Pinal County Source Apportionment Study

Table 9. CMB modeled $PM_{2.5}$ source attributions for Cowtown, Pinal County (µg/m³)

Sample Date	Soil	Feedlot	MvEmi	VgBrn	ColPP	AmSulf	AmNitr	Other	Modeled Mass	Measured Mass	Mass Uncertainty
10/3/2003	7.2554	6.4645		1.5175	2.2696		0.3079		17.8148	17.5841	± 1.7289
10/9/2003	11.9786	12.8093		2.7656	4.6708		1.2033	0.2034	33.4276	33.6310	± 2.2196
10/12/2003	2.7947	1.4130		3.3627	3.9892		2.0972	2.0532	13.6568	15.7100	± 1.6672
10/15/2003	8.8901	15.9002	2.3095	2.0004	3.8764		1.3907		34.3673	33.8109	± 2.1916
10/18/2003	21.0411	39.7001	1.9249	2.9297	5.0472		1.9682	3.9779	72.6112	76.5891	± 4.1162
10/21/2003	28.2177	56.0196		3.3708	4.0222		1.7199	8.4489	93.3502	101.7991	± 5.2951
10/27/2003	29.7366	146.2936		2.8682			1.4445	3.0382	180.3429	183.3811	± 9.2745
10/30/2003	5.3520	21.7607	4.6372	3.2046	1.7272		1.7788	1.2150	38.4605	39.6755	± 2.4489
11/5/2003	12.9410	36.2181	2.7196	2.7851	3.3337		2.2621		60.2595	56.9682	± 3.7120
11/8/2003	23.4094	71.7697	2.8366	2.1736	2.8420		2.2010	7.0732	105.2323	112.3055	± 5.7816

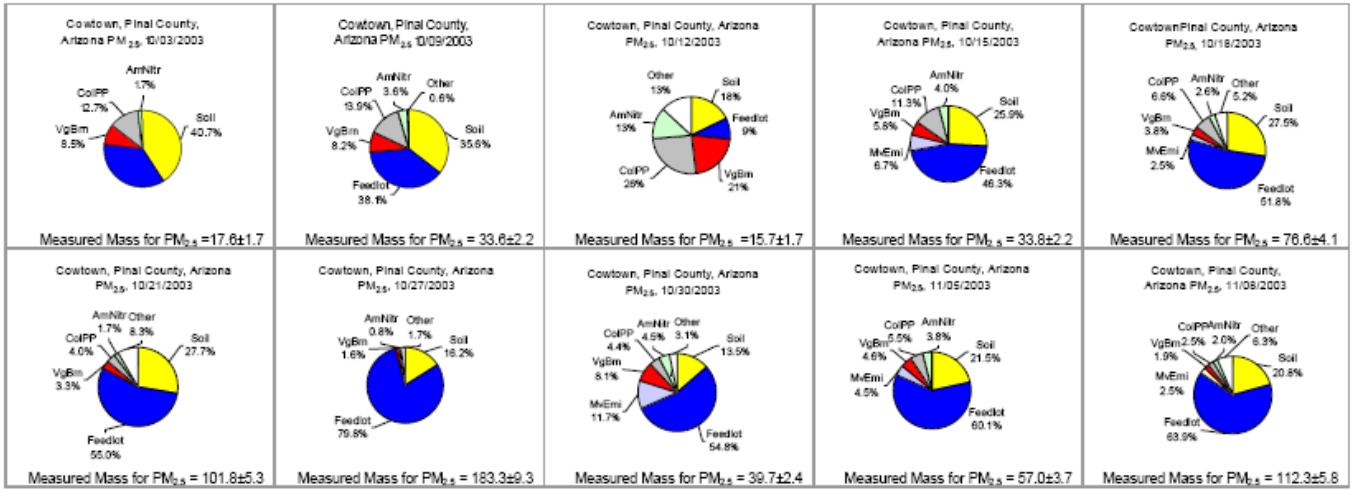


Figure 7. CMB modeled source attributions for $PM_{2.5}$ data subsets from Cowtown, Pinal County

The Pinal County source apportionment study results indicate that violations of the 2006 24-hour $PM_{2.5}$ NAAQS in Pinal County may be the result of contribution from significant local, rather than regional, sources of emissions of $PM_{2.5}$. For example, the high proportion of directly emitted particles suggests that there is little contribution from more distant sources of $PM_{2.5}$ precursor emissions in surrounding counties. Unlike other areas, where the monitored $PM_{2.5}$ does not have such characteristics, and instead reflects both regional and local contribution, the analysis of this area indicates that certain source categories in the surrounding area are those that contribute sufficiently to require inclusion within the designated nonattainment area.

The following sections of this TSD further discuss how other factors, including air quality data and meteorology, indicate that nearby direct $PM_{2.5}$ emission sources are responsible for the majority of the monitored $PM_{2.5}$ levels at the Cowtown monitoring site.

Factor 2: Air Quality Data

This factor considers the 24-hour $PM_{2.5}$ design values (in $\mu g/m^3$) for air quality monitors in Pinal County and the surrounding counties based on data for the 2006-2008 period. A monitor's design value indicates whether that monitor attains a specified air quality standard. The 24-hour $PM_{2.5}$ standards are met when the 3-year average of a monitor's 98^{th} percentile values are $35 \mu g/m^3$ or less. A design value is only valid if minimum data completeness criteria are met. The location of $PM_{2.5}$ monitors and design values for these monitors are shown in Figure 8.

Eligible monitors for providing design value data generally include state and local air monitoring stations (SLAMS) at population-oriented locations with a federal reference method (FRM) monitor. All data from special purpose monitors (SPM) using an FRM is eligible for comparison to the relevant NAAQS, subject to the requirements given in the October 17, 2006 Revision to Ambient Air Monitoring Regulations (71 FR 61236). All monitors used to provide data must meet the monitor siting and eligibility requirements given in 71 FR 61236 to 61328 in order to be acceptable for comparison to the 24-hour $PM_{2.5}$ NAAQS for designation purposes.

The 24-hour $PM_{2.5}$ design values for the individual monitors in Pinal County are shown in Table 3. Table 4 lists the design value for surrounding counties (based on the highest reading monitor).

Table 3. $PM_{2.5}$ Pinal County Air Quality Monitoring Data

Site Name	AQS ID	$PM_{2.5}$ 24-hour Design Value 2006-2008
Casa Grande	04-021-0001-1	20 $\mu g/m^3$
Apache Junction	04-021-3002-1	13 $\mu g/m^3$
Cowtown	04-021-3013-1	48 $\mu g/m^3$

EPA notes that the monitor located at Cowtown shows ambient levels more than twice as high as those of the other monitors located in Pinal. This suggests that there may be sources that contribute more to that monitor than to the others, and that the sources may be in the vicinity of the violating monitor.

The Cowtown monitor is located near a number of cattle feedlots. A grain processing facility and a commercial composting facility are also located nearby. This source mix mostly likely represents a relatively unique situation. Analysis of wind and pollution roses during exceedance days show that the Cowtown monitor is most likely significantly influenced by the cattle feedlots located upwind. See Factor 6 discussion of meteorology.

Table 4. $PM_{2.5}$ Air Quality Monitoring Data for Pinal County and Nearby Counties

County	Design Value Site	AQS ID	$PM_{2.5}$ 24-hour Design Value 2006-2008
Cochise	Douglas	04-003-1005-1	15 $\mu g/m^3$
Gila*	Payson	04-007-1008-1	23 $\mu g/m^3$
Maricopa	West Phoenix	04-013-0019-1	27 $\mu g/m^3$
Pima	Orange Grove	04-019-0011-1	12 $\mu g/m^3$
Pinal	Cowtown	04-021-3013-1	48 $\mu g/m^3$
Yavapai**	Prescott Valley	04-025-2002-1	12 $\mu g/m^3$
Yuma**	Yuma	04-027-0004-1	21 $\mu g/m^3$
Santa Cruz***	Nogales	04-023-2002-2	40 $\mu g/m^3$

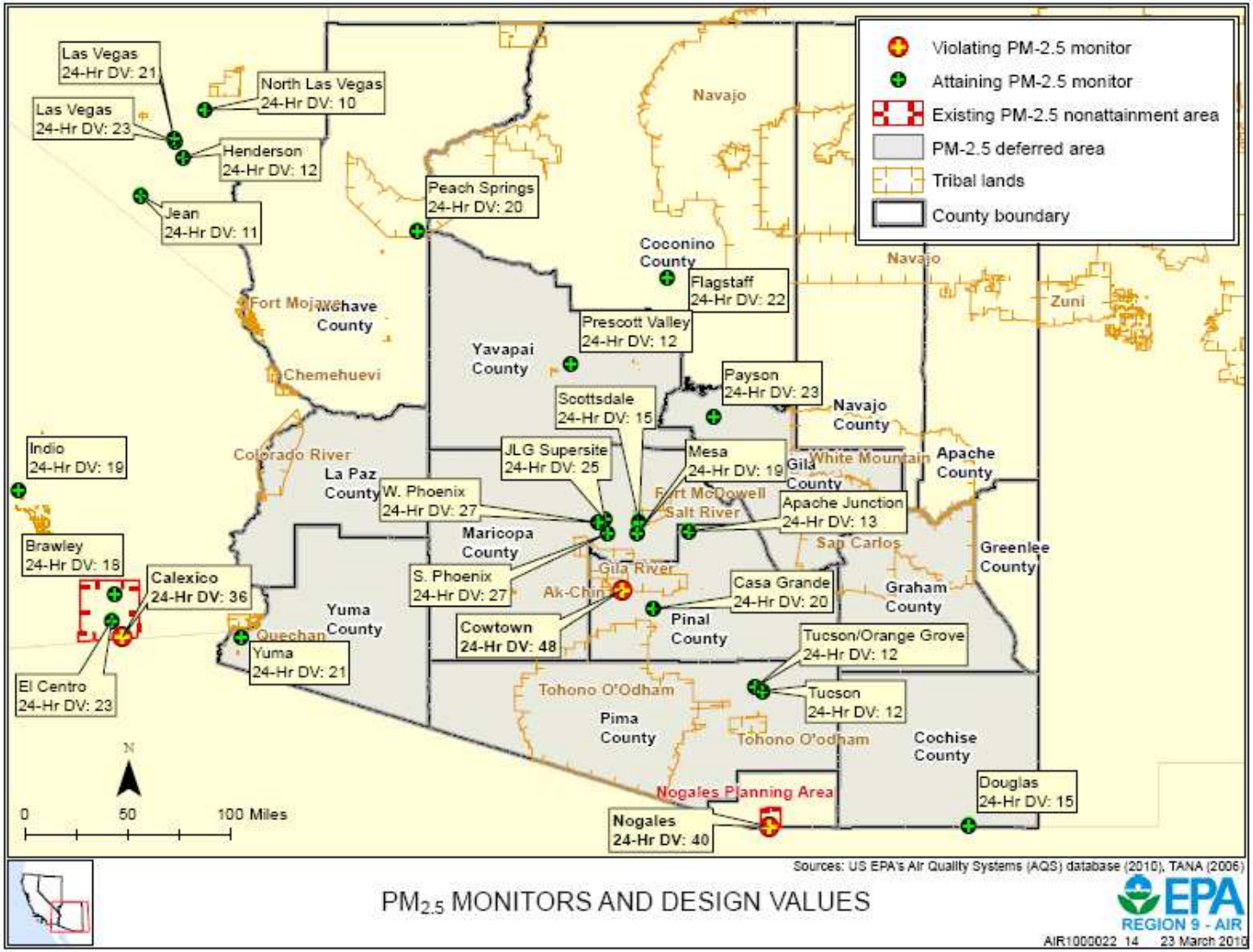
*Only two years of data available

**Only one year of data available

*** The Nogales planning area in Santa Cruz County, which lies south of Pima County, has been designated nonattainment. It is the only other area in Arizona that violates the $PM_{2.5}$ 24-hour NAAQS.

All of the counties surrounding Pinal County have much lower $PM_{2.5}$ concentrations. This information coupled with the meteorological information and topographic information (following) lends support to a finding of predominate local influence over $PM_{2.5}$ concentrations at the Cowtown monitor.

Figure 8. $PM_{2.5}$ Monitors and Design Values



Factor 3: Population density and degree of urbanization (including commercial development)

Table 5 shows the 2005 population and population density for each county in the area being evaluated.

Table 5. Population: Pinal and Surrounding Counties

County	State Recommended Nonattainment?	2005 Population	2005 Population Density (pop/sq mi)
Pinal*	No	240,044	45
Maricopa	No	3,683,481	394
Cochise	No	126,153	20
Gila	No	51,528	11
Graham	No	33,089	7
La Paz	No	20,225	4
Pima	No	925,000	101
Yavapai	No	198,841	24
Yuma	No	181,598	33

*Arizona submitted its recommendations on December 19, 2007. At that time, Pinal County was attaining the 24-hr PM2.5 standard

Table 6 shows the 2008 population density for municipalities and reservations within Pinal County.

Table 6: Population Density within Pinal County – 2008

Entity	Area in Square Miles	2008 Population Density	2008 Population
Pinal County Total	5,369.6	65.3	350,558
Apache Junction	34.23	1,108.7	32,776
Casa Grande	48.17	936	41,152
Coolidge	5.03	2,447.5	10,261
Eloy	71.67	225.4	12,750
Florence	8.29	2,903.1	20,781
Kearny	2.79	1,177.5	3,297
Mammoth	1.08	2,339.1	2,573
City of Maricopa	31.9	1,428.6	45,571
Queen Creek	25.8	944.2	Pinal Co: 5,700 Maricopa Co: 18,661 Total: 24,361
Superior	1.93	1,766.3	3,335
Ak Chin	87.2	48.3	1,591
GRIC**	581.1	37	21,665
San Carlos Apache**	2,896.6	3.6	10,416
Tohono O'odham**	4,453	3.1	13,635

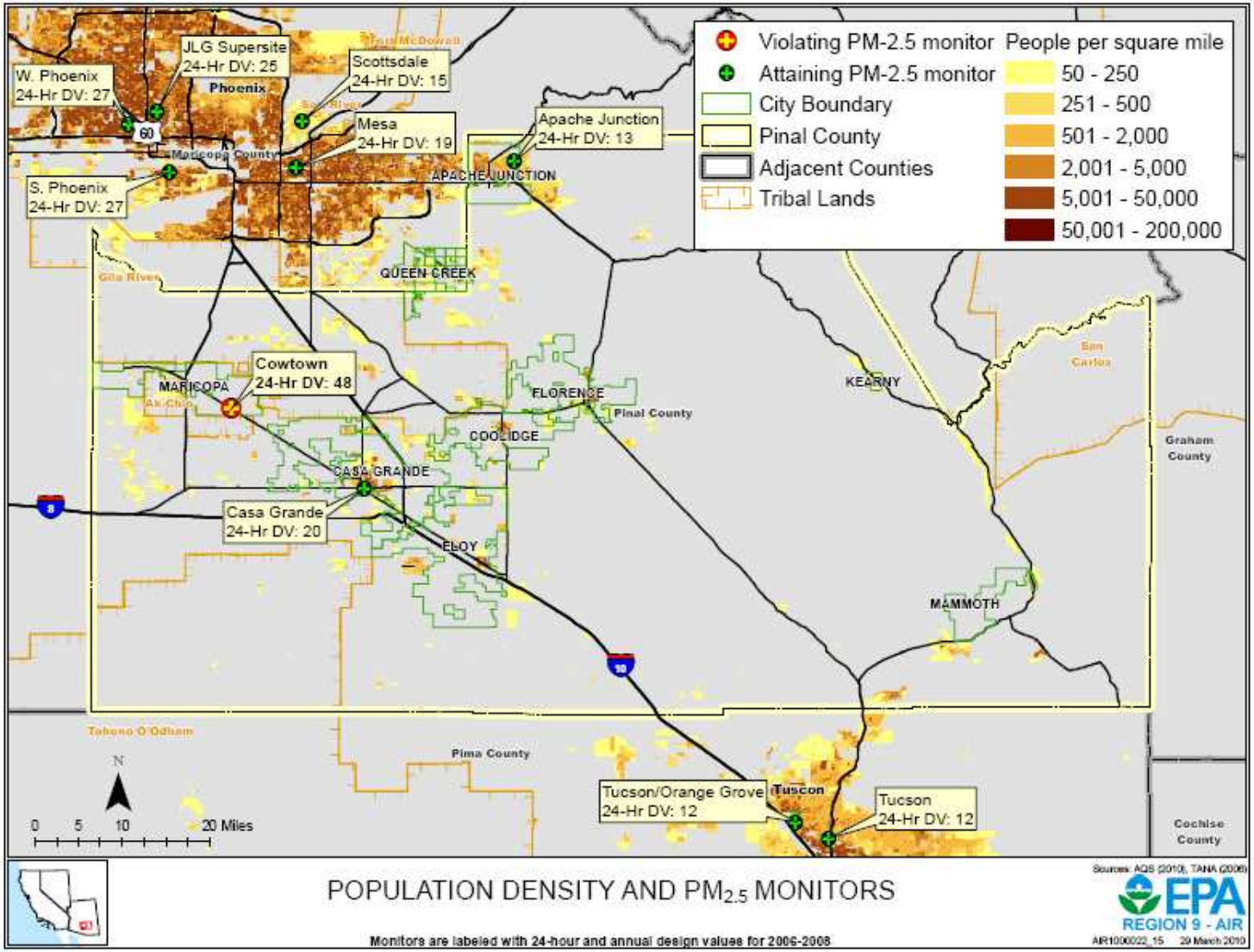
Source: U.S. Census Bureau and ADEQ TSD

*Maricopa 2008 area from ADEQ PM_{10} boundary recommendation TSD
**Population for entire reservation, including portions that lie outside of Pinal County.

Table 5 illustrates that, with the exception of Maricopa County, Pinal County and other surrounding counties are relatively sparsely populated. Maricopa County, which lies to the north and includes the Phoenix metro area, has a population density of 394 people per square mile, but does not violate the 2006 24-hour $PM_{2.5}$ NAAQS. As illustrated by Figure 9, about 95% of the Pinal County population resides in the more urbanized areas that lie in the western/central portion of the County, where a number of relatively densely populated areas are located. Even within those more densely populated areas, the numbers of inhabitants are relatively low (see Table 6).

Population data can give an indication of whether it is likely that population-based emissions are contributing to $PM_{2.5}$ levels at the violating monitor. For this area, population density, however, does not appear to be a driving factor in the high $PM_{2.5}$ levels measured at the Cowtown monitor in Pinal County. Instead, the violations in this area appear to be contributed to most heavily by cattle feedlots and other agricultural activities that in fact are inversely related to the population density. Therefore, in this area, population and population density are not as relevant to evaluating the geographic extent of the area with emissions activities contributing to the violations.

Figure 9. Population Density and $PM_{2.5}$ Monitors



Factor 4: Traffic and commuting patterns

This factor considers the number of commuters in each surrounding county who drive to Pinal County, the percent of total commuters in each county who commute to Pinal County, the percent of total commuters in each county who commute into the statistical area in which Pinal County is located, as well as the total vehicle miles traveled (VMT) for each county, in millions of miles.

Data on commuting illustrate that the majority of Pinal County's working residents are employed within the county. Data from 2000[12] illustrate that a sizeable number (19,918) commute to Maricopa County to the north, with 7,750 commuters entering Pinal from Maricopa County. About 2,600 Pinal County residents commute to Pima County to the south, while 1,970 Pima County residents commute into Pinal County. The number of commuters to and from other surrounding counties is negligible. See Table 7 and Figure 10.

Table 7. Traffic and Commuting Patterns – 2005

County	State Recommended Non-attainment?	2005 VMT (millions of miles)	Number Commuting to Pinal County	Percent Commuting to Pinal County	Number Commuting into statistical area*	Percent Commuting into statistical area
Pinal	No	3,126	35,960	60.1	55,880	93.4
Maricopa	No	32,392	7,750	0.6	1,389,480	98.9
Cochise	No	1,906	40	0.1	260	0.6
Gila	No	536	330	1.9	1,390	7.9
Graham	No	373	-	0.0	150	1.4
La Paz	No	684	-	0.0	150	1.4
Pima	No	8,759	1,970	0.5	3,810	1.0
Yavapai	No	2,385	30	0.0	3,640	5.4
Yuma	No	1,902	10	0.0	240	0.5

*Pinal and Maricopa Counties comprise the Phoenix-Mesa-Scottsdale CBSA

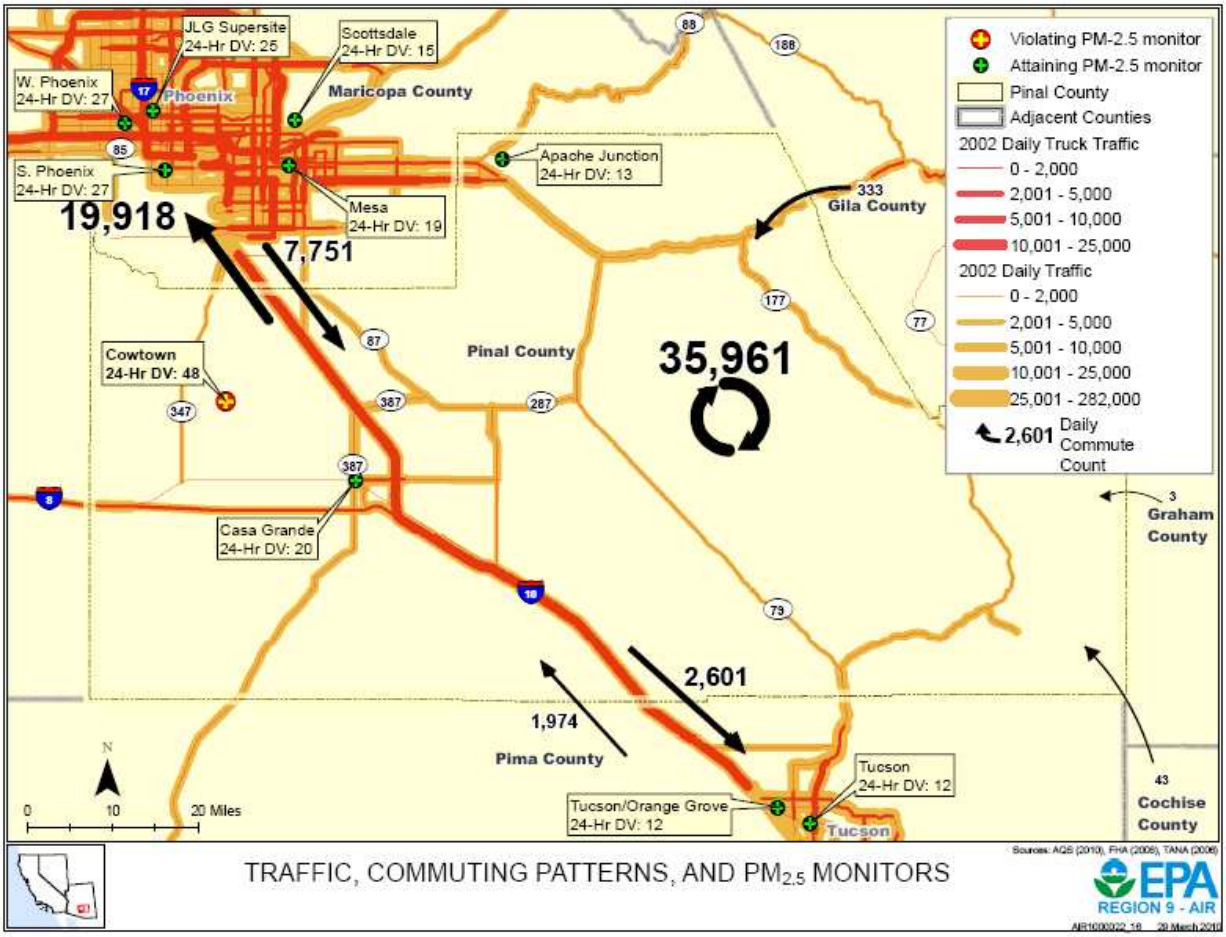
Commuting patterns can indicate the extent of an urban area and can serve as an indicator of likely contribution to fine particle concentrations in an area. However, in this area, the technical analysis suggests that the violations at the Cowtown monitor are the result of contribution not from secondary particles from more distant mobile source emissions, but rather from other types of emissions activity closer to the violating monitor. The nature of the $PM_{2.5}$ violation in Pinal County indicates the violations occurring there are driven primarily by nearby stationary and area sources of $PM_{2.5}$. See Factors 1 and 2. Traffic may contribute somewhat to the $PM_{2.5}$ levels on days with violations at the Cowtown monitor, but it does not appear to be one of the major factors in the violations.

Note: The 2005 VMT data used for Tables 7 and 8 of the 9-factor analysis has been derived using methodology such as that described in "Documentation for the 2005 Mobile National Emissions Inventory," Version 2, December 2008, prepared for the Emission Inventory Group,

[12] Arizona Air Quality Designations Technical Support Document; Boundary Recommendation for the Pinal County 24-hour PM_{10} Nonattainment Area, Table 3-6, March 15, 2010.

U.S. EPA. This document can be found at: at ftp://ftp.epa.gov/EmisInventory/2005_nei/mobile_sector/documentation//2005_mobile_nei_version_2_report.pdf

Figure 10. Traffic, Commuting Patterns, and PM2.5 Monitors



Factor 5. Growth rates and patterns

This factor considers population growth for 2000-2005 and growth in vehicle miles traveled for 1996-2005 for Pinal and the surrounding counties, as well as patterns of population and VMT growth. Population growth within Pinal County between the years of 2000 and 2008 is also reviewed. A county with rapid population or VMT growth is generally an integral part of an urban area and likely to be contributing to fine particle concentrations in the area.

Table 8 below shows population, population growth, VMT and VMT growth between 1996 and 2005 for Pinal and the surrounding counties.

Table 8. Population and VMT Values and Percent Change

Location	Population (2005)	Population Density (2005)	Population % change (2000 - 2005)	2005 VMT (millions mi)	VMT % change (1996 to 2005)
Pinal	240,044	45	32	3,126	54
Maricopa	3,683,481	394	17	32,392	53
Cochise	126,153	20	7	1,906	29
Gila	51,528	11	0	536	6
Graham	33,089	7	-1	373	32
La Paz	20,225	4	3	684	48
Pima	925,000	101	9	8,759	52
Yavapai	198,841	24	18	2,385	12
Yuma	181,598	33	13	1,902	38

Table 9 shows the 2006 and 2008 population density for municipalities within Pinal County.

Table 9. Population Growth within Pinal County

Entity	Area in Square Miles	Population Density		Population	
		2000	2008	2000	2008
Pinal County Total	5,369.6	33.5	65.3	179,727	350,558
Apache Junction	34.23	929.3	1108.7	31,814	32,776
Casa Grande	48.17	523.7	936	25,224	41,152
Coolidge	5.03	1,549.1	2,447.5	7,786	10,261
Eloy	71.67	144.8	225.4	10,375	12,750
Florence	8.29	2,056.2	2,903.1	17,054	20,781
Kearny	2.79	805.4	1,177.5	2,249	3,297
Mammoth	1.08	1,626.5	2,339.1	1,762	2,573
City of Maricopa*	2000 – 4.04 2008 – 31.9	257.6	1,428.6	1,040	45,571
Queen Creek**	25.8	167.3	944.2	Pinal Co: 119 Maricopa Co: 4,197 Total: 4,316	Pinal Co: 5,700 Maricopa Co: 18,661 Total: 24,361
Superior	1.93	1,684.6	1,766.3	3,254	3,335

Source: U.S. Census Bureau and ADEQ TSD

*Maricopa 2008 area from ADEQ PM10 boundary recommendation TSD

** Queen Creek straddles the Pinal and Maricopa County border, with about 23.4% of the city's area lying within Pinal County. The population figures in the table are pro-rated to reflect the proportion of the city that is within each county, but density is not pro-rated.

The State of Arizona has experienced rapid population growth in recent years (26.7% between 2000 and 2008); however, vast areas remain sparsely inhabited. In Pinal County the population increased 82% between 2000 and 2008, with almost all of the population growth occurring in the central and western portion of the county. Along with this growth, VMT has also increased dramatically.

Growth in Pinal County may be contributing somewhat to the $PM_{2.5}$ levels on days with violations at the Cowtown monitor; however, it does not appear to be one of the major factors in the violations.

Factor 6. Meteorology

Like most of Arizona, Pinal County is hot and dry. Average maximum temperatures at the Maricopa weather station (part of the National Weather Service Cooperative Network) range from 67 degrees Fahrenheit (^oF) in January to 107 ^oF in July, and minimum temperatures from 25 ^oF in January to 75 ^oF in August. The rainiest month is July, with just over an inch of rain; the yearly total averages 8 inches. Despite the dryness, there is substantial agriculture in Pinal County, supported by irrigation from groundwater and the Central Arizona Project. Weather systems typically arrive from the west, except during "monsoon" season, which occurs June through August or September, when moisture from the south arrives and creates thunderstorms.

The wind at the Cowtown monitor is typically from the southeast during the cooler hours of 7 pm - 6 am, corresponding to downhill drainage flow down the Gila River valley. Flow at other times is less consistent, though there can be steady winds from the west in late morning through the afternoon, and on occasion from the north or south. While there are periods of high wind and gusts, especially during "monsoon" season, wind speeds are most often 3 meters per second (m/s) or less, with higher speeds usually from the west. High wind and gusts, especially over disturbed desert areas, can lead to substantial fugitive dust emissions. Sometimes there are "haboob" dust storms that have the appearance of an approaching "wall of dust," in which visibility is very low and gusts very strong.

EPA examined available PM and meteorological data in a number of ways to assess the extent to which surrounding nearby areas could be contributing to $PM_{2.5}$ violations at the Cowtown monitor. Results of these analyses are presented below in the form of: a) a pollution rose for daily $PM_{2.5}$ levels, b) a graph of the correlation of $PM_{2.5}$ with PM_{10} at four monitoring sites in the Pinal County area, and c) graphs showing the diurnal pattern of PM_{10}, wind speed, and temperature for $PM_{2.5}$ exceedance days. The potential for transport of $PM_{2.5}$ from the metropolitan Phoenix area to the north was considered in the analyses, given the large number of emitting sources and the high population density there.

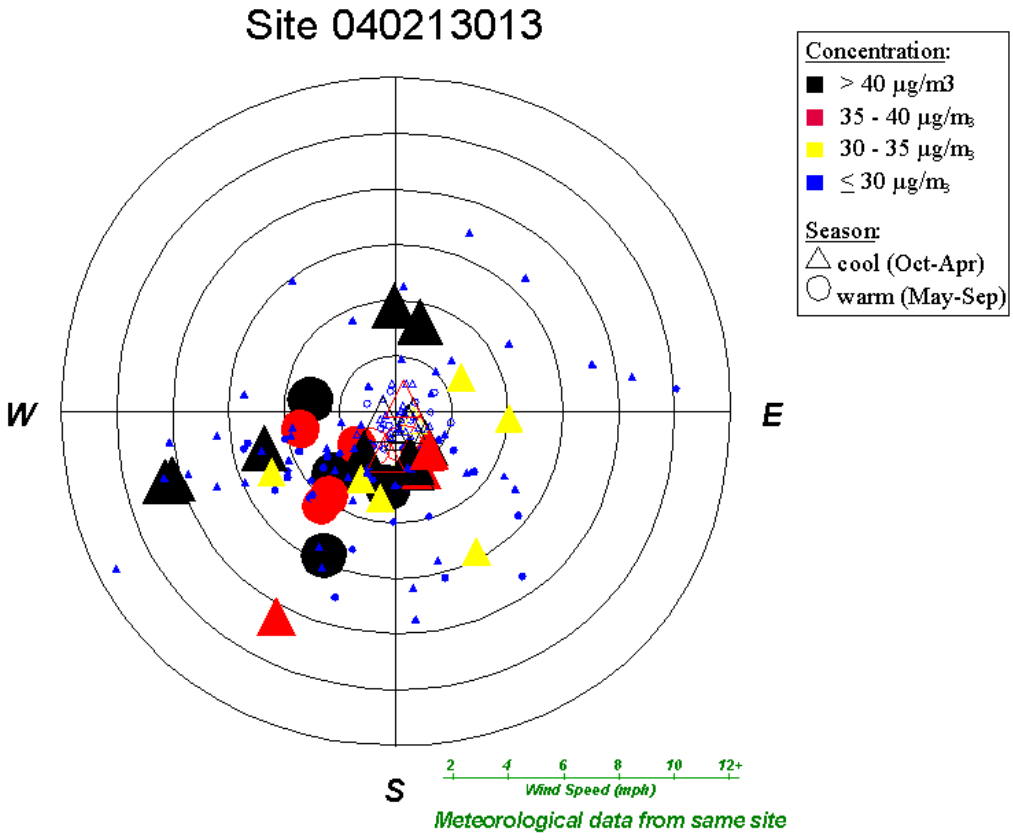
a. Pollution rose

EPA developed a "pollution rose" for the Cowtown site to understand the prevailing wind direction and wind speed on the days with highest fine particle concentrations. Figure 11 categorizes 24-hour $PM_{2.5}$ values by color: days exceeding $35 \mu g/m^3$ are denoted with large red or

black symbols. Small blue symbols are for days under 30µg/m^3, and intermediate sized yellow symbols are between 30 and 35µg/m^3. Symbol shape distinguishes time of year the exceedance occurred: a circle for the warm season (May through September), and a triangle for the cool season (October through April). The center of the figure indicates the location of the air quality monitoring site, and distance of the symbol from the center indicates average wind speed on the day, with lower wind speeds nearer the center. The angular location of the symbol indicates the compass direction from which the average wind was blowing on that day. (Note that, since a pollution rose symbol direction is the resultant of 24 hourly winds during each day, a symbol in the southwest may be a combination of westerly and southerly flow, for example.)

The pollution rose indicates that most $PM_{2.5}$ exceedances occur when resultant wind is from the southwest through southeast, although there are a number of days with no clear wind direction (symbols without fill, near the center), and a few days with wind from the north and northeast. There does not seem to be a clear separation between the cool and warm seasons. The highest $PM_{2.5}$ concentrations (black symbols) have wind directions from the south or southwest, and two from the north. Only a few days have resultant wind speeds above 8 m/s; the vast majority have speeds of 4 m/s or less. Altogether, the pollution rose indicates that $PM_{2.5}$ exceedances are generally not associated with steady strong winds, or with winds from the north. This is evidence that the exceedances of the 24-hour $PM_{2.5}$ standard measured at the Cowtown monitor are likely due to local sources.

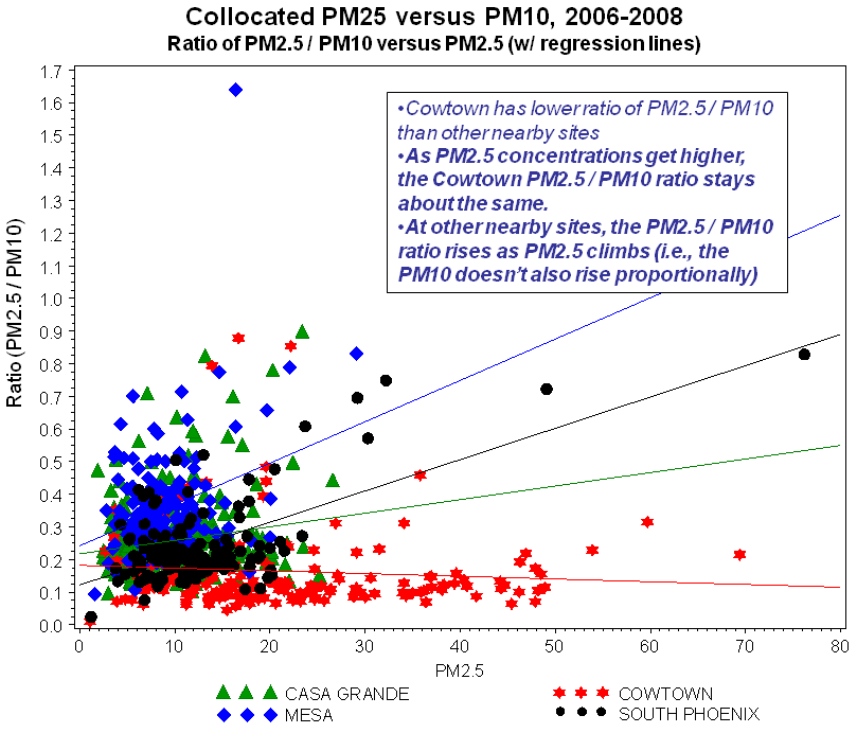
Figure 11. Pollution Rose



b. Correlation of $PM_{2.5}$ and PM_{10}

EPA examined the correlation of daily PM_{10} with daily $PM_{2.5}$, and also the correlation of the $PM_{2.5}$/ PM_{10} ratio with $PM_{2.5}$, for various monitoring sites in Pinal County and neighboring Maricopa County, as illustrated in Figure 12. The Cowtown monitor has a consistent $PM_{2.5}$/ PM_{10} ratio that is lower than other nearby sites, suggesting that the causes of Cowtown $PM_{2.5}$ concentrations are different than for other locations. In addition, the Cowtown ratio is independent of the $PM_{2.5}$ level, whereas for other sites, the ratio increases with $PM_{2.5}$. This indicates that the Cowtown monitor is impacted by different $PM_{2.5}$ sources than other locations. The correlation of the $PM_{2.5}$/ PM_{10} ratio with $PM_{2.5}$ concentrations at the Cowtown monitor also suggests that $PM_{2.5}$ and PM_{10} concentrations at the Cowtown monitoring site are generated by the same sources.

Figure 12. Correlation Between Ratio of $PM_{2.5}$/ PM_{10} and $PM_{2.5}$



c. Diurnal pattern of PM_{10}, wind speed, wind direction, and temperature

Hourly $PM_{2.5}$ data are not available for the Cowtown site, but hourly PM_{10} data are. EPA examined the diurnal variation of PM_{10}, wind speed, wind direction, and temperature, together with daily $PM_{2.5}$ values. PM_{10}, wind speed, and temperature for two representative quarters are presented in Figures 13 and 14.[13] Hourly wind direction for all exceedance days is provided in Figure 15. While PM_{10} is not the same as $PM_{2.5}$, the correlation of 24-hour PM_{10} and $PM_{2.5}$ described above suggests that diurnal PM_{10} patterns may provide useful information about $PM_{2.5}$.

[13] Appendix B includes meteorological data for all quarters.

Figure 13. Diurnal Variation of PM_{10}, Wind Speed, and Temperature on $PM_{2.5}$ Exceedance Days in Quarter 1

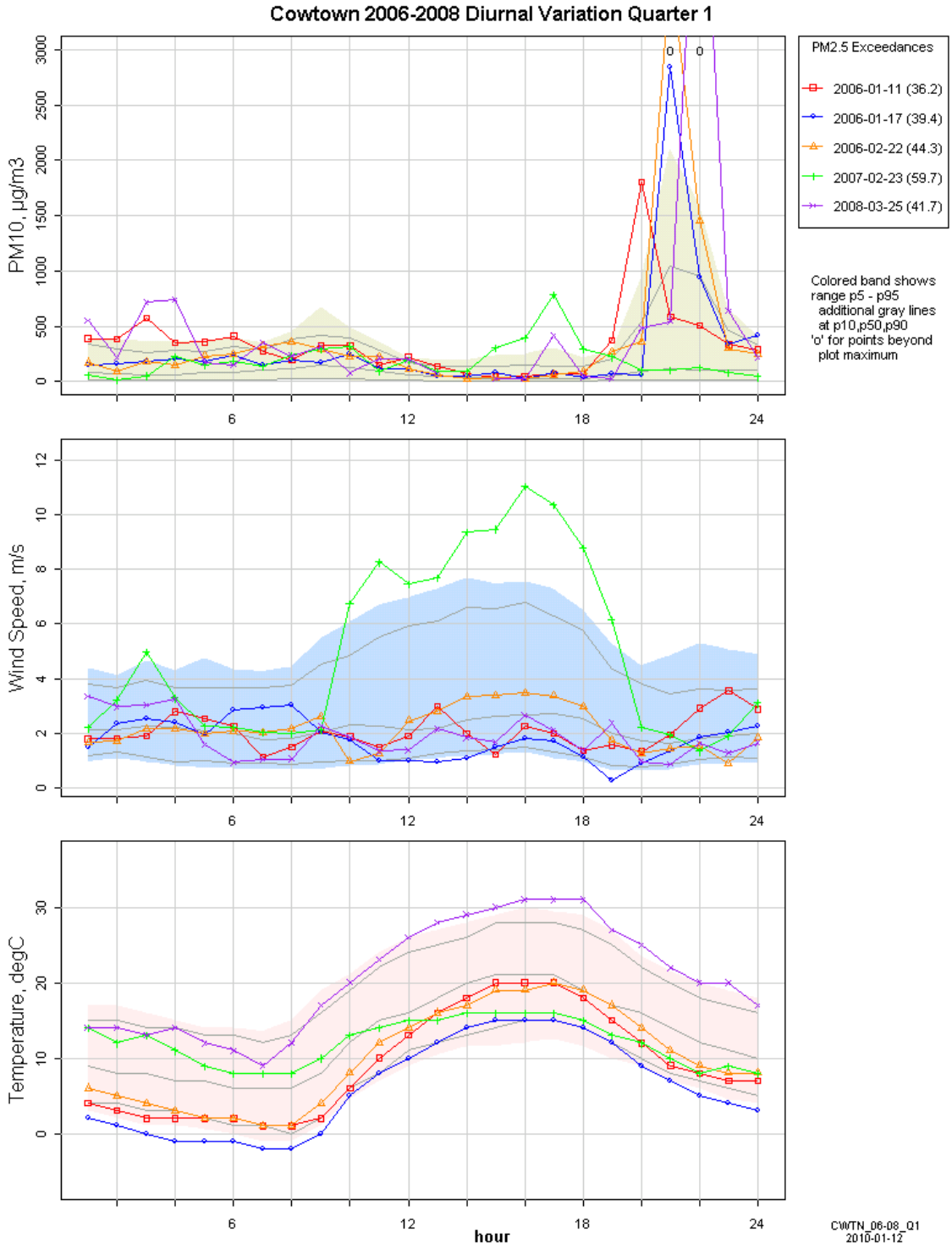


Figure 14. Diurnal Variation of PM_{10}, Wind Speed, and Temperature on $PM_{2.5}$ Exceedance Days in Quarter 4

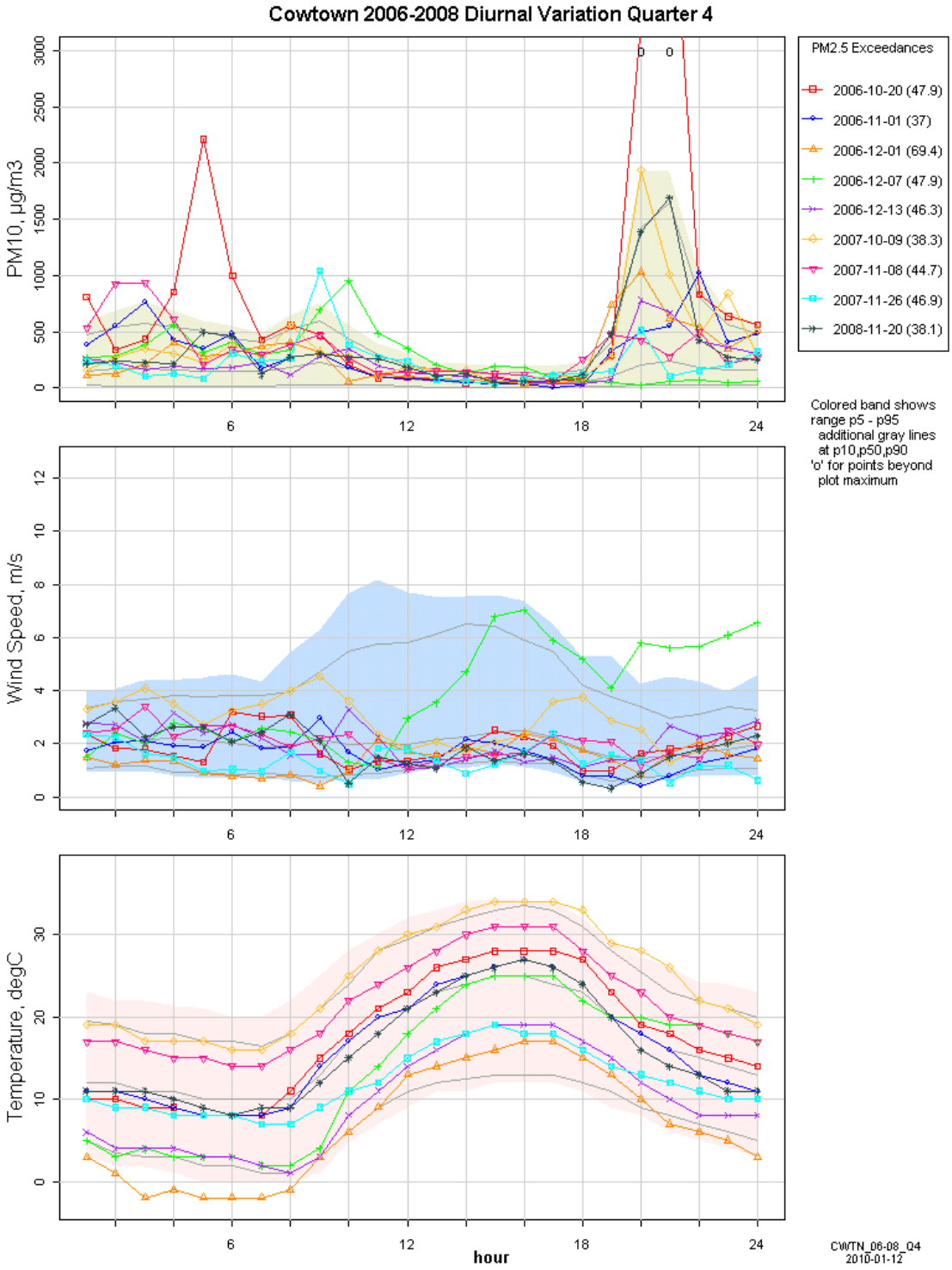
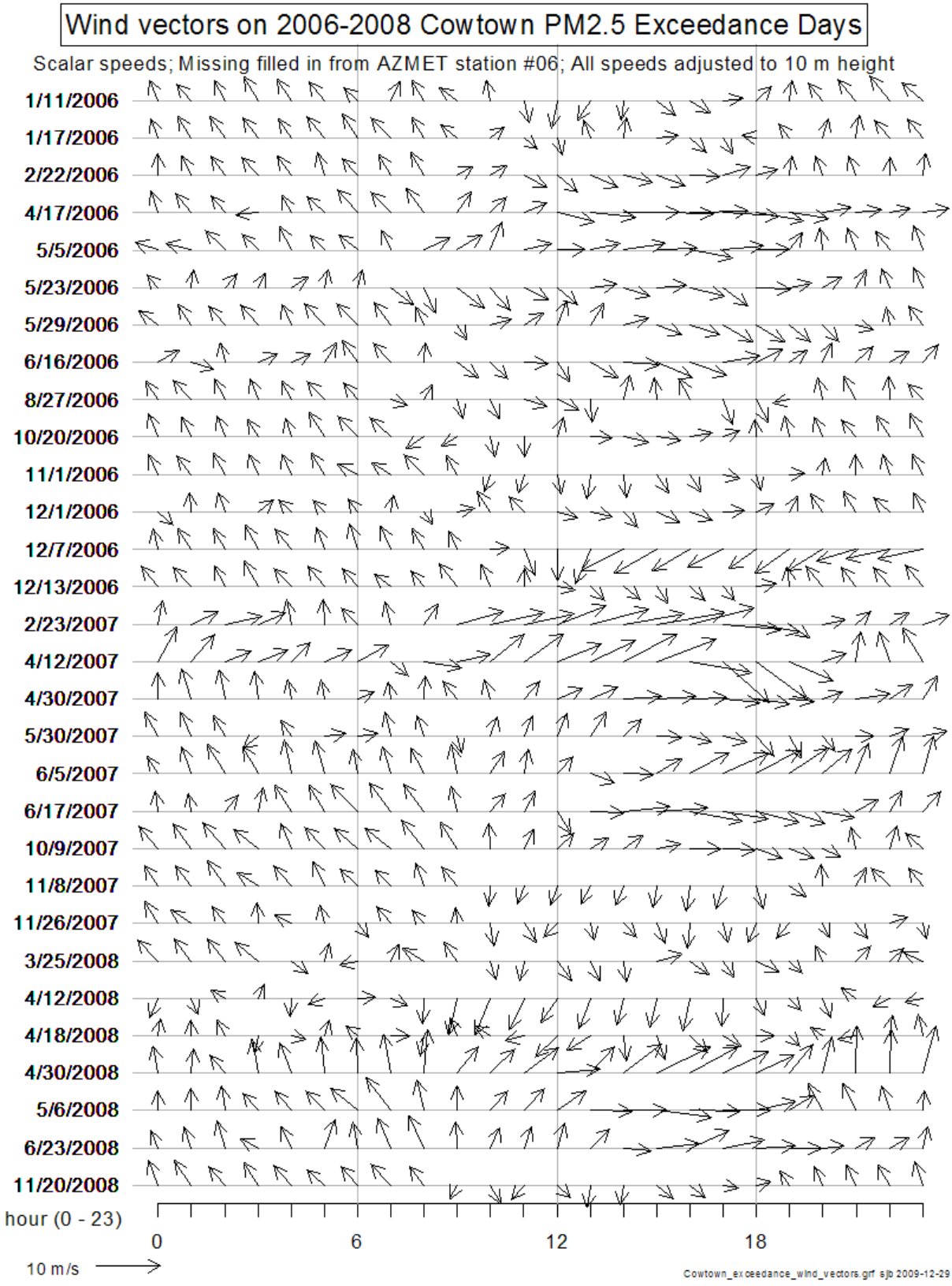


Figure 15. Wind Vectors on 2006-2008 Cowtown $PM_{2.5}$ Exceedance Days



Most of the $PM_{2.5}$ exceedance days have a very large PM_{10} "spike" (1000 - 3000 $\mu g/m^3$) some time in hours 20-23 (Figures 13 and 14, top panel). This spike is independent of wind speed (Figures 13 and 14, middle panel), temperature (Figures 13 and 14, bottom panel), or direction (Figure 15) during the day. During the rest of the day, PM_{10} is generally low, though with morning excursions on a few days. Thus, the PM_{10} spike appears to be associated with some local activity, possibly at the nearby feedlots.

A few days (e.g., 2007-10-09) have elevated PM_{10} after elevated winds (10 m/s); other days have high wind, but well before any increase in PM_{10} levels. However, in general, wind speeds are at most 4 m/s, so high PM_{10} is not typically caused by local wind-generated fugitive dust.

The height of the PM_{10} spike is not directly related to the $PM_{2.5}$ value for the day, despite the overall correlation of 24-hour PM_{10} and $PM_{2.5}$. High winds do not seem to be the cause of the $PM_{2.5}$ exceedances, though may be a contributing factor in a few cases.

Approximately half of the $PM_{2.5}$ exceedance days have steady wind from the north during the afternoon (Figure 15). However, the period of northerly wind generally coincides with the period of lowest PM_{10}. Quarter 4 includes December 1, 2006, one of the two exceedance days shown in the pollution rose (Figure 11) where the resultant wind direction was from the north. The hourly PM_{10} concentrations for 12/1/2006 show the same spike during the hours of 20-23, which coincides with wind directions from the south rather than the north (Figure 15). Thus, it is unlikely that PM_{10} transported from the north (i.e., metropolitan Phoenix) is the cause of elevated PM_{10} concentrations. Since daily $PM_{2.5}$ and PM_{10} levels rise and fall roughly together at the Cowtown site, as described above, this is evidence that $PM_{2.5}$ levels measured at the Cowtown monitoring site are due to local activity.

The overall correlation between $PM_{2.5}$ and PM_{10} at the Cowtown monitoring site, combined with the generally low wind speeds, is evidence that the $PM_{2.5}$ levels are likely due to emissions from local sources.

The fact that wind speeds and PM_{10} concentrations are low when the wind is from the north is evidence that emissions from the north do not contribute to $PM_{2.5}$ exceedances. This is unlike what might have been expected based on the proximity and large emissions of the greater Phoenix metropolitan area, but these analyses provide evidence that the Phoenix area does not contribute to $PM_{2.5}$ exceedances at the Cowtown monitor.

Factor 7. Geography and Topography

The geography/topography analysis evaluates the physical features of the land that might have an effect on the airshed and, therefore, on the distribution of $PM_{2.5}$ into and within the Pinal County area.

The counties of Yavapai, Gila, Graham, and Cochise, which lie to the north and east of Pinal and Maricopa counties, are separated topographically from Pinal County by mountainous terrain, which impedes the transport of emissions. This lends weight to EPA's determination that the

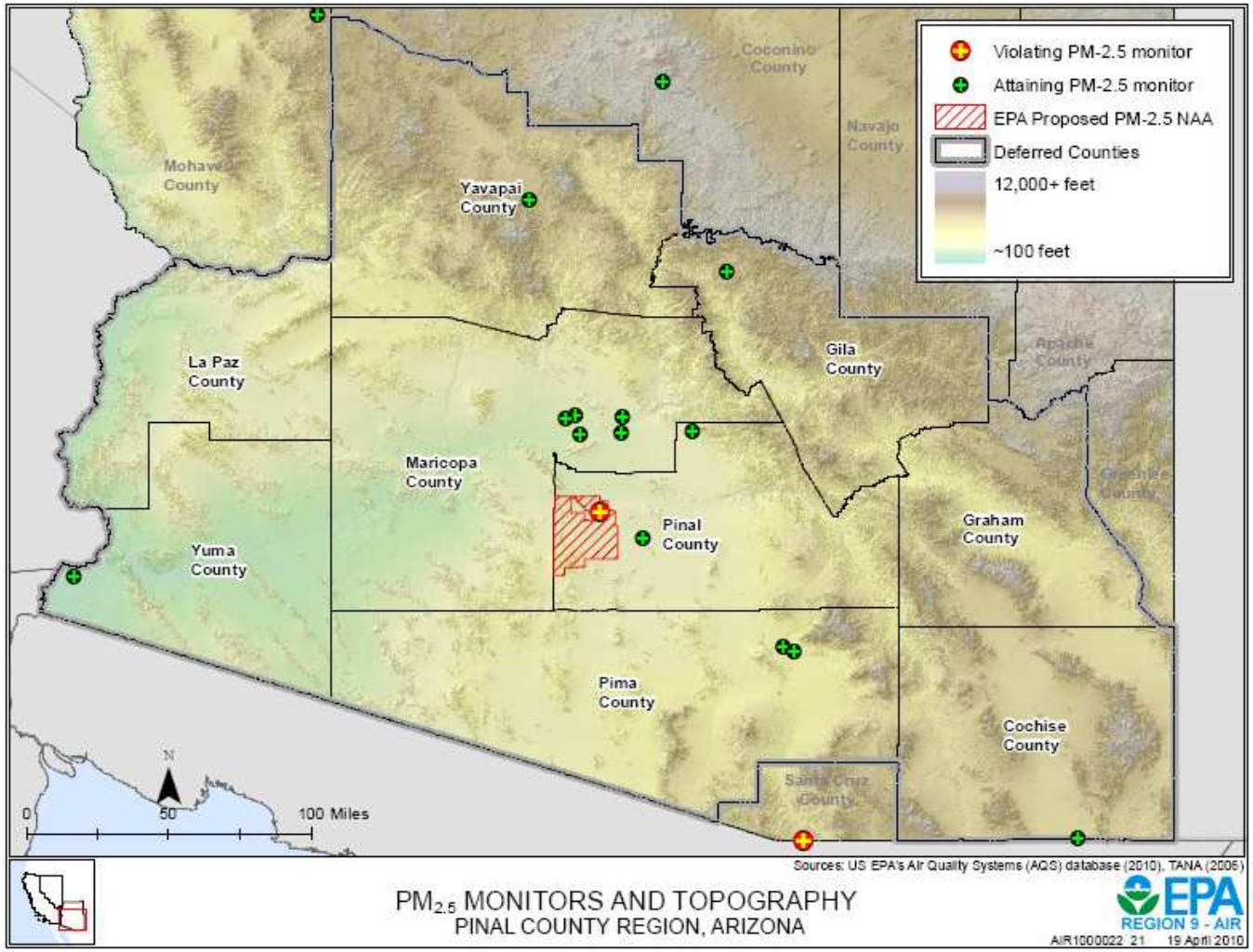
Yavapai, Gila, Graham, and Cochise counties are unlikely contributors to violations at the Cowtown monitor.

Figure 16 illustrates the general topographic features for Pinal County and the surrounding counties. Pinal County itself area has topographical barriers significantly limiting air pollution transport within its airshed and from neighboring airsheds, though these barriers are not absolute. Therefore, this factor provides some support for EPA's suggested boundary for the nonattainment area. Pinal County generally has fairly low relief and is at around 1,200 feet elevation, but it is punctuated by various mountains and ranges having peaks from 3,000 to 5,000 feet. The mountain ranges generally run southeast-northwest, and form broad desert valleys. In the vicinity of the violating monitor, there are the Sacaton Mountains to the east, rising to 2,235 feet, the Maricopa Mountains to the west to 2,400 feet. Nearest is the southeastern tip of the Sierra Estrella Mountains, starting at about 10 miles northwest of the monitor; they have peaks to 3,000 and 4,500 feet. To the north, between Pinal and Maricopa Counties, are the South Mountains rising to 2,500 feet; they run west-southwest to east-northeast unlike most of the ranges. They are only 10 miles long, but along with the Sierra Estrella they form a partial barrier between Pinal and metropolitan Phoenix to the north. Approximately 50 miles east of the violating monitor, the eastern quarter of the county becomes more mountainous, ultimately rising to some 6,000 feet near the eastern borders with Gila and Graham Counties. Overall, the mountains within the county can redirect winds, and form a partial barrier to transport from the eastern portions of the County and from neighboring counties.

Approximately 12 miles north of the monitor is the Gila River channel, which in this area is dry. It descends toward the west-northwest before it joins the Salt River in Maricopa County, and ultimately the Colorado River. The general area around the monitor is in the valley of this river, which is oriented in the same direction as that of the mountain ranges. As a result, air drainage flows towards the northwest are typically seen.

The presence of topographic barriers both outside and within Pinal County supports EPA's suggested partial county boundary for the nonattainment area and lends further support to a designation of "unclassifiable/attainment" to the surrounding counties.

Figure 16. Topography



Factor 8: Jurisdictional boundaries

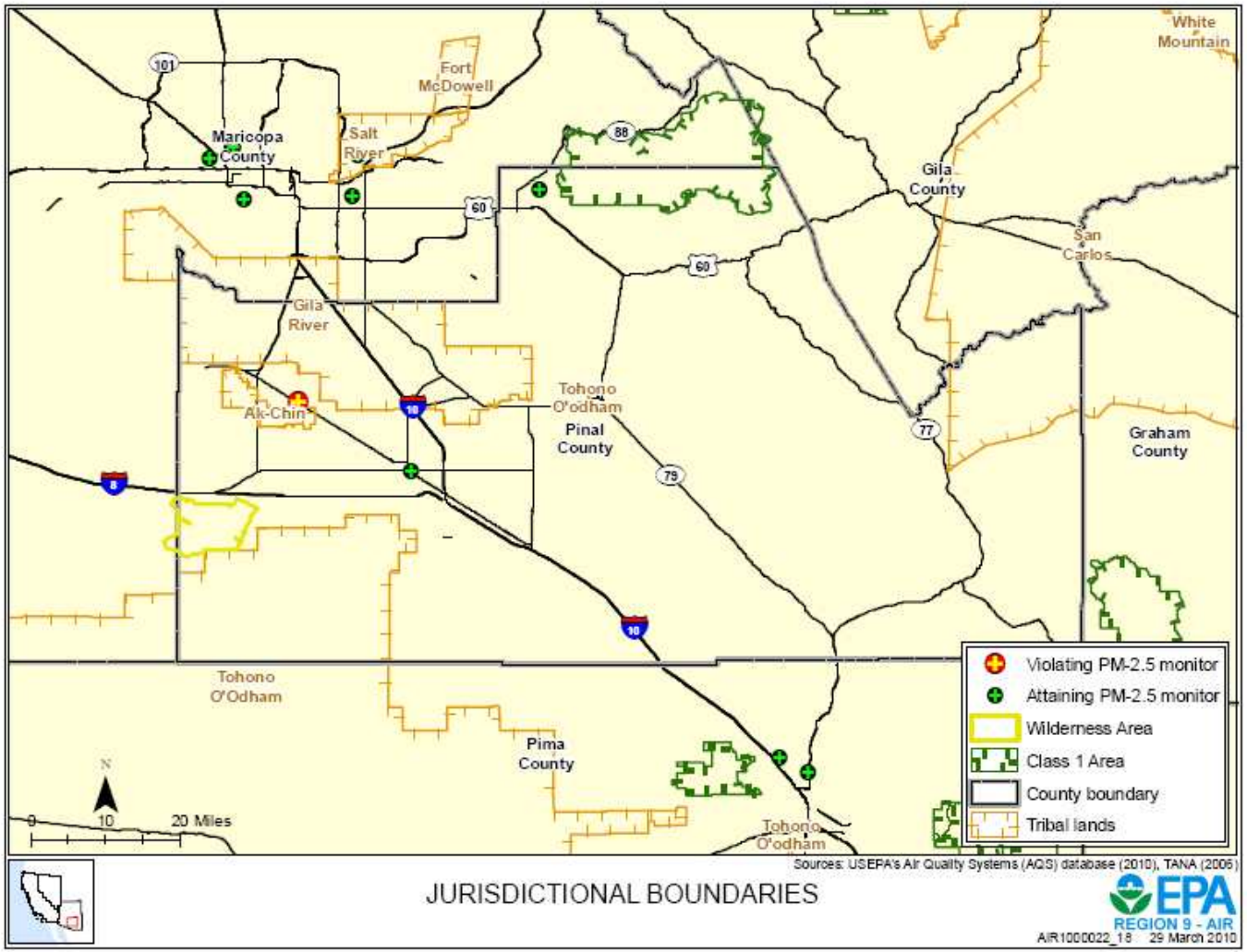
In evaluating the jurisdictional factor, EPA considered the planning and organizational structure of Pinal County, the State of Arizona, and Indian country to ensure that the implementation of controls within the prospective nonattainment area can be carried out in a cohesive manner. See Figure 17 for jurisdictional boundaries.

The Arizona Department of Environmental Quality has overall jurisdiction over environmental programs in the state of Arizona, as well as jurisdiction over certain source types, including smelters, refineries, and coal-fired power plants, and retains authority for regulating emissions from agricultural operations. Three Arizona counties, Maricopa, Pima, and Pinal, have their own air pollution control programs and operate pursuant to agreements with ADEQ. The lead air quality planning agencies responsible for state implementation plans (SIPs) for Maricopa County and Pima County are the metropolitan planning organizations (MPO), the Maricopa Association of Governments (MAG) and the Pima Association of Governments (PAG), respectively. There is no MPO and thus no lead air quality planning agency for SIP purposes in Pinal County. Therefore, ADEQ is responsible for developing SIPs for Pinal County. Pinal County has permitting authority, and can adopt control measures by rule, but is preempted from adopting rules regulating certain categories of sources.

Four tribes are located in Pinal County. A portion of the Tohono O'odham Nation (TON) lies in southeastern Pinal County, south of the proposed nonattainment area. A portion of the San Carlos Apache tribal lands lie within the eastern part of Pinal County, east of the proposed nonattainment area. Both the TON and San Carlos Apache lands are within the area EPA intends to designate "unclassifiable/attainment." As explained above, EPA is deferring designation of the two remaining tribes pending consideration of issues unique to tribal lands and completion of formal consultation. The Ak-Chin Indian Community tribal lands lie entirely within the County, and are encircled by the new nonattainment area. The Gila River Indian Community tribal lands lie to the north of the nonattainment area and straddle the Pinal-Maricopa boundary. Neither ADEQ nor the counties have jurisdiction over tribal lands.

Of the four tribes, only the Gila River Indian Community has treatment as a state (TAS) status for Clean Air Act section 107 designations, and an air quality monitoring network that reports quality-assured data to EPA's Air Quality System (AQS). None of the tribes currently monitor for $PM_{2.5}$.

Figure 17. Jurisdictional Boundaries



Factor 9: Level of control of emission sources

Under this factor, the existing level of control of emission sources is taken into consideration. The emissions data used by EPA in this technical analysis and provided in Table 1 (under Factor 1) represent emissions levels taking into account any control strategies implemented in Pinal and nearby counties before 2005 on stationary, mobile, and area sources. Data are presented for $PM_{2.5}$ components that are directly emitted (carbonaceous $PM_{2.5}$ and crustal $PM_{2.5}$) and for pollutants that react in the atmosphere to form fine particles (e.g., SO_2, NOx, VOC, and ammonia). EPA is not aware of any additional information on emissions controls that is relevant to assessing sources contributing to the monitored violation.

Appendix A
Emissions in Pinal County: Primary $PM_{2.5}$, NO_x, NH_3, SO_2, VOCs.

Pinal County: Primary $PM_{2.5}$ (includes filterables + condensibles) Sources. 2005 NEI version2.

Source Category	Emissions (tpy)	% of Total Primary $PM_{2.5}$ Emissions, Pinal County
Nonpoint		
Waste Disposal - Open Burning	886	21%
Agric - Crop Tilling & Livestock Dust	751	18%
Unpaved Roads	626	15%
Construction	547	13%
Wildfires	395	9%
Indus Process – NEC	220	5%
Paved Roads	152	4%
Other Nonpoint	105	2%
Nonroad		
Non-Road Equipment - Diesel	166	4%
Planes, Trains, & Ships	64	2%
Non-Road Equipment - Gasoline	38	1%
Onroad		
On-Road Vehicles - Diesel	116	3%
On-Road Vehicles - Gasoline	42	1%
Point		
Misc. Point	102	2%
TOTAL:	**4,210**	**100%**

Pinal County: Nitrogen Oxides (NO_x) Sources. 2005 NEI version 2.

Source Category	Emissions (tpy)	% of Total NO_x Emissions, Pinal County
Onroad		
On-Road Vehicles - Diesel	3,889	31%
On-Road Vehicles - Gasoline	3,715	30%
Nonroad		
Planes, Trains, & Ships	2,275	18%
Non-Road Equipment - Diesel	1,775	14%
Non-Road Equipment - Gasoline	142	1%
Nonpoint		
Waste Disposal - Open Burning	235	2%
Wildfires	113	1%
Fuel Comb - Industrial Boilers, ICEs	81	1%
Fuel Comb - Residential Fossil	65	1%
Other Nonpoint	35	0%
Point		
Fuel Comb - Electric Utility	173	1%
Misc. Point	47	0%
TOTAL:	**12,545**	**100%**

Pinal County: Ammonia (NH_3) Sources. 2005 NEI version 2.

Source Category	Emissions (tpy)	% of Total NH_3 Emissions, Pinal County
Nonpoint		
Livestock Waste	4,344	77%
Fertilizer Application	845	15%
Other Nonpoint	75	1%
Onroad		
On-Road Vehicles - Gasoline	305	5%
On-Road Vehicles - Diesel	9	0%
Point		
Fuel Comb - Electric Utility	65	1%
Nonroad		
Misc. Nonroad	2	0%
TOTAL:	**5,646**	**100%**

Pinal County: Sulfur Dioxide (SO_2) Sources. 2005 NEI version 2.

Source Category	Emissions (tpy)	% of Total SO_2 Emissions, Pinal County
Nonroad		
Non-Road Equipment - Diesel	244	32%
Planes, Trains, & Ships	163	22%
Non-Road Equipment - Gasoline	1	0%
Nonpoint		
Fuel Comb - Industrial Boilers, ICEs	130	17%
Wildfires	48	6%
Other Nonpoint	21	3%
Onroad		
On-Road Vehicles - Diesel	105	14%
On-Road Vehicles - Gasoline	38	5%
Point		
Misc. Point	7	1%
TOTAL:	**757**	**100%**

Pinal County: Volatile Organic Compounds (VOC) Sources. 2005 NEI version 2.

Source Category	Emissions (tpy)	% of Total VOC Emissions, Pinal County
Onroad		
On-Road Vehicles - Gasoline	3,539	38%
On-Road Vehicles - Diesel	200	2%
Nonroad		
Non-Road Equipment - Gasoline	1,476	16%
Non-Road Equipment - Diesel	195	2%
Planes, Trains, & Ships	96	1%
Nonpoint		
Wildfires	978	11%
Gas Stations	687	7%
Waste Disposal - Open Burning	642	7%
Solvent - Non-industrial	518	6%
Surface Coating - Industrial	206	2%
Miscellaneous Sources	186	2%
Surface Coating - Architectural	176	2%
Other Nonpoint	239	3%
Point		
Misc. Point	80	1%
TOTAL:	**9,217**	**100%**

Table 8. CMB modeled PM_{10} source attributions for Cowtown, Pinal County ($\mu g/m^3$)

Sample Date	Soil	Feedlot	MvEmi	VgBrn	ColPP	AmSulf	AmNitr	Other	Modeled Mass	Measured Mass	Mass Uncertainty
10/3/2003	25.1033	41.0073	1.5905		2.2148		0.9428	3.6569	70.8587	74.5156	± 3.9983
10/9/2003	45.6091	60.3676	2.4250		3.4559		2.6796		114.5372	113.1195	± 5.8313
10/12/2003	12.0387	36.4932	3.6659		3.5709		3.4876		59.2563	55.4905	± 3.1193
10/15/2003	40.3176	72.1687	2.4969				2.6798		117.6629	113.8643	± 5.8715
10/18/2003	113.8341	154.9450		4.3458			3.8895		277.0144	264.3609	± 13.2989
10/21/2003	93.8503	168.2944		2.7966			3.6637	25.5040	268.6050	294.1090	± 14.7752
10/27/2003	*Void										
10/30/2003	41.8415	78.6916		2.4347			2.8110		125.7788	120.5839	± 6.1944
11/5/2003	72.5156	129.7945		1.8544			4.6339	12.9470	208.7984	221.7454	± 11.1744
11/8/2003	58.8056	147.6984			3.8127		5.8832	49.4339	216.1999	265.6338	± 13.3523

*Void - No recorded mass for Teflon filter

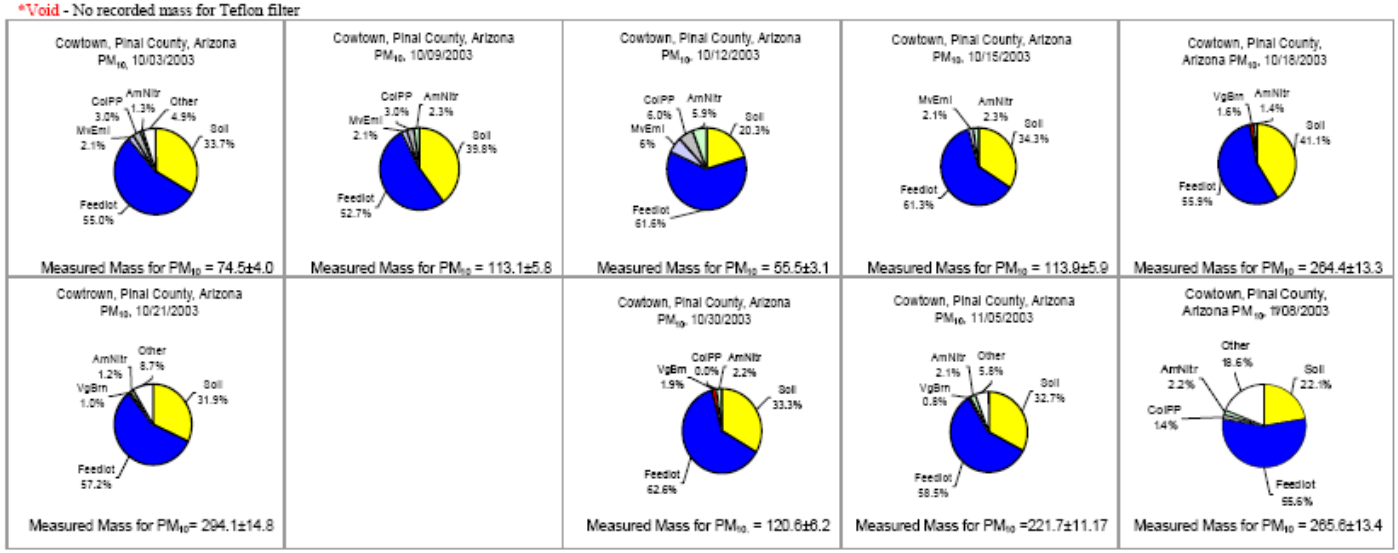
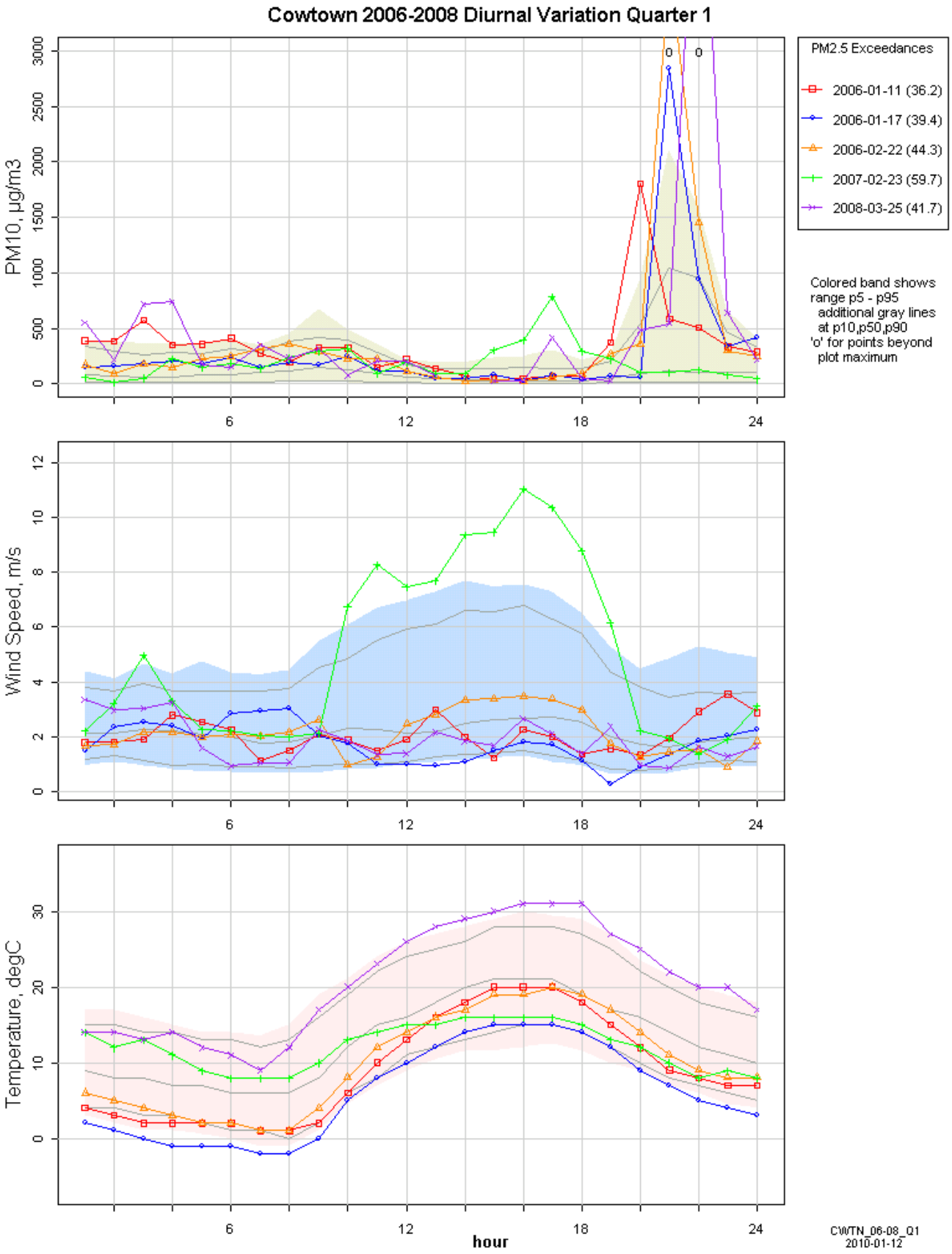
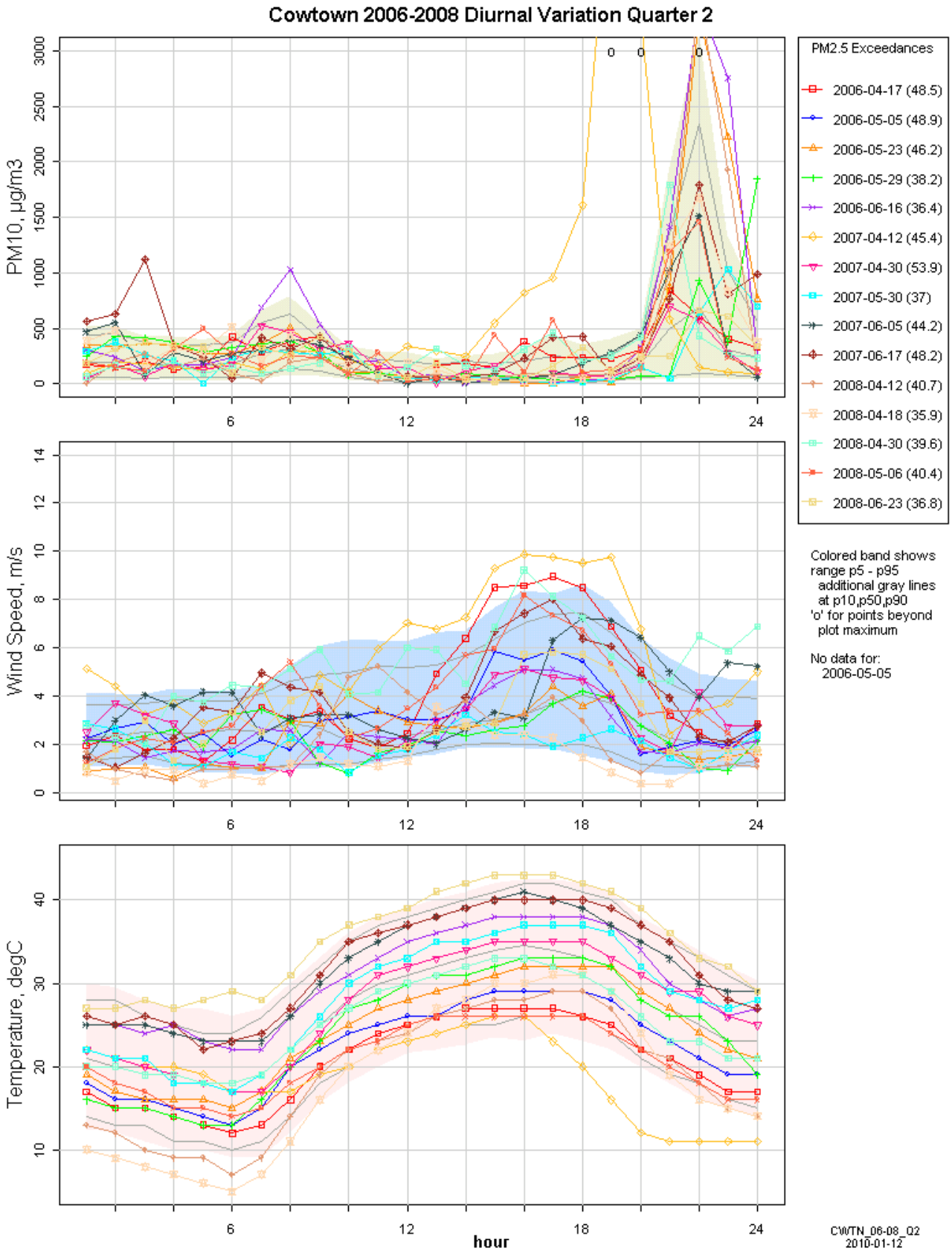
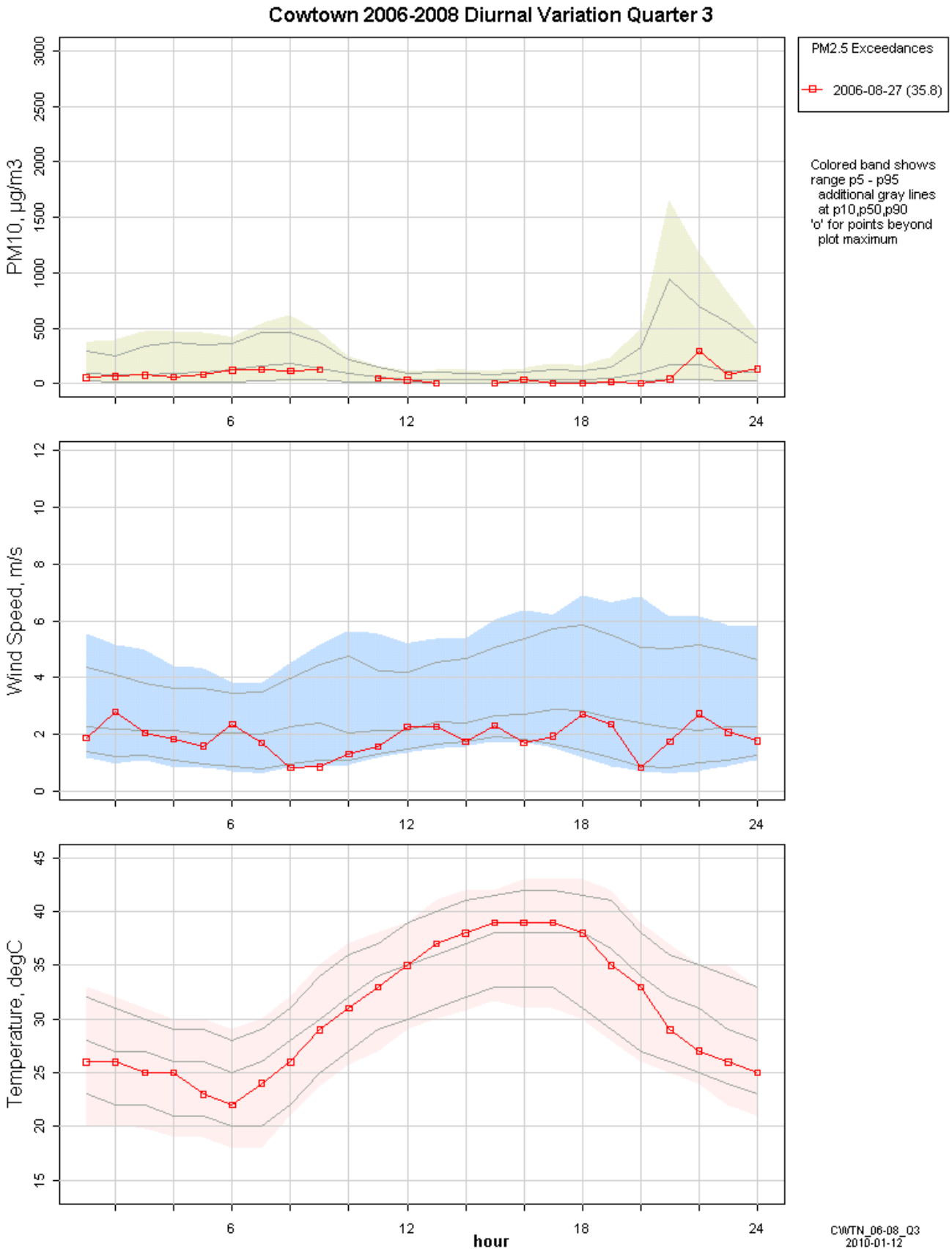


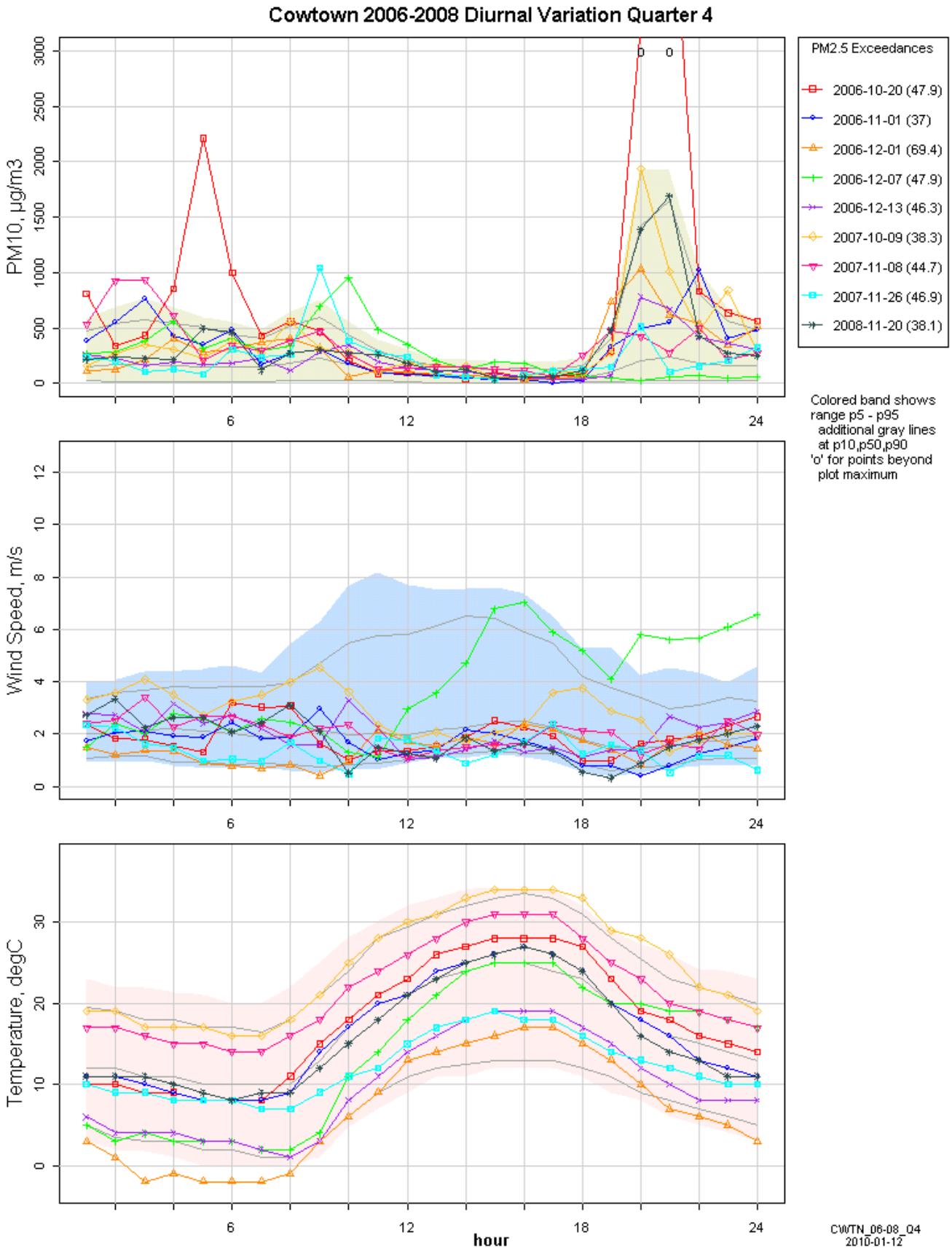
Figure 6. CMB modeled source attributions for PM_{10} data subsets from Cowtown, Pinal County

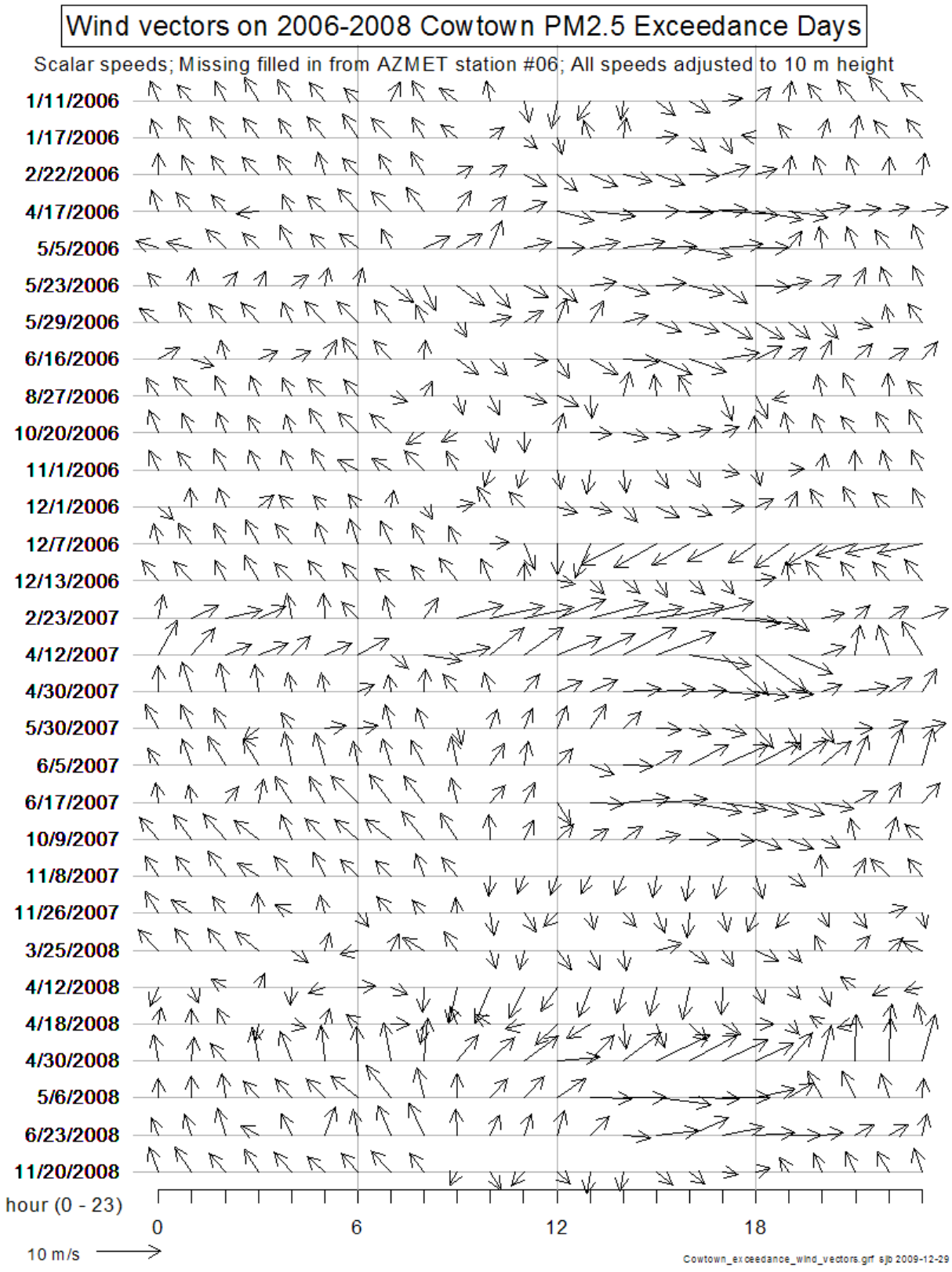
Appendix B
Meteorological Data


Cowtown 2006-2008 Diurnal Variation Quarter 1
PM10, µg/m3
Wind Speed, m/s
Temperature, degC
hour
PM2.5 Exceedances
2006-01-11 (36.2)
2006-01-17 (39.4)
2006-02-22 (44.3)
2007-02-23 (59.7)
2008-03-25 (41.7)
Colored band shows range p5 - p95
additional gray lines at p10,p50,p90
'o' for points beyond plot maximum
CWTN_06-08_Q1
2010-01-12


Cowtown 2006-2008 Diurnal Variation Quarter 2
PM10, µg/m3
Wind Speed, m/s
Temperature, degC
hour
0 0 0
PM2.5 Exceedances
2006-04-17 (48.5)
2006-05-05 (48.9)
2006-05-23 (46.2)
2006-05-29 (38.2)
2006-06-16 (36.4)
2007-04-12 (45.4)
2007-04-30 (53.9)
2007-05-30 (37)
2007-06-05 (44.2)
2007-06-17 (48.2)
2008-04-12 (40.7)
2008-04-18 (35.9)
2008-04-30 (39.6)
2008-05-06 (40.4)
2008-06-23 (36.8)
Colored band shows range p5 - p95
additional gray lines at p10,p50,p90
'o' for points beyond plot maximum
No data for:
2006-05-05
CWTN_06-08_Q2
2010-01-12


Cowtown 2006-2008 Diurnal Variation Quarter 3
PM2.5 Exceedances
2006-08-27 (35.8)
Colored band shows
range p5 - p95
additional gray lines
at p10,p50,p90
'o' for points beyond
plot maximum
PM10, µg/m3
0
500
1000
1500
2000
2500
3000
Wind Speed, m/s
0
2
4
6
8
10
12
Temperature, degC
15
20
25
30
35
40
45
6
12
18
24
hour
CWTN_06-08_Q3
2010-01-12


Cowtown 2006-2008 Diurnal Variation Quarter 4
PM10, µg/m3
Wind Speed, m/s
Temperature, degC
hour
PM2.5 Exceedances
2006-10-20 (47.9)
2006-11-01 (37)
2006-12-01 (69.4)
2006-12-07 (47.9)
2006-12-13 (46.3)
2007-10-09 (38.3)
2007-11-08 (44.7)
2007-11-26 (46.9)
2008-11-20 (38.1)
Colored band shows range p5 - p95
additional gray lines at p10,p50,p90
'o' for points beyond plot maximum
CWTN_06-08_Q4
2010-01-12


Wind vectors on 2006-2008 Cowtown PM2.5 Exceedance Days
Scalar speeds; Missing filled in from AZMET station #06; All speeds adjusted to 10 m height
1/11/2006
1/17/2006
2/22/2006
4/17/2006
5/5/2006
5/23/2006
5/29/2006
6/16/2006
8/27/2006
10/20/2006
11/1/2006
12/1/2006
12/7/2006
12/13/2006
2/23/2007
4/12/2007
4/30/2007
5/30/2007
6/5/2007
6/17/2007
10/9/2007
11/8/2007
11/26/2007
3/25/2008
4/12/2008
4/18/2008
4/30/2008
5/6/2008
6/23/2008
11/20/2008
hour (0 - 23)
0
6
12
18
10 m/s
Cowtown_exceedance_wind_vectors.grf sjb 2009-12-29