Panhandle and West Texas Area Evaluation

(Amarillo, Lubbock, Abilene, Midland, and San Angelo Regions)

Panhandle and West Texas Area Characteristics

Terrain

The Panhandle and West Texas areas are primarily composed of the Central Great Plains, Southwestern Tablelands, High Plains, and the Edwards Plateau regions. The Central Great Plains, which extend from Wichita Falls in the east to the area just west of Abilene, are characterized by irregular topography and an elevation of approximately 1,000 to 1,500 feet. The Southwestern Tablelands form a north-south transitional zone between the Central Great Plains to the east and the High Plains to the north and west. More extreme weather events, such as thunderstorms and tornadoes, are common due to the climate and flat topography leading to the escarpments on the eastern edge of the area. The Southwestern Tablelands extend from eastern edge of Amarillo, Lubbock, and Big Spring to the Texas-Oklahoma border and the area west of Abilene and south to San Angelo. The High Plains make up the rest of the Panhandle and western portion of West Texas to the Midland-Odessa area. The area is characterized by flat, elevated terrain dotted with playa lakes. The western edge of the Edwards Plateau forms the southern edge of the West Texas area and is marked by gently rolling hills. Reeves and Pecos Counties, the counties on the western edge of this area, are part of the Trans-Pecos area and exhibit transitions from mountains to inter-mountain plains. (Griffith et al. 2004)

Regional terrain characteristics influence pollutant transport and area dispersion. The plains, tablelands, and plateaus of the Panhandle and West Texas area provide few wind breaks, allowing pollutant transport across the entire region with few areas of geographic concentration. Blowing dust and smoke from outside the area are often visible by satellite imagery and measured across multiple monitors, emphasizing the regional focus on particulate matter.

Climate

The Panhandle and West Texas climates transition from sub-tropical in the east to semi-arid in the far west. Annual average temperatures range from 63°F to 68°F in the Wichita Falls and Abilene areas, to 65°F to 68°F in the Edwards Plateau region, to 59°F to 62°F in the High Plains region. Annual average precipitation follows a general east-west gradient, with highest precipitation (up to an average of 37 inches per year in Wichita Falls) occurring in the east, transitioning to the low precipitation in the High Plains (average of 19 inches per year) and the Midland-Odessa area (15 inches per year). As in other regions, the Panhandle and West Texas regions received uncharacteristically low precipitation during the recent extended drought period beginning in 2010, sometimes up to more than 20 inches per year less than the annual average. (NCDC 2015) As shown in Figure 78, wind patterns in the Lubbock and Odessa areas are dominated by south and southwesterly flows. In the Panhandle area, dominant wind flows are from the south and south-southwest.

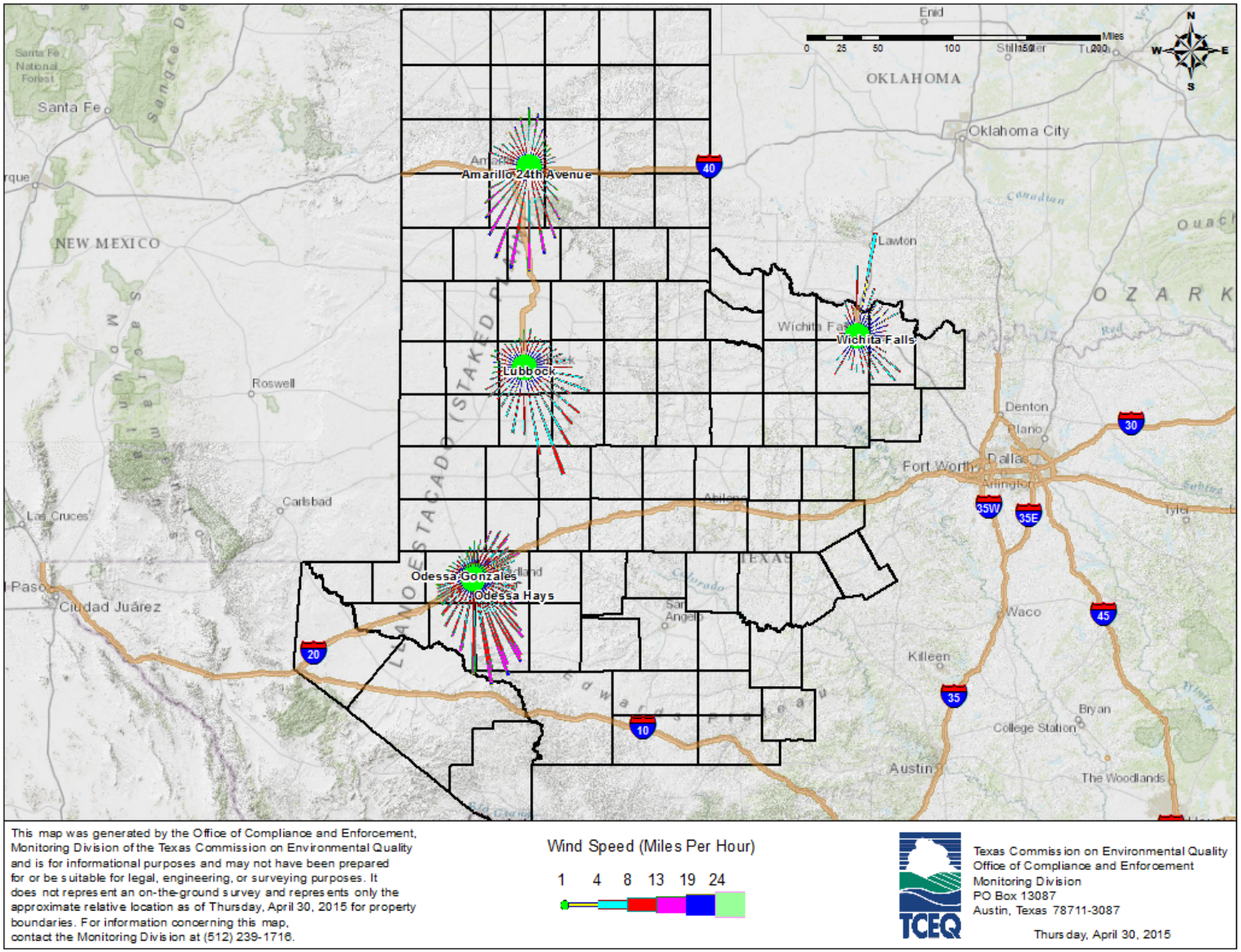


Figure 78: Panhandle and West Texas Area Counties, Terrain, and Wind Data from Ambient Air Quality Monitors

Population

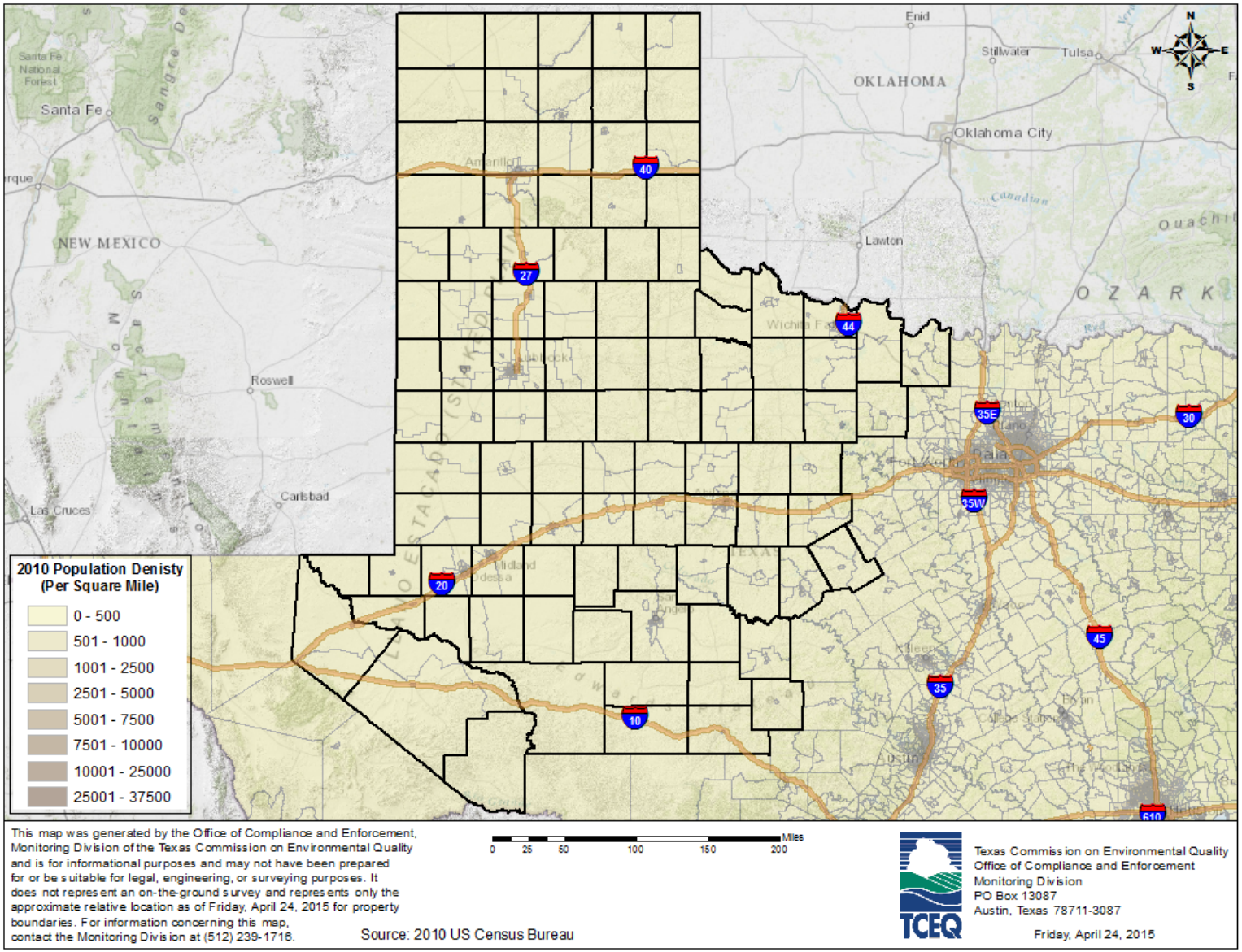
The Panhandle and West Texas area has seven major MSAs that include multiple counties.

- Abilene: Callahan, Jones, and Taylor Counties
- Amarillo: Armstrong, Carson, Oldham, Potter, and Randall Counties
- Lubbock: Crosby, Lubbock, and Lynn Counties
- Midland: Martin and Midland Counties
- Odessa: Ector County
- San Angelo: Irion and Tom Green Counties
- Wichita Falls: Archer, Clay, and Wichita Counties

In 2010, the combined population of these seven MSAs was almost 1.25 million people with the largest populations in Lubbock (290,805) and Amarillo (251,933). The 2014 population estimates indicate an overall 5% increase in the last four years, with the fastest growth of 12% in Midland. Figure 79 and Figure 80 map the population densities across the Panhandle and West Texas area based on 2010 United States Census Bureau data.

Minimum monitoring network design requirements in 40 CFR Part 58, Appendix D, Section 4, for ozone, CO, NO_2, $PM_{2.5}$, and PM_{10} are partially based on MSA populations. With the 2014 area MSA population estimates and 2014 design values for these pollutants, no regulatory monitors are required in the Panhandle and West Texas area.

According to the Texas State Data Center, the Midland and Odessa MSAs are projected to have the highest population growth rates (14%) of the Panhandle and West Texas area from 2010 to 2020. The Amarillo and Lubbock MSAs are projected to grow 12% and 11% by 2020, respectively. The Abilene, San Angelo, and Wichita Falls MSA populations are projected to increase by less than 10%. If these projections are accurate, none of the Panhandle and West Texas MSAs would require the addition of regulatory monitors based on population alone.



This map was generated by the Office of Compliance and Enforcement, Monitoring Division of the Texas Commission on Environmental Quality and is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location as of Friday, April 24, 2015 for property boundaries. For information concerning this map, contact the Monitoring Division at (512) 239-1716.

Figure 79: Panhandle and West Texas Area Population Density

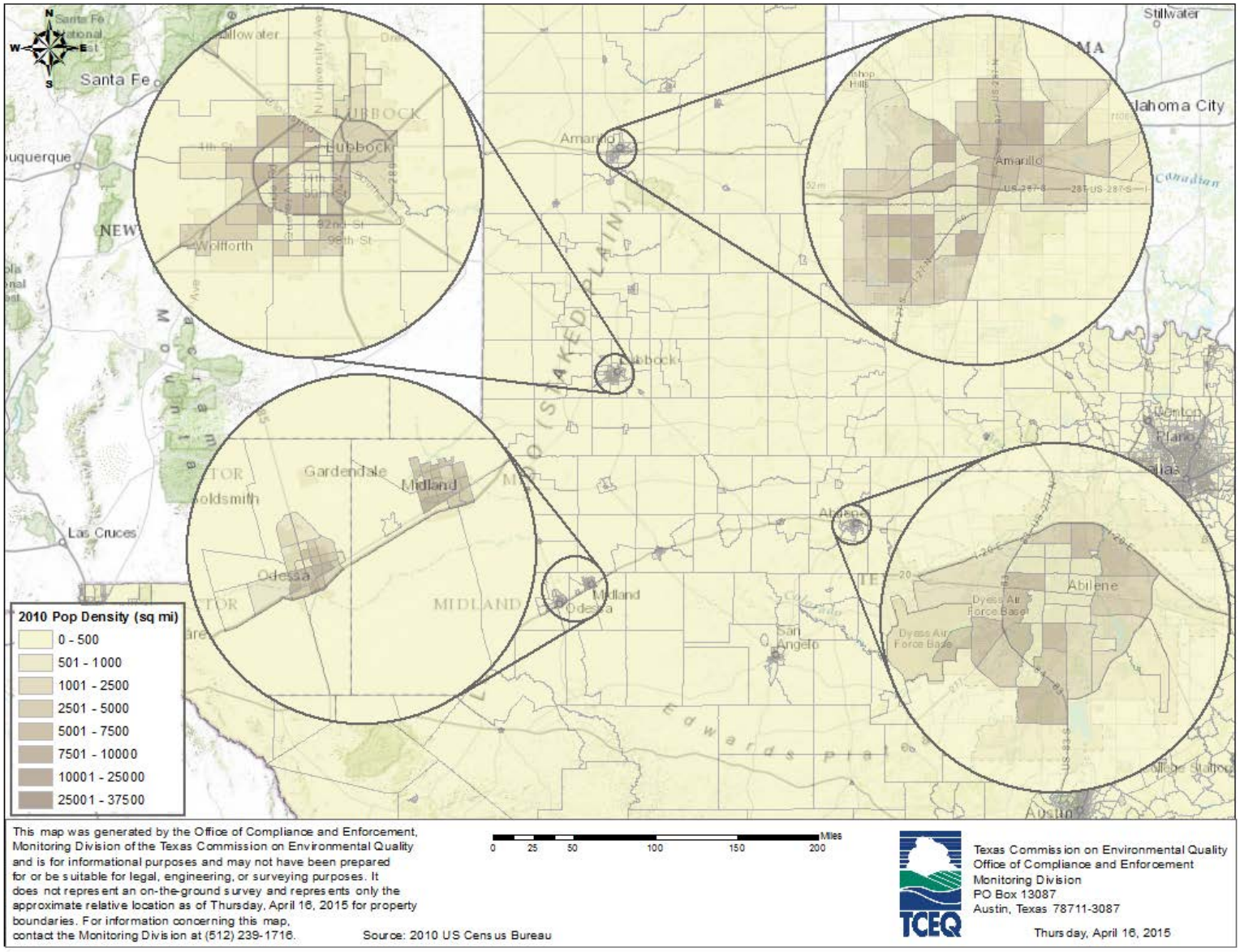


Figure 80: Panhandle and West Texas Metropolitan Statistical Area Population Density

Pollutant Sources

Anthropogenic Sources

Data from EI source categories show that mobile sources (on-road and non-road) are the dominant contributor of CO (70%), and NO_x (49%) in the Panhandle and West Texas area. Area sources contributed the most PM_{10} (97%), $PM_{2.5}$ (88%), and VOCs (93%). Point sources emitted the vast majority (over 90%) of SO_2. Non-road mobile sources (75%) and point sources (25%) accounted for all lead emissions in the Panhandle and West Texas area.

A review of pending and issued air permits within the Panhandle and West Texas area (detailed in Appendix D) indicated that new facilities were well dispersed between Amarillo and Midland and between Midland and Abilene. This review did not identify any new sources that would require additional air quality monitors.

Natural Sources

The Panhandle and West Texas area is affected by the same seasonal pollutant transport that influences air quality in the North, Coastal, and Far West Texas areas. Regional blowing dust from the White Sands vicinity of New Mexico, eastern New Mexico, and local Texas Panhandle areas can be transported behind strong cold fronts. These regional-scale dust storms occur mainly in the spring, but can develop from late October through the winter and spring into early June. The origin and tracks of these storms can be characterized using satellite imagery and correlated with increased local $PM_{2.5}$ data during these events. Since 2010, the highest $PM_{2.5}$ daily average measured during a regional dust storm event was 40.5 $\mu g/m^3$ in Lubbock on January 22, 2012.

Smoke events that affect the Panhandle and West Texas area are typically prevalent in the summer months. Accumulated smoke and haze from the eastern United States generally arrive in late spring through early fall, while smoke from agricultural burning in Mexico and Central America arrives in April and May. Like dust storms, these events are also often visible on satellite imagery and can be associated with discernable increases in local $PM_{2.5}$. Since 2010, occasional high $PM_{2.5}$ events dominated by transported smoke have resulted in daily averages as high as 18.1 $\mu g/m^3$ as measured in Odessa on April 16, 2013.

Regional Air Quality

Criteria Pollutants

As of January 2015, all Panhandle and West Texas geographical areas were classified as attainment/unclassifiable for all the current NAAQS. In June 2010, the primary SO_2 NAAQS was revised to a one-hour standard of 75 ppb. The Governor has recommended designating all Texas areas as attainment for the one-hour SO_2 NAAQS, but a final action has not been taken by the EPA. Prior to making final determinations on area designations for the revised SO_2 standard, the EPA proposed the SO_2 Data Requirements Rule. This rule, proposed in April 2014, could result in additional source-oriented SO_2 monitoring to characterize ambient air quality around larger area SO_2 sources and inform area designations.

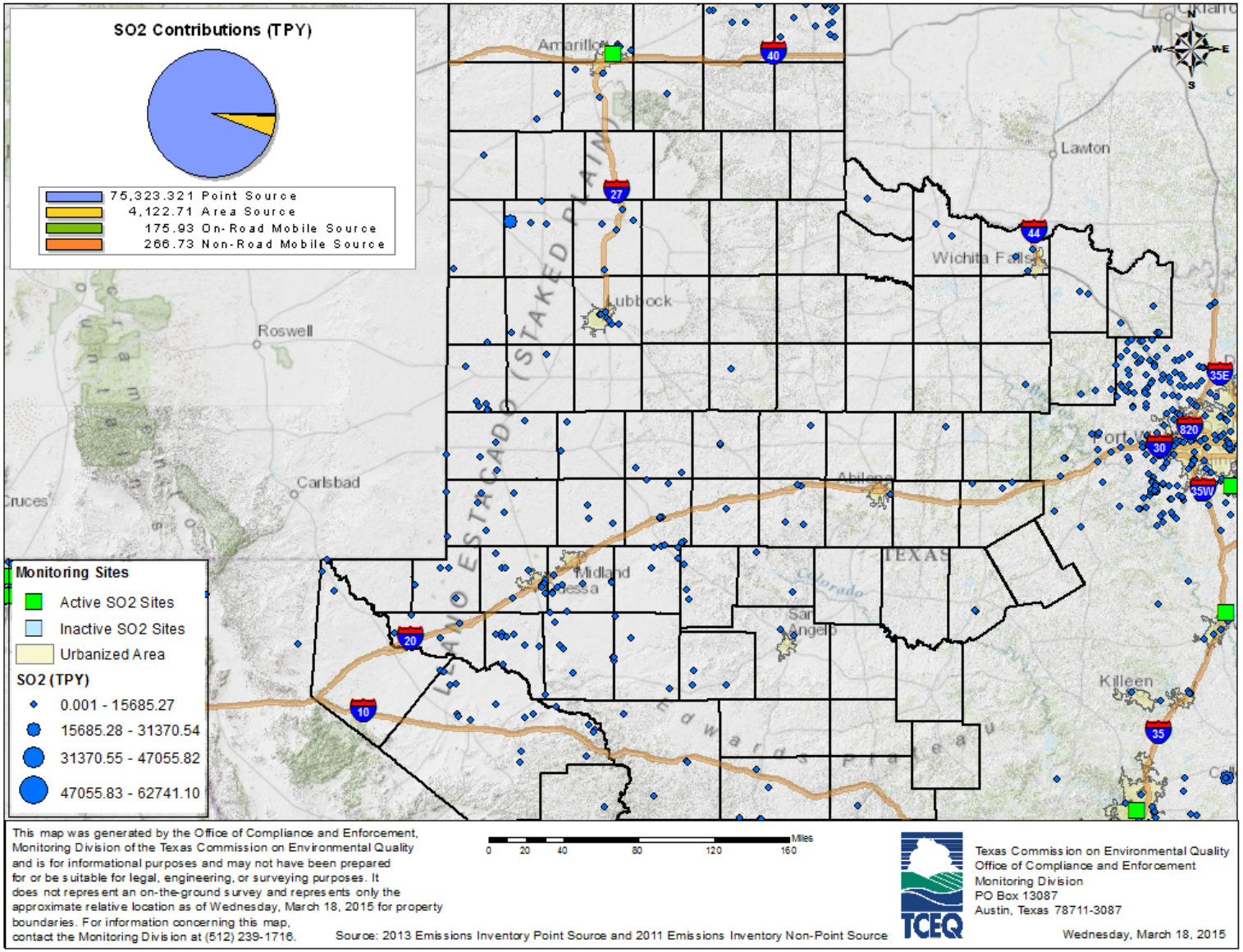
No areas within the Panhandle and West Texas area were listed on the APWL. Review of the area's ambient air data by the TCEQ Toxicology Division indicated that for the last five years annual average concentrations of all reported VOCs were below their long-term AMCVs and would not be expected to cause adverse health effects or odors. The 2014 review of Amarillo air quality data also concluded that with the exception of two samples, 24-hour concentrations of respirable PM_{10} were below the comparison value of 150 $\mu g/m^3$, and the twenty-four hour concentrations of Pb, reported as TSP, were below the comparison value of 0.15 $\mu g/m^3$.

Monitoring Network Evaluation

Sulfur Dioxide

Network History

As of January 1, 2015, the TCEQ operated one SO_2 monitor in the Panhandle and West Texas area. The Amarillo 24th Avenue SO_2 monitor, located in northeast Amarillo near the edge of a residential area, was sited to measure SO_2 concentrations in a highly populated area. Deployed in 2013, this monitor fulfilled federal monitoring requirements related to the Amarillo MSA's PWEI. Based on PWEI, no other MSA in the Panhandle and West Texas area is required to conduct SO_2 monitoring at this time. Locations of point sources and the Amarillo 24th Avenue SO_2 monitor are shown in Figure 81. Appendix A lists the area's SO_2 monitors, as well as their location, monitoring objectives, and associated spatial scales.



TPY – tons per year

Figure 81: Panhandle and West Texas Sulfur Dioxide (SO_2) Point Sources and Monitor

Design Values and Trends

Given the monitor's deployment in 2013, the Amarillo 24th Avenue site has yet to attain three complete years of data for the calculation of an official design value. As a substitute, the TCEQ calculated the 99th percentile of the one-hour daily maximum using the data available. The 99th percentile of daily maximums averaged over two years was 22 ppb, less than 30% of the level of the one-hour SO_2 NAAQS of 75 ppb.

Network Evaluation

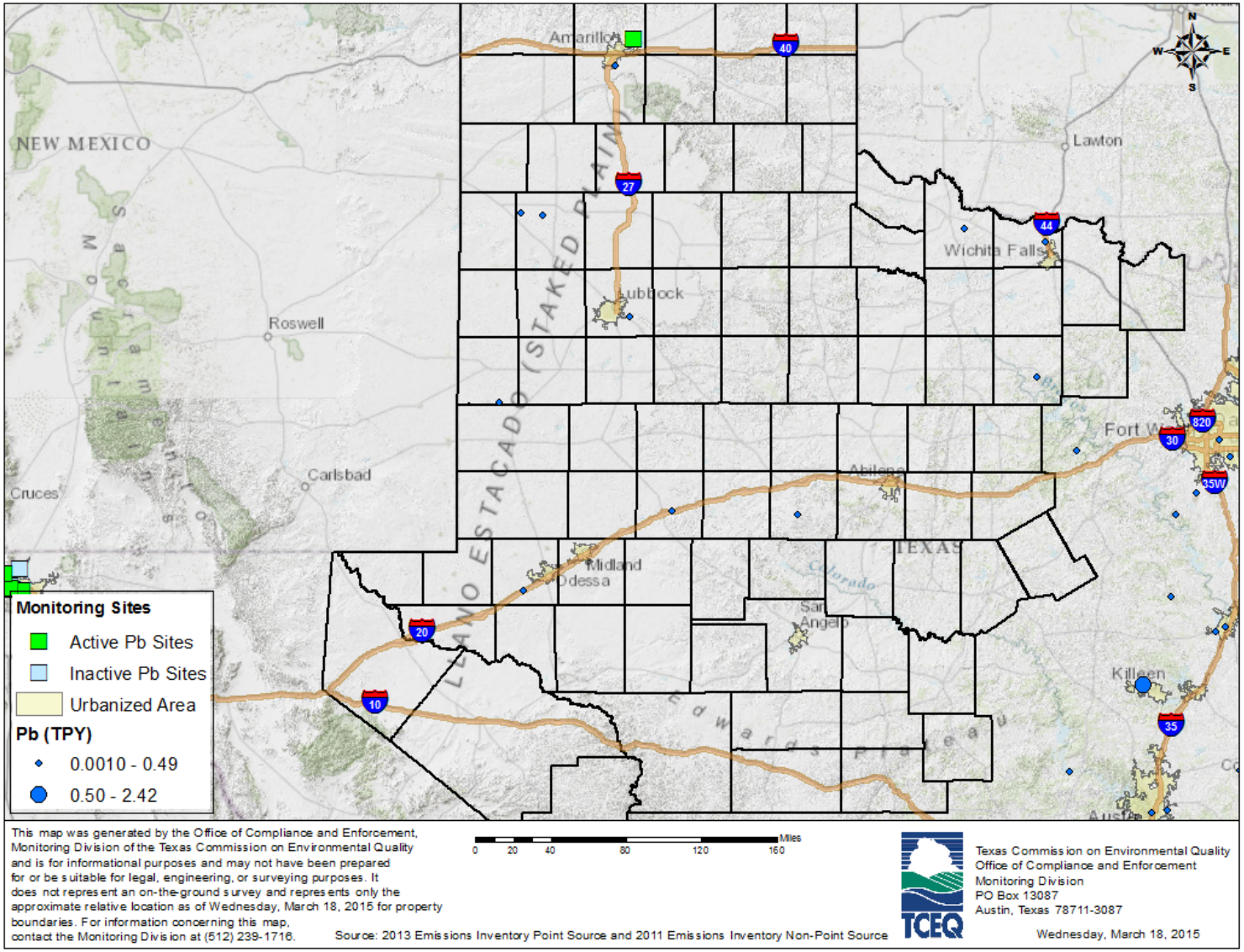
The existing Amarillo 24th Avenue SO_2 monitor in the Panhandle and West Texas area exceeds all current federal monitoring requirements, although it continues to meet the original monitoring objective of measuring population exposure. Given the updated EI using 2014 population, 2013 point source emissions, and 2011 non-point source emissions, this SO_2 monitor is no longer required for the Amarillo MSA. The SO_2 monitor, however, is of high value due to its placement near a major SO_2 source (the Xcel Energy Harrington Generation Station).

Due to proposed federal regulatory action and pending designations for the 2010 one-hour SO_2 standard, no network changes are currently recommended. Once the EPA's final SO_2 Data Requirements Rule is promulgated, the TCEQ will evaluate the existing SO_2 network for potential optimization that will provide for compliance with any associated SO_2 monitoring requirement changes. These network changes will be included in the *2016 Annual Monitoring Network Plan*.

Lead

Network History

As of January 1, 2015, Pb monitoring was only conducted at one monitoring site within the Panhandle and West Texas area as shown in Figure 82. Current federal rules require source-oriented monitoring to measure maximum Pb concentrations near each point source emitting 0.50 tpy or more of Pb and each airport emitting 1.0 tpy or more of Pb based on the NEI or other justifiable method. Based on historically reported Pb point source emissions, one source within the Panhandle and West Texas area has emitted greater than 0.50 tpy of Pb, the ASARCO Copper Refinery. The Amarillo SH 136 monitor was deployed in 2010 to monitor ambient lead concentrations downwind of the ASARCO copper refinery located approximately nine miles north of Amarillo along Texas Highway 136. Based on reported Pb point source emissions within the Panhandle and West Texas area, no additional source-oriented Pb monitoring is required. Appendix A lists the location, monitoring objective, and associated spatial scale for the Amarillo SH 136 Pb monitor.



TPY – tons per year

Figure 82: Panhandle and West Texas Lead (Pb) Point Sources and Monitor

Design Values and Trends

Due to insufficient data, 2014 design values are not available for the Amarillo SH 136 Pb monitor; however, unofficial highest combined site summaries indicate consistently low ambient levels (0.01 μg/m^3 in 2011, 0.02 μg/m^3 in 2012, 0.00 μg/m^3 in 2013, and 0.00 μg/m^3 in 2014). Furthermore, 3-month rolling average Pb values collected since 2011 have remained well below the NAAQS level of 0.15 μg/m^3.

Network Evaluation

The existing Pb monitoring network in the Panhandle and West Texas area meets all current federal monitoring requirements and continues to meet existing monitoring objectives. The Amarillo SH 136 Pb monitor, located near the ASARCO Copper Refinery, is considered of high value as it continues to provide valuable data sufficient to understand point source emissions from this facility. Given the reported Pb emissions from existing point sources in the area and low measured concentrations, no additional network changes are recommended at this time. Appendix C provides a detailed description of the assessed value for the Amarillo SH 136 Pb monitor.

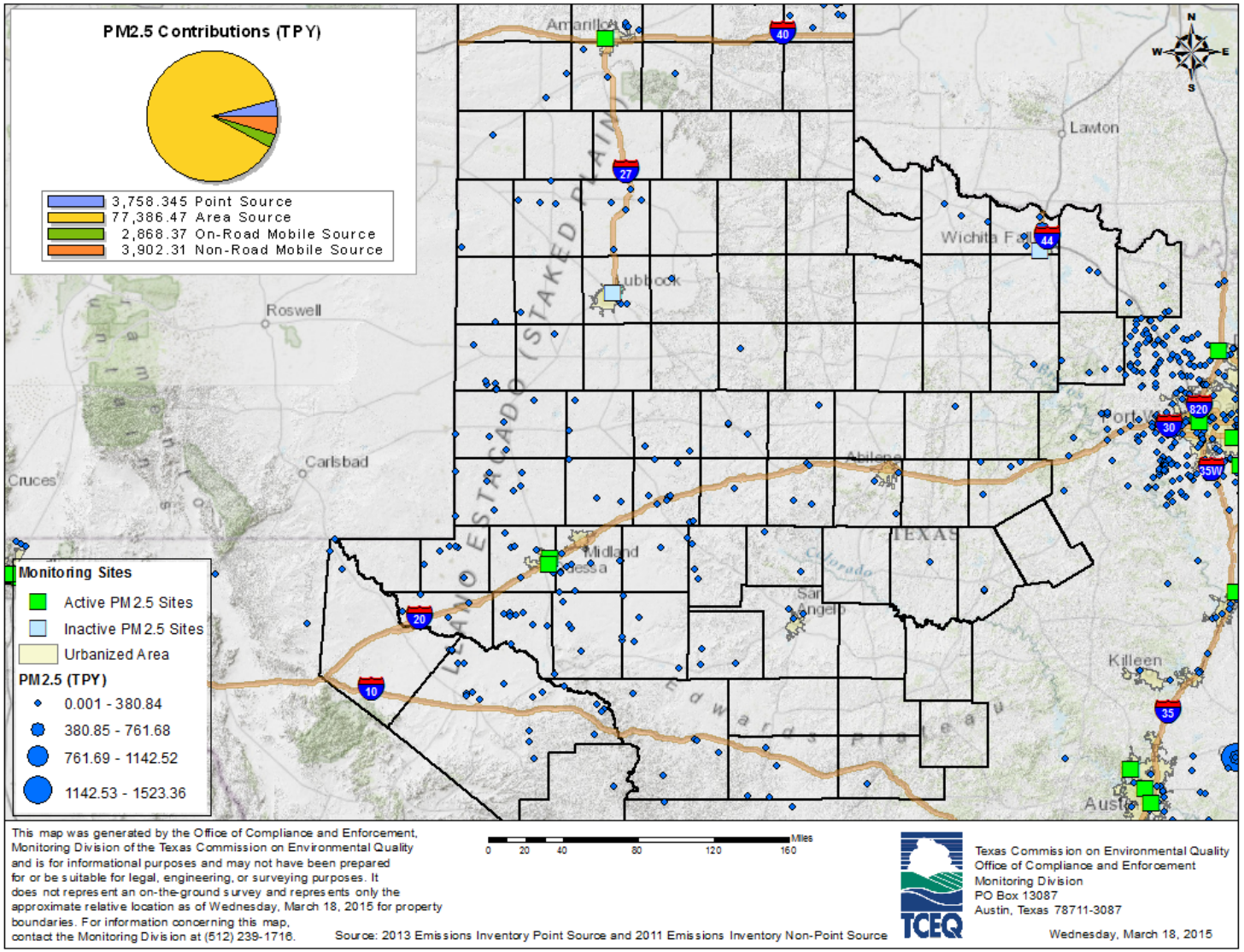
Particulate Matter of 2.5 Micrometers or Less

Network History

As of January 1, 2015, the Panhandle and West Texas area $PM_{2.5}$ network consisted of three continuous monitors located in Amarillo and Odessa, as shown in Figure 83. These monitors exceed current regulatory requirements. A continuous $PM_{2.5}$ monitor and $PM_{2.5}$ FRM monitor were deployed at the Amarillo A&M site from 2005 to 2010 to measure ambient concentrations in populated areas of Amarillo. The TCEQ decommissioned the FRM monitor in 2010 and retained the continuous $PM_{2.5}$ monitor due to its importance in evaluating the effect of regional dust storms in the Texas Panhandle. In addition, the Odessa-Hays Elementary School and Odessa Gonzales continuous $PM_{2.5}$ monitors were deployed in 2000 and 2002, respectively, to improve spatial coverage in West Texas and aid in exceptional event support. Both continuous $PM_{2.5}$ monitors provide data representative of ambient conditions in populated areas of Odessa. Since the last five-year assessment, an FRM monitor was decommissioned at the Odessa-Hays Elementary School site in 2010 because of historically low design values and adequate monitoring coverage by the continuous $PM_{2.5}$ monitors in the Odessa area.

The Lubbock area currently does not have any active monitors and two monitors have been decommissioned since the last five-year assessment. The Lubbock $PM_{2.5}$ speciation monitor was decommissioned in 2010 due to low ambient concentrations and low monitor value. The remaining Lubbock $PM_{2.5}$ continuous monitor was decommissioned in November 2014 at the property owner's request to vacate the site. Although not federally required, the continuous $PM_{2.5}$ monitor provided meaningful information about regional transport of $PM_{2.5}$ in the Lubbock area, as well as information on ambient $PM_{2.5}$ conditions in Lubbock's populated urban area. The TCEQ is evaluating potential locations within the MSA and plans to relocate the monitor in late 2015.

The Wichita Falls area currently does not have any active monitors. The continuous $PM_{2.5}$ monitor was decommissioned in 2014 at the property owner's request to vacate the location based on the sale of the property. The monitor was not relocated because it measured very low concentrations historically, was operated beyond minimum requirements, and was of low value.



TPY – tons per year

Figure 83: Panhandle and West Texas Particulate Matter of 2.5 Micrometers or Less in Diameter ($PM_{2.5}$) Point Sources and Monitors

Design Values and Trends

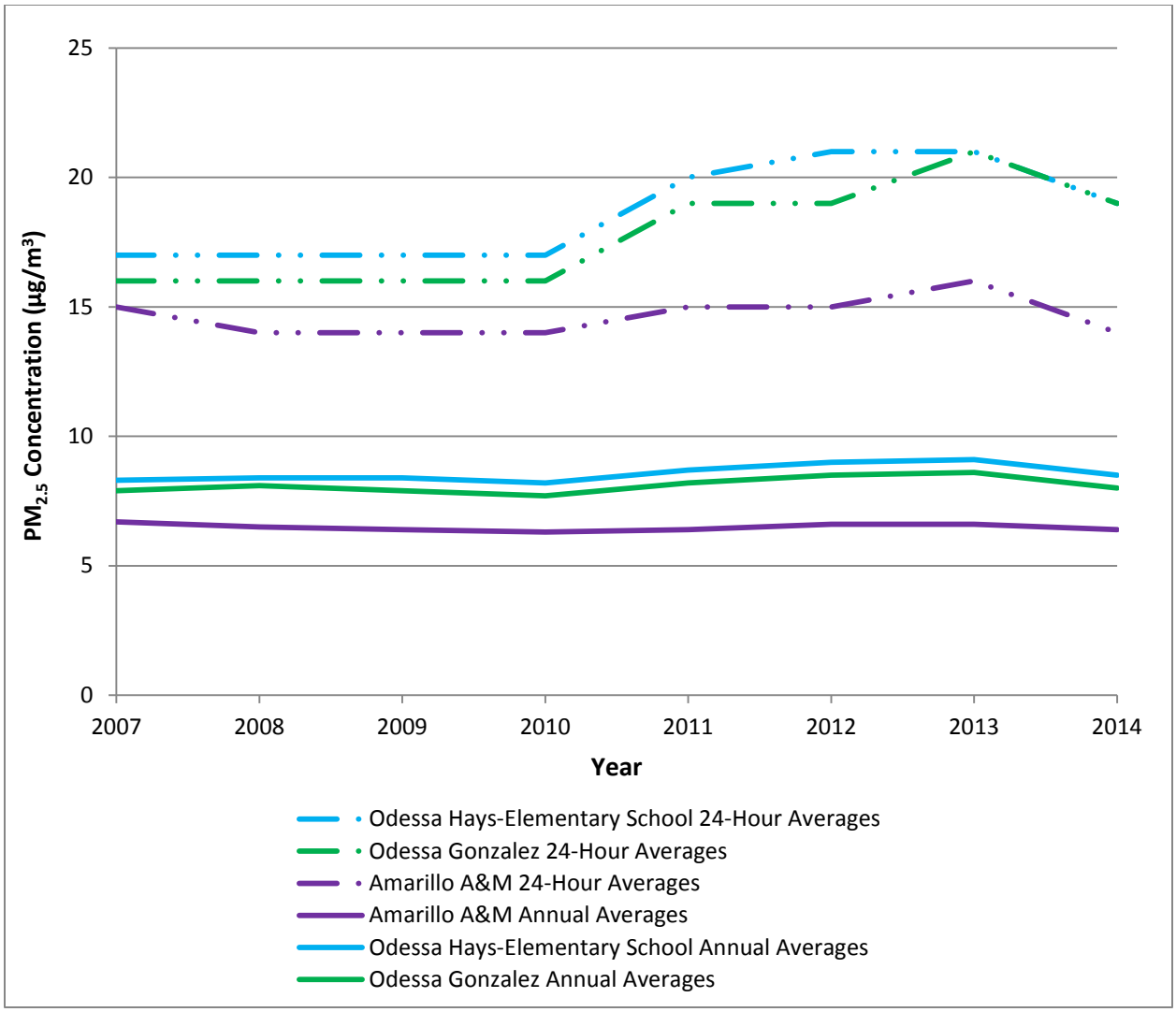
Amarillo Area

Without FRM/FEM monitors to calculate a valid design value, the TCEQ calculated unofficial 24-hour design values for the Amarillo A&M continuous $PM_{2.5}$ monitor using the 98th percentile of 24-hour averages averaged over three year periods. From 2007 until 2014, these unofficial 24-hour design values ranged from 14 to 15 μg/m^3, with a peak value of 16 μg/m^3 in 2013. The data suggest that ambient concentrations have been stable over the review period and that design values would be less than 50% of the 24-hour NAAQS of 35 μg/m^3.

Similarly, the TCEQ calculated unofficial annual design values by averaging annual averages from the Amarillo A&M non-FRM continuous monitor over three year periods. Unofficial annual design values from 2007 through 2014 ranged from 6.3 to 6.7 μg/m^3 and indicate consistently low annual concentrations below the level of the annual $PM_{2.5}$ NAAQS of 12 μg/m^3.

Odessa Area

Unofficial design values were also calculated for the two continuous $PM_{2.5}$ monitors in the Odessa area. As shown in Figure 84, the 98th percentile of 24-hour measurements that were averaged over three years, as well as annual averages, have consistently remained low. Both data trends indicate an increase in ambient $PM_{2.5}$ concentrations from 2011 through 2013, with a subsequent decrease in 2014.



$PM_{2.5}$ – Particulate Matter of 2.5 Micrometers or Less
µg/m^3 - micrograms per cubic meter

Figure 84: Trends of 98th Percentile of 24-hour and Annual Averages of Particulate Matter of 2.5 Micrometers or Less in Diameter ($PM_{2.5}$) Averages from the Odessa and Amarillo Area Continuous Monitors, 2007-2014

Network Evaluation

Area sources are the primary $PM_{2.5}$ contributor in the Panhandle and West Texas areas. Therefore, it is appropriate for the Panhandle and West Texas $PM_{2.5}$ monitoring network to continue to be focused on monitoring concentrations of incoming transported $PM_{2.5}$, rather than evaluating downwind concentrations near smaller, local point sources. As discussed below, the TCEQ has deemed each monitor valuable and does not have plans to decommission any of the current $PM_{2.5}$ monitoring network.

Due to MSA populations, there are no current federal requirements for $PM_{2.5}$ monitors in the Panhandle and West Texas area; however, continuous $PM_{2.5}$ measurements provide meaningful data regarding regional $PM_{2.5}$ transport and exceptional events in areas that have historically been impacted by dust events. For these reasons, the

Amarillo A&M and previous Lubbock $PM_{2.5}$ continuous monitors are considered of high value in understanding ambient conditions in the Texas Panhandle. Monitoring data from the Lubbock area is particularly important because historical concentrations had been as high as 67% of the 24-hour NAAQS. The TCEQ expects to redeploy a continuous $PM_{2.5}$ monitor in the Lubbock area in late 2015.

Similarly, the two existing continuous $PM_{2.5}$ monitors in the Odessa area are considered of medium value because of their locations at elementary schools and the spatial coverage they provide for the West Texas area. Analysis of data from the Odessa-Hays Elementary School and Odessa Gonzales continuous $PM_{2.5}$ monitors indicates the monitors are moderately correlated (Pearson's coefficient=0.939, relative difference=0.111). This correlation is expected due to the close proximity of these two monitors (approximately 4 kilometers apart). With these close data trends, one monitor could provide good coverage to the Odessa network. The TCEQ does not currently have any plans to decommission either monitor, but continues to evaluate the effectiveness of these two closely located monitors.