Ozone and Particulate Matter Concentrations Along U.S./Mexico Border

The border between the U.S. and Mexico spans approximately 2,000 miles, from the Pacific Ocean to the Gulf of Mexico. The area is subjected to a unique blend of increased industrial development (especially on the Mexican side of the border), intense pressures because of the shifting and growing population related to this development, and an arid climate that can exacerbate many air quality problems. Ozone and particulate matter are air pollutants of particular concern (U.S. EPA, 2003).

Ground-level ozone is harmful to both human health and the environment (the Ozone Concentrations indicator). Although some industrial sources release ozone directly into the environment, most ground-level ozone forms from chemical reactions involving nitrogen oxides, volatile organic compounds, and sunlight. Ozone levels are typically highest during the afternoon hours of the summer months, when the influence of direct sunlight is the greatest (U.S. EPA, 2013).

"Particulate matter" (PM) is the general term used for a mixture of solid particles and liquid droplets found in the air. Primary PM is released directly from emissions sources into the atmosphere, while secondary PM is formed in the air from reactions involving precursor chemicals (e.g., ammonia, nitrogen oxides, sulfur dioxide, particle-producing organic gases). Ambient air monitoring stations measure air concentrations of two size ranges of particles: $PM_{2.5}$ (fine particles with aerodynamic diameter less than or equal to 2.5 micrometers [µm]) and PM_{10} (particles with aerodynamic diameters less than or equal to 10 µm, including $PM_{2.5}$). Exposure to coarse particles (i.e., particles with aerodynamic diameters between 2.5 and 10 µm) can aggravate respiratory conditions such as asthma, and exposure to fine particles is associated with various additional human health effects (the PM Concentrations indicator) (U.S. EPA, 2009).

This Ozone and Particulate Matter Concentrations along U.S./Mexico Border indicator shows trends in ambient air concentrations of ozone and particulate matter in the U.S. counties at the U.S./Mexico border area in comparison to U.S. national trends, where appropriate. These trends are shown for the longest duration of time supported by the underlying monitoring data. For ozone, this indicator reports the average of the fourth highest daily maximum 8-hour concentrations for three consecutive calendar years. For PM_{10}, this indicator reports the 3-year average of the second highest 24-hour concentrations. For $PM_{2.5}$, this indicator reports the 3-year average of the seasonally weighted annual average concentration. For ozone and $PM_{2.5}$, national trend lines are also depicted because the statistics used to report data in this indicator are similar to those used in the corresponding national indicators. For PM_{10}, national data are not presented, because the approach used to track PM_{10} concentrations in the U.S./Mexico border region differs from that used on the national scale. This indicator is based on all monitoring stations that operated within 100 kilometers of the border on the U.S. side during this time period.

In EPA Region 6, ozone monitoring data from border locations were collected in Dona Ana, Grant, and Luna Counties in New Mexico and El Paso, Brewster, Webb, Hidalgo, and Cameron Counties in Texas. In EPA Region 9, ozone monitoring data from border locations were collected in the counties of Cochise, Pima, and Yuma in Arizona and Imperial and San Diego in California. PM_{10} sampling data for EPA Region 6 are from Cameron, Hidalgo, Webb and El Paso Counties in Texas and Dona Ana, Luna, and Grant Counties in New Mexico. $PM_{2.5}$ data were available for all of the above counties except for Luna County, New Mexico. For EPA Region 9, PM_{10} monitoring data were collected in the counties of Cochise, Pima, Santa Cruz, and Yuma in Arizona and Imperial and San

Diego in California. For EPA Region 9, $PM_{2.5}$ monitoring data were collected in the counties of Cochise, Pima, and Santa Cruz in Arizona and Imperial and San Diego in California.

What the Data Show

Trends for 8-Hour Ozone Concentrations

In EPA Region 6, average border ozone concentrations decreased by 11 percent between the 1986-1988 and 1992-1994 time periods (a smaller decrease than the national average, which was 12 percent) and by 9 percent between the 1993-1995 and 2011-2013 periods (again, smaller than the national average decrease of 17 percent) (Exhibit 1). In EPA Region 9, border ozone concentrations decreased by 6 percent between the 1986-1988 and 1992-1994 time periods and then decreased by 16 percent between the 1993-1995 and 2011-2013 periods.

Trends for 24-Hour PM_{10} Concentrations

In EPA Region 6, the second highest 24-hour PM_{10} concentrations at border monitoring sites varied considerably over the period of record, with an increase in PM_{10} concentrations in the two most recent 3-year periods (Exhibit 2). The highly variable PM_{10} concentrations most likely result from variation in meteorological conditions (e.g., drought, rainfall, wind speed) and soil erosion, and no clear long-term trend is apparent from the Region 6 data. In EPA Region 9, corresponding PM_{10} concentrations at border monitoring sites did not exhibit such strong temporal variations, and the average second highest 24-hour concentrations do not show an obvious trend from 1988 to present.

Trends for Annual Average $PM_{2.5}$ Concentrations

Between 1999-2001 and 2011-2013, average annual ambient $PM_{2.5}$ concentrations in the border counties of EPA Region 6 varied from year to year, with no clear long-term trends (Exhibit 3). Over the same time frame, average annual ambient $PM_{2.5}$ concentrations at the Region 9 border trend sites decreased by 30 percent. Average annual ambient $PM_{2.5}$ concentrations decreased 32 percent nationwide over the same period.

Limitations

- Many counties along the U.S./Mexico border do not have ambient air quality monitors; these counties are not characterized by this indicator.
- This indicator does not include data from the Mexican side of the border. When a technical review concludes the quality of these data is appropriate for the intended use, the indicator will be updated with those data.
- Short-term trends in PM_{10} concentrations are often highly dependent on meteorological conditions. The maximum concentration for a given site can be influenced by wind-blown dust and will exhibit considerable variations from day to day. Trends over the longer term are far less likely to be influenced by unusual meteorological conditions.
- The long-term ozone trends are derived from an increasing number of monitors over the course of time from 1986 to 2013, but an analysis of the limited number of border sites that have full periods of record show that the slopes of the trends are similar to those in this indicator.
- The trend lines present composite averages of the particular trend statistic over all monitoring sites that met the selection criteria; all monitoring sites were weighted equally in calculating the composite average trend statistic.
- Because most of the monitoring sites are located in urban areas, the trends might not

accurately reflect conditions outside the immediate urban monitoring areas.

Data Sources

Summary data in this indicator were provided by EPA's Office of Air Quality Planning and Standards, Region 6, and Region 9. These summaries were based on ozone and PM ambient air monitoring data in EPA's Air Quality System (U.S. EPA, 2014a) (https://www.epa.gov/aqs). Trends in this indicator are based on the subset of ozone and PM monitoring stations located in counties along the U.S./Mexico border that have sufficient data to assess trends over the period of record.

References

U.S. EPA (United States Environmental Protection Agency). 2014a. Data from the Air Quality System. Accessed 2014. https://www.epa.gov/aqs.

U.S. EPA. 2014b. History of the national ambient air quality standards for ozone. http://www3.epa.gov/ttn/naaqs/standards/ozone/s_o3_history.html.

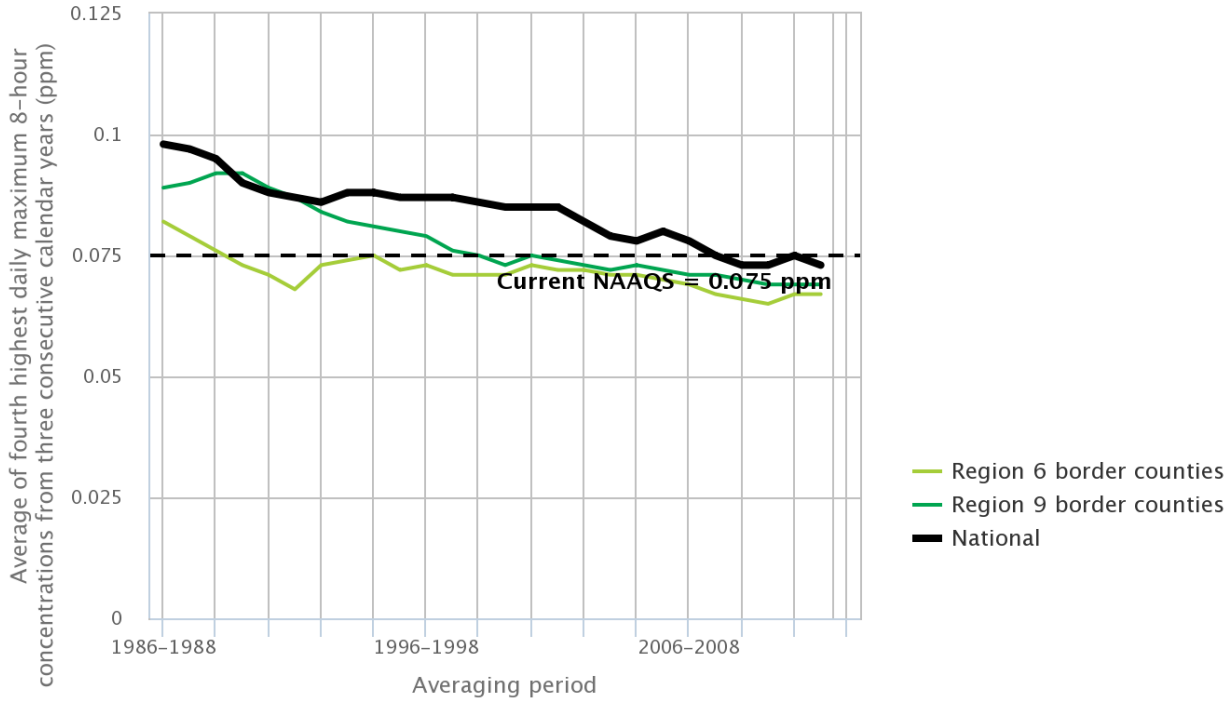
U.S. EPA. 2014c. History of the national ambient air quality standards for particulate matter. http://www3.epa.gov/ttn/naaqs/standards/pm/s_pm_history.html.

U.S. EPA. 2013. Integrated science assessment for ozone and related photochemical oxidants. EPA 600R/R-10/076F. Research Triangle Park, NC. http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=247492.

U.S. EPA. 2009. Integrated science assessment for particulate matter. EPA/600/R-08/139F. Washington, DC. http://cfpub.epa.gov/ncea/isa/recordisplay.cfm?deid=216546.

U.S. EPA. 2003. Border 2012: U.S.-Mexico environmental program. EPA/160/R-03/001. Washington, DC.

Exhibit 1. Ambient 8-hour ozone concentrations in U.S. counties in the U.S./Mexico border area, 1986–2013



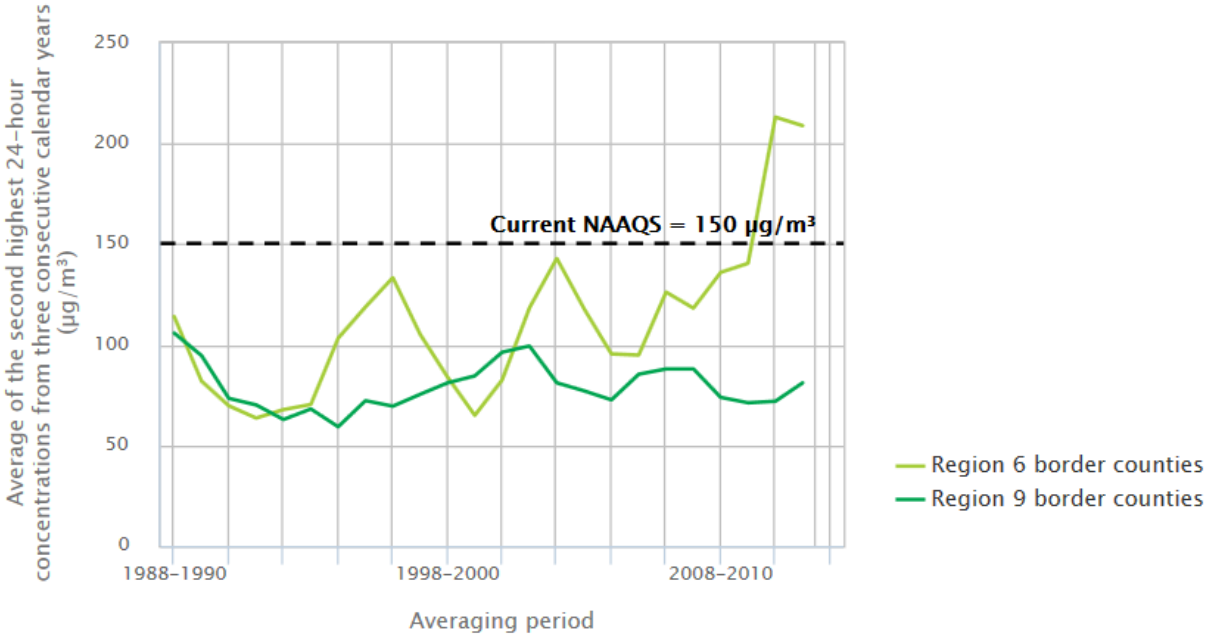
The current NAAQS was established in 2008 and is shown to provide context for the magnitude of pollutant concentrations. It is more stringent than all previous NAAQS (e.g., the concentration levels for the previous NAAQS are higher) (U.S. EPA, 2014b).

Coverage: 40 combined ozone monitoring sites located in U.S. counties along the U.S./Mexico border that have sufficient data to assess trends from 1986 to 2013. Not all sites meet criteria used to calculate indicator for each three year average.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2014a

Exhibit 2. Ambient 24-hour PM_{10} concentrations in U.S. counties in the U.S./Mexico border area, 1988–2013



The current 24-hour NAAQS was established in 1987 and has not been revised since (U.S. EPA, 2014c).

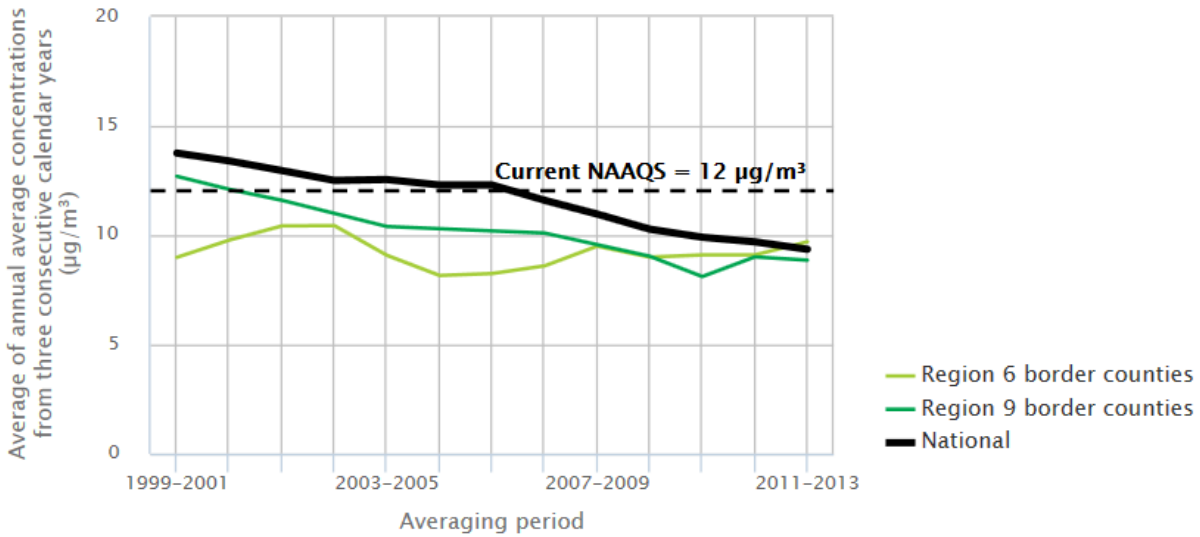
Coverage: 33 combined PM_{10} monitoring sites located in U.S. counties along the U.S./Mexico border that have sufficient data to assess trends from 1988 to 2013. Not all sites meet criteria used to calculate indicator for each three year average.

National PM_{10} data are not depicted because the approach used to track PM_{10} concentrations in the U.S./Mexico border region differs from that used on the national scale.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2014a

Exhibit 3. Ambient annual $PM_{2.5}$ concentrations in U.S. counties in the U.S./Mexico border area, 1999–2013



The current NAAQS was established in 2012 and is shown to provide context for the magnitude of pollutant concentrations. It is more stringent than all previous NAAQS (e.g., the concentration levels for the previous NAAQS are higher) (U.S. EPA, 2014c).

Coverage: 18 combined $PM_{2.5}$ monitoring sites located in U.S. counties along the U.S./Mexico border that have sufficient data to assess trends from 1999 to 2013. Not all sites meet criteria used to calculate indicator for each three year average.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: U.S. EPA, 2014a