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PRELIMINARY DOCUMENTATION

Assessment of Qualification for Treatment under the Arizona Natural and Exceptional Events Policy for the High Particulate (PM₁₀ and PM_{2.5}) Concentration Event in the Nogales, Arizona Area on January 1, 2008

Background

The Arizona Department of Environmental Quality (ADEQ) operates monitors at the Post Office in Nogales, Arizona for PM₁₀ and PM_{2.5} and at the Fire Station in Nogales, Sonora for PM₁₀. Federal Reference Method (FRM) filter-based samples are collected at both locations. Two Beta-Attenuation Monitor Systems (BAMS) collect hourly PM₁₀ and PM_{2.5} concentration data at the Post Office site.

During the evening of December 31, 2007, a strong night-time temperature inversion set up in the Nogales area. With no significant ventilating winds available to break up the surface inversion, the inversion intensified and set up a drainage flow from the higher terrain to the south in Mexico through Nogales, Sonora and into Nogales, Arizona.

The event brought significant elevated ambient concentrations of PM₁₀ and PM_{2.5} and exceeded the PM_{2.5} National Ambient Air Quality Standards (NAAQS) at the ADEQ Nogales Post Office monitors. The fact that ambient concentrations exceed the NAAQS satisfies the criteria in 40 CFR 50.1(j) that the event "affects air quality."

Preliminary indications were that emissions from sources in Mexico, which are not subject to control by the Arizona State Implementation Plan (SIP), may have contributed to the event.

A PM₁₀ SIP exists for Nogales, Arizona. All appropriate SIP control measures were in place during the event demonstrating, per 40 CFR 50.1(j), that the event "is not reasonably controllable or preventable," if in fact emissions from Mexico caused the exceedance.

Elevated PM₁₀ and PM_{2.5} concentrations were measured in the Nogales area. The table below shows the key PM monitor readings for the monitors examined in this report. While the PM₁₀ BAM monitor did not exceed the NAAQS, the data were included in this analysis to show the temporal variability of the PM concentrations. Similarly, the PM_{2.5} BAM data were also included. The PM_{2.5} BAM did exceed the PM_{2.5} NAAQS, but this monitor is not an EPA approved federal reference or equivalent method. These data are particularly useful for the Event Contribution Analysis contained in Figure 1.

Monitor (Operator/Type)	AQS ID*	24-hr Avg PM ₁₀ or PM _{2.5}	1-hr Max PM ₁₀ or PM _{2.5}	Time of Max 1- hr	Flag**
NOGALES AREA					
Nogales AZ Post Office PM ₁₀ (ADEQ/BAM)	04-023-0004 (3)	115	368	0000	
Nogales AZ Post Office PM _{2.5} (ADEQ/BAM)	04-023-0004 (3)	52.2	189	0000	IL
Nogales AZ Post Office PM _{2.5} FRM Primary	04-023-0004 (1)	46.7	N/A	N/A	RL
Nogales AZ Post Office PM _{2.5} FRM Collocated	04-023-0004 (2)	46.9	N/A	N/A	RL

* EPA Air Quality System Identification Number

** 24-hr PM₁₀ concentration influenced by exceptional event (international transport) to be flagged.

Type Abbreviations: BAM – Beta-Attenuation Mass Monitor (Continuous monitor)

FRM – Federal Reference Method

The preliminary findings from this analysis were presented at a stakeholders meeting on November 19, 2008, in Phoenix, Arizona. This document is being submitted to

EPA to satisfy the requirements of 40 CFR 50.14(c)(2)(iii), and will be supplemented and made available for public comment to satisfy the requirements of 50.14(c)(3)(i).

Assessment Under the Technical Criteria Document (TCD)

1. Properly qualify and validate the air quality measurement to be flagged. As this was a filter sampling date (1-in-6 run day), data from both continuous and filter based monitors were examined. The air quality monitoring data were reviewed by ADEQ, the agency responsible for operation of the monitors. All hourly PM₁₀ and PM_{2.5} readings from the Nogales BAMS monitors were found to be valid for January 1st. Additionally, data from the Nogales Post Office federal reference monitors were also valid. No specific local sources were reported as significantly contributing to the air quality episode.

2. Review suspected contributing sources. The event began on the evening of New Years Eve. Very heavy PM_{2.5} concentrations were noted. This is unusual for the arid southwest, except when smoke from smoldering fires can be a significant source of PM_{2.5}. Lack of any significant transport winds would indicate that the emissions were probably from nearby the monitor. The plot of hourly PM₁₀ and PM_{2.5} concentration data in the upper right corner of Figure 1, in conjunction with the wind direction data, confirms the identical timing of the transport from the south across the U.S./Mexico border when the elevated PM concentrations began. It is clear from the plot that nearly 50% of the PM₁₀ was in the form of PM_{2.5}, probably from fireplace smoke. ADEQ staff is familiar with events of this character. Drainage flow smoke plumes are characterized by a high proportion of fine particulate in the overall PM measurement, consistent with the measurements at the Nogales Post Office on January 1st.

3. Examine all air quality monitoring information. Data from all monitors in the network were reviewed. Monitors from the Nogales area are summarized in the table in the Background section of this assessment. Pursuant to 40 CFR 50.14(c)(3)(iii)(C), the "Historical Distribution" Table in Figure 1 has been included to demonstrate that the event is associated with measured concentrations in excess of normal historical fluctuations, including background (i.e., concentrations greater than the 95th percentile).

4. Examine the meteorological conditions before and during the event. Figure 1 includes a map showing the terrain and drainage patterns in the Nogales area. Cold air forming in the mountains south of the border flows northward into the Santa Cruz River Drainage Basin. National Weather Service (NWS) data from the Nogales

Airport, northeast of the city, showed calm to light and variable winds in the early morning hours. The data from ADEQ's wind monitor are also included in Figure 1. The NWS and ADEQ wind data show nearly calm conditions during the evening of December 31st and early morning hours of January 1st. These data also show that these very light winds contained a southerly component. During this period of light, southerly winds, PM₁₀ and PM_{2.5} concentrations peaked at the Nogales Post Office monitoring location. As daytime heating commenced in the late morning hours of January 1st, diurnal surface winds shifted out of the east / northeast, resulting in a sudden decrease in PM₁₀ and PM_{2.5} concentrations. It appears the source was coming from Mexico, since there are no sources in the United States between the monitor and the border.

5. Perform a qualitative attribution to emission source(s). All evidence indicates the elevated PM₁₀ and PM_{2.5} concentrations in the Nogales, Arizona area can be attributed to smoke emissions from sources south of Nogales, Arizona in Nogales, Sonora. The data available for this analysis do not allow for development of a source specific emission allocation. The hourly concentration data do not show any significant source other than the drainage smoke associated with the event.

6. Estimation of Contribution from Source or Event. The primary source appears to be drainage smoke from Mexico for which there is no effective or efficient method to estimate the relative contributions from specific sources. The demonstration analysis contained in this report establishes the linkage between the measurements to be flagged and the event, thus satisfying the requirement in 40 CFR 50.14(c)(3)(iii)(B). Pursuant to 40 CFR 50.14(c)(3)(iii)(D), the "Event Contrib. Analysis" Table in Figure 1 has been included to demonstrate that there would have been no exceedances or violations but for the event (i.e., the contribution during the event overwhelmed the 24-hour averages).

7. Determination that a Natural or Exceptional Event Contributed To an Exceedance. Based on this analysis, the event satisfies the requirement in 40 CFR 50.1(j) that the elevated concentrations at the Nogales Post Office monitors were attributed to an exceptional event caused by international transport of emissions into the United States.

Conclusion

International transport of emissions. The elevated PM₁₀ and PM_{2.5} event on January 1, 2008, in Nogales, Arizona was the result of emissions from Mexico which were transported into the United States in a slow moving drainage flow originating in the mountains south of Nogales, Sonora. The fact that all appropriate SIP control measures were in place and emissions from international transport caused the exceedance demonstrates, per 40 CFR

50.1(j), that the event "is not reasonably controllable or preventable." The "other" (RL and IL) flag were applied to the PM_{2.5} measurements, as the monitors would have been below the NAAQS but for the contribution of the event. (All data regardless of the type of monitor were impacted by international transport. The "IL" flag was applied to the PM_{2.5} BAMS monitor since the "RL" flag could not be set.)