Missouri Department of Natural Resources

National Ambient Air Quality Standards-Particulate Matter Less Than Ten Microns

Particulate Matter Less Than Ten Microns (PM_{10}) is defined as inhalable particles that are less than ten microns in diameter. PM_{10} that is generated at industrial sites or along roadways can be comprised of various materials including soil, dust, metals, acids (nitrates and sulfates) or organic chemicals. On June 14, 2012, the Environmental Protection Agency decided to retain the existing primary PM_{10} National Ambient Air Quality Standards, NAAQS, at 150 $\mu g/m^3$ for the 24-hour averaging period, refer to Table 1. The annual PM_{10} standard was revoked in actions taken on July 18, 1997 and is no longer considered for NAAQS compliance purposes.

Table 1
PM_{10} NAAQS

Pollutant	Averaging Time	NAAQS	Comment
		($\mu g/m^3$)	
PM_{10}	24-Hour	150.0	Not to be exceeded more than once per year on average over three years

Table 1 is the actual form of the standard and monitored compliance with the 24-hour NAAQS is demonstrated when no more than one exceedance per year occurs on average over a three year period. Modeled compliance, on the other hand, is based upon a five year average; as such, the highest, sixth high concentration over the five year period under consideration is used for comparison to the NAAQS for PM_{10}. The Environmental Protection Agency has indicated that the use of the five years of data does not result in biased model results and should be used for NAAQS compliance purposes, refer to Section 8.3.1.2 of Appendix W to Part 51 which states "[T]he use of 5 years of NWS [National Weather Service] meteorological data or at least 1 year of site specific data is required."

If a facility is required to conduct an air quality analysis for PM_{10}, the analysis must include the emissions from the proposed source, existing "interactive" sources and monitored background concentrations. The modeled emission rates must reflect the maximum allowable operating conditions for each source based upon federally enforceable emission limits and operating level(s).

IMPORTANT! **All** permit applicants that trigger a full impact analysis for PM_{10} must demonstrate compliance with the NAAQS based upon the total amount of particulate matter that is emitted from the facility, including the condensable fraction.

If the predicted impact due to the proposed source, interactive sources and the monitored background value is below the NAAQS for the 24-hour averaging period, compliance has been demonstrated and no further analysis for the PM_{10} NAAQS will be necessary.

If violations of the PM_{10} NAAQS are predicted to occur at one or more receptors, the applicant will be required to determine if the proposed project or modification has a significant ambient impact. If the source can demonstrate that it does not have a significant impact on a violating receptor(s), measured in time and space, a permit can be issued without further review of the standards. If the source cannot demonstrate less than significant impacts, the facility must consider emission limits, the installation of controls or other measures in order to reduce its ambient impact at violating receptors.

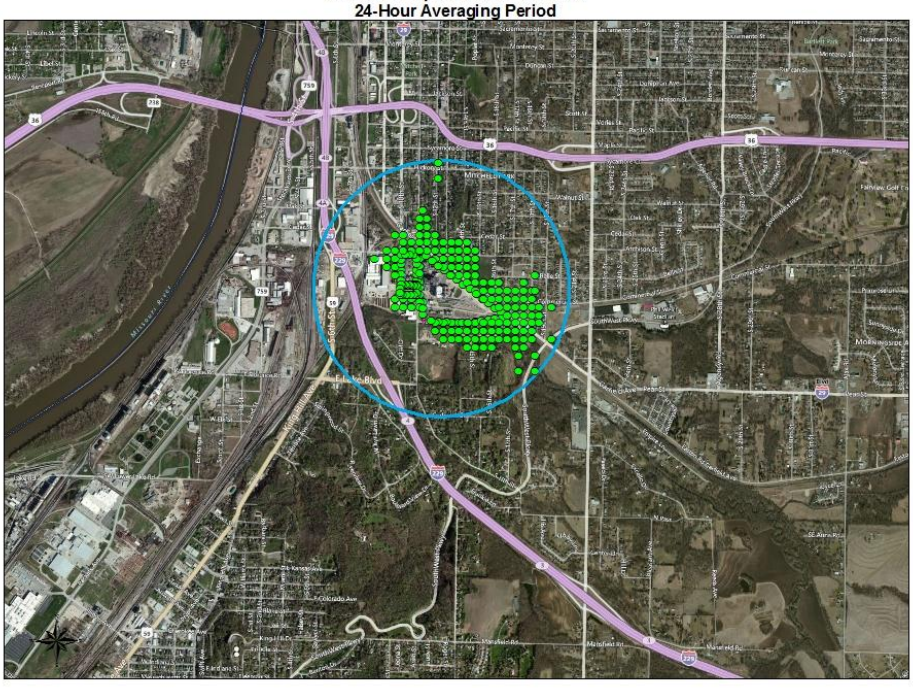
The following paragraphs provide a hypothetical example of a NAAQS evaluation for PM_{10}. The data describes a basic situation and is not meant to address all modeling scenarios and/or issues that might arise during the review process.

Example NAAQS Demonstration

Facility A is proposing to install a food processing facility at an existing site. Based upon the emissions from the worst case operating load, the preliminary impact analysis indicates that Facility A's radius of impact extends 0.84-kilometers beyond the center of the proposed facility, refer to Figure 1. Because the ambient impact due to the proposed construction exceeds the 24-hour significant impact threshold of 5.0 $\mu g/m^3$, a full impact analysis is required and must include an evaluation of compliance with the NAAQS.

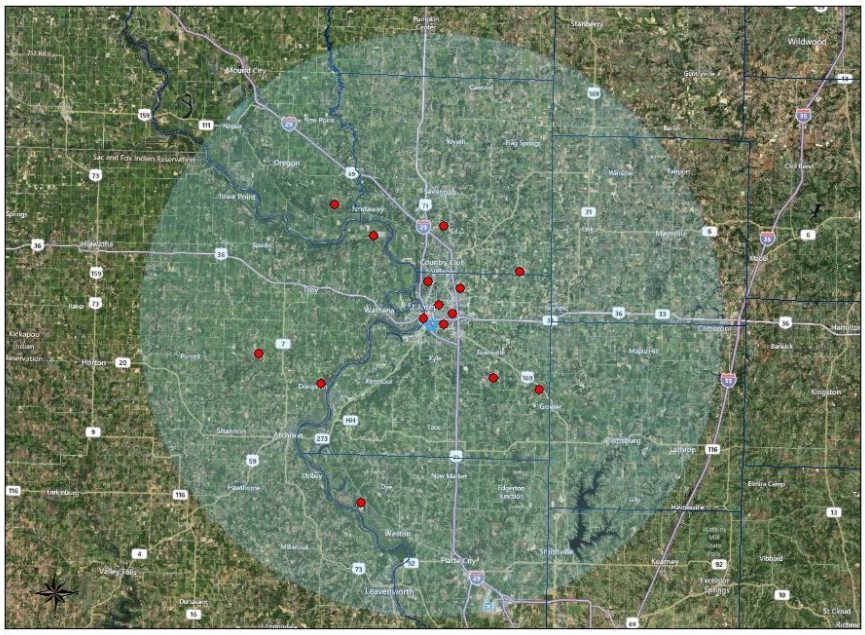
As noted in the introduction, NAAQS compliance is based upon the impact due to the combination of the emissions from the proposed source, existing "interactive" sources and monitored background concentrations. In order to determine the impact due to the proposed source and interactive sources, the emissions from Facility A and existing PM_{10} sources were explicitly modeled. The monitored background value was obtained from a representative monitoring site.

Figure 1
PM_{10} Significant Impact Determination
Radius of Impact-0.84-Kilometers
24-Hour Averaging Period



The radius of impact due to the proposed project determined what sources were explicitly modeled for compliance purposes. Facility A is undergoing a Prevention of Significant Deterioration (PSD) review and; as such, the air quality analysis considered any emission source that could significantly impact the air quality within the region of Facility A, i.e. 50-kilometers beyond the furthest extent of the significant impact area, refer to Figure 2.

Figure 2
PM_{10} Prevention of Significant Deterioration Domain
Interactive Source Inventory Development



Emission rates and release parameters for each source within the inventory were input into the air quality model. The combined ambient impact due to the modeled sources were calculated and output on a receptor by receptor basis for use in the compliance demonstration. It is important to note that the model outputs do not include the monitored background concentration; this value must be added to the model predictions prior to determining compliance with the NAAQS. Table 2 contains the model outputs for a sampling of receptors that were evaluated for this example.

Table 2 PM_{10} NAAQS Compliance Determination						
24-Hour Averaging Period *(NAAQS = 150.0 µg/m³)*						
Easting	Northing	Elevation	Hill	High Sixth High (2005-2009)	Background	NAAQS
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(µg/m³)*	*(µg/m³)*	*(µg/m³)*
				(H6H)	*(Monitored)*	*(H6H)*
341400.00	4400300.00	254.30	272.00	122.15	36.00	158.15
341100.00	4399600.00	271.60	317.00	121.06	36.00	157.06
341656.64	4400414.62	253.90	253.90	119.93	36.00	155.93
341763.80	4400623.97	256.03	256.03	115.00	36.00	151.00
341741.64	4400623.97	256.03	256.03	114.97	36.00	150.97
339500.00	4396000.00	253.60	253.60	114.11	36.00	150.11
341778.30	4400850.50	257.50	301.00	113.54	36.00	149.54
337500.00	4403000.00	244.00	244.00	113.44	36.00	149.44
341668.22	4400594.49	256.03	256.03	112.50	36.00	148.50
341763.80	4400436.00	256.95	256.95	97.03	36.00	133.03

The first four columns contain information regarding the location of the receptor under review, followed by the predicted concentration from the dispersion model for the five year period under consideration. The high, sixth high concentration for the five-year period was obtained and added to the monitored background number. The sum represents the total concentration that should be compared to the NAAQS in order to determine compliance. Based upon the results contained within Table 2, the first six concentrations for the 24-hour averaging period exceed the NAAQS of 150.0 µg/m^3. Because NAAQS violations are predicted to occur, the analysis must go one step further to determine if Facility A has a significant impact on a violating receptor, refer to Table 3.

Table 3 PM_{10} NAAQS Violations vs. Significant Impact					
24-Hour NAAQS (150.0 µg/m³) vs. Significance (5.0 µg/m³)					
Easting	Northing	Elevation	Hill	NAAQS	Significant Impact Concentration
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(µg/m³)*	*(µg/m³)*
				(H6H)	*(H1H)*
341400.00	4400300.00	254.30	272.00	158.15	3.28
341100.00	4399600.00	271.60	317.00	157.06	0.94
341656.64	4400414.62	253.90	253.90	155.93	5.77
341763.80	4400623.97	256.03	256.03	151.00	8.35
341741.64	4400623.97	256.03	256.03	150.97	7.49
339500.00	4396000.00	253.60	253.60	150.11	0.38

Facility A had a significant impact on three of the violating receptors; as such, it must be determined if the significant impact occurs at the same time as a violation. In order to demonstrate that a significant impact does not occur at the same time as a violation, the applicant must determine the ambient concentration for each 24-hour period in the year due to

the proposed project (significance analysis) and due to all sources (NAAQS analysis). Table 4 contains sample output from a time of day evaluation.

Table 4
PM_{10} Time of Day Evaluation

Easting	Northing	Elevation	Hill	First High Modeled NAAQS Concentration	Background	NAAQS	Significant Impact Concentration	Date
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*(YYMMDDHH)*
341656.64	4400414.62	253.90	253.90	7.67	36.00	43.67	0.77	05010124
341763.80	4400623.97	256.03	256.03	11.53	36.00	47.53	0.67	05010124
341741.64	4400623.97	256.03	256.03	11.43	36.00	47.43	0.74	05010124
341656.64	4400414.62	253.90	253.90	2.62	36.00	38.62	0.03	05010224
341763.80	4400623.97	256.03	256.03	2.62	36.00	38.62	0.03	05010224
341741.64	4400623.97	256.03	256.03	2.64	36.00	38.64	0.02	05010224
341656.64	4400414.62	253.90	253.90	3.83	36.00	39.83	0.04	05010324
341763.80	4400623.97	256.03	256.03	3.80	36.00	39.80	0.03	05010324
341741.64	4400623.97	256.03	256.03	3.95	36.00	39.95	0.03	05010324
341656.64	4400414.62	253.90	253.90	2.16	36.00	38.16	0.03	05010424
341763.80	4400623.97	256.03	256.03	2.16	36.00	38.16	0.03	05010424
341741.64	4400623.97	256.03	256.03	2.20	36.00	38.20	0.03	05010424

Based upon the time of day evaluation, Facility A did not have a significant impact at the same time that a violation occurred; as such, no further analysis is necessary and NAAQS compliance has for Facility A has been demonstrated.