Missouri Department of Natural Resources

Increment Standards-Particulate Matter Less Than Two and One-Half Microns

Particulate Matter Less Than Two and One Half Microns ($PM_{2.5}$) consists of particles that are less than two and one half microns in diameter. $PM_{2.5}$ is generated from various sources including the combustion of fuel, fires, industrial processes and vehicles. The scope of this document is limited to a discussion on demonstrating compliance with the increment standards. For a general discussion on increment, please refer to the document entitled "Increment Standards."

The major source baseline date and the trigger date for $PM_{2.5}$ were established in final rulemaking dated September 30, 2010. Based upon this rulemaking, the major source baseline date was established as the date upon which the final rule was published on October 20, 2010. The trigger date became effective one year after the baseline date on October 20, 2011. To date, the minor source baseline date has not been triggered within of the State of Missouri. As defined within Section 107 of the Clean Air Act, the air quality control regions for $PM_{2.5}$ are based upon individual county boundaries. As such, the first Prevention of Significant Deterioration permit that is received will trigger the minor source baseline date for the county in which it is located and any adjacent county where a significant ambient impact is predicted to occur on an annual basis. If the impact area is limited to the county where the facility will be located, the baseline date will be triggered for that county only.

Compliance with the 24-hour Class II increment standard for $PM_{2.5}$ is based upon the second highest concentration that is predicted to occur at each receptor within the modeling domain. The 24-hour standard can be exceeded once per year. Conversely, the annual increment standard for $PM_{2.5}$ cannot be exceeded and is based upon the maximum annual concentration that is predicted to occur at each receptor within the modeling domain, refer to Table 1.

Table 1
Class II Increment Standard-$PM_{2.5}$

Pollutant	Averaging Time	Increment	Comment
		($\mu g/m^3$)	
$PM_{2.5}$	24-Hour	9	Not to be exceeded more than once per year
$PM_{2.5}$	Annual	4	Not to be exceeded

If the predicted impact due to the proposed source and interactive sources is below the Class II increment standards for the 24-hour and annual averaging periods, compliance has been demonstrated and no further analysis for the $PM_{2.5}$ increment standards will be necessary.

If, on the other hand, violations of the $PM_{2.5}$ increment standards 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 standard. 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 Class II increment evaluation for $PM_{2.5}$. 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 Increment 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 (project emissions only), indicates that Facility A's radius of impact extends 0.84-kilometers beyond the center of the proposed facility, refer to Figure 1.

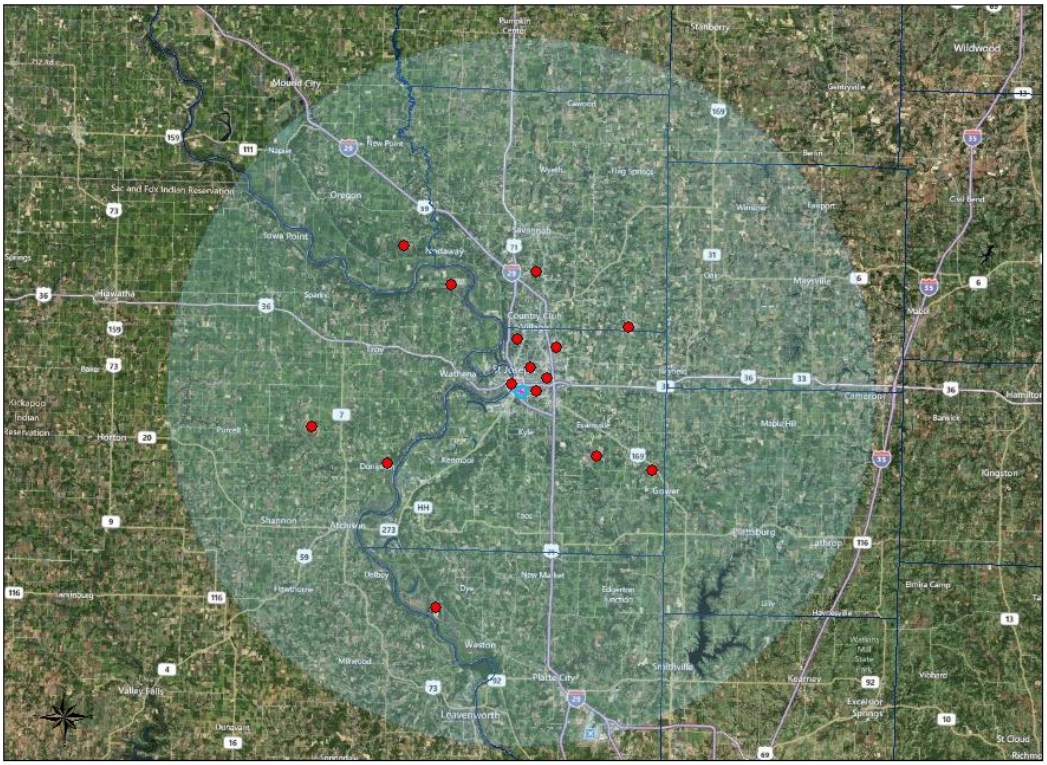
Figure 1
$PM_{2.5}$ Significant Impact Determination
24-Hour and Annual Significant Impact Comparison

Because the ambient impact due to the proposed construction exceeds the 24-hour and annual significant impact thresholds of 1.2 and 0.3 $\mu g/m^3$, a full impact analysis is required and must include an evaluation of compliance with the increment standards.

As noted in the introduction, increment compliance is based upon the impact due to the combination of the emissions from the proposed source and existing "interactive" sources. In order to determine the impact due to the proposed source and interactive sources, the emissions from Facility A and existing $PM_{2.5}$ sources must be explicitly modeled and compared to the increment standard. The radius of impact due to the proposed project determined what sources were explicitly modeled for compliance purposes. The air quality analysis must consider

any emission source that could consume increment within the significant impact area of the facility under consideration, refer to Figure 2.

Figure 2
$PM_{2.5}$ 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. Table 2 contains the model outputs for a sampling of receptors that were evaluated for this example.

Table 2 $PM_{2.5}$ Increment Compliance Determination										
24-Hour Averaging Period *(Increment = 9.0 μg/m³)*										
Easting	**Northing**	**Elevation**	**Hill**	**2003**	**2004**	**2005**	**2006**	**2007**	**2nd High**	**Increment**
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*
				(H2H)	*(H2H)*	*(H2H)*	*(H2H)*	*(H2H)*	*(H2H)*	*(H2H)*
340800.00	4399700.00	247.60	315.00	8.980	7.303	11.686	12.408	10.544	12.408	9
341656.60	4400390.80	253.90	253.90	4.380	3.698	4.676	4.437	10.940	10.940	9
341656.60	4400375.90	255.12	255.12	3.523	3.365	6.756	4.418	10.809	10.809	9
340900.00	4399800.00	247.90	315.00	7.080	8.708	8.811	10.268	10.022	10.268	9
340500.00	4400000.00	247.70	247.70	7.592	8.504	9.637	10.175	9.731	10.175	9
346500.00	4398500.00	302.60	302.60	7.844	7.514	7.989	7.992	7.716	7.992	9
341675.20	4400375.90	255.12	255.12	2.496	2.191	3.482	3.158	7.466	7.466	9
Annual Averaging Period *(Increment = 4.0 μg/m³)*										
Easting	**Northing**	**Elevation**	**Hill**	**2003**	**2004**	**2005**	**2006**	**2007**	**Max**	**Increment**
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*	*(μg/m³)*
				(H1H)	*(H1H)*	*(H1H)*	*(H1H)*	*(H1H)*	*(H1H)*	*(H1H)*
341400	4400600	253.2	253.2	4.280851	4.054281	4.933793	4.907395	4.992185	4.992185	4
347500	4399500	291.1	291.1	2.101226	2.75117	4.250611	4.774301	4.292148	4.774301	4
340900	4400100	250	250	1.839294	1.994571	2.571671	2.927548	2.635009	2.927548	4
338500	4398500	244	244	2.353656	2.4692	2.700961	2.470311	2.2566	2.700961	4
347500	4399000	287	287	1.348485	1.323036	1.691215	2.228329	2.08825	2.228329	4
341400	4400500	252.6	252.6	1.698725	1.736826	1.779408	1.939939	2.107931	2.107931	4
340900	4400200	251.6	251.6	1.048428	1.142491	1.718844	1.586324	1.431795	1.718844	4

The first four columns contain information regarding the location of the receptor under review, followed by the predicted concentration from the dispersion model for each year under consideration. To determine compliance with the 24-hour standard, the second highest concentration for each year was determined on a receptor by receptor basis. The maximum, second high value that was predicted across the five year period was compared to the increment standard of 9.0 μg/m^3. According to Table 2, a total of five receptors exceeded the 24-hour standard.

For the annual averaging period, the maximum concentration for the five year period was obtained and compared to the increment standard. Based upon the results contained within Table 2, the top two annual concentrations exceed the increment standard of 4.0 μg/m^3.

Because increment violations are predicted to occur, the applicant must determine if Facility A has a significant impact on a violating receptor, refer to Table 3.

Table 3 $PM_{2.5}$ Increment Violations vs. Significant Impact					
24-Hour Increment (9.0 µg/m^3) vs. Significance (1.2 µg/m^3)					
Easting	Northing	Elevation	Hill	Increment	Significant Impact Concentration
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(µg/m^3)*	*(µg/m^3)*
				(H1H)	*(H1H)*
340800.00	4399700.00	247.60	315.00	12.408	1.486
341656.60	4400390.80	253.90	253.90	10.940	1.302
341656.60	4400375.90	255.12	255.12	10.809	1.154
340900.00	4399800.00	247.90	315.00	10.268	1.105
340500.00	4400000.00	247.70	247.70	10.175	0.984
Annual Increment (4.0 µg/m^3) vs. Significance (0.3 µg/m^3)					
Easting	Northing	Elevation	Hill	Increment	Significant Impact Concentration
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(µg/m^3)*	*(µg/m^3)*
				(H1H)	*(H1H)*
341400	4400600	253.2	253.2	4.992185	0.128
347500	4399500	291.1	291.1	4.774301	0.098

For the 24-hour averaging period, Facility A had a significant impact on two 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 maximum concentration for each 24-hour period in the year due to the proposed project (significance analysis) and due to all sources (increment analysis). Table 4 contains sample output from a time of day evaluation.

Table 4 $PM_{2.5}$ Time of Day Evaluation						
Easting	Northing	Elevation	Hill	First High Modeled Increment Concentration	Significant Impact Concentration	Date
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(µg/m^3)*	*(µg/m^3)*	*(YYMMDDHH)*
341656.6	4400376	255.12	255.12	9.3262	1.18776	06010124
341656.6	4400391	253.9	253.9	6.7377	1.0282	06010124
341656.6	4400376	255.12	255.12	1.41727	0.0128	06010224
341656.6	4400391	253.9	253.9	10.3639	0.01158	06010224
341656.6	4400376	255.12	255.12	0.74915	0.23682	06010324
341656.6	4400391	253.9	253.9	0.66827	0.21572	06010324
341656.6	4400376	255.12	255.12	3.24251	0.01054	06010424
341656.6	4400391	253.9	253.9	3.64282	0.01025	06010424
341656.6	4400376	255.12	255.12	0.25698	0.01135	06010524
341656.6	4400391	253.9	253.9	0.24835	0.01104	06010524
341656.6	4400376	255.12	255.12	0.52604	0.01549	06010624
341656.6	4400391	253.9	253.9	0.53074	0.01519	06010624

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 increment compliance for Facility A has been demonstrated.