Missouri Department of Natural Resources

Increment Standards-Particulate Matter Less Than Ten Microns

Particulate Matter Less Than Ten Microns (PM_{10}) is defined as inhalable coarse particles whose size is 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. 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 1977 Clean Air Amendments established the major source baseline date for total suspended particulate as January of 1975 with a trigger date of August 1977. Subsequently, in October of 1989, the Environmental Protection Agency implemented an "Equivalent Substitution" approach in order to replace the total suspended particulate matter increment standards with new particulate standards that focused on particles whose diameters were less than ten microns in circumference. The replacement of the total suspended particulate standards was made official in Section 166(f) of the 1990 Clean Air Act Amendments. As part of this action, the Environmental Protection Agency maintained the original particulate matter baseline dates and areas established as of January 1975. The PM_{10} increment standard became effective in June of 1994.

Assuming a trigger date of August 1977, the minor source baseline date has been triggered for all of the air quality control regions (AQCRs) within the State of Missouri, refer to Figure 1. The minor source baseline dates that denote where increment is being consumed is based upon six differing dates:

- November 1977-Southeastern AQCR,
- August 1978-Southwestern AQCR,
- May 1979-St. Louis AQCR,
- September 2005-Pike and Ralls Counties AQCR,
- January 1979-Kansas City AQCR, and
- February 1978-Northern AQCR.

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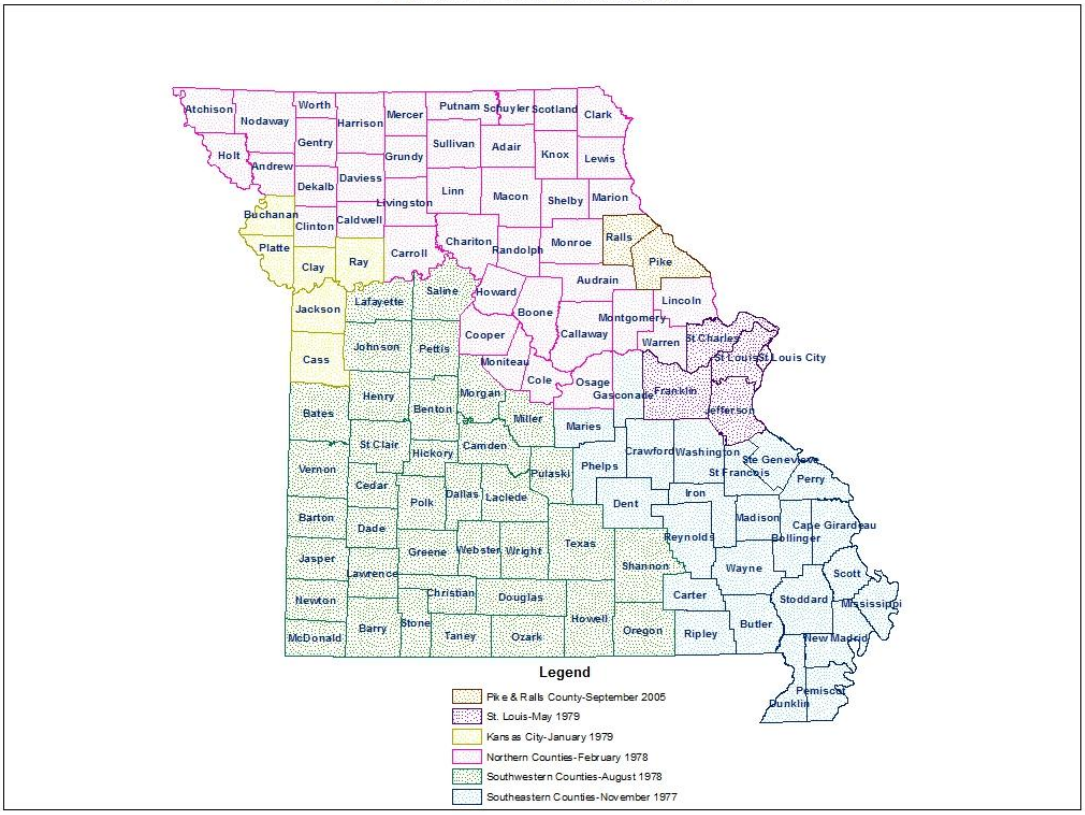
Figure 1
PM_{10} Minor Source Baseline Dates



Compliance with the 24-hour Class II increment standard for PM_{10} 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_{10} 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_{10}

Pollutant	**Averaging Time**	**Increment**	**Comment**
		($\mu g/m^3$)	
PM_{10}	24-Hour	30	Not to be exceeded more than once per year
PM_{10}	Annual	17	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_{10} increment standards will be necessary.

If, on the other hand, violations of the PM_{10} 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_{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 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 2.

Figure 2
PM_{10} Significant Impact Determination
24-Hour and Annual Significant Impact Comparison

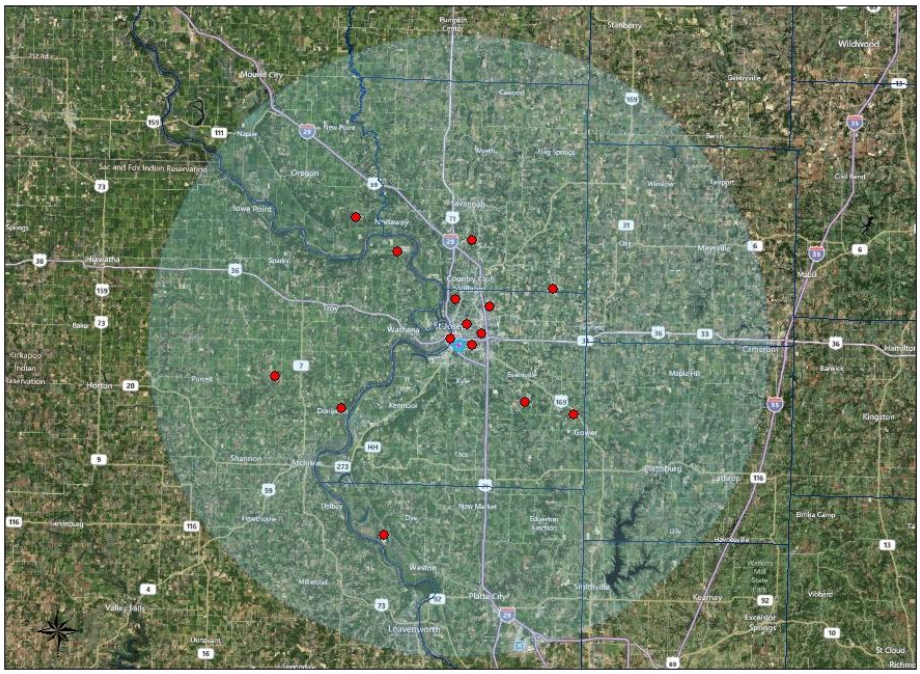
Legend

Annual Significant Impact Receptor | Annual Radius of Impact | 24-Hour Significant Impact Receptor | 24-Hour Radius of Impact | Property Boundary

Because the ambient impact due to the proposed construction exceeds the 24-hour and annual significant impact thresholds of 5.0 and 1.0 $\mu g/m^3$, 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_{10} 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 3.

Figure 3
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. Table 2 contains the model outputs for a sampling of receptors that were evaluated for this example.

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Table 2 PM_{10} Increment Compliance Determination										
24-Hour Averaging Period *(Increment = 30.0 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)*
341656.6	4400375.9	255.12	255.12	7.0464	6.72939	13.5112	8.83547	32.42667	32.42667	30.0
341656.6	4400390.8	253.9	253.9	8.75934	7.39584	9.35259	8.87318	32.82009	32.82009	30.0
340800	4399700	247.6	315	17.96091	14.60531	23.37186	24.81583	31.63314	31.63314	30.0
340900	4399800	247.9	315	21.24011	26.12503	26.43374	30.80442	30.06629	30.80442	30.0
340500	4400000	247.7	247.7	22.77688	25.51132	28.91039	30.52379	29.19259	30.52379	30.0
346500	4398500	302.6	302.6	23.53235	22.54099	23.96614	29.97665	23.14834	29.97665	30.0
341675.2	4400375.9	255.12	255.12	7.48791	6.57249	10.44737	9.47456	29.86402	29.86402	30.0
Annual Averaging Period *(Increment = 17.0 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	34.24681	32.43425	39.47034	39.25916	39.93748	39.93748	17.0
347500	4399500	291.1	291.1	16.80981	22.00936	34.00489	38.19441	34.33718	38.19441	17.0
340900	4400100	250	250	14.71435	15.95657	20.57337	23.42038	21.08007	23.42038	17.0
338500	4398500	244	244	18.82925	19.7536	21.60769	19.76249	18.0528	21.60769	17.0
347500	4399000	287	287	10.78788	10.58429	13.52972	17.82663	16.706	17.82663	17.0
341400	4400500	252.6	252.6	13.5898	13.89461	14.23526	15.51951	16.86345	16.86345	17.0
340900	4400200	251.6	251.6	8.38742	9.13993	13.75075	12.69059	11.45436	13.75075	17.0

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 30.0 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 Table 2, the top five annual concentrations exceeded the increment standard of 17.0 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_{10} Increment Violations vs. Significant Impact					
24-Hour Increment (30.0 μg/m^3) vs. Significance (5.0 μg/m^3)					
Easting	Northing	Elevation	Hill	Increment	Significant Impact Concentration
(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*(μg/m^3)*	*(μg/m^3)*
				(H1H)	*(H1H)*
341656.6	4400375.9	255.12	255.12	32.42667	5.70099
341656.6	4400390.8	253.9	253.9	32.82009	5.25508
340800	4399700	247.6	315	31.63314	0.9636
340900	4399800	247.9	315	30.80442	0.92713
340500	4400000	247.7	247.7	30.52379	1.57448
Annual Increment (17.0 μg/m^3) vs. Significance (1.0 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	39.93748	0.12815
347500	4399500	291.1	291.1	38.19441	0.00292
340900	4400100	250	250	23.42038	0.04456
338500	4398500	244	244	21.60769	0.00674
347500	4399000	287	287	17.82663	0.00408

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_{10} 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	6.3262	3.48776	06010124
341656.6	4400391	253.9	253.9	6.7377	3.8282	06010124
341656.6	4400376	255.12	255.12	1.41727	0.0128	06010224
341656.6	4400391	253.9	253.9	1.3639	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.