Missouri Department of Natural Resources

Nitrogen Dioxide Significant Impact Determination

Nitrogen dioxide (NO_2) is one component of a group of highly reactive gases known as oxides of nitrogen (NO_x). NO_2 rapidly forms in the atmosphere due to the release of emissions from vehicles, combustion processes and off-road equipment.

If a construction project triggers the need for an ambient air quality impact analysis, the applicant must perform an initial assessment, or preliminary impact analysis, to determine if a full impact analysis is necessary. The preliminary impact analysis should only consider the potential emissions due to the proposed construction or the net emissions increase due to a modification. The results obtained from the preliminary impact analysis will be used to determine if the applicant can avoid a detailed, cumulative air quality analysis that requires an assessment of compliance with the National Ambient Air Quality Standards (NAAQS) and the Prevention of Significant Deterioration (PSD) increment standards. Initially, the preliminary impact analysis will be used to answer the following questions:

1. Does the ambient concentration due to the proposed project exceed the significant impact levels?
2. Does the ambient concentration due to the proposed project exceed the significant monitoring thresholds (applies to PSD permit applications only)?
3. If a significant impact is predicted to occur, what is the furthest extent of the significant impact area?

NO_2 is said to have a significant impact if the five year average of the maximum concentrations for the 1-hour averaging period or the maximum annual average concentration exceeds the thresholds contained within Table 1.

Table 1
NO_2 Significant Impact Thresholds

Pollutant	Averaging Time	Significant Impact Level	Comment
		($\mu g/m^3$)	
NO_2	1-Hour	7.55 (4 parts per billion)*	The Multiyear Average of the Highest 1-Hour Value at Each Receptor
NO_2	Annual	1.0	Maximum Annual Impact

**Interim Significant Impact Level per EPA guidance document entitled "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program" assuming 25 degrees Celsius and 760 millimeters of mercury (53 ppb = 100 $\mu g/m^3$)*

It is important to note that the 1-hour significant impact level for NO_2 is based upon a multiyear average of the highest 1-hour values at each receptor rather than the maximum, first high impact at each receptor. The use of the multiyear average is based upon the March 1, 2011 guidance document from the Environmental Protection Agency entitled "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 National Ambient Air Quality Standard." This document states that the determination of significant impact should be based upon an average of the annual distribution of daily maximum 1-hour values to reflect the form of the NAAQS standard. The annual significant impact level continues to be based upon the overall, maximum annual impact on a

receptor by receptor basis. Unlike the 1-hour averaging period, the concentrations for the annual averaging period should not be averaged over the five year period.

For example, Table 2 contains a sample summary of 1-hour NO_2 concentrations obtained over a five-year period. The first four columns contain a description of the receptor data that denotes the location of the receptor followed by the predicted concentration due to the construction of a NO_2 source for each year modeled. The last column contains the multiyear average for the five-year period. The multiyear average determines if a significant ambient impact occurred for the 1-hour averaging period.

Table 2
Example 1-Hour NO_2 Significant Impact Determination

Receptor Data					Maximum 1-Hour Concentration					Multiyear Average
Receptor #	**Easting**	**Northing**	**Elevation**	**Hill Hgt**	**2005**	**2006**	**2007**	**2008**	**2009**	**5-Year Average**
	(Meters)	***(Meters)***	***(Meters)***	***(Meters)***	***($\mu g/m^3$)***	***($\mu g/m^3$)***	***($\mu g/m^3$)***	***($\mu g/m^3$)***	***($\mu g/m^3$)***	***($\mu g/m^3$)***
1	740500	4223200	124.19	220.31	4.958156	7.770907	7.636872	10.19683	13.87681	8.887914
2	740500	4223100	119.57	220.31	4.899004	7.869608	7.275533	10.23368	13.79228	8.8140216
3	740500	4223000	119.73	232.45	4.870075	8.028838	6.982549	10.32657	13.77559	8.7967244
4	740400	4223100	120.39	239.25	4.766516	7.573929	7.266455	10.55234	13.65421	8.7626908
5	738300	4222500	177.86	231.9	7.31702	7.769094	8.856696	6.369357	7.339911	7.5304156
6	742700	4222900	117.33	117.33	6.143518	5.307496	9.046806	8.944531	8.203999	7.52927
7	743100	4223000	114.76	114.76	5.748597	5.729507	8.858939	8.814608	8.49377	7.5290842
8	740900	4223500	113.86	113.86	4.822196	6.926244	6.776129	7.503318	11.6162	7.528818
9	738000	4220500	126.43	126.43	8.204233	7.61187	5.714349	8.511988	7.573838	7.5232556
10	738300	4220300	120.63	275.56	5.410657	7.781389	8.190596	7.211781	8.445436	7.4079718
11	738722.2	4218747	225.4	282.43	9.697253	5.041271	5.589094	9.863495	6.356561	7.3095348
12	738000	4220300	124.13	275.56	5.764435	7.078492	7.72701	7.54561	7.902521	7.2036136
13	737747.4	4219350	133.21	269.78	4.573254	7.669438	7.915684	8.215625	7.17451	7.1097022
14	742700	4219500	169.51	195.97	5.226256	8.29895	7.255299	8.423581	6.343284	7.109474
15	742500	4219400	173.69	214.79	5.322323	9.103639	5.898299	8.269765	6.485623	7.0159298
16	741400	4223400	116.13	117.21	5.850678	5.074955	7.419041	9.588989	6.113863	6.8095052
17	743800	4221600	117.54	117.54	5.588388	7.9769	5.906676	8.187326	6.30392	6.792642
18	744100	4222900	117.03	117.03	5.678394	5.7823	7.892094	7.510133	7.098849	6.792354

Based upon the 5-year average, Receptor #'s 1-9 exceed the 1-hour significant impact threshold of 7.55 $\mu g/m^3$.

Table 3 provides an example of the annual significant impact determination. As noted previously, the annual significant impact determination is based upon the maximum impact that was predicted over the five year period, not the average of the values over the five year period.

Table 3
Example Annual NO_2 Significant Impact Determination

Receptor Data					Maximum Annual Concentration					
Receptor #	**Easting**	**Northing**	**Elevation**	**Hill Hgt**	**2005**	**2006**	**2007**	**2008**	**2009**	**Max Impact**
	(Meters)	*(Meters)*	*(Meters)*	*(Meters)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*	*($\mu g/m^3$)*
1	741040.3	4222332	118.3	211.26	1.37501	1.60945	2.14145	1.06627	0.91374	2.14145
2	741081.1	4222249	120.78	211.26	1.34819	1.61872	2.16673	1.06163	0.87258	2.16673
3	740958.8	4222498	118.16	220.31	1.40046	1.59837	2.02267	1.05488	0.97593	2.02267
4	741000	4222500	113.55	220.31	1.37949	1.57364	2.0233	1.06383	0.96585	2.0233
5	741123.6	4222177	121.12	211.26	1.30151	1.61581	2.14058	1.04329	0.8237	2.14058
6	740800	4222700	113.55	220.31	1.31538	1.51521	1.71123	0.92156	0.94295	1.71123
7	741000	4223800	113.84	113.84	1.0734	1.18316	1.21025	0.88563	0.9191	1.21025
8	740400	4222800	119.69	239.25	1.05635	1.21691	1.30343	0.66143	0.71373	1.30343
9	741600	4224400	116.95	124.12	0.96506	0.99777	1.14451	0.94628	0.89698	1.14451
10	741500	4224400	116.11	116.11	0.97232	1.01517	1.12635	0.92949	0.89933	1.12635
11	741800	4224300	117.19	117.19	0.94002	0.96407	1.19183	0.96809	0.87652	1.19183
12	742000	4222700	113.55	113.55	0.86626	1.14221	1.31078	0.89819	0.72214	1.31078
13	742000	4222500	118.4	118.4	0.84306	1.18974	1.28194	0.86947	0.71277	1.28194
14	740300	4222800	119.66	239.25	0.98622	1.12956	1.23617	0.62052	0.65015	1.23617
15	738633.6	4219759	171.32	275.56	0.80616	0.8809	1.25631	0.74991	0.81812	1.2563
16	740500	4223900	113.9	113.9	0.89811	0.99293	0.96862	0.69186	0.72131	0.99293
17	742250	4225500	117.04	117.04	0.75948	0.75761	0.88888	0.81029	0.73893	0.88888
18	742600	4222500	118.73	118.73	0.65056	0.60423	0.51568	0.66386	0.63649	0.66386

Based upon the 5-year maximum, Receptor #'s 1-15 exceed the annual significant impact threshold of 1.00 $\mu g/m^3$.

If it is determined that a significant impact will take place for either averaging period, the applicant must determine the radius of impact due to the construction of the proposed project or modification. This information will be used to determine the extent of the model domain for the cumulative impact assessment and will aid in interactive source inventory development.

The radius of impact, commonly referred to as the significant impact area, is the circular area whose radius extends from the center of the facility to the most distant receptor where a significant impact is predicted to occur, or 50-kilometers, whichever is less. In order to determine the furthest extent of the impact area, each averaging period must be reviewed. For example, the model output for a new construction project indicates that the significant impact for the 1-hour averaging period occurs out to a distance of 4.52-kilometers from the source and out to a distance of 3.38-kilometers from the same source for the annual averaging period. The NO_2 radius of impact for the project becomes 4.52-kilometers because this is the largest area of impact that is predicted to occur; refer to Figure's 1, 2 and 3.

Figure 1
NO_2 Significant Impact Determination
Radius of Impact-4.52-Kilometers
1-Hour Averaging Period

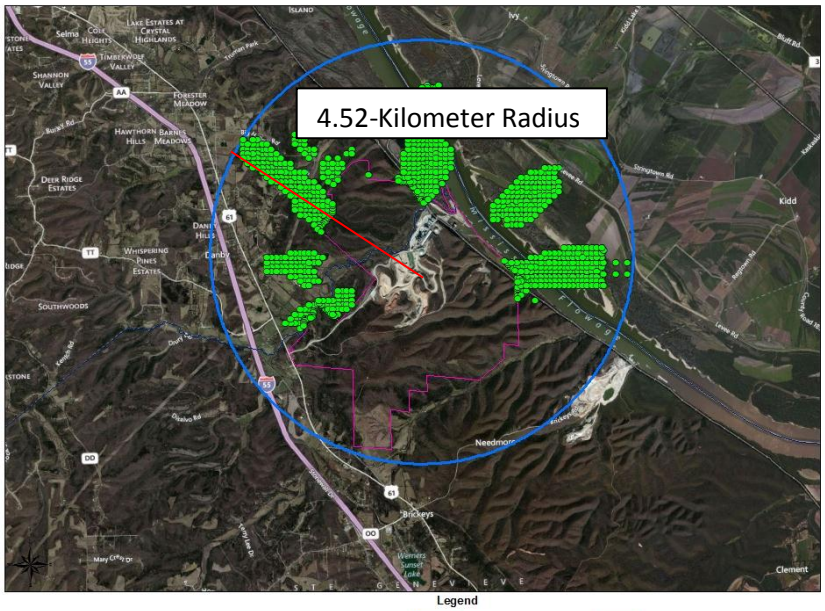


Figure 2
NO_2 Significant Impact Determination
Radius of Impact-3.38-Kilometers
Annual Averaging Period

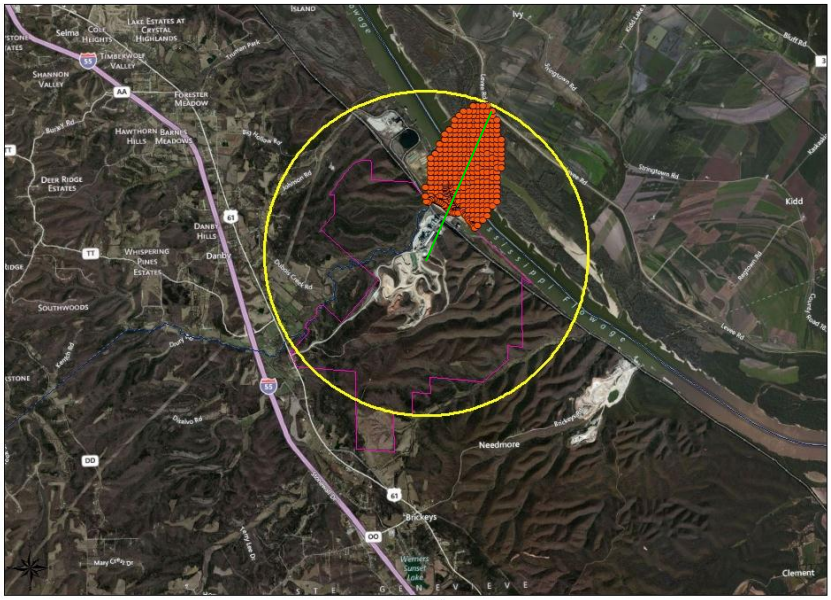
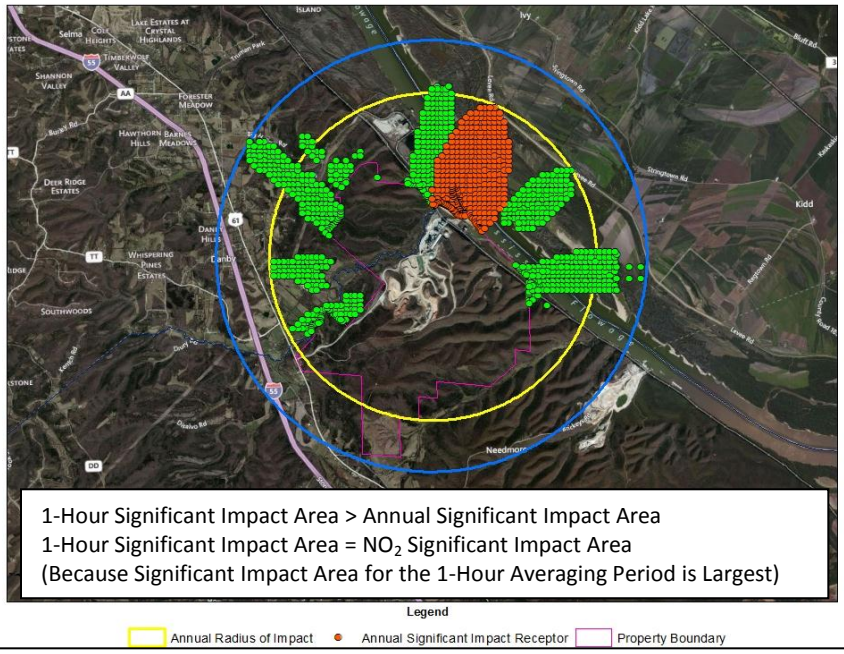


Figure 3
NOx Significant Impact Determination
1-Hour & Annual Significant Impact Comparison



Legend

Annual Radius of Impact · Annual Significant Impact Receptor · Property Boundary

It is important to note that the determination of ambient impact due to new source or modification must consider quantifiable point source releases and fugitive source releases.

IMPORTANT!!! If a significant impact is predicted to occur and a ***Section 8,*** major source permit is being sought, the applicant must determine if pre-construction monitoring will be required. Part D, of the 1977 Clean Air Act Amendments, requires PSD applicants to collect site-specific monitoring data for NO_2 if the significant monitoring threshold of 14 $\mu g/m^3$ is exceeded for the annual averaging period. The primary objective of the data collection effort is to ensure that the existing air quality within the region is in compliance with the NAAQS.

The applicant must collect a minimum of one-year of data if it is determined that preconstruction monitoring is required. Additional information regarding preconstruction data collection efforts can be found at the following link: Preconstruction Monitoring Requirements.

In addition, if the proposed NO_2 emissions exceed 100 tons per year, the applicant must submit preconstruction monitoring data for a full ozone season that spans the period from April 1st through October 31st. It is important to note that preconstruction ozone monitoring should be collected continuously for one entire ozone season. Data collection efforts that do not span a single ozone season must be continued the following year for the entire season. For example, if the monitoring study began in July 2013, the applicant would have to collect data from July 2013-October 2013 and April 2014-October 2014.