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IDEM Air Quality Modeling Policies

Introduction

This policy provides the Indiana Department of Environmental Management’s (IDEM’s) requirements for Major Source Prevention of Significant Deterioration (PSD) modeling, non-attainment New Source Review (NSR) modeling, and Hazardous Air Pollutants (HAPs) emissions modeling.

This Modeling Guidance outlines current IDEM air quality modeling policies and does not supersede any state or federal rules. This guidance is to be used as a supplement to the United States Environmental Protection Agency (U.S. EPA) Guideline on Air Quality Models, Appendix W (see Reference 1), which identifies air quality modeling procedures U.S. EPA considers acceptable. IDEM follows all air quality modeling procedures established in the U.S. EPA guidelines for PSD, NSR, and State Implementation Plan (SIP) revisions.

Modeling is necessary to demonstrate that proposed facilities or modifications to existing facilities required to obtain air construction and operating permits will not cause or significantly contribute to a violation of National Ambient Air Quality Standards (NAAQS) or PSD increments. There may be certain modeling situations that will need a case-by-case assessment for resolution of an issue. If that is the situation, consultation with IDEM is necessary to determine what has to be done before any modeling is completed and submitted to the agency.

A source applying for a new PSD permit or modification is required to perform modeling when the potential to emit (PTE), that is the maximum capacity of a source or major modification to emit a pollutant under its physical and operational design, is over the thresholds used to determine PSD applicability (326 IAC 2-2-2) (see Reference 2).

For new sources, the PTE must be greater than 100 or 250 tons per year, depending on the source category, to require PSD modeling. If an existing source is already major (a PSD source), any modification involving any criteria pollutant must exceed the Significant Emission Rates (SER) to make it a major modification. Existing sources proposing major modifications must conduct PSD modeling. Potential emissions after controls are used for these determinations.

HAPs are also modeled for PSD sources, as well as for minor sources, for potential health impacts associated with HAPs emissions. A source is major for HAPs if its PTE emissions equal or exceed 10 tons/year for any single HAP or equal or exceed 25 tons/year for all HAPs combined.

Definitions

AERMIC – American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee.

AERMAP – A terrain data preprocessor that incorporates complex terrain using U.S. Geological Survey (USGS) digital elevation data.
AERMET – A meteorological data preprocessor that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts.

AERMOD – American Meteorological Society/Environmental Protection Agency Regulatory Model - The U.S. EPA approved regulatory dispersion model designed by AERMIC.

AERSURFACE – A surface characteristics preprocessor.

BPIP PRIME – A multi-building dimensions program incorporating the GEP technical procedures for PRIME applications.

AERMINUTE – A preprocessor to AERMET to read 1-minute and optionally, 5-minute Automated Surface Observation Station (ASOS) data to calculate hourly average winds for input into AERMET.

AERSCREEN – Screening version of AERMOD; conservative, for less refined analysis.

CALPUFF – An alternative model that may be applied when assessment is needed of reasonably attributable haze impairment or atmospheric deposition due to one source or a small group of sources. U.S. EPA approval is required for CALPUFF use.

Downwash – Turbulent wakes downwind of building structures can affect pollutant concentrations from releases near these structures.

Good Engineering Practice (GEP) – Stacks should comply with GEP requirements established in 326 IAC 1-7-4.

Inventory – Emissions from either NAAQS or PSD increment sources that are examined for significant impact out to a distance equal to 50 km plus the radius of the distance of the significant area.

MET Data – Meteorological Data.

MERPs – Model Emissions Rates for Precursors.

NAAQS – National Ambient Air Quality Standards.

Potential to Emit (PTE) – The maximum capacity of a source or major PSD modification to emit a pollutant under its physical and operational design.

PSD Increment – The maximum increase of a modeled pollutant concentration that is allowed to occur above a baseline concentration for PM$_{10}$, SO$_2$, and NO$_2$, which results from emission increases and decreases at major stationary sources after the baseline date. See 326 IAC 2-2-6.

PSD Major Modification – An existing PSD major source whose modification involves any NAAQS pollutant exceeding the de minimis significant emission levels to make it a major modification. See 326 IAC 2-2-1.

PSD Major Source – A new source whose potential emissions after controls are greater than 100 or 250 tons per year depending on the source category.

Receptor Grid – A network of organized points placed beyond the property boundary of the applicant used to define air quality concentrations.
**Significant Emissions Rate (SER)** – Defines the rate at which a net emissions increase of a pollutant will trigger major NSR permitting requirements. Any lower emissions increases are considered de minimis.

**Significant Impact Area (SIA)** – A circular area with a radius extending out to the most distant point where the modeling predicts a significant ambient impact, not to exceed 50 km. This is the geographical area for the NAAQS and PSD increment analysis. It is based on modeling the proposed major new source or modification only.

**Significant Impact Level (SIL)** – A reference concentration for each pollutant used to determine the significant impact area from the new or modified source. Each pollutant for each relevant time-averaging period is modeled and compared to its significant impact level. For those below this level, further refined modeling is not required.

**VISCREEN** – Visibility Screening Model.

**Major Source PSD Modeling**

**Applicability**

A source applying for a PSD permit or modification is required to perform modeling when its PTE is over the thresholds used to determine PSD applicability (326 IAC 2-2-1) (see Reference 3).

For new sources, the PTE must be greater than 100 or 250 tons per year, depending on the source category, to require PSD modeling. If an existing source is already major (a PSD source), any modification involving any criteria pollutant must exceed the SER, see Table 1, to make it a major modification. Sources proposing major modifications must conduct PSD modeling. Potential emissions after controls are used for these determinations.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>tons/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>100</td>
</tr>
<tr>
<td>Nitrogen Oxides (NOx)</td>
<td>40¹</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO2)²</td>
<td>40¹</td>
</tr>
<tr>
<td>Particulate Matter (PM2.5)²</td>
<td>10</td>
</tr>
<tr>
<td>Particulate Matter (PM10)</td>
<td>15</td>
</tr>
<tr>
<td>Ozone (VOCs)/(NOx)²</td>
<td>40</td>
</tr>
</tbody>
</table>

Table 1. PSD Significant Emission Rates (326 IAC 2-2-1)
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead (Pb)</td>
<td>0.6</td>
</tr>
<tr>
<td>Asbestos</td>
<td>0.007</td>
</tr>
<tr>
<td>Beryllium</td>
<td>0.0004</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.1</td>
</tr>
<tr>
<td>Vinyl Chloride</td>
<td>1</td>
</tr>
<tr>
<td>Fluorides</td>
<td>3</td>
</tr>
<tr>
<td>Sulfuric Acid Mist</td>
<td>7</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>10</td>
</tr>
<tr>
<td>Total Reduced Sulfur</td>
<td>10</td>
</tr>
<tr>
<td>Reduced Sulfur Compounds</td>
<td>10</td>
</tr>
</tbody>
</table>

1 These values also apply to the new 1-hour standards.

2 AERMOD is used to model direct PM$_{2.5}$ emissions. However, secondary formation of PM$_{2.5}$ resulting from SO$_2$ and NO$_2$ emissions must also be evaluated. Also, the formation of Ozone must be examined from volatile organic compounds (VOCs) and/or nitrogen oxides (NO$_x$). U.S. EPA has finalized a two-tiered demonstration approach for addressing single-source impacts on ozone and secondary PM$_{2.5}$. This is discussed later in this document.

3 While there are no National Ambient Air Quality Standards for these pollutants, they do have monitoring concentration thresholds listed in 326 IAC 2-2-4. Modeled concentrations less than the de minimis levels listed in 326-IAC 2-2-4 are exempt from the monitoring requirements. Sulfuric Acid Mist has no monitoring concentration threshold listed in 326 IAC 2-2-4. No air quality analysis is required for Sulfuric Acid Mist under the PSD regulations.

**Modeling Protocols**

A proposed modeling protocol must be submitted to IDEM for review before the actual modeling analysis. Among the suggested modeling methodology topics for discussion are:

- Meteorology and terrain;
- Receptor network and property lines;
- Downwash and GEP;
- AERMOD model version;
  - Applicants must use the regulatory default option in AERMOD for PSD approvability. The use of non-default and beta options must be discussed with IDEM and will need U.S. EPA approval prior to use;
- Pollutants and emission rates that will be used in the permit – this cannot be left out of the protocol;
- Background concentrations and source inventories;
- Modeling averaging times used for the pollutant(s) in the analysis. This pertains to the Significant Impact Levels (SILs), NAAQS, and PSD increment analyses;
- NAAQS and PSD increment analyses, including a method of evaluating nearby source inventories to include in the modeling;
- HAPs analyses; and
- Additional impact analysis (growth, soils, vegetation, visibility impairment).

IDEM will review the submittal and contact the applicant with any questions to develop an approved protocol. This process generally takes one to three weeks, depending on the issues affecting the modeling. Modeling protocols help facilitate the approval process of the modeling application submittal since most of the technical details are worked out in advance. Failure to submit a protocol will delay IDEM’s review of any modeling submitted. In addition, any issues found by IDEM involving the methodologies used in the modeling may require the modeling to be resubmitted with corrections.

Modeling protocols that are not acted upon in four months once IDEM gives its approval will be considered outdated and no longer valid. The applicant must resubmit a new protocol before any modeling is sent in or submit in writing that none of the assumptions made in the previous protocol have been changed.

If the applicant needs to use an alternative model, Appendix W of 40 CFR Part 51, section 3.2, Use of Alternative Models, 3.2.2 Requirements, outlines what is required for alternative model acceptability. The latest information on the use of these options can be viewed on U.S. EPA’s Support Center for Regulatory Atmospheric Modeling (SCRAM) website.

### AERMOD Components

AERMOD fully replaced ISCST3 as the regulatory model on December 9, 2006, after a one-year grandfather period. The rule was promulgated in the Federal Register on November 9, 2005, (40 CFR Part 51) (see Reference 4). The Register states that AERMOD, including the PRIME building downwash algorithm, should be used for air dispersion modeling evaluations of criteria air pollutant and toxic air pollutant emissions from typical industrial facilities. The latest version of AERMOD is to be used for all modeling submittals. The latest version of the model and the associated components can be found on the SCRAM website. Further information about implementation of AERMOD can be found in the AERMOD Implementation Guide (see Reference 5). IDEM can also answer any questions concerning the use of AERMOD and the latest version to be used.
This is a list of programs associated with the model:

Regulatory components

- AERMOD
- AERMAP
- AERMET

Non-Regulatory components

- AERSCREEN
- AERSURFACE
- BPIP PRIME
- AERMINUTE

New AERMOD Enhancements

Meteorological ADJ_U*

U.S. EPA has integrated the ADJ_U* regulatory option into the AERMET meteorological processor for AERMOD to address issues with model overprediction of ambient concentrations from some sources associated with underprediction of the surface friction velocity (u*) during light wind, stable conditions. U.S. EPA has adopted the ADJ_U* option in AERMET as a regulatory option. Proposed LOWWIND options (LowWind 1, LowWind 2, and LowWind 3) were not incorporated as a regulatory option in AERMOD. U.S. EPA is deferring action on the LOWWIND options in general pending further analysis and evaluation in conjunction with the modeling community.

Tall Stacks

U.S. EPA recognized the need to address observed overpredictions by AERMOD when applied to situations involving tall stacks located near small urban areas. U.S. EPA has finalized the model formulation update, as proposed, into the regulatory version of AERMOD. This change was made within the model itself so no user input is required as long as the correct version of AERMOD (i.e., v161216r or later) is used.

Horizontal and Capped Stacks

U.S. EPA has also updated the regulatory options in AERMOD to address plume rise for horizontal and capped stacks based on the July 9, 1993, U.S. EPA memorandum entitled “Proposal for Calculating Plume Rise for Stacks with Horizontal Releases or Rain Caps for Cookson Pigment, Newark, New Jersey.”

Integrated the Buoyant Line and Point Source (BLP) Model

This model was designed to handle unique modeling scenarios where plume rise and downwash effects from stationary line sources are important. In this update, BLP was removed from 40 CFR Part 51, Appendix A as a preferred model and integrated directly into AERMOD for use. This enhancement will help those sources with emissions that exhaust from roof monitors/vents/cupolas.
Preliminary Impact Analysis

The first step is to model the impact of the significant net emissions increase from the proposed new source or modification to an existing source. For further guidance, see the NSR Workshop Manual (Reference 6) on significant net emissions increases. Once the significant net emissions increase is determined, the proposed project is modeled to determine if it is above the SILs. The SILs for each pollutant are listed in Table 2 and are compared to the modeled concentration for each pollutant for Class II areas (see Reference 7). If the project does not exceed the SILs for all pollutants emitted above its significant emission rates, no further modeling is required.

If the project exceeds one or more of the SILs, the modeling impact analysis must include: the potential emissions after controls from the proposed new source or emissions from the existing source including the potential emissions from the proposed modification after controls; all other sources inside the SIA; and other distant sources taken from the NAAQS inventory that may impact this SIA. These are modeled together to determine overall air quality impacts.

### Table 2. Significant Impact Levels

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Significant Impact Level (SIL) (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM₂.₅</td>
<td>Annual</td>
<td>0.3²</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>1.2²</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>Annual</td>
<td>4³</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>5³</td>
</tr>
<tr>
<td>SO₂</td>
<td>Annual</td>
<td>1⁴</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>5⁴</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>25⁵</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>7.8 (3ppb)⁶</td>
</tr>
<tr>
<td>NO₂</td>
<td>Annual</td>
<td>1⁷</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>7.5 (4ppb)⁸</td>
</tr>
<tr>
<td>CO</td>
<td>8-hour</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>2000</td>
</tr>
</tbody>
</table>
For all pollutants and averaging times unless otherwise specified below, the highest modeled pollutant concentration for each averaging time is used to determine whether the source will have significant ambient impact for that pollutant. This is based on 5 years of meteorological data in which the highest year is chosen. This is from the October 1990, New Source Review Workshop Manual, page C.27.

For the 1-hour NO$_2$ standard based on the June 29, 2010, memorandum from U.S. EPA they recommended that the SIL should be compared to either of the following:

- The highest of the 5-year averages of the maximum modeled 1-hour NO$_2$ concentrations predicted each year at each receptor, based on 5 years of National Weather Service (NWS) data; or
- The highest modeled 1-hour NO$_2$ concentration predicted across all receptors based on 1 year of site-specific meteorological data, or the highest of the multi-year averages of the maximum modeled 1-hour NO$_2$ concentrations predicted each year at each receptor, based on 2 or more years, up to 5 complete years of available site-specific meteorological data.

For the 1-hour SO$_2$ standard, according to the March 01, 2011, U.S.EPA memorandum which references the above document for NO$_2$ SIL averaging, this same topic should also apply equally to the SO$_2$ SIL.

According to the May 20, 2014, U.S. EPA memorandum, due to the form of the PM$_{2.5}$ standard, U.S EPA recommends that the PM$_{2.5}$ SIL be compared to either of the following, depending on the meteorological data used in the analysis:

- The highest of the 5-year averages of the maximum modeled 24-hour or annual PM$_{2.5}$ concentrations predicted each year at each receptor, based on 5 years of representative NWS data; or
- The highest modeled 24-hour or annual PM$_{2.5}$ concentrations predicted across all receptors based on 1 year of site-specific meteorological data, or the highest of the multi-year averages of the maximum modeled 24-hour or annual PM$_{2.5}$ concentrations predicted each year at each receptor, based on 2 or more years, up to 5 complete years of available site-specific meteorological data.

Based on the above information, the 1-hour NO$_2$, 1-hour SO$_2$, 24-hour and annual PM$_{2.5}$ SILs will use the highest of the 5-year averages since most modeling is based on 5 years of NWS data in Indiana. Stated another way, this is a 5-year average taking the highest/maximum value modeled.

U.S. EPA adopted final SILs, PSD increments, and significant monitoring concentrations (SMCs) for PM$_{2.5}$ on September 29, 2010. Due to the January 22, 2013, decision from the U.S. Court of Appeals on the use of PM$_{2.5}$ SILs, U.S. EPA has recommended the following procedure to be used prior to the use of the SIL. The court decision did not preclude the use of the SILs so U.S. EPA recommends taking the difference between the NAAQS and the representative monitoring background data. If the difference is greater than or equal to the SIL, then U.S. EPA believes it would be sufficient in most cases to use the SIL value as a screening tool for the applicant. (Final SIL guidance is due out late spring of 2018.)
3 U.S. EPA retained the PM$_{10}$ annual and 24-hour PSD increments. They also retained the PM$_{10}$ 24-hour NAAQS standard. Compliance with these standards still applies. U.S EPA revoked the PM$_{10}$ annual standard on December 17, 2006, and Indiana removed it from 326 IAC rules on January 16, 2013. Since it is no longer a part of the state rules, it does not have to be modeled.

4 U.S. EPA revoked the 24-hour and annual SO$_2$ standard. Although U.S. EPA announced that it is revoking the annual and 24-hour SO$_2$ NAAQS, the June 22, 2010, preamble to the final rule states the annual and 24-hour SO$_2$ NAAQS will remain in effect for a limited period of time as follows: for current SO$_2$ nonattainment areas and SIP call areas, until attainment and maintenance SIPs are approved by U.S. EPA for the new 1-hour SO$_2$ NAAQS; for all other areas, for one year following the effective date of April 9, 2018 for the initial designations under section 107(d)(1). Accordingly, the annual and 24-hour SO$_2$ NAAQS must continue to be protected under the PSD program. U.S. EPA made the initial designations for Indiana so these standards still remain in effect for a PSD area until April 9, 2019. The 24-hour and annual increment remain in effect since they have been retained by U.S. EPA.

5 The 3-hour SO$_2$ standard and increment still apply since they have been retained by U.S. EPA.

6 SO$_2$ Conversion is derived by: (196.2 µg/m$^3$ / 75 ppb) * 3 ppb = 7.848 µg/m$^3$ - 7.8 µg/m$^3$
(The 196.2 µg/m$^3$ = 75 ppb conversion comes from the Federal Register dated November 7, 2011, Volume 76, Number 215.)

7 For NO$_2$, compliance with the annual standard still applies.

8 NO$_2$ Conversion is derived by: (100 µg/m$^3$ / 53 ppb) * 4 ppb = 7.547 µg/m$^3$ - 7.5 µg/m$^3$
(The 100 µg/m$^3$ = 53 ppb conversion comes from a federal notice regarding modeling for the new hourly NO$_2$ NAAQS dated February 25, 2010.)

Source Inventories

The model must use an inventory of existing emissions from sources within 50 km of the proposed source. There are two types of inventories: NAAQS inventories (see Reference 8) and PSD increment inventories (see Reference 9). NAAQS inventories are taken from IDEM’s EMITS (Emission Inventory Tracking System) in accordance with 326 IAC 2-6. EMITS source emissions are actuals and are in tons per year units. NAAQS inventory source screening can be conducted using actual emissions. In Appendix W, Part 51, Guideline on Air Quality Models, January 17, 2017, Table 8-2 allows for the applicant to account for actual operations in developing the emissions inputs for dispersion modeling of nearby sources, while other sources are best represented by air quality monitoring data. An operating factor has to be developed and used in order to do this. Approval must be given beforehand before using typical actuals from IDEM and U.S. EPA. See Appendix W, Table 8-2 below.

IDEM’s PSD increment inventories include sources that affect the increment based on the major and minor source baseline dates and are compiled from permits issued by IDEM. PSD increment inventory emissions are permit allowables and are in metric units. IDEM maintains these inventories and will provide them for sources located in the state.
of Indiana. If the 50 km inventory radius falls into another state, the applicant is responsible for obtaining emission information for out-of-state inventory sources (40 CFR 52.21).

This is Table 8-2 from Appendix W.

| Proposed Major New or Modified Source | Design capacity or federally enforceable permit condition. | Continuous operation (i.e., 8760 hours).  
Annual & quarterly | Maximum allowable emission limit or federally enforceable permit limit. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term (≤ 24 hours)</td>
<td>Maximum allowable emission limit or federally enforceable permit limit.</td>
</tr>
</tbody>
</table>

**Nearby Source(s)**

<table>
<thead>
<tr>
<th>Annual &amp; quarterly</th>
<th>Maximum allowable emission limit or federally enforceable permit limit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term (≤ 24 hours)</td>
<td>Maximum allowable emission limit or federally enforceable permit limit.</td>
</tr>
</tbody>
</table>

**Other Source(s)**

<table>
<thead>
<tr>
<th>Annual &amp; quarterly</th>
<th>Annual level when actually operating, averaged over the most recent 2 years.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term (≤ 24 hours)</td>
<td>Temporarily representative level when actually operating, reflective of the most recent 2 years.</td>
</tr>
</tbody>
</table>

The ambient impacts from Non-nearby or Other Sources (e.g., natural sources, minor sources and distant major sources, and unidentified sources) can be represented by air quality monitoring data unless adequate data do not exist.

1. Terminology applicable to fuel burning sources; analogous terminology (e.g., lb/throughput) may be used for other types of sources.
2. If operation does not occur for all hours of the time period of consideration (e.g., 3 or 24-hours) and the source operation is constrained by a federally enforceable permit condition, an appropriate adjustment to the modeled emission rate may be made (e.g., if operation is only 8 a.m. to 4 p.m. each day, only these hours will be modeled with emissions from the source. Modeled emissions should not be averaged across non-operating time periods.
3. Operating levels such as 50 percent and 75 percent of capacity should also be modeled to determine the load causing the highest concentration.
4. Includes existing facility to which modification is proposed if the emissions from the existing facility will not be affected by the modification. Otherwise use the same parameters as for major modification.
5. See Section 8.9.3.
6. Unless it is determined that this period is not representative.
7. Temporarily representative operating level could be based on Continuous Emissions Monitoring (CEM) data or other information and should be determined through consultation with the appropriate reviewing authority (Paragraph 3.0(b)).
8. For those permitted sources not in operation or that have not established an appropriate factor, continuous operation (i.e., 8760) should be used.
9. See Section 8.9.2.

Recent U.S. EPA guidance concerning the new 1-hour standards suggest that emphasis on determining which nearby sources to include in the modeling analysis should focus on the area within 10 kilometers of the applicant location in most cases. This doesn’t exempt the applicant from examining large emitting sources (i.e., utilities) out to 50 kilometers. The applicant must be cognizant of the fact that these sources could have a significant
impact on the applicant’s SIA and should be discussed with IDEM prior to submitting any modeling.

Preliminary (Screening) Modeling

AERSCREEN or AERMOD can be used to determine whether inventory sources, within 50 kilometers, will impact the Significant Impact Area (SIA) of the proposed source. U.S. EPA released AERSCREEN in March 2011, a screening model based on the AERMOD dispersion algorithms, which is expected to generally yield realistic concentrations, while maintaining conservatism over more refined analyses. On April 11, 2011, U.S. EPA issued a clarification memo stating that AERSCREEN was intended to replace the SCREEN3 model; a change that is allowed, without formal rulemaking, in the Guideline on Air Quality Models (Appendix W of 40 CFR Part 51).

IDEM prefers the use of AERMOD over AERSCREEN for screening purposes.

Preconstruction Monitoring

The determination of the preconstruction monitoring requirement is handled on a case-by-case basis (326 IAC 2-2-4) (see Reference 10). This requirement may be satisfied if representative monitoring is available. Representative preconstruction monitoring is usually within 10 km of the proposed site, but greater distances are allowed. Applicants need to follow “Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)” (U.S. EPA-450/4-87-007), May 1987, and “Meteorological Monitoring Guidance for Regulatory Modeling Applications” (see Reference 11). The preconstruction monitoring requirement is triggered when an applicant exceeds the Significant Monitoring Concentrations (SMCs) outlined in Table 3.

Table 3. Significant Monitoring Concentrations

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Significant Monitoring Concentration (SMC) (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>1-hour</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>-</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>24-hour</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>-</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>24-hour</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>-</td>
</tr>
</tbody>
</table>
For all pollutants and averaging times unless otherwise specified, the highest modeled pollutant concentration for each averaging time is used to determine whether the source exceeds the SMC for that pollutant. This is based on 5 years of meteorological data in which the highest year is chosen. This is from the October 1990, New Source Review Workshop Manual, page C.17.

For the 1-hour NO₂, 1-hour SO₂, 24-hour and annual PM₂.₅ SMCs will use the highest of the 5-year averages since most modeling is based on 5 years of NWS data in Indiana. Stated another way, this is a 5-year average taking the highest/maximum value modeled.

See above Table 2 above for more details on modeling averaging times.

### Background Concentrations (Monitoring Data)

Background concentrations account for those sources that are either too small or too distant to be included in the modeling analysis. Monitoring data from the monitoring stations closest to the proposed source should generally be used for all pollutants. Background concentrations (see Reference 12) should be from the most current three-year period and are calculated as shown in Table 4. For on-site preconstruction monitoring data, the latest full year of data should be used. The applicant should submit the on-site preconstruction monitoring data to IDEM so that it can be quality assured before using it for modeling (326 IAC 2-2-5). Seasonal/hourly background can also be used and can be provided upon request.

#### Table 4. Calculating Background Concentrations

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Calculation of Background Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>1-hour</td>
<td>The 3-year average of the 99(^{th}) percentile of the annual distribution of daily maximum 1-hour average concentrations (4(^{th}) highest)</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>The average of the 2nd high for all 3 years</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>The average of the 2nd high for all 3 years</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>Highest annual value over the 3-year period</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>PM$_{2.5}$</strong></td>
<td>24-hour</td>
<td>The average of the 98$^{th}$ percentile 24-hour values over 3 years</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>The average of the annual mean concentrations over 3 years</td>
</tr>
<tr>
<td><strong>PM$_{10}$</strong></td>
<td>24-hour</td>
<td>The average of the 2nd high for all 3 years</td>
</tr>
<tr>
<td><strong>NO$_2$</strong></td>
<td>1-hour</td>
<td>The 3-year average of the 98$^{th}$ percentile of the annual distribution of daily 1-hour concentrations (8$^{th}$ highest)</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>Highest annual value over the 3-year period</td>
</tr>
<tr>
<td><strong>CO</strong></td>
<td>1-hour</td>
<td>The average of the 2nd high for all 3 years</td>
</tr>
<tr>
<td></td>
<td>8-hour</td>
<td>The average of the 2nd high for all 3 years</td>
</tr>
<tr>
<td><strong>Pb</strong></td>
<td>Rolling 3 month average</td>
<td>Maximum rolling 3 month average evaluated over a 3-year period</td>
</tr>
</tbody>
</table>

**Meteorological Data**

The meteorological data must be adequately representative and from a nearby National Weather Service (NWS) or comparable station (site-specific), or prognostic meteorological data. In almost all cases, NWS data provides adequate coverage for the state. The meteorological data should ensure that worst-case meteorological conditions are adequately represented in the model results. The use of 5 years of adequately representative NWS or comparable meteorological data, at least 1 year of site-specific, or at least 3 years of prognostic meteorological data, are required. While spatial or geographical representativeness is best achieved by collection of all of the needed model input data in close proximity to the actual site of the source(s). Site-specific measured data are, therefore, preferred as model input, provided that appropriate instrumentation and quality assurance procedures are followed, and that the data collected are adequately representative (free from inappropriate local or microscale influences) and compatible with the input requirements of the model to be used. For some modeling applications, there may not be a representative NWS or comparable meteorological station available (e.g., complex terrain), and it may be cost prohibitive or infeasible to collect adequately representative site-specific data. For these cases, it may be appropriate to use prognostic meteorological data, if deemed “adequately representative,” in a regulatory modeling application. The prognostic data should be compared to NWS observational data or other comparable data in an effort to show that the data are adequately replicating the observed meteorological conditions of the time periods modeled. An operational evaluation of the modeling data for all model years (i.e., statistical, graphical) should be completed and provided to IDEM. Approval of the use of prognostic data is on a case-by-case basis.
When using NWS data, the most recent five years of available meteorological data is used (326 IAC 2-2-5). The current meteorology that is acceptable to use for modeling projects is 2012 – 2016 however IDEM should be consulted on the latest meteorological data available. IDEM pre-processes all meteorological files to be used for any air quality modeling. NWS meteorological data can be found on IDEM’s modeling website (see Reference 13). Please check with IDEM to make sure this is the latest meteorological data set. IDEM will update the meteorological data as it becomes available and updated AERMET and associated programs are available from U.S. EPA. Surface data should be taken from the Evansville, Fort Wayne, Indianapolis, South Bend, Cincinnati, OH, or Louisville, KY NWS stations, whichever is closest to the proposed site. Upper air data should be taken from Wilmington, OH or Lincoln, IL stations. Site name, profile base elevation, latitude, longitude, and WBAN ID numbers are provided in Table 5. If on-site meteorological data are available, the latest full year of data should be used for modeling at a minimum. IDEM can provide assistance for processing the on-site meteorological data with IDEM reviewing the final meteorological data files for accuracy.

Table 5. National Weather Service Sites

<table>
<thead>
<tr>
<th>Site ID Number</th>
<th>Site Name</th>
<th>State</th>
<th>Profile Base Elevation (meters)</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>14827</td>
<td>Fort Wayne Int’l Airport</td>
<td>Indiana</td>
<td>252</td>
<td>40.972472</td>
<td>-85.206357</td>
</tr>
<tr>
<td>04833</td>
<td>Lincoln, Illinois (UA)*</td>
<td>Illinois</td>
<td>n/a</td>
<td>40.151</td>
<td>-89.337</td>
</tr>
<tr>
<td>14848</td>
<td>South Bend Michiana Regional Airport</td>
<td>Indiana</td>
<td>236</td>
<td>41.707229</td>
<td>-86.316294</td>
</tr>
<tr>
<td>13841</td>
<td>Wilmington Airborne Park, Ohio (UA)*</td>
<td>Ohio</td>
<td>n/a</td>
<td>39.420</td>
<td>-83.822</td>
</tr>
<tr>
<td>93817</td>
<td>Evansville Regional Airport</td>
<td>Indiana</td>
<td>121.9</td>
<td>38.050159</td>
<td>-87.514665</td>
</tr>
<tr>
<td>93819</td>
<td>Indianapolis Int’l Airport</td>
<td>Indiana</td>
<td>246</td>
<td>39.725149</td>
<td>-86.281600</td>
</tr>
<tr>
<td>93821</td>
<td>Louisville Int’l Airport</td>
<td>Kentucky</td>
<td>149</td>
<td>38.177378</td>
<td>-85.730754</td>
</tr>
<tr>
<td>On-Site</td>
<td>Gary IITRI**</td>
<td>Indiana</td>
<td>183</td>
<td>41.6067</td>
<td>-87.3048</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------</td>
<td>---------</td>
<td>-----</td>
<td>---------</td>
<td>----------</td>
</tr>
<tr>
<td>93814</td>
<td>Cincinnati Northern Kentucky Airport</td>
<td>Ohio</td>
<td>267</td>
<td>39.044429</td>
<td>-84.672418</td>
</tr>
</tbody>
</table>

* Upper air data station
** IDEM meteorological monitor to account for Lake Michigan enhanced meteorology

U.S. EPA incorporated ADJ_U* as a regulatory option in AERMOD’s meteorological data preprocessor (AERMET). ADJ_U* works by adjusting the surface friction velocity and addresses issues with AERMOD overprediction of concentrations under stable, low wind speed conditions. It is not uncommon for an emissions source to have its highest concentrations predicted to occur during periods of low wind speed and stable atmospheric conditions. Previously, ADJ_U* was an alternative option (i.e., beta) that required U.S. EPA Regional Office approval; now ADJ_U* can be used without U.S. EPA Regional Office approval. IDEM has the latest five years of NWS ADJ_U* meteorological data posted on its [website](#).

**Land Use Determination**

Section 7.2.1.1 of the Appendix W, Part 51, Guideline on Air Quality Models, January 17, 2017, provides the basis for determining the urban/rural status of a source. For most applicants the land use procedure described in Section 7.2.1.1 (i) is sufficient for determining which status to use. The AERMOD Implementation Guide dated March 19, 2009, under section 5 provides more details about the urban/rural determination. Also, the selection of population for the urban mode must be consistent with the guidance. Any variation of population selection will be reviewed on a case-by-case basis provided sufficient justifications are provided.

**Inventory Source Screening**

The applicant may use any of the following three methods to screen NAAQS/PSD inventory sources. The applicant must explain in the modeling protocol what method or methods are used in screening the inventory sources.

**Method 1 – Screening Using a 50 km Distance and the SIL**

The applicant may screen the NAAQS/PSD inventory sources to determine whether they impact the SIA of the proposed source by using the applicable SIL. The SILs determine the significant impact of an inventory source at the SIA of the proposed source. When screening out NAAQS/PSD sources from the inventory, a receptor grid must be placed at the proposed PSD facility's SIA for each pollutant to measure the inventoried source's impact on the SIA. Sources found not to have a significant impact on the SIA of the applicant can be eliminated from the inventory. Sources with a significant impact must be included in the air quality analysis.
NAAQS inventory source screening can be conducted using actual emissions. In Appendix W, Part 51, Guideline on Air Quality Models, January 17, 2017, Table 8-2 allows for the model user to account for actual operations in developing the emissions inputs for dispersion modeling of nearby sources. An operating factor has to be developed and used in order to do this. Approval must be given beforehand before using typical actuals from IDEM and U.S. EPA. For screening PSD inventory sources, IDEM’s PSD increment inventories include sources that affect the increment based on the major and minor source baseline dates and are compiled from permits issued by IDEM. PSD increment inventory emissions are based on permit potentials and are in metric units. This is a more conservative approach than using actuals. IDEM maintains these inventories and will provide them for sources located in the state of Indiana. IDEM allows the elimination of sources in the inventory if they emit 1 ton per year or less per facility.

To determine the modeling inventory source impact, a 50 km distance outside the significant impact area of the facility is examined. Any inventoried source that is significant in the applicant’s SIA must be included in the inventory. Also any inventoried source physically located inside the applicant’s SIA must also be included.

Method 2 – Screening Using IDEM Look-Up Tables

IDEM developed NAAQS/PSD inventory look-up screening tables to simplify the process of removing sources out of the modeling inventory. The look-up tables are based on the seven National Weather Service (NWS) locations using the latest available meteorological year. If the applicant decides to use these tables, the meteorology used in the modeling must correspond to the look-up table meteorological location.

IDEM made certain assumptions when creating the look-up tables. IDEM ran AERMOD using flat terrain and a polar grid with 36 radials spaced every 10 degrees of 50 rings with 1 kilometer spacing between the rings. Since there is a linear relationship between the emission rate and the concentration using a single stack source, IDEM used a 1 ton per year emission rate stack with worst case parameters for the impact. Values used for the stack are 12 meters high, 1 foot in diameter, and a 1 meter/second stack velocity. For each time-averaging period, the impact at each distance is the 1st high impact of the latest year of meteorology at that particular ring of 36 receptors. From this, a calculation is made to find the maximum emission rate that would have an impact less than a SIL at each kilometer distance for each averaging period. IDEM then placed these values in a spreadsheet at the appropriate distance. The screening distance is the length of the outermost point of the SIA of the project to the inventory source in question.

For example, an applicant is concerned with the 1-hour SO2 standard and has to do a NAAQS analysis. The applicant is located in the Evansville meteorological area. They have an SO2 NAAQS inventory source 10 km away from the applicant’s SIA. The inventory source emits 10 tons per year of SO2. Based on this example and using the Evansville look-up table, that source needs to be included in the modeling inventory. Any sources emitting less than 4.9 tons per year at the 10 km distance can be omitted from the inventory.
Table 6. Evansville SO₂ Look-up Screening Table

<table>
<thead>
<tr>
<th>Distance km</th>
<th>Annual &lt; TPY</th>
<th>24-hour</th>
<th>3-hour</th>
<th>1-hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6.4</td>
<td>2.8</td>
<td>4.3</td>
<td>1.1</td>
</tr>
<tr>
<td>2</td>
<td>10.8</td>
<td>5.3</td>
<td>7.1</td>
<td>1.6</td>
</tr>
<tr>
<td>3</td>
<td>16.9</td>
<td>8.4</td>
<td>10.8</td>
<td>2.1</td>
</tr>
<tr>
<td>4</td>
<td>24.1</td>
<td>10.9</td>
<td>14.6</td>
<td>2.5</td>
</tr>
<tr>
<td>5</td>
<td>32.0</td>
<td>13.7</td>
<td>18.5</td>
<td>3.0</td>
</tr>
<tr>
<td>6</td>
<td>40.9</td>
<td>17.0</td>
<td>21.1</td>
<td>3.6</td>
</tr>
<tr>
<td>7</td>
<td>50.6</td>
<td>20.8</td>
<td>23.9</td>
<td>4.1</td>
</tr>
<tr>
<td>8</td>
<td>61.2</td>
<td>25.1</td>
<td>27.1</td>
<td>4.4</td>
</tr>
<tr>
<td>9</td>
<td>72.6</td>
<td>29.8</td>
<td>29.1</td>
<td>4.6</td>
</tr>
<tr>
<td>10</td>
<td>84.7</td>
<td>34.2</td>
<td>31.1</td>
<td>4.9</td>
</tr>
</tbody>
</table>

An Excel copy of the tables can also be downloaded from IDEM’s modeling website. Actual emissions can be used for screening NAAQS sources.

**Method 3 – Screening Distance for the 1-Hour Standards**

Based on the March 01, 2011, U.S. EPA memo from Tyler Fox, which discusses guidance for the 1-hour SO₂ and NO₂ standards, a 10 kilometer distance is considered adequate to determine which nearby sources to include. The guidance states, “Even accounting for some terrain influences on the location and gradients of maximum 1-hour concentrations, these considerations suggest that the emphasis on determining which nearby sources to include in the modeling analysis should focus on the area within approximately 10 kilometers of the project location in most cases. The routine inclusion of all sources within 50 kilometers of the project location, the nominal distance for which AERMOD is applicable, is likely to produce an overly conservative result in most cases.” IDEM also understands large emitters like utilities can be outside the 10 kilometer boundary but should also be examined to determine if they are significant within the applicant’s SIA. Consultation with IDEM concerning inclusion of large sources is recommended.

**PSD Area Classification**

The PSD requirements provide for a system of three area classifications to identify local land use goals. Class I areas are primarily wilderness areas and national parks. These areas allow only a small degree of air quality deterioration. The very southern portions of Spencer, Perry, and Harrison counties fall within 100 km of Mammoth Cave, Kentucky, which is a Class I area. Different SILs and PSD increments apply to Class I areas.

Contact IDEM if a proposed project is located in one of these counties. All the rest of Indiana is considered a Class II area. Class III areas have the largest increment and allow the largest amount of development. There are no Class III areas in Indiana.

**Receptor Placement**

The first two sets of receptors need to be set around the fence line or the property line. These boundaries usually define areas restricted to the public. Spacing of receptors 100 meters (328 feet) along the property line is acceptable. Further receptor placement must have adequate density and should provide adequate coverage for determining the facility’s maximum concentration. A Cartesian coordinate system is recommended.
Terrain Elevations

AERMOD includes a data preprocessor for streamlining data input for terrain. AERMAP is a terrain preprocessor that simplifies the computation of receptor elevations and effective height scales for numerous types of digital data formats. AERMAP has been revised (beginning with version 09040) to support processing of terrain elevations from the National Elevation Dataset (NED) developed by the U.S. Geological Survey (USGS). The USGS digital elevation model (DEM) files are now static and will not be updated in the future, while the NED data are being actively supported and checked for quality. Therefore, NED represents a more up-to-date and improved resource for terrain elevations for use with AERMAP. Due to the number of problems that have been encountered with DEM data, U.S. EPA encourages AERMOD users to transition to the use of NED data as soon as practicable.

IDEM has all the NED files for the state and can provide the applicant any needed files upon request or the applicant can download the NED data from the USGS National Map Seamless Server. All applicants are required to use terrain files in their modeling.

PSD Increments

A new or modified source may consume up to 80 percent of the available PSD Class II increment (326 IAC 2-2-6) (see Reference 14). If the 50 km inventory radius falls into another state, the proposed source must obtain and model out-of-state increment consuming sources. Major source actual emission changes that occur after the major source baseline date affect the amount of available increment. The major source baseline dates are PM - January 6, 1975, SO₂ - January 6, 1975, NO₂ - February 8, 1988, and PM₂.₅ - October 20, 2010. For the minor source baseline dates, certain counties have dates established which were triggered by the first PSD application in the county. Like the major source actual emission changes, minor source actual emission changes can affect the amount of available increment. Minor source actual emission increases can be from any stationary source, area source, or mobile source occurring after the minor source baseline date. The PSD minor source baseline dates for another state may be different from Indiana's. As mentioned above, a PSD Increment Inventory can be obtained from IDEM which takes into account major and minor source baseline dates.

Downwash (Stack Height)

Section 123 of the Clean Air Act defines Good Engineering Practice (GEP), with respect to stack heights, as “the height necessary to insure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies or wakes which may be created by the source itself, nearby structures or nearby terrain obstacles.” Stacks should comply with GEP requirements established in 326 IAC 1-7-4 (see Reference 15). If stacks are lower than GEP, excessive ambient concentrations due to aerodynamic downwash may occur. Stacks can be built less than GEP stack height and are acceptable provided they meet the provisions in 326 IAC 1-7. The applicant must show that concentrations do not violate the NAAQS or PSD increment if the stack is constructed at less than GEP stack height. Building Profile Input Program (BPIP) calculations are applied when stacks are less than GEP for downwash effects. Dispersion modeling credit for physical stacks taller than 65 meters (213 feet) are limited to GEP for establishing emission limitations,
and the stack height must be justified as necessary to avoid building or terrain downwash from the released effluent.

Building dimension data are needed if the stack is not at or above GEP stack height. GEP is determined by evaluating all nearby structures using one of two formulas. For stacks on which construction started on or before January 12, 1979, the formula for determining GEP stack height is $H_{GEP} = 2.5H$. The formula for determining GEP stack heights for stacks constructed after January 12, 1979, is $H_{GEP} = H + 1.5L$. $H$ is the height of the structure and $L$ is the lesser of the height or projected width of the structure. The projected width is the projection of the building dimensions that is a maximum for any direction of wind flow.

Wind direction specific building dimensions can be developed for AERMOD. This allows the model to include the effects of the critical structure for each wind direction, relative to the stack. Wind direction specific building dimensions can be developed using facility plot plans and manually determining the dominant structure dimensions for each wind direction for each stack. Alternatively, several commercial software packages are available which will calculate the dimensions for each wind direction.

If the stack is not at or above GEP stack height, building dimension data may be found in the source file. Building dimensions are not contained in state or federal emission databases. These data need to be obtained from facility personnel if sources at that facility are subject to building downwash. IDEM does not typically require applicants to include downwash for inventory sources within the SIA or sources outside the SIA who are significant. This is due to the difficulty of obtaining building dimensions for sources and the time it takes to compile this information. Downwash for adjacent sources should be included if they are close to the applicant and pose possible problems.

**Non-Standard Point Source Emissions – Horizontal and Capped Stacks**

AERMOD was updated to address plume rise for horizontal and capped stacks. This included updating the POINTHOR and POINTCAP options from beta to default options. The POINTHOR and POINTCAP include adjustments to account for the Plume Rise Model Enhancements (PRIME) algorithm, which accounts for entrainment of plume mass into the cavity recirculation region, for sources subject to building downwash. This change will help small and large emission sources address their capped and horizontal stacks in a more realistic manner than was available with previous versions of AERMOD.

**Worst Case Load or Operation Condition – Maximum Ground-Level Concentration**

At a minimum, the source should be modeled using the design capacity (100 percent load). If a source operates at greater than design capacity for periods that could result in violations of the NAAQS or PSD increments, this load should be modeled. Where the source operates at substantially less than design capacity, and the changes in the stack parameters associated with the operating conditions could lead to higher ground level concentrations, loads such as 50 percent and 75 percent of capacity should also be modeled. Malfunctions which may result in excess emissions are not considered to be a normal operating condition. They generally should not be considered in determining allowable emissions.
Additional Impact Analysis

All PSD applicants must prepare an additional impact analysis for each criteria pollutant. The analysis assesses the impacts of air, ground, and water pollution on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth. The additional impact analysis generally has three parts: growth, soil and vegetation, and visibility impairment. All additional impact analyses must follow the Federal New Source Review Workshop Manual, Chapter D, which contains more details about this subject.

Growth Analysis

The elements of the growth analysis include: (1) a projection of the associated industrial, commercial, and residential source growth that will occur in the area due to the source, (2) an estimate of the air emissions generated by the above associated industrial, commercial, and residential growth, and (3) a determination whether or not this growth will cause an increase in air emissions that could have an adverse impact on air quality.

Soil and Vegetation Analysis

The soil and vegetation analysis should be based on an inventory of the soil and vegetation types found in the impact area. A soil map is provided below in Figure 1 to identify the different types of soil in the state. This inventory should include all vegetation with any commercial or recreational value. A reference for vegetation is the Indiana Agricultural Census – Crops (see Reference 16). The Endangered Species Act needs to be addressed in this section of the analysis. The applicant needs to list the endangered or threatened species throughout the state and what might be pertinent to the impact area. The secondary NAAQS will be the significance levels used for the endangered species. Two website references for endangered species are Indiana Department of Natural Resources Division of Fish & Wildlife (see Reference 17) and U.S. Fish & Wildlife Service (see Reference 18).
Figure 1: Indiana Soil Map

Soil Regions, Their Parent Materials, and Representative Soil Series for Map

1. Sandy and loamy lacustrine posits and eolian sand (Maumee, Rensselaer, Plainfield)
2. Silty and clayey lacustrine deposits (McGary, Patton, Hoytville, Dubois)
3. Alluvial and outwash deposits (Fox, Genessee, Warsaw, Wheeling)
4. Eolian sand deposits (Plainfield, Oshtemo, Bloomfield)
5. Thick loess deposits (Alford, Hosmer, Iva)
6. Loamy glacial till (Riddles, Miami, Crosier, Brookston)
7. Clayey glacial till (Blount, Pewamo, Morley)
8. Thin loess over loamy glacial till (Brookston, Crosby, Miami, Parr)
9. Moderately thick loess over loamy glacial till (Fincastle, Russell, Miami, Brookston)
10. Moderately thick loess over weathered loamy glacial till (Cincinnati, Avonburg, Vigo, Ava)
11. Discontinuous loess over weathered sandstone and shale (Zanesville, Berks, Wellston, Muskingum)
12. Discontinuous loess over weathered limestone (Crider, Frederick, Corydon)
13. Discontinuous loess over weathered limestone and shale (Eden, Switzerland, Pate)

Visibility Impairment Analysis

In the visibility impairment analysis, the applicant is concerned with three kinds of impacts, near and long-range Class 1 impacts and localized visibility. The long range Class I impacts are broken down into two subgroups. They are: (1) a source within 50 km of a Class 1 area and (2) sources greater than 50 km. Local impacts address visibility impairment at nearby interstates or airports. The components of a good visibility impairment analysis are: (1) determination of the visual quality of the area, (2) initial screening of emission sources to assess the possibility of visibility impairment, and (3), if warranted, a more in-depth analysis involving computer models.

To successfully complete a visibility impairment analysis, refer to a U.S. EPA document entitled “Workbook for the VISCREEN Model” (see Reference 19). In this workbook, U.S. EPA outlines a screening procedure designed to expedite the analysis of emissions impacts on the visual quality of an area. The workbook was designed for Class I area impacts, but the outlined procedures are generally applicable to Class II or Class III areas as well. The following sections are a brief synopsis of the screening procedures.

Visibility Screening Procedures: Level 1

The Level 1 visibility screening analysis is a series of conservative calculations designed to identify those emission sources that have little potential of adversely affecting visibility. The VISCREEN model is used for this level and level 2. Calculated values relating source emissions to visibility impacts are compared to a standardized screening value. Those sources with calculated values greater than the screening criteria are judged to have potential visibility impairments. If potential visibility impairments are indicated, then the Level 2 analysis is undertaken.
Visibility Screening Procedures: Level 2

The Level 2 screening procedure is similar to the Level 1 analysis in that its purpose is to estimate impacts during worst-case meteorological conditions. However, more specific information regarding the source, topography, regional visual range, and meteorological conditions is assumed available.

Visibility Screening Procedures: Level 3

If the Levels 1 and 2 screening analyses indicated the possibility of visibility impairment, an even more detailed analysis is undertaken in Level 3 with the aid of a visibility model and meteorological and other regional data. The purpose of the Level 3 analysis is to provide an accurate description of the magnitude and frequency of occurrence of impacts. The analysis may be performed with alternative models. See the U.S. EPA SCRAM website for more information and consult with IDEM modeling staff.

For additional information on long range visibility analysis, IDEM recommends reviewing the Federal Land Managers’ Air Quality Related Values Work Group (FLAG) Phase 1 Report—Revised (2010) for Class 1 areas, available on the National Park Service website.

FLAG addresses assessments for sources proposed for locations near (generally within 50 km) and at large distances (greater than 50 km) from these areas. Some of the components of the recommendations are stated below.

In general, FLAG recommends that an applicant:

- Apply the Q/D test (Q=annual emissions in tons per year, D=distance in km, where Q/D≤10 warrants no further analysis) for proposed sources greater than 50 km from a Class I area to determine whether or not any further visibility analysis is necessary.
- Consult with IDEM and with the Federal Land Manager for the affected Class I area(s) or other affected area for confirmation of preferred visibility analysis procedures.
- The Q/D test also applies to ozone impacts and deposition impacts. Consult with IDEM and with the Federal Land Manager for further action.

Mammoth Cave, Kentucky is the closest Class I area at UTM coordinates Northing 4124.526, Easting 566.448, zone 16. U.S. EPA lists all federal Class 1 areas on its website. It is advisable to look at this for the latest additions to Class 1 areas which could be affected by an Indiana PSD source.

NAAQS and PSD Increment Consumption Modeling Results

The modeler should add the NAAQS modeling results to the background and compare the total concentration with the NAAQS limit. PSD increment modeling results are compared with 80% of the available PSD increment. View the reference rule (326 IAC 2-2-6) for Indiana’s increment consumption requirements. Table 7 contains the averaging periods and the modeling thresholds used for NAAQS and PSD increment analysis. All model inputs must correlate with permit limits.
Table 7. Modeling Results Comparison to NAAQS/PSD Increments

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Modeling Averaging Period</th>
<th>Concentration Used for Comparison to Standard (5 years of modeling) – For NAAQS Standard Only</th>
<th>NAAQS Standard (µg/m³)</th>
<th>PSD Increment Standard (µg/m³) Indiana Class II Area¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Primary</td>
<td>Secondary</td>
<td></td>
</tr>
<tr>
<td>PM_{2.5}</td>
<td>Annual</td>
<td>Highest average of the annual averages across 5 years</td>
<td>12</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>Multiyear average of 8⁰ highest (98⁰ percentile) across 5 years</td>
<td>35</td>
<td>-</td>
</tr>
<tr>
<td>PM_{10}</td>
<td>Annual</td>
<td>Highest</td>
<td>Revoked</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>Highest Sixth High over 5 years</td>
<td>150</td>
<td>-</td>
</tr>
<tr>
<td>SO₂</td>
<td>Annual</td>
<td>Highest</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>Highest Second High</td>
<td>365</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>Highest Second High</td>
<td>-</td>
<td>1300</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>Multiyear average 4⁰ highest (99⁰ percentile)</td>
<td>196.2 (75 ppb)</td>
<td>-</td>
</tr>
<tr>
<td>NO₂</td>
<td>Annual</td>
<td>Highest</td>
<td>100 (53 ppb)</td>
<td>Same as primary</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>Multiyear average 8⁰ highest (98⁰ percentile)</td>
<td>188.6 (100 ppb)</td>
<td>-</td>
</tr>
<tr>
<td>O₃¹</td>
<td>8-hour</td>
<td>None</td>
<td>75 ppb</td>
<td>Same as primary</td>
</tr>
</tbody>
</table>
CO

<table>
<thead>
<tr>
<th></th>
<th>Highest Second High</th>
<th>10000</th>
<th>NA</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-hour Highest Second High</td>
<td>10000</td>
<td>NA</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>1-hour Highest Second High</td>
<td>40000</td>
<td>NA</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Pb Rolling 3 Month Average Highest</td>
<td>0.15</td>
<td>Same as primary</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Section 163(a) of the Clean Air Act provides that “In the case of any maximum allowable increase (increment) for a pollutant based on concentrations permitted under the national ambient air quality standards for any period other than an annual period, such regulations shall permit such maximum allowable increase (increment) to be exceeded during one such period per year [emphasis added].” Accordingly, the existing PSD rules allow one exceedance per year of each short-term increment defined by the rules. See 40 CFR 51.166(c) and 52.21(c). The existing provision allows one exceedance per year for any averages outside the annual. Thus, when modeling increment compliance, the highest value of the second-highest (high second high) modeled concentration is estimated at each model receptor for averaging times less than the annual averaging time. For the annual increments, the modeled annual averages (high first high) should not exceed the annual maximum allowable increase (increment) for any pollutant with an annual average. Please note this requirement does apply to PM$_{2.5}$ 24-hour, PM$_{2.5}$ annual, and PM$_{10}$ 24-hour standards with increments. If 5 years of NWS data is used, you pick the highest second high value during that 5 year period. For the annual you pick the highest first high value during that 5-year period. No averaging is performed.

The Federal Register states that the emissions from major stationary sources that commence construction after the major source baseline date (October 20, 2010), regardless of the date on which their PSD application is submitted, must be counted toward consumption of the PM$_{2.5}$ increments. These sources will not be required to submit an increment analysis for PM$_{2.5}$ as part of their complete application as long as they receive their PSD permit before the trigger date (October 20, 2011) for PM$_{2.5}$. However, the emissions increases resulting from the permitting of these sources ultimately must be counted toward the PM$_{2.5}$ increments when the first PSD permit application submitted after the trigger date establishes the minor source baseline date for the area of concern, and in all subsequent PM$_{2.5}$ increment analyses for that area.

Single Source Ozone and PM$_{2.5}$ Secondary Formation Demonstrations

Air pollutants formed through chemical reactions in the atmosphere are referred to as secondary pollutants. Secondary PM$_{2.5}$ and O$_3$ are closely related in that they share common sources of emissions and are formed in the atmosphere from chemical reactions with similar precursors. The formation of secondary pollutants such as O$_3$ and PM$_{2.5}$ is useful for interpreting modeled impacts due to changes in emissions to that area from new PSD major sources or PSD major modifications. IDEM will take the lead and provide all necessary analysis for this demonstration.

A facility is required to perform a secondary analysis when emissions from a new major PSD source or increases from a proposed PSD project will exceed the PSD significance emission rates for ozone precursors (i.e., 40 tpy increases for either VOCs and NOX) and/or PM$_{2.5}$ (i.e., 10 tpy) and its precursors (i.e., 40 tpy increases for either SO$_2$ and NOX).
The procedure explained below is currently being used for the secondary analysis. This procedure can change based upon U.S. EPA guidance and ongoing policy changes (see Reference 20).

Maximum Emission Rates for Precursors (MERPs) can be used to evaluate if a facility’s proposed emission increases will result in total impacts that are above the SIL and NAAQS. Only pollutants above their respective significant emission rate need to be included in the MERPs analysis.

In order to address this issue, U.S. EPA has proposed revisions to the Guideline on Air Quality Models (published as Appendix W to 40 CFR Part 51) (see Reference 21) to establish a recommended two-tiered approach for addressing single source impacts on O₃ or secondary PM₂.₅. (The final guidance for O₃/PM₂.₅ SILs, MERPs, and O₃/PM₂.₅ permit modeling guidance is to come out late summer of 2018.) The first tier (or Tier 1) involves use of appropriate and technically credible relationships between emissions and ambient impacts developed from existing modeling studies deemed sufficient for evaluating a project source’s impacts. The second tier (or Tier 2) involves more sophisticated case-specific application of chemical transport modeling (e.g., with an Eulerian grid or Lagrangian model).

On December 2, 2016, U.S. EPA published draft guidance for the development of Modeled Emission Rates for Precursors (MERPs) as part of a Tier 1 demonstration for O₃ and PM₂.₅ for the Prevention of Significant Deterioration (PSD) permitting.

- **MERPs:** Modeled Emission Rates for Precursors are evaluated in tons per year (tpy).
- **Critical Air Quality Threshold:** The critical air quality threshold will be determined by each permitting authority and will be used to indicate that a value above this threshold number will contribute to a violation of the appropriate NAAQS. For ozone, the critical air quality threshold is provided in units of either parts per million (ppm) or parts per billion (ppb). For PM₂.₅, the critical air quality threshold is provided in units of micrograms per cubic meter (µg/m³). The SIL can be used for this value.
- **Modeled Emission Rate from Hypothetical Source:** The emissions rate of precursor emissions for ozone or PM₂.₅ of the source that is evaluated as part of the PSD permitting analysis. These hypothetical sources should represent sources in a given area near the proposed source or modification. This is evaluated in tpy.
- **Maximum Modeled Air Quality Impact from Source:** The result of the air dispersion modeling analysis for the source that you are evaluating as part of the PSD permitting analysis. This is evaluated in the same units as the critical air quality threshold.

The equation below is used to calculate a MERP.

\[
\text{MERP (tpy)} = \text{SIL (Critical Air Quality Threshold)} \times \left( \frac{\text{Precursor Emissions Rate (tpy)}}{\text{Maximum Model Impact}} \right)
\]
These MERP values will vary across the nation reflecting different sensitivities of an area’s air quality level to precursor emissions.

IDEM has calculated default MERP values (tpy) for PSD applications in the state.

### Table 8. Default MERPs Values for Indiana Sources

<table>
<thead>
<tr>
<th>Precursor</th>
<th>8-Hour Ozone</th>
<th>24-hour PM$_{2.5}$</th>
<th>Annual PM$_{2.5}$*</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO$_X$</td>
<td>234</td>
<td>2308</td>
<td>8333</td>
</tr>
<tr>
<td>SO$_2$</td>
<td>-----</td>
<td>305</td>
<td>3125</td>
</tr>
<tr>
<td>VOC</td>
<td>1163</td>
<td>-----</td>
<td>-----</td>
</tr>
</tbody>
</table>

*The annual PM$_{2.5}$ MERPs provided here are based on a SIL value of 0.2 micrograms per cubic meter. This is based on the final MERPs guidance which is due to come out sometime mid-2018.

For the SIL analysis, the source’s proposed emissions increases are used to determine if the secondary impacts above the SIL. The following equations are used.

For ozone, the following equation should be used:

\[
(EMIS\textunderscore NOx ÷ MERP\textunderscore NOx) + (EMIS\textunderscore VOC ÷ MERP\textunderscore VOC) < 1
\]

For PM$_{2.5}$, the following equation should be used:

\[
(HMC\textunderscore PM_{2.5} ÷ SIL\textunderscore PM_{2.5}) + (EMIS\textunderscore SO2 ÷ MERP\textunderscore SO2) + (EMIS\textunderscore NOx ÷ MERP\textunderscore NOx) < 1
\]

HMC is the highest modeled concentration (annual or H1H averaged over 5 years)

For the cumulative analysis the following equations are used if the source fails the SILs analysis.

For ozone, the following equation should be used:

\[
Background\textunderscore ozone + ((EMIS\textunderscore NOx ÷ MERP\textunderscore NOx) + (EMIS\textunderscore VOC ÷ MERP\textunderscore VOC)) × SIL\textunderscore ozone ≤ NAAQs\textunderscore ozone
\]

For PM$_{2.5}$, the follow equation should be used:

\[
Background\textunderscore PM_{2.5} + DV\textunderscore PM_{2.5} + ((EMIS\textunderscore SO2 ÷ MERP\textunderscore SO2) + (EMIS\textunderscore NOx ÷ MERP\textunderscore NOx)) × SIL\textunderscore PM_{2.5} ≤ NAAQs\textunderscore PM_{2.5}
\]
If a facility cannot meet the SIL or NAAQS using the Tier 1 approach, the applicant may be required to do a photochemical modeling analysis (Tier 2). This approach will increase the resources and timing needed to complete the analysis. IDEM will perform this analysis for the applicant. However, once the analysis is completed, it can be used again in future PSD permitting applications, as required.

**Other PSD Modeling Issues**

**Rerunning Modeling Analyses**

A modeling analysis may need to be rerun for a variety of circumstances. The following are some of the scenarios and is not inclusive why an applicant needs to rerun their analysis.

**Outdated Version of the Model or Meteorology**

Anytime a new version of the model comes out and a project is in the process of being reviewed, the latest version of the model should be used if the project is still uncompleted after 5 months of the new version release. IDEM can answer any questions concerning this and how this may impact the modeling review.

Again, the latest version of meteorology should be used. Usually, the latest version is posted on the IDEM modeling [website](#), but sometimes newer meteorology has just been recently processed and has not made it out to the website. Please check with IDEM to make sure the latest version has been posted to the site. Projects still incomplete 1 year after the posting of new meteorology must remodel with the latest MET data set.

**Source Geometry or Physical Changes**

If an applicant decides to reposition or relocate emission units or buildings within a proposed facility’s property after the modeling analysis is complete, the applicant will need to remodel the source using all five meteorological years. The changes in the source’s geometry can affect the worst-case meteorological year and concentration values.

The source must account for stack reconfigurations, changes in stack height, diameter changes, emission rates, stack releases from horizontal to vertical, or missing equipment, etc. in the modeling and use all 5 meteorological years.

**Permit Corrections**

If a PSD permit is being modified due to possible emission corrections (changes in emission factors, air flow rate, capacity, loading, or missing equipment, etc.) from the applicant’s original or latest PSD permit, modeling is required to determine if the air quality standards are being protected. Any concentration increase from changes due to missing units or increased emissions are added to the previous PSD modeling performed (original PSD concentration + concentration from increase = new value). If this new value is below the NAAQS after the background is added or is below the increment, then the source would not have to remodel the whole facility.
We allow a one-time modeling correction event. The use of this procedure will be determined on a case-by-case basis. Facilities cannot come in multiple times and keep adding small sources or emissions to their original or latest PSD permit. This could be considered circumvention of PSD rules. These changes can change the original design of the PSD permit which in turn can change the outcome of the modeling. The use of the latest version of the model will be required in the event modeling is deemed necessary.

**Tier NO\textsubscript{2} Screening Modeling**

In Appendix W, Part 51, Guideline on Air Quality Models, January 17, 2017, section 4.2.3.4 states a new screening approach for NO\textsubscript{2} modeling. There are three “tiers” of NO\textsubscript{2} modeling that are available to the user.

- **Tier 1 =** Full NO\textsubscript{x} to NO\textsubscript{2} conversion
- **Tier 2 =** Ambient Ratio Method 2 (ARM2) - 0.5 minimum to 0.9 maximum
  - U.S. EPA replaced the existing Tier 2 ARM factors of 0.75 for the annual and 0.8 for the 1-hour with a revised ARM2 approach. The ARM2 essentially multiples the modeled concentrations by a NO\textsubscript{2}/NO\textsubscript{x} ratio. These are variable NO\textsubscript{x} to NO\textsubscript{2} ratios which includes a minimum ratio of 0.5 and a maximum ratio of 0.9. These are national defaults. Preferably, an alternative minimum ambient NO\textsubscript{2}/NO\textsubscript{x} ratio should be based on source specific data which satisfies all quality assurance procedures for data accuracy for both NO\textsubscript{2} and NO\textsubscript{x} within the typical range of measured values. However, alternate information may be used to justify a source’s anticipated NO\textsubscript{2}/NO\textsubscript{x} in-stack ratios, such as manufacturer test data, peer-reviewed literature, and/or U.S. EPA’s NO\textsubscript{2}/NO\textsubscript{x} ratio database. Whatever is used outside of the national default values has to be well documented and have regulatory authority approval.
  - **Tier 3 =** Detailed Screening Technique
    - This technique can be used on case-by-case basis. Before this option is used, consultation with IDEM and U.S. EPA Region 5 is required even though it is a regulatory default option. A separate protocol to use this technique needs to be drafted and sent to IDEM. IDEM will review the protocol and will also send a copy to U.S. EPA Region 5 for comments. The Ozone Limiting Method (OLM) and the Plume Volume Molar Ratio Method (PVMRM) are the two detailed screening techniques that may be used. Both PVMRM and OLM require that ambient ozone concentrations be provided on an hourly basis and with explicit specification of the NO\textsubscript{2}/NO\textsubscript{x} in-stack ratios. PVMRM works best for relatively isolated and elevated point source modeling while OLM works best for large groups of sources, area sources, and near-surface releases, including roadway sources. Well documented assumptions are required for this technique to be used.

The NO\textsubscript{2} screening tiers can be used for the SIL analysis. One caveat is if emission credits are being considered, there needs to be some discussion with U.S. EPA on how to model them because of the concern of negative emission impacts being overestimated. Also, Tier 3 usage involves “consultation” with the U.S. EPA regional office.
Intermittent Emissions

Guidance for 1-hour SO$_2$ and 1-hour NO$_2$

The U.S. EPA memo from Tyler Fox, dated March 1, 2011, addresses intermittent emissions for the new 1-hour NO$_2$ and 1-hour SO$_2$ standards on pages 8 through 11. Intermittent emissions can be defined as emergency generators, start-up and shutdown operations, or from any intermittent/infrequent emission scenarios which are random in nature and are not scheduled. This guidance for the treatment of intermittent emissions applies only for the 1-hour standards. It does not apply for other NAAQS pollutants and other averaging periods. They will be treated differently and are explained after the 1-hour guidance.

To determine if a source’s operation is intermittent/infrequent, U.S. EPA gives some guidance in the Tyler Fox memo. Guidance from the memo states:

“For example, an intermittent source that is permitted to operate up to 500 hours per year, but typically operates much less than 500 hours per year and on a random schedule that cannot be controlled would be appropriate to consider under this guidance. On the other hand, an “intermittent” source that is permitted to operate only 365 hours per year, but is operated as part of a process that typically occurs every day, would be less suitable for application of this guidance since the single hour of emissions from each day could contribute significantly to the modeled design value based on the annual distribution of daily maximum 1-hour concentrations. Similarly, the frequency of startup/shutdown emission scenarios may vary significantly depending on the type of facility. For example, a large baseload power plant may experience startup/shutdown events on a relatively infrequent basis whereas as a peaking unit may go through much more frequent startup/shutdown cycles. It may be appropriate to apply this guidance in the former case, but not the latter.”

In most cases, emergency generators can be classified as intermittent sources provided they have a permit limit of 500 hours per year of operation and are random and infrequent in nature. Evaluating other emission sources like a natural gas turbine’s start-up/shutdown emissions can be challenging in order to determine how those emissions can be classified due to the way they operate. Again, a large baseload power plant with a permit limit of 500 hours per year of operation for start-up/shutdown emissions with a random and infrequent schedule helps determine the source’s intermittent classification in that particular situation. Turbine operations need to be discussed with IDEM before any assessment is made for the modeling analysis.

Once a source has been determined to be intermittent/infrequent, U.S. EPA gives two options for handling intermittent emission sources for the new NAAQS standards. One option is to exclude them from the modeling analysis completely. If this is the case, any rationale why intermittent emissions are to be excluded from the analysis must be justified based on the guidance outlined in pages 8 through 11 of the Tyler Fox memo dated March 1, 2011. Exclusions must be approved prior to submitting any modeling. For situations where additional discretion is needed or there is uncertainty on what to do, U.S. EPA allows the applicant to use emission averaging. This takes the maximum
hourly emission rate x (the number of “permitted” hours under consideration/8760). This procedure takes into account intermittent emissions by spreading it over the whole year and this would account for worst-case meteorological conditions.

Guidance for averaging periods outside the 1-hour standards

For these averaging periods, emergency generators could still possibly be classified as intermittent sources and use emission averaging provided they have a permit limit of 500 hours per year of operation and are random and infrequent in nature. Other emission sources like a natural gas turbine’s start-up/shutdown events have to be treated differently even though they may qualify as an intermittent source for the 1-hour analysis. This is because the Tyler Fox memo doesn’t address emission averaging for other pollutant time-averaging periods. This issue is more appropriately addressed in Appendix W. See Table 8-2 below from Appendix W, footnote 2.

<table>
<thead>
<tr>
<th>Averaging time</th>
<th>Emissions limit (lb/MMBtu)</th>
<th>Operating level (MMBtu/hr)</th>
<th>Operating factor (e.g., hr/yr, hr/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Major New or Modified Source</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual &amp; quarterly</td>
<td>Maximum allowable emission limit or federally enforceable permit limit.</td>
<td>Design capacity or federally enforceable permit condition.</td>
<td>Continuous operation (i.e., 8760 hours).²</td>
</tr>
<tr>
<td>Short term (≤ 24 hours)</td>
<td>Maximum allowable emission limit or federally enforceable permit limit.</td>
<td>Design capacity or federally enforceable permit condition.³</td>
<td>Continuous operation, i.e., all hours of each time period under consideration (for all hours of the meteorological database).⁴</td>
</tr>
<tr>
<td>Nearby Source(s)² ⁵</td>
<td>Annual &amp; quarterly</td>
<td>Maximum allowable emission limit or federally enforceable permit limit.⁵</td>
<td>Annual level when actually operating, averaged over the most recent 2 years.⁶</td>
</tr>
<tr>
<td>Short term (≤ 24 hours)</td>
<td>Maximum allowable emission limit or federally enforceable permit limit.⁵</td>
<td>Temporarily representative level when actually operating, reflective of the most recent 2 years.⁴ ⁵</td>
<td>Continuous operation, i.e., all hours of each time period under consideration (for all hours of the meteorological database).⁶</td>
</tr>
<tr>
<td>Other Source(s)³ ⁹</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ambient impacts from Non-nearby or Other Sources (e.g., natural sources, minor sources and, distant major sources, and unidentified sources) can be represented by air quality monitoring data unless adequate data do not exist.

1. Terminology applicable to fuel burning sources; analogous terminology (e.g., lb/throughput) may be used for other types of sources.
2. If operation does not occur for all hours of the time period of consideration (e.g., 3 or 24 hours) and the source operation is constrained by a federally enforceable permit condition, an appropriate adjustment to the modeled emission rate may be made (e.g., if operation is only 8 a.m. to 4 p.m. each day, only these hours will be modeled with emissions from the source. Modeled emissions should not be averaged across non-operating time periods.
3. Operating levels as less than 50 percent and 75 percent of capacity should also be modeled to determine the load causing the highest concentration.
4. Includes existing facility to which modification is proposed if the emissions from the existing facility will not be affected by the modification. Otherwise use the same parameters as for major modification.
5. See Section 8.3.3.
6. Unless it is determined that this period is not representative.
7. Temporally representative operating levels could be based on Continuous Emissions Monitoring (CEM) data or other information and should be determined through consultation with the appropriate reviewing authority (Paragraph 3.0(c)).
8. For those permitted sources not in operation or that have not established an appropriate factor, continuous operation (i.e., 8760) should be used.
9. See Section 8.3.2.
Footnote 2 states, “If operation does not occur for all hours of the time period of consideration (e.g., 3 or 24-hours) and the source operation is constrained by a federally enforceable permit condition, an appropriate adjustment to the modeled emission rate may be made (e.g., if operation is only 8 a.m. to 4 p.m. each day, only these hours will be modeled with emissions from the source. Modeled emissions should not be averaged across non-operating time periods.” For example, for the 24-hour PM$_{2.5}$ NAAQS the applicant must include steady state operations for 23 hours and 1 hour for start-up emissions to cover the full time period of operation. This would accurately reflect what is discussed in the Table 8-2, Footnote 2, of Appendix W. In order to do this, AERMOD allows the use of Emission Factors or Scalars to account for hours of operation. There you will see several different options for Emission Rate Flags, including HROFDY (Hour Of Day). HROFDY allows the user to apply Emission Factors to a source or group of sources on an hour-by-hour basis that is applied to every day modeled. The HROFDY array includes a field for each of the 24 hours of the day. You can place a scalar that is multiplied by the emission rate input into each hourly field in the Sources tab. That is, you put in a "1" in the field for a particular hour and the emission rate is multiplied by 1. Likewise, if a source is not operating for a particular hour, a "0" is input to the hour’s field, yielding a modeled emission rate of 0.

AERMOD uses a nomenclature of Hour 1, Hour 2, etc. To correspond to actual times, AERMOD interprets Hour 1 as the hour from midnight to 1 am, Hour 2 is 1 a.m. to 2 a.m., etc. Also, Daylight Saving Time is not accounted for in the use of Emission Scalars.

When to invoke start-up/shutdown emissions with normal operations will depend on how the facility will be operated. Assumptions will have to made and documented in the analysis.

Merging Gas Streams

The October 28, 1985, U.S. EPA memorandum concerning "Implementation of Stack Height Regulations - Exceptions from Restrictions on Credit for Merged Stacks," establishes demonstration requirements to merge gas streams in the modeling. Before merging gas streams in the modeling, the applicant must show that these demonstration requirements are met. If these requirements cannot be met, co-located stacks will need to be used in the air quality modeling analysis.

Two Sources Sharing a Common Property Line

Any applicant sharing a common property line with a neighboring source is not allowed to cause a violation of a NAAQS on the neighboring source's property. This situation can best be explained by the following example: The applicant shares a property line with a neighboring source. The neighboring source is allowed to cause a violation on its own property with its own emissions. The receptors that are located on the neighboring source’s property are analyzed using only the applicant's emissions. The receptors outside the neighboring source's property will include impacts from both the applicant's and the neighboring source's emissions.
Modifications Less Than the PSD Significant Rate for PSD Sources

Usually, for a source modification where the emission increases are below PSD significant emission rates, modeling is not required. There are many factors to consider. Consideration of stack flow rates, stack temperatures, building geometry, and proximity to the property line are some of these factors. If the source's modification comes close to the significant emission rate, IDEM may perform screen modeling as a precautionary measure. Also, based on the permit reviewer's discretion, modeling can be requested. If there is a question whether modeling needs to be performed, the applicant can contact IDEM and describe the situation in detail so a determination can be made.

New NAAQS Standards – Miscellaneous Information

PM$_{2.5}$

The representative monitored PM$_{2.5}$ design value, rather than the overall maximum monitored background concentration, is to be added to the appropriate modeled concentration. IDEM can provide PM$_{2.5}$ design values for the latest available time period.

NO$_2$

While the 1-hour NAAQS for NO$_2$ is defined in terms of the three-year average for monitored design values to determine attainment of the NAAQS, this definition does not preempt the Appendix W requirement for the use of five years of National Weather Service data. The 5-year average serves as an unbiased estimate of the 3-year average for purposes of modeling demonstrations of compliance with the NAAQS.

The monitored design value can be used from a representative monitor and added to the appropriate modeled concentration. IDEM can provide 1-hour NO$_2$ design values.

SO$_2$

The monitored design value can be used from a representative monitor and added to the appropriate modeled concentration. IDEM can provide 1-hour SO$_2$ design values.

Non-Attainment NSR

Major Source Non-Attainment Modeling

For PM$_{2.5}$ nonattainment areas, where emission offsets are being made, modeling is not required for PM$_{2.5}$.

For ozone nonattainment areas, new sources, or modifications of existing sources, involving VOC or NO$_x$ emissions increases need only consider emissions offsets as opposed to modeling. Since the ambient impact of these pollutants is area-wide rather than localized, one pound of increased emissions will be balanced in ambient effect by one pound of decreased emissions within the same broad geographic area, and the precise location of those increases and decreases ordinarily is not necessary. For VOC and NO$_x$, such “pound-for-pound” trades may therefore be treated as equal in ambient
effect in lieu of modeling where all sources involved in the trade are located in the same control strategy demonstration area. Therefore, for nonattainment areas, once offsets are obtained, there is no air quality analysis required.

An NO₂ PSD analysis may be required for the source if it is major or has a major modification for NO₂. The NO₂ NAAQS and increment analysis is a separate issue from the emission offsets occurring for ozone nonattainment, especially if the offset occurred outside the applicant’s facility or a full offset was not completed. Localized impacts for NO₂ could still occur around the applicant’s facility.

For particulate matter, SO₂, CO, or lead emission trading, use the following guidelines:

Indiana follows the Emissions Trading Policy Statement (December 4, 1986 51 FR 43814-43860) only for a Level 3 analysis. The Bubble Policy has been removed from the Emissions Trading Policy Statement and is no longer followed by U.S. EPA Region 5. All offsets should perform a Level 3 analysis or run the risk of disapproval in the rulemaking process no matter how small the emission change. The applicant can make the choice to perform an air quality analysis that is less than a Level 3 (Level 1 or Level 2) for insignificant emission changes, but their request may not be approved by U.S. EPA.

A Level 3 analysis is required whenever there will be a net increase of emissions in a nonattainment area. This typically involves modeling all of the sources in the nonattainment region (NAAQS analysis). The county sources and the expected modeled impacts from the proposed project are added to monitored background readings and compared to the standard. If there are no modeled violations, the project has no significant impact. If there are violations, the contributions of the project are compared to the excess violation of the standard at each violating receptor. If the project contribution is found to have culpability, then the project has caused that modeled violation. These situations will be handled on a case-by-case basis in consultation with U.S. EPA. The latest 5 years of meteorological data are used for a Level 3 analysis.

### Hazardous Air Pollutants (HAPs) Modeling

**Applicability**

This section applies to major sources of HAPs. (A source consists of all emission locations within a contiguous area that are under common control; see 326 IAC 1-2-73.) A source is major if its PTE HAPs emissions equal or exceed 10 tons/year for any single HAP or equal or exceed 25 tons/year for all HAPs combined. PTE emissions are based on the maximum capacity under the source’s physical and operational design with no air pollution control equipment in place. However, PTE emissions may be restricted by federally enforceable permit conditions.

For an existing source that meets the requirements in Paragraph 1 and has applied for a permit to modify its operations, only the HAPs emissions from the proposed modification that exceed the above thresholds will be subject to the procedure contained in this section.
For a proposed new source that meets the requirements in Paragraph 1, all HAPs emissions will be subject to the procedure contained in this section. The risk analysis can either be performed by IDEM or the applicant.

IDEM will use a U.S. EPA approved air dispersion model (AERSCREEN or AERMOD) to calculate off-site (i.e., at or beyond the source’s property boundary) HAPs concentrations in conjunction with toxicological information to conduct a cancer risk and hazard screening evaluation as prescribed in this document. If the screening analysis indicates potential health risks above defined thresholds, then a more refined analysis will be employed.

This analysis is a modeling requirement to obtain a permit and is done to provide additional information to the public about potential health impacts associated with HAP emissions. If the applicant decides not to perform this analysis or does not provide the necessary HAPs information so IDEM can perform the analysis, the issuance of the permit could be delayed or not issued. This analysis will be incorporated into IDEM's modeling review.

**Screening Methodology**

IDEM will use the maximum off-site model estimated concentration of each applicable HAP emitted in the initial evaluation. Off-site, at this stage, is at or beyond the source’s property boundary. These concentrations along with toxicological data will be part of the inhalation risk and hazard evaluation as provided by U.S. EPA. Toxicological dose response information that will be used by IDEM is available on IDEM’s website.

Facilities may suggest the use of toxicological data other than that contained in IDEM’s toxicological tables. However, the facility must provide reference documentation for the data. IDEM reserves the authority to use the data that it considers most appropriate.

The toxic screening assessment will be performed assuming an acute (short term) and a chronic (long term) exposure duration. An acute evaluation will assume exposure duration of 1 to 14 days. (At this time, a 24-hour modeled concentration will be used in the evaluation of acute risk.) A chronic evaluation will assume exposure duration of 24 hours a day, 365 days per year, for 70 years. (An annual average modeled concentration will be used in the evaluation of chronic exposure.)

**Non-Cancer Chronic Hazard Screening**

IDEM will take the maximum, modeled concentration for each applicable HAP at or beyond the property boundary and compare it to the appropriate Inhalation Reference Concentration (RfC) to obtain the Hazard Quotient (HQ).

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\text{Hazard Quotient} = \frac{\text{Modeled concentration}}{\text{Reference Concentration}}
\]

IDEM will perform this evaluation for all applicable HAPs.

IDEM will compute the cumulative effects of multiple HAPs by summing the individual HQs in order to determine the total Hazard Index (HI). This form of Hazard Index
evaluation assumes that all the adverse critical effects of the different HAPs are the same and cumulative. If the HQ and HI are below a value of one, then there is no reasonable expectation that adverse health effects would occur due to exposure solely from the subject facility.

If the results of the non-cancer evaluation produce values equal to or greater than one, then there is potential for adverse health effects to occur because of emissions from the source. At this point, IDEM will conduct a refined analysis by using a more sophisticated air dispersion model and inputs. If after a refined analysis is performed the HQ is still above “1,” then IDEM may perform an evaluation based on the critical effects of the HAP(s) as well as hold discussions with the source on ways to reduce HAP emissions.

**Cancer Risk Screening**

IDEM will compute cancer risks for individual HAPs by multiplying the maximum, modeled annual concentration by its corresponding Unit Risk Factor (URF) for carcinogenic HAPs to estimate the potential incremental cancer risk for an individual.

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\text{Cancer Risk} = \text{Annual Concentration} \times \text{Unit Risk Factor}
\]

The result is a unitless value that represents an estimated individual cancer risk, expressed as an upper bound probability that a person may develop cancer over the course of his lifetime because of exposure to the HAP. IDEM will perform this evaluation for all carcinogenic HAPs. This evaluation assumes a constant exposure 24 hours a day, 365 days per year, for 70 years (i.e., a lifetime risk).

IDEM will compute a cumulative cancer risk for a facility by summing the cancer risk posed by each carcinogenic HAP. IDEM will consider a cancer risk above 1x10^{-6} level to be a level of concern. If the cumulative cancer risk is above 1x10^{-6}, IDEM will conduct a refined analysis by using a more refined air dispersion model and inputs. U.S. EPA considers one in ten thousand (1.0E-04) excess cancer risks to be the upper range of acceptability with an ample margin of safety.

At this stage of the process, the assumption is that the source is either in compliance with the above metrics or its hazard and risk levels are still above any of the following levels (HQ>1, HI>1, Risk >1x10^{-6}). In the latter case, IDEM will initiate discussions with the source to explore ways to reduce HAPs emissions and the corresponding risk.

**References and Federal Resource Documents**


Federal Resource Documents for New NAAQS Standards

PM$_{2.5}$
- The Federal Register dated October 20, 2010, defines PM$_{2.5}$ increments, SILs, and SMC

NO$_2$
- Tyler Fox memorandum dated March 01, 2011
- Stephen Page memorandum dated June 29, 2010
- Anna Marie Wood memorandum dated June 28, 2010
- Tyler Fox memorandum dated June 28, 2010

SO$_2$
- Anna Marie Wood memorandum dated August 23, 2010
- Tyler Fox memorandum dated August 23, 2010
- Tyler Fox memorandum dated March 01, 2011 can also be used for SO$_2$ even though it is guidance for NO$_2$