INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

AIR QUALITY MODELING POLICIES

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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 PSD 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 for at least one pollutant must be greater than 100 or 250 tons per year, depending on the source category, to require PSD modeling and any remaining pollutants above the Significant Emission Rates (SER) after controls are used for PSD model determination. If an existing source is already major (a PSD source), any modification involving any criteria pollutant must exceed the SER after controls to make it a major modification. Existing sources proposing major modifications must conduct PSD modeling and are determined by having potential emissions above the SER after controls.

HAPs are also modeled for PSD sources, as well as for some minor sources, for informational purposes and may provide potential health impacts associated with those 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

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.

AERMIC – American Meteorological Society/Environmental Protection

Agency Regulatory Model Improvement Committee.

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.

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

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

AERSURFACE – A surface characteristics preprocessor.

ALTERNIVE MODELS – These models are outside of the "preferred" models used for regulatory application. U.S.EPA has set forth a protocol to assist in developing a consistent approach when justifying the use of other-than-preferred models recommended in Appendix W of 40 CFR Part 51, section 3.2, Use of Alternative Models, 3.2.2 Requirements.

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

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.

CMAQ – Is an acronym for the Community Multi-scale Air Quality Model. CMAQ has the capability to accurately predict air pollution concentrations resulting from secondary formation like ozone and particulate levels.

CAMX - Comprehensive Air Quality Model with Extensions. CAMx is a multi-scale, three-dimensional photochemical grid model. CAMx is appropriate for simulating hourly ozone, CO, and PM concentrations from the urban scale to regional-scale modeling demonstrations.

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. GEP stack height is creditable in an air quality modeling demonstration. Tall stacks above GEP stack height cannot be given credit for its full stack height within a modeling demonstration. See Downwash (Stack Height) section for further discussion.

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 – Modeled 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 – Any 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 in the modeling.

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 2). In most cases, this applicability determination is performed by IDEM's permit review branch.

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 1. PSD Significant Emission Rates (326 IAC 2-2-1)

Pollutant	tons/year
Carbon Monoxide (CO)	100
Nitrogen Oxides (NO_x)	40[1]

Sulfur Dioxide (SO_2)[2]	40[1]
Particulate Matter ($PM_{2.5}$)[2]	10
Particulate Matter (PM_{10})	15
Ozone (VOCs)/(NO_x)[2]	40
Lead (Pb)	0.6
Asbestos	0.007
Beryllium (Be)[3]	0.0004
Mercury (Hg)[3]	0.1
Vinyl Chloride (C2H3Cl)[3]	1
Fluorides (F^-)[3]	3
Sulfuric Acid Mist (H2SO4)[3]	7
Hydrogen Sulfide (H2S)[3]	10
Total Reduced Sulfur[3]	10
Reduced Sulfur Compounds[3]	10

[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 <u>must be submitted</u> to IDEM for review and approval before the actual modeling analysis is submitted to the agency. Among the suggested modeling methodology topics for discussion are:

- Meteorology and terrain;
- Receptor network and ambient air boundaries (see "Receptor Placement" section for further discussion);
- 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 must be included in 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;
- Single source ozone and $PM_{2.5}$ secondary formation demonstrations;
- 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 review and approval process of the protocol 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 any modeling conducted by the applicant to be resubmitted with corrections.

Modeling protocols that are not acted upon within four months of IDEM's 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 a letter stating 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. It should be noted that U.S. EPA's review process of requests for use of alternative models can take several weeks or longer for approval.

AERMOD Components

AERMOD fully replaced Industrial Source Complex Short Term, version 3 (ISCST3) as the regulatory air dispersion 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 3). 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 4, 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 as alpha or beta options 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. This was primarily designed to handle dispersion from aluminum smelter potline operations. 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 (line sources) where buoyancy is important.

Preliminary Impact Analysis

Once an applicability determination has been completed by an IDEM permit reviewer, a source will either be a proposed new major source or major modification. A preliminary impact analysis is required for these determinations. There are basically two cases to determine what emissions are used in the preliminary impact analysis. The first is a proposed new major source or second, a proposed new major modification which has not begun normal operations. For the first scenario, the PTE must be used in the analysis.

For the second case, a proposed major modification is made to existing unit(s) in current operation. In this scenario, calculations are made to determine what emissions are to be modeled. There are two aspects of emissions that are required to be examined. First, the baseline (old) emissions level is determined by calculating the average rate in tons per year at which the unit(s) actually emitted the pollutant during the 2-year period just prior to the change which resulted in the emission increase. Secondly, the proposed allowable emissions are determined for the new project. The difference between the actual emissions over the last 2-year period that is representative of normal source operation and proposed allowable emissions will be used in the preliminary modeling analysis. The difference between project allowable and current actual emissions may differ from the net emission increase used for determining PSD applicability. For further guidance, see the NSR Workshop Manual (Reference 6). Once the 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, additional modeling impact analyses must be conducted and include the following: 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[1]

Pollutant	Averaging Period	Significant Impact Level (SIL) (μg/m^3)
$PM_{2.5}$	Annual	0.3[2]
	24-hour	1.2[2]
PM_{10}	Annual	1[3]
	24-hour	5[3]
SO_2	Annual	1[4]
	24-hour	5[4]

	3-hour	25[5]
	1-hour	7.8 (3 ppb)[6]
NO_2	Annual	1[7]
	1-hour	7.5 (4 ppb)[8]
CO	8-hour	500
	1-hour	2000
O_3	8-hour	1 ppb[9]

[1] 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 5-year average 1-hour NO_2 concentrations 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 5-year average of 24-hour or annual $PM_{2.5}$ concentrations predicted 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.

[2] 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. On April 17, 2018, U.S. EPA released the final Guidance on Significant Impact Levels for Ozone and Fine Particles in the Prevention of Significant Deterioration Program (Ozone and PM2.5 SIL Guidance). U.S. EPA states that their guidance is non-binding and it will be used to collect information to justify the application of the SIL values stated in the guidance document. IDEM feels since this is nonbinding guidance and will be used for data collection purposes, sources applying for a PSD permit do not have to comply with this document until final U.S. EPA rulemaking action is taken.

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 U.S. EPA Region 5 states in their comments to IDEM dated 6/27/2018 that the 1-hour SO2 NAAQS is 196.4 $\mu g/m^3$ instead of 196.2 $\mu g/m^3$.

7 For NO_2, compliance with the annual standard still applies.

8 NO_2 Conversion is derived by: (100 $\mu g/m^3$ / 53 ppb) * 4 ppb = 7.547 $\mu g/m^3$ ~ 7.5 $\mu g/m^3$ (The 100 $\mu g/m^3$ = 53 ppb conversion comes from a federal notice regarding modeling for the new hourly NO_2 NAAQS dated February 25, 2010.)

9 Used as the critical air quality threshold value for the MERPs analysis.

Source Inventories

The applicant must use an inventory of existing emissions from sources within 50 km of the proposed source to account for nearby source impacts. 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 conjunction with a maximum allowable emission limit, in developing the emissions inputs for dispersion modeling of nearby inventory sources, while other sources are best represented by air quality monitoring data. An operating level/factor has to be developed and used in order to do this. This means multiplying the federally enforceable permit limit with the actual operating level and operating factor from the most current 2-year period. Table 8-2 in Appendix W provides an emission value that is less than the potential emission (PTE) rate but greater than the actual emission rate. This “modified permit operating level” must follow what is outlined in in Table 8-2 in Appendix W.

Also, potential PSD sources that could be locating in an area in which the applicant is considering to build as well need to be included in the modeling inventory if they could be in the applicant’s area of influence. This is a proactive approach to include potential inventory sources which could synergistically affect the air quality in a given area. This determination will be made case by case, based on the review of potential PSD permits currently under IDEM review, and is contingent on the potential PSD source having submitted a PSD construction permit application with the state.

IDEM’s PSD increment inventories include sources that consume 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 of 40 CFR Part 51, Guideline on Air Quality Models.

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Table 8-2. - Point Source Model Emission Inputs for NAAQS Compliance in PSD Demonstrations

Averaging time	Emissions limit (lb/MMBtu)[1]	x	Operating level (MMBtu/hr)[2]	x	Operating factor (*e.g.*, hr/yr, hr/day)
Proposed Major New or Modified Source					
Annual & quarterly	Maximum allowable emission limit or federally enforceable permit limit.		Design capacity or federally enforceable permit condition.		Continuous operation (i.e., 8760 hours).[2]
Short term (≤ 24 hours)	Maximum allowable emission limit or federally enforceable permit limit.		Design capacity or federally enforceable permit condition.[3]		Continuous operation, i.e., all hours of each time period under consideration (for all hours of the meteorological database).[2]
Nearby Source(s) [4, 5]					
Annual & quarterly	Maximum allowable emission limit or federally enforceable permit limit.[5]		Annual level when actually operating, averaged over the most recent 2 years.[6]		Actual operating factor averaged over the most recent 2 years.[6, 8]
Short term (≤ 24 hours)	Maximum allowable emission limit or federally enforceable permit limit.[5]		Temporally representative level when actually operating, reflective of the most recent 2 years.[6, 7]		Continuous operation, i.e., all hours of each time period under consideration (for all hours of the meteorological database).[2]
Other Source(s) [5, 9]					
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 8.3.3.
6. Unless it is determined that this period is not representative.
7. Temporally 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 8.3.2.

Recent U.S. EPA guidance concerning the new 1-hour standards suggest that emphasis on determining which inventory sources to include in the modeling analysis should focus on the area within 10 kilometers of the applicant location in most cases. This does not 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. Monitoring must be representative of the geographic area the proposed source is locating and could even include the nearest monitor in an adjacent state. 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 (SMC) [1]

Pollutant	Averaging Period	Significant Monitoring Concentration (μg/m^3)
SO_2	1-hour	-
	3-hour	-
	24-hour	13
	Annual	-
$PM_{2.5}$	24-hour	0[2]
	Annual	-
PM_{10}	24-hour	10
	Annual	-

NO_2	1-hour	-
	Annual	14
CO	1-hour	-
	8-hour	575
Pb	Rolling 3-month Average	-

[1] 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 NO_2, 1-hour SO_2, 24-hour and annual $PM_{2.5}$ SMCs are compared with 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 Table 3 above for more details on modeling averaging times.

[2] On January 22, 2013, the DC Circuit Court of Appeals vacated the 24-hour $PM_{2.5}$ SMC (see Sierra Club v. EPA, 705 F.3d 458 (D.C. Cir. 2013), available at https://www.cadc.uscourts.gov/internet/opinions.nsf/3964717CAD7BDA0085257AFB0055425F/$file/10-1413-1416378.pdf). Consistent with the DC Circuit's decision, U.S. EPA promulgated rules on December 9, 2013 changing the $PM_{2.5}$ SMC at 40 CFR §§ 51.166(i)(5)(i) and 52.21(i)(5)(i) to 0 µg/m³, meaning that there is no preconstruction monitoring exemption available (see 78 FR 73698, available online at https://www.federalregister.gov/documents/2013/12/09/2013-29196/prevention-of-significant-deterioration-for-particulate-matter-less-than-25-micrometers-significant). As discussed in the Implementation section on 78 FR 73700, U.S. EPA advised permitting authorities to revise the SIP to change the $PM_{2.5}$ SMC to 0 µg/m³ as soon as feasible. Until the SIP is updated to change the $PM_{2.5}$ SMC to 0 µg/m³, U.S. EPA advise permitting authorities to not apply the 4 µg/m³ $PM_{2.5}$ SMC even prior to revising the SIP as its use to exempt $PM_{2.5}$ preconstruction monitoring requirements is unlawful.

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

Pollutant	Averaging Period	Calculation of Background Value
SO_2	1-hour	The 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour average concentrations (4th highest)
	3-hour	The average of the 2nd high for all 3 years
	24-hour	The average of the 2nd high for all 3 years
	Annual	Highest annual value over the 3-year period
$PM_{2.5}$	24-hour	The average of the 98th percentile 24-hour values over 3 years
	Annual	The average of the annual mean concentrations over 3 years
PM_{10}	24-hour	The average of the 2nd high for all 3 years
NO_2	1-hour	The 3-year average of the 98th percentile of the annual distribution of daily 1-hour concentrations (8th highest)
	Annual	Highest annual value over the 3-year period
CO	1-hour	The average of the 2nd high for all 3 years
	8-hour	The average of the 2nd high for all 3 years
Pb	Rolling 3-month average	Maximum rolling 3-month average evaluated over a 3-year period

Meteorological Data

The meteorological data must be adequately representative and taken from a nearby National Weather Service (NWS) or comparable station (site-specific), or prognostic meteorological data. The meteorological data should ensure that worst-case meteorological conditions are adequately represented in the model results. In almost all cases, NWS data provides adequate coverage for the state and provides 5 years or 43,800 hours of meteorological data. This data covers a wide range of meteorological conditions. U.S. EPA states other comparable meteorological data can be used. One year of site-specific or at least 3 years of prognostic meteorological data can be used. Spatial or geographical representativeness is best achieved by collection of all needed model input data near the actual site of the source(s). Site-specific measured data can be preferred provided that appropriate instrumentation and quality assurance procedures are followed correctly, and worst-case meteorological conditions can be captured and represented. Data collected must be adequately representative (free from inappropriate local or microscale influences) and compatible with the input requirements of the model to be used. Site-specific data may not always capture worst-case meteorological conditions for a given year since conditions can vary on a year-by-year basis. For some limited 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 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 made on a case-by-case basis and would require several weeks or longer to complete.

When using NWS data, the most recent five years of available meteorological data is to be used (326 IAC 2-2-5), 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 either 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

Site ID Number	Site Name	State	Profile Base Elevation (meters)	Latitude (degrees)	Longitude (degrees)
14827	Fort Wayne Int'l Airport	Indiana	252	40.972472	-85.206357
04833	Lincoln, Illinois (UA)*	Illinois	n/a	40.151	-89.337
14848	South Bend Michiana Regional Airport	Indiana	236	41.707229	-86.316294

13841	Wilmington Airborne Park, Ohio (UA)*	Ohio	n/a	39.420	-83.822
93817	Evansville Regional Airport	Indiana	121.9	38.050159	-87.514665
93819	Indianapolis Int'l Airport	Indiana	246	39.725149	-86.281600
93821	Louisville Int'l Airport	Kentucky	149	38.177378	-85.730754
On-Site	Gary IITRI**	Indiana	183	41.6067	-87.3048
93814	Cincinnati Northern Kentucky Airport	Ohio	267	39.044429	-84.672418

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

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. IDEM requires applicants to use the land use procedure described in Section 7.2.1.1(b)(i). This is the Auer scheme and is sufficient for land use determination for Indiana. The AERMOD Implementation Guide dated April 2018, 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 with sufficient justifications provided to IDEM. The applicant must provide a map of the proposed site with documentation for IDEM's review for urban/rural status in the modeling protocol.

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 applicant to account for actual operations in developing the emissions inputs for dispersion modeling of inventory 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 the inventories for sources located in the state of Indiana. IDEM allows the elimination of sources in the NAAQS/PSD increment inventory if they emit 1 ton per year or less of each applicable pollutant 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 SO_2 standard and has to do a NAAQS analysis. The applicant is located in the Evansville meteorological area. They have an SO_2 NAAQS inventory source 10 km away from the applicant's SIA. The inventory source emits 10 tons per year of SO_2. 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 11.1 tons per year at the 10 km distance can be omitted from the inventory.

Table 6. Evansville SO_2 Look-up Screening Table

SO2 Screenable Sources
Using SIL factor as limit

Distance km	Annual	24-hour	3-hour < TPY	1-hour
1	8.1	4.5	5.6	1.4
2	23.1	11.5	13.4	2.7
3	43.8	20.5	23.5	4.1
4	69.6	30.6	35.4	5.1
5	99.9	42.0	49.1	6.2
6	134.6	54.5	64.5	7.1
7	173.3	68.0	77.7	8.1
8	216.0	82.5	87.2	9.1
9	262.5	98.0	96.7	10.1
10	313.5	114.3	106.3	11.1

An Excel copy of the tables can also be downloaded from IDEM's modeling website. Actual emissions can be used for screening NAAQS sources. Applicants must provide their screening work if the screening tables are used.

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 SO_2 and NO_2 standards, a 10-kilometer distance is considered adequate to determine which inventory 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 inventory 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 – Class I and Class II

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

IDEM requires a standardized receptor grid. The first set of receptors need to be set around the ambient air boundary only to the extent that a fence line or a physical barrier that precludes access to the general public is used. These boundaries usually define areas restricted to the public. Spacing of receptors 50 meters (164 feet) along the property line is required provided access is restricted. A standardized receptor grid is outlined below:

- Grid containing 50-meter receptor spacing along the property boundary,
- Grid containing 100-meter receptor spacing from the property boundary to 2 kilometers,
- Grid containing 250 meters receptor spacing from 2 to 5 kilometers,
- Grid containing 500 meters receptor spacing from 5 to 10 kilometers,
- Grid containing 1000 meters receptor spacing from 10 to 25 kilometers,
- Grid containing 2000 meters receptor spacing from 25 to 50 kilometers.

Further receptor placement (i.e., finer nested grid) may be necessary for adequate receptor density and should provide adequate coverage for determining the facility's maximum concentration. A Cartesian coordinate system is recommended.

On December 2, 2019, U.S. EPA provided revised policy on Exclusions for "Ambient Air" (see Reference 14). U.S. EPA revised their ambient air policy by replacing "a fence or other physical barriers" with "measures, which may include physical barriers that are effective in deterring or precluding access to the land by the general public." This change is to give greater flexibility in determining where to place receptors for an air quality analysis. With advances in technology, U.S. EPA believes there are various measures other than fencing or other physical barriers that a facility can employ to serve as an effective deterrent to public access. Some of these measures may include video surveillance and monitoring, clear signage, routine security patrols, drones, and other potential future technologies. An applicant has to prove the alternative measures are as good as fencing or other physical barriers to deter public access. Without adequate justification to maintain an ambient air boundary around the facility using new technologies, federal approval would be very difficult if not impossible to obtain for this approach. It should be noted that U.S. EPA may require additional time to review these justifications that may include review by U.S. EPA's – Office of Air Quality Planning and Standards (OAQPS) Ambient Air Review Team.

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 are quality assured. 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 15). 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, SO_2 - January 6, 1975, NO_2 - February 8, 1988, and $PM_{2.5}$ - 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, or area source occurring after the minor source baseline date. The PSD minor source baseline dates for another state may be different from Indiana's so that state should be contacted for their minor source baseline dates. As mentioned above, a PSD Increment Inventory can be obtained from IDEM's website, the inventory takes into account Indiana's major and minor source baseline dates.

Minor sources are not included in the PSD Increment Inventory. It is possible minor sources might have to be added to the inventory to account for increment consumption which is location dependent. IDEM recommends minor sources be included if necessary, before modeling is performed. Minor sources that must be included have a significant impact on proposed PSD source significant impact area. Minor sources can be screened using one of the two methods described in the modeling policies.

IDEM has recently revised their increment inventory as of December 31, 2020. This revision improved the overall accuracy of the inventory. Increment modeling consumption results can be provided by county but it is for informational purposes only. If an applicant exceeds a SIL, a PSD refined modeling analysis will be necessary to determine compliance with the increment standards. Also, possible increment changes may have occurred since the increment inventory was revised. Applicants should consult with IDEM to determine if additional PSD increment sources have been added to the inventory or for possible increment source shutdowns.

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 results 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 16). 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 for all stacks within the influence area of a building. 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.

For all stacks within the influence area of a building, 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, but applicants should include building data for nearby sources that could influence downwash. 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 scenario should be modeled to determine worst-case emissions. 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.

Flares

Flare stacks are primarily used for burning off flammable gas releases from plant equipment and are considered a control device. During plant or partial plant startups and shutdowns, they are also often used for the planned combustion of gases over relatively short periods of time.

Flares are typically modeled similar to point sources but a certain factors need to be taken into consideration. A flare includes a plume rise factor due to radiative heat loss. Since this is the case, US EPA recommends sources such as flares be modeled in AERMOD using the parameter input methodology described in Section 2.1.2 of the AERSCREEN User's Guide (U S EPA, 2011b). If certain flare characteristics are inputted into AERSCREEN it can give the desired inputs needed to be modeled as point source in AERMOD.

Other modeling procedures besides AERSCREEN are also available to model flares. If flares are involved for the proposed PSD source the applicant needs to outline in the modeling protocol what procedure will be used when modeling these emission releases. Depending on the method an applicant may want to use, consultation with IDEM and U.S. EPA is needed before that procedure may be used in the modeling analysis.

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

Pollutant	Modeling Averaging Period	Concentration Used for Comparison to Standard (5 years of modeling) – For NAAQS Standard Only	NAAQS Standard (µg/m³)		PSD Increment Standard (µg/m³) Indiana Class II Area[1]
			Primary	Secondary	
$PM_{2.5}$	Annual	Highest average of the annual averages across 5 years	12	-	4[2]
	24-hour	Multiyear average of 8th highest (98th percentile) across 5 years	35	-	9[2]
PM_{10}	Annual	Highest	Revoked	-	17
	24-hour	Highest Sixth High over 5 years	150	-	30

SO_2	Annual	Highest	80	-	20
	24-hour	Highest Second High	365	-	91
	3-hour	Highest Second High	-	1300	512
	1-hour	Multiyear average 4th highest (99th percentile)	196.4[3] (75 ppb)	-	-
NO_2	Annual	Highest	100 (53 ppb)	Same as primary	25
	1-hour	Multiyear average 8th highest (98th percentile)	188.6 (100 ppb)	-	-
O_3[1]	8-hour	None	75 ppb	Same as primary	-
CO	8-hour	Highest Second High	10000	NA	-
	1-hour	Highest Second High	40000	NA	-
Pb	Rolling 3 Month Average	Highest	0.15	Same as primary	-

[1] 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, use the highest second high value during that 5-year period. For the annual use, the highest first high value during that 5-year period. No averaging is performed.

[2] 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.

[3] U.S. EPA Region 5 states in their comments to IDEM dated 6/27/2018 that the 1-hour SO_2 NAAQS is 196.4 µg/m^3 instead of 196.2 µg/m^3.

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 secondary analysis is necessary 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/or NOX). If a source triggers PSD for $PM_{2.5}$ based on direct $PM_{2.5}$ (i.e., 10 tpy) and/or its precursors (i.e., 40 tpy increases for either SO_2 and/or NO_X), a secondary analysis is required.

For example, if a source triggers PSD for ozone based on either NOx or VOC emissions exceeding the PSD significance emission rate, then the MERP analysis must consider both NOx and VOC emissions. If a source triggers PSD for $PM_{2.5}$ based on direct $PM_{2.5}$ emissions, NOx emissions or SO_2 emissions individually, then the analysis should consider the modeled impact from direct $PM_{2.5}$ emissions and secondary $PM_{2.5}$ impacts from both NOx and SO_2 precursor emissions.

The procedure explained below is currently being used for the secondary analysis.

In order to address this issue, U.S. EPA revised the Guideline on Air Quality Models (published as Appendix W to 40 CFR Part 51) (see Reference 17) to establish a recommended two-tiered approach for addressing single source impacts on O_3 or secondary $PM_{2.5}$. (The final guidance for O_3/$PM_{2.5}$ SILs, MERPs, and O_3/$PM_{2.5}$ permit modeling guidance was released April 30, 2019. This was a memorandum titled "Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program" from Richard A. Wayland.) 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 a Eulerian grid or Lagrangian model).

U.S. EPA anticipates only in a few circumstances where a Tier 2 demonstration would be necessary. They expect in most situations compliance can be demonstrated under the Tier 1 analysis. If a Tier 2 demonstration is necessary, IDEM will take the lead with the source and U.S. EPA to have meetings to discuss the specifics of potential CAMx or CMAQ photochemical modeling.

Below are definitions of MERPs terms to better understand this secondary pollutant analysis.

MERPs Definitions

- **MERPs:** Modeled Emission Rates for Precursors are evaluated in annual emissions expressed in tons per year (tpy).
- **CMAQ –** Is an acronym for the Community Multi-scale Air Quality Model. CMAQ has the capability to accurately predict air pollution concentrations resulting from secondary formation like ozone and particulate levels.
- **CAMX -** Comprehensive Air Quality Model with Extensions. CAMx is a multi-scale, three-dimensional photochemical grid model. CAMx is appropriate for simulating hourly ozone, CO, and PM concentrations from the urban scale to regional-scale modeling demonstrations.
- **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 $PM_{2.5}$, the critical air quality threshold is provided in units of micrograms per cubic meter ($\mu g/m^3$). The SIL can be used for this value.
- **Modeled Emission Rate from Hypothetical Source:** The emissions rate of precursor emissions for ozone or $PM_{2.5}$ 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 Hypothetical Source:** The result of the air dispersion modeling analysis for the source to be evaluated 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 -

MERP (tpy) = SIL (Critical Air Quality Threshold) × (Modeled emission rate from hypothetical source (tpy) ÷ Modeled air quality impact from hypnotical source)

These MERP values will vary across the nation reflecting different sensitivities of an area's air quality level to precursor emissions.

The December 2nd, 2016 MERPS Guidance had three hypothetical facilities modeled in Indiana, located in Dubois (18037), Grant (18053), and Porter (18127) Counties.
In the final April 30th, 2019 MERP guidance, an additional hypothetical source was added

in Boone County (18011), as well as a source in Owen County, Kentucky (21187), which can be used as a representative source for sources locating in southeast Indiana.

Table 8 lists the lowest default MERPS values for Indiana. These values are the lowest MERPS values for any of the hypothetical sources modeled in the state. These default MERP values represent the most conservative and stringent values for a facility locating in the state. Facilities with emissions below these values would not be expected to contribute to a violation of the NAAQS for that MERP, however the cumulative impact of precursor emissions for each pollutant must be evaluated. Facilities with emissions above these MERPS may be evaluated with a MERP value that is more representative of the geographical location of the facility as well as its stack height and emission rates.

The significant impact level (SIL) for each pollutant's NAAQS was selected as the critical air quality threshold value for this MERP analysis. The SIL are as follows: 8-hour ozone – 1 part per billion (ppb); 24-hour $PM_{2.5}$ – 1.2 micrograms per cubic meter ($\mu g/m^3$); and annual $PM_{2.5}$ – 0.3 $\mu g/m^3$.

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Table 8. Default Ozone and $PM_{2.5}$ MERPs Values for Indiana Sources

Precursor	8-Hour Ozone	24-hour $PM_{2.5}$	Annual $PM_{2.5}$*
NO_X	234	2570	12636
SO_2	----	348	4646
VOC	1159	----	----

*The annual $PM_{2.5}$ MERPs provided here are based on a SIL value of 0.3 micrograms per cubic meter. This is based on the final MERPs guidance which was released on April 30, 2019.

SILs Analysis

MERPs can be used to determine if a facility's proposed emission increases will result in secondary impacts that are above the SILs. If one of the precursor pollutants triggers this analysis because their emissions are above the PSD Significant Emission Rates (SERs), then emissions of the other precursor pollutant must be included in the analysis to determine the synergistic impact that both pollutants have together, even though one pollutant's emissions may fall below the SER. The analysis is unnecessary only when emissions of both precursor pollutants are below their respective SERs.

The following equations are used for the SIL analysis.

For ozone, the following equation should be used:

$$(EMIS\_NOx \div MERP\_NOx) + (EMIS\_VOC \div MERP\_VOC) < 1$$

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

$$(HMC\_PM_{2.5} \div SIL\_PM_{2.5}) + (EMIS\_SO_2 \div MERP\_SO_2) + (EMIS\_NOx \div MERP\_NOx) < 1$$

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

If a facility fails this analysis for a pollutant averaging time, then a cumulative analysis must be performed for that pollutant and averaging time.

Cumulative Analysis

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

For ozone, the following equation should be used:

$$Background_{ozone} + ((EMIS\_NOx \div MERP\_NOx) + (EMIS\_VOC \div MERP\_VOC)) \times SIL\_ozone \leq NAAQs\_ozone$$

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

$$Background_{PM2.5} + DV_{PM2.5} + ((EMIS\_SO_2 \div MERP\_SO_2) + (EMIS\_NOx \div MERP\_NOx)) \times SIL\_PM_{2.5} \leq NAAQs\_PM_{2.5}$$

If a facility cannot meet the SIL or NAAQS using the Tier 1 approach, a photochemical modeling analysis (Tier 2) may be required. This approach will increase the resources and time 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.

Class 1 Source Impact Analysis for $PM_{2.5}$ PSD Increment at Distances Greater than 50 km

The April 30, 2019, final guidance for O3/$PM_{2.5}$ SILs, MERPs, and O3/$PM_{2.5}$ permit modeling outlined a screening approach for the primary $PM_{2.5}$ for PSD Class 1 areas beyond 50 km. The first step would be to select one or more hypothetical sources modeled for the April 30, 2019, guidance document that are similar to the project source. After this is done, the maximum secondary $PM_{2.5}$ impacts modeled from the hypothetical source at or greater than 50 km would be used in combination with the proposed source's primary $PM_{2.5}$ impacts estimated with AERMOD results at 50 km downwind from the source for comparison to the U.S. EPA recommended $PM_{2.5}$ Class I SIL value.

If the results of the initial screening step show an exceedance of the $PM_{2.5}$ Class I SIL value, a second more refined screening step would involve selecting the highest modeled secondary $PM_{2.5}$ impact at or less than the downwind distance of the Class I area relative to the proposed source. That value would be combined with the primary $PM_{2.5}$ impacts estimated from AERMOD at 50 km downwind and compared with the U.S. EPA Class I SIL.

If results using this refined screening step exceeds the SIL, use of a chemical transport model may be required and the source should consult with IDEM on appropriate next steps.

Table 9. Class 1 $PM_{2.5}$ Significant Impact Level Values

Pollutant	Averaging Period	PSD Class 1 SIL (ug/m3)
PM2.5	Annual	0.06
	24-hr	0.07

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. Lastly, IDEM performs a HAPs screening as part of the additional impact analysis for informational purposes only. This part of the analysis has no federal or state regulatory authority.

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, Vegetation and Endangered/Threatened Species Analysis

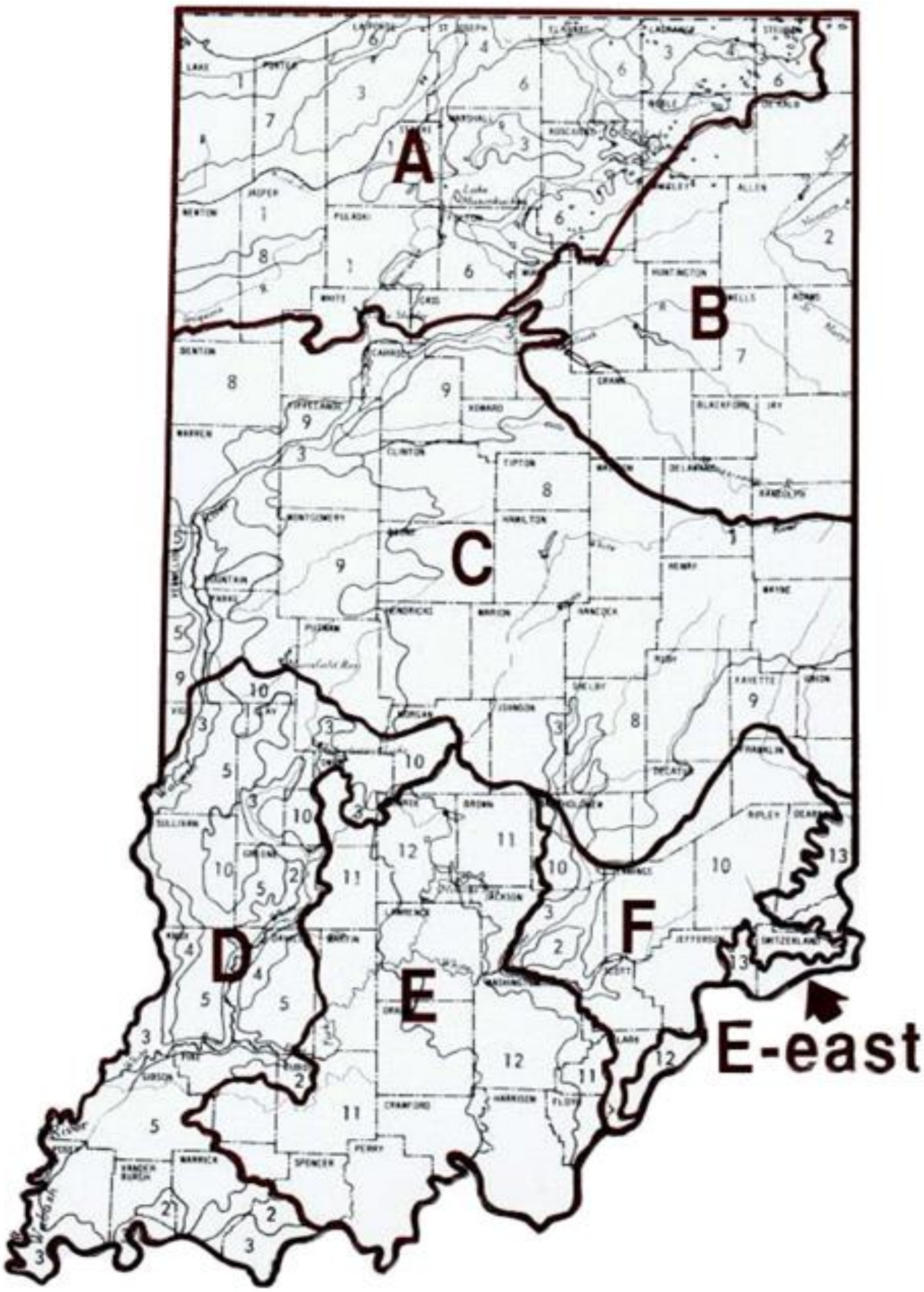
The soil and vegetation analysis should be based on an inventory of the soil and vegetation types found in the impact area. A soil map is provided below in Figure 1 to identify the different types of soil in the state. This inventory should include all vegetation with any commercial or recreational value. A reference for vegetation is the Indiana Agricultural Census – Crops (see Reference 18).

The Endangered Species Act needs to be addressed in this section of the analysis. The United States Congress passed the Endangered Species Act (ESA) in 1973. The Act charges the federal government to protect plant and animal species that are likely to become extinct or endangered in all or a significant part of their range. The United States Fish & Wildlife Service (USFWS) oversees the management of all terrestrial animals, plants, freshwater fish, and freshwater mollusks. When a species is being considered as a candidate under the ESA, the USFWS compiles data, in part, from state biologists. Wildlife Diversity biologists survey and monitor the status of Indiana's nongame amphibians, birds, fish, mammals, mollusks, and reptiles. They work closely with the USFWS, as well as other state agencies and universities, to protect those species in greatest need of conservation.

Section 7(a)(2) of the ESA requires federal agencies including U.S. EPA, in consultation with U.S. Fish and Wildlife Service ("FWS") and/or the National Oceanic and Atmospheric Administration Fisheries Service ("NOAA Fisheries," and, with FWS, the "Services"), to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of federally-listed threatened or endangered species or result in the destruction or adverse modification of designated critical habitat of such species. This requirement applies to Indiana's federal PSD permitting program.

The applicant needs to list the federal endangered/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. The website reference for federal endangered species is U.S. Fish & Wildlife Service (see Reference 19).

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 20). 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.

The Class II visibility analysis is for informational purposes as there is no established criterion for Class II areas. The criteria used to determine plume visual impacts within the VISCREEN modeling system were developed to protect Class I areas from harm and were not designed to determine if visibility degradation within Class II areas is likely. As such, the prediction of Class I impacts may or may not indicate an adverse impact within a Class II region. IDEM relies on the significant impact analysis and NAAQS and PSD Increment modeling to determine primary and secondary impacts on the surrounding areas from the source.

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 based on 24-hour maximum allowable emissions, 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 information.

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 review this list for the latest additions to Class 1 areas which could be affected by an Indiana PSD source.

Hazardous Air Pollutants (HAPs) Screening

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.) In accordance with Section 112(b) of the CAA, the state evaluates HAPs emissions greater than 10 tons per year of a single HAP or 25 tons per year of total HAPs. 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.

Any air quality dispersion modeling conducted for HAPs is not explicitly required by the State of Indiana statutes. The HAPs modeling is conducted for informational purposes only and should not be construed as an exhaustive analysis for health risk for a given geographical area. This evaluation consists of air dispersion screening and comparison of the results with applicable non-cancer chronic reference concentrations and cancer unit risk factors. No federal or state ambient air quality standards have been developed for HAPs.

IDEM currently requests data concerning the emission of 187 HAPs regulated by the U.S.EPA under the CAA; the original list included 189 pollutants. Since 1990, U.S. EPA has modified the list through rulemaking, so the current list includes 187 hazardous air pollutants. These chemicals are listed in the 1990 Clean Air Act Amendments (CAAA) as either carcinogenic or otherwise considered toxic and may be used by industries in the State of Indiana. These substances are listed as air toxic compounds on the State of Indiana, Department of Environmental Management, Office of Air Quality's construction permit application Form GSD-08. In addition, the air toxics provisions of the CAA required U.S. EPA to develop and enforce regulations to protect the public from exposure to airborne contaminants that are known to be hazardous to human health. In accordance with Section 112 of the CAA, U.S. EPA established National Emission Standards for Hazardous Air Pollutants (NESHAP) in order to ensure emissions levels of HAPs that are already being achieved by the best-controlled and lowest-emitting sources in an industry. These health-based emission limits are enforceable to protect public health or welfare.

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 with screening conducted for all HAPs exceeding the major source HAPs emission threshold. The risk analysis can either be performed by IDEM or by the applicant with IDEM conducting a thorough review of the applicant's HAPs analysis.

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 screening requirement to obtain an NSR/PSD 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 screening 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 as a conservative estimate to 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).

Hazard Quotient = Modeled concentration / Reference Concentration

Non-cancer health effects are determined using the Reference Concentration (RfC). The RfC is an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a person's lifetime. Dividing the pollutant's estimated annual concentration by the RfC will determine the pollutant's Hazard Quotient (HQ). All of the HAPs' Hazard Quotients added together determine the overall Hazard Index (HI). A Hazard Index above 1 does not represent a level where adverse health effects will be observed but indicates that the potential for a risk of health effects could exist. A Hazard Index below 1 is not considered to be a health concern.

IDEM will perform this evaluation for all applicable HAPs.

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.

Cancer Risk = Annual Concentration x Unit Risk Factor

The Unit Risk Factor (URF) is unitless value and is the upper-bound excess lifetime cancer risk estimates that would result from continuous inhalation exposure to a pollutant over a 70-year lifetime at that modeled high concentration receptor location. Multiplying the estimated annual concentration by the URF for each HAP will produce a conservative cancer risk estimate, usually expressed as the number of additional cancer cases in a given number of people, e.g., one in a million. For screening purposes, the cancer estimates for each pollutant are considered to be additive when deriving the cumulative maximum individual cancer risk. The URF values are taken from several health-based entities, of which are listed below:

IRIS - U.S. EPA's Integrated Risk Information System
ATSDR - Agency for Toxic Substances and Disease Registry
CAL – California
TRI – Toxic Release Information
HWIR - Hazardous Waste Identification Rule for Contaminated media
HEAST - Health Effects Assessment Summary Tables - EPA
OAQPS -Office of Air Quality Planning and Standards
SCDM - Superfund Chemical Data Matrix
OPP-CAN - Office of Pesticide Programs - Canada
ACGIH - American Conference of Governmental Industrial Hygienists

The U.S. EPA will generally presume that if the risk to an individual is no higher than 100 in a million, that risk level is considered acceptable and U.S. EPA would then consider other health and risk factors to complete an overall judgment on acceptability. Lifetime cancer risks that fall between the one in a million and 100 in a million range may generate discussion between IDEM and the source to address the impacts, taking into account the assumptions used to determine the estimate. While we do not have any federal standard or law by which to prompt a source to reduce their emissions of HAPs below these risk levels, any risks over 100 in a million could result in additional review by IDEM and U.S.EPA.

For comparison purposes, the American Cancer Society (ACS) reports that the annual average incidence of cancer in Indiana between 2012 and 2016 was 4,571 per a million (age adjusted to the 2000 US standard population); these statistics are for all cancers based on the current ACS 2020 estimates.

As stated above, the location of the modeling predicted high is also a factor concerning the risk to an individual and must be taken into consideration when evaluating the HAPs screening analyses for a proposed PSD source. Location is directly tied to the high concentration predicted by the model. Lifetime cancer risk estimates are a result from continuous inhalation exposure to a pollutant over a 70-

year lifetime at that modeled high concentration receptor location. In reality, no one stays in one location over a 70-year lifetime. The probability for the general public to be exposed to the maximum modeled concentration of HAPs from a source for 24 hours a day, seven days a week, 52 weeks a year for 70 years is considered very minimal. The maximum model concentration is usually at one location either at the property line or beyond. Other concentrations at different locations will be below that maximum modeled concentration and would indicate lower health risk to an individual.

Other PSD Modeling Issues

Rerunning Modeling Analyses

Various reasons may require an applicant to rerun a modeling analysis. The scenarios shown below are not all inclusive. Special situations will be dealt with on a case-by-case basis.

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 completed by the applicant, the latest version of the model should be used if the project is still uncompleted after 6 months of the new version release. If the project is being reviewed by IDEM, the model version used during application would be grandfathered unless during the review it is deemed revised modeling was required. At that point, IDEM would use the new version of the model during its review and report any concentration changes to the applicant. Also, the latest version of model is to be used if the release date of the model occurs before IDEM approves an applicant's modeling protocol. Applicants may need to use the most recent version of the model if bug fixes affect model concentrations which could affect approvability. 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. Ongoing projects still incomplete 1 year after the posting of new meteorology must remodel with the latest MET data set. Ongoing projects are projects that are in-house waiting on revised modeling, new emission rates, new stack locations, etc.

Source Geometry or Physical Changes

If an applicant decides to reposition or relocate emission units and associated stacks/exhaust points to the atmosphere 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 such as changes in stack height or stack diameters, stack flow rates, 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 increases 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.

IDEM allows a one-time modeling correction event on past modeling used in a previously issued PSD permit for a facility. The use of this procedure will be determined on a case-by-case basis. Facilities cannot come in multiple times and add 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_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_2 modeling. There are three "tiers" of NO_2 modeling that are available to the user.

- Tier 1 = Full NOx to NO_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 multiplies the modeled concentrations by a NO_2/NOx ratio. These are variable NOx to NO_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_2/NOx ratio should be based on source specific data which satisfies all quality assurance procedures for data accuracy for both NO_2 and NOx within the typical range of measured values. However, alternate information may be used to justify a source's anticipated NO_2/NOx in-stack ratios, such as manufacturer test data, peer-reviewed literature, and/or U.S. EPA's NO_2/NOx ratio database. Whatever NO_2/NOx ratio 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 a 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_2/NO_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_2 screening tiers can be used for the SIL analysis. One caveat is if emission credits are being considered, there needs to be discussion with U.S. EPA on how to model the NOx credits 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 NO_2 and 1-hour SO_2 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 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. All intermittent operations by the applicant 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 method takes the maximum hourly emission rate multiplied by 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 does not address emission averaging for other pollutant time-averaging periods. This issue is more appropriately addressed in Appendix W. See Table 8-2 from Appendix W, in the source inventories section of this document.

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 are 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. Place a scalar that is multiplied by the emission.

rate input into each hourly field in the Sources tab. That is, place 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. The source should consult with IDEM on appropriate modeling methodologies before conducting its modeling.

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.

Modeled Impacts on Neighboring or Nearby Sources

Any neighboring or nearby source impact on its “own” property due to their emissions can be excluded from the modeling analysis to the extent that their property is <u>not</u> considered ambient air.

For example, 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’s modeled impacts from its own emissions on its own property are not relevant. 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 stack flow rates, stack temperatures, building geometry, and proximity to the property line. If the source's modification comes close to the significant emission rate, IDEM may perform screen modeling as a precautionary measure to determine modeled impacts. 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 (complete with stack and building information, emissions, and property maps) so a determination can be made.

<u>Odor</u>

IDEM does not conduct modeling for odor detection since odor detection can be subjective and depends on the person’s sensitivity. Individuals display tremendous variability in olfactory perception including differences in odor detection threshold, quality, intensity, and pleasantness.

An odor detection threshold of a chemical compound is determined in part by its shape, polarity, partial charges, and molecular mass. The olfactory mechanisms responsible for a compound's different detection threshold is not well understood. As such, odor thresholds cannot be accurately predicted. Rather, they must be measured through extensive tests using human subjects in laboratory settings.

The federal government does not directly regulate odors under the Clean Air Act or under any other regulatory program; however, odors are sometimes regulated indirectly under traditional ambient air quality standards and emission source regulations insofar as regulating air toxics or other emissions may have beneficial impacts in reducing odors. In this case, if a hazardous air pollutant (HAP) is emitted by the source above major source thresholds, IDEM will conduct modeling for that HAP to address its air impacts.

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 obtained, 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 NOx, 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. The amount of emission offsets varies on the severity of the nonattainment designation to ensure a reasonable further progress towards attainment. Offset levels are found in 326 IAC 2-3-3(5)(B).

An NO_2 PSD analysis may be required for the source if it is major or has a major modification for NO_2. The NO_2 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 NO_2 could still occur around the applicant's facility.

For particulate matter, SO_2, 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's modeled contribution is found to have culpability, then the project has caused or contributed to 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.

References and Federal Resource Documents

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2. Title 326 IAC 2-2-1, Indiana General Assembly, Indiana Administrative Code, April 2012, URL: http://www.in.gov/legislative/iac/iac_title?iact=326.

3. 40 CFR Part 51 pg. 68218-68621, Federal Register, U.S. Environmental Protection Agency, Guideline on Air Quality Models, November 2005, URL: http://www.epa.gov/scram001/guidance/guide/appw_05.pdf.

4. AERMOD Implementation Guide, U.S. Environmental Protection Agency, Air Quality Modeling Group, Support Center for Regulatory Atmospheric Modeling (SCRAM), URL: https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and- recommended-models.

5. AERMOD Implementation Guide, U.S. Environmental Protection Agency, Air Quality

Modeling Group, Support Center for Regulatory Atmospheric Modeling (SCRAM), Dated August 2019,
URL: https://www3.epa.gov/ttn/scram/models/aermod/aermod_implementation_guide.pdf

6. Draft New Source Review Workshop Manual – Prevention of Significant Deterioration and Nonattainment Area Permitting pg. A.24-5, U.S. Environmental Protection Agency, Technology Transfer Network, October 1990,
URL: https://www.epa.gov/nsr/new-source-review-publications.

7. Technical Support Document (TSD) for AERMOD-Based Assessments of Long-Range Transport Impacts for Primary Pollutants, URL:
https://www3.epa.gov/ttn/scram/11thmodconf/AERMOD_LRT_TSD.pdf.

8. NAAQS Inventories, Indiana Department of Environmental Management, Office of Air Quality, Air Dispersion Modeling, URL: https://www.in.gov/idem/airquality/2375.htm.

9. PSD Increment Inventories, Indiana Department of Environmental Management, Office of Air Quality, Air Dispersion Modeling,
URL: https://www.in.gov/idem/airquality/2375.htm.

10. Title 326 IAC 2-2-4, Indiana General Assembly, Indiana Administrative Code, April 2012, URL: http://www.in.gov/legislative/iac/iac_title?iact=326.

11. Meteorological Monitoring Guidance for Regulatory Modeling Applications, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, February 2000, URL: http://www.epa.gov/scram001/guidance/guide/mmgrma.pdf.

12. Background concentrations, Indiana Department of Environmental Management, Office of Air Quality, Air Dispersion Modeling,
URL: https://www.in.gov/idem/airquality/2375.htm.

13. Meteorological Data, Indiana Department of Environmental Management, Office of Air Quality, URL: https://www.in.gov/idem/airquality/2375.htm.

14. “Revised Policy on Exclusions from “Ambient Air” memorandum URL:
https://www.epa.gov/sites/production/files/2019-12/documents/revised_policy_on_exclusions_from_ambient_air.pdf

15. Title 326 IAC 2-2-6, Indiana General Assembly, Indiana Administrative Code, April 2012, URL: http://www.in.gov/legislative/iac/iac_title?iact=326.

16. Title 326 IAC 1-7-4, Indiana General Assembly, Indiana Administrative Code, April 2012, URL: http://www.in.gov/legislative/iac/iac_title?iact=326.

17. PSD Modeling for Ozone, U.S. Environmental Protection Agency, Air Quality Modeling Group, Support Center for Regulatory Atmospheric Modeling (SCRAM), August 2007, URL: https://www.epa.gov/scram/air-modeling-announcements.

18. Indiana Agricultural Census - Crops, National Agricultural Statistics Service, United

States Department of Agriculture, Indiana Statistics, Agricultural Census 2017, URL: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Indiana/index.php/.

Also for trees:
https://maps.indiana.edu/previewMaps/Environment/Land_Cover_Tree_Canopy_2001.html

19. The Endangered Species Program, U.S. Fish & Wildlife Service, URL: https://www.fws.gov/midwest/endangered/lists/Indiana-spp.html.

20. Workbook for the VISCREEN Model, U.S Environmental Protection Agency, Air Quality Modeling Group, Support Center for Regulatory Atmospheric Modeling (SCRAM), December 2006, URL: https://www.epa.gov/scram/air-quality-dispersion-modeling-screening-models.

Federal Resource Documents for New NAAQS Standards

$PM_{2.5}$

- Stephen Page memorandum dated March 23, 2010 and March 20, 2014
- 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

- Stephen Page memorandum dated August 23, 2010, March 24, 2011, and April 23, 2014
- 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