REQUEST FOR REDESIGNATION AND MAINTENANCE PLAN UNDER THE ANNUAL NATIONAL AMBIENT AIR QUALITY STANDARD FOR FINE PARTICLES

Southwestern Indiana Area

Prepared By:
The Indiana Department of Environmental Management

April 2011

This page intentionally left blank

TABLE OF CONTENTS

FIGURES

TABLES

GRAPHS

CHARTS

APPENDICES

REQUEST FOR REDESIGNATION AND MAINTENANCE PLAN UNDER THE ANNUAL NATIONAL AMBIENT AIR QUALITY STANDARD FOR FINE PARTICLES

SOUTHWESTERN INDIANA AREA

1.0 INTRODUCTION

This document supports Indiana's request that Dubois, Vanderburgh, and Warrick counties, Montgomery Township in Gibson County, Ohio Township in Spencer County, and Washington Township in Pike County (herein referred to as the "Southwestern Indiana Area"), be redesignated from nonattainment to attainment of the 1997 annual standard for fine particles. All monitors for fine particles in the Southwestern Indiana Area have recorded three years of quality assured ambient air quality monitoring data for the years 2007 through 2009, demonstrating attainment with the annual standard for fine particles; therefore, the Southwestern Indiana Area is eligible for redesignation.

Section 107 of the Clean Air Act (CAA) establishes specific requirements to be met in order for an area to be considered for redesignation, including:

(a) A determination that the area has attained the annual standard for fine particles.
(b) A State Implementation Plan (SIP) for the area under Section 110(k) is approved.
(c) A determination that the improvement in air quality is due to permanent and enforceable reductions in emissions resulting from implementation of the SIP and other federal requirements.
(d) A maintenance plan under Section 175A is fully approved.
(e) A determination that all Section 110 and Part D requirements have been met.

A maintenance plan provides for the continued attainment of the air quality standard by an area for a period of ten years after the United States Environmental Protection Agency (U.S. EPA) has formally redesignated the area to attainment. The plan also provides assurances that even if there is a subsequent exceedance of the air quality standard, measures in the maintenance plan will prevent any future occurrences through contingency measures that would be triggered.

This document addresses each of these requirements and provides additional information to support continued compliance with the annual standard for fine particles.

1.1 Background

The CAA requires states with areas designated nonattainment of the applicable National Ambient Air Quality Standard (NAAQS) for fine particles to develop SIPs to expeditiously attain and maintain the standard. In 1997, U.S. EPA set daily and annual air quality standards for fine particles ($PM_{2.5}$), as shown in Table 1.1. The terms "fine particles" and "$PM_{2.5}$" are used synonymously throughout this document. The $PM_{2.5}$ standards were legally challenged and upheld by the U.S. Supreme Court in February of 2001. In 1999, Indiana began monitoring for fine particle concentrations. U.S. EPA designated areas in Indiana under the annual fine particle standards on December 17, 2004, as attainment, nonattainment or unclassifiable, with an effective date of April 5, 2005.

Table 1.1
National Ambient Air Quality Standards for Fine Particles

	Annual	**24-Hour**
1997 $PM_{2.5}$ Standard	**15 μg/m^3** Annual arithmetic mean, averaged over three years	**65 μg/m^3** 24-hour average, 98th percentile, averaged over three years
2006 $PM_{2.5}$ Standard	**15 μg/m^3** Annual arithmetic mean, averaged over three years	**35 μg/m^3** 24-hour average, 98th percentile, averaged over three years

Note: The Southwestern Indiana Area meets the 1997 and 2006 24-hour NAAQS for fine particles. Since this area is solely designated nonattainment under the 1997 annual standard for fine particles, this document only addresses the annual standard.

On December 17, 2004, based on 2001 through 2003 monitoring data, U.S. EPA designated the Southwestern Indiana Area as nonattainment of the annual standard for fine particles, and subject to Section 172 of the CAA, including the development of a plan to reduce nitrogen oxides (NO_x), sulfur dioxide (SO_2), and direct $PM_{2.5}$ particle emissions and a demonstration that the area will meet the annual standard for fine particles by April 5, 2010. In order to satisfy these requirements, Indiana submitted a redesignation petition and maintenance plan to U.S. EPA on April 3, 2008, demonstrating that the Southwestern Indiana Area had met the NAAQS for fine particles by April 5, 2010, with an ample margin of safety. The Southwestern Indiana Area monitors have continued to meet the annual NAAQS for fine particles since the end of 2006.

There were no fine particle monitors in the Southwestern Indiana Area that violated the 1997 24-hour standard for fine particles and none that currently violate the 2006 24-hour standard for fine particles. As a result, the Southwestern Indiana Area was designated nonattainment for fine particles solely under the 1997 annual standard. Therefore, this document pertains only to the 1997 annual standard for fine particles.

The Southwestern Indiana nonattainment area for fine particles, as defined in Section 1.2, has not previously been subject to nonattainment area rulemakings for fine particles. However, the area had been subject to nonattainment area rulemakings under the 1-hour and the 8-hour ozone standards. The 1-hour ozone standard was revoked on June 15, 2005 and both Vanderburgh and Warrick counties were redesignated to attainment of the 1997 8-hour ozone standard on January 30, 2006.

1.2 Geographical Description

The Southwestern Indiana nonattainment area for fine particles consists of Dubois, Vanderburgh, and Warrick counties, Montgomery Township in Gibson County, Ohio Township in Spencer County, and Washington Township in Pike County. The Southwestern Indiana Area includes cities such as Evansville, Jasper, Boonville, Huntingburg, Petersburg, and Rockport and such towns as Yankeetown, Inglefield, Owensville, Ferdinand, Chandler, Newburgh, and Kasson. This area is depicted in Figure 3.1.

The agency responsible for assuring the nonattainment area for fine particles complies with the CAA requirements is the Indiana Department of Environmental Management (IDEM), which is responsible for the entire Southwestern Indiana Area. IDEM has worked cooperatively with U.S. EPA Region V to address attainment planning issues.

1.3 Status of Air Quality

Monitoring data for fine particles for the three years, 2007 through 2009, demonstrates that air quality has met the annual NAAQS for fine particles in the Southwestern Indiana Area. For reference purposes, 2010 monitoring data is included in Appendix A-2. This fact, accompanied by the permanent and enforceable reductions in emission levels discussed in Section 4.0, justifies a redesignation to attainment for the area based on Section 107(d)(3)(E) of the CAA.

2.0 REQUIREMENTS FOR REDESIGNATION

2.1 General

Section 110 and Part D of the CAA list a number of requirements that must be met by nonattainment areas prior to consideration for redesignation to attainment. In addition, U.S. EPA has published detailed guidance in a document entitled "Procedures for Processing Requests to Redesignate Areas to Attainment," issued September 4, 1992, to Regional Air Directors. This document is hereafter referred to as "Redesignation Guidance." This Request for Redesignation and Maintenance Plan is based on the Redesignation Guidance, supplemented with additional guidance received from staff of the Attainment Planning and Maintenance Section of U.S. EPA Region V. The specific requirements for redesignation are listed below.

2.2 Fine Particle Monitoring

1) A demonstration that the annual standard for fine particles, as published in 40 Code of Federal Regulations (CFR) 50.13, has been attained. Fine particle monitoring data must show that violations of the annual ambient standard are no longer occurring.

2) Ambient monitoring data quality assured in accordance with 40 CFR 58.15, recorded in the U.S. EPA Air Quality System (AQS) database and available for public view.

3) A showing that the three-year average of annual values, based on data from all monitoring sites in the area or its affected downwind environs, do not exceed 15.0 micrograms per cubic meter ($\mu g/m^3$). This showing must rely on three complete, consecutive calendar years of quality assured data.

4) A commitment that, once redesignated, the state will continue to operate an appropriate monitoring network to verify the area is in compliance (maintenance) with the standard.

2.3 Emission Inventory

1) A comprehensive emission inventory of the precursors of fine particles (direct $PM_{2.5}$, NO_x and SO_2) completed for the base year (2005 in this case).

2) A projection of the emission inventory to a year at least ten years following redesignation.

3) A demonstration that the projected level of emissions is sufficient to maintain the annual standard for fine particles.

4) A demonstration that improvement in air quality between the year violations occurred and the year attainment was achieved is based on permanent and enforceable emission reductions and not on temporary adverse economic conditions or unusually favorable meteorology.

5) Provisions for future annual updates of the inventory to enable tracking of the emission levels, including an annual emission statement from major sources.

2.4 Modeling Demonstration

While no modeling is required for redesignating nonattainment areas, IDEM has evaluated the results of federal control-case modeling to demonstrate that compliance with the standard will be maintained.

2.5 Controls and Regulations

1) A U.S. EPA-approved SIP control strategy that includes Reasonably Available Control Technology (RACT) requirements for existing stationary sources covered by Control Technology Guidelines (CTG) and non-CTG RACT for all major sources.

2) Evidence that control measures required in past SIP revisions have been fully implemented.

3) Acceptable provisions to provide for new source review.

4) Assurances that existing controls will remain in effect after redesignation, unless the state demonstrates through photochemical modeling that the standard can be maintained without one or more controls.

5) If appropriate, a commitment to adopt a requirement that all transportation plans conform with, and are consistent with, the SIP.

2.6 Corrective Actions for Potential Future Violations of the Fine Particle Standard

1) A commitment to submit a revised plan eight years after redesignation.

2) A commitment to expeditiously enact and implement additional contingency control measures in response to exceeding specified predetermined levels (triggers) or in the event that future violations of the ambient standard occur.

3) A list of potential contingency measures that would be implemented in such an event.

4) A list of NO_x, SO_2, and direct $PM_{2.5}$ sources potentially subject to future controls.

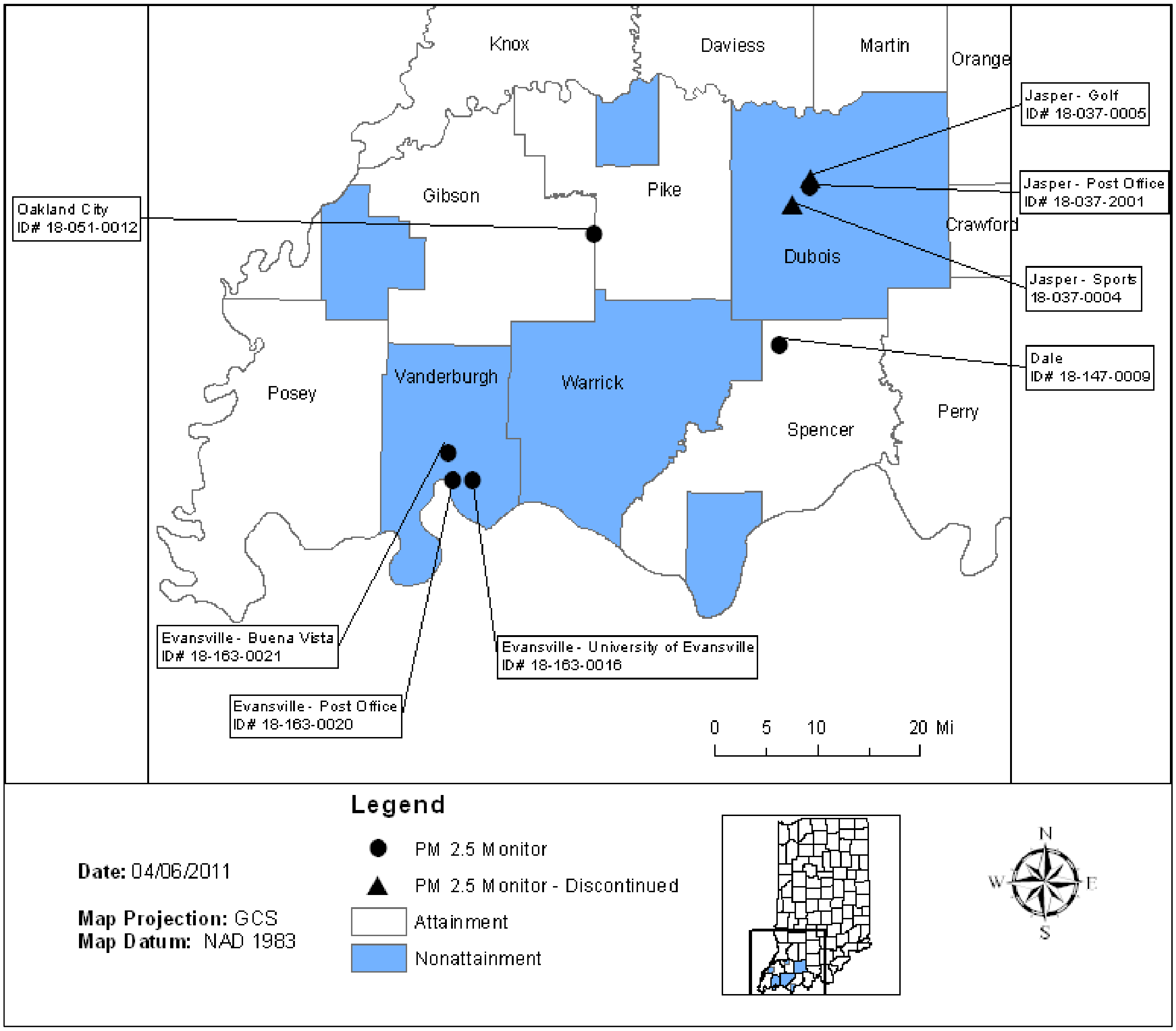
3.0 FINE PARTICLES MONITORING

3.1 Fine Particle Monitoring Network

There are currently four Federal Reference Method monitors measuring fine particle concentrations in this nonattainment area. These monitors are located in Dubois County (Jasper, Indiana) and Vanderburgh County (Mill Road/Buena Vista, Civic Center/Post Office and University of Evansville, Evansville, Indiana). The four monitors are operated by IDEM's Office of Air Quality (OAQ). A listing of the monitor readings from 2007 through 2009, is shown in Table 3.1 and Appendix A-1 and was retrieved from U.S. EPA's AQS database. The locations of the monitoring sites for this nonattainment area are shown in Figure 3.1.

Included as supporting material are two fine particle monitors that operated in Dubois County (Jasper, Indiana) from 2006 to 2008. IDEM also operates two fine particle monitors in nearby Spencer County (Dale, Indiana) and Gibson County (Oakland City, Indiana) that are not part of the Southwestern Indiana Area.

Figure 3.1
Southwestern Indiana Area



3.2 Ambient Fine Particle Monitoring Data

The following information summarizes U.S. EPA's "Guideline on Data Handling Conventions for the PM NAAQS," U.S. EPA-454/R-99-008, April 1999. Three complete years of fine particle monitoring data are required to demonstrate attainment at a monitoring site. The annual ambient air quality standard for fine particles is met at an ambient air quality monitoring site when the three-year average of the annual average of fine particle concentrations is less than or equal to 15.0 µg/m^3. When this occurs, the site is said to be in attainment. While calculating design values, three significant digits must be carried in the computations, with final values rounded to the nearest 0.1 µg/m^3. Decimals 0.05 or greater are rounded up, and those less than 0.05 are rounded down, so that 15.049 µg/m^3 is the largest concentration that is less than or equal to 15.0 µg/m^3. Values at or below 15.0 µg/m^3 meet the standard. Values equal to or greater than 15.1 µg/m^3 exceed the standard.

Data handling procedures are applied on an individual basis at each monitor in the area. An individual site's three-year average of the annual average fine particle concentration is also called the site's *design value*. An area is in compliance with the annual NAAQS for fine particles only if all monitoring sites meet the NAAQS. The air quality design value for the area is the highest design value among all sites in the area. Table 3.1 outlines the annual fine particle values by site and the 2007 through 2009 design values for the six active fine particle monitoring sites in the Southwestern Indiana Area. In addition, two discontinued fine particle monitoring sites (Jasper Sport and Jasper Golf) are outlined for historical reference.

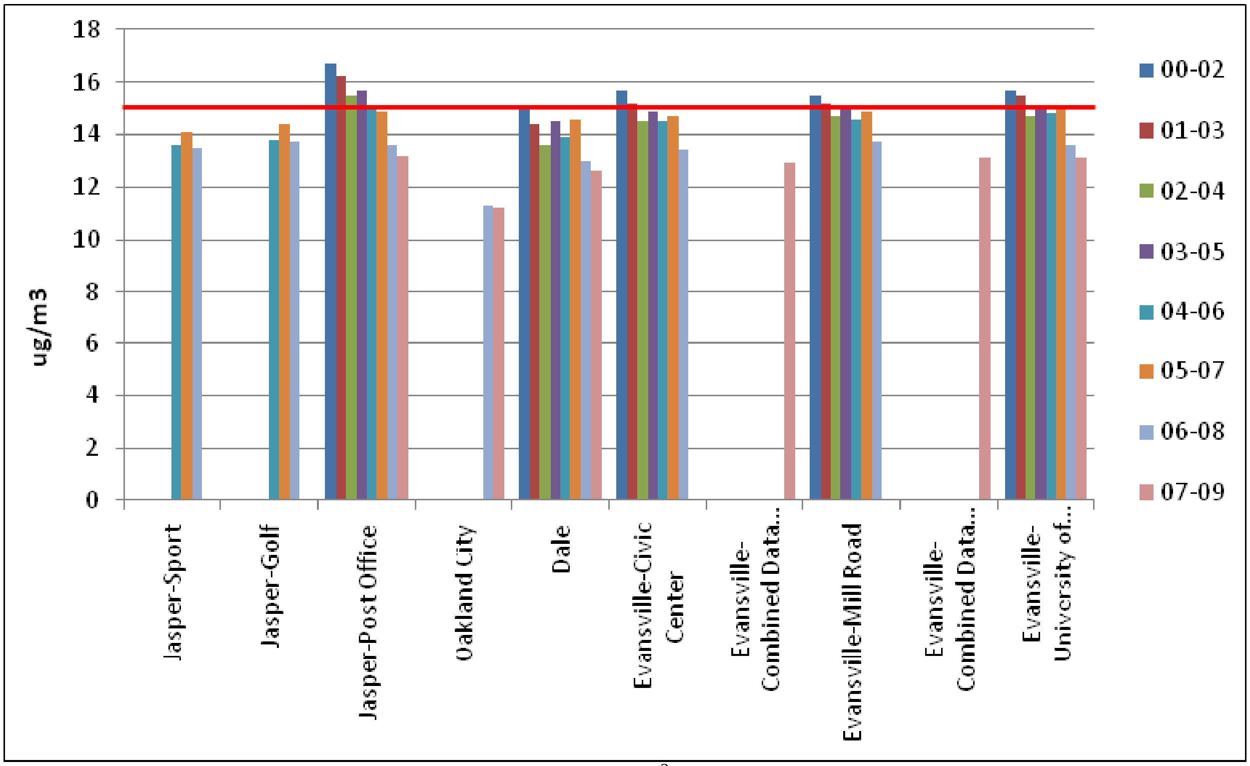
Table 3.1
Monitoring Data for the Southwestern Indiana Area
(Annual Average and 2007-2009 Design Values)

SITE ID	COUNTY	SITE NAME	YEAR	Annual Average µg/m3	2007-2009 Average µg/m3
18-037-0004	Dubois	Jasper-Sport[1]	2007	14.61	13.4[5]
			2008	12.10	
			2009		
18-037-0005	Dubois	Jasper-Golf[1]	2007	14.92	13.7[5]
			2008	12.53	
			2009		
18-037-2001	Dubois	Jasper-Post Office	2007	14.26[2]	13.2[3]
			2008	12.93	
			2009	12.49	
18-051-0012	Gibson	Oakland City[4]	2007		11.2[5]
			2008	11.33	
			2009	11.00	
18-147-0009	Spencer	Dale	2007	14.13	12.6
			2008	12.03	
			2009	11.77	
18-163-0006/20	Vanderburgh	Evansville-Civic Center/Post Office[6]	2007	13.91	12.9
			2008	12.58	
			2009	12.32	
18-163-0012/21	Vanderburgh	Evansville-Mill Road/Buena Vista[7]	2007	14.23	13.1
			2008	12.70	
			2009	12.28	
18-163-0016	Vanderburgh	Evansville-University of Evansville	2007	14.21	13.1
			2008	12.53	
			2009	12.49	

[1] The Jasper Sport and Jasper Golf monitors began operation February 1, 2006 and were discontinued on December 31, 2008.
[2] Exceptional event data removed from calculations.
[3] Incomplete data see Appendix G.
[4] The Oakland City monitor began operation on January 18, 2008.
[5] Indicates design value is based on two years of data.
[6] The Evansville Civic Center monitor was replaced by the Evansville Post Office monitor and data for 2009 as well as the 2007-2009 design value have been combined.
[7] The Evansville Mill Road monitor was replaced by the Evansville Buena Vista monitor and data for 2009 as well as the 2007-2009 design value have been combined.

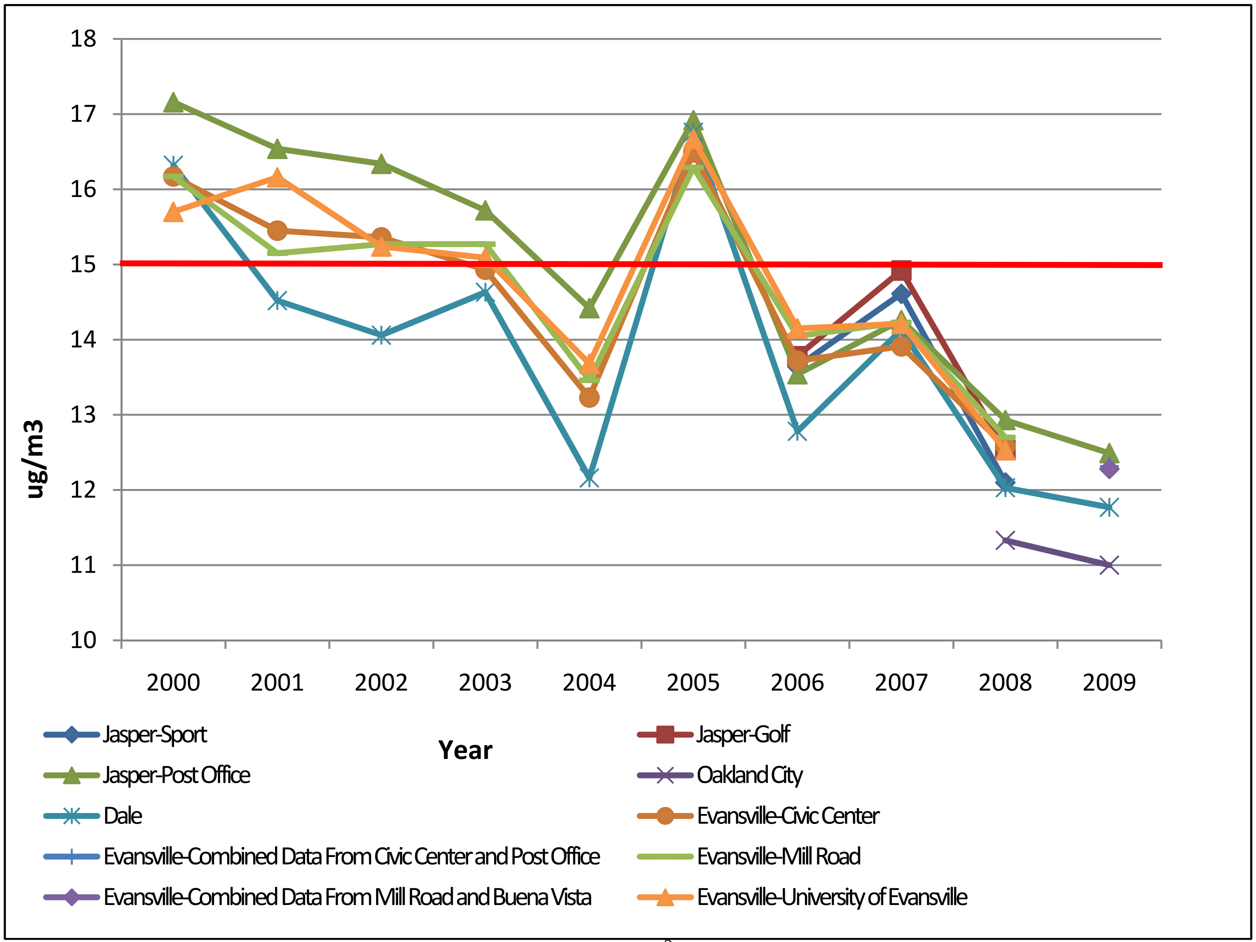
Graph 3.1 visually demonstrates the 2000 through 2009 design values for the Southwestern Indiana Area.

Graph 3.1
Design Values for the Southwestern Indiana Area for Fine Particles - 2000 through 2009



Red line represents annual $PM_{2.5}$ standard of 15 µg/m^3

Graph 3.2
Southwestern Indiana Annual Fine Particle Trends - 2000 through 2009



Red line represents annual $PM_{2.5}$ standard of 15 $\mu g/m^3$

The design values for the Southwestern Indiana Area demonstrate that the annual NAAQS for fine particles has been attained. Appendix A-1 contains the complete fine particle monitoring data summary for the years 2000 to 2009.

Graph 3.1 shows the trend in design values for the region, while Graph 3.2 shows the trend for annual fine particles. A comprehensive list of the fine particle monitoring site design values over this period is outlined in Appendix A. The area's design values have recently trended downward, as emissions have declined due to programs such as the Acid Rain program and cleaner automobiles and fuels, both regionally and locally. U.S. EPA's rule to control nitrogen oxides from specific source categories (40 CFR Parts 51, 72, 75, and 96, published on October 17, 1998, and referred to as the "NO_x SIP Call") has significantly reduced emissions from large electric generating units (EGUs), industrial boilers, and cement kilns. Indiana's NO_x SIP Call Rule was adopted into the Indiana Administrative Code (IAC) on June 6, 2001, at 326 IAC 10-3 and 326 ICA 10-4. The elevated fine particle values for 2005 are considered an abnormal occurrence. An analysis of meteorological conditions and monitoring values is included in Section 7.0 and supports the conclusion that attainment of the standard as of 2009 is not the result of unusually favorable meteorological conditions. It is expected that this downward trend will continue as the above programs continue and U.S. EPA's proposed Clean Air Transport Rule (Transport Rule) is implemented.

3.3 Quality Assurance

IDEM has quality assured all data shown in Appendix A in accordance with 40 CFR 58.10 and recorded the data in the AQS database and, thus, the data is available to the public.

3.4 Continued Monitoring

Indiana commits to continue monitoring fine particle concentrations at the active sites indicated in Table 3.1 and Appendix A. IDEM will consult with U.S. EPA Region V staff prior to making changes to the existing Indiana monitoring network through the annual network review should changes become necessary in the future. IDEM will continue to quality assure the Indiana monitoring data to meet the requirements of 40 CFR 58. IDEM will enter all data into AQS on a timely basis in accordance with federal guidelines.

4.0 EMISSION INVENTORY

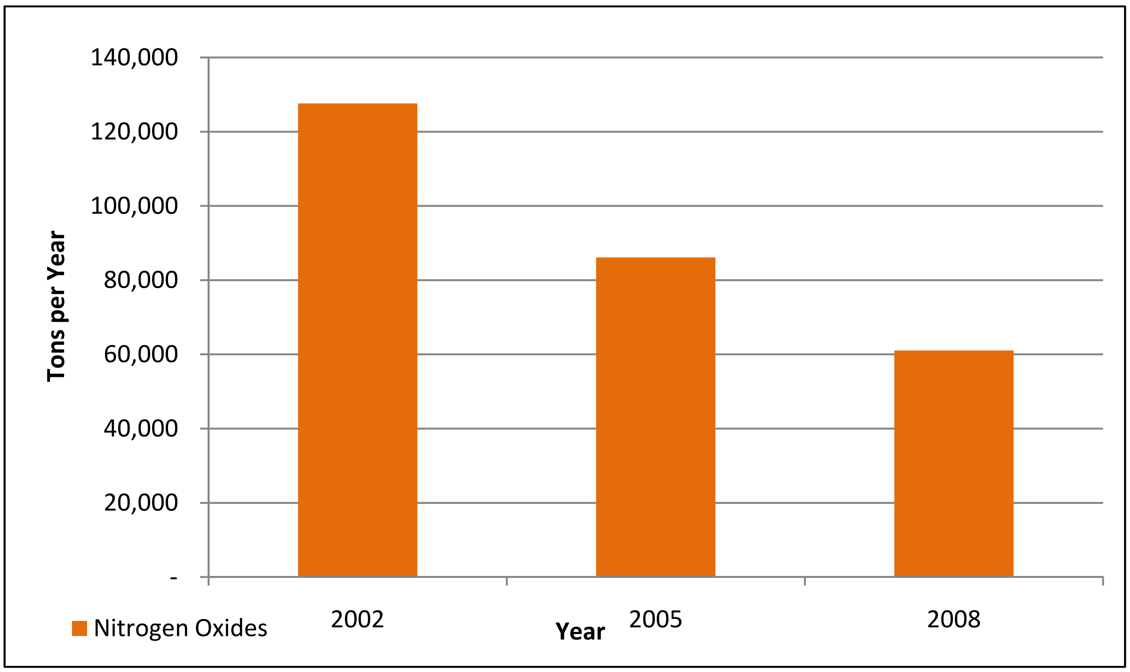
U.S. EPA's Redesignation Guidance and Implementation Rules require the submittal of a comprehensive inventory of precursor emissions for fine particles (NO_x, SO_2 and direct $PM_{2.5}$) representative of the year when the area achieved attainment of the annual NAAQS for fine particles (base year). Indiana is using 2005 as the base year. IDEM must also demonstrate that the improvement in air quality between the year that violations occurred and the year that attainment was achieved is based on permanent and enforceable emission reductions. Other requirements related to the emission inventory include: a projection of the emission inventory to a year at least ten years following redesignation; a demonstration that the projected level of emissions is sufficient to maintain the annual standard for fine particles; and, a commitment to provide future updates of the inventory to enable tracking of emission levels during the ten year maintenance period. Consistent with the implementation rule for fine particles, IDEM and U.S. EPA do not consider volatile organic compounds (VOCs) or ammonia (NH_3) to be significant contributors to fine particles. The following subsections address each of these requirements.

4.1 Emission Trends

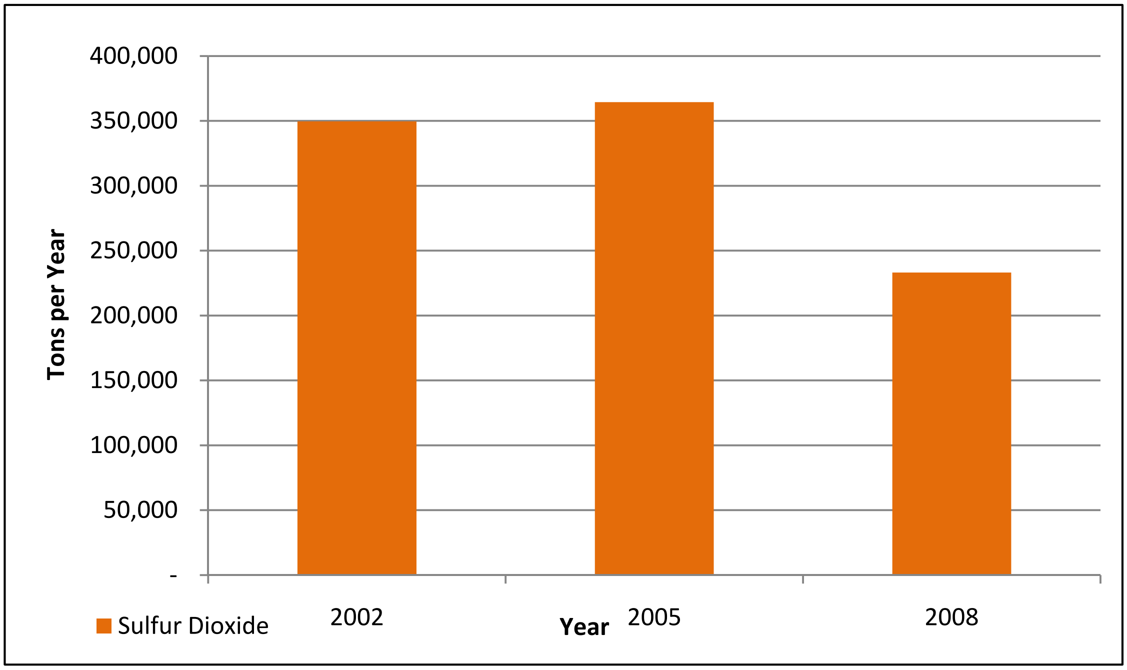
Point Sources

Graphs 4.1, 4.2, and 4.3 demonstrate that the trend in point source emissions of NO_x, SO_2, and direct $PM_{2.5}$ for the Southwestern Indiana Area generally correspond to the years of monitored values used in this redesignation petition. A secondary validation year of 2008 is used in this document for informational purposes only. The point source data are obtained from Indiana's emissions reporting program and are based on county point source totals, as opposed to township level emissions. The Southwestern Indiana Area had a 33% reduction in NO_x point source emissions and a slight increase (4%) in SO_2 point source emissions from 2002 to 2005. A moderate increase in direct $PM_{2.5}$ point source emissions from 2002 to 2005 is noted; this increase in direct $PM_{2.5}$ emissions is due to the fact that most companies did not submit their direct $PM_{2.5}$ emissions data in 2002, but did submit direct $PM_{2.5}$ data in the 2005 emission inventory. The Southwestern Indiana Area had a 29% reduction in NO_x point source emissions and a 36% reduction in SO_2 point source emissions from 2005 to 2008. As Graph 4.7 illustrates, Southwestern Indiana NO_x emissions from electric generating units have decreased substantially during this time period as well. Graphs and data tables of emissions for the point source category can be found in Appendix B.

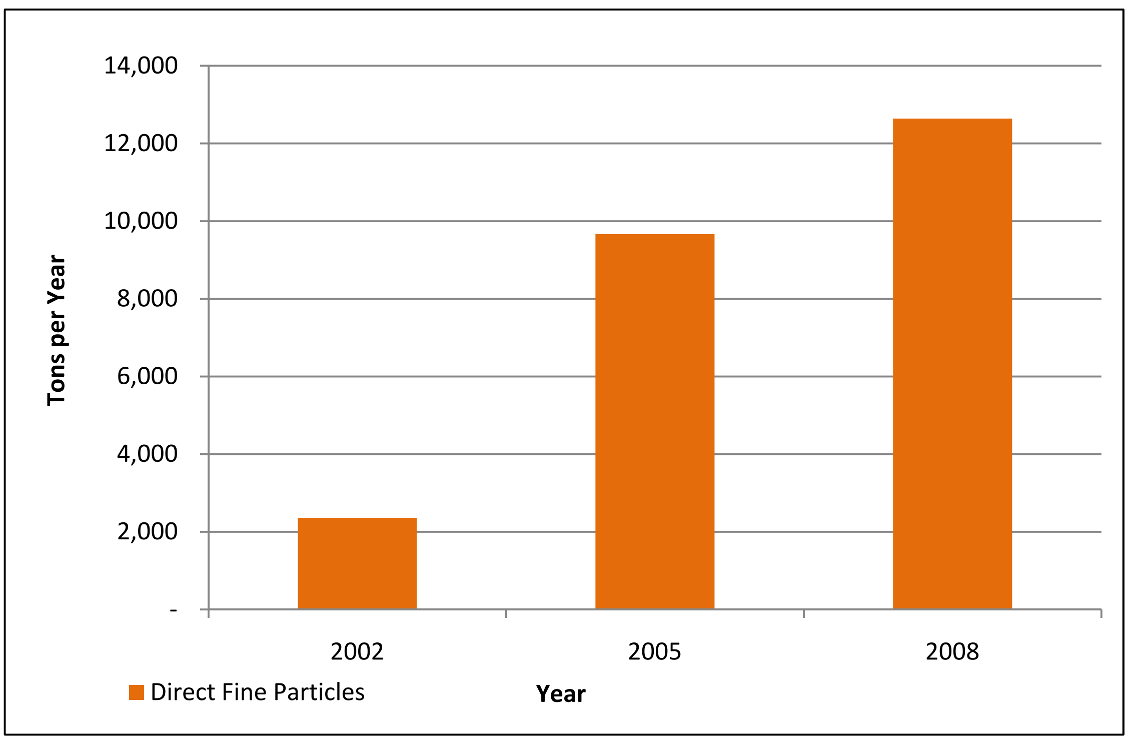
Graph 4.1
Southwestern Indiana Area NO_x Point Source Emissions Trend - 2002, 2005 and 2008



Graph 4.2
Southwestern Indiana Area SO_2 Point Source Emissions Trend - 2002, 2005 and 2008



Graph 4.3
Southwestern Indiana Area Direct $PM_{2.5}$ Point Source Emissions Trend - 2002, 2005 and 2008



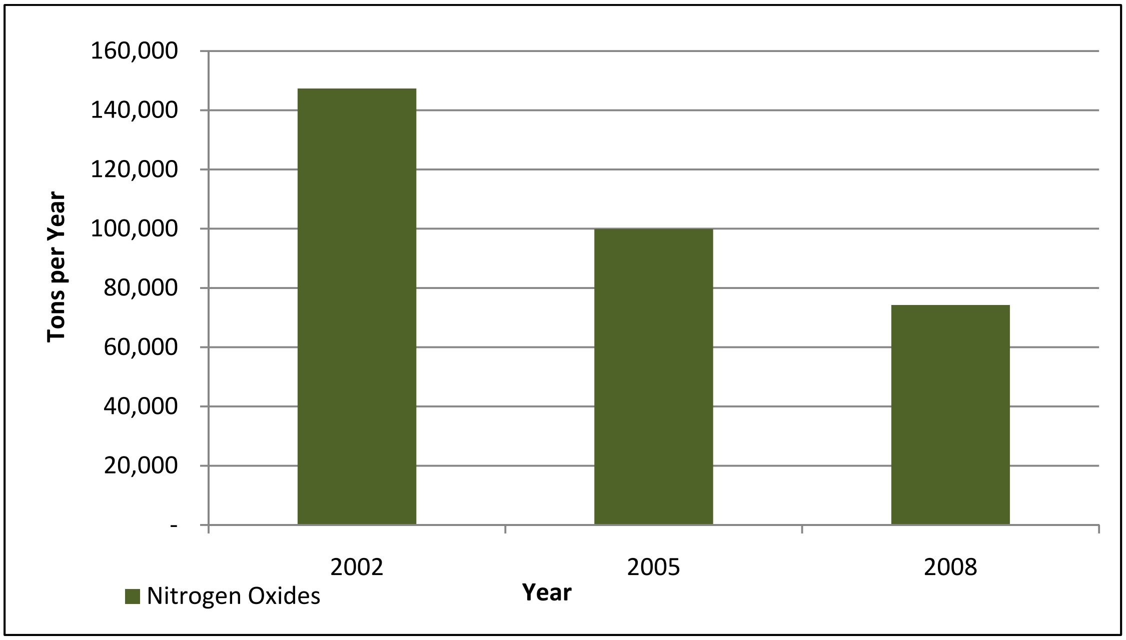
All Anthropogenic Sources

Periodic inventories, which include emissions from all sectors (mobile, area, nonroad and point sources), were prepared for 2002, 2005, and 2008. The 2008 data were extrapolated from the 2005 emission inventory. Graphs 4.4, 4.5, and 4.6 illustrate the trend in anthropogenic source emissions for the Southwestern Indiana Area. Regional NO_x emission reductions affect fine particle levels in the Southwestern Indiana Area far more so than NO_x emission reductions within the nonattainment area itself. These emission trends roughly follow the years of monitored trends discussed in Section 3.0. There is a downward trend in NO_x emissions from 2002 to 2005 and a further decrease through 2008. The decrease in NO_x can be largely attributed to the impact of the NO_x SIP Call. There is a general downward trend in SO_2 emissions from 2002 to 2008, as well. While an increase in direct $PM_{2.5}$ anthropogenic source emissions from 2002 to 2005 for the Southwestern Indiana Area is noted, this increase in direct $PM_{2.5}$ emissions from 2002 to 2005 is due to previously unreported emissions from companies that did not submit their direct $PM_{2.5}$ emissions data in 2002, but did submit direct $PM_{2.5}$ data in the 2005 emission inventory, from which the 2008, 2015, 2020, and 2022 data is extrapolated. Graphs and data tables of emissions from each source category are available in Appendix C.

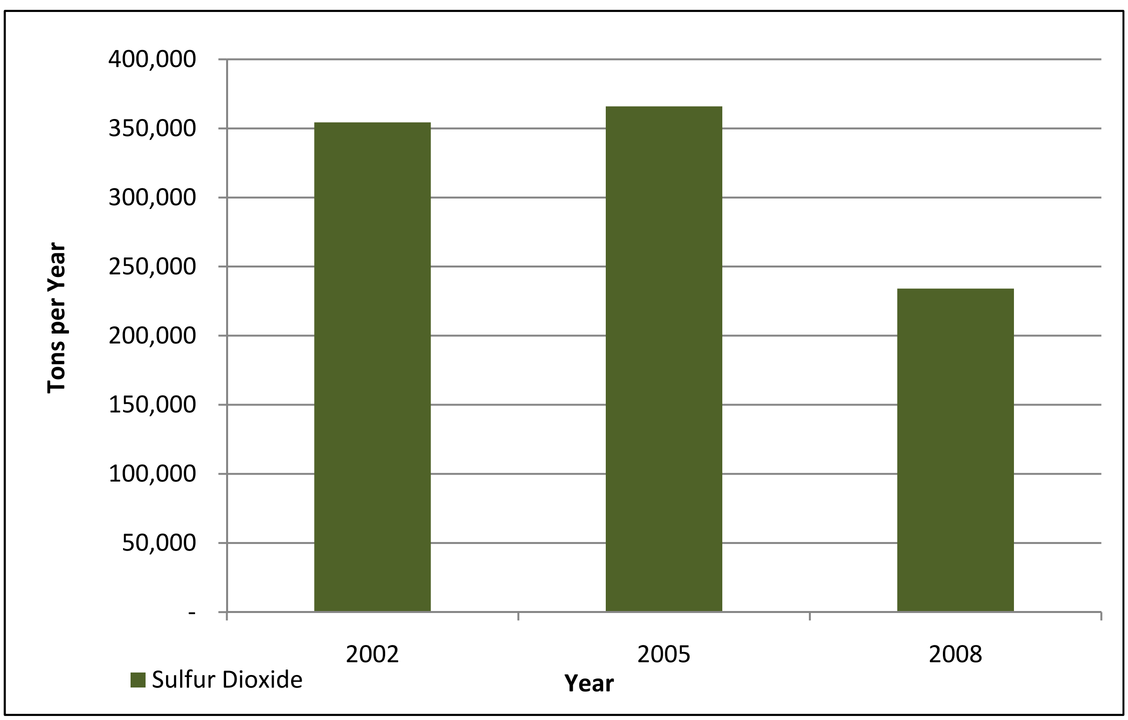
Mobile emissions inventories and projections for all counties were prepared by the Evansville Metropolitan Planning Organization (EMPO) and the Indiana Department of Transportation (INDOT) and are explained in further detail in Section 5.0. All 2005 data for the Southwestern Indiana Area are from the 2005 periodic inventory which has been identified as one of the preferred databases for SIP development. For the 2008 attainment year, emissions were extrapolated from the 2005 Lake Michigan Air Directors Consortium's (LADCO) modeling inventory, using LADCO's growth factors, for all sectors except point sources (electrical generating units and non-electrical generating units). Point source emissions for 2008 were compiled from Indiana's annual emission inventory database.

The emission inventory development and emissions projection discussion below, with the exception of the mobile emission inventory and projections, identify procedures used by IDEM and LADCO regarding emissions for the Southwestern Indiana Area.

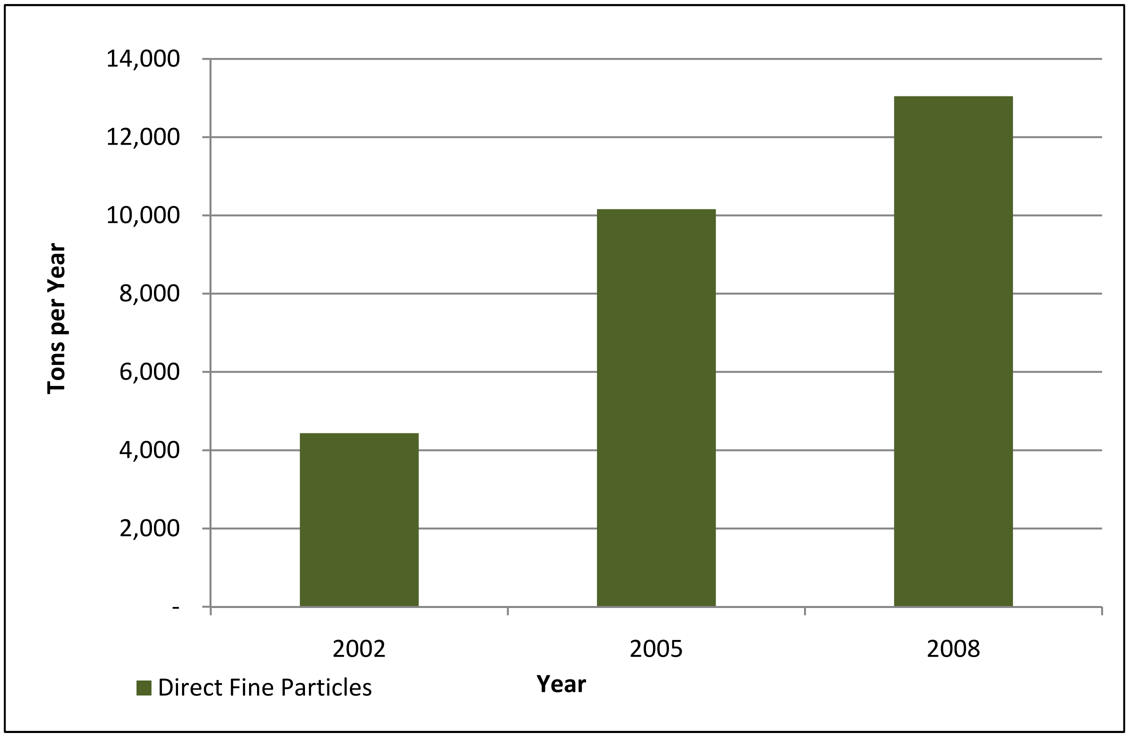
Graph 4.4
NO_x Emissions Trend, All Sources
in the Southwestern Indiana Area - 2002, 2005 and 2008



Graph 4.5
SO_2 Emissions Trend, All Sources
in the Southwestern Indiana Area - 2002, 2005 and 2008



Graph 4.6
Direct $PM_{2.5}$ Emissions Trend, All Sources
in the Southwestern Indiana Area – 2002, 2005 and 2008



EGU Sources

Graphs 4.7 and 4.8 show both NO_x and SO_2 emissions are decreasing substantially in response to national programs affecting all EGUs, such as the Acid Rain program and the NO_x SIP Call. Other sectors of the inventory also impact the formation of fine particles, but large regional sources, such as EGUs, have a substantial impact on the formation of fine particles.

The data were taken from U.S. EPA's Clean Air Markets database located at http://www.epa.gov/airmarkets. Data are available sooner for these units than other point sources in the inventory because of the NO_x SIP Call budget and trading requirements. Information from 2003 is significant because some EGUs started operation of their NO_x SIP Call controls in order to generate Early Reduction Credits for their future year NO_x budgets. The first season of the NO_x SIP Call budget period began May 31, 2004.

As part of the NO_x SIP Call, the states were required to adopt into their rules a budget for all large EGUs. Indiana’s budget is referenced in 326 IAC 10-4. The budget represents a statewide cap on NO_x emissions. Although each unit is allocated emissions based upon historic heat input, utilities can meet this budget by over-controlling certain units or purchasing credits from the market to account for overages at other units. To summarize, NO_x emissions have dramatically decreased over the years represented on these graphs.

These emissions, capped by the state rule, are expected to remain near these levels throughout the maintenance period covered by this request. The state cap for the NO_x SIP Call remained in place through 2008, at which time the Clean Air Interstate Rule (CAIR) program superseded it. CAIR, issued in March 2005, adopted by the Indiana Air Pollution Control Board on November 1, 2006, and implemented beginning in 2010, will continue to reduce regional EGU NO_x emissions statewide by approximately another 17% by 2015 and 57% for EGU SO_2 emissions by 2015. The D.C. Circuit court's vacatur of CAIR in July of 2008 and subsequent remand without vacatur of CAIR in December 2008, directs U.S. EPA to revise the CAIR rule in the future. The proposed Transport Rule (CAIR's replacement rule) will result in similar or greater emission reductions than assumed within the current emission inventories once it is implemented.

As demonstrated by Figure 4.1 and Graph 4.7, significant reductions of NO_x associated with the NO_x SIP Call and preparation for CAIR have been achieved statewide as well as regionally. For the six state region (Arkansas, Indiana, Illinois, Kentucky, Missouri and Tennessee) shown in Figure 4.1, within the area south of latitude 38 and west of longitude -87 (the southwest quadrant denoted by brown lines), there has been a reduction in upwind EGU emissions of more than 197,000 tons of NO_x from 2002 to 2009. These six states are important because they represent the predominant upwind states most likely to affect the Southwestern Indiana Area. The specific EGU emissions for NO_x and SO_2 from the southwest quadrant, as well as the change in emissions from 1999 to 2009 are listed in Appendix D.

Graph 4.7
Regional NO_x Emissions from EGUs - 1999 to 2009

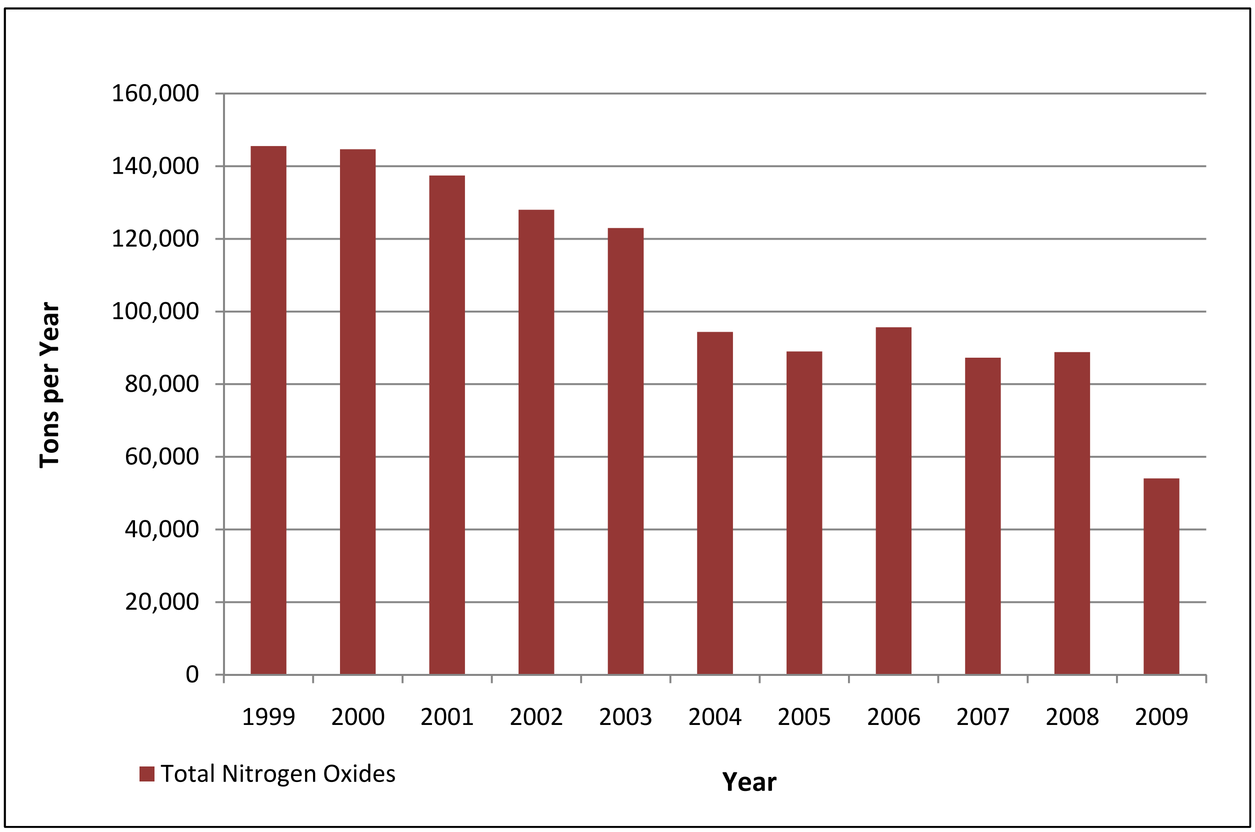
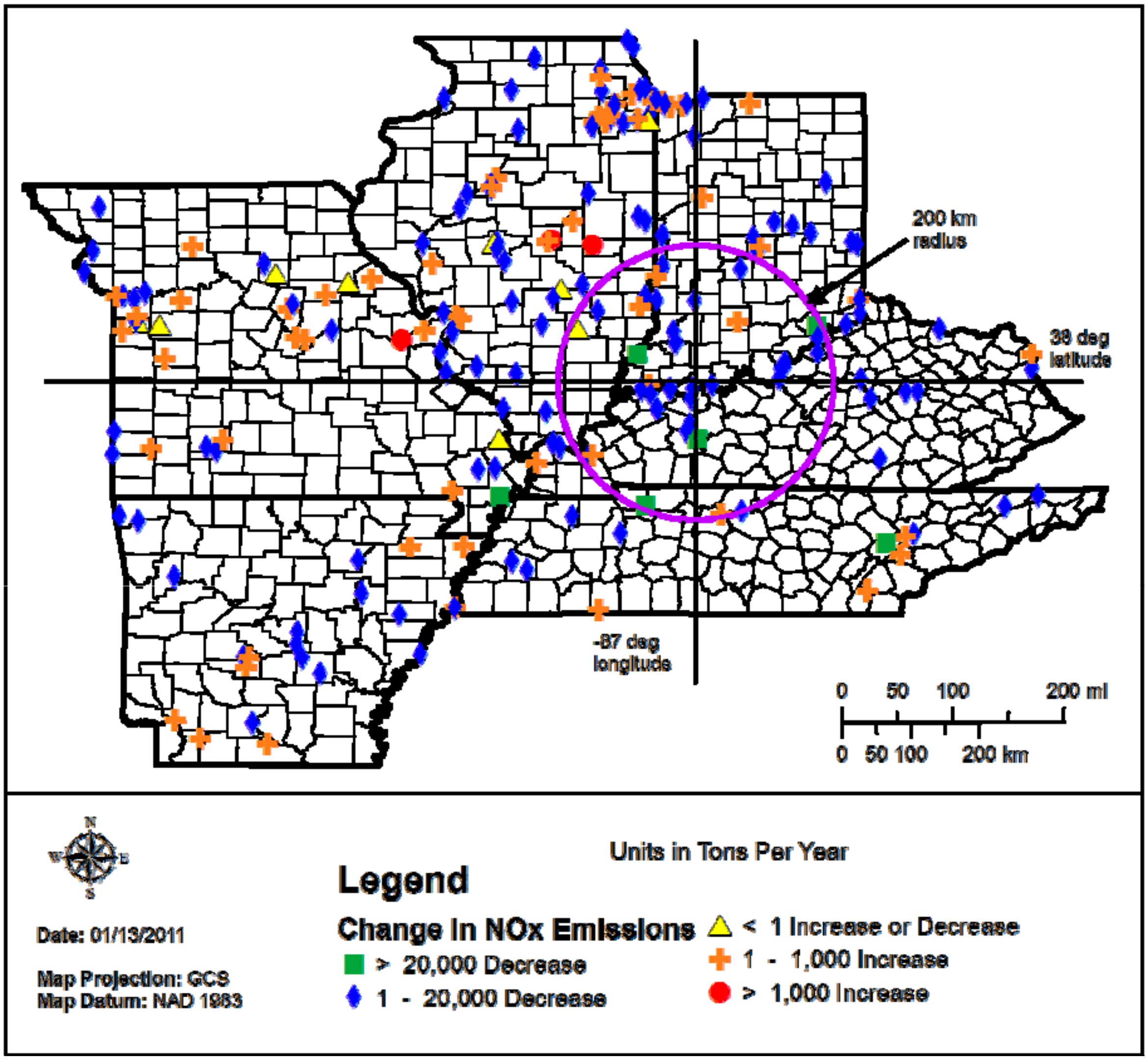


Figure 4.1 Regional NO_x EGU Reductions Between 2002 and 2009



As demonstrated by Figure 4.2, reductions of regional SO_2 from upwind EGUs have also been achieved. For the six state region (Arkansas, Indiana, Illinois, Kentucky, Missouri and Tennessee) shown in Figure 4.2, in the area south of latitude 38 and west of longitude -87 (the southwest quadrant denoted by the brown lines), there has been a reduction of upwind EGU emissions of over 24,000 tons of SO_2 from 2002 to 2009. The specific EGU emissions for NO_x and SO_2 from the southwest quadrant, as well as the change from 1999 to 2009 are listed in Appendix D.

Although there are minor fluctuations in the SO_2 emissions over time, as shown in Graph 4.8, well over 50% in reductions have been realized to date. As noted in Graph 4.10, significant reductions are expected in SO_2 emissions from the CAIR program and Best Available Retrofit Technology (BART), once implemented. As a result of the CAIR program, five EGU's will achieve significant reductions in SO_2. It is expected that this downward trend will continue as the above programs continue and U.S. EPA's proposed Transport Rule is implemented. Alcoa and Cayuga both installed scrubbers in 2008 that will result in a 90% reduction in SO_2 emissions, to meet CAIR rules. Gibson installed Flue Gas Desulfurization (FGD) systems on Units 1, 2, and 3 between 2006 and 2008. Clifty Creek is in the process of installing FGD systems which will also result in 90% reductions in SO_2 at those facilities, despite some technology-related problems. Wabash Valley was ordered to shut down Units 2, 3, and 5 and complied by September 30, 2009. As a result of Wabash Valley's successful legal appeal, they may restart these units in the future. At this time, there is no clear indication that Wabash Valley will restart units 2, 3, and 5. Edwardsport is replacing all of the coal-fired boilers with an Integrated Gasification Combined Cycle (IGCC) system which will result in a slight increase in NO_x of 32.49 tons per year and a substantial reduction in SO_2 of 9,834 tons per year. Also, as a result of a recent settlement agreement, American Electric Power (AEP) Rockport will install scrubbers to achieve a 90% reduction in SO_2. Appendix B shows detailed emissions for the point source emissions and Appendix D shows detailed emissions for the electric generating units.

Graph 4.8
Regional SO_2 Emissions from EGUs - 1999 to 2009

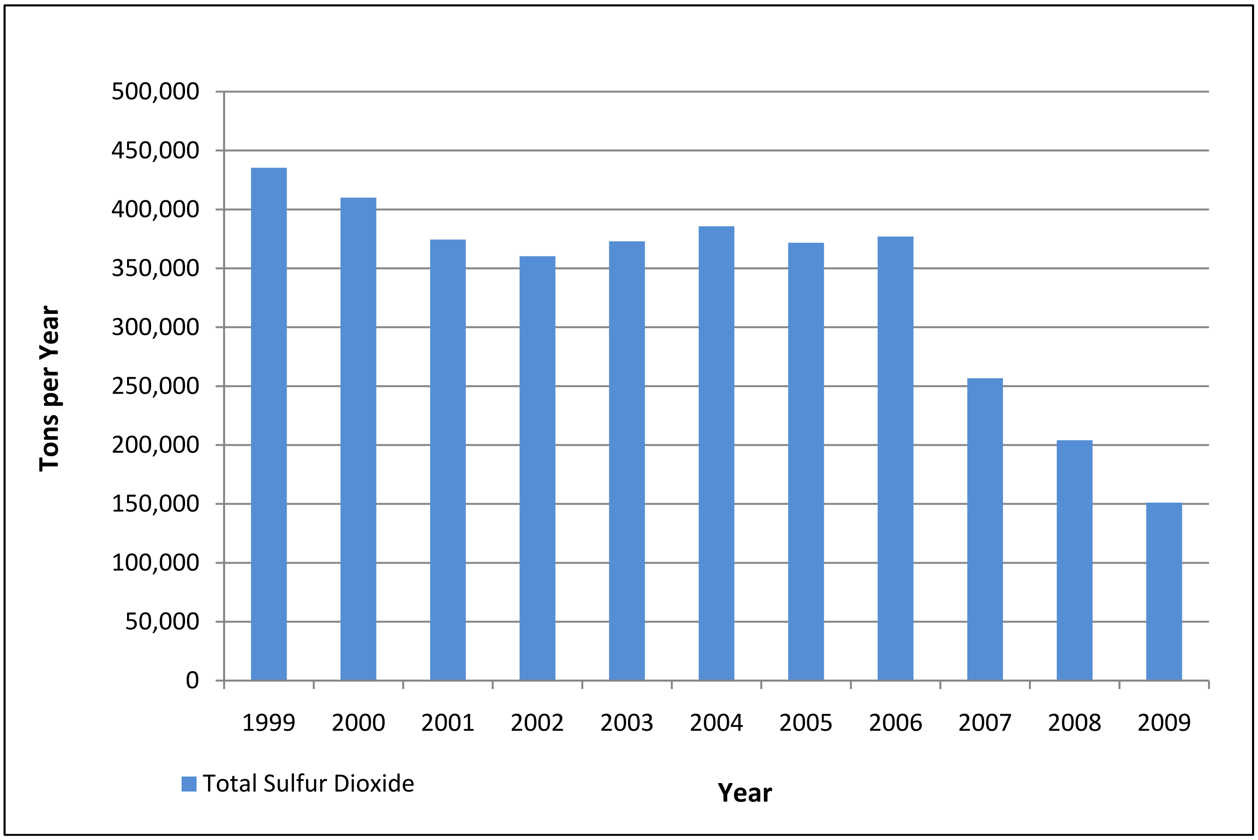
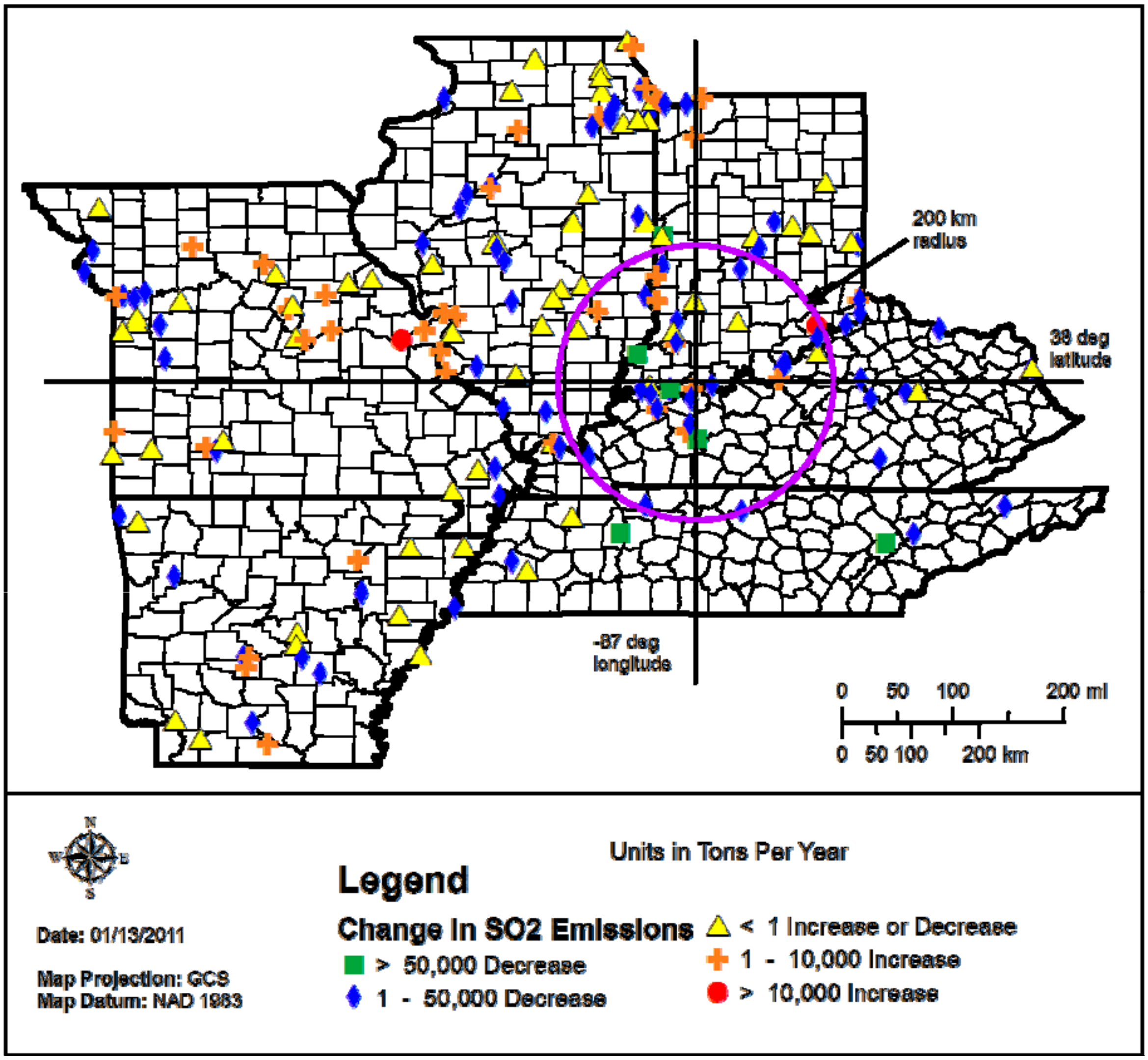


Figure 4.2 Regional SO_2 EGU Reductions Between 2002 and 2009



4.2 Base Year Inventory

IDEM prepared a comprehensive inventory for the Southwestern Indiana Area, including area, mobile, nonroad, and point sources for the regulated precursors of fine particles (NO_x, SO_2 and direct $PM_{2.5}$) for 2005 and 2008 (the years with the most complete emission inventories available at this time). The 2005 emission inventory represents a base year for maintenance purposes. The 2007 implementation rule for the annual fine particle standard states that NO_x, SO_2, and direct $PM_{2.5}$ are the regulated precursors of fine particles. Ammonia and VOCs are not required to be addressed unless the state or U.S. EPA makes a technical demonstration that emissions of these pollutants from sources in the state significantly contribute to $PM_{2.5}$ concentrations in a given nonattainment area. U.S. EPA and IDEM have not determined ammonia or VOCs to be significant contributors to fine particles formation in the State of Indiana. Indiana's 2005 base year inventory was determined by the following:

- Area sources were extrapolated from the Indiana 2005 periodic inventory submitted to U.S. EPA.
- Mobile source emissions were calculated from MOBILE6.2 model-produced emission factors and data extracted from the region's travel-demand model. These emissions were then interpolated as needed to determine 2005 base year values.
- Point source information was compiled from IDEM's emissions statement database and U.S. EPA's Clean Air Markets acid rain database.
- Biogenic emissions are not specifically included in these summaries, but are included in the photochemical modeling results represented in Section 7.0.
- Nonroad emissions were extrapolated from the 2002 National Emissions Inventory (NEI). To address concerns about the accuracy of some of the categories in U.S. EPA's nonroad emissions model, LADCO contracted with two companies to review the base data and make recommendations. One of the contractors also estimated emissions for two nonroad categories not included in U.S. EPA's nonroad model. Emissions were estimated for commercial marine vessels and railroads. The recreational motorboat population and spatial surrogates (used to assign emissions to each) were significantly updated. The populations for the construction equipment category were reviewed and updated based upon surveys completed in the Midwest and the temporal allocation for agricultural sources was also updated. A new nonroad estimation model was provided by U.S. EPA for the 2002 analysis.

Appendix C contains data tables and graphs of these emissions.

4.3 Emission Projections

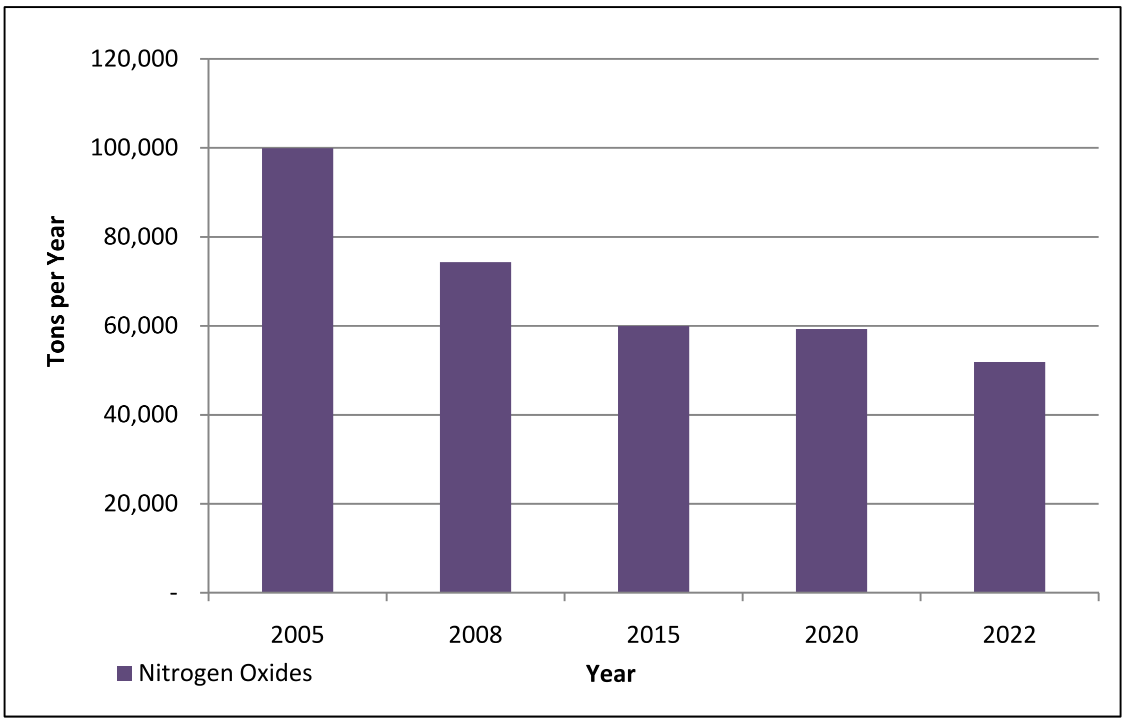
In consultation with U.S. EPA and other stakeholders, IDEM selected the year 2022 as the maintenance year for this redesignation request. This document contains projected emission inventories for 2015, 2020, and 2022 for the Southwestern Indiana Area. These emission projections were prepared by IDEM, with assistance from LADCO and the EMPO. The projected emission inventories for 2020 and 2022 were extrapolated from 2018 estimates developed by LADCO.

The detailed 2015, 2020, and 2022 emission inventory for the Southwestern Indiana Area can be found in Appendix E. Emission trends are an important gauge for continued compliance with the annual standard for fine particles. Therefore, IDEM performed an initial comparison of the inventories for the base year of 2005, secondary validation year of 2008, interim years of 2015 and 2020 and maintenance year of 2022 for the Southwestern Indiana Area.

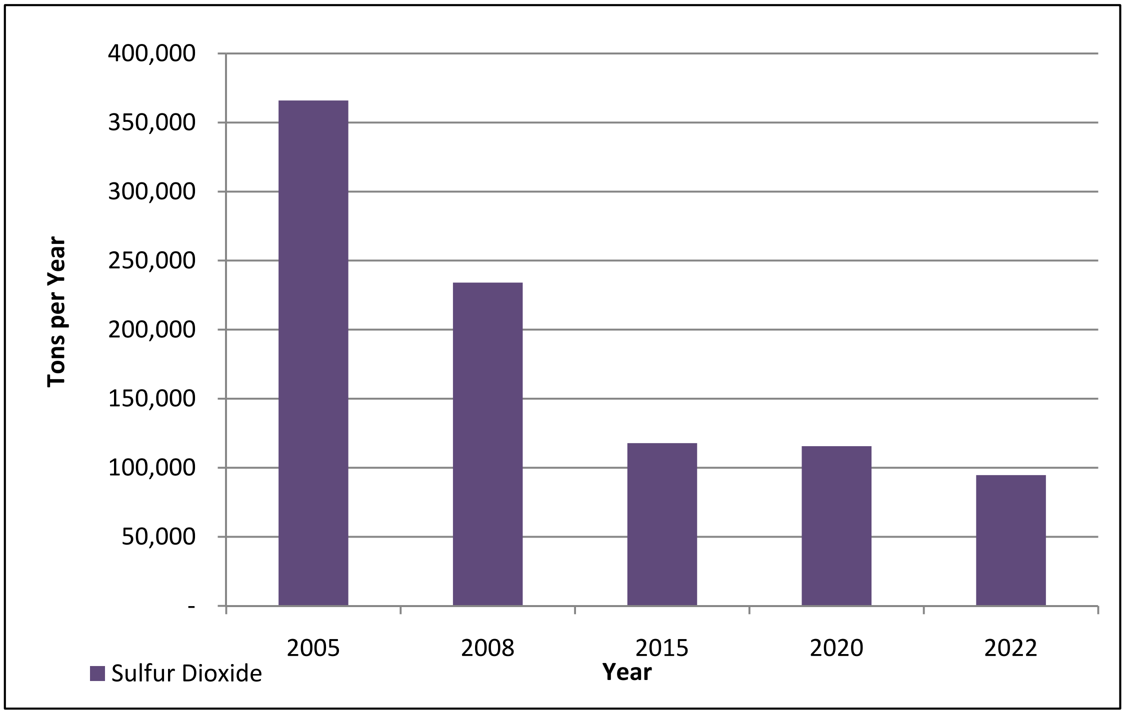
The 2005 LADCO modeling inventory was used as the basis for estimated emissions for the years 2008, 2015, 2020, and 2022, using LADCO's growth factors, for all sectors except point sources (electrical generating units and non-electrical generating units). Point source emissions for 2005 and 2008 were compiled from Indiana's annual emission inventory database. The 2008 secondary validation emissions for other sectors were extrapolated from 2005 values. The 2015 interim year emissions were interpolated based on the 2009 and 2018 LADCO modeling inventory, using LADCO's growth factors, for all sectors. The 2020 interim year emissions and the 2022 maintenance year emissions were extrapolated from the 2018 LADCO modeling inventory.

Graphs 4.9, 4.10, and 4.11 visually compare 2005 (base year) and 2008 (secondary validation year) NO_x, SO_2, and direct $PM_{2.5}$ county total estimated emissions with the 2015, 2020, and 2022 projected emissions for the Southwestern Indiana Area. Mobile source emission inventories are further described in Section 5.0. In addition to LADCO's estimates, point source emissions were projected based upon the statewide EGU NO_x budgets from the Indiana NO_x SIP Call rule. It should be noted that EGU emission estimates for 2015, 2020, and 2022 were projected using the Department of Energy Information's Annual Energy Outlook Supplemental tables for the year 2018. These tables were generated for the reference case of the Annual Energy Outlook 2007 using the National Energy Modeling System. Graphs and data tables of emissions from the EGU source category can be found in Appendix D.

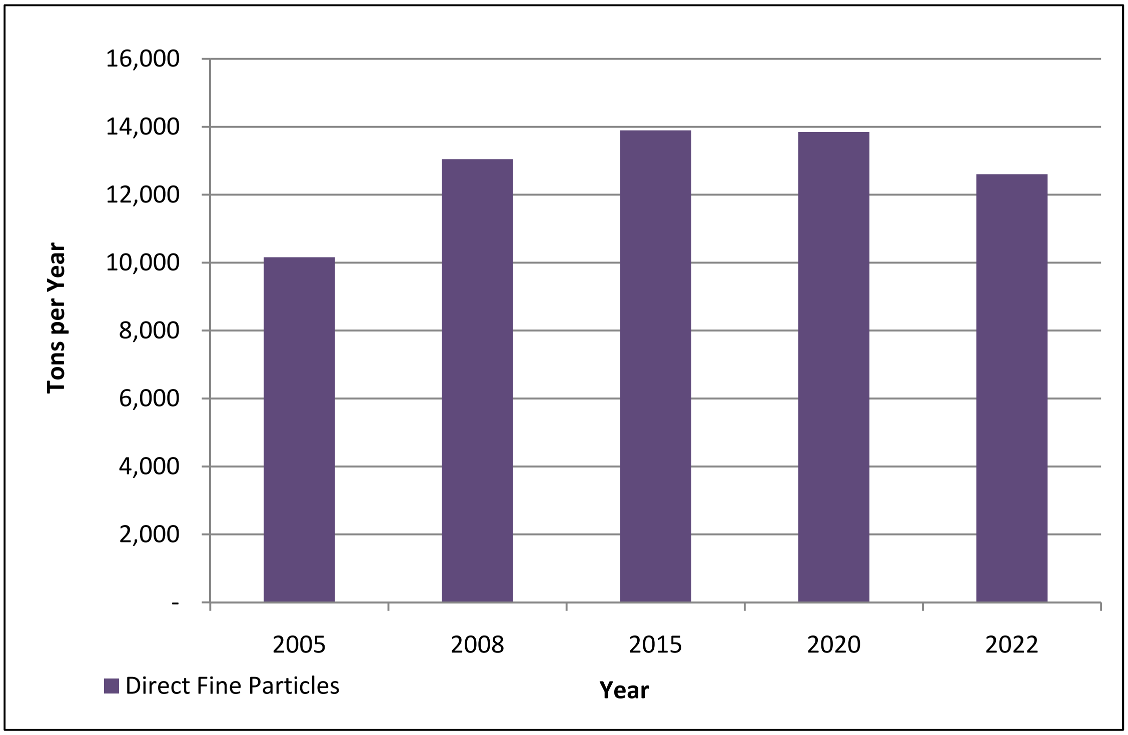
Graph 4.9
Comparison of 2005, 2008, 2015, 2020 and 2022 Projected NO_x Emissions for the Southwestern Indiana Area



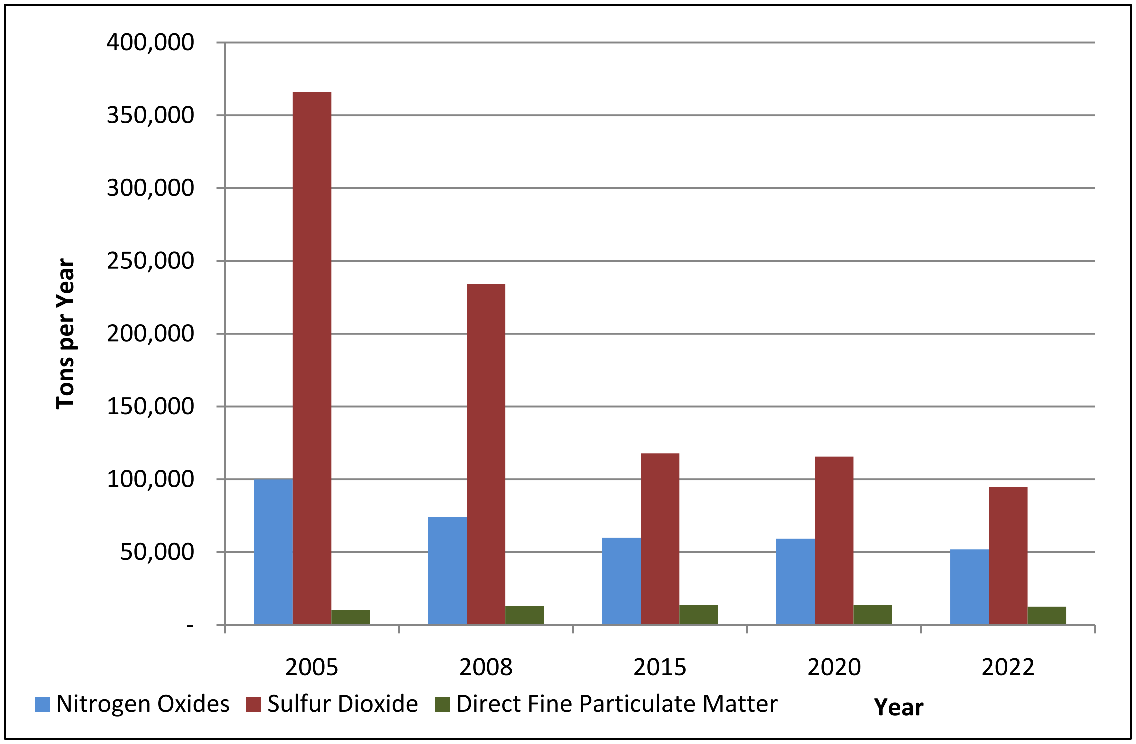
Graph 4.10
Comparison of 2005, 2008, 2015, 2020 and 2022 Projected SO_2 Emissions for the Southwestern Indiana Area



Graph 4.11
Comparison of 2005, 2008, 2015, 2020 and 2022 Projected Direct $PM_{2.5}$ Emissions for the Southwestern Indiana Area



Graph 4.12
Comparison of 2005, 2008, 2015, 2020 and 2022 Projected NO_x, SO_2 and Direct $PM_{2.5}$ Emissions for the Southwestern Indiana Area



NO_x emissions within the Southwestern Indiana Area are projected to decline by 48% between 2005 and 2022. Emission reduction benefits from U.S. EPA rules covering the NO_x SIP Call, Tier 2 Motor Vehicle Emission Standards and Gasoline Sulfur Control Requirements, Heavy-Duty Highway Engine Rule, and the Nonroad Diesel Engine Rule are factored into the changes. Additionally, due to implementation of the NO_x SIP Call across the eastern United States, NO_x and fine particle levels entering the Southwestern Indiana Area will also be decreased. SO_2 emissions within the Southwestern Indiana Area are projected to decline by 74% between 2005 and 2022. While an increase in direct $PM_{2.5}$ emissions in the Southwestern Indiana Area is noted, this increase in emissions from 2002 to 2005 is due to previously unreported emissions from companies that did not submit their direct $PM_{2.5}$ emissions data in 2002, but did submit direct $PM_{2.5}$ data in the 2005 emission inventory, from which the 2008, 2015, 2020, and 2022 data is extrapolated. The 2015, 2020, and 2022 emission projections assume no additional controls will be installed. This approach over-predicts future year emissions as it is reasonable to assume a significant number of facilities will need to install additional controls to comply with CAIR or the proposed Transport Rule. The increase in direct $PM_{2.5}$ emissions in the Southwestern Indiana Area is outweighed by the significant regional reductions in NO_x and SO_2 that have occurred and will continue to occur in the future.

Table 4.1
Comparison of 2005 Estimated and 2022 Projected Emission Estimates, Southwestern Indiana Area (Annual-Tons)

	2005	2022	Change	% Change
NO_x	99,921.66	51,884.76	-48,036.90	48.07% decrease
SO_2	365,954.11	94,626.89	-271,327.22	74.14% decrease
Direct $PM_{2.5}$	10,159.65	12,604.06	2,444.41	24.06% increase

Table 4.2
Comparison of 2008 Estimated and 2022 Projected Emission Estimates, Southwestern Indiana Area (Annual-Tons)

	2008	2022	Change	% Change
NO_x	74,286.88	51,884.76	-22,402.12	30.16% decrease
SO_2	234,126.80	94,626.89	-139,499.91	59.58% decrease
Direct $PM_{2.5}$	13,045.38	12,604.06	-441.32	3.38% decrease

4.4 Demonstration of Maintenance

Quality-assured ambient air quality data from all the monitoring sites indicate that air quality in the Southwestern Indiana Area met the annual NAAQS for fine particles for the three-year period ending in 2009. U.S. EPA's Redesignation Guidance states, "A state may generally demonstrate maintenance of the NAAQS by either showing that future emissions of a pollutant or its precursors will not exceed the level of the attainment inventory, or by modeling to show that the future mix of sources and emission rates will not cause a violation of the NAAQS" (Page 9). Section 3.0 of this document shows that the Southwestern Indiana Area has in fact measured attainment for fine particles for the four consecutive periods ending in 2006, 2007, 2008, and 2009. Additionally, emission projections outlined in Section 4.0 of this document clearly illustrate that regional NO_x and SO_2 emissions in the area will continue to decline leading to local reductions between 2005 (base year) and 2022 (maintenance plan horizon). Section 7.0 further discusses the implications of these emission trends and provides an analysis to support these conclusions.

In Indiana, major point sources in all counties are required to submit air emissions information once every three years, or annually, if the NO_x or SO_2 potential to emit is greater than 2,500 tons per year in accordance with the Emission Reporting Rule, 326 IAC 2-6. IDEM prepares a new periodic inventory for all precursor emission sectors every three years. These precursor emission inventories will be prepared for 2011, 2014, and 2017, as necessary, to comply with the inventory reporting requirements established in the CAA. Emissions information will be compared to the 2005 base year and the 2022 projected maintenance year inventories to assess emission trends, as necessary, to assure continued compliance with the annual standard for fine particles.

4.5 Permanent and Enforceable Emission Reductions

Permanent and enforceable reductions of NO_x and SO_2 have contributed to the attainment of the annual standard for fine particles. Some of these reductions were due to the implementation of the NO_x SIP Call rule and some were due to the application of tighter federal standards on motor vehicles and fuels.

Section 6.0 identifies the emission control measures specific to the Southwestern Indiana Area, as well as the implementation status of each measure.

4.6 Provisions for Future Updates

As required by Section 175A(b) of the CAA, Indiana commits to submit to the Administrator, eight years after redesignation, an additional revision of this SIP. The revision will contain Indiana's plan for maintaining the national primary fine particles air quality standard for ten years beyond the first ten-year period after redesignation.

5.0 TRANSPORTATION CONFORMITY BUDGETS

U.S. EPA requirements outlined in 40 CFR 93.118(e)(4) stipulate that motor vehicle emission budgets (MVEBs) for direct $PM_{2.5}$ and NO_x be established as part of a SIP. The MVEBs are necessary to demonstrate conformance of transportation plans and improvement programs with the SIP.

5.1 Onroad Emission Estimates

The EMPO is the Metropolitan Planning Organization (MPO) for the Evansville area. The EMPO study area contains approximately 650 square miles in Indiana, including the City of Evansville, Vanderburgh County, Warrick County and a very small area of eastern Posey County. In Kentucky, the study area encompasses approximately 440 square miles which includes the City of Henderson and Henderson County. Additionally, INDOT and the EMPO have executed an agreement for the EMPO to provide planning assistance in rural Gibson County.

The EMPO maintains a travel demand forecasting model that was updated and improved in 2006. The model incorporates the road network of a five county area, which includes the Indiana counties of Vanderburgh, Warrick, Gibson, and Posey, and Henderson County in Kentucky. Incorporated into the travel demand model is a post-processor that uses the U.S. EPA-required emissions estimation model, MOBILE6.2, to calculate total emissions.

The EMPO travel demand model is used to simulate the traffic in the area and to predict what traffic would be in future years given growth expectations. The model is used mostly to identify where travel capacity will be needed and to determine the infrastructure requirements necessary to meet that need. It is also used to support the calculation of mobile source emissions. The travel demand forecasting model is used to predict the total daily vehicle miles traveled (VMT) and MOBILE6.2 is used to produce emission factors to calculate the emissions per mile. The product of these two outputs, once combined, is the total amount of pollution emitted by onroad vehicles for the particular analyzed area. Dubois County, Ohio Township in Spencer County and Washington Township in Pike County are Indiana areas included in U.S. EPA's nonattainment designations for fine particles that do not fall under the jurisdiction of EMPO. In cases such as this, INDOT uses Highway Performance Monitoring System (HPMS) baseline data to estimate and project mobile source emissions. This is a national program that requires state Departments of Transportation to collect traffic counts throughout the state on a regular basis under a certain regulated method. This HPMS data was collected and provided by INDOT and was used for these three areas beyond Evansville MPO's jurisdiction.

5.2 Overview

Broadly described, MOBILE6.2 is used to generate "emission factors," which are the average emissions per mile (grams/mile) for precursors of fine particles, including NO_x, SO_2 and direct $PM_{2.5}$. There are numerous variables that can affect the emission factors. The vehicle-fleet (vehicles on the road) age and the vehicle types have a major affect on the emission factors. The facility-type on which the vehicles are traveling (MOBILE6.2 facility types are Freeway, Arterial, Local and Ramp) and the vehicle speeds also affect the emission factor values. Meteorological factors such as air temperature and humidity affect the emission factors, as does fuel type, such as low Reid Vapor Pressure gasoline. These data are estimated using the *best available data* to generate emission factors for NO_x, SO_2 and direct $PM_{2.5}$. After emission factors are generated, they must be multiplied by the VMT to determine the quantity of vehicle-related emissions. This information is derived from the travel demand model (TDM).

It should be noted that each year analyzed will have different emission factors, volumes, speeds and likely results in additional modeling. MOBILE6.2 input and output files can be found in Appendix F.

5.3 Analysis Years

The travel demand model contains road networks that are time specific. The EMPO has modeled the years 2002, 2010, 2015, 2025, and 2035. Information, including emissions, has also been interpolated from 2002 and 2010 for the years 2005 and 2008 and from 2015 and 2025 for the years 2020 and 2022. This Redesignation Petition provides emission inventory estimates for 2002, 2005, 2008, 2010, 2020, and 2022 to meet the requirements specified by the CAA and U.S. EPA. The emission estimates outlined in Section 4.0 of this document include the 2005, 2008, 2010, 2020, and 2022 mobile source emissions data referenced in Table 5.1.

5.4 Emission Estimations

Table 5.1 outlines predicted onroad emission estimates for the entire nonattainment area for the years 2005 (base year), 2008 (attainment year), 2015 (interim year), 2020 and 2022 (horizon year). The following emission estimates are based on the TDM network runs for the years 2005, 2008, 2015, 2020, and 2022.

Table 5.1
Emission Estimations for Onroad Mobile Sources
for the Southwestern Indiana Area

	2005	**2008**	**2015**	**2020**	**2022**
Direct $PM_{2.5}$ (tons/year)	117.67	91.59	54.33	50.48	48.93
NO_x (tons/year)	6,528.04	5,018.06	2,503.19	1,929.38	1,699.86

5.5 <u>Motor Vehicle Emission Budgets</u>

Table 5.2 contains the MVEBs for the entire nonattainment area for the years 2015 and 2022.

Table 5.2
Mobile Source Emission Budgets
for the Southwestern Indiana Area

	2015	**2022**
$PM_{2.5}$ (tons/year)	57.05	53.83
NO_x (tons/year)	2,628.35	1,869.84

Consistent with the federal implementation rule for fine particles, IDEM does not consider mobile source SO_2 emissions to be a significant contributor to fine particles for this nonattainment area, as SO_2 constitutes less than 1% of the area's total anthropogenic emissions for the years 2005, 2008, 2015, 2020 or 2022.

This document creates an interim year budget for 2015 and a horizon year budget for 2022 for the Southwestern Indiana Area. These budgets are based on the 2005 onroad emission inventory used to support photochemical modeling for the same year and has incorporated an appropriate safety margin as described below.

In an effort to accommodate future variations in TDMs and VMT forecast when no change to the network is planned, IDEM consulted with the interagency consultation group, including U.S. EPA Region V, to determine a reasonable approach to address this variation. The interagency consultation group approved a 5% safety margin for $PM_{2.5}$ and NO_x mobile source emission estimates for the year 2015 and a 10% safety margin for $PM_{2.5}$ and NO_x mobile source emission estimates for the year 2022.

The safety margins are appropriate because: 1) there is an acknowledged potential variation in VMT forecast and potential estimated mobile source emissions due to expected modifications to TDM and mobile emission models; and 2) the total decrease in emissions from all sources is sufficient to accommodate the safety margin allocations detailed above to mobile sources while still continuing to maintain total emissions in the Southwestern Indiana Area well below the 2008 attainment level of emissions. These safety margins were calculated by adding a straight-line percentage to the mobile source emission estimates for the years 2015 and 2022. Safety margin, as defined by the conformity rule, looks at the total emissions from all sources in the nonattainment area. The resulting 2015 and 2022 MVEBs for $PM_{2.5}$ and NO_x emissions remain well below the 2005 base year emissions referenced in Table 5.1.

In summary, the mobile budget safety margin allocation translates into:

- An allocation of 2.72 tons/year for $PM_{2.5}$ and 125.16 tons/year for NO_x for 2015.
- An allocation of 4.90 tons/year for $PM_{2.5}$ and 169.98 tons/year for NO_x for 2022.

The rule at 40 CFR 93.101 defines safety margin as the amount by which the total projected emissions from all sources of a given pollutant are less than the total emissions that would satisfy the applicable requirement for reasonable further progress, attainment or maintenance. When compared to the overall safety margin as defined by 40 CFR 93.101, it is evident this allocation to mobile sources is significantly below the total safety margin for all sources in the Southwestern Indiana Area as detailed in Table 4.1.

While IDEM believes that this is sufficient to support the requested increase, IDEM and its partners will be conducting additional air quality modeling which will include the adjusted mobile emissions, as well as any additional corrections and modifications that may be necessary due to the constant review and evaluation of the model inputs.

5.6 Commitment to Amend Motor Vehicle Emission Budgets Using Motor Vehicle Emission Simulator (MOVES)

On March 2, 2010, U.S. EPA published a Notice of Availability for the Motor Vehicle Emission Simulator (MOVES) model. Indiana is committed to submitting a revision to the MOBILE6.2 developed MVEBs using the MOVES model as soon as possible and well in advance of the March 2, 2012, expiration of the transportation conformity “grace period.” IDEM recognizes that U.S. EPA will allow the MOBILE6.2 budgets to be replaced through an adequacy notice in place of a full publication to the Federal Register.

All methodologies, latest planning assumptions, margins of safety and MOVES model commitments were determined appropriate through the interagency consultation process.

6.0 CONTROL MEASURES AND REGULATIONS

This section provides specific information on the control measures that have been or will be implemented in the Southwestern Indiana Area, including CAA requirements and additional state or local measures implemented beyond CAA requirements.

6.1 Reasonably Available Control Technology (RACT)

As required by Section 172 of the CAA, in the mid-1990s, Indiana promulgated rules requiring RACT for emissions of VOCs. There were no specific rules required by the CAA, such as RACT for existing sources, beyond statewide rules. Statewide RACT rules have applied to all new sources locating in Indiana since that time. The Indiana rules are found in 326 IAC 8. The following is a listing of applicable rules:

326 IAC 8-1-6	BACT for Non-Specific Sources
326 IAC 8-2	Surface Coating Emission Limitations
326 IAC 8-3	Solvent Degreasing Operations
326 IAC 8-4	Petroleum Sources
326 IAC 8-5	Miscellaneous Operation
326 IAC 8-6	Organic Solvent Emission Limitations

Since the Southwestern Indiana Area attained the annual NAAQS for fine particles prior to an Attainment SIP or RACT SIP being due, and since the Implementation Rule for fine particles stipulates that states are only required to draft and implement RACT rules for the precursor emission reductions necessary to attain the standard, no further RACT rules are required for this area. These Indiana rules are CAA requirements already in the SIP and provide secondary benefits for $PM_{2.5}$.

6.2 Implementation of Past State Implementation Plan (SIP) Revisions

The area was designated nonattainment for the annual standard for fine particles in 2003 and the area attained the standard well in advance of its attainment deadline of 2010. As a result, Indiana is no longer required to develop and submit an Attainment SIP or RACT SIP for this area under the annual NAAQS for fine particles.

6.3 Nitrogen Oxides (NO_x) Rule

The U.S. EPA NO_x SIP Call required twenty-two states to adopt rules that would result in significant emission reductions from large EGUs, industrial boilers, and cement kilns in the eastern United States. The Indiana rule was adopted in 2001. Beginning in 2004, this rule accounts for a reduction of approximately 31% of all NO_x emissions statewide compared to previous uncontrolled years.

Twenty-one other states have also adopted these rules. The result is that significant reductions have occurred regionally and within the nonattainment area because of the number of affected units within the region. From Graph 4.7 and Figures 4.1 and 4.2, it can be seen that emissions covered by this program have been generally trending downward since 1999. Table 6.1, compiled from data taken from the U.S. EPA Clean Air Markets Web site, quantifies the gradual NO_x reductions that have occurred in Indiana as a result of Title IV (Acid Rain) of the CAA and the NO_x SIP Call Rule. The NO_x SIP Call cap stayed in place through 2008, at which time the caps in the CAIR program superseded it. Since CAIR is a regional cap and trade program, it cannot be predicted at this time what effect this will have on EGU units located in the nonattainment area or other upwind counties.

Further, U.S. EPA published Phase II of the NO_x SIP Call that establishes a budget for large (emissions of greater than 1 ton per day) stationary internal combustion engines. In Indiana, the rule decreases emissions statewide from natural gas compressor stations by 4,263 tons during the ozone season (April through September). The Indiana Phase II NO_x SIP Call Rule became effective February 26, 2006, and implementation began in 2007.

Table 6.1
Trends in EGU NO_x Emissions Statewide in Indiana

Year	NO_x Emissions (tons /year)
1999	347,216.5
2000	334,522.1
2001	315,419.7
2002	281,146.1
2003	260,980.0
2004	224,311.3
2005	207,981.6
2006	202,728.0
2007	196,553.1
2008	196,134.5
2009	110,968.9
Budget 2009-2014	108,935
Budget 2015 and later	90,779

6.4 Measures Beyond Clean Air Act SIP Requirements

Reductions in fine particle precursor emissions have occurred, or are anticipated to occur, as a result of local and federal programs. These additional control measures include those listed in this section.

Tier 2 Vehicle Standards[8]

Federal Tier 2 motor vehicle standards require all passenger vehicles in a manufacturer's fleet, including light-duty trucks and sport utility vehicles (SUVs), to meet an average standard of 0.07 grams of NO_x per mile. Implementation began in 2004 and was completed in 2007. The Tier 2 standards also cover passenger vehicles over 8,500 pounds gross vehicle weight rating (larger pickup trucks and SUVs), which are not covered by the current Tier 1 standards. For these vehicles, the standards were phased in beginning in 2008, with full compliance in 2009. The new standards require vehicles to be 77% to 95% cleaner than those on the road prior to the program. The Tier 2 standards also reduced the sulfur content of gasoline to 30 parts per million (ppm) beginning in January 2006. Most gasoline sold in Indiana prior to January 2006 had a sulfur content of about 500 ppm. Sulfur occurs naturally in gasoline, but interferes with the operation of catalytic converters on vehicles resulting in higher NO_x emissions. Lower sulfur gasoline is necessary to achieve the Tier 2 vehicle emission standards.

8 http://www.epa.gov/fedrgstr/EPA-AIR/2000/February/Day-10/a19a.htm

Heavy-Duty Gasoline and Diesel Highway Vehicle Standards[9]

New U.S. EPA standards designed to reduce NO_x and VOC emissions from heavy-duty gasoline and diesel highway vehicles took effect in 2004. A second phase of standards and testing procedures, that began in 2007, reduced $PM_{2.5}$ emissions from heavy-duty highway engines and also reduced highway diesel fuel sulfur content to 15 ppm since the sulfur can damage emission control devices. The total program is expected to achieve a 90% reduction in direct $PM_{2.5}$ emissions and a 95% reduction in NO_x emissions for these new engines using low sulfur diesel, compared to existing engines using higher sulfur content diesel. There will also be SO_2 reductions from these rules. U.S. EPA has not quantified the expected reductions.

Large Nonroad Diesel Engine Standards[10]

In May 2004, U.S. EPA promulgated new rules for large nonroad diesel engines, such as those used in construction, agricultural, and industrial equipment, to be phased in between 2008 and 2014. The nonroad diesel rules also reduce the allowable sulfur in nonroad diesel fuel by over 99%. Prior to 2006, nonroad diesel fuel averaged approximately 3,400 ppm sulfur. This rule limited nonroad diesel sulfur content to 500 ppm by 2006 with a further reduction to 15 ppm by 2010. The combined engine and fuel rules will reduce NO_x and PM emissions from large nonroad diesel engines by over 90%, compared to current nonroad engines using higher sulfur content diesel.

Nonroad Spark-Ignition Engines and Recreational Engine Standards

This new standard, effective in July 2003, regulates NO_x, VOCs, and carbon monoxide (CO) for groups of previously unregulated nonroad engines. The new standard applies to all new engines sold in the United States and imported after the standards went into effect. The standard applies to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all-terrain vehicles), and recreational marine diesel engines. The regulation varies based upon the type of engine and vehicle.

The large spark-ignition engines contribute to ozone formation and ambient CO and PM levels in urban areas. Tier 1 of this standard was implemented in 2004 and Tier 2 started in 2007. Like the large spark-ignition engines, recreational vehicles contribute to ozone and fine particles formation and ambient CO and PM levels. For Model Year 2006 off-highway motorcycles and all-terrain vehicles, at least 50% of a manufacturer’s fleet was required to meet the new exhaust emissions standard and 100% of the fleet was required to meet the standards in 2007. Recreational marine diesel engines over 37 kilowatts are used in yachts, cruisers and other types of pleasure craft. Recreational marine engines contribute to ozone formation and PM levels, especially surrounding marinas.

When all of the nonroad spark-ignition engines and recreational engine standards are fully implemented, an overall 72% reduction in VOC, 80% reduction in NO_x, and 56% reduction in

---

9 http://www.epa.gov/fedrgstr/EPA-AIR/1997/October/Day-21/a27494.htm

10 http://www.epa.gov/fedrgstr/EPA-AIR/1998/October/Day-23/a24836.htm

CO emissions are expected by 2020.

Reciprocating Internal Combustion Engine Standards[11]

This new standard, effective in May 2010, regulates emissions of air toxics from existing diesel powered stationary reciprocating internal combustion engines that meet specific site rating, age and size criteria. These engines are typically used at industrial facilities (e.g. power, chemical and manufacturing plants) to generate electricity for compressors and pumps and to produce electricity to pump water for flood and fire control during emergencies.

The standard applies to stationary diesel engines: (1) used at area sources of air toxics and constructed or reconstructed before June 12, 2006; (2) used at major sources of air toxics, having a site rating of less than or equal to 500 horsepower, and constructed or reconstructed before June 12, 2006; and, (3) used at major sources of air toxics for non-emergency purposes, having a site rating of greater than 500 horsepower, and constructed or reconstructed before December 19, 2002.

Operators of existing engines will be required to: (1) install emissions control equipment that would limit air toxics up to 70% for stationary non-emergency engines with a site rating greater than 300 horsepower; (2) perform emission tests to demonstrate engine performance and compliance with rule requirements; and, (3) burn ultra-low sulfur fuel in station non-emergency engines with a site rating greater than 300 horsepower.

When all of the reciprocating internal combustion engine standards are fully implemented in 2013, U.S. EPA estimates that emissions from these engines will reduce air toxics by approximately 1,000 tons per year (tpy), $PM_{2.5}$ by 2,800 tpy, CO by 14,000 tpy, and VOCs by 27,000 tpy.

Category 3 Marine Diesel Engine Standards[12]

This new standard, effective in June 2010, promulgates more stringent exhaust emission standards for new large marine diesel engines with per-cylinder displacement at or above 30 liters (commonly referred to as Category 3 compression-ignition marine engines) as part of a coordinated strategy to address emissions from all ships that affect U.S. air quality. These emission standards are equivalent to those adopted in the amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL Annex VI). The emission standards apply in two stages—near-term standards for newly built engines will apply beginning in 2011; long-term standards requiring an 80% reduction in NO_X emissions will begin in 2016.

U.S. EPA is adopting changes to the diesel fuel program to allow for the production and sale of diesel fuel with up to 1,000 ppm sulfur for use in Category 3 marine vessels. The regulations generally forbid production and sale of fuels with more than 1,000 ppm sulfur for use in most U.S. waters, unless operators achieve equivalent emission reductions in other ways.

---

11 http://www.epa.gov/ttn/atw/rice/fr03mr10.pdf

12 http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480ae43a6

U.S. EPA is also adopting provisions to apply some emission and fuel standards to foreign-flagged and in-use vessels that are covered by MARPOL Annex VI.

When this strategy is fully implemented in 2030, U.S. EPA estimates that NO_x and PM emissions in the U.S. will be reduced by approximately 1.2 million tpy and 143,000 tpy, respectively.

Clean Air Interstate Rule (CAIR)

On May 12, 2005, U.S. EPA promulgated the "Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Clean Air Interstate Rule); Revisions to Acid Rain Program; Revisions to the NO_x SIP Call"; Final Rule (70 FR 25162). This rule established the requirement for states to adopt rules limiting the emissions of NO_x and SO_2 and provided a model rule for the states to use in developing their rules to meet federal requirements. The purpose of CAIR was to reduce interstate transport of precursors of fine particles and ozone.

CAIR applied to: (1) any stationary, fossil fuel-fired boiler or stationary, fossil fuel-fired combustion turbine, a generator with a nameplate capacity of more than 25 megawatt electrical (MWe) producing electricity for sale; and (2) for a unit that qualifies as a cogeneration unit during the 12-month period starting on the date that the unit first produces electricity and continues to qualify as a cogeneration unit, a cogeneration unit serving at any time a generator with a nameplate capacity of more than 25 MWe and supplying in any calendar year more than one-third of the unit's potential electric output capacity or 219,000 megawatt hours (MWh), whichever is greater to any utility power distribution system for sale.

This rule provided annual state caps for NO_x and SO_2 in two phases, with the Phase I caps for NO_x and SO_2 starting in 2009 and 2010, respectively. Phase II caps become effective in 2015. U.S. EPA allows the caps to be met through a cap and trade program if a state chooses to participate in the program.

In response to U.S. EPA's rulemaking, IDEM adopted a state rule in 2006 based on the model federal rule. IDEM's rule includes an annual and seasonal NO_x trading program and an annual SO_2 trading program. This rule required compliance effective January 1, 2009.

SO_2 emissions from power plants in the 28 eastern states and the District of Columbia covered by CAIR will be cut by 4.3 million tons by 2009 and reduced by an additional 5.4 million tons in 2015. NO_x emissions will be cut by 1.7 million tons by 2009 and reduced by an additional 1.3 million tons in 2015. The D.C. Circuit court's vacatur of CAIR in July 2008 and subsequent remand without vacatur of CAIR in December 2008 directs U.S. EPA to revise or replace CAIR in order to properly address the deficiencies outlined by the court.

Since the court's opinion made it clear that CAIR is deficient and must be revised or replaced, the program cannot be defined as permanent and enforceable for SIP purposes. On July 6, 2010, U.S. EPA proposed the Transport Rule to replace CAIR. The Transport Rule will result in even further benefits above and beyond CAIR than what is assumed within the emission inventories and modeling.

Together, these rules will substantially reduce local and regional sources of fine particle precursors. The modeling analyses discussed in Section 7.0 include these rules and show the reductions in annual fine particle concentrations expected to result from the implementation of these rules.

6.5 Controls to Remain in Effect

Indiana commits to maintain the control measures listed above after redesignation, or submit to U.S. EPA, as a SIP revision, any changes to its rules or emission limits applicable to NO_x, SO_2 or direct $PM_{2.5}$ sources as required for maintenance of the annual standard for fine particles in the Southwestern Indiana Area.

Indiana, through IDEM's OAQ and its Compliance and Enforcement Branch, has the legal authority and necessary resources to actively enforce any violations of its rules or permit provisions. After redesignation, it intends to continue enforcing all rules that relate to the emission of fine particles and fine particle precursors in the Southwestern Indiana Area.

6.6 New Source Review Provisions

Indiana has a long standing and fully implemented New Source Review (NSR) program that is outlined in rule at 326 IAC 2. The rule includes provisions for the Prevention of Significant Deterioration (PSD) permitting program in 326 IAC 2-2. Indiana's PSD program was conditionally approved on March 3, 2003, (68 FR 9892) and received final approval on May 20, 2004, (69 FR 29071) by U.S. EPA as part of the SIP.

Any emission unit that is not listed in the 2005 emission inventory, or for which credit through the shutdown or curtailment of operation was taken in demonstrating attainment, will not be allowed to construct, reopen, modify, or reconstruct without meeting all applicable permit rule requirements. The review process will be identical to that used for new sources. Once the area is redesignated, OAQ will implement NSR through the PSD program, which requires an air quality analysis to evaluate whether the new source will threaten the NAAQS.

7.0 MODELING AND METEOROLOGY

Although U.S. EPA's Redesignation Guidance does not require modeling for nonattainment areas seeking redesignation, extensive modeling has been performed covering the Southwestern Indiana Area to determine the effect of national emission control strategies on fine particle levels. These modeling analyses determined that the Southwestern Indiana Area, including Vanderburgh, Warrick, and Dubois counties and Montgomery Township in Gibson County, Ohio Township in Spencer County, and Washington Township in Pike County, is significantly impacted by regional transport of fine particles and its precursors, and that regional SO_2 and NO_x reductions are an effective way to attain the annual standard for fine particles in this area. Future year modeled annual fine particle concentrations are expected to be reduced by 2% to 9% from baseline design values. Examples of these modeling analyses are described in this section and can be found in Appendix K.

7.1 Summary of Modeling Results to Support Rulemakings

U.S. EPA Modeling for Transport Rule 2010[13]

U.S. EPA performed modeling to support the emission reductions associated with the proposed Transport Rule. U.S. EPA used the Comprehensive Air Quality Model with Extension (CAMx Version 5), applied to the 2005 meteorology, as processed by the Mesoscale Model (MM5), Version 3.7.4. Emissions input into CAMx included SO_2, NO_x, VOCs, NH_3, and direct $PM_{2.5}$ for 2005. The modeling was based on the annual fine particle design values calculated from 2003 through 2005, 2004 through 2006, and 2005 through 2007. Future year modeling was conducted, which included the Southwestern Indiana Area, and the future year design values for 2012 and 2014 were evaluated for attainment of the annual NAAQS for fine particles of 15 $\mu g/m^3$, as shown in Table 7.1. Fine particle concentrations are accounted for by modeling both the base future year emissions and then the emission reductions associated with the Transport Rule. U.S. EPA found model performance met suggested benchmark performance goals within or close to the ranges found in other comparable modeling applications.

Table 7.1
Transport Rule Modeling Results from U.S. EPA – 2010

County	Monitor ID	Design Value 2003-2007 ($\mu g/m^3$)	Future Design Value 2012 Base ($\mu g/m^3$)	Future Design Value 2014 Base ($\mu g/m^3$)
Vanderburgh Co.	18-163-0006	14.69	14.55	14.02
Vanderburgh Co.	18-163-0012	14.82	14.64	14.09
Vanderburgh Co.	18-163-0016	14.99	14.84	14.30
Dubois Co.	18-037-2001	15.18	15.07	14.50
Knox Co.	18-083-0004	14.03	13.94	13.33
Spencer Co.	18-147-0009	14.32	14.21	13.65
Daviess Co. – KY	21-059-0005	14.10	14.14	13.59

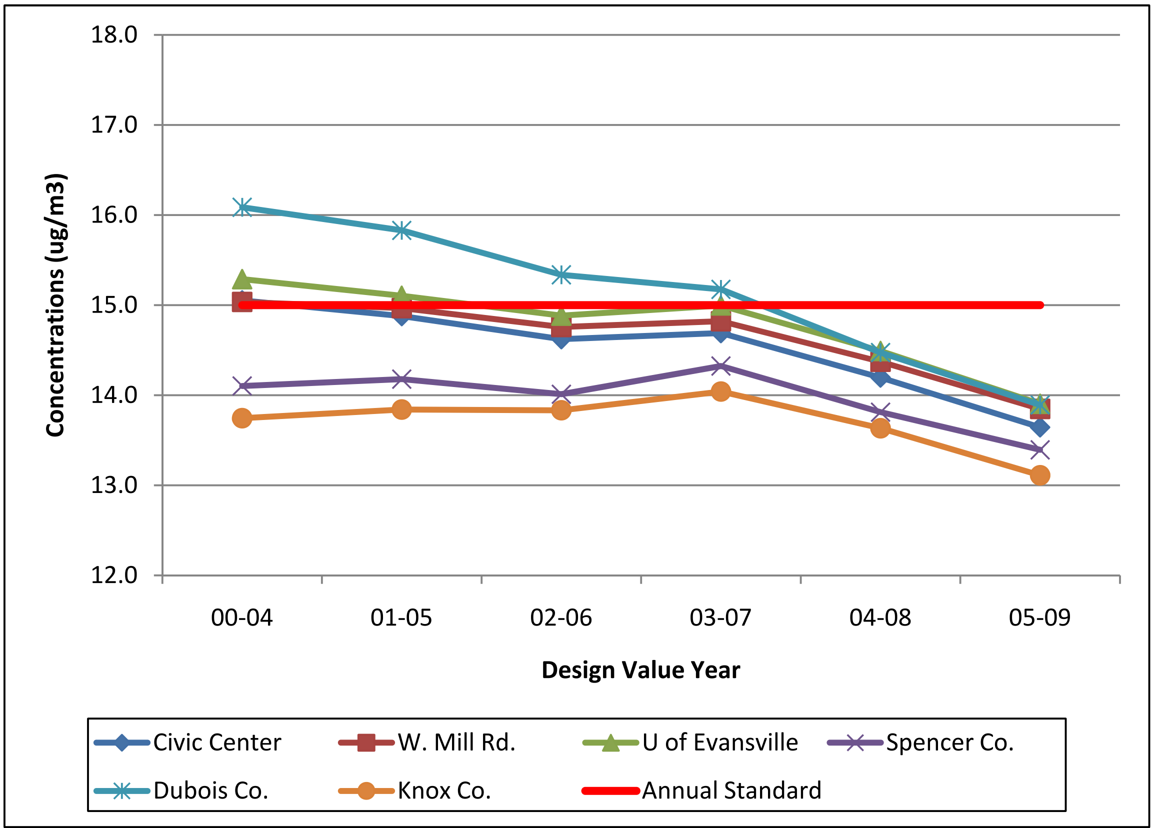
Modeling results show that the base future year modeling with emission reductions from the Transport Rule accounts for decreases of 0.1 to 0.2 $\mu g/m^3$ in concentrations for 2012 as well as a 0.5 to 0.7 $\mu g/m^3$ decrease in concentrations for 2014 in the Southwestern Indiana Area.

While results of U.S. EPA's Transport Rule modeling show modeled concentrations above the standard using base case emissions at the DuboisCounty $PM_{2.5}$ monitoring site, it should be noted that the base year design value used by U.S. EPA was taken from 2003 through 2007 and is higher than 2005 through 2009 design values in the area. Graph 7.1 shows the downward trend of the design values from 2000 through 2009 for the $PM_{2.5}$ monitors in the Southwestern Indiana Area. The resulting decrease of the 2003 through 2007 design value to the 2005 through 2009 design value at the Dubois County $PM_{2.5}$ monitor is 1.3 $\mu g/m^3$ with all the area's $PM_{2.5}$

13 http://www.epa.gov/airquality/transport/pdfs/TR_AQModeling_TSD.pdf

monitors design values decreasing from 0.9 µg/m^3 to 1.3 µg/m^3. Therefore, U.S.EPA's Transport Rule modeling, using 2005 through 2009 design values, shows all modeled concentrations below the annual fine particles standard of 15.0 µg/m^3.

Graph 7.1
$PM_{2.5}$ Design Value Trends for the Southwestern Indiana Area - 2000 through 2009



Red line represents annual $PM_{2.5}$ standard of 15 µg/m^3

Results of the Transport Rule modeling show that the Southwestern Indiana Area will attain the annual fine particle NAAQS in 2012 with modeled impacts reduced by 1% to 2% and remain below 15 µg/m^3. With further reductions projected in the Transport Rule for 2014, all design values decrease by 4% to 5% and the area will continue to attain the annual NAAQS for fine particles.

LADCO Modeling for Clean Air Interstate Rule (CAIR)

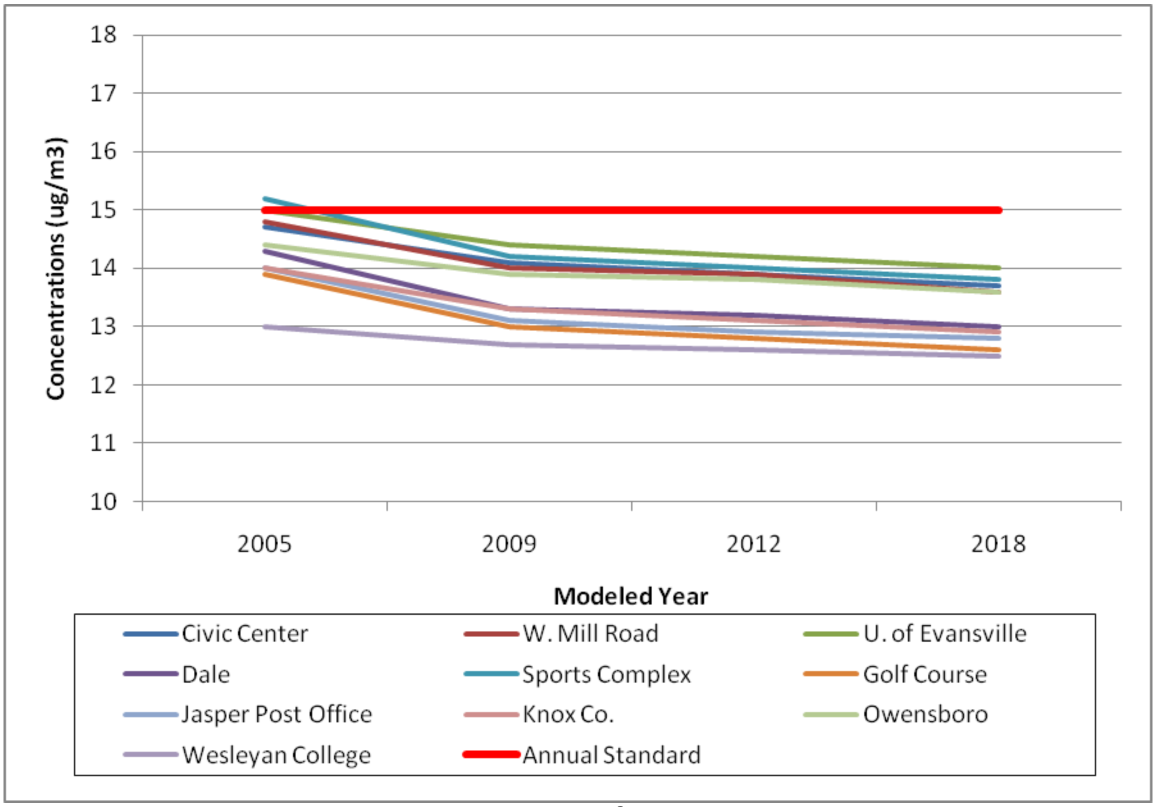
LADCO conducted modeling to determine the impact of CAIR in the Midwest. LADCO's modeling used the CAMx model applied to the year 2005 meteorology, as processed by the MM5. Emissions input into CAMx included SO_2, NOx, VOCs, NH_3, and direct $PM_{2.5}$ for 2005. The modeling was based on 2003 through 2007 design values. Future year modeling for 2012 and 2018 was conducted and the future year design values were determined without the emission reductions associated with CAIR (Round 6), as shown in Table 7.2. The Transport Rule is expected to provide reductions above and beyond CAIR.

Table 7.2
LADCO Round 6 Modeling Results
(Without the Clean Air Interstate Rule emission reductions)

Monitor ID	Monitor Name	County	Design Value 2003-2007 (µg/m^3)	Base-case 2012 (µg/m^3)	Base-case 2018 (µg/m^3)
18-163-0006	Civic Center	Vanderburgh	14.7	13.9	13.7
18-163-0012	W. Mill Rd.	Vanderburgh	14.8	13.9	13.6
18-163-0016	Univ. of Evansville	Vanderburgh	15.0	14.2	14.0
18-147-0009	Dale	Spencer	14.3	13.2	13.0
18-037-2001	Jasper Post Office	Dubois	15.2	14.0	13.8
18-037-0004	Sports Complex	Dubois	13.9	12.8	12.6
18-037-0005	Jasper Golf Course	Dubois	14.0	12.9	12.8
18-083-0004	SW Purdue Ag.	Knox	14.0	13.1	12.9
21-059-0005	Owensboro	Daviess - KY	14.4	13.8	13.6
21-059-0014	Wesleyan College	Daviess - KY	13.0	12.6	12.5

Results of the LADCO Round 6 modeling show that the Southwestern Indiana Area would attain the annual NAAQS for fine particles by 2012. As shown in Table 7.2, future year modeled annual fine particle concentrations for 2012 will be 3% to 8% lower than baseline annual fine particle design values, and 4% to 9% lower in 2018 and will continue to decrease thereafter. A graphical representation of LADCO's Round 6 modeling results is shown in Graph 7.2, showing future year modeled results that the Southwestern Indiana Area will attain the annual fine particles NAAQS.

Graph 7.2
LADCO Modeling Results for Southwestern Indiana
$PM_{2.5}$ Monitors – 2005, 2009, 2012 and 2018



Red line represents annual $PM_{2.5}$ standard of 15 $\mu g/m^3$

7.2 <u>LADCO Round 5 Speciated Modeled Attainment Test Results</u>

The Speciated Modeled Attainment Test (SMAT) is the attainment test for annual fine particles. To determine the future year annual fine particle concentrations, speciated data is calculated. The different species that were modeled and are associated with fine particles include sulfates, nitrates, organic carbon, elemental carbon, ammonium, particle bound water, “other” primary inorganic fine particles and passively collected mass. The SMAT results from LADCO’s Round 5 modeling are listed below. Percent ranges of the model results from the six fine particle monitors in Southwestern Indiana were broken down into these speciated constituents of fine particle emissions. The percent decrease from the observed speciated data in 2005 to the modeled results for 2009 are listed in Table 7.3.

Table 7.3
LADCO Round 5 SMAT Modeling Results for Southwestern Indiana
(Percent decrease from observed to modeled concentrations)

Species of $PM_{2.5}$	**2009**
Sulfates	24% - 29%
Nitrates	0% - 8%
Organic Carbon	0% - 4%
Elemental Carbon	0% - 20%
Ammonium	16% - 26%
Particle Bound Water	19% - 31%

The results demonstrate that sulfate, ammonium, and particle bound water concentration decreases are projected to occur by at least 16% in 2009. Lesser nitrate reductions are projected to occur, up to 8%, with organic carbon reductions occurring up to 4%. LADCO modeling shows good performance for sulfates and elemental carbon predicted baseline concentrations, slight over-prediction for nitrate concentrations and under-predictions of organic carbon concentrations. Overall, model performance is adequate for SIP planning and gives a good idea of the effects of emission reductions from national emission control measures on the Southwestern Indiana Area.

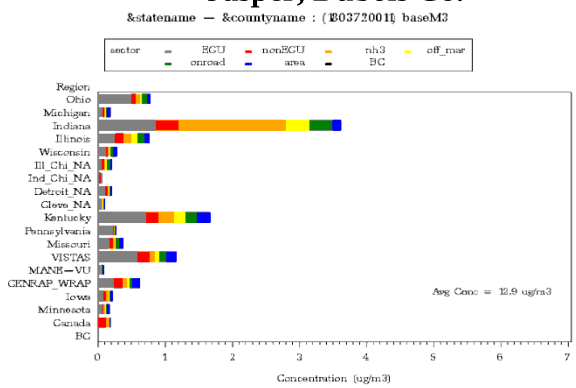
7.3 LADCO Round 5 Particulate Source Apportionment Results

Particulate Source Apportionment (PSAT) modeling was conducted by LADCO. The results of the PSAT Round 5 modeling shows the regional contributions by emission sectors on each monitor that was modeled. Chart 7.1 displays the PSAT modeling results for the: Jasper, Dubois County fine particles monitor; Civic Center, West Mill Road, and University of Evansville fine particles monitors in Vanderburgh County; Dale, Spencer County fine particles monitor; and the Knox County fine particles monitor. Indiana was the biggest regional contributor to the Jasper, West Mill Road and the Dale fine particle monitors. Kentucky was the biggest regional contributor to the Civic Center and University of Evansville fine particle monitors. Illinois was the biggest regional contributor to the Knox County fine particles monitor.

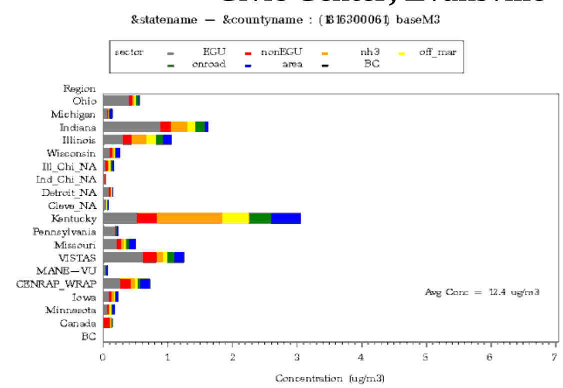
The PSAT Round 5 modeling results indicate the majority of Indiana's emission sector contributions to fine particle concentrations come from EGUs, ammonium emission sources, off-road (including marine, aircraft, and railroad) and non-EGU sources. These results are considered to be representative of the entire Southwestern Indiana Area as EGU, ammonium, and non-EGU emissions impact the entire area.

Chart 7.1
Regional/Emission Sector PSAT Results

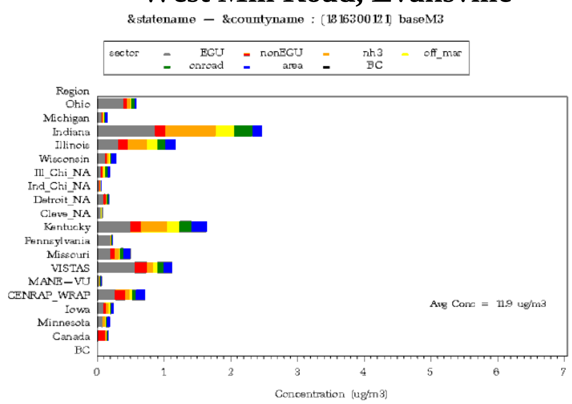
Jasper, Dubois Co.



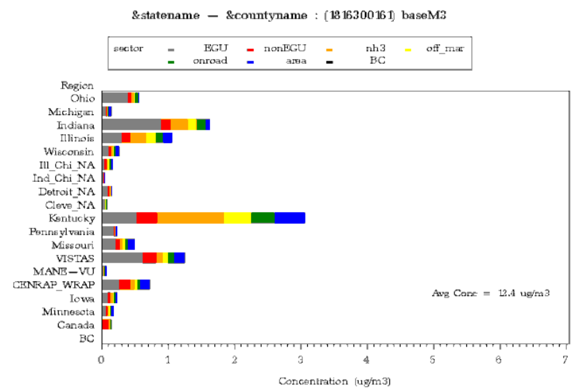
Civic Center, Evansville



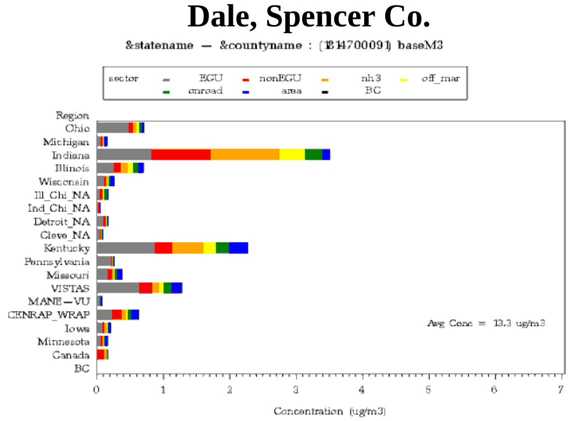
West Mill Road, Evansville



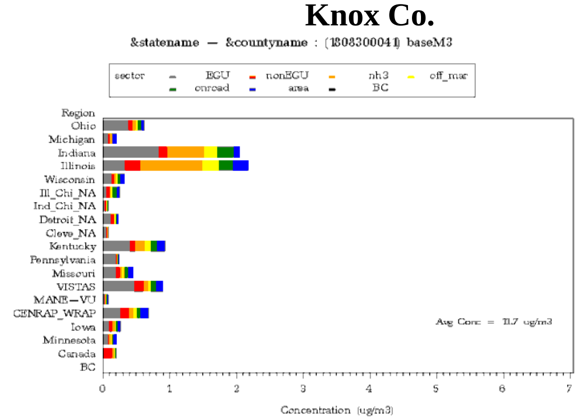
University of Evansville



Dale, Spencer Co.



Knox Co.



The following pie charts depict the contribution by species to fine particle concentrations at the Southwestern Indiana monitors. The pie charts include both the observed 2005 contributions and 2009 modeled contributions for each monitor. Since the monitors are in close proximity of each other, results are fairly similar in the distribution of species concentrations among the monitors. Charts 7.2 and 7.3 cover the fine particle monitors in the Southwestern Indiana Area with the highest monitored concentrations that are used to determine compliance with the annual NAAQS for fine particles.

Chart 7.2
Modeled Contribution by Species to Jasper, Dubois Co. $PM_{2.5}$ Monitor
(Observed Concentrations = 14.8 µg/m^3) (Modeled Concentrations =14.0 µg/m^3)

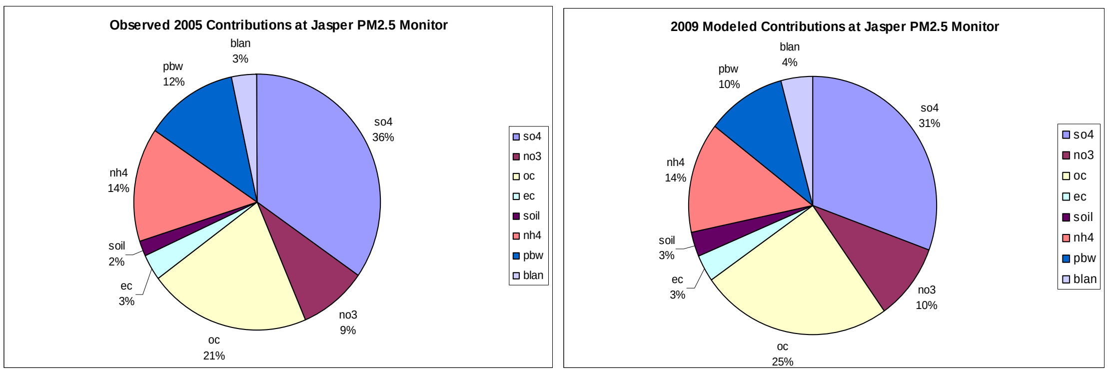
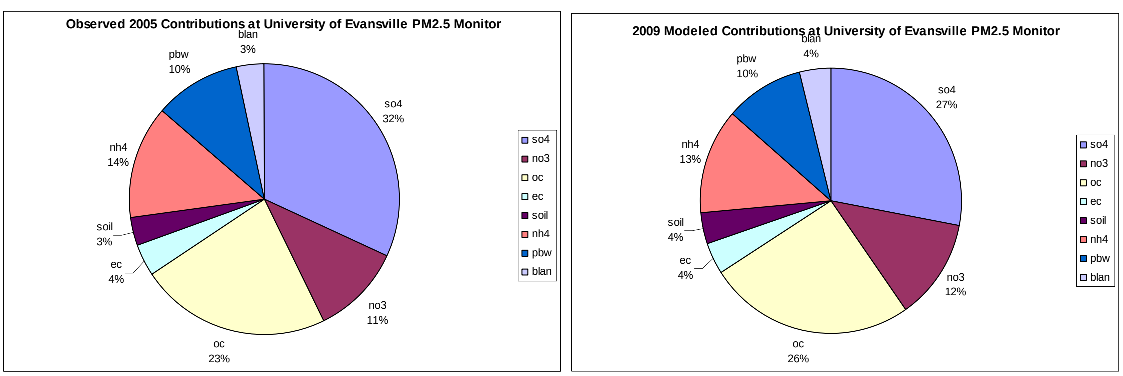


Chart 7.3
Modeled Contribution by Species to University of Evansville $PM_{2.5}$ Monitor
(Observed Concentrations = 15.4 µg/m^3) (Modeled Concentrations =14.1 µg/m^3)



Results of the Round 5 PSAT modeling for Southwestern Indiana fine particle monitors show the highest pollutant contributors to base-case and future year fine particle concentrations are sulfate, organic carbon, ammonium, and nitrate. Future year modeling shows decreases in sulfates (due to the emission reductions from CAIR) and ammonium. The future year modeling did show slight increases in organic carbon and nitrates from the base-case modeled concentrations.

7.4 Summary of Existing Modeling Results

U.S. EPA and LADCO modeling for future year design values have consistently shown that existing national emission control measures will bring the Southwestern Indiana Area into attainment of the annual NAAQS for fine particles. Emission control measures to be implemented in the next several years will provide even greater assurance that air quality will continue to meet the standard into the future. Modeling support for CAIR has shown that future year design values for the Southwestern Indiana Area will continue to attain the annual standard for fine particles with modeled future year design values below 15 $\mu g/m^3$. U.S. EPA future year modeling of national emission control strategies showed the Southwestern Indiana Area will attain the annual NAAQS for fine particles without additional national emission controls. Future national and local emission control strategies will ensure that the Southwestern Indiana fine particle nonattainment area will maintain lower fine particle concentrations with an increasing margin of safety.

7.5 Meteorological Analysis for Southwestern Indiana

Meteorological conditions are one of the most important factors that influence development and transport of fine particles. Stagnant surface conditions during any time of the year and upper air ridging provides conducive conditions for development and transport of fine particles. Ultimately, passage of surface cold fronts with a clean air mass change will lower fine particle readings in the Southwestern Indiana Area.

7.6 Surface Air Conditions Present during High Fine Particle Concentrations Days

Higher concentrations of fine particles tend to correlate with warmer temperatures and lighter wind speeds, although high fine particle episodes can occur in the summer or winter. It should be noted that higher annual fine particle concentrations are driven by individual days with higher fine particle concentrations throughout the monitored year. Therefore, it is difficult to attribute higher fine particle concentrations to annualized meteorological rankings. Review of several of the higher fine particle concentration episodes over the past few years reveal that conditions were hot in the summer with temperatures in the middle 80^os Fahrenheit (^oF) or higher and average wind speeds were fairly light. Fall and winter days with higher fine particle concentrations had near normal temperatures but wind speeds were very light.

7.7 Upper Air Conditions Present during High Fine Particle Concentration Days

Upper air ridges and more stagnant surface wind conditions predominately affect development and build up of fine particles. Slow moving upper air ridges can effectively suppress mixing within the many levels of the atmosphere and cause pollutants to build up over time. Inversions or increases in temperature with a rise in altitude will prevent mixing with air from the upper atmosphere. These conditions can occur at any time of the year and are evident in elevated fine particle episodes in spring, summer, fall, and winter months. Review of surface and upper air features of higher fine particle concentration days showed stagnant surface conditions and upper air ridges existed on those days and helped in the buildup of fine particle concentrations.

7.8 Analyses of Atmospheric Conditions during High Fine Particle Concentration Days

Analyses have been conducted to determine the atmospheric conditions that are most prevalent during higher fine particle concentration days in Indiana. LADCO applied a Classification and Regression Tree (CART) analysis to data from Indiana that correlated different levels of fine particle concentrations to meteorological conditions from 1999 through 2004. (Donna Kenski, 2005). This type of analysis evaluates the meteorological conditions, such as temperature, pressure, wind speed, wind direction, relative humidity, and dew point temperatures at the surface, as well as morning and evening mixing heights in the upper atmosphere which were present when higher concentrations of fine particles were monitored. Results of this CART analysis indicated factors that played a larger role in higher fine particle concentrations in Indiana were warm-weather conditions with high dew points, southwest winds, and high evening mixing heights. Previous day's concentrations of fine particles play a key role in higher impacts as well.

Fine particles are made up of several constituents, including direct $PM_{2.5}$, sulfates, nitrates, ammonium, organic carbon, and elemental carbon. Depending on the time of the year, concentrations of particulate constituents vary, with nitrates being more prevalent in the winter and sulfates more prevalent in the summer. Sulfate and nitrate emission reductions have the biggest impact on lower future year fine particle concentrations.

7.9 Summary of Air Quality Index Days in Southwestern Indiana

An analysis was conducted to review the daily fine particle concentrations over a year to determine the Air Quality Index (AQI) trends. Chart 7.4 below shows by year (2001 through 2009), the percentage number of days during the calendar year which fine particle concentrations reached the AQI ranges for "Good" (0 to 15.3 $\mu g/m^3$), "Moderate" (15.4 $\mu g/m^3$ to 40.4 $\mu g/m^3$) and "Unhealthy for Sensitive Groups (USG)"(40.5 $\mu g/m^3$ to 65.4 $\mu g/m^3$). There were no days during which fine particle levels reached the "Unhealthy" level of 65.5 $\mu g/m^3$ to 150.4 $\mu g/m^3$.

Chart 7.4
Distribution of $PM_{2.5}$ Concentration Days
on the AQI Levels of Health Concern

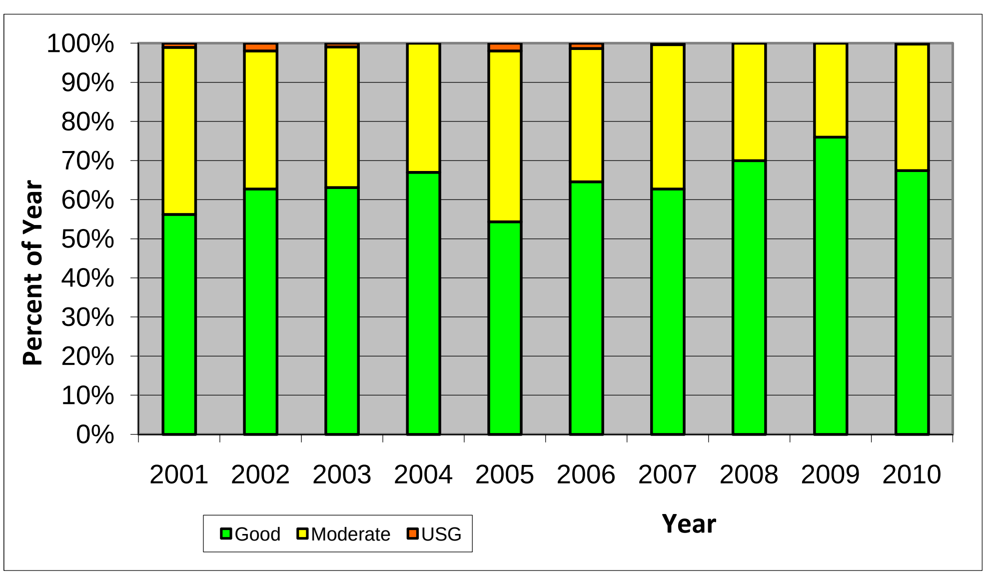


Table 7.4 shows how the years ranked for the three AQI ranges. The year 2009 had the most "Good" concentration days during the 9-year period analyzed (2001 through 2009). The year 2005 had the most "Moderate" concentration days and the years 2002, 2005, and 2006 had the most "Unhealthy for Sensitive Group (USG)" concentration days with no USG days recorded in 2004, 2007, 2008, and 2009.

Table 7.4
Ranking of Highest Number of Days at AQI Levels of Health Concern

Ranking	Good	Moderate	Unhealthy for Sensitive Group
1st	**2009** – 76%	**2005** – 44%	**2002** – 2%
2nd	**2008** – 70%	**2001** – 43%	**2005** – 2%
3rd	**2004** – 67%	**2007** – 37%	**2006** – 1%
4th	**2006** – 65%	**2003** – 36%	**2001** – 1%
5th	**2003** – 63%	**2002** – 35%	**2003** – 1%
6th	**2007** – 63%	**2006** – 34%	
7th	**2002** – 63%	**2004** – 33%	
8th	**2001** – 56%	**2008** – 30%	
9th	**2005** – 54%	**2009** – 24%	

7.10 Summary of Meteorological Analysis for Southwestern Indiana

Annual fine particle concentrations in the Southwestern Indiana Area are driven by higher fine particle concentration days that can occur during any time of the year. Conditions that are most prevalent during higher fine particle concentration days are lighter winds, higher relative humidity, and above average temperatures in the summer and near normal temperatures in the fall, winter or spring. Approximately 70% of the days when $PM_{2.5}$ concentrations were in the USG range occurred in the summer months with maximum high temperatures of 80^{o} F or above. Weather plays a large role in fine particle concentration development and transport as 2001, 2002, 2005, and 2006 were warmer than normal summers which translated to more days of moderate and unhealthy for sensitive group levels of air quality. Upper air weather patterns generally include ridging over the area with stagnant conditions at the surface. Surface winds from any direction can transport pollutants from surrounding areas into the Southwestern Indiana Area. Nitrates are bigger contributors to fine particle concentrations in the winter and sulfates are bigger contributors to fine particle concentrations in the summer.

8.0 CORRECTIVE ACTIONS

8.1 Commitment to Revise Plan

As noted in Section 4.6, IDEM commits to review and revise, as appropriate, its Maintenance Plan eight years after redesignation, as required by Section 175A of the CAA.

8.2 Commitment for Contingency Measures

IDEM will monitor fine particle concentrations to determine whether trends indicate higher values or whether emissions appear to be increasing. If it is determined that fine particle levels and emissions are increasing and action is necessary to reverse that trend, IDEM will take action to reverse the noted trend, prior to a violation of the standard occurring.

IDEM commits to adopt and expeditiously implement necessary corrective action in accordance with an Action Level Response described below.

Action Level Response

An Action Level Response shall be prompted whenever a violation of the standard (three year average annual arithmetic mean value of 15.1 $\mu g/m^3$ or greater) occurs. In the event that the Action Level is triggered and is not found to be due to an atypical unfavorable meteorological condition, exceptional event, malfunction or noncompliance with a permit condition or rule requirement, IDEM will determine additional control measures needed to assure future attainment of the annual NAAQS for fine particles. In this case, measures that can be implemented in a short time will be selected in order to be in place within eighteen months from the end of the year that prompted the Action Level Response.

Control Measure Selection and Implementation

Adoption of any additional control measures is subject to the necessary administrative and legal processes. This process will include publication of notices, an opportunity for public hearing and other measures required by Indiana law for rulemaking by state environmental boards.

If a new measure or control is already promulgated and scheduled to be implemented at the federal or state level, and that measure or control is determined to be sufficient to address the upward trend in air quality, additional local measures may be unnecessary. Furthermore, IDEM will submit to U.S. EPA an analysis to demonstrate the proposed measures are adequate to return the area to attainment.

8.3 Contingency Measures

Contingency measures to be considered will be selected from a comprehensive list of measures deemed appropriate and effective at the time the selection is made. Listed in this section are example measures that may be considered. The selection of measures will be based upon cost-effectiveness, emission reduction potential, economic and social considerations or other factors that IDEM deems appropriate. IDEM will solicit input from interested and affected persons in the maintenance area prior to selecting appropriate contingency measures. All of the listed contingency measures are potentially effective or proven methods of obtaining significant reductions of fine particle precursor emissions. Because it is not possible at this time to determine what control measure will be appropriate at an unspecified time in the future, the list of contingency measures is not comprehensive. IDEM anticipates that if contingency measures should ever be necessary, it is unlikely that a significant number (i.e., all those listed below) will be required.

1) Alternative fuel and diesel retrofit programs for fleet vehicle operations.
2) Require NO_x or SO_2 emission offsets for new and modified major sources.
3) Require NO_x or SO_2 emission offsets for new and modified minor sources.
4) Increase the ratio of emission offsets required for new sources.
5) Require NO_x or SO_2 controls on new minor sources (less than 100 tons).
6) Wood stove change-out program.
7) Require increased recovery efficiency at sulfur recovery plants.
8) Various emission reduction measures or dust suppressant for unpaved roads and/or parking lots.
9) Idling Restrictions.
10) Broader geographic applicability of existing measures.
11) One or more transportation control measures sufficient to achieve at least 0.5% reduction in actual area-wide precursor emissions. Transportation measures will be selected from the following, based upon the factors listed above, after consultation with affected local governments:
    a) Trip reduction programs, including, but not limited to, employer-based transportation management plans, area wide rideshare programs, work schedule changes and telecommuting.
    b) Transit improvements.
    c) Traffic flow improvements.
    d) Other new or innovative transportation measures not yet in widespread use that affect state and local governments, as deemed appropriate.

No contingency measure shall be implemented without providing the opportunity for full public participation during which the relative costs and benefits of individual measures, at the time they are under consideration, can be fully evaluated.

9.0 PUBLIC PARTICIPATION

Indiana published notification for a public hearing and solicitation for public comment concerning the draft Redesignation Petition and Maintenance Plan on the IDEM Web site on February 9, 2011, with subsequent publication in the following newspapers on the following dates:

1) The Indianapolis Star, Indianapolis, Indiana (February 11, 2011).
2) The Evansville Courier, Evansville, Indiana (February 8, 2011).
3) The Herald, Jasper, Indiana (February 8, 2011).

A public hearing to receive comments concerning the redesignation request was conducted on March 15, 2011, in the Vectren Auditorium at the Evansville Main Campus of the Ivy Tech Community College, located in Evansville, Indiana. The public comment period closed on March 18, 2011. No formal comments were received. Appendix L includes a copy of the public notice, public hearing script, certifications of newspaper publication of the public notice, and the official transcript from the public hearing.

10.0 CONCLUSIONS

The Southwestern Indiana Area has attained the annual NAAQS for fine particles. This petition demonstrates that the Southwestern Indiana Area has complied with the applicable provisions of the CAA regarding redesignation of nonattainment areas for fine particles. IDEM has prepared a State Implementation and Maintenance Plan that meets the requirement of Section 110(a)(1) of the CAA.

Indiana has performed an analysis that shows the air quality improvements are due to permanent and enforceable measures and that additional significant regional NO_x and SO_2 reductions following implementation of the Phase II NO_x SIP Call rule and CAIR or its replacement rule will ensure continued compliance (maintenance) with the standard. Furthermore, emission projections indicate that NO_x and SO_2 emissions will continue to decline, ensuring that the area continues to maintain compliance with the standard and provide for an increasing margin of safety. Based on this presentation, the Southwestern Indiana nonattainment area for fine particles meets the requirements for redesignation under the CAA (Section 107(d)(3)) and U.S. EPA guidance for fine particles.

Consistent with the authority granted to U.S. EPA, the State of Indiana requests that the Southwestern Indiana nonattainment area for fine particles be redesignated to attainment for the annual fine particles standard simultaneously with U.S. EPA approval of this Indiana State Implementation and Maintenance Plan and the provisions contained herein.