Chart 5.5
Statewide NOx Emissions Trends

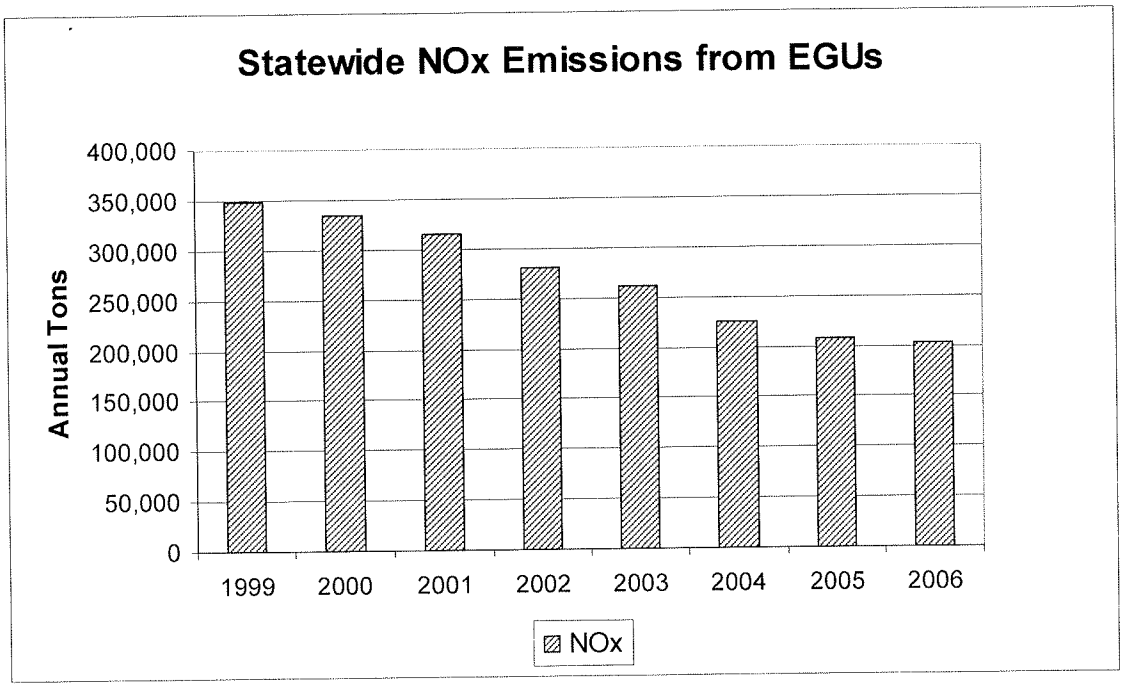


Table 5.4
Statewide Annual NO_x and SO_2 EGU Budget

STATEWIDE EGU NOx TRENDS	
Year	NO_x Emissions tons / annual
1999	347,217
2000	334,522
2001	315,420
2002	281,146
2003	260,980
2004	224,311
2005	207,982
2006	202,728
Budget 2009-2014	108,935
Budget 2015 and later	90,779

STATEWIDE EGU SO_2 TRENDS	
Year	SO_2 Emissions tons / annual
1999	941,852.4
2000	874,617.2
2001	795,505.6
2002	778,868.0
2003	804,828.6
2004	862,876.4
2005	870,811.8
2006	820,993.4
Budget 2010-2014	254,599
Budget 2015 and later	178,219

As demonstrated by Figure 5.1, significant reductions of NO_x associated with the NO_x SIP Call and CAIR have been achieved statewide, as well as regionally. For the six-state (Arkansas, Indiana, Illinois, Kentucky, Missouri and Tennessee) region shown in Figure 5.1 (the area south of latitude 39.3052 and west of longitude -84.8194 (the southwest quadrant denoted by crosshairs)) there is an estimated reduction in upwind EGU emissions of more than 203,000 tons of NO_x from 2005 to 2010.

Figure 5.1 Regional NO_x Reductions 2005 - 2010

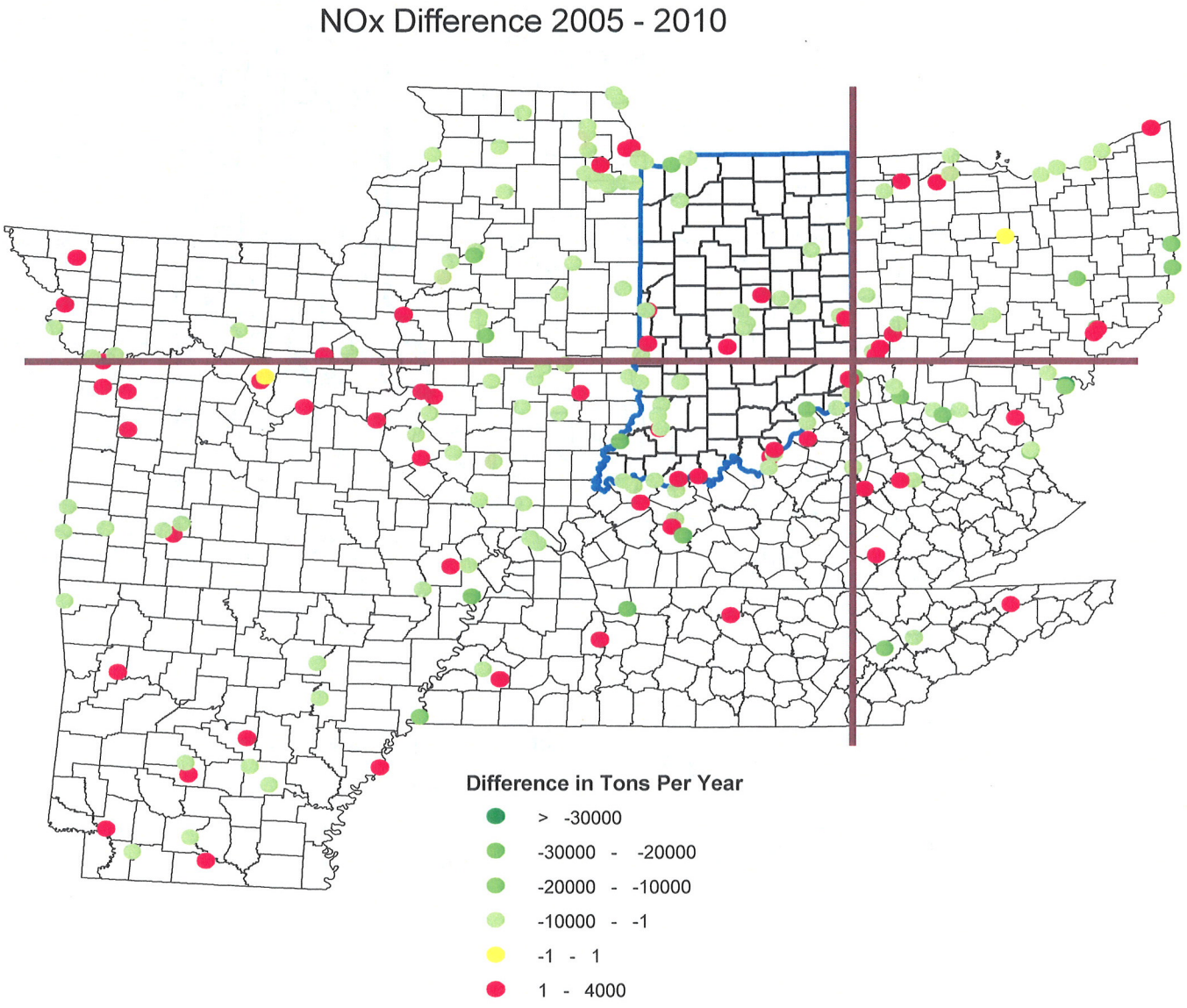
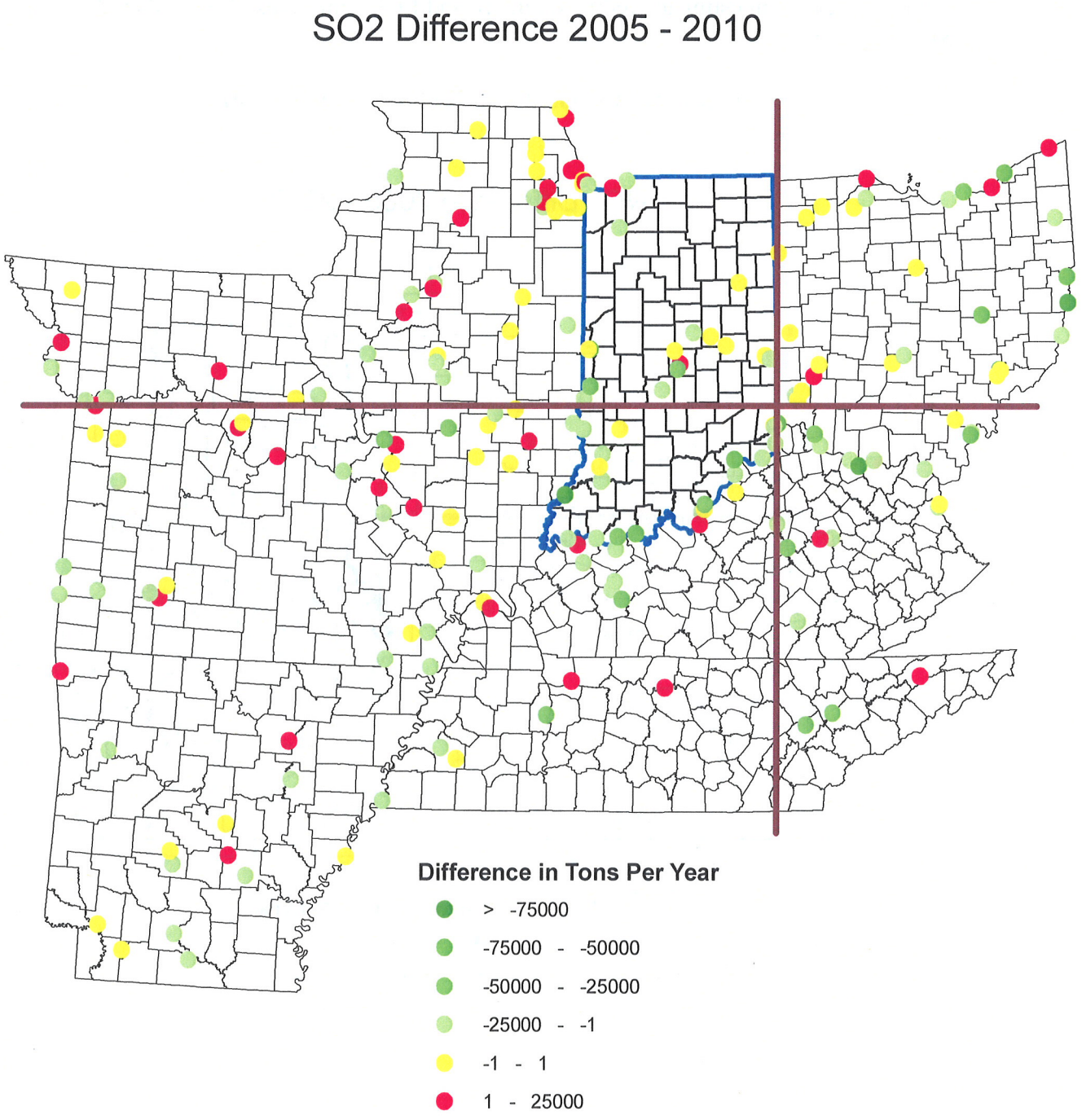


Figure 5.2 Regional SO_2 Reductions 2005 - 2010



As demonstrated by Figure 5.2, reductions of regional SO_2 from upwind EGUs have also been achieved. For the six-state (Arkansas, Indiana, Illinois, Kentucky, Missouri and Tennessee) region shown in Figure 5.1 (the area south of latitude 39.3052 and west of longitude -84.8194 (the southwest quadrant denoted by crosshairs)) there is an estimated reduction in upwind EGU emissions of more than 570,000 tons of SO_2 from 2005 to 2010.

6.0 CONTROL STRATEGY

Several control measures already in place or being implemented over the next few years will reduce point, on-road mobile and non-road source emissions. The Federal and State control measures included in the photochemical modeling for the future year design value and additional control measures due to be implemented, but not included in the modeling, are less certain, are discussed in Sections 6.1 and 6.2. While the impacts of VOC reductions are minimal, they are nevertheless beneficial for controlling fine particle levels. Therefore, control measures that reduce VOC emissions are included in the following sections.

6.1 MODELED CONTROL MEASURES

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 regulations. For these vehicles, the standards will be 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 today. The Tier 2 standards also reduced the sulfur content of gasoline to 30 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 emissions standards.

6.1.1 Heavy-Duty Gasoline and Diesel Highway Vehicle Standards

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 particulate matter from heavy-duty highway engines and also reduced highway diesel fuel sulfur content to 15 ppm since the sulfur can damage emissions control devices. The total program is expected to achieve a 90% reduction in direct particulate matter (PM) 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. The U.S. EPA has not quantified the expected reductions.

6.1.2 Large Non-Road Diesel Engine Standards

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

6.1.3 Non-Road Spark-Ignition Engines and Recreational Engines Standards

This new standard, effective in July 2003, regulates NO_x, VOCs and carbon monoxide (CO), for groups of previously unregulated non-road 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 formation and ambient CO and PM levels. For the off-highway motorcycles and all-terrain vehicles, model year 2006, at least 50% of a manufacture'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 non-road spark-ignition engines and recreational engine standards are fully implemented, an overall 72% reduction in VOCs, 80% reduction in NO_x and 56% reduction in CO emissions are expected by 2020. These controls will help reduce ambient concentrations of ozone, CO and fine PM.

6.1.4 NO_x SIP Call

The U.S. EPA NO_x SIP Call required twenty-two (22) states to adopt rules that would result in significant emissions reductions from large electric generating units (EGUs), industrial boilers, and cement kilns in the eastern United States. Indiana adopted this rule in 2001. Beginning in 2004, this rule accounts for a reduction of approximately thirty-one percent (31%) of total NO_x emissions statewide compared to previous uncontrolled years.

Twenty-one (21) other states have also adopted these rules, including states surrounding Indiana. The result is that significant reductions have occurred upwind and within the Louisville KY-IN fine particle nonattainment area because of the number of affected sources within the region.

6.1.5 Clean Air Interstate Rule (CAIR)

On May 12, 2005, the 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. This rule established the requirement for states to adopt rules limiting the emissions of NO_x and sulfur dioxide (SO_2) and provided a model rule for the states to use in developing their rules to meet Federal requirements. The purpose of CAIR is to reduce interstate transport of precursors to fine particles and ozone.

CAIR applies to: (1) any stationary, fossil-fuel-fired boiler or stationary, fossil-fuel-fired combustion turbine, a generator with nameplate capacity of more than 25MWe producing electricity for sale. (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 MWh, whichever is greater to any utility power distribution system for sale.

This rule provides 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. The U.S. EPA is allowing 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 its 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 requires compliance effective January 1, 2009.

6.2 ADDITIONAL CONTROL MEASURES

This section provides a summary of the additional control measures that have been or will be implemented in the nonattainment area and were not included in the modeling demonstration.

6.2.1 Indiana Kentucky Electric Company – Clifty Creek Station Controls

Indiana Kentucky Electric Company has begun construction of SO_2 scrubbers for all six of the electric generating units located at the Clifty Creek Station in Madison Township, Jefferson County, Indiana. These units will go on-line in 2010, shortly after the Louisville area is projected to attain the annual standard for fine particles. This will significantly reduce SO_2 emissions for the area for all years post-2009 and provide for even greater margin of safety.

6.2.2 Federal Controls

* Portable Fuel Container (Gas Can) Controls

U.S. EPA issued a final rule on February 26, 2007 (71 FR 15830) to regulate VOC emissions from portable gasoline containers, or gas cans. Portable fuel containers are consumer products used to refuel a wide variety of gasoline-powered equipment, including lawn and garden equipment, recreational equipment, and passenger vehicles that have run out of gas. The proposed standards will reduce hydrocarbon emissions from evaporation, permeation, and spillage. These standards would significantly reduce benzene and other toxics, as well as VOC more generally.

The rule proposed a performance-based standard of 0.3 grams per gallon per day of hydrocarbons, based on the emissions from the can over a diurnal test cycle. The standard will apply to gas cans manufactured on or after January 1, 2009. U.S. EPA also proposed test procedures and a certification and compliance program, in order to ensure that gas cans meet the emissions standard over a range of in-use conditions. The proposed standards will result in the use of best available control technologies, such as durable permeation barriers, automatically closing spouts, and cans that are well-sealed.

Emissions reductions expected to be 18% by 2009, 54% reduction at full implementation in 2015.

* Small Non-Road Engine Rule

On April 17, 2007, U.S. EPA proposed a rule to control emissions from new gasoline-powered small non-road engines, including lawn and garden equipment (<25 hp) and recreational watercraft. Under the proposed rule, the exhaust emissions standards for Class I non-road engines will take effect in 2012 and for Class II engines in 2011. The watercraft standards will take effect in 2009. U.S. EPA anticipates that when fully implemented, the proposed standards will result in a 70% reduction in hydrocarbon and NO_x emissions and a 20% reduction in CO from new engines' exhaust, as well as a 70% reduction in evaporative emissions.

6.2.3 Indiana Statewide Controls

IDEM is proposing to implement several statewide VOC control rules. Through LADCO consultation, the other LADCO states (Illinois, Indiana, Michigan, Ohio, and Wisconsin) have also agreed to implement a series of similar controls to address regional ozone and particulate matter nonattainment areas in the upper Midwest. The rules will apply region-wide to consumer and commercial products, architectural and industrial maintenance (AIM), automobile refinishing operations, cold cleaning degreasing and Stage I vapor recovery.

* Consumer and Commercial Products (326 IAC 8)

Proposed new rule to adopt the Ozone Transport Commission (OTC) model rule with additional product coverage and more stringent VOC limits (14.2 % reduction beyond Federal Part 59 rule, for a total reduction of 21% from uncontrolled emissions).

* Architectural and Industrial Maintenance (AIM) Coatings (326 IAC 8-14)

This rule will adopt more stringent VOC limits for AIM coatings based on OTC model rule, 21% reduction beyond Federal Part 59 limits.

* Automobile Refinishing Operations (326 IAC 8-10)

This rule will extend existing regulations statewide. A 55% reduction is expected from uncontrolled emissions, 24% reduction beyond Federal Part 59 limits.

* Stage I Vapor Recovery (326 IAC 8-4)

The existing regulation requires gasoline dispensing facilities with a monthly gasoline throughput of 10,000 gallons per month or greater to maintain vapor balance systems to collect gasoline vapors displaced during the transfer of gasoline between storage tanks and delivery trucks. The proposed rulemaking will amend 326 IAC 4-1 to apply to all gasoline dispensing facilities regardless of when the storage tank was installed. IDEM estimates that the rules requiring submerged loading and vapor balancing will achieve a 90% reduction in VOC emissions versus uncontrolled underground storage tank loading.

6.2.4 Kentucky Statewide Controls

Kentucky has adopted a number of regulations and legislation to address pollution issues across the state. These include the NOx SIP Call Rule, Open Burning Ban and Clean Air Interstate Rule. All of these regulations were modeled in the attainment demonstration. These regulations are summarized below.

* NOx SIP Call Rule

In response to the U.S. EPA's NOx SIP call, Kentucky adopted rules to control the emissions of NOx from EGUs and large stationary combustion sources. These rules cover (1) fossil fuel-fired stationary boilers, combustion turbines, and combined cycle systems serving a generator with a nameplate capacity greater than 25 megawatts and selling any amount of electricity, (2) fossil fuel-fired stationary boilers, combustion turbines, and combined cycle systems having a maximum design heat input greater than 250 million British thermal units per hour, and (3) reciprocating stationary internal combustion engines rated at equal to or greater than 2400 brake horsepower (3000 brake horsepower for diesel engines and 4400 brake horsepower for dual fuel engines). As part of the NOx SIP call, the U.S. EPA rules established a NOx budget for sources in

Kentucky and other states. Kentucky's NOx SIP Call rule was predicted to reduce summertime NOx emissions from power plants and other industries by 66% by 2006. In August 2001, the Kentucky Natural Resources and Environmental Protection Cabinet adopted rules requiring the reductions.

* Open Burning Bans

Kentucky revised the open burning regulation to prohibit most types of open burning in moderate ozone nonattainment areas within Kentucky during the period of May-September. This requirement continues in the Northern Kentucky area.

* Clean Air Interstate Rule

In response to the U.S. EPA's CAIR, the KYDAQ developed rules to implement CAIR. Under the rule, Kentucky has caps as follows:

• Annual NOx: 83,205 tons for 2009-2014 and 69,337 tons for 2015 and each year thereafter;
• Ozone season NOx: 36,109 tons for 2009-2014 and 30,651 tons for 2015 and each year thereafter;
• Annual SO_2: 188,773 tons for 2010-2014 and 132,141 tons for 2015 and each year thereafter.

The state's NOx allocations have been distributed based on allocation methodologies in 401 KAR 52:210 and 220. The U.S. EPA will determine the SO_2 allocations, which are based on the acid rain program. For the most part the rules follow the U.S. EPA's model rule. This rule does not preclude the DAQ from adopting additional emissions reduction requirements for covered sources if necessary to attain or maintain an ambient air quality standard.

The KYDAQ CAIR regulations became effective February 2, 2007.

6.2.5 Louisville Fine Particle Air Quality Task Force

Local Controls

Louisville's Fine Particle Air Quality Task Force was formed in May 2007 to identify, evaluate, and recommend strategies for reducing $PM_{2.5}$ to achieve the annual fine particle standard. Part of the task force's charge was to assess potential RACM/RACT opportunities. The task force did not identify any new control measures to be recommended for inclusion in Kentucky's attainment demonstration for the Louisville KY-IN fine particle nonattainment area. However, the task force noted that the following new control measures are in the process of being implemented:

- Gallagher Station (Duke Energy), Floyd County, IN, is in the process of replacing electrostatic precipitators with more effective fabric filter collectors for all four units, to be completed by May 2008.

- General Electric, Jefferson County, KY, is replacing a backup coal-fired power boiler with a landfill gas/natural gas boiler.

- Süd-Chemie (a catalyst manufacturer), Jefferson County, KY, is installing high efficiency particulate air (HEPA) filters following existing fabric filter collectors to further reduce particulate emissions.

- Kosmos (a cement kiln), Jefferson County, KY, since 2005, has replaced several fabric filter collectors and added measures to control fugitive dust. Kosmos is also in the process of modifying some of its existing fabric filter collectors to increase their control efficiencies.

7.0 SUPPLEMENTAL ANALYSIS

U.S. EPA's fine particle modeling guidance requires states to submit a basic supplemental analysis demonstration if future year modeled design values are "close" to the standard (> 14.5 $\mu g/m^3$) in order to determine if additional information supports the modeling result [see "Guideline on the Use of Models and Other Analysis in Demonstrating Attainment of Air Quality Goals for Ozone, $PM_{2.5}$ and Regional Haze" (April 2007)].

Because the 2009 future year design value for the Louisville KY-IN nonattainment area is significantly below the annual fine particle standard (13.6 $\mu g/m^3$), Indiana is including a basic supplemental analysis to demonstrate that the area will attain the standard by the required date of April 5, 2010.

The supplemental analysis relies on existing modeling conducted by LADCO and U.S. EPA for CAIR, U.S. EPA modeling results addressing the Heavy Duty Engine and Vehicle Standards and Highway Diesel Fuel Rule, and reductions from additional control measures to be implemented that were not included in the modeling analyses. The supplemental analysis further supports the fact that the design value will continue downward and leads to the conclusion that the nonattainment area will comply with the fine particle standard by its attainment date.

7.1. LADCO'S ROUND 5 MODELING

LADCO conducted modeling to determine the impact of CAIR in the Midwest. LADCO's modeling used the CAMx applied to the year 2005 meteorology, as processed by MM5. Emissions input into CAMx included sulfur dioxide, nitrogen oxides, volatile organic compounds, ammonia and direct $PM_{2.5}$ for 2005. The modeling was based on 2003 through 2006 design values. Future year modeling for 2009, 2012, and 2018 was conducted and the future year design values were determined, as shown in Table 7.1.

Table 7.1
LADCO's Round 5 Modeling Results for the Clean Air Interstate Rule

Monitor ID	Monitor Name	County	Design Value 2003-2006	Basecase with CAIR 2009	Basecase with CAIR 2012	Basecase with CAIR 2018
			($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
18-019-0006	Pfau	Clark	16.5	13.6	13.6	13.2
18-043-1004	Green Valley School	Floyd	14.9	12.1	12.0	11.5
21-029-0006	Carpenter Street	Bullitt	14.9	12.4	12.4	12.0
21-093-0006	Elizabethtown	Hardin	13.5	11.2	11.2	10.7
21-111-0043	Southern Avenue	Jefferson	15.7	12.8	12.7	12.1
21-111-0044	Wyandotte Park	Jefferson	15.4	12.8	12.8	12.4
21-111-0048	Barret Ave.	Jefferson	15.2	12.5	12.5	12.1
21-111-0051	Watson Elementary	Jefferson	14.7	12.1	12.1	11.7

Results of the LADCO CAIR modeling show that all counties within the Louisville KY-IN fine particle nonattainment area will attain the annual NAAQS for fine particles of 15.0 $\mu g/m^3$ by 2009. As shown in Figure 7.1, future year modeled annual fine particle concentrations for 2009 will be 17% to 19% lower than the baseline annual fine particle design values, 17% to 20% lower in 2012 and 20% to 23% lower in 2018 and will continue to decrease thereafter.