Regional Air Quality Snapshot

I. Introduction

The quality of the air is arguably one of the most important components of life – quite literally affecting our health, but also impacting our environment and economy. Air pollution can impair normal activity and cause severe illness and even death in humans, it damages trees, crops, and other plants and animals, it erodes buildings, impacts water quality, and obstructs vistas. Regulations governing air quality play a role in where industries locate, how much energy is used, how we travel and how our transportation systems grow. Air quality is integrated into daily life. It also exemplifies an issue that crosses jurisdictional boundaries, both on a local scale within the northeastern Illinois region, as well as a larger scale with our neighboring states and countries.

As important as it is, air quality is not easily measured or predicted – it represents a complex interaction between natural climate and weather patterns and human actions. Therefore, the goal of this snapshot report is to understand the current conditions of air quality in northeastern Illinois, including exploring related impacts and regulations, and potential air quality improvement strategies.

Why is Air Quality Important to our Region?

Understanding the region's air quality is important, especially because the region is in nonattainment. Nonattainment means that northeastern Illinois does not meet the requirements of the Clean Air Act – the air pollution in this region exceeds levels established as protective of human health. Even though air quality in the region has shown improvement, more stringent standards have been adopted to further protect health and the environment. Numerous partners across the region and the state have done much good work to quantify the status of air quality, and a role of this report is to compile this information into a regional scale and comprehensively describe these efforts.

In addition to being a stand-alone report taking a snapshot of air quality in northeastern Illinois, this snapshot report will contribute to *GO TO 2040*, the metropolitan Chicago region's comprehensive planning campaign. The *GO TO 2040* plan will be a long-range plan, identifying needed policies, strategies, and investments for our region. It will cover the region's transportation system, land use and development patterns, the natural environment, economic and community development, housing, social systems including health, education, and human services, and other quality-of-life factors.

As a part of the *GO TO 2040* planning process, a Regional Vision was adopted, representing a set of shared values expressed through a comprehensive public participation process. According to the *GO TO 2040* Regional Vision, "In 2040, decision making in northeastern Illinois will be informed by considerations of environmental health, energy use, and water supply." Air quality is specifically identified as one of the aspects of protecting the environment; therefore it is important to understand it fully on a regional level in order to incorporate it into the *GO TO 2040* plan. This snapshot is a study meant to depict where the region stands regarding air quality.

Air quality will also be used as an indicator to understand how the *GO TO 2040* plan's different development scenarios will impact the environment. Different transportation options, patterns of development, and other policies and strategies will have differing air quality impacts. These differences will be tracked with several indicators in order to fully understand their impacts on the region, and air quality will be one such indicator.

Please note that this report does not directly address greenhouse gas emissions, including carbon dioxide. CMAP has other work underway to address this issue.

Understanding this Snapshot Report

The snapshot report is divided into five sections. Following this introduction, Section II discusses the general sources and effects of air pollution. Section III evaluates the existing conditions of the region's air quality as well as trends over time. A breakdown of the key federal and state regulations is outlined in Section IV, followed by a description of current voluntary efforts in Section V. As a conclusion, Section VI identifies some proposed strategies to address the air quality problems here in the region.

II. Air Pollution Sources and Effects

The Clean Air Act identifies six common air pollutants, known as "criteria pollutants," which are of highest concern when it comes to protecting air quality. These are particle pollution, ground-level ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead.

Through the Clean Air Act, human health-based and/or environmental-based criteria set permissible levels for each of the six criteria pollutants. The human health limit is the primary standard, and the environmental limit is the secondary standard. A geographic area with air quality that does not meet the primary standard for a criteria pollutant is a nonattainment area. Northeastern Illinois is one such nonattainment area, and is required to take action to improve air quality. The regulations governing the region's actions are discussed in more detail in Section IV.

In addition to the criteria air pollutants, the U.S. EPA has identified 187 pollutants as air toxics; examples include benzene, dioxin, asbestos, cadmium, mercury, and chromium. These hazardous air pollutants are emitted from a wide variety of sources, and the U.S. EPA has established standards to reduce these emissions from industrial sources, commercial products, and motor vehicles and fuel. The U.S. EPA is continuing to work to create additional emission reduction standards for them. These air toxics are a concern, but the national policy to guide regional action is still under development.

Of the six criteria pollutants, ground-level ozone and fine particle pollution are the two pollutants for which the northeastern Illinois region is in nonattainment. This snapshot focuses on them.

Ozone Pollution

Ground-level ozone is commonly known as smog. It is different than the ozone naturally occurring in the stratosphere high above the earth's surface, forming a layer of protection against ultraviolet radiation from the sun. In the earth's lower atmosphere, at ground-level, ozone's strong reactive properties are dangerous to human health and the environment.

Ozone is created by a chemical reaction between volatile organic compounds (VOC) and oxides of nitrogen (NOx) in the presence of sunlight. VOCs are released by cars burning gasoline, petroleum refineries, chemical manufacturing plants, and other industrial facilities. The solvents used in paints and other common household products also contain VOCs. Even the smells released by a bakery contain VOCs. NOx is produced when gasoline, coal, or oil is burned by cars or other sources like power plants and industrial boilers. During the summertime "ozone season," these chemicals react in heat and sunlight, forming ground-level ozone.

Particulate Matter Pollution

Particle pollution, also known as fine particulate matter, is a mixture of extremely small particles and liquids, including acids (such as nitrates and sulfates), organic chemicals, metals, and very fine dust, soot, and smoke. The smaller fine particles are produced when fuels such as coal, wood, or oil are burned, mixing with other chemicals and water vapor.

According to research, the size of the particles is directly linked to their potential for causing health problems. "Inhalable coarse particles," smaller than 10 micrometers in diameter are called PM_{10}, whereas "fine particles" are 2.5 micrometers in diameter and smaller – called $PM_{2.5}$.

Prior to the 1990 update of the Clean Air Act, U.S. EPA set limits on PM_{10}; but research has shown that $PM_{2.5}$ is more likely to harm human health. So, in 1997, U.S. EPA published limits for these fine particles (U.S. EPA [9]). In northeastern Illinois, the region is in nonattainment for the smaller $PM_{2.5}$ pollutants.

Sources of Air Pollution

Although ozone and particulate matter occur naturally, the excessive levels of these pollutants that are of concern are caused by interactions between human actions and weather conditions. In order to more effectively mitigate the emissions caused by human sources, U.S. EPA separates them into categories: point, area and mobile.

- Point sources are large, stationary emitters, such as power plants, chemical producers, manufacturing plants, or petroleum refineries.
- Area sources are small, stationary emitters, usually located in urban areas with other emitters that combine to form collectively significant emissions. Typically, these sources emit less than 25 tons/year of any combination of hazardous air pollutants or less than 10 tons/year of any one hazardous air pollutant. Examples of area sources include gas stations, dry cleaners, motor vehicle refinishing shops, and households using consumer products.
- Mobile sources are those emitters which move under their own power. This typically means on-road transportation sources such as motor vehicles (cars, trucks, and buses); but a large portion of mobile source air pollution is generated by off-road sources such as gas-powered lawn and farm equipment, construction and industrial equipment, boats, planes, and trains.

Illinois EPA tracks the region's air pollution by source, among other measures. Detailed information about the percentages of pollution by source in the Northeastern Illinois region are explored in Section III, *Our Region's Air Quality*. Regulating these different sources require different approaches. There are more details about how the U.S. EPA tackles this in Section IV, *Current Regulatory Actions*.

Effects of Air Pollution

Air pollution caused by ozone and fine particles can be deleterious to human health and the environment. As mentioned above, those effects which are deemed to be harmful to health are termed "primary effects" and those which impact the environment or property are termed "secondary effects" (U.S. EPA [7]).

Health research shows that repeated exposure to ozone can make people more susceptible to respiratory infections and lung inflammation, and aggravate pre-existing respiratory diseases such as asthma or emphysema. Ozone attacks lung tissue by reacting chemically with it, causing irritation. Some immediate symptoms of this irritation include shortness of breath, chest pain during deep inhalation, wheezing, and coughing. Ground-level ozone can even lead to increased need for medical treatment and hospital admissions, especially for people with lung diseases like asthma or chronic obstructive pulmonary disease. Prolonged or repeated exposure to ozone has even been shown to permanently scar lung tissue (U.S. EPA [10]).

In addition to health effects, ground-level ozone can impact the environment, including damaging plants, trees, and crops. Research has shown ozone makes plants more susceptible

to certain diseases, insects, competition, and harsh weather; damages tree leaves; and reduces forest growth and crop yields (U.S. EPA [10]).

Fine particles can get deep into the lungs, or can even pass from the lungs into the bloodstream. This can cause serious health problems and exacerbate existing lung conditions. Like ozone, fine particles can aggravate asthma, cause acute respiratory symptoms such as coughing, reduce lung functioning resulting in shortness of breath, and cause chronic bronchitis (U.S. EPA [11]).

Particulate matter pollution can also cause atmospheric haze and discolor buildings and monuments. Haze reduces visibility, which is often noticed in places where vistas and scenic views are most cherished, such a national parks and wilderness areas. This is often due to sources miles away, because particulate matter can get suspended in the air and travel long distances with the wind. The soot, smoke, and dust that make up fine particle pollution also land on our buildings and monuments, resulting in a grimy film of dirt that can damage surfaces and be expensive to remove (U.S. EPA [11]).

The elderly, children, and those with chronic lung diseases are most susceptible to health-related impacts of air pollution. People who have cardiovascular disease, or have suffered a stroke or heart attack, are also at risk. Children in particular are vulnerable because their lungs are still developing and their airways are smaller, and because they tend to be outside more often in summer months, when ozone levels are highest – playing, exercising, and exerting themselves, taking in more air.

III. Our Region's Air Quality

Levels of criteria air pollutants (ozone, particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, and lead) have been measured and recorded in northeastern Illinois for several decades using monitoring stations managed by the Illinois Environmental Protection Agency (IEPA). Of particular interest to the region are levels of ozone and particulate matter, which currently exceed the National Ambient Air Quality Standards (NAAQS). Although the number and location of ozone and particulate matter monitoring stations has varied over the years, the monitors reflect an accurate measurement of their respective criteria pollutants (IEPA [1], 2008).

Ozone Standards

Ground-level ozone has had two standards. The first standard, in place since the 1970s, was based on an hourly average of ground-level ozone concentrations. In 1997, this was superseded by the second standard, which is based on an 8-hour average of ground-level ozone concentrations. The 8-hour standard can be attained if the 3-year average of the fourth-highest daily maximum 8-hour average ground-level ozone concentration does not exceed 0.08 ppm (parts per million). In March 2008, the standard was lowered to 0.075 ppm.

Particulate Matter Standards

Like ground-level ozone, PM_{10} has been monitored for several years. While common in drier, dust-prone, western states, high concentrations of PM_{10} are unusual in northeastern Illinois, and are usually restricted to operations such as rock quarries, grain handling operations, and steel mills. Accordingly, the application of targeted dust control technologies has brought specific areas within the region into compliance with the PM_{10} standard.

In 1997, the U.S. EPA set separate air quality standards for the smaller, more health-affecting $PM_{2.5}$. Monitoring in Illinois began two years later. Two standards were set for $PM_{2.5}$ in 1997 – 24-hour and annual. The 24-hour standard is attained if the 3-year average of the 98^{th} percentile of 24-hour concentrations does not exceed 65 micrograms per cubic-meter ($\mu g/m^3$). In 2006, the 24-hour standard was lowered to 35 $\mu g/m^3$. The annual standard sets a threshold of 15 $\mu g/m^3$. The 3-year average of the weighted annual mean $PM_{2.5}$ concentration is measured against the threshold to determine attainment. The northeastern Illinois region is in nonattainment for these standards.

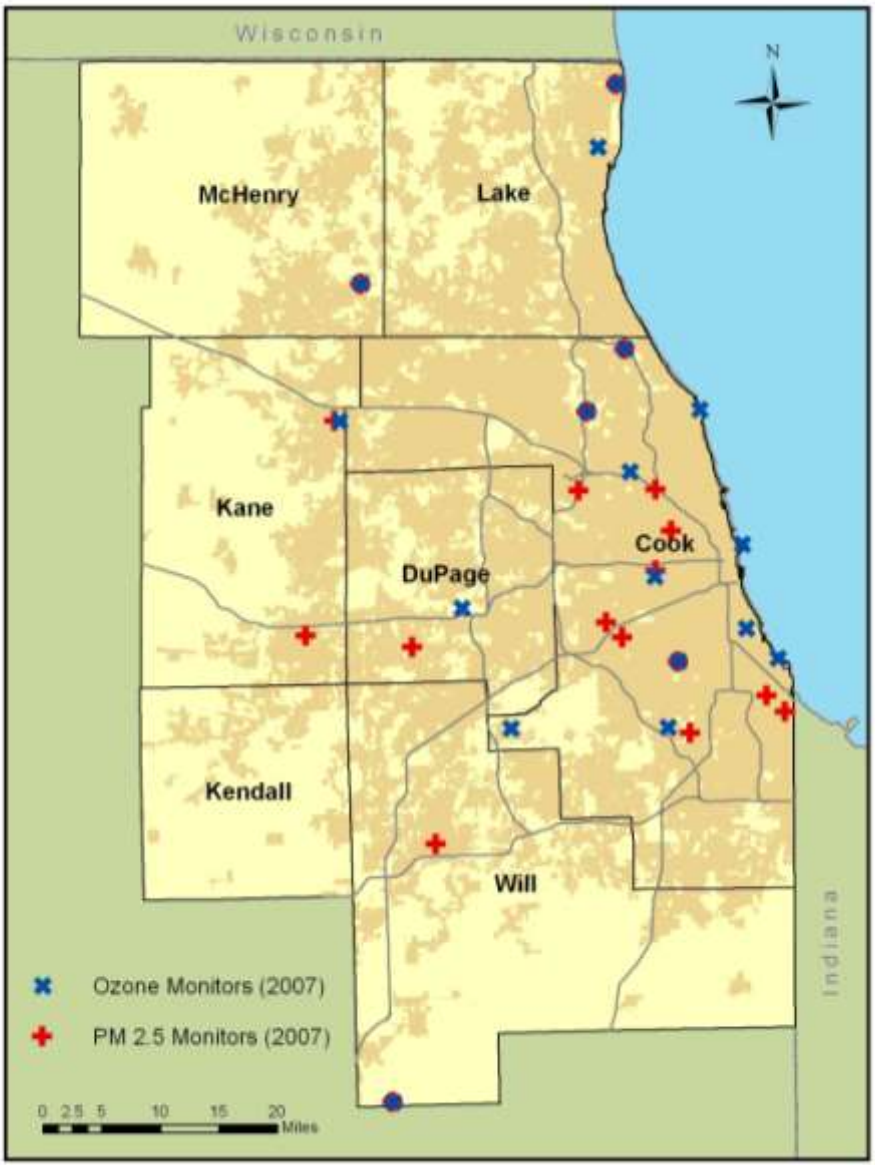
IEPA Annual Air Quality Report

IEPA publishes the *Illinois Annual Air Quality Report* which presents air quality levels over the past year. The report provides basic statistics (e.g. arithmetic mean and maximum reported values) for the criteria pollutants and discusses general trends in Illinois and specific regions of the state.

The number of days ozone is monitored varies, but generally the "ozone season" is from April to October, during which time the weather is most conducive to higher ozone concentrations. IEPA tracks these "ozone conducive days" and includes them in the report as well. $PM_{2.5}$ is monitored throughout the year.

Monitor sites are typically located in populated areas, but change from year to year (IEPA [1], 2008). Of the northeastern Illinois counties, ozone and $PM_{2.5}$ are both currently monitored in Cook, DuPage, Kane, Lake, McHenry, and Will Counties (U.S. EPA [1]), but sites for both ozone and $PM_{2.5}$ are not always at the same locations. Figure 1, below, depicts the current (2007) locations of monitors in the region.

Figure 1: Ozone and $PM_{2.5}$ Monitor Locations in Northeastern Illinois (2007)



Source: U.S. Environmental Protection Agency Air Quality System Database
Note: Location of some monitors not exact.

Air Data

Data collected by the criteria pollutant monitors is given by state environmental agencies to the U.S. EPA for compilation. The data, available on the U.S. EPA's website, is disseminated as annual summaries as a part of the *Air Quality System* database.

Ground-level ozone and $PM_{2.5}$ data for northeastern Illinois were queried and downloaded from the U.S. EPA. Ground-level ozone data was obtained for the 30-year time period of 1978 to 2007 inclusive. $PM_{2.5}$ data was available from 1999 to 2007 inclusive. This data was analyzed to highlight ground-level ozone and $PM_{2.5}$ trends in the region. The relationship between population and the two pollutants will be briefly discussed.

Understanding the Data

The data measured by the IEPA and compiled by the U.S. EPA are focused on meeting the standards, the NAAQS; therefore, violations are used as the measurement to track progress in their reports and analyses. But in order to also get a picture of "every-day" conditions, not just when violations occur, this analysis reviews the data in a variety of ways, including exceedances (not all of which constitute a violation), and averaged data across all the regional monitors. While this information portrays more details of ozone and particulate levels over the years, interpretation of their meaning can be complex.

It is important to reiterate that achievement of federally-adopted health standards are reflected in violations, which have been steadily declining in the region for both ozone and $PM_{2.5}$.

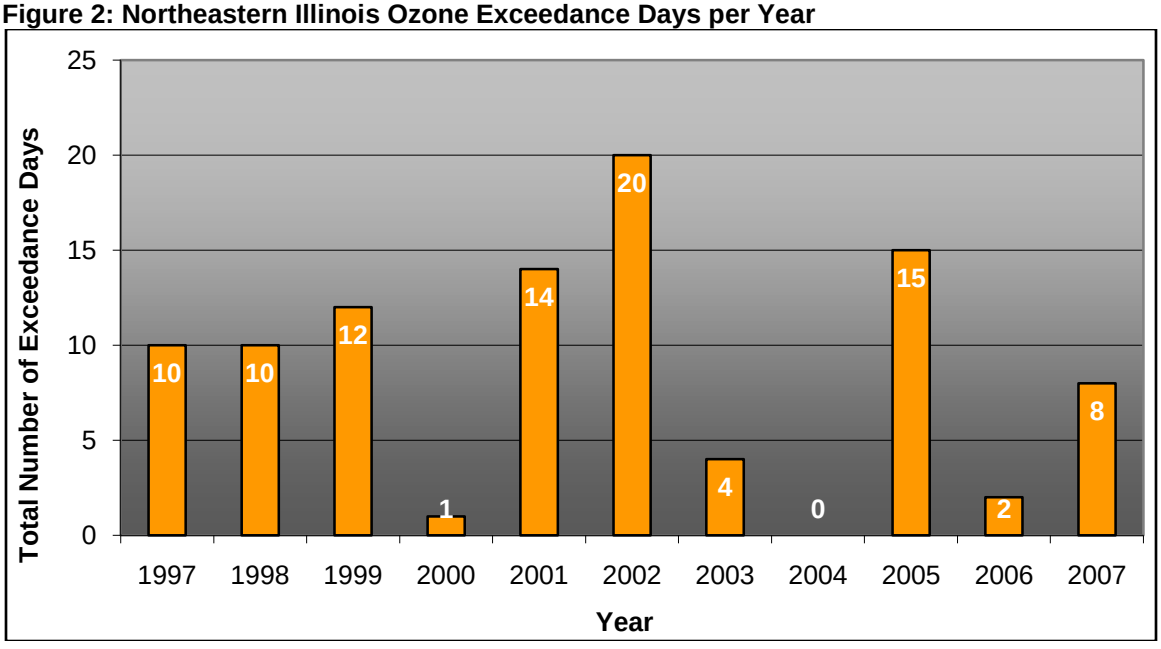
Regional Ground-Level Ozone

There are many factors involved in monitoring ground-level ozone, as evidenced by the complex way in which the U.S. EPA determines violations. In order to understand ground-level ozone on a regional level, a few different approaches were taken.

The region is in nonattainment for ozone because of violations, but exceedance data can reveal a more detailed picture. Because violations are triggered by the 4th-highest exceedance, averaged over three years, there can be a number of exceedances across different monitors before a violation occurs. Figure 2 identifies how many days per year ozone monitors in northeastern Illinois recorded an exceedance. Exceedances are based on NAAQS thresholds at the time, so the data before 1997 are not comparable. The chart gives a rough idea of regional ozone exceedances, and shows a slight decrease in exceedance days over time. (See the Appendix for tabular data.)

However, tracking the number of exceedances does not give a full picture of ground-level ozone. Are these exceedances anomalies – peaks in ground-level ozone levels that are otherwise much lower? Or are these exceedances representative of consistently high ozone?

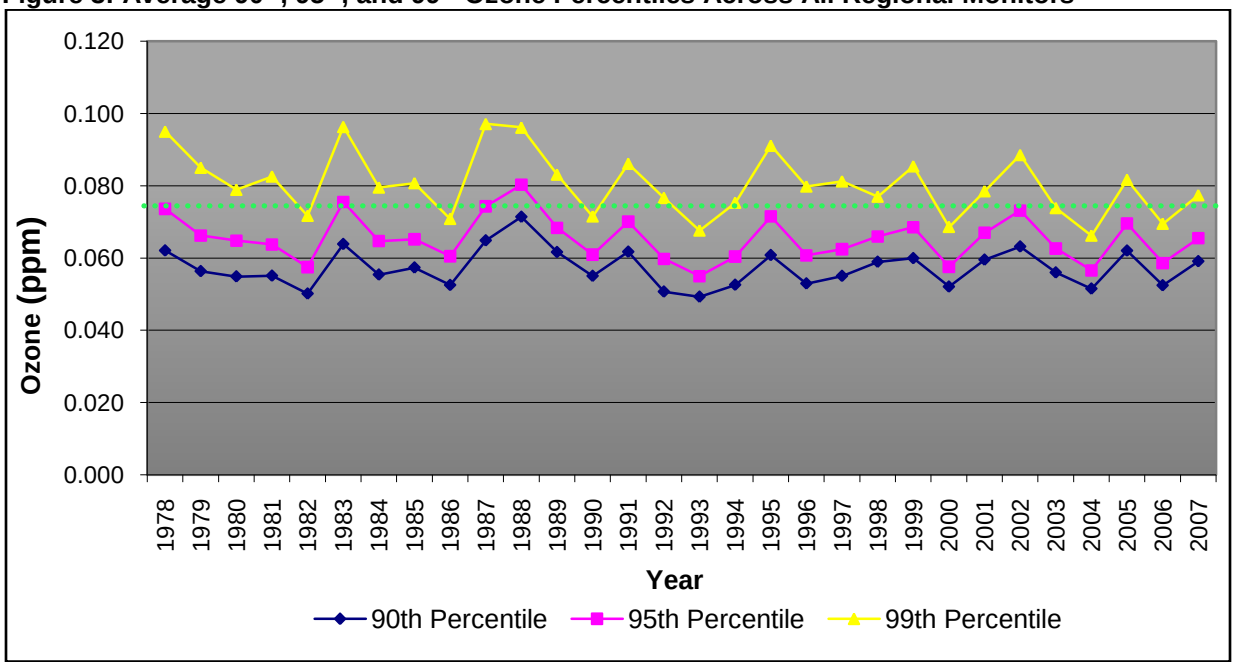
Figure 2: Northeastern Illinois Ozone Exceedance Days per Year



Source: U.S. Environmental Protection Agency Air Quality System Database

Because exceedance data don't reveal ozone pollution on a day-to-day basis, average ozone levels were reviewed. However, ozone formation is affected by different photochemical processes, different weather conditions and sunlight levels. Incorporating the different variables into an analysis of average ozone levels is a research issue beyond the scope of this snapshot. Therefore, Figure 3 takes a look at three higher ozone levels – the 90th, 95th, and 99th percentiles. Because the "ozone season" is approximately 200 days per year, the 90th, 95th, and 99th percentiles are the equivalent of the worst 20, 10, and 2 days per year respectively. (The dashed green line represents 0.075 ppm, the standard.)

Figure 3: Average 90th, 95th, and 99th Ozone Percentiles Across All Regional Monitors



Source: U.S. Environmental Protection Agency Air Quality System Database

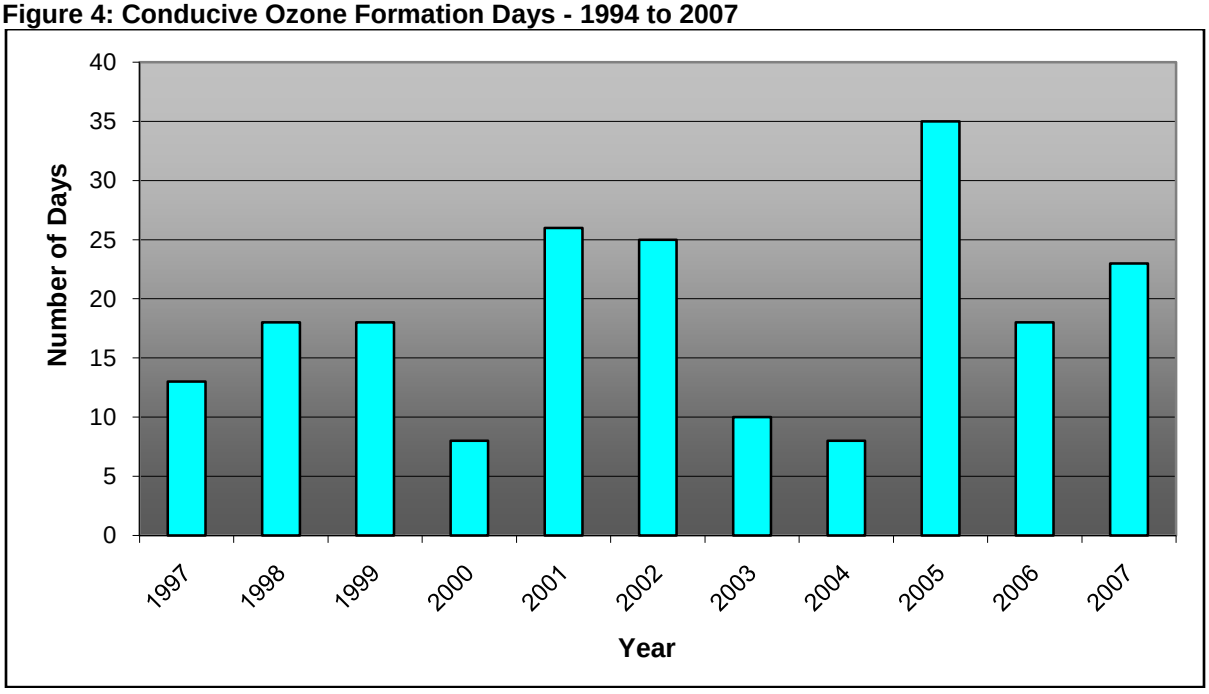
As portrayed in Figure 3, the regional average's worst two days each year, the 99th percentile, are usually above the standard. This underscores the region's nonattainment status, since the NAAQS for ozone focuses on the fourth worst day for each monitor. But perhaps a more interesting story is that the regional average's worst ten days per year are in the range of values considered when the 8-hour ozone standard was most recently updated and the worst twenty days per year periodically reach that range.

It is important to note that there are other factors at play in this evaluation, including background ozone precursors coming in from other regions, and the loss of daily variation when averaging ozone levels over an entire season. Therefore, regional ozone was tracked in a third approach – using the Air Quality Index (AQI). More information about these results is described below.

As previously mentioned, ozone formation is dependent on daily weather conditions. IEPA tracks "ozone conducive days" –days during the ozone season in which weather patterns are most favorable for the formation and transport of ozone. Conduciveness results from warmer temperatures, light winds, lack of precipitation, and high sunlight levels on a given day. Figure 4, below, displays the number of "conducive days" over a 10-year period. Although the specific

impacts of climate change in our region remain to be seen, it is likely that warming temperatures will cause an increase in conducive ozone formation days.

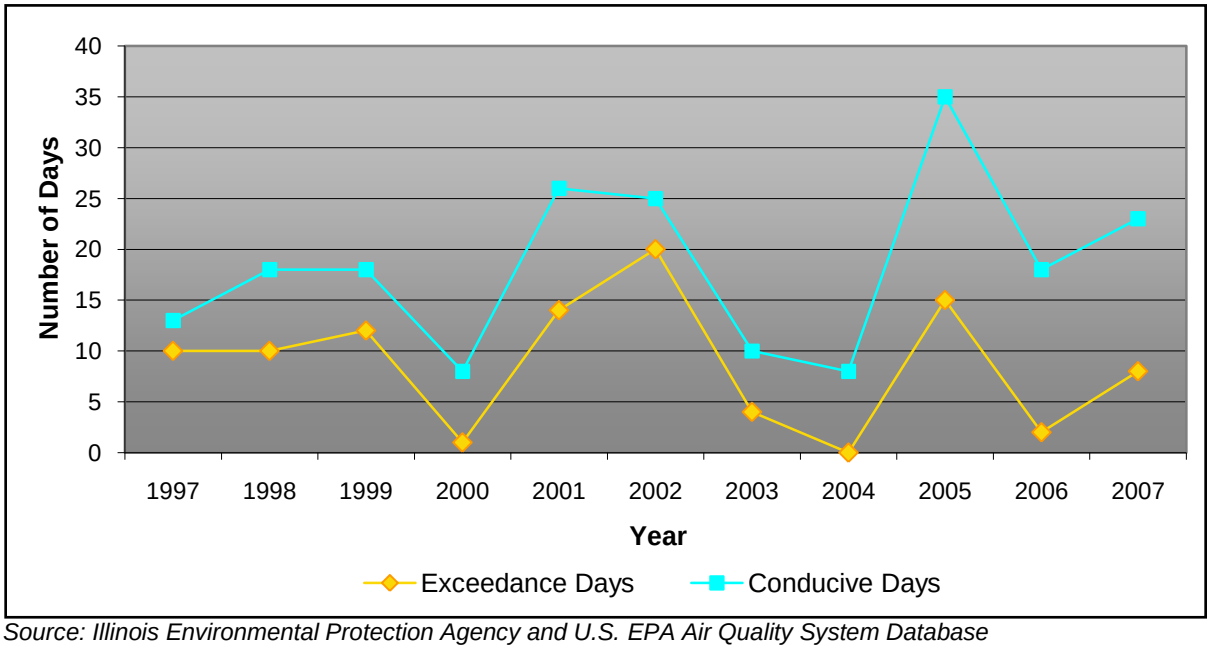
Figure 4: Conducive Ozone Formation Days - 1994 to 2007



Source: Illinois Environmental Protection Agency

It is interesting to compare the number of conducive days with the number of exceedances for the same time period, as shown in Figure 5, below. The number of conducive days plays a key role in excessive ozone levels, as evidenced in the graph, where the two values are clearly highly correlated. However, results from recent years indicate that the difference between the number of conducive days and exceedances has started to increase.

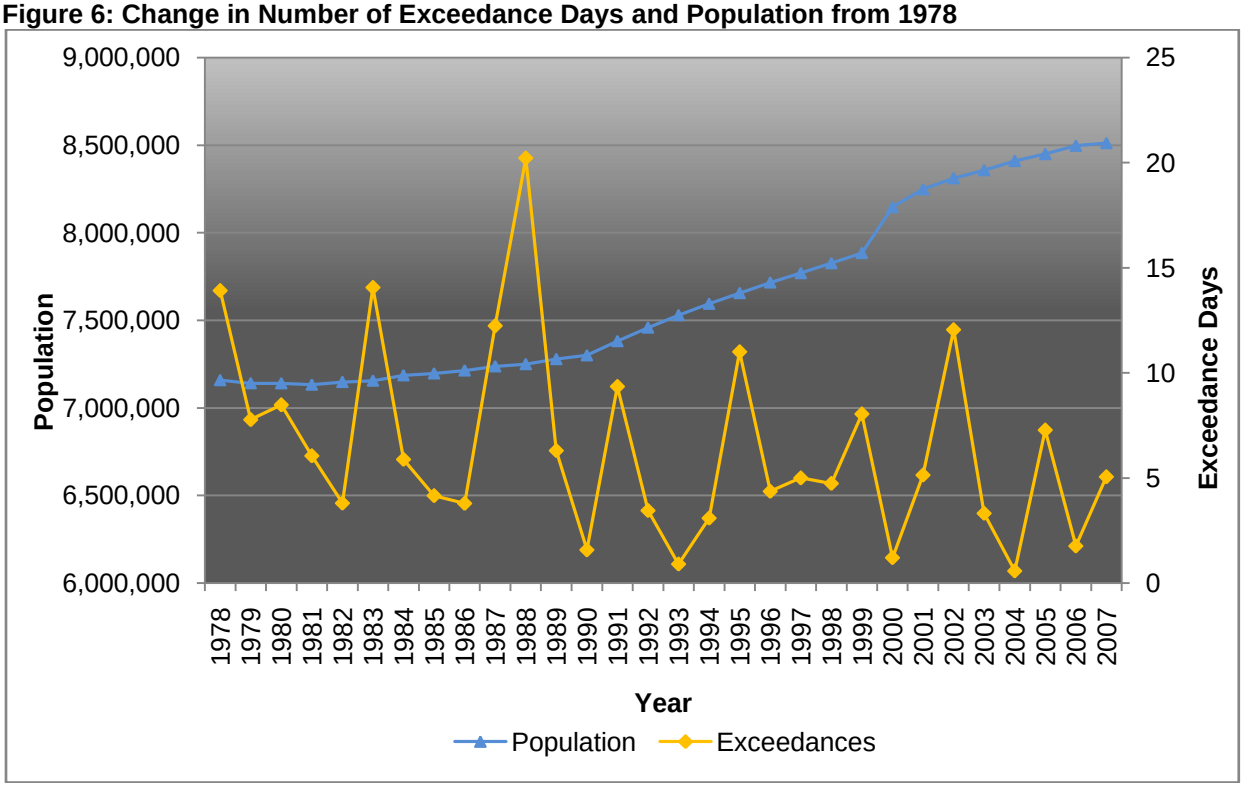
Figure 5: Number of Exceedances and Conducive Days in Northeastern Illinois (1994-2007)



Source: Illinois Environmental Protection Agency and U.S. EPA Air Quality System Database

In addition to weather, regional population plays a role in the ozone levels; as the region grows, there will be more sources of emissions – more driving, more power consumed, more activities like dry cleaning, painting, and so on. Figure 6, below, tracks the change in population with the number of exceedance days. Although northeastern Illinois' population has increased by more than 1.3 million people since 1978, there has not been comparably consistent growth in exceedances. This is probably due to advances in technology and tightening regulations, which have both served to reduce ozone precursor emissions.

Figure 6: Change in Number of Exceedance Days and Population from 1978



Source: U.S. Census Bureau, Population Division and U.S. EPA Air Quality System Database

Intuitively, using annual average ozone concentrations for general monitoring would seem reasonable. However, ozone formation is complex:

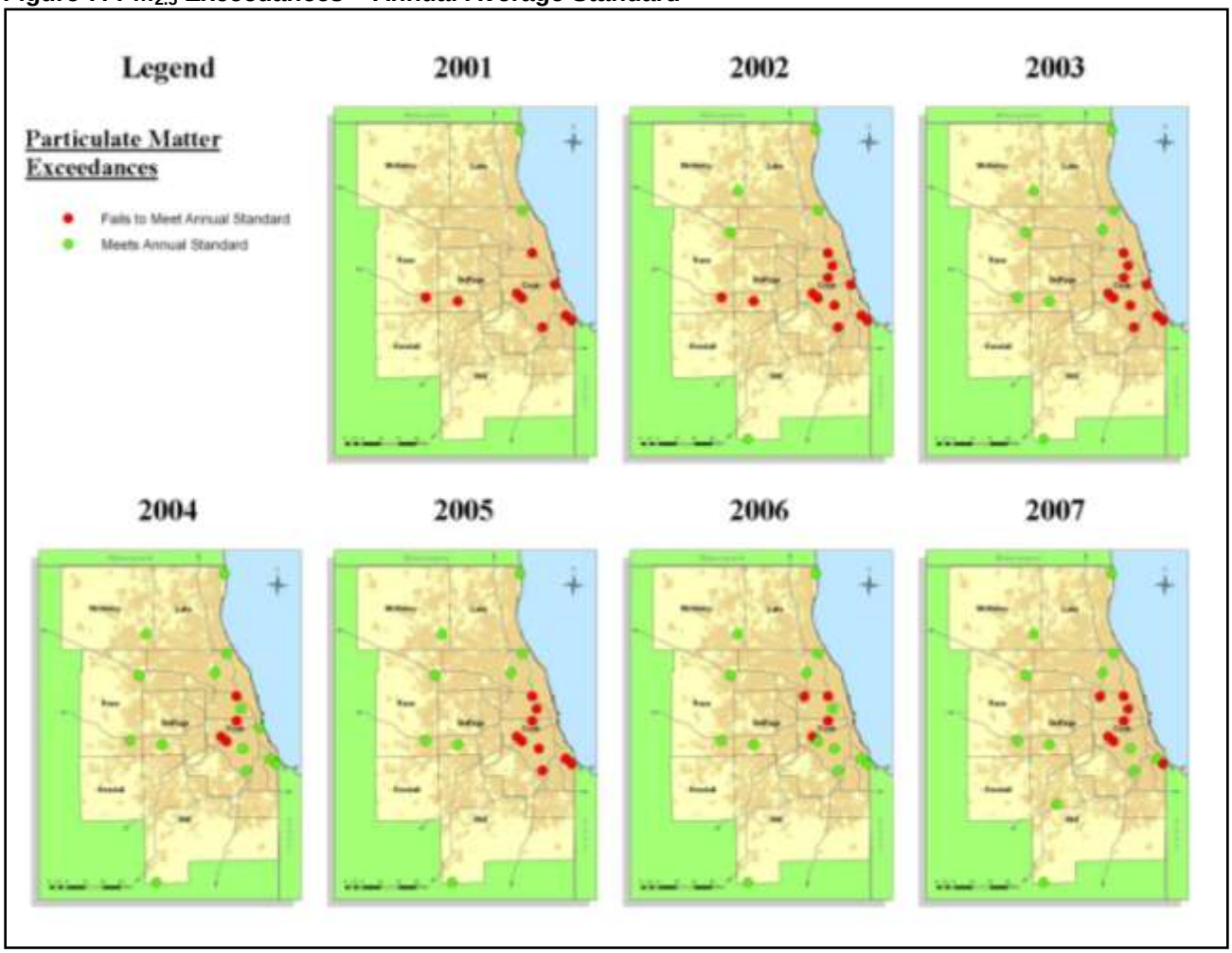
- Ozone is not directly emitted. Instead, precursors are emitted, which, in the presence of sunlight create ozone. By the time ozone is formed, the precursors may have moved some distance from where they were emitted.
- Under certain conditions, ozone can actually be "scavenged" by nitrogen oxide emissions that, under other conditions, lead to ozone and particulate matter formation. Ozone is "scavenged" (usually at night) when nitrogen oxides react with ozone particles to create oxygen. This essentially reduces ozone levels, even though nitrogen oxides are ozone precursors.
- Ozone exists at ground level naturally, and varies from region to region depending on sources (e.g. vegetation) and meteorology.
- In addition, background levels of ozone are significant. Background levels are measured at a site in southwestern Will County, upwind of the region's pollution-generating activities. This monitor helps determine how much of our air pollution is blowing in from out of the region. This observation emphasizes the point that air pollution is a multi-state problem, as discussed later.

Regional Particulate Matter ($PM_{2.5}$)

The other criteria pollutant for which the region is in nonattainment is fine particulate matter ($PM_{2.5}$). In 2006, the IEPA reported 12 exceedances of the daily standard. The number of $PM_{2.5}$ exceedances in 2006 was affected by the fact that in that year the 24-hour standard was lowered from 65 µg/m^3 to 35 µg/m^3. Since recording began in 1999 through 2005, none of the *Illinois Annual Air Quality Reports* noted exceedances of the 65 µg/m^3 standard (IEPA, 1999-2007).

In addition to the 24-hour standard, there is an annual average standard. Figure 7, below, displays $PM_{2.5}$ monitors that have exceeded the 15 µg/m^3 annual standard during the 1999 to 2007 time period. Again, note that this standard only became effective in 2007.

Figure 7: $PM_{2.5}$ Exceedances – Annual Average Standard

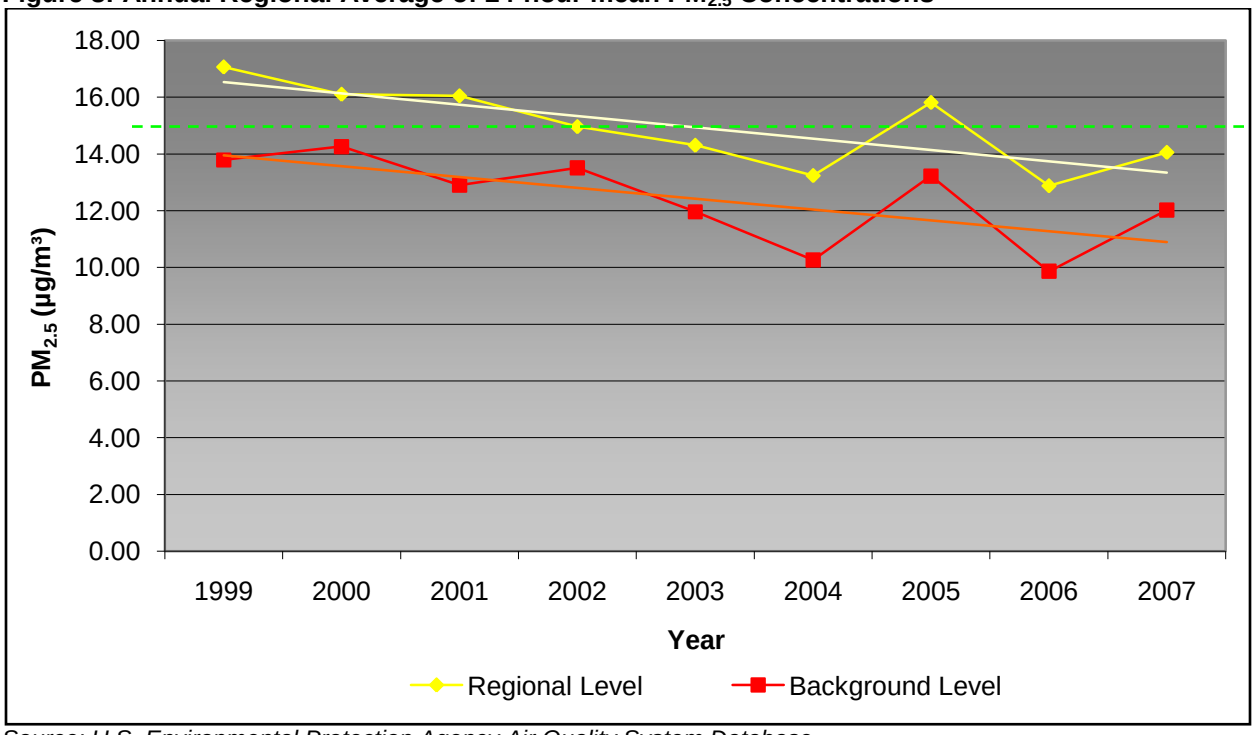


Source: U.S. EPA Air Quality System Database, IEPA Air Quality Reports 1998 to 2006, and Navteq Illinois Address Locator
Note: Location of some monitors not exact. Standard only became effective in 2007.

Because particulate matter doesn't have a "season" like ozone, it is monitored all year round. Therefore, unlike ozone, this allows for the monitoring data to be averaged more readily, both for annual average PM results per monitor (as displayed above) as well as annual average PM results across all monitors. Figure 8, below, displays the average annual 24-hour mean $PM_{2.5}$

concentration for northeastern Illinois, as well as the background monitor levels. An analysis of the regional average shows a decrease of approximately 0.40 µg/m^3 per year; the background monitor shows a similar decrease. (The dashed green line represents 15.00 µg/m^3, the annual standard.)

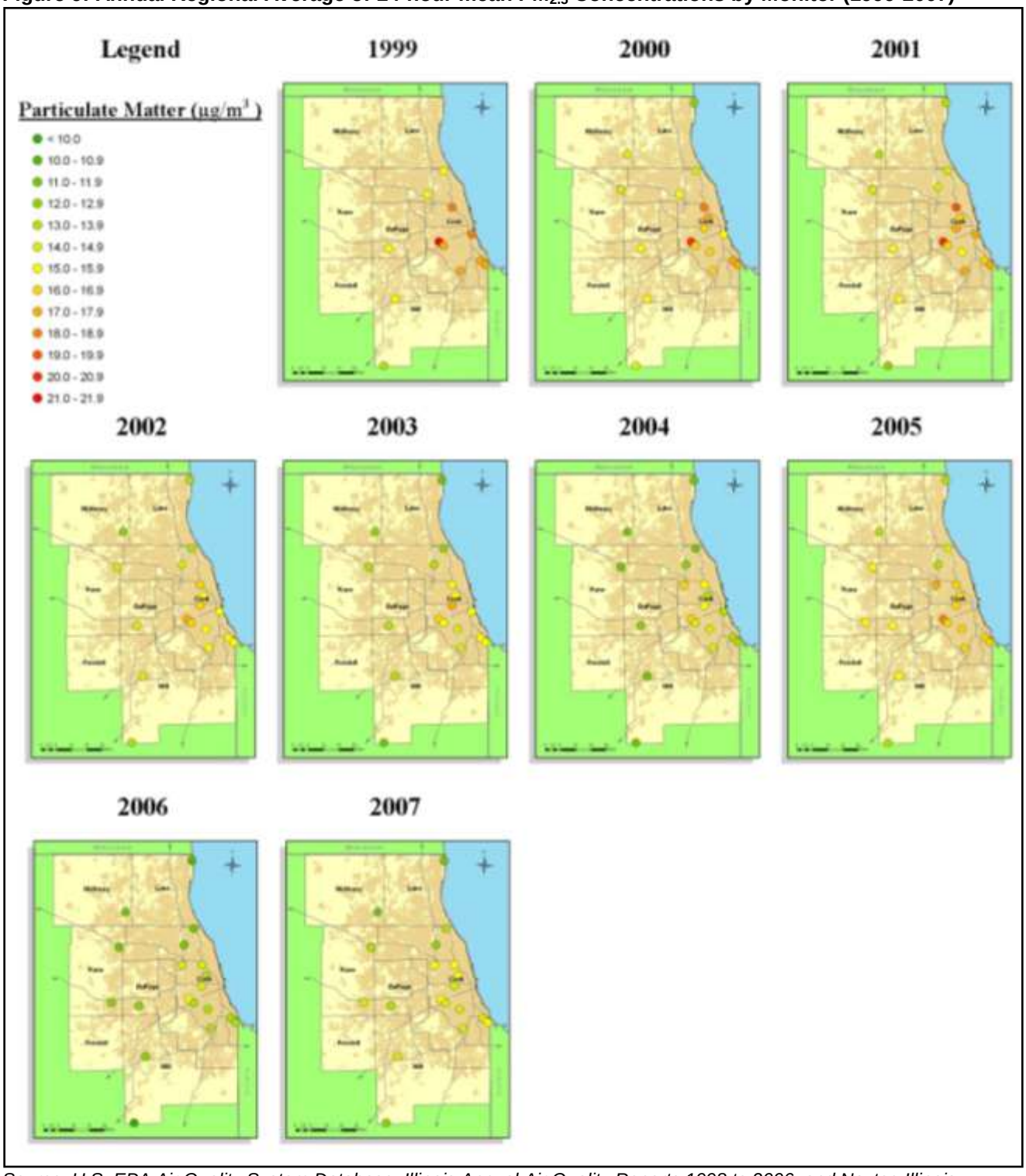
Figure 8: Annual Regional Average of 24-hour mean $PM_{2.5}$ Concentrations



Source: U.S. Environmental Protection Agency Air Quality System Database

To put this in a geographic context, the annual average $PM_{2.5}$ concentrations for each individual monitor were mapped from 1999 to 2007, shown in Figure 9, below. The maps show that the more urbanized areas tend to have higher particulate levels, but also show the improvement since the inception of $PM_{2.5}$ monitoring in the region.

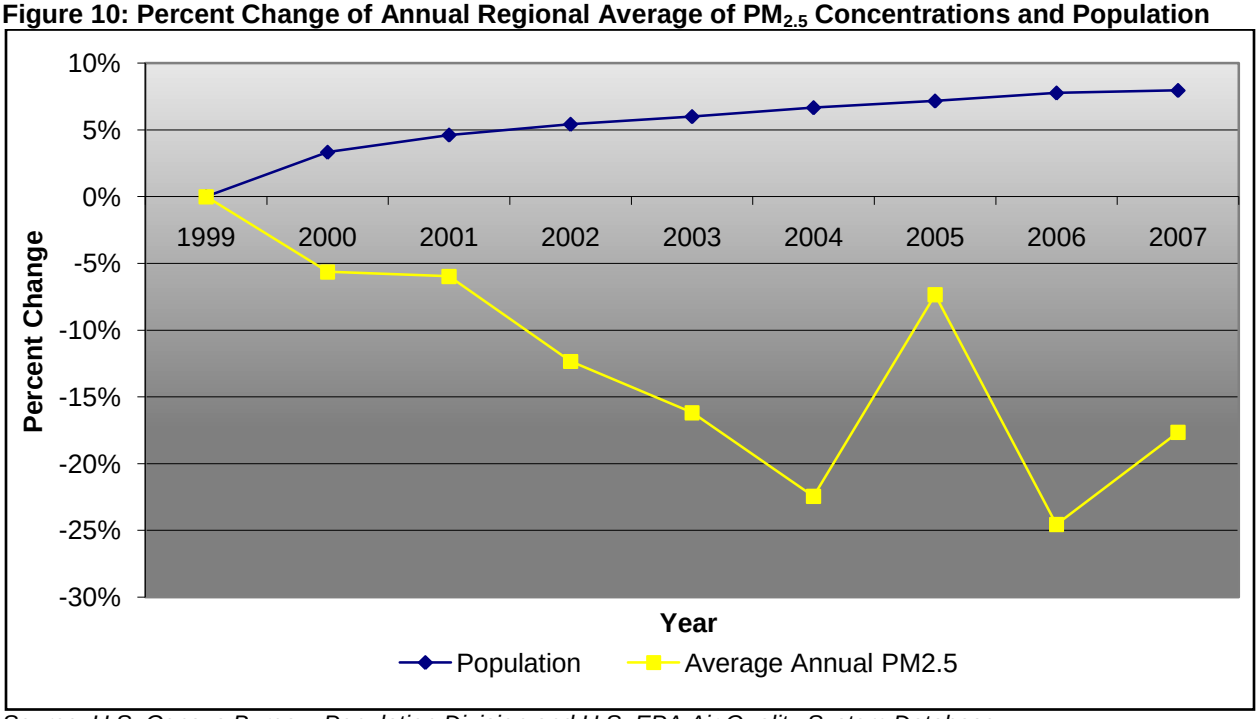
Figure 9: Annual Regional Average of 24-hour mean $PM_{2.5}$ Concentrations by Monitor (1999-2007)



Source: U.S. EPA Air Quality System Database, Illinois Annual Air Quality Reports 1998 to 2006, and Navteq Illinois Address Locator
Note: Location of some monitors not exact. Color gradient relative to years shown, not to other factors (e.g. health, attainment, etc.)

Particulate emissions, like ozone, are related to levels of human activity. Figure 10, below, shows the percent change of both annual $PM_{2.5}$ concentrations and population compared to 1999. Although population is increasing in the region, $PM_{2.5}$ levels are generally decreasing. This is likely due to improvements in technology as a result of regulations. Note that, in the absence of additional controls, particulate concentrations will rise as people in the region consume more power, have more goods shipped to and through the region, and take part in other activities that generate particulates.

Figure 10: Percent Change of Annual Regional Average of $PM_{2.5}$ Concentrations and Population



Source: U.S. Census Bureau, Population Division and U.S. EPA Air Quality System Database

Air Quality Index

Another measure for understanding regional air quality is the Air Quality Index (AQI). The AQI is a national index for reporting daily air quality in a user-friendly way. It predicts the air quality each day, with a color-coded system from 0 to 500. The higher the value, the greater the expected level of air pollution and the more severe the associated health effects. The U.S. EPA calculates the AQI for all the criteria pollutants (except lead). The levels coincide with the NAAQS, as shown in Figure 11, below.

Figure 11: Air Quality Index (AQI)

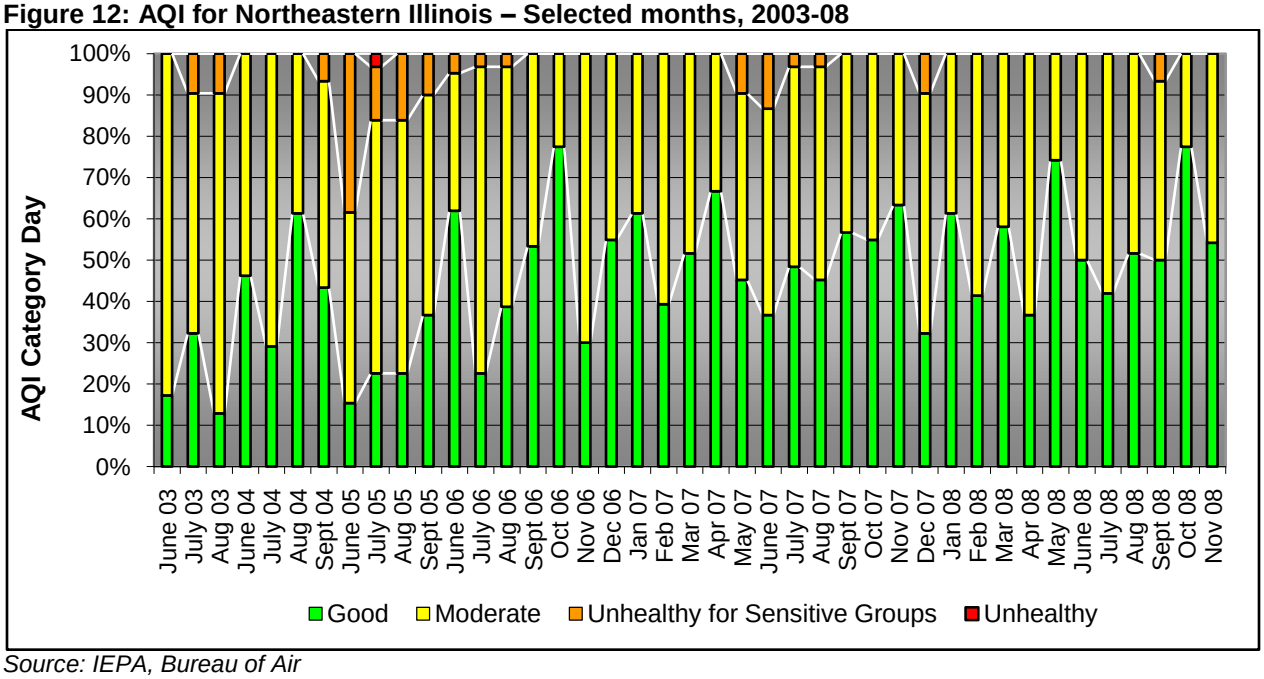
Color	Category	AQI Value	Meaning	Ozone 8-hr (ppm)	$PM_{2.5}$ 24-hr ($\mu g/m^3$)
	Good	0-50	Air quality is considered satisfactory, air pollution poses little or no risk	0.000-0.059	0.0-15.4
	Moderate	51-100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution	0.060-0.075	15.5-35.5
	Unhealthy for Sensitive Groups	101-150	Members of sensitive groups may experience health effects; the general public is not likely to be affected	0.076-0.095	35.5-55.4
	Unhealthy	151-200	Everyone may begin to experience health effects; member of sensitive groups may experience more serious health effects	0.096-0.115	55.5-140.4
	Very Unhealthy	201-300	Health alert; everyone may experience serious health effects	0.116-0.374	140.5-210.4
	Hazardous	301-500	Health warning of emergency conditions; entire population likely to be affected	0.375+	210.5+

Source: U.S. EPA, www.airnow.gov

IEPA forecasts and calculates the AQI every day for Northeastern Illinois, using monitored measurements. It also indicates which pollutant – ozone or particulate matter – will be the primary pollutant of concern each day. This information is tracked on a daily basis and reported to the public. If the AQI is above 100, IEPA must also report which groups may be sensitive to a specific pollutant. This information is shared in weather reports, online, and in newspapers.

Although primarily a public health service, AQI can also be used to understand existing conditions of air quality in the region over time. Although the data has been transformed into an index, it provides a picture of the number of "good" and "moderate" days compared to "unhealthy for sensitive groups" and "unhealthy" days over time. (Fortunately, the region has no AQI days of "very unhealthy" or "hazardous" on record.) This is shown in Figure 12, below. Graphically, it is clear that the vast majority of days reported in the past five years have an AQI less than 100. It is important to note that the graph lacks winter months for the period before particulate matter began to be monitored.

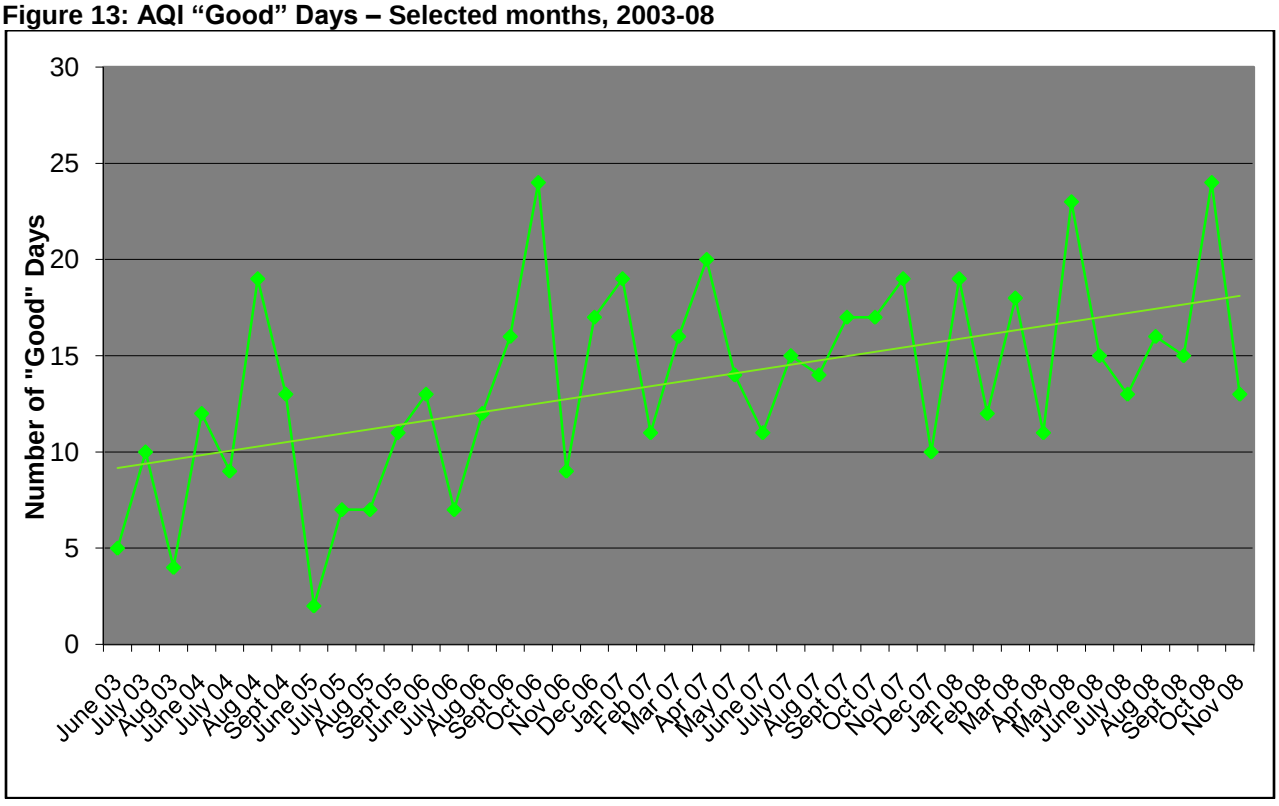
Figure 12: AQI for Northeastern Illinois – Selected months, 2003-08



Source: IEPA, Bureau of Air
Note: Data is only available for ozone season during the first few years.

Another way of looking at this information is to track just the good days, shown below in Figure 13. This graph shows a slight upward trend in the number of good days. Again, note that the information is only for selected months as the monitoring of fine particulates began in 2006.

Figure 13: AQI "Good" Days – Selected months, 2003-08



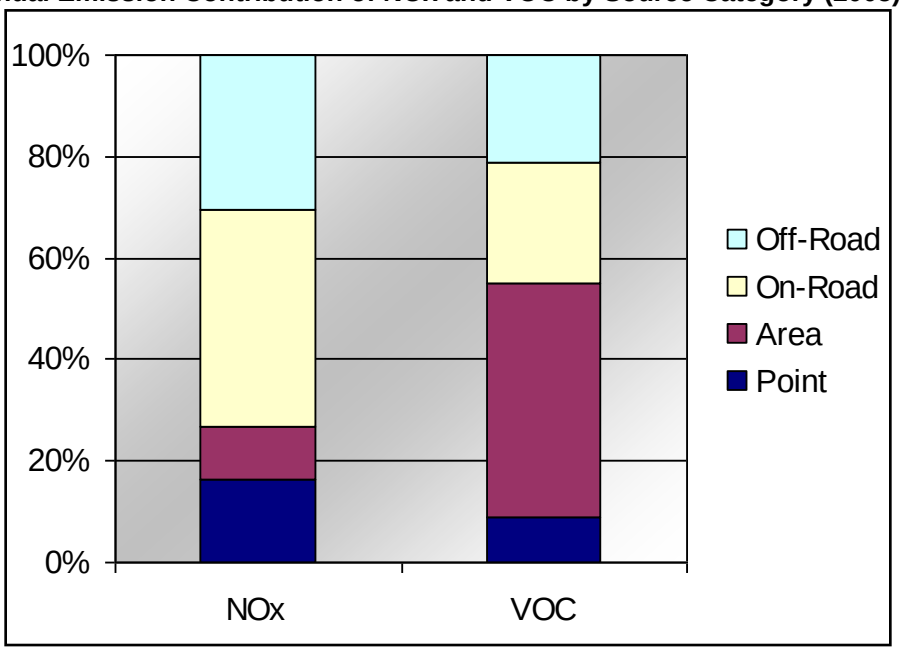
Source Categories

In addition to reporting the region's current air quality, it is important to evaluate the regional sources impacting it. As described in more detail in Section II, IEPA measures the sources in four categories:

- Point – large, stationary emitters such as power plants, chemical producers, and manufacturing plants;
- Area – small, stationary emitters (< 25 tons/year) such as dry cleaners, gas stations, bakeries, or motor vehicle refinishers;
- On-Road – mobile emitters such as cars, trucks, and buses; and
- Off-Road – mobile emitters such as gas-powered lawn and farm equipment, construction equipment, boats, planes, and trains.

IEPA periodically estimates the amount of ozone precursors (NOx and VOC) these source categories emit in the Chicago Nonattainment Area. The most recent data are for 2005; previous measurements were taken in 1990, 1996, and 2002. Figure 14 displays the percentage of air pollution emitted by category for 2005.

Figure 14: Annual Emission Contribution of NOx and VOC by Source Category (2005)



The change in NOx and VOC emitted by these sources over time is portrayed in Figures 15-18. Figures 15 and 16 show NOx source data. Figure 15, displaying the total amount of NOx by source – in 1990, 1996, 2002, and 2006 – indicates how there has been a small decrease in total NOx over time. The second NOx chart (Figure 16) displays the change in the amount contributed by each source over time, highlighting how on-road and point sources have declined over the years.

Figures 17 and 18 portray VOC source data. Figure 17, displaying the total amount of VOC by source – in 1990, 1996, 2002, and 2006 – show significant progress in reducing VOC emissions overall. The second VOC chart (Figure 18) displays the change in each source category, again highlighting the significant decrease in on-road and point source VOC emissions since 1990.

Figure 15: Regional NOx by Emission Source Category

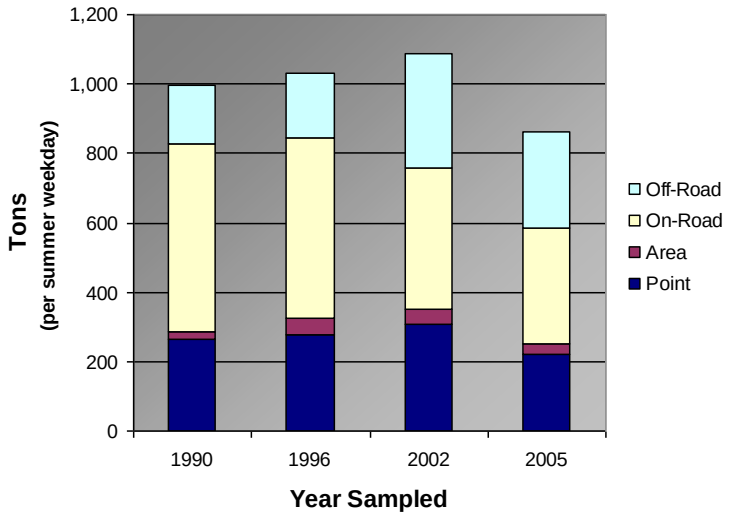


Figure 16: Regional NOx (1990-2005) by Emission Source Category

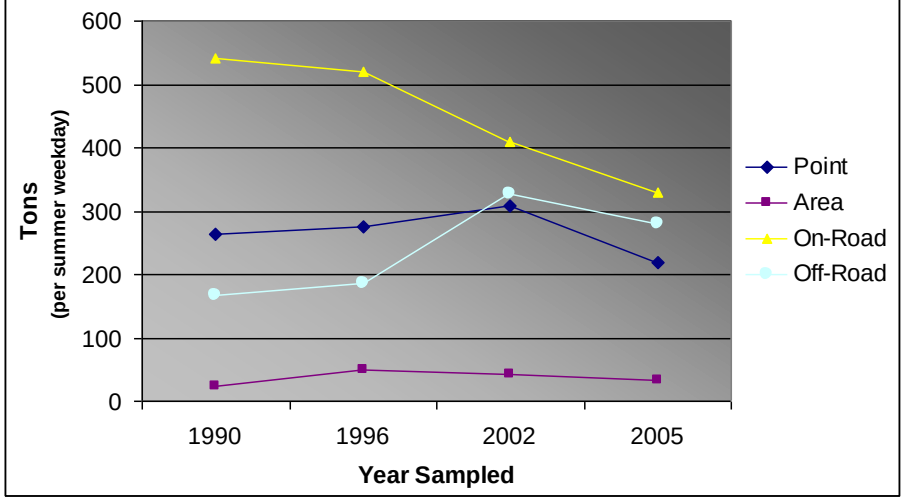


Figure 17: Regional VOC by Emission Source Category

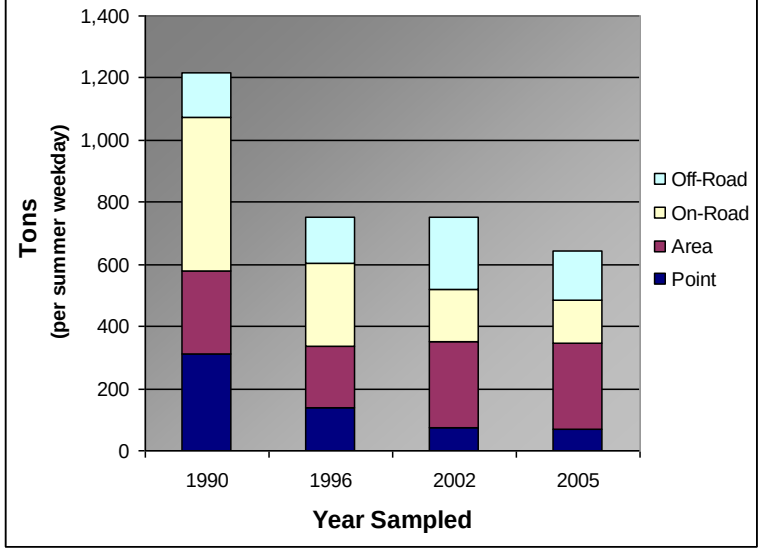
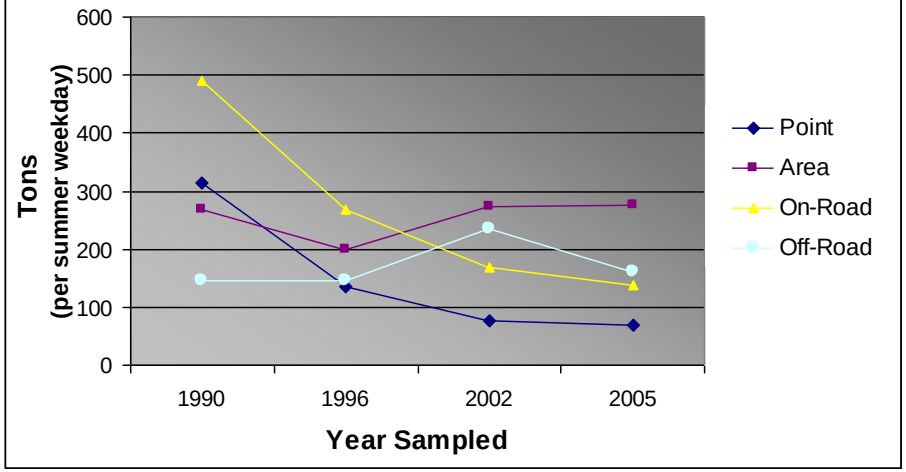
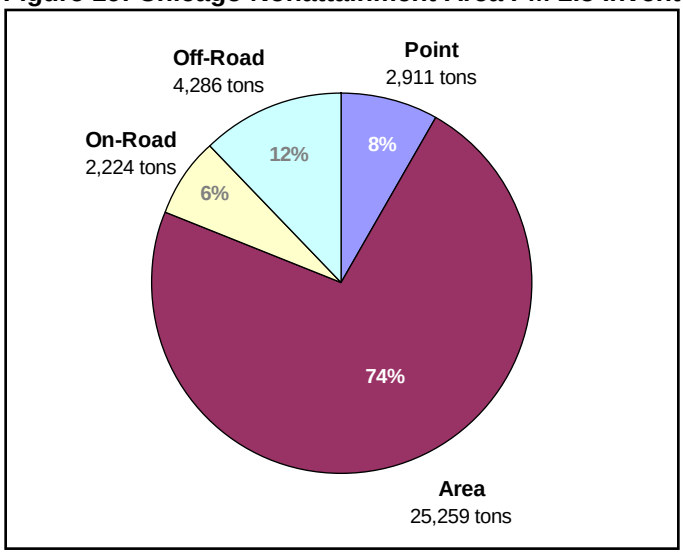


Figure 18: Regional VOC (1990-2005) by Emission Source Category



In addition to ozone precursors, IEPA also evaluated the sources of particulate matter pollution in 2005. Shown in Figure 19, below, the vast majority of $PM_{2.5}$ pollution is attributed to area sources. Of this, more than half (approximately 14,438 tons) is due to road construction.

Figure 19: Chicago Nonattainment Area PM 2.5 Inventory by Source Category (2005)



Air Quality in the Upper Midwest Region

Even for large regions such as northeastern Illinois, the effects of air pollution are not isolated. Weather conditions, particularly wind speed and direction, can transport air pollution from region to region, state to state, and country to country. In 1989, the states of Illinois, Indiana, Michigan, and Wisconsin recognized the spatial dynamic of air pollutants over a large geographic area. That year, the states formed the Lake Michigan Air Directors Consortium (LADCO) and designated the responsibility of providing technical input on air quality issues in the larger region to the group (Lake Michigan Air Directors Consortium, Nov 2002).

LADCO's 2002 report, *Ozone Trends in the Lake Michigan Region*, stated that, generally, 1-hour ground-level ozone levels decreased from 1981 to 2001. The total number of exceedance days in the 1990s (89 days) was less than those in 1980s (207 days). LADCO notes that although average temperatures were less in the 1990s, differences between the two decades were not substantial. Thus, temperature influences are not the cause of the reduction in exceedances. The report also notes that ozone trend patterns differed geographically. On the western side of Lake Michigan ozone concentrations generally trended downward; whereas on the southern and eastern sides of the Lake ozone concentrations were weakly decreasing or not decreasing at all (Lake Michigan Air Directors Consortium, May 2002 [2]).

LADCO's evaluation was primarily based on the 1-hour 0.12 ppm standard, which was revoked three years after the study, in 2005. LADCO did, however, compare 1-hour peaks to 8-hour peaks. They concluded that, while somewhat similar, 8-hour peaks indicated increasing trends in "more recent" years (Lake Michigan Air Directors Consortium, May 2002 [2]).

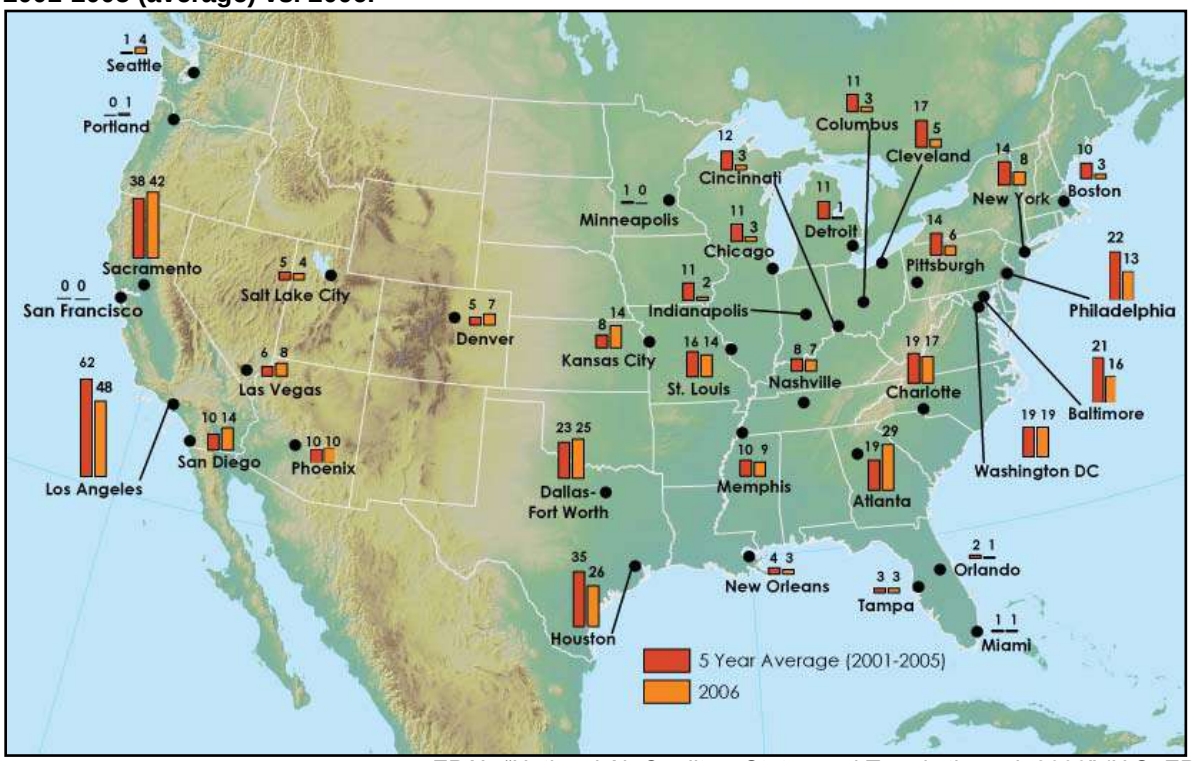
Another 2004 LADCO report, *$PM_{2.5}$ in Urban Areas in the Upper Midwest*, investigated various factors of $PM_{2.5}$ pollution in eight urban areas including Chicago, Gary, and Milwaukee metropolitan statistical areas. LADCO found a gradient of increasing $PM_{2.5}$ levels towards downtown Chicago over the 2000 to 2002 period. Although the average annual standard was exceeded throughout the Midwestern region, no 24-hour standard exceedances were recorded. This coincides with the findings discussed above specific to the northeastern Illinois region. Since LADCO's report was completed, the 24-hour standard has been reduced from 65µg/m^3 to 35 µg/m^3 (Lake Michigan Air Directors Consortium, 2004).

Nationwide Comparison of Air Quality

Comparing the air quality in Northeastern Illinois with that of other metro regions throughout the country is a difficult task. Confounding variables like geography and climate, as well as unique sources, all make it difficult to compare ourselves with other metro regions. Areas like Dallas-Fort Worth and metro Atlanta will always have more ozone conducive days because of their warmer, sunnier climate. Greater Los Angeles sits in a valley, bounded by a mountain range which keeps all emissions from blowing away. Cities in Ohio and Pennsylvania are served by mostly local coal-fired power plants. Cities in the West are subject to more dust and wind. In addition to different populations and land use patterns, these variables all make it nearly impossible to make any fair comparisons.

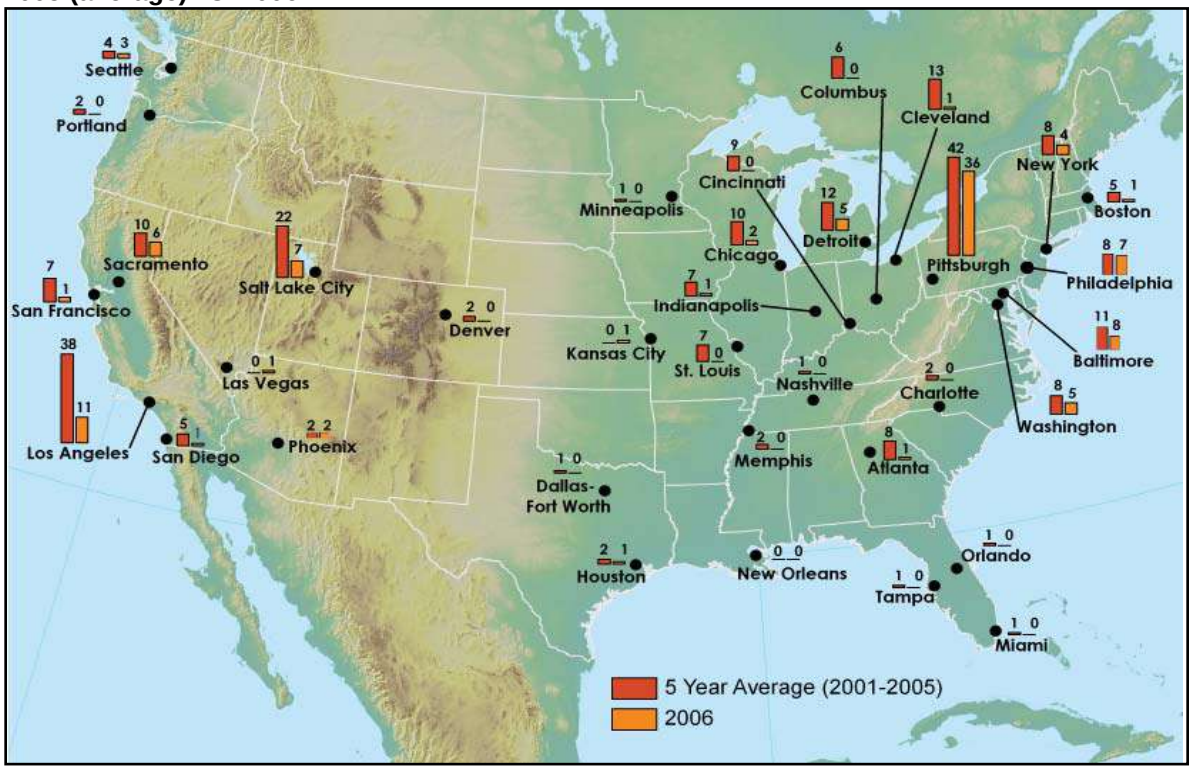
That being said, there are some national studies which attempt to understand air quality on a larger scale, highlighting these metro regions. The U.S. EPA puts out an annual "National Air Quality – Status and Trends" report (U.S. EPA [6]). Figure 20 and 21 are two maps, taken from the 2007 version of this report, which show this national comparison of ozone and particulate matter, respectively, based on AQI.

Figure 20: Number of days reaching Unhealthy for Sensitive Groups for ozone on the AQI for 2001-2005 (average) vs. 2006.



Source: U.S. EPA's "National Air Quality – Status and Trends through 2006" (U.S. EPA [6])

Figure 21: Number of days reaching Unhealthy for Sensitive Groups for $PM_{2.5}$ on the AQI for 2001-2005 (average) vs. 2006.

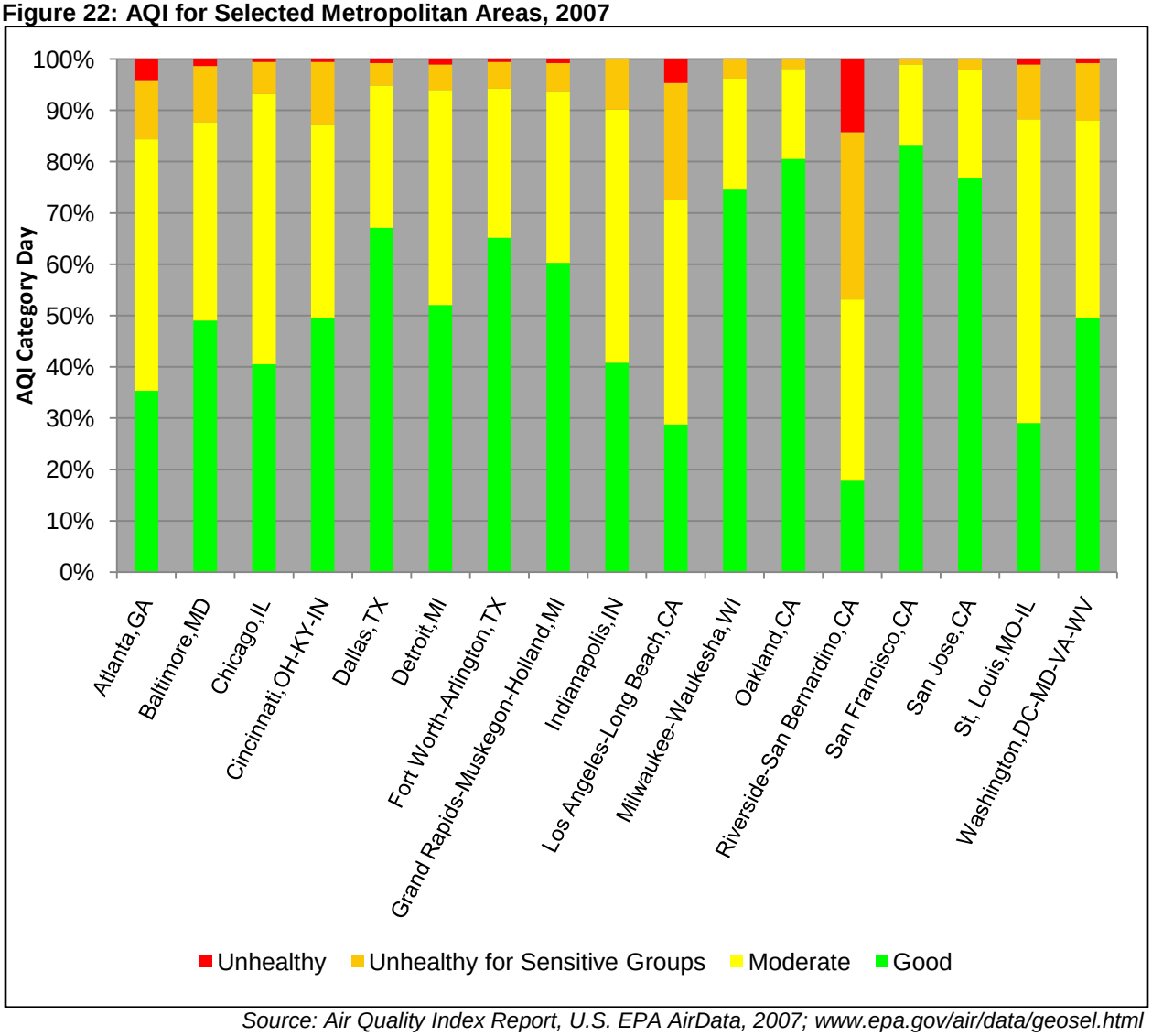


Source: U.S. EPA's "National Air Quality – Status and Trends through 2006" (U.S. EPA [6])

These maps give some idea of our region's air quality in comparison to other major metropolitan areas throughout the country. The purpose of the report, however, is to get an idea of national air quality, not make regional comparisons.

In a similar analysis, Figure 22 shows the AQI from 2007 for several major metropolitan areas throughout the country, as well as several smaller metropolitan regions in the Lake Michigan basin. The results for the Chicago region, when compared to other regions, reveal that it has fewer "Unhealthy" and "Unhealthy for Sensitive Groups" days than many regions, but still not as many "Good" days as other regions. Again, it is difficult to draw many conclusions from this comparison because it only includes data from one year, and doesn't take into consideration the geography, climate, and air quality issues unique to northeastern Illinois.

Figure 22: AQI for Selected Metropolitan Areas, 2007



Source: Air Quality Index Report, U.S. EPA AirData, 2007; www.epa.gov/air/data/geosel.html

Data Summary

- This section of the snapshot reviewed air quality trends and their relation to attainment. The potential factors affecting these trends were briefly explored.

- The number of ozone exceedences has declined over time; the region has submitted a request for re-designation to attainment of the 0.08 ppm 8-hour standard.

- Ozone levels observed on a more regular basis – five to ten percent of the time during the ozone season – are still within the range of values considered when the 8-hour ozone standard was most recently updated.

- Although $PM_{2.5}$ levels appear to be on a downward trend, the annual average since 2004 appears to be relatively flat. Future monitoring of the region will indicate whether this trend will continue.

- The Air Quality Index can also be used to understand regional air quality. Although year-round data exist only since 2006, there are some signs of increases in "good" AQI days and decreases in the number of "Unhealthy for Sensitive Groups" or "Unhealthy" days.

- The LADCO data confirms many of the conclusions found using regional data, and also shows that much of our regional pollution is influenced by conditions outside the region.

- Finally, IEPA's analysis of source categories reveals some significant declines in air pollution caused by point and on-road mobile sources. Area and off-road mobile sources have seen little change over the limited number of years studied.

IV. Current Regulatory Actions

As evidenced by how both the IEPA and the U.S. EPA are involved in setting standards and monitoring and tracking conditions, air quality is a heavily regulated issue. This section identifies the key regulatory actions related to air quality. The federal, state, regional, and local components of regulating air quality are often interrelated, but this section is organized by these different layers of government.

The Federal Role

The Clean Air Act

The single most significant piece of federal legislation regarding air quality is the Clean Air Act. First passed in 1963, the Clean Air Act was strengthened in 1970, and dramatically improved in 1990. Under the Clean Air Act, the U.S. EPA has the authority to place limits on air pollution and emissions throughout the nation; states are not allowed to have weaker pollution controls than those set for the whole country.

If regions do not meet the standards set by the U.S. EPA, the states containing them must have plans for reducing air pollution. These state implementation plans (SIPs) explain how the state will take measures to achieve those standards. The law recognizes that states are better equipped to implement the regulations because pollution control problems often require specific understanding of local geography, development patterns, and industries, as well as the authority to mandate air pollution controls. But the SIPs must be approved by the U.S. EPA, and if found unacceptable, the U.S. EPA can impose sanctions, or take over enforcement of the Clean Air Act in that state. More details about the states' role in implementing the Clean Air Act are included in the following subsection.

In addition to enforcement, the federal government, through the U.S. EPA, assists the states by providing scientific research and funding to support clean air programs.

The Clean Air Act requirements are comprehensive and cover many different pollution sources and a variety of clean-up methods to reduce air pollution. The requirements are organized into six sections:

- Title I: Air Pollution Prevention and Control – sets the NAAQS, sets standards for stationary sources, sets requirements for state implementation plans for nonattainment areas;
- Title II: Emission Standards for Moving Sources – sets standards for mobile source emissions, sets requirements for aircraft and clean fuel vehicles;
- Title III: General – sets requirements for monitoring, modeling, and analysis;
- Title IV: Acid Deposition Control – sets regulations to prevent acid rain;
- Title V: Permits – sets requirements for permitting programs;
- Title VI: Stratospheric Ozone Protection – sets requirements to limit production of ozone-depleting chemicals.

For the purposes of this *Regional Air Quality Snapshot*, the first two sections of the Clean Air Act, dealing with protection of air quality and regulation of emissions, are the most relevant. But it is important to note how all-encompassing the legislation is, and how it has resulted in reductions in acid rain and a phase-out of chemicals causing ozone layer damage. More details are available through the U.S. EPA's *Plain English Guide to the Clean Air Act* (http://www.epa.gov/air/caa/peg/index.html).

The Clean Air Act calls upon the federal government to prevent and control air pollution (Title 1); it serves as the basis for the National Ambient Air Quality Standards (NAAQS) for criteria pollutants. Previously described in Section III, the six common air pollutants include particle pollution (PM), ground-level ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead. A geographic area with air quality that is cleaner than the NAAQS is an "attainment" area; areas that do not meet the primary standard are called "nonattainment" areas. Through an extensive network of air quality monitors, U.S. EPA and state governments identify nonattainment areas where the air does not meet allowable limits for a criteria pollutant. The Chicago nonattainment area has been identified for the northeastern Illinois and northwestern Indiana region.

Particle pollution and ground-level ozone are the two criteria pollutants for which northeastern Illinois is in nonattainment. These are the two most widespread health threats for the rest of the country as well, so the U.S. EPA has several efforts specifically aimed at tackling ozone and PM pollution. Many of the clean-up requirements for particle pollution and ground-level ozone target large industrial sources (power plants, chemical producers, and petroleum refineries), as well as on-road motor vehicles (cars, trucks, and buses). Controls are also required for smaller pollution sources, such as gasoline stations and paint shops. Engine standards for nonroad mobile sources are less developed than those for on-road sources, but some have recently gone into effect, and others will take effect over the next several years.

In addition to criteria air pollutants, the Clean Air Act regulates air toxics, also known as hazardous air pollutants (HAPs). "Air toxics are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects" (U.S. EPA [2]). The U.S. EPA has identified 187 pollutants as air toxics; examples include benzene, dioxin, asbestos, cadmium, mercury, and chromium. They are emitted from a variety of sources, including dry cleaning facilities, foundries, and paints.

In addition to monitoring and setting acceptable standards, the Clean Air Act authorizes additional regulatory actions. The following is a brief description of the most significant of those actions.

Emission Standards for New Vehicles

The Clean Air Act sets levels of acceptable exhaust emissions from all mobile sources. They are divided into standards for on-road vehicles and standards for nonroad vehicles, engines, and equipment. On-road vehicles, sometimes called "highway vehicles," include cars and light trucks, heavy trucks, buses, and motorcycles.

Until 2004, standards for controlling tailpipe emissions from cars and light trucks were divided into five categories, allowing different levels of emissions from different weight vehicles. This standard has been phased out in favor of Tier 2 standards which divide vehicles into 11 "bins" ranked from cleanest to dirtiest, rather than weight. Manufacturers can make vehicles which fit into any of the bins, but still must meet average targets for their entire fleets. Additionally, the dirtiest three bins were phased out at the end of 2008.

Trucks, buses and other heavy-duty highway vehicles are categorized differently because they use diesel engines. But Tier 2 standards also strengthened the requirements for pollution control technology in new trucks and buses. In addition, the

Tier 2 standards set limits on the amount of sulfur allowed in gasoline and diesel fuel, because sulfur can hamper the effectiveness of catalytic converters and particulate filters in engines.

The Tier 2 standards represent the first time that SUVs and other light-duty trucks are subject to the same national pollution standards as cars, and the first time that vehicles and fuels are dealt with simultaneously.

In addition to highway vehicles, nonroad vehicles, engines, and equipment are also a key source of air pollution. This includes aircraft, diesel boats and ships, gasoline boats and personal watercraft, nonroad diesel equipment (farm, construction, etc.), forklifts, generators, industrial equipment, lawn and garden equipment, locomotives, and off-road recreational vehicles (dirt bikes, snowmobiles, ATVs, etc.) The U.S. EPA has adopted emission standards for nearly all these nonroad categories. They are also separated into tiers, based on horsepower. The highest tier, Tier 3, regulates engines over 50 hp, with the standards similar to those for highway heavy-duty engines (like trucks and buses).

Furthermore, in 2004, the U.S. EPA promulgated Tier 4 standards, the Clean Air Nonroad Diesel Rule (www.epa.gov/cleandiesel), which changed the way nonroad diesel engines function and the way diesel fuel is refined to reduce emissions. To support this rule, as well as Tier 2 standards for on-road diesel engines, the U.S. EPA created funding opportunities to induce states to establish diesel emission reduction programs, and manufacturers to develop new technologies. These funds (Diesel Emission Reduction Program) are available through the State Clean Diesel Grant Program and the National Clean Diesel Campaign (U.S. EPA [8]).

Emission Standards for Existing Vehicles

Another aspect of the Clean Air Act's emission standards includes efforts to reduce air pollution from the existing fleet of vehicles. Many of these vehicles, especially diesel vehicles, are operated for 20 years or more.

The Clean Air Act required the implementation of inspection and maintenance (I/M) programs in certain ozone nonattainment areas across the country, including northeastern Illinois. These programs help identify on-road vehicles with high emissions that may need repairs. Owners of vehicles must have their vehicles tested periodically, every two years in northeastern Illinois, as a condition of renewing registration. Vehicles that fail the emissions test must be repaired, retested, and brought into compliance.

As described above, the Diesel Emission Reduction Program provides funds for diesel emission reduction projects. The grants support efforts to retrofit existing diesel vehicles with pollution controls, implement emission testing programs for diesel vehicles, create and implement anti-idling programs, and promote clean fuel alternatives like ultra-low sulfur diesel and compressed natural gas (U.S. EPA [8]).

Fuel Regulations

As a counterpart to regulating vehicles and their emissions, the Clean Air Act also regulates vehicle fuels. Some of these regulations are tied into the emission regulations described above (e.g., Tier 2 limits on sulfur). The U.S. EPA's first major fuel regulation

was the phase-out of lead in gasoline. By the summer of 1974, unleaded gasoline was available around the country, and by 1996, the use of leaded gasoline in on-road vehicles was finally banned. Under the Clean Air Act, the U.S. EPA has put into place standards to reduce other hazardous air pollutants from fuel.

The Clean Air Act requires that nonattainment areas like northeastern Illinois use reformulated gasoline. Reformulated gasoline reduces hydrocarbon emissions and hazardous air pollutants. One of the ways to reduce hazardous air pollutant emissions is to add ethanol; this is the technique used in most of the reformulated gasoline areas of the Midwest, including northeastern Illinois.

As described above in the subsections about regulating vehicle emissions, the Clean Air Act restricts the level of sulfur in gasoline and diesel fuel. The removal of sulfur from fuels allows the use of advanced emission control devices to further reduce emissions.

In addition to these regulations, the Clean Air Act encourages development and sale of alternative fuels, including ethanol, natural gas, propane, electricity, and biodiesel. These fuels can reduce vehicle emissions, can be made from renewable sources, and are often produced domestically.

Permit Programs

There are three major permit programs required by the Clean Air Act:

- Acid rain permits (called Title IV permits);
- Preconstruction permits (called New Source Review permits); and
- Operating permits (called Title V permits).

Stationary source air pollution can come from large facilities that can have thousands of potential emissions points, like chemical plants or oil refineries, or from smaller but more common stationary sources, like print shops or furniture manufacturers. Permit programs ensure that these stationary sources are regulated effectively for their emissions.

The acid rain program is a market-based system which grants emission allowances to sources, thereby putting a cap on the total. The new source review program requires that industrial sources install Best Available Control Technology (BACT) when they construct or modify their facilities. This assures that new emissions do not slow progress toward cleaner air in nonattainment areas, and advances in pollution control occur concurrently with industrial expansion. Thirdly, the operating permit program requires that major stationary sources obtain a permit that consolidates all of the applicable air quality requirements for the facility into one document, thereby reducing violations and improving enforcement. In Illinois, new source reviews and operating permits are issued by the state, through the IEPA, but minimum standards are set by the U.S. EPA. These sources receive a full compliance evaluation by the state office periodically, depending on the facility's size and importance.

Air Toxics Rules

Section 112(c) of the Clean Air Act requires that the U.S. EPA regulate source categories and subcategories that produce hazardous air pollutants. The law requires that the U.S. EPA promulgate technology-based emission standards and allow for possible addition of health-based standards.

The provisions require major sources of toxic air pollution to use "maximum achievable control technology" (MACT), which are methods of control currently being used by the best-performing sources of a particular pollutant. This ensures that both new and existing major sources will use the kind of technology that provides the best control of air toxics on an ongoing basis. A list of the sources with promulgated MACT standards can be found on the U.S. EPA website (www.epa.gov/ttn/atw/mactfnlalph.html).

In addition, the U.S. EPA has identified a list of 33 air toxics that pose the greatest potential health threat in urban areas, and then identified the area source categories that represent 90% of the emission of these 33 air toxics. This results in 70 area source categories, which are in the process of being regulated, as the U.S. EPA develops standards.

The Clean Air Act also requires the additional precaution of establishing "residual risk" standards within 8 years after the implementation of MACT, thereby limiting the amount of air toxic pollution emitted even with MACT.

All components of the Clean Air Act are constantly being updated and adjusted as science advances and more is learned about the quality of the air and the impacts of pollution.

Finally, the Clean Air Act has some ancillary impacts as well, in terms of education and information collection. The legislation led to the U.S. EPA creating the Air Quality Index (AQI), a tool which provides easily-understood data on local air quality and the health concerns for different levels of pollution. The U.S. EPA is also the clearinghouse for information, including AirData, the database used to create the results in Section 3, *Our Region's Air Quality*, and similar databases compiling information about hazardous air pollutants and major source locations.

Clean Air Interstate Rule

The Clean Air Interstate Rule (CAIR) is one of the first federal attempts to regulate air pollution that travels from one region to another. Although a part of it was recently vacated by the Supreme Court, CAIR currently remains in place after a federal appeals court ruling. Despite having "fatal flaws" in its regulations, the court concluded that CAIR should be kept in place on a temporary basis to preserve the environmental benefits. The regulations tighten the cap on sulfur-dioxide emissions and establish a new cap on emissions of nitrogen oxides, both under an existing cap-and-trade system (Peters and Talley).

Also vacated by the Supreme Court, the Clean Air Mercury Rule would have worked to reduce mercury emissions from power plants. Unlike CAIR, the vacature has not been reversed. The Clean Air Mercury Rule would have permanently capped and reduced a hazardous air pollutant, mercury. Like CAIR, the rule dealt with air pollution transport beyond a state's borders. However, in December 2006, the Illinois Pollution Control Board adopted a regulation requiring significant reductions in mercury emissions from Illinois coal-fired power plants. The regulation required that power plants reduce their mercury emissions by 90% beginning in January 2010. Sources unable to meet this requirement are, on a case-by-case basis, allowed to delay full compliance with the 90% reduction requirement until 2018, but are still required to implement certain mercury reduction programs as well as achieve significant additional reductions in both NOx and SOx emissions.

SAFETEA-LU

SAFETEA-LU (Safe Accountable Flexible Efficient Transportation Equity Act: A Legacy for Users) represents the largest surface transportation investment in US history, with guaranteed funding for highways, highway safety, and public transportation that totals over $244 billion. In addition to being the main source of funding and programming for improvements to the county's surface transportation infrastructure, SAFETEA-LU provides opportunities to mitigate the impacts of mobile source air pollution.

SAFETEA-LU and its predecessors created or enhanced the following programs, specifically targeting air quality:

Congestion Mitigation and Air Quality Improvement Program (CMAQ)
CMAQ provides funding in ozone and carbon monoxide nonattainment and maintenance areas. It pays for projects and programs which reduce transportation-related emissions or congestion. The language in SAFETEA-LU states that diesel retrofits and other cost-effective activities should be given priority. In 2009, approximately $90 million is apportioned for CMAQ in northeastern Illinois.

High Occupancy Vehicle (HOV) Lanes
SAFETEA-LU enhances and clarifies provisions governing the use and operation of HOV lanes. States set the requirements for what constitutes a HOV, and what vehicles are permitting to travel in HOV lanes (such as multiple-occupant, motorcycle, public transportation, low-emission or energy-efficient vehicles).

Safe Routes to School
This program seeks to enable and encourage children to walk and bicycle to school by making it more safe and appealing. The program works to support efforts that improve public health and safety, and to reduce traffic, fuel consumption, and air pollution within the vicinity of schools. Funds can be used for engineering (infrastructure) improvements as well as education and encouragement. The 2009 apportionment for the state of Illinois is approximately $7.5 million.

Interstate Idling Reduction Facilities
This provision allows States to provide idling reduction facilities for commercial vehicles (trucks) in rest areas on interstate rights-of-way, as long as it doesn't reduce the number of truck parking spaces.

In addition to these, SAFETEA-LU also includes significant new environmental requirements for the Statewide and Metropolitan Planning process; air quality and transportation conformity requirements will be described in later subsections.

National Environmental Policy Act (NEPA)

NEPA requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. Specifically, all federal agencies must prepare detailed studies which assess the impact of major actions on the environment. They must also consider alternatives during this decision-making process.

In terms of air quality, this translates into a need for government projects (e.g. the expansion of O'Hare International Airport) that would increase emissions to be accounted for in State Implementation Plans and conform with Clean Air Act regulations.

Federal Energy Policy

Air pollution is intrinsically linked to energy, as some of the primary sources of emissions are from energy production (e.g., power plants) and vehicle miles traveled. Efforts to increase energy efficiency and fuel economy and to use "clean" energy have direct air quality benefits as well.

Energy Policy Acts have been passed (in 1992, 2005, 2007) which focus on reducing greenhouse gas emissions and reducing dependence on foreign oil. Even so, these measures have promoted clean, renewable energy, and encouraged energy conservation and efficiency, thereby having air quality impacts. Some provisions of the Acts include:

- subsidies for wind and solar power generation,
- providing incentives for advances in technology for clean coal and nuclear generation,
- offering tax breaks for energy conservation,
- increasing fuel economy requirements, and
- modernizing the electricity grid.

The U.S. EPA also administers several fuel economy and emissions programs.

Fuel Economy Labels and Guide
The U.S. EPA and Department of Energy (DOE) have established a method to determine a vehicle's fuel economy for city and highway driving. This information is published annually in a Guide as well as posted on the window sticker labels of all new cars and light trucks.

CAFE
Corporate Average Fuel Economy (CAFE) is the required average fuel economy for a vehicle manufacturer's entire fleet of passenger cars and light trucks for each model year. This is done using information from the Fuel Economy Guide, but combining results from the city and highway test. Congress sets the CAFE standards for cars, the National Highway Traffic and Safety Administration (NHTSA), which is part of DOT, is responsible for establishing and amending the CAFE standards for trucks.

Gas Guzzler Tax
The Gas Guzzler Tax is imposed on manufacturers of new model year cars that fail to meet the minimum fuel economy level of 22.5 mpg. The tax is intended to discourage the production and purchase of fuel inefficient vehicles. It does not include minivans, sport utility vehicles or pick-up trucks, however.

Green Vehicle Guide
The U.S. EPA publishes emission information for all new model year cards and light trucks on a user-friendly website designed to help consumers choose a clean, efficient vehicle.

The State Role

State Implementation Plan (SIP)

Under the Clean Air Act, the U.S. EPA establishes the standards (NAAQS), but the states have the primary responsibility for achieving and maintaining them. The manner in which the NAAQS will be achieved, maintained, and enforced is outlined in a State Implementation Plan (SIP) for each given pollutant. A SIP is a collection of the regulations, programs, and policies that a state will use in each air quality control region within that state. Various SIP requirements and procedures are triggered depending on the degree of nonattainment of the NAAQS.

In addition, the SIP includes modeling to demonstrate that the efforts the state has adopted will improve air quality to the level of the NAAQS by the federally-specified attainment date. This modeling is known as the attainment demonstration. If the state has achieved the standards, then an analysis referred to as a "Maintenance Plan" demonstrates that it will continue to do so.

A state must involve the public in the development of the SIP, through hearings and opportunities to comment, then must get approval from the U.S. EPA. If the U.S. EPA finds the SIP incomplete or does not meet the Clean Air Act's minimum criteria, it is required to promulgate a Federal Implementation Plan (FIP) and impose sanctions. Therefore, it is in the best interest of the states to submit effective SIPs.

The Clean Air Act gives states broad discretion in crafting control measures to help attain the NAAQS, but each SIP must include several basic elements (CAA Section 110(a)(2)). The most significant include:

- Enforceable emission limitations and other control measures or techniques to meet the Clean Air Act requirements, and a program for enforcement of such measures. This can include economic incentives such as fees, marketable permits, and auctions of emission rights.
- Specific schedules and timetables for compliance. At least 80 percent of the commitments on the timetable must be in regulatory form in order to be approved by the U.S. EPA.
- Appropriate means to monitor, compile, and analyze ambient air quality data, and to make such data available to the U.S. EPA.
- Regulation of modifications and construction to any stationary sources, usually through a new source permitting program.
- Prohibition of significant contributions to nonattainment in other areas and interference with measures of SIPs of other states.
- Assurances regarding adequate resources (personnel, funding, and authority) to carry out the SIP.
- Adequate contingency plans, and authority for emergency powers if necessary.

(Martineau 2004)

Permitting

According to the SIP, the states are required to manage the permitting process called for by the Clean Air Act.

New Source Review is the process any new pollution source needs to go through in order to get permitted. It is separated into two sets of rules – those for construction or modification in a

nonattainment area, called Nonattainment NSR, or those for construction or modification in an attainment area, called Prevention of Significant Deterioration. Because the Northeastern Illinois Region is in nonattainment, the focus of this review is on the Nonattainment NSR. However, some sources may be subject to both; a review is necessary for each pollutant the facility emits.

NSR rules require that all major sources must complete an air quality analysis of ambient air quality and that a net air quality benefit from the project. Under NSR, the owner or operator is required to apply the lowest achievable emission rate, the most stringent emission limitation achieved in practice by such class or source without taking into account economic, energy, or other environmental impact analysis. Finally NSR requires offsets (either internal or external) if the proposed project has a potential to emit over 25 tons/year.

State Construction Permits are required for non-major projects to construct any new sources, or for modification of an existing source below the NSR/PSD thresholds. These sources will also need a State Operating Permit. There are three subcategories of Operating Permits: Lifetime State Operating Permits, Clean Air Act Permit Program (CAAPP) Permits, and Federally Enforceable State Operating Permits (FESOP).

The ***Clean Air Act Permit Program*** is the most comprehensive type of operating permit program. CAAPP permits are needed by any major source, or certain sources subject to U.S. EPA's New Source Performance Standards or National Emission Standards for Hazardous Air Pollutants (NESHAP), or any coal-fired utilities subject to acid-rain control requirements.

A ***Federally Enforceable State Operating Permit*** is an operating permit that contains conditions that can be enforced by the U.S. EPA. These conditions can set limits on the operations of the plant, effectively restricting the potential to emit a pollutant to below major source levels. A FESOP is available on a voluntary basis, and can be used instead of a CAAPP permit.

If a facility's potential to emit for each of the criteria pollutants and HAPs is below major source limits, or it is a new source not subject to CAAPP or FESOP, the facility may qualify for a ***Lifetime State Operating Permit***. This type of permit does not require renewal except by special request of the IEPA.

Emission Reduction Market System (ERMS)

The Illinois EPA's Bureau of Air is responsible for crafting the enforceable emission restrictions to meet Clean Air Act requirements. IEPA manages the state's Emissions Reduction Market System (ERMS), a "cap and trade" market system in which participating sources must hold "trading units" for their VOM emissions. ERMS came about in 2000 because Illinois had already adopted several rules requiring sources to implement measures to reduce VOM emissions, and any further "command and control" would have been extremely costly. As a consequence, the state adopted ERMS to minimize the cost of further VOM reductions.

The ERMS is directed at only large VOM-emitting sources in the Chicago nonattainment area; the sources must have baseline VOM emissions of 10 tons/season. They are required to obtain a CAAPP permit or a FESOP, if eligible, the mechanism by which allotments are established. A source may be exempt from ERMS if it requests a 15 ton/season VOM limit in its permit, or a reduction of 18% from its baseline emissions.

Inspection and Maintenance

Motor vehicle inspection and maintenance (I/M) programs are an integral part of the effort to reduce mobile source air pollution. The emission control systems in cars and trucks must be working properly in order to prevent air pollution; even minor malfunctions that don't impact the drivability of a vehicle can have serious air quality impacts. Therefore, it is important for the vehicles to inspected and maintained regularly, ensuring that their emission control systems are working effectively. The Illinois EPA administers the I/M program for the nonattainment areas within the state. The Clean Air Act requires emission test programs for these nonattainment areas.

In northeastern Illinois, most 1996 and newer gasoline-powered passenger vehicles, light and heavy duty trucks, and buses are subject to testing after they are four years old. The test must be repeated every other year after that as a condition of renewing the vehicle's registration. Some vehicles are exempt from this testing, including diesel-powered and electricity-powered vehicles. In addition, the Illinois Department of Transportation operates an inspection program for heavy-duty trucks. Not all areas with the Chicago nonattainment area are required to participate in the emissions testing; some rural sections of Kane, Kendall, McHenry, and Will counties are exempt. If a vehicle fails the test, it will need to be repaired and re-tested.

Monitoring and Reporting

The Clean Air Act requires that states monitor air quality in addition to their responsibility for enforcement. Illinois submits its annual air monitoring network plan each calendar year to the U.S. EPA. The plan details the monitoring network for the six criteria pollutants, and outlines which monitoring sites fall under each of the different monitoring categories: NCore (national trend sites), SLAMS (state and local air monitoring sites), SPM (special purpose monitors), $PM_{2.5}$ speciation sites (trend and State), and PAMS (photochemical assessment monitoring sites). The plan also includes specific site information about each sampling location, objectives, spatial scale, sampling schedule, and equipment used.

The monitoring is, at its core, used to determine if the state's air meets NAAQS. The results of the monitoring are submitted to the U.S. EPA's AirData website, and compiled with national data.

Furthermore, the monitoring results inform the Air Quality Index on a daily basis. The Air Quality Index synthesizes the complex monitoring data into user-friendly descriptor categories portrayed by colors (e.g., green is good, brown is hazardous); the program also identifies the critical pollutant for each day, and forecasts the Air Quality Index for tomorrow. These results are portrayed by AirNow, a national website showing real time information about air quality, as well as on the IEPA website. AirNow even allows visitors to sign-up for email, cell phone, or pager air quality notices specific to them.

In addition to this, Illinois puts out an Annual Air Quality Report for the state. It summarizes detailed monitoring data from the network, shows comparisons to the air quality standards, and portrays trends over time.

The Regional/Local Role

Chicago Metropolitan Agency for Planning (CMAP)

Conformity

Transportation conformity is a way to ensure that Federally-funded transportation activities are consistent with air quality goals. It ensures that these transportation activities do not worsen air quality or interfere with the purpose of the SIP, which is to meet the NAAQS (FHWA, 2008). Meeting the NAAQS often requires emissions reductions from mobile sources, so conformity ensures that the transportation emissions meet the requirements established in the SIP. Control strategy SIPs contain annual on-road motor vehicle emissions budgets related to the air quality plan being developed. These budgets cap the region's level of emissions from the implementation of transportation plans and programs. As the regional MPO, CMAP plays a key role in attaining air quality standards.

Developed by the MPO, the transportation plan and the transportation improvement program (TIP) guide long- and short-term transportation investments. A regional emissions analysis is performed to demonstrate the consistency of the transportation plan and TIP with the SIP motor vehicle emissions budgets. This analysis forms the basis for the conformity determination, measuring the emissions impact of the plans' projects, and weighing that against any proposed transportation control measures.

Conformity applies to transportation plans, transportation improvement programs (TIPs), and projects funded or approved by the Federal Highway Administration (FHWA) or Federal Transit Administration (FTA) in nonattainment areas. In northeastern Illinois, the Metropolitan Planning Organization (MPO) Policy Committee makes conformity determinations, which are then approved at the Federal level by the U.S. Department of Transportation (FHWA/FTA). Conformity is met if the total emissions for a plan or program are within the emission budgets established by the SIP. If a SIP has not been submitted for a NAAQS, U.S. EPA has established interim standards that must be met instead.

If a region cannot meet air quality standards on the basis of projects in its plan and TIP, then it may choose to adopt transportation control measures (TCMs). These are additional projects specifically designed to help meet the NAAQS. Some examples include: transit improvements, HOV lanes, employer-sponsored programs to permit flexible work hours, signal light timing, bicycle and pedestrian facilities, or land use planning. TCMs are included in the SIP, and thus are legally enforceable. The MPO must ensure that any transportation control measures are implemented in a timely fashion. When projects in the TIP affecting air quality are amended, a determination of conformity must be made, and if it is not made, Federal funding is restricted.

Congestion Mitigation and Air Quality Improvement Program (CMAQ)

The CMAQ program is jointly administered by the FHWA and the FTA; it was first authorized under ISTEA, and renewed in subsequent transportation authorizations. In SAFETEA-LU the program is authorized for over $8.6 billion dollars in federal funds from 2005-2009. The funds go to States to invest in projects that reduce congestion and criteria air pollutants created by transportation-related sources. In states with nonattainment areas, like Illinois, funding must be used to improve air in those nonattainment areas. Distributing funds is done through a formula which considers an area's population and severity of its air pollution. Our region receives approximately $90 million annually from CMAQ funds, which are programmed by CMAP through its Board and MPO Policy Committee.

Regional Planning

In addition to these aspects of federal and state legislation, as a regional planning agency, CMAP plays a role in promoting actions with air quality benefits. Among other things, the agency works to promote open space protection, reduce congestion, encourage biking and pedestrian amenities, increase transportation efficiency, and redevelop underutilized land – all efforts which have air quality impacts.

Lake Michigan Air Directors Consortium (LADCO)

As described in Section III: *Our Region's Air Quality*, air pollution doesn't just impact our seven-county region, but flows across our borders. The states of Illinois, Indiana, Michigan, Wisconsin, and Ohio form the Lake Michigan Air Directors Consortium (LADCO), a non-profit organization with the express purpose of analyzing and providing technical input on the larger region's air quality. LADCO's major pollutants of concern are ozone, particulate matter, and regional haze and their precursors; however, problems related to other pollutants (such as air toxics) may also be assessed. LADCO receives funding from the U.S. EPA and from the member states.

The consortium plays a key role as the framework for coordination on the upper Midwest's air pollution problems. LADCO fosters cooperation among the states, combining resources, sharing data, and collaborating on technical activities. This cooperation has led to advanced technical expertise and modeling, supporting policy-making throughout all member states.

Local Enforcement

In addition to state permitting, local governments sometimes elect to permit smaller, area sources of air pollution such as dry cleaners or auto paint shops. In northeastern Illinois, Cook County's Department of Environment and the City of Chicago's Department of Environment both have additional permitting programs to handle the large concentration of area sources within the city limits and suburban Cook. Both permitting programs are funded through an annual state grant, essentially transferring enforcement powers of the Clean Air Act down from the state to the county and the city.

The County requires installation permits (similar to State Construction Permit) for anything that has an emission unit, with no exemptions – from small water heaters to large industrial equipment. Anything overlapping with State permitting requirements is usually deferred to the State for approval, but also requires a County permit. Once equipment receives an installation permit, it is required to be inspected every year thereafter to receive its annual certificate of operations (similar to the State Operating Permit).

The City requires permits for any (non-major source) industrial process/control equipment. Like the County, permitting is a two-step process: an installation permit is needed (similar to the State Construction Permit) for any new source, and registration for certificate of operations (similar to the State Operating Permit) is needed annually. In addition to the permitting, the City inspects these sources regularly, supporting the State's responsibility to enforce SIP requirements.

V. Current Voluntary and Supplemental Efforts

Although heavily regulated and monitored, air pollution is a persistent issue that is also addressed by voluntary efforts. There are non-government organizations dedicated to working for cleaner air, as well as government-sponsored air quality programs targeting private business and citizens. Like the prior section, this section describing current voluntary and supplemental program for clean air is organized into national, state, and local efforts.

National Efforts

Commuter Choice

Developed by the Association for Commuter Transportation and the Transportation Demand Management Institute, and funded by the U.S. EPA and the U.S. DOT, Commuter Choice (www.commuterchoice.com) is a website and service dedicated to linking employees and employers with transportation providers. By providing detailed information about all the transit, biking, carsharing, telecommuting, and other commuting options available to an employee, the service helps reduce driving during peak times, thereby cutting down on air pollution. The website also helps employers use financial mechanisms to promote these choices as perks to their employees. Commuter Choice has more recently been working with school districts and developers and communities to provide connections to alternative transportation options in a variety of capacities.

ENERGY STAR©

In 1992, the U.S. EPA introduced ENERGY STAR© (www.energystar.gov) as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. It is a joint program of the U.S. EPA and the U.S. Department of Energy. Computers and monitors were the first labeled products, but now the ENERGY STAR© label is on over 50 product categories including major appliances, office equipment, lighting, and home electronics. It has recently been extended to include new homes, commercial and industrial buildings, and home improvement. In addition to the labeling program, the ENERGY STAR© program has partnerships with more than 12,000 private and public sector organizations, providing technical information and tools to help organizations and consumers choose energy-efficient solutions. By making improvements in energy efficiency, there is a decrease in demand for electrical power generation, resulting in less burning of fossil fuels.

Clean Air Markets

A division of the U.S. EPA, the Clean Air Markets Division manages various market-based regulatory programs designed to improve air quality. The focus is to cost-effectively lower emissions through the operation and evaluation of “cap and trade” and similar programs. The most well-known of these programs are U.S. EPA’s Acid Rain Program and NOx Programs, which reduce emissions of sulfur dioxide (SO_2) and nitrogen oxides (NOx). In addition to designing these programs, the Clean Air Markets Division also researches emission control technology and monitoring, assesses the impacts of the programs on the environment, public health, and economy, and runs public education campaigns (U.S. EPA [3]).

Fuel Economy Guide and Green Vehicle Guide

The U.S. EPA and U.S. Department of Energy produce the Fuel Economy Guide to help car buyers choose the most fuel-efficient vehicle that meets their needs (Fuel Economy Guide, 2009). Fuel economy has a direct relationship to air quality, with vehicles boasting better fuel economy also having lower air quality impacts.

As an impartial ranking of all vehicles' fuel economy, the Guide serves to minimize manufacture bias and provides a service to consumers. In addition, the fuel economy estimates generated by the guide are posted as labels on cars for sale. This raises awareness of the importance of fuel economy, as well as providing an opportunity for competition to increase fuel economy among manufacturers.

Using the Fuel Economy Guide, the U.S. EPA's Green Vehicle Guide is an online tool providing information about the environmental performance of vehicles and giving the user the ability to search, sort, and compare vehicles (U.S. EPA [5]). In addition to fuel economy, the vehicles are ranked on their "air pollution score" and "greenhouse gas score." If a vehicle scores well in all environmental performance categories, it is given the SmartWay designation; if it scores even higher, it can achieve a SmartWay Elite designation. The Green Vehicle Guide is a one-stop-shop for users interested in learning more about the air quality impacts of their current vehicle or one they want to purchase. It makes a difficult concept user-friendly.

Diesel Emission Reduction Program/National Clean Diesel Campaign

The U.S. EPA established the National Clean Diesel Campaign (NCDC) to promote diesel emission reduction strategies. It includes incentive programs to address the millions of diesel engines already in use. Although new diesel engines are subject to tighter emission standards, older engines may stay in use for a very long time. Therefore, these NCDC programs to address emissions from existing diesel engines can have a significant impact. In conjunction with state and local governments, public interest groups, and industry partners, the NCDC set up several specific programs to provide technical and financial assistance to stakeholders interested in reducing their fleet's emissions (U.S. EPA [8]).

The U.S. EPA determined there were general sectors that provided the best opportunity to obtain significant reductions – over-the-road, agriculture, construction, and ports. School buses were identified as an area where diesel emission control can greatly help a susceptible population (U.S. EPA [4]). Furthermore, the SmartWay program also certifies "green" diesel engines for freight, and provides innovating financing options to incent purchasing these certified engines.

State Efforts

Illinois Green Fleets

Illinois Green Fleets (www.illinoisgreenfleets.org) is a voluntary program in which Illinois businesses, organizations, and local governments gain recognition and additional marketing opportunities for having "green," domestic, renewable fuel vehicles in their fleet. Fleets with a percentage of vehicles using natural gas, propane, 85% ethanol (E-85), electricity, biodiesel, or other clean, American fuels will qualify. The program is administered by the IEPA, partnering with the *Chicago Area Clean Cities* coalition in the northeastern Illinois region.

The *Illinois Green Fleets* program also helps interested fleet owners learn about the economic benefits of having a green fleet and the resources available to do so. It provides assistance with the many federal, state, and local government incentives as well as manufacture incentives that minimize upfront capital costs for vehicles and alternative fuel infrastructure.

Illinois Clean School Bus Program and Clean Diesel Grant Program

Similar to the National Clean Diesel Campaign's Clean School Bus program, IEPA developed the *Illinois Clean School Bus Program*. The program provides funding assistance to schools/school districts to retrofit existing diesel-powered buses or purchase new buses, thereby reducing emissions. The program creates partnerships between the business community, IEPA, and the school districts (IEPA, 2008). Additional information can be found at www.illinoisgreenfleets.org.

Maximum Achievable Control Technology (MACT) Training

In conjunction with the Lake Michigan Air Director's Consortium (LADCO) and U.S. EPA Region V, IEPA offers quarterly trainings on MACT standards. As described in Section IV, the Maximum Achievable Control Technology (MACT) standard is a level of control for sources of hazardous air pollutants. These quarterly trainings seek to educate a large number of field inspectors, engineers, and small business owners on the most recent developments and changes in the laws governing various MACT standards, as they vary by source category and pollutant.

Regional/Local Efforts

Partners for Clean Air

Partners for Clean Air (www.cleantheair.org) is a regional coalition of businesses, transportation organizations, health advocacy groups, and local governments in metropolitan Chicago and northwest Indiana. Partners signing a pledge and voluntarily take actions to reduce air pollution. Citizens can also become partners by following a "Top 12 Tips" list which includes simple, voluntary actions to reduce air pollution.

Partners for Clean Air also issues "Air Pollution Action Days," days when the daily Air Quality Index forecasts unhealthy levels of ozone or particulate matter. On these days, various media outlets are notified and report the alert to the public, partner businesses and organizations inform their employees, and alerts go out to via e-mail to subscribers.

The *Partners for Clean Air* website is also a source of information, posting the Air Quality Index and the Air Pollution Action Days when they occur. The Partners also sponsors a fun public-outreach campaign, championed by the character Breathe Easy Man.

Chicago Area Clean Cities

The *Chicago Area Clean Cities* (www.chicagocleancities.org) coalition is a voluntary organization dedicated to encouraging the use of clean fuels and clean vehicle technologies in the Chicago metropolitan area and throughout Illinois. *Chicago Area Clean Cities* is a part of the U.S. Department of Energy's *Clean Cities* program, and one of 89 similar programs across the country. Coalition members represent government, businesses, educational and research institutions, fuel providers, utilities, and environmental organizations. The coalition works in a

variety of ways to promote clean fuels. It coordinates efforts to implement clean fuel projects, supports legislation that promotes clean fuels and technology, and educates the public and regional fleet operators about the benefits of clean fuels and technology.

Clean Air Counts

Clean Air Counts (www.cleanaircounts.org) is a public-private initiative to voluntarily improve air quality in the Chicago metropolitan region. Managed by the Metropolitan Mayors Caucus, it is a collaboration with the City of Chicago, U.S. EPA Region V, and IEPA; it is funded by the U.S. EPA and several foundations, and has many other regional partners.

Clean Air Counts seeks to achieve specific and significant reductions in targeted air pollutants and major reductions in energy consumption. Most of the strategies are voluntary, but include incentives to encourage source reductions that traditionally have been difficult to target, such as non-regulated businesses, local government, and individual households. Joining the campaign means that individuals and organizations make a commitment to undertake voluntary efforts to reduce emissions, and agree to annual reporting of their strategies. *Clean Air Counts* tries to quantify the impacts of these strategies, thereby monitoring the region's progress toward achieving attainment. The campaign has an education component, publishing policy papers and tools online to help communities assess the impact of potential air quality improvement policies.

City of Chicago

Alternative Fuel Program

The City of Chicago, with partners in the Chicago Area Clean Cities coalition and the Metropolitan Mayors Caucus, is working to use alternative fuel vehicles in municipal fleets. Using CMAQ funds, the City is building 25 private alternative fueling stations, providing compressed natural gas, E-85 (85% ethanol gasoline), propane, and biodiesel.

Diesel Retrofit Program

Chicago's Department of Environment is retrofitting a portion of the City's diesel-powered fleet using oxidation catalysts (catalytic converters). Oxidation catalysts reduce particulate matter emissions by 20-30%, hydrocarbons by 50%, and carbon monoxide by 40%. The Department plans to retrofit the City's entire diesel fleet over time, pending funding availability. The project also uses CMAQ funds.

Locomotive Retrofit Program

In a recent pilot project, the Chicago Department of Environment partnered with the U.S. EPA, a private emission control device manufacturer, and three railroad companies to test the benefits of a new locomotive technology (GenSet engines) designed to reduce idling, thereby saving fuel and improving air quality.

In this project, seven switchyard diesel locomotives were repowered with GenSet engines. The new technology allowed the locomotive engines to use only a fraction of full power when idling or pulling lighter loads. It reduces emissions, as well as fuel and oil consumption, noise, and maintenance costs.

Little Village Environmental Justice Organization

The Little Village Environmental Justice Organization (LVEJO) is a community-based organization in the Chicago neighborhoods known as Little Village and Pilsen. This area makes up the second largest Mexican-American urban area in the country, and is one of the most densely populated areas in Chicago. Concerned with air quality and other environmental health issues, LVEJO was formed in 1997. The organization has since worked on several campaigns concerning air quality.

One priority is the cleaning up of two coal-fired power plants in the neighborhood. LVEJO was instrumental in working with the governor to establish the Illinois Clean Air Mercury Rule, which could shut down both plants by 2015. LVEJO has continued, however, to put pressure on the City to clean-up the plants prior to this deadline.

With a grassroots approach, LVEJO has organized hundreds of residents to demand enforcement by local emitters and polluters. It has found success by negotiating "good neighbor agreements" with local businesses, using the press to motivate City officials, and partnering with local universities.

LVJEO has also used Freedom of Information Action requests to track the records of 64 local businesses, including emissions data. LVEJO has compiled this information into a data source for neighborhood residents to monitor and advocate for improvements in the performance of local businesses. The organization has become a specialist in providing access to information, and has branched out to advocate for several other environmental causes.

Private Efforts

Chicago Climate Exchange (CCX)

CCX operates a self-regulatory cap and trade exchange for greenhouse gas emissions in North America. CCX emitting members make a voluntary but legally binding commitment to meet annual greenhouse gas emission reduction targets. Those who reduce their emissions below the targets then have surplus allowances to sell or bank; those who emit above the targets comply by purchasing CCX contracts. This is the first "carbon-trading" program of its kind in North America. Although focused on action on climate change, the emission reductions have air quality benefits as well.

VI. Conclusions and Potential Next Steps

Air quality is a regional issue with far-reaching impacts. This snapshot report looks at the issue through a regional lens, in an attempt to understand current air quality sources, conditions, regulations, and efforts specific to northeastern Illinois. Exploring each aspect of air quality proved to be a complex task, but some conclusions can be drawn.

Air Quality and Long-Range Planning

This report has shown that the region has made progress in improving air quality, but there is still much work to be done. Federal standards have been strengthened over time, requiring continual improvement of air quality. There is no reason to expect that this trend will stop. It is likely that standards will be tightened between now and 2040, requiring the region to consider new and innovative solutions to improve air quality.

Furthermore, the northeastern Illinois region is forecasted to grow by 2.8 million people in the next 30 years. This increase in population has the potential to result in an increase in air emissions and pollution. Yet it would be unrealistic to rely solely on advances in technology to counteract this increase. Coupled with a tightening of standards, this increase in emissions could prove a difficult regional issue in the future.

As these considerations show, even though the region has improved its air quality over time, it is still a critical issue that must be directly addressed in long-range planning.

Understanding Current Conditions and Sources

Historically, controls implemented nationally, such as vehicle emissions and fuel standards, have provided much of the improvements in air quality. Continued improvements in these controls will benefit this region and other parts of the country without placing any one region at a "competitive disadvantage" or placing industry in the position of making different products for different parts of the country solely for air quality purposes. The region should encourage continued federal leadership on the issue of air quality, and should expect and support continued improvements in air quality requirements.

There has been a general improvement in ozone levels in the region, but the multi-state nature of the problem means that status of areas downwind of the region must also be considered. In these areas, unacceptable ozone levels are expected to persist for a number of years.

Also, with the stricter ozone standard now in place, the region may have to turn toward measures beyond the types currently in place. Specifically, greater reductions from area sources and off-road mobile sources may be required. It may also be necessary to consider behavioral approaches for on-road sources, such as ride-sharing programs, or commute trip reduction efforts. These could be voluntary measures, or "controls," the requirements mandated by regulators to prevent air pollution.

The overall reduction in ozone throughout the region continues, as shown by the fact that IEPA is currently in the process of seeking an attainment classification for the 8-hour, 0.08 ppm ozone standard for northeastern Illinois.

In comparison to ozone, particulate matter is still a relatively new air quality concern in the region. Monitoring data is limited because of the short amount of time this pollutant has been

tracked. At this point, data shows slightly declining levels of regional $PM_{2.5}$. In addition, although source data is also limited, it points to area sources as the largest contributor. This may suggest that efforts to improve air quality will need to expand beyond the traditional on-road transportation sector that has been the focus of regional planners.

For public understanding of regional air quality, the AQI may be best method for tracking progress. With daily measurements, and designations based on NAAQS, it is an excellent resource for assessing air quality (both $PM_{2.5}$ and ozone) throughout the region.

Potential Additional Efforts

In general, the public sector can use four different types of implementation actions to accomplish goals: education, regulation, incentives, or direct investment. Currently, air quality is regulated heavily in a "top-down" manner – primarily due to the Clean Air Act and the states' obligation to uphold it. But there are some examples throughout the country of additional efforts that can be administered at a regional or local level. The following is a preliminary list of these potential efforts.

Grassroots Efforts
As evidenced by the progress made by LVEJO (see Section V: Regional/Local Efforts), grassroots efforts can have a significant impact on air quality. Local organizations can help enforce the Clean Air Act and its associated regulations, by tracking and monitoring emitters in their neighborhoods. They can develop creative partnerships with other organizations and schools or universities, be a resource for information about air pollution, and create campaigns to encourage reduced emissions in their neighborhoods. CMAP could support the work of these community organizations, especially through the provision of data as well as analysis and mapping tools, so neighborhoods can become their own advocates for cleaner air.

Land Use Planning
It is important to consider how land use decisions have air quality impacts. Transportation choices are connected to how land is developed, and when emphasis is placed on encouraging transit usage, walking, and bicycling, there are air quality benefits. CMAP's *GO TO 2040* plan is taking this into consideration on a regional scale, but land use and transportation planning must also consider air quality on a local scale. Again, CMAP could help foster local land use planning strategies that help improve air quality.

Vehicle Scrappage
Several regional and local agencies and governments throughout the country implement vehicle scrappage programs, offering monetary incentives to remove older vehicles from operation. These programs usually partner with salvage yards and auto recyclers to dismantle the vehicles and recycle the spare parts or metals. Some programs compensate vehicle owners, while others provide vouchers or other incentives.

Rather than taking older vehicles off the road, there is the potential to help clean them up instead. For example, the San Francisco MTC proposed a pilot project to retrofit vehicles older than 1994 in their 2030 plan.

Educating about Voluntary Retrofits

There are currently many voluntary programs in place to promote the retrofitting of older engines, both off-road and stationary. There is a potential for Clean Air Act regulations to start targeting these air pollution sources, as current regulations for point and on-road sources are showing improvements. Although retrofitting can be expensive, there are several grant programs available for these engine owners. There is a potential for local or regional agencies to help owners apply for these funds, especially in advance of any impending requirements.

Contract Leveraging
There is an opportunity to promote reduced emissions or cleaner vehicles by considering air quality impacts in awarding contracts. Administrators of funds could impose contract requirements that recipients use air pollution reduction technology while working on a contracted project. For example, although busing children to school does not have direct air quality benefits, the school system can require that recipients of busing contracts only operate alternative fuel school buses. In other cases, construction projects can be required, by contract, to use alternative fuel vehicles or clean diesel construction equipment as well, as has been done on at least some of the O'Hare expansion work. Contract leveraging can also be coupled with current air quality funding programs, like CMAQ or DERA, to ensure that the contractors are able to acquire the needed technology.

These strategies, and others like them, can all play a role in benefiting the region's air quality, if implemented. But they are likely complements to more rigorous and far-reaching federal and state policies regarding air quality.

Measuring Impacts

The *GO TO 2040* plan will use a set of indicators to track its progress toward achieving the goals set out in the Regional Vision. These include several for air quality, including the number of good air quality days per year, annual emissions of select pollutants, and participation by local governments, businesses, and other organizations in clean air programs.

In addition to tracking progress, a smaller set of indicators, including a measure of air quality, will be used to evaluate the impact of potential recommendations made in the plan. Any action recommended in the plan – including transportation improvements, land use and housing policies, environmental regulations, and others – will be evaluated to see how it affects these indicators. In this way, the recommendations of the *GO TO 2040* plan will be grounded in an understanding of their impacts.

Sources Cited

CATS, 1995. *A Clean Air Primer for Northeastern Illinois*. Chicago Area Transportation Study, Chicago, IL.

FHWA, 2008. *Transportation Conformity Reference Guide*. Federal Highway Administration. www.fhwa.dot.gov/environment/conformity/ref_guid/

Fuel Economy Guide, 2009. www.fueleconomy.gov

IEPA (1). Communication with Terry Sweitzer, June 2008.

IEPA, 2008. Bureau of Air website. www.epa.state.il.us/air

IEPA, 2007. *Illinois Annual Air Quality Report 2006*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2006. *Illinois Annual Air Quality Report 2005*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2005. *Illinois Annual Air Quality Report 2004*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2004. *Illinois Annual Air Quality Report 2003*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2003. *Illinois Annual Air Quality Report 2002*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2002. *Illinois Annual Air Quality Report 2001*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2001. *Illinois Annual Air Quality Report 2000*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

IEPA, 2000. *Illinois Annual Air Quality Report 1999*. Springfield, IL: Illinois Environmental Protection Agency Bureau of Air.

Lake Michigan Air Directors Consortium, 2002 (1). *Lake Michigan Air Directors Consortium Program Overview*. Nov 2002. www.ladco.org/about/factsheet1.pdf

Lake Michigan Air Directors Consortium, 2002 (2). *Ozone Trends in the Lake Michigan Region.* May 2002. www.airtoxics.org/reports/ladco/Ozone%20Trends%20in%20the%20Lake%20Michigan%20Area1.pdf

Lake Michigan Air Directors Consortium, 2004. *$PM_{2.5}$ in Urban Areas in the Upper Midwest.* Feb 2004. www.ladco.org/reports/ladco/PM25doc-urban1.pdf

Mark Peters and Ian Talley, "Court Reinstates Clean-Air Rule During EPA Fix," Wall Street Journal, December 30, 2008.
Robert J. Martineau, Jr. and David P. Novello, eds. 2004. The Clean Air Act Handbook. Second edition. American Bar Association – Section of Environment, Energy, and Resources.

U.S. EPA (1). "About AirData" www.epa.gov/air/data/info.html

U.S. EPA (2). "Air Toxics" www.epa.gov/ttn/atw/

U.S. EPA (3). "Clean Air Markets" www.epa.gov/airmarkets/

U.S. EPA (4). "Clean School Bus" www.epa.gov/cleanschoolbus/

U.S. EPA (5). "Green Vehicle Guide" www.epa.gov/greenvehicles/

U.S. EPA (6). "National Air Quality – Status and Trends Through 2006" www.epa.gov/air/airtrends/2007/report/trends_report_full.pdf

U.S. EPA (7). "National Ambient Air Quality Standards (NAAQS)" www.epa.gov/air/criteria.html

U.S. EPA (8). "National Clean Diesel Campaign" www.epa.gov/otaq/diesel/

U.S. EPA (9). "Ozone Pollution – Basic Information" www.epa.gov/air/ozonepollution/basic.html

U.S. EPA (10). "Particle Pollution – Basic Information" www.epa.gov/air/particlepollution/basic.html

U.S. EPA (11). "PM Standards" www.epa.gov/air/particlepollution/standards.html

U.S. EPA, 2007. *The Plain English Guide to the Clean Air Act.* April 2007. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC. Publication No. EPA-456/K-07-001. www.epa/gov/air/caa/peg/peg.pdf

Appendices

Appendix A – Additional Ozone Information

Ground-level ozone data included both 1-hour and 8-hour monitor recording intervals. One-hour data, used for the rescinded 0.12 ppm standard, was not analyzed. At the suggestion of the IEPA, the Sears Tower, 233 S. Wacker Drive, monitor site (17-031-0042-44201-02) was removed from the data set. This site is intended to monitor at over one-thousand feet above ground level and is used for research purposes (IEAP Staff, Direct Communication, 19 June 2008). Monitor sites with missing field values (e.g. missing arithmetic mean), were also omitted from the analysis.

Across the seven-county northeastern Illinois region for the period of 1978 to 2007, there were 606 usable data values. On average, slightly over 20 ground-level ozone monitors were active in each year over the 30 year period. A list of the locations of active 2007 sites is provided in Table 1, below.

Table 1: Active 2007 Ground-Level Ozone Monitoring Sites

County	Monitor #	Address/Location	City
Cook	17-031-0001-44201-01	4500 W. 123rd St.	Alsip
Cook	17-031-0076-44201-01	7801 Lawndale	Chicago
Cook	17-031-0072-44201-01	1000 E. Ohio	Chicago
Cook	17-031-0032-44201-01	3300 E. Cheltenham	Chicago
Cook	17-031-1003-44201-01	6545 W. Hurlbut	Chicago
Cook	17-031-0064-44201-01	5720 S. Ellis	Chicago
Cook	17-031-4002-44201-01	1830 S. 51st Ave.	Cicero
Cook	17-031-4007-44201-01	9511 W. Harrison	Des Plaines
Cook	17-031-7002-44201-01	531 Lincoln	Evanston
Cook	17-031-1601-44201-01	729 Houston	Lemont
Cook	17-031-4201-44201-02	750 Dundee Rd.	Northbrook
DuPage	17-043-6001-44201-01	Morton Arboretum	Lisle
Kane	17-089-0005-44201-01	665 Dundee	Elgin
Lake	17-097-1002-44201-01	Gold & Jackson	Waukegan
Lake	17-097-1007-44201-01	Camp Logan	Zion
McHenry	17-111-0001-44201-01	1st St. & Three Oaks	Cary
Will	17-197-1011-44201-01*	36400 S. Essex Rd.	Braidwood

** Denotes Background Site*
Source: Illinois Environmental Protection Agency Bureau of Air

Monitors 17-197-1011-44201-01 and 17-197-1007-44201-01, located in Braidwood, Illinois, were used as background monitors for ground-level ozone. Monitor 17-197-1007-44201-01 monitored background ground-level ozone intermittently from 1979 to 1994 (no values given for 1987, 1990, and 1991). Monitor 17-197-1011-44201-01 was used as a background monitor from 1995 to 2007. Monitor 17-197-1011-44201-01 is located at 36400 S. Essex Rd., Braidwood, Illinois. The now deactivated monitor, 17-197-1007-44201-01, was located within one half-mile of the 17-197-1011-44201-01 Braidwood site (IEPA Staff, Direct Communication, 25 June 2008).

For each year, the fourth-highest daily maximum 8-hour average ozone level were averaged across all active monitors located in northeastern Illinois. For purposes of comparing to the NAAQS, the 3-year average of the fourth-highest daily maximum 8-hour average ground-level ozone level was computed from the resultant metropolitan average. Data for the years 1976 and

1977 were obtained to calculate the 3-year average for 1978 and 1979. The results are displayed in Table 2 below.

Table 2: Northeastern Illinois Average Ozone Level and Fourth-Highest Daily Maximum 1978 – 2007

Year	Annual Fourth-Highest Daily Maximum 8-Hour Average Ozone level (ppm)	Annual Fourth-Highest Daily Maximum 8-Hour Average Ozone Level 3-Year Average (ppm)
1978	0.089	0.086
1979	0.078	0.083
1980	0.076	0.081
1981	0.080	0.078
1982	0.070	0.075
1983	0.093	0.081
1984	0.076	0.079
1985	0.077	0.082
1986	0.069	0.076
1987	0.093	0.082
1988	0.093	0.088
1989	0.080	0.090
1990	0.070	0.082
1991	0.084	0.078
1992	0.074	0.076
1993	0.066	0.074
1994	0.074	0.071
1995	0.089	0.076
1996	0.078	0.080
1997	0.080	0.082
1998	0.076	0.078
1999	0.084	0.080
2000	0.067	0.076
2001	0.077	0.076
2002	0.087	0.077
2003	0.073	0.079
2004	0.065	0.075
2005	0.081	0.073
2006	0.068	0.072
2007	0.077	0.075

Source: U.S. Environmental Protection Agency Air Quality System Database

Appendix B: Additional $PM_{2.5}$ Data

$PM_{2.5}$ data was provided in annual averages of 24-hour recording intervals. For the 1999 to 2007 time period, northeastern Illinois had 162 usable data values. On average, slightly less than 18 $PM_{2.5}$ monitors were active in each year over the nine year period. Monitoring sites with missing field values (e.g. missing arithmetic mean), were omitted from the analysis. A list of the locations of active 2007 sites is provided in Table 3, below.

Table 3: Active 2007 $PM_{2.5}$ Monitoring Sites

County	Monitor #	Address/Location	City
Cook	17-031-2001-88101-01	12700 Sacramento	Blue Island
Cook	17-031-0076-88101-01	7801 Lawndale	Chicago
Cook	17-031-0052-88101-01	4850 Wilson Ave.	Chicago
Cook	17-031-0050-88101-01	103rd & Luella	Chicago
Cook	17-031-0057-88101-01	1745 N. Springfield Ave.	Chicago
Cook	17-031-0022-88101-01	3535 E. 114th St.	Chicago
Cook	17-031-6005-88101-01	13th St. & 50th Ave.	Cicero
Cook	17-031-4007-88101-01	9511 W. Harrison	Des Plaines
Cook	17-031-1016-88101-01	50th St. & Glencoe Ave.	LaGrange
Cook	17-031-4201-88101-01	750 Dundee Road	Northbrook
Cook	17-031-3103-88101-01	4743 Mannheim Rd.	Schiller Park
Cook	17-031-3301-88101-01	60th St. & 74th Ave.	Summit
DuPage	17-043-4002-88101-01	400 S. Eagle St.	Naperville
Kane	17-089-0007-88101-01	1240 N. Highland	Aurora
Kane	17-089-0003-88101-01	258 Lovell St.	Elgin
Lake	17-097-1007-88101-01	Camp Logan	Zion
McHenry	17-111-0001-88101-01	1st St. & Three Oaks Rd.	Cary
Will	17-197-1011-88101-01*	34000 S. Essex Rd.	Braidwood
Will	17-197-1002-88101-01	Midland & Campbell	Joliet

** Denotes Background Site*
Source: Illinois Environmental Protection Agency Bureau of Air

As with ground-level ozone, the IEPA uses a Braidwood, Illinois monitoring site (17-197-1011-88101-01) as an indicator of background levels of $PM_{2.5}$ (IEPA Staff, Direct Communication, 25 June 2008). This site has been active since $PM_{2.5}$ monitoring began in 1999.

For each of the nine relevant years, the annual average annual arithmetic mean of the 24-hour average and the weighted annual mean were averaged across all active monitors located in northeastern Illinois. For purposes of comparing to the NAAQS, the 3-year average of the weighted annual mean was computed from the resultant metropolitan average. Years 1999 and 2000 were omitted from the 3-year average because data for $PM_{2.5}$ was absent before 1999. The results are displayed in Table 4 below.

Table 4: Northeastern Illinois Average Annual Mean of 24-hour Average and 3-year Average of Weighted Annual Mean of $PM_{2.5}$ Concentrations

Year	Average Annual Mean of 24-hour Average ($\mu g/m^3$)	3-year Average of Weighted Annual Mean ($\mu g/m^3$)
1999	17.06	-
2000	16.10	-
2001	16.04	16.5
2002	14.96	15.8
2003	14.30	15.2
2004	13.23	14.2
2005	15.81	14.5
2006	12.87	14.0
2007	14.05	14.3

Source: U.S. Environmental Protection Agency Air Quality System Database

No graph of average number of exceedances was produced. As previously mentioned, the *Air Quality System* database reports exceedances based on the 24-hour standard (3-year average of the 98th percentile of 24-hour concentrations of $PM_{2.5}$). The U.S. EPA did not report the exceedances of the annual arithmetic mean standard (3-year average of the weighted annual mean $PM_{2.5}$ concentrations). The U.S. EPA also did not report the 98th percentile of the 24-hour average – no derivation of the number of exceedances could be calculated. Only 2007 reported an average of 3.2 exceedances because of a change in the 24-hour standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$, which began that year. No previous year exceeded the 65 $\mu g/m^3$ standard.