

Draft  
The Unifour Strategic Air Quality Plan



2/11/10 Revision

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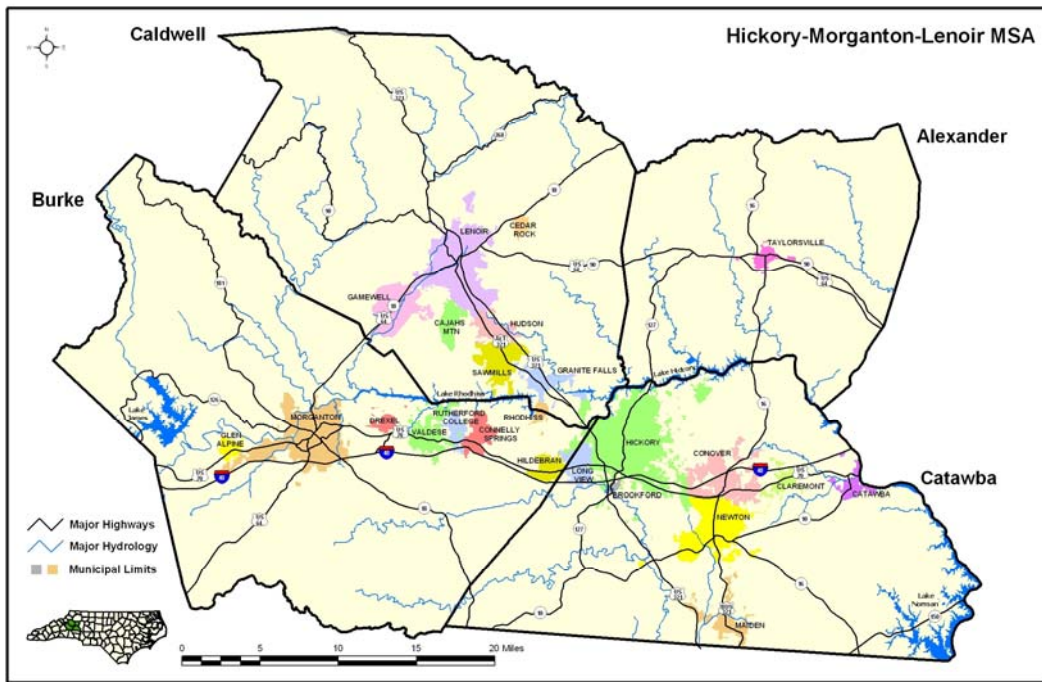
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# 1. Introduction and Background

## 1.1 Community Profile

The Unifour Counties (Alexander, Burke, Caldwell and Catawba) and the Western Piedmont Council of Governments are located in the foothills of North Carolina’s Blue Ridge Mountain range. This area is home to one of the State’s largest remaining concentrations of furniture and textile industries. Like much of the State and Southeast Region of the U.S., the Hickory Metro area has struggled to find a new economic identity after losing 43,000 jobs since January, 2001.



Furniture manufacturing and national trade has been a source of income for the timber-rich region of middle and western North Carolina since at least the 1880’s when sawmill owners began to realize that greater profits could be made by making furniture closer to the mill rather than shipping the raw input across state lines to finished and resold elsewhere. Along with the furniture trade other suppliers of dowels, hinges, varnishes, glues, casters, drawer pulls and so forth also flourished. By 1921, North Carolina had a permanent furniture exposition in High Point, and Hickory and the surrounding area also have similar exhibitions to show the latest designs and styles. Local artisans produced high quality and unique furniture products that sold from coast-to-coast and could be found in stylish London homes as well. A hundred years later what had started out as a valuable tool to generate much-needed income during the Reconstruction Era had translated into North Carolina in the early 1980’s acquiring the moniker “The Furniture

Capital of the World.” The 1990’s and early 2000’s have not been kind to the furniture industry, as the area has been witness to a number of downsizings and plant closures due to international trade policies and pricing structures that have made competition all but impossible. This has produced a strong sensitivity in the region to any potential threat to the remaining businesses that still employ many people in the area and indirectly support many other suppliers, shop owners, and retail businesses. Since any new or expanded business that might contribute significantly to PM<sub>2.5</sub> pollution has to undergo a “new source review,” this is seen – to borrow a word from the N.C. Governor – as a “dampening” factor on industry. Perhaps just as importantly, no government or business official wants their area to be perceived as having “bad air” for the sake of its residents as well as placing it at a competitive disadvantage relative to others in a regional market. Currently the area is attracting many retirees and transitioning to a service oriented economy.

## **1.2 The UAQC/UAQOC**

The Unifour Air Quality Committee (UAQC) is made up of stakeholders from the private and public sector that are dedicated to improving the air quality in the Unifour area. The Unifour Air Quality Oversight Committee members are comprised of ten elected officials from the Unifour (Alexander County, Town of Taylorsville, Burke County, City of Morganton, Caldwell County, City of Lenoir, Catawba County, City of Conover, City of Hickory, City of Newton). The 10 elected members are based upon the ten original EAC members. The UAQ was formed to make policy and financial decisions for regional air quality activities. Staff support for the UAQC and UAQOC is provided by the Western Piedmont Council of Governments (WPCOG). Funding for the UAQC/UAQOC activities is provided by the Greater Hickory Metropolitan Planning Organization (GHMPO), the Unifour Rural Planning Organization (URPO), and a small assessment of the 28 local governments in the region (based on population).

In January 1999 the WPCOG learned that Unifour Region’s ozone levels would violate the new EPA 8-Hour Standard. The following spring and summer public meetings were held with local governments, the North Carolina Division of Air Quality, Economic Development Corporations, Chambers of Commerce and other interested groups. In November 1999 the Catawba Air Quality Committee (CAQC) was formed. During the next four years the CAQC was expanded to include other regional members to form the Unifour Air Quality Coalition. The coalition eventually evolved into more formal Unifour Air Quality Committee (UAQC) and the Unifour Air Quality Oversight Committee (UAQOC) which is made up of stakeholders and elected officials from throughout the region.

## **1.3 Air Quality in the Unifour**

Ozone and particulate matter (PM) are two pollutants found in air that can cause harm to the health of people. (See attachments for the composition and affects of these

substances.) The Clean Air Act of 1990 passed by Congress directed the Environmental Protection Agency to issue regulations regarding these and other air quality issues. During the 1990's, the EPA conceived regulatory mechanisms requiring the states to submit plans and abatement strategies for ozone and PM to the EPA. Suits challenging the legality of EPA regulations were filed in the courts; thus, enforcement by the federal agency was delayed until the U.S. Supreme Court upheld EPA ozone and PM standards and clarified regulatory processes.

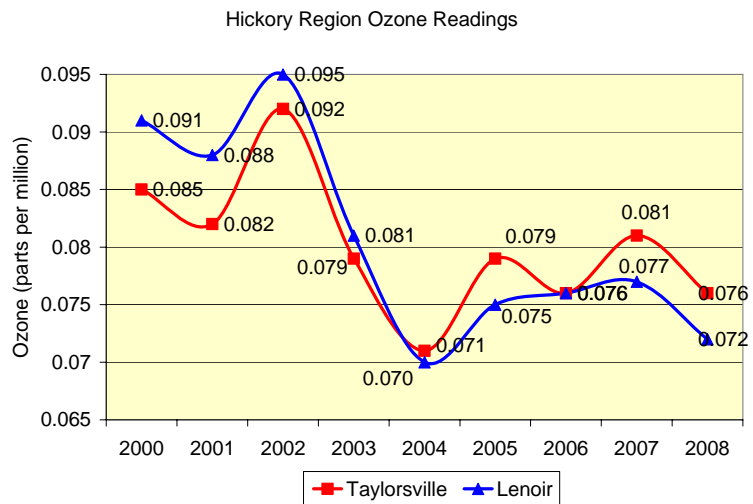
With the legal certification of the EPA's scientific methods and enforcement powers by the Court, the EPA directed the states to submit plans, which included designation of "non-attainment" and "attainment areas" within their borders. These "State Improvement Plans" must be approved by the Federal EPA. The N.C. Division of Air Quality (NCDAQ), part of the N.C. Department of Environment and Natural Resources (DENR) is the state agency with the authority and responsibility for plan submission to the Federal government.

### A. Ozone

Ozone can harm people's lungs, and EPA is particularly concerned about individuals with asthma or other lung diseases, as well as those who spend a lot of time outside, such as children. Ozone exposure can aggravate asthma, resulting in increased medication use and emergency room visits, and it can increase susceptibility to respiratory infections.

The United States has made significant progress reducing ground-level ozone across the country. Since 1980, ozone levels have dropped 21 percent as EPA, states and local governments have worked together to improve the quality of the nation's air. EPA expects improvement to continue, as a result of landmark regulations such as the Clean Air Interstate Rule, to reduce emissions from power plants in the East, and the Clean Diesel Program, to reduce emissions from highway, nonroad and stationary diesel engines nationwide.

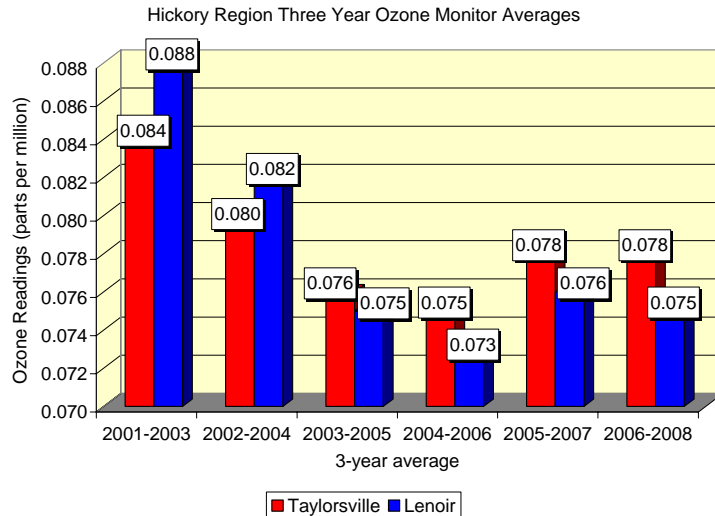
Ozone monitor readings that affect our area have been on the decrease since 1999 and since 2003 the levels have been lower than the federal standard. The Unifour would have been designated as non-attainment for ozone, if not for the development of an Early Action Compact (EAC). Our area worked with EPA and NC Division of Air Quality (DAQ) to adopt 14 local control measures to address ozone formation.



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Throughout the early 2000's we meet all our milestones are now in compliance as of early 2008. The newly proposed standards may put our area in jeopardy of non-compliance again. (information on new standards found later in document).

The Unifour has two ozone air monitors; one near Lenoir and the other in Taylorsville. Currently, the three-year average of ozone concentrations is under the 1997 8-hour air standard for both monitors. However, previous three-year averages (calendar year 2001-2003 and 2002-2004) indicated ozone levels above the acceptable federal level (see graphs). Therefore, the EPA designated the Unifour as a



“non-attainment” area in April 2004. The designation leads to penalties involving the loss of federal and state grant funds for road and transportation improvements as well as, additional requirements for locating new industry/business in the area. Beyond the direct economic impacts, the “non-attainment” label can cause people not to move to geographic location, which can hurt economic growth and employment opportunities, etc.

Although, the area was designated “non-attainment”, Catawba County and all other government jurisdictions, working under the structure of the Western Piedmont Council of Governments (WPCOG), formed a Unifour Air Quality Committee (UAQC), which has taken numerous proactive measures to inform the public about ozone levels and instruct the community about methods to abate the problem. The most significant and important measure was to enter into an Early Action Compact (EAC), which is an agreement signed by the EPA, DENR, and all Unifour local governments (see Local Control Measures and Catawba County Activities attached). The formal document, establishes a means for the entire Unifour to come into compliance with Federal EPA ozone standards at an accelerated pace. By entering into this agreement the Unifour avoided federal penalties until December 2007. The deferment was conditional upon no milestone being missed by local governments. If an EAC requirement is not achieved on time, the penalties immediately take effect.

Every milestone requirement in the Unifour EAC has been met within appropriate time frames. In fall 2007, the EPA announced that 14 regions around the U.S. (who had entered into EAC's) were ahead of schedule for ozone level reductions, the Hickory/Catawba County Unifour area was one of those recognized for its efforts and accomplishing a reduction. In April 2008, EPA will declare our areas officially in



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Although PM<sub>2.5</sub> has not been regulated for as long a time period as “coarse” particulates (PM<sub>10</sub>), it is considered to be an even graver threat to human health since the finer particles are more readily absorbed deeper in lung tissue. The health effects of being exposed to high levels of PM<sub>2.5</sub> are serious, and include decreased lung function, irregular heart function including heart attacks, and exacerbating pre-existing asthma conditions. The formation and transportation of PM<sub>2.5</sub> is still under considerable study, however, it is known that PM<sub>2.5</sub> has both primary sources and secondary sources. Secondary sources can be generated from fuel combustion working in conjunction with sunlight and water vapor. The primary sources of PM<sub>2.5</sub> pollution are many and varied: wood smoke from residential or commercial combustion; automobile exhaust in the form of oxides of nitrogen; coal-fired power plants; small engines; open burning of trash or construction debris; and dust from agricultural operations or open areas.

After several years of analyzing various health and scientific research studies, EPA issued fine particle standards in 1997. Since 1999, the local PM<sub>2.5</sub> readings have decreased steadily, however it is still above the annual standard and therefore puts our region in non-attainment status. Hickory and the whole of Catawba County were designated as a non-attainment area for PM<sub>2.5</sub> (fine particulate matter) by the USEPA in December, 2004. Once an area has been designated as non-attainment with regard to USEPA standards for a controlled pollutant, the area’s local and state governments typically respond to have the designation overturned or lessened (geographically in size or in severity of the designation), or, if it is clear that the designation cannot be ameliorated, they must work to develop and implement a plan to bring the area back into attainment with the national standard.

These standards were then revised in 2006. Currently, the yearly standard is set at 15 micrograms per cubic meter based on a three-year average of annual PM<sub>2.5</sub> concentrations. The 24-hour standard is currently 35 micrograms per cubic meter.

Within the Unifour area, only one official monitor tracks PM<sub>2.5</sub> levels. The monitor is located one block west of US 321 close to the water tank owned by the City of Hickory (see picture).



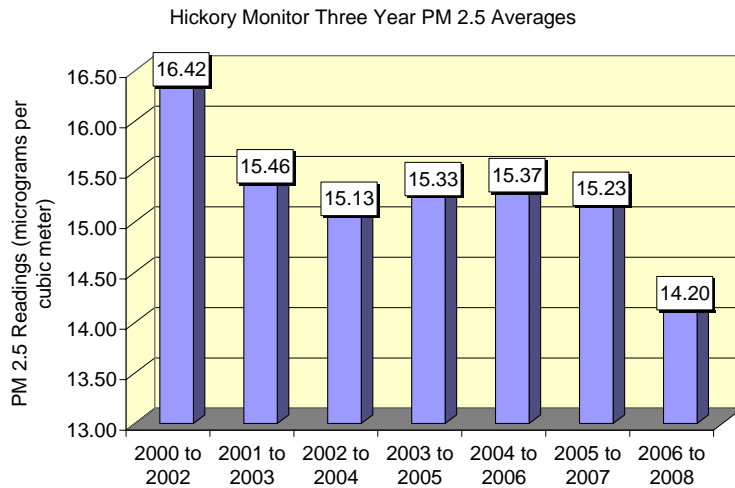
After adding 1,200 monitors across the country between 1997 and 2003, in April, 2003 EPA issued a memorandum to state governments showing the schedule for designating areas that were either in attainment or non-attainment for the

new standard. EPA would “designate an area non-attainment if it has violated the fine particle standards over a three-year period, or if relevant information indicates that it contributes to violations in a nearby area.” The three-year period was defined by EPA from 2001 to 2003.

The table shows the yearly readings for the Hickory monitor between 2001 and 2008. Monitor results reveal a decline in PM<sub>2.5</sub> levels from 15.98 in 2001 to 15.04 in 2003. The three-year average between 2001 and 2003, however, equaled 15.36, or just slightly above the standard. Since the monitor was above the standard, however, EPA initially recommended Catawba and a portion of Burke and Caldwell counties be deemed non-attainment for PM<sub>2.5</sub>. In February 2004, the NC Division of Air Quality (NCDAQ) recommended that only the part of Catawba County (defined as the portion of Catawba County within the boundary of the Greater Hickory Metropolitan Planning Organization) be deemed for non-attainment since Burke, Caldwell and the rural portion of Catawba County was not contributing the PM<sub>2.5</sub> problem. In December 2004 EPA made its final designations. It placed all of Catawba County in non-attainment status for PM<sub>2.5</sub> based on the three-year average between 2001 and 2003 being slightly above the 15.0 standard. Davidson and Guilford counties in North Carolina were also placed in non-attainment status.

Annual PM <sub>2.5</sub> Values for the Hickory Monitor, 2001-2008	
Year	PM <sub>2.5</sub> Values (Micrograms per Cubic Meter)
2001	15.98
2002	15.36
2003	15.04
2004	14.95
2005	15.95
2006	15.16
2007	14.60
2008	12.80

EPA, however, would place an area back in attainment if the 2002-04 average was less than the 15 standard. Even though data in 2004 had PM<sub>2.5</sub> values less than 15 micrograms per cubic meter, the three-year average for the area was 15.13, or .09 above the standard (see graph). In April 2005 the PM<sub>2.5</sub> designation for Catawba County was consequently published in the federal register.



In 2005 the annual PM level rose to 15.95 micrograms per cubic meter. After being above standard again in 2006, PM<sub>2.5</sub> levels fell to 14.60 micrograms per cubic meter in 2007 and fell again to 12.90 micrograms per cubic meter in 2008. The reduction in PM in 2007 and 2008 may have been caused by the addition of pollution scrubbers at the

Marshall Steam Station last year as well as traffic signal timing improvements and lower traffic congestion due to the weak economy.

As with ozone, the State is required to submit a State Improvement Plan (SIP). This plan details how the State will bring the area into attainment. The SIP submittal date is April 2008 (see chart on the next page). The attainment date for Catawba is April 5, 2010 based on data from 2007, 2008 and 2009. The low PM<sub>2.5</sub> reading 2007 bodes well for the region making attainment status in 2010.

In addition to the SIP, there are significant emission controls already underway including the Clean Smokestacks Act, vehicle emission testing, ultra low sulfur fuels and cleaner vehicle engines.

Not waiting on federal or state action alone, the UAQC has been active in determining the causes behind PM<sub>2.5</sub> in the Hickory area and creating solutions to reduce PM<sub>2.5</sub> levels. In 2007 the UAQC hired the Louis Berger Group as consultants to determine the causes of locally created PM<sub>2.5</sub> in the region. The study showed that wood smoke was a significant contributor to PM<sub>2.5</sub> as well as vehicle emissions and other point sources. The UAQC has also authorized Lenoir-Rhyne College through the Reese Institute for the Conservation of Natural Resources to conduct studies of residential wood smoke use near the water tower monitor.

### **C. Other Criteria Pollutants**

EPA sets National Ambient Air Quality Standards for four other criteria pollutants. They are carbon monoxide, sulfur oxides, nitrogen oxides, and lead. These pollutants can harm health and the environment. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards.

Carbon monoxide, or CO, is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It is a component of motor vehicle exhaust, which contributes about 56 percent of all CO emissions nationwide. Other non-road engines and vehicles (such as construction equipment and boats) contribute about 22 percent of all CO emissions nationwide. Higher levels of CO generally occur in areas with heavy traffic congestion. In cities, 85 to 95 percent of all CO emissions may come from motor vehicle exhaust. Other sources of CO emissions include industrial processes (such as metals processing and chemical manufacturing), residential wood burning, and natural sources such as forest fires. Woodstoves, gas stoves, cigarette smoke, and unvented gas and kerosene space heaters are sources of CO indoors. The highest levels of CO in the outside air typically occur during the colder months of the year when inversion conditions are more frequent. The air pollution becomes trapped near the ground beneath a layer of warm air.

Nitrogen dioxide (NO<sub>2</sub>) is one of a group of highly reactive gasses known as "oxides of nitrogen," or "nitrogen oxides (NO<sub>x</sub>)." Other nitrogen oxides include nitrous acid and nitric acid. While EPA's National Ambient Air Quality Standard covers this entire group of NO<sub>x</sub>, NO<sub>2</sub> is the component of greatest interest and the indicator for the larger group of nitrogen oxides. NO<sub>2</sub> forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO<sub>2</sub> is linked with a number of adverse effects on the respiratory system.

Sulfur dioxide (SO<sub>2</sub>) is one of a group of highly reactive gasses known as "oxides of sulfur." The largest sources of SO<sub>2</sub> emissions are from fossil fuel combustion at power plants (66%) and other industrial facilities (29%). Smaller sources of SO<sub>2</sub> emissions include industrial processes such as extracting metal from ore, and the burning of high sulfur containing fuels by locomotives, large ships, and non-road equipment. SO<sub>2</sub> is linked with a number of adverse effects on the respiratory system.

Lead (Pb) is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. As a result of EPA's regulatory efforts to remove lead from gasoline, emissions of lead from the transportation sector dramatically declined by 95 percent between 1980 and 1999, and levels of lead in the air decreased by 94 percent between 1980 and 1999. Today, the highest levels of lead in air are usually found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

## **2. Air Quality and Emissions**

### **2.1 Ozone**

#### **A. Assessment of Ozone Trends**

The NCDAQ is required to evaluate design value (DV) trends and ozone exceedance trends to determine if any of the EAC areas show increases in ozone formation. Specifically, the NCDAQ evaluated the following data as part of the air quality analyses:

- 8-hour Ozone Design Value Trends – Most recent design values (1 and 3 year average of the 4th highest 8-hour ozone average), compared to the trend in design values from the 2000 timeframe to present.
- 8-Hour Ozone Exceedances – Number of exceedances of the 8-hour ozone standard at each monitor in the EAC areas for the most recent ozone season, compared to the number of exceedances at each monitor from 2000 to present.

#### **8-hour Ozone Design Value Trends**

The Federal standard for ozone in 2000 until 2008 was 0.085 parts per million (ppm). The standard was lowered in 2009 to 0.075 ppm. Table X below shows the trend in 8-hour ozone values at monitors in Alexander and Caldwell County. The design values are presented in ppm, with design values exceeding the standard highlighted with bold lettering.

8-hour ozone values peaked in 2000, 2001, and 2002. There is a general decrease in the values following the 2002 period. Both areas have been below the 8-hour ozone standard since the 2003 period. The Unifour area saw continued decreases in the 2004 period as well, with a small increase in 2005 and 2007. As discussed further in the 2007 ozone season weather patterns section, the 2007 season was very conducive to ozone development, with warm temperatures and relatively little precipitation. 2009 showed the lowest number of all, which could be attributed to multiple factors, including traffic improvements, more precipitation, and a poor economy.

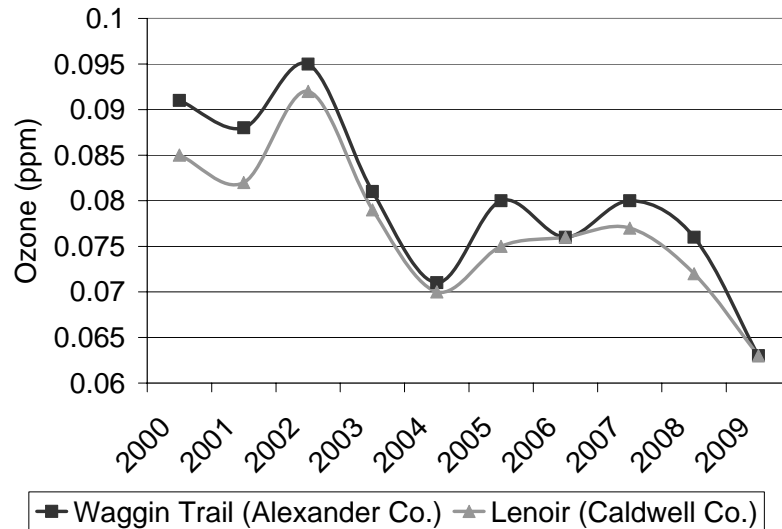
Monitor	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Waggin Trail (Alexander Co.)	<b>0.091</b>	<b>0.088</b>	<b>0.095</b>	0.081	0.071	0.080	0.076	0.080	0.076	0.063
Lenoir (Caldwell Co.)	<b>0.085</b>	0.082	<b>0.092</b>	0.079	0.070	0.075	0.076	0.077	0.072	0.063

Source: USEPA and NCDAQ, 2009.

Note: Data based on 0.085 8-hour federal ozone standard in 2000 to 2008 and the 0.075 parts per million standard in 2009. Grey shading are years that fourth highest 8-hour ozone value was higher than the federal standard. Federal ozone standards are currently under EPA review.

Figure X shows the 4<sup>th</sup> highest 8-hour ozone values for both monitoring sites within the Unifour area. As can be seen from the data, 2002 was a year in which high ozone was observed in both Alexander and Caldwell County. Since 2002, there have not been any instances where the 4<sup>th</sup> highest value was above the 8-hour ozone standard.

**Figure X.  
Unifour Area 4<sup>th</sup> Highest Ozone Values, 2000-2009**



Source: USEPA and NCDAQ, 2009.

### 8-Hour Ozone Exceedance Trends

Table X below shows the number of 8-hour ozone exceedances at monitors in Alexander and Caldwell County. The numbers exceeding the standard are highlighted with bold lettering.

The number of 8-hour ozone exceedances peaked during the 2002 season, in which 27 exceedances were observed at both monitors. Since 2002, exceedances of the 8-hour

standard have decreased dramatically. There have been no exceedances of the 8-hour ozone NAAQS in the last six years (2004-2009) at either monitor.

Monitor	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Waggin Trail (Alexander Co.)	7	5	17	1	0	0	0	0	0	0
Lenoir (Caldwell Co.)	4	2	10	3	0	0	0	0	0	0

Source: USEPA and NCDAQ, 2009.

Note: Data based on 0.085 8-hour federal ozone standard in 2000 to 2008 and the 0.075 parts per million standard in 2009. Grey shading are years that four or more exceedances occurred for that year. Federal ozone standards are currently under EPA review.

#### 4th Highest Value Trends

The design value is calculated by averaging the 4<sup>th</sup> highest 8-hour ozone value for each of three years. Since the design value is an average of three years, a decrease may be the result of one really good air quality year; or conversely, a increase may be the result of one bad air quality year. Therefore, looking at the trends of the 4<sup>th</sup> highest value can give insight as to how the air quality in an area is improving.

Table X displays the 4<sup>th</sup> highest 8-hour ozone 3-year averages for the Unifour area. Although there can be a great deal of fluctuation in the 4<sup>th</sup> highest value, the general trend since 2001-2003 has been downward. There was an increase in these values from 2005 to 2007, however these levels were still significantly lower than the 2001-2003 values. This downward trend continued with the 2007-2009 data. The 2009 value of 0.063 ppm for both monitors helped bring the 3 year averages below the 2009 standard of 0.075 ppm.

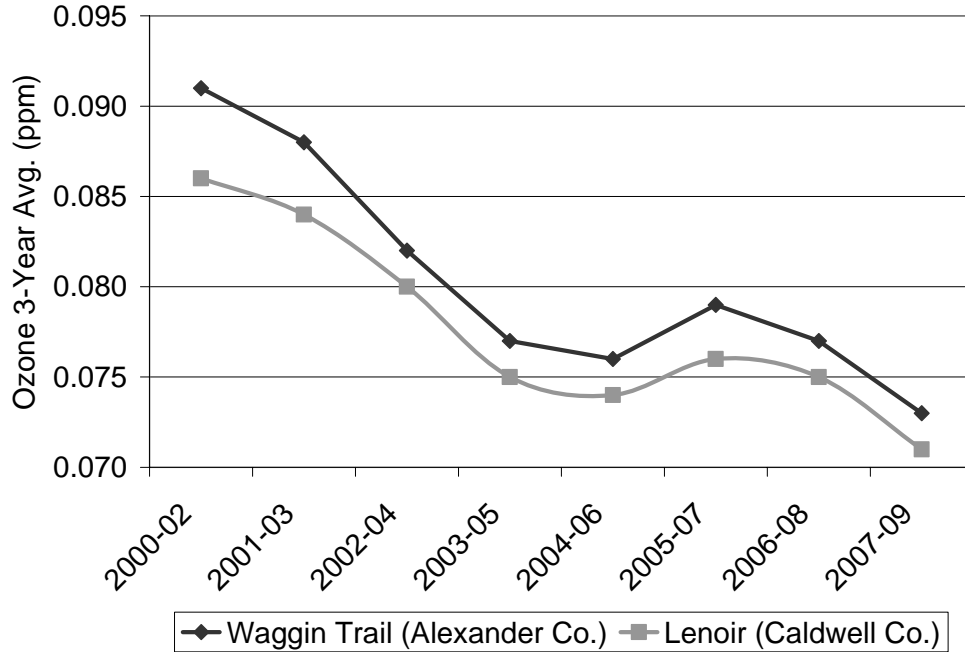
Monitor	2000-02	2001-03	2002-04	2003-05	2004-06	2005-07	2006-08	2007-09
Waggin Trail (Alexander Co.)	0.091	0.088	0.082	0.077	0.076	0.079	0.077	0.073
Lenoir (Caldwell Co.)	0.086	0.084	0.080	0.075	0.074	0.076	0.075	0.071

Source: USEPA and NCDAQ, 2009.

Note: Data based on 0.085 8-hour federal ozone standard in 2000 to 2008 and the 0.075 parts per million standard in 2009. Grey shading are violations of the three-year ozone federal standard (design value). Federal ozone standards are currently under EPA review.

Figure X shows the 4<sup>th</sup> highest ozone 3-year averages for both monitoring sites within the Unifour area. As can be seen from the data, as of the 2002-2004 season, the area has been in attainment of the 0.085 ppm federal ozone standard. Since 2002, there have not been any instances where the 4<sup>th</sup> highest value was above the 8-hour ozone standard.

**Figure X.**  
**Unifour Area 4<sup>th</sup> Highest Ozone 3-Year Averages (or Design Values), 2000-2009**



Source: USEPA and NCDAQ, 2009.

## **B. Early Action Compact Summary**

### **Overview of Unifour EAC Program**

On December 17, 2004, the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Air Quality (NCDAQ), submitted to the United States Environmental Protection Agency (USEPA) North Carolina's 8-hour ozone National Ambient Air Quality Standard (NAAQS) attainment demonstration for regions designated as Early Action Compact (EAC) areas. The EAC areas in North Carolina include the Cumberland County EAC area; the Mountain EAC area (Buncombe, Haywood, and Madison Counties); the Triad EAC area (Alamance, Caswell, Davidson, Davie, Forsyth, Guilford, Randolph, Rockingham, Stokes, Surry, and Yadkin Counties); and the Unifour EAC area (Alexander, Burke, Caldwell, and Catawba Counties).

Early Action Compact areas were given the opportunity to develop local control strategies to meet the 8-hour ozone NAAQS earlier than required by the Clean Air Act. In turn, the USEPA agreed to defer the effective date of the nonattainment designation for these areas. If an EAC area attains the 8-hour ozone NAAQS by December 31, 2007 and meets all of their EAC milestones, the USEPA will designate the area as attainment. The Mountain EAC area in North Carolina was designated as attainment in April 2004; however, the three counties listed above decided to continue their EAC agreement because of the public health benefits of the program. The December 2004 attainment demonstration predicts all of North Carolina's EAC areas meeting the 8-hour ozone NAAQS by December 31, 2007 and maintaining that standard through 2017. The air quality in the EAC areas has improved considerably since the designations. The Unifour and Cumberland EAC areas attained the 8-hour ozone NAAQS with the 2002-2004 design value period, three years earlier than required. Whereas, the Triad EAC area attained the 8-hour ozone NAAQS with the 2003-2005 design value period, two years earlier than required.

The Unifour Early Action Compact (EAC) illustrates efforts being made in the Unifour to reduce the formation of ground level ozone pollution. It serves to "facilitate self-evaluation and communication with EPA, NCDENR, stakeholders, and the public" in regards to the EAC program and to promote the program's goal to achieve cleaner air faster in the Unifour region. It documents the area's progress regarding the implementation of local control measures and provides specific information identifying the government agency or department that has the responsibility for implementation of each measure. In June 2007, the Unifour submitted the previous biannual progress report detailing activities that have taken place in the region up to that point and significant progress being made implementing the control measures. This document builds on previous progress reports and describes stakeholder meetings and other activities by local members that have occurred since July 1, 2007.

The local emission reduction strategies were adopted and implemented based on their suitability for addressing ozone pollution from three primary approaches:

education/awareness, transportation, and land use activities. Throughout the Unifour region there have been widespread efforts towards educating the public and raising awareness about air quality while also suggesting practical methods individuals can use to help improve the region's ambient air quality. Presentations to school children and elected officials, as well as a sustained media campaign focusing on ozone, have been the foundation of the education/outreach program. Local and regional newspapers, television and radio, and a growing internet presence, have also been very useful in making Unifour residents aware about ozone and air quality conditions.

### **Local Control Measures Implemented in the Unifour**

1. **Expand the Inspection and Maintenance program for passenger vehicles.** Catawba County began July 1, 2003; Burke and Caldwell Counties began July 1, 2005. Authority and responsibility: NCDMV.
2. **A new regional transit system implemented service on July, 1 2008.** The Greenway Transit System combined four (4) individual providers into one multi-county transit system. All of the fleet's diesel vehicles use bio-diesel fuel and a hybrid vehicle has been ordered.
3. **Promotion of Compressed Work Weeks and Flex-time.** All ten members have agreed to this measure which is estimated to reduce NOX 1.3 tons/year. Authority and responsibility: Local EAC members.
4. **Develop Regional Bicycle and Pedestrian Plan.** Has been estimated to reduce NOx 1.6 tons/year and VOCs 2 tons/year. Greater Hickory MPO/Local EAC members.
5. **Outdoor Burning Ban.** The NC Environmental Management Commission approved a new rule that bans open burning on "Air Quality Action Days" when the AQI is Code Orange or above. Authority and responsibility: NCDAQ.
6. **City and County Energy Plans.** An energy conservation plan has been developed and adopted by all ten local EAC members that directs city and county departments to reduce energy consumption and conserve natural resources in an effort to reduce emissions from EGUs. Authority and responsibility: Local EAC members.
7. **Alternative Fuel Vehicles and the Clean Cities Program.** The UAQC is a Core Stakeholder in the Centralina Clean Fuels Coalition and all members of the EAC are committed to the pursuit and use of alternative fuel technologies. The area has several refueling stations for AFVs including biodiesel, CNG, and ethanol. Authority and responsibility: UAQC, Greater Hickory MPO, and Local EAC members.
8. **Support Efforts and Coordination of Metropolitan Planning Organization and Rural Planning Organization.** The Greater Hickory MPO and Unifour RPO do long range transportation planning to ensure that highway and transit programs conform to the air quality goals established by the EAC. Authority and responsibility: MPO/RPO and Local EAC members.

9. **Improve Traffic Operational Planning, Engineering, and Maintenance.** The City of Hickory optimized its synchronized traffic signals along US 321, effectively increasing traffic flow and reducing congestion. Authority and responsibility: MPO/RPO and Local EAC members.
10. **Implement Smart Growth, Mixed Use and Infill Development Policies.** This measure helps reduce vehicle miles traveled and improve air quality through land use management programs. Several members have adopted land use regulations based upon Smart Growth concepts. Authority and responsibility: Local EAC members.
11. **Air Awareness Program.** All local members participate in the Air Awareness program and have adopted "Ozone Action Plans" that include provisions to help reduce ozone formation. Authority and responsibility: UAQC and Local EAC members.
12. **Adopt a Local Clean Air Policy.** Local stakeholders promote air quality awareness and work to minimize ozone pollution in their respective local communities. Authority and responsibility: Local EAC members.
13. **Air Quality Contacts for Each Local Member of the EAC.** Contacts disseminate information to local governments and assure adherence to goals of the EAC program. Authority and responsibility: Local EAC members.
14. **Landscaping Standards and Urban Forestry.** Implementation throughout Unifour to help mitigate the effect of the "Urban Heat Island" and promote energy conservation and reduce emissions from EGUs. Authority and responsibility: Local EAC members.

## 2. PM 2.5

### 2.1 PM2.5: Assessment and Trends

The NCDAQ is required to evaluate PM 2.5 to determine if Catawba County is in attainment for the Federal Standards for PM 2.5. Specifically, the NCDAQ evaluated the following data as part of the air quality analyses:

- Annual PM 2.5 Averages – Average daily reading during the course of one calendar year.
- PM 2.5 3-year Averages – Average of the last three years used to determine change over longer period of time.
- PM 2.5 98<sup>th</sup> Percentile Daily Reading – 6<sup>th</sup> or 7<sup>th</sup> Highest reading during the course of a year.

#### Annual PM 2.5 Averages

The current annual standard for PM 2.5 is 15 micrograms per cubic meter. Table X below shows the trend in PM 2.5 averages at the monitor in Catawba County. The design values are presented in micrograms per cubic meter, with values exceeding the standard highlighted with bold lettering.

Annual PM 2.5 Averages peaked in 2000, 2001, and 2002. There is a general decrease in the values for the 2003 and 2004 periods before increasing again in 2005 and 2006. Both areas have been below the standard of 15.0 micrograms per cubic meter since the 2007 period. 2008 showed the lowest number of all, which could be attributed to multiple factors, including scrubbers at Marshall steam station, traffic improvements, more precipitation, and a poor economy.

<b>Monitor</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Hickory Water Tower	<b>17.9</b>	<b>16.0</b>	<b>15.4</b>	15.0	15.0	<b>16.0</b>	<b>15.2</b>	14.6	12.8	N/A

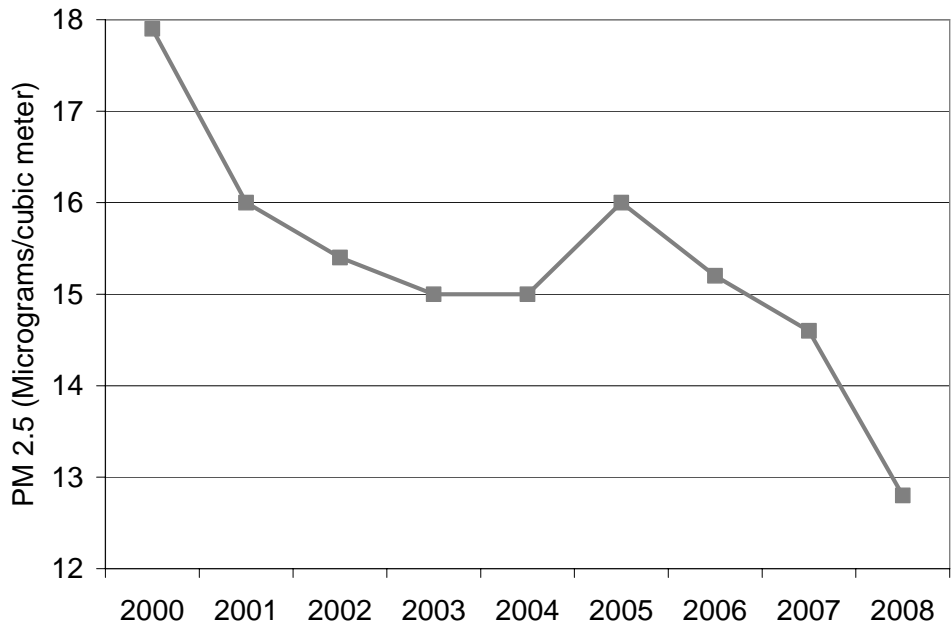
Source: USEPA and NCDAQ, 2009. (Final 2009 Data Currently not available)

Note: Grey shading are years that the annual average exceeded the annual federal standard of 15 micrograms/per cubic meter. Federal PM 2.5 standards are currently under EPA review.

Figure X shows reduction in PM 2.5 in the Unifour Area. There was a spike during 2005 and 2006. Despite this, readings continue to drop.

Figure X.

Unifour Area Annual PM 2.5 Averages (micrograms per cubic meter), 2000-2008



Source: USEPA and NCDAQ, 2009.

### PM 2.5 3-year Averages

The PM 2.5 three year average is a health based standard and is used to see how air quality is changing over time, so they average over a longer period of time. It is calculated by averaging the average value for each of three years. Since the design value is an average of three years, a decrease may be the result of one really good air quality year; or conversely, an increase may be the result of one bad air quality year. Therefore, looking at the trends of the 3-year average can give insight as to how the air quality in an area is improving.

Table X displays the 3-year averages for the Unifour area. The Unifour area was in nonattainment for the 15 micrograms per cubic meter until the 2006-2008 season, where the drop in the annual PM 2.5 average final became apparent.

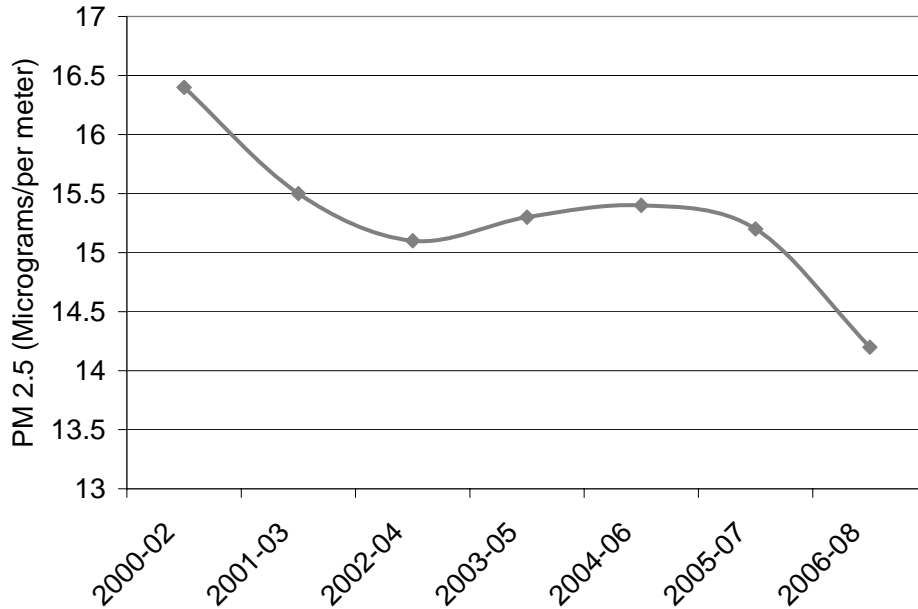
Table X. PM 2.5 3-year Averages (micrograms per cubic meter), 2000-2009								
Monitor	2000-02	2001-03	2002-04	2003-05	2004-06	2005-07	2006-08	2007-09
Hickory Water Tower	16.4	15.5	15.1	15.3	15.4	15.2	14.2	N/A

Source: USEPA and NCDAQ, 2009. (Final 2009 Data Currently not available)

Note: Grey shading are years that the annual average exceeded the annual federal standard of 15 micrograms/per cubic meter. Federal PM 2.5 standards are currently under EPA review.

Figure X demonstrates a downward trend with respect to the three year average despite not being in attainment for the PM 2.5 three year average until 2008.

**Figure X.**  
**Unifour Area 3-Year PM 2.5 Averages (micrograms per cubic meter), 2000-2008**



Source: USEPA and NCDAQ, 2009.

### PM 2.5 98<sup>th</sup> Percentile Daily Reading

The PM 2.5 98<sup>th</sup> Percentile Daily Reading is EPA Approximately 6<sup>th</sup> or 7<sup>th</sup> highest reading per year. The annual federal standard is currently 35 micrograms per cubic meter. The PM 2.5 98<sup>th</sup> Percentile Daily reading has been below the standard every year except in 2005.

Monitor	Yearly Readings					3-Year Average		
	2004	2005	2006	2007	2008	2004-06	2005-07	2006-08
Hickory Water Tower	34.0	36.9	32.9	30.7	25.6	34.6	33.5	29.7

Source: USEPA and NCDAQ, 2009. (Final 2009 Data Currently not available)

Note: Grey shading are years that the 98<sup>th</sup> daily reading exceeded the annual federal standard of 35 micrograms/per cubic meter. Federal PM 2.5 standards are currently under EPA review.

## **B. Source Apportionment Summary**

### **Attaining Pollution Standards in Catawba County**

During the fall of 2006 and early winter of 2007, the Western Piedmont Council of Governments (WPCOG) sponsored a study to determine the sources of and control strategies for fine particulate matter, known commonly as PM<sub>2.5</sub>. The concern motivating the study was prompted by Catawba County being designated as a non-conforming area for the pollutant by the U.S. Environmental Protection Agency (USEPA). The USEPA is responsible, based in part upon recommendations from each state's governor, for designating areas not in compliance with PM<sub>2.5</sub> pollution standards established by the National Ambient Air Quality Standards (NAAQS) under Section 107(d) of the Clean Air Act and later amendments.

Once an area has been designated as non-attainment with regard to USEPA standards for a controlled pollutant, the area's local and state governments typically respond to have the designation overturned or lessened (geographically in size or in severity of the designation), or, if it is clear that the designation cannot be ameliorated, they must work to develop and implement a plan to bring the area back into attainment with the national standard. In the current case, the first action was to have the initial USEPA-recommended non-attainment area reduced from four counties to just one: Catawba.

The technical data employed by North Carolina was sufficient for USEPA to reduce the non-attainment area from four counties to one county. Two other counties to the east in North Carolina also fell into non-attainment.

**The Monitoring Site Location** This sensitivity to the new standard in Catawba County expressed itself most clearly by the local governments' strong belief that the siting of the Hickory monitoring device, known as the Hickory Water Tower monitoring site, was inappropriate. Several actions challenging the validity of the location and/or data readings taken at the site took place between the time that the Catawba County designation took affect and the WPCOG hired a consultant to study the sources and control measures of PM<sub>2.5</sub>.

The first of these challenges was to ask North Carolina Department of Environment and Natural Resources Division of Air Quality (NCEAQ) to place a second monitor within approximately one mile of the water tower site to determine if the second monitor (located at the Hickory Rescue Squad) would show lower readings than the Water Tower location. For each quarter between July 2004 and June 2006 the rescue squad monitor  $PM_{2.5}$  levels were lower than the water tower monitor readings, indicating that localized

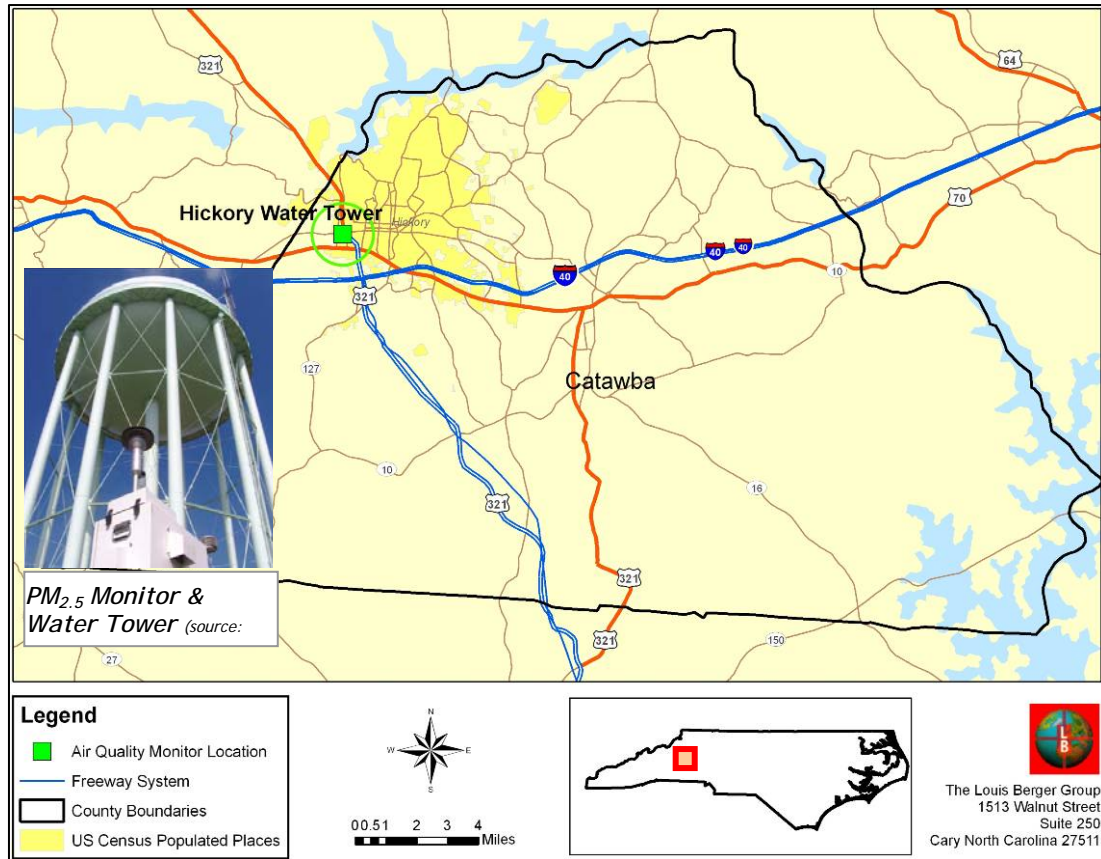


Figure 1. Location of Catawba County, City of Hickory, and Monitoring Site events were impacting the monitor at the water tower. In December 2005 the Unifour Air Quality Committee (UAQC) asked for an EPA audit of both of the rescue squad and water tower monitors. The audit was completed in March 2006. The USEPA auditors concluded that both sites “technically” met the USEPA citing criteria. They also concluded, however, that local impacts could adversely be affecting the results at the water tower monitor.

Based on the conclusions of the audit and the two monitor comparisons, the UAQC sent out a Request for Proposals in May 2006 to determine the source apportionment of the water tower  $PM_{2.5}$  monitor. In July 2006, the Louis Berger Group, Inc. was asked to conduct the study. The following is a list of measures that were a result of that study.

**Mitigation Measure Strategies**

The Hickory-Unifour Area and State of North Carolina already have a number of measures in place or in the process of implementation to address PM<sub>2.5</sub> pollution. In general, these measures were adopted originally to manage ozone precursors. The following (Table 1) illustrates the local control measures that have been adopted through the Early Action Compact (EAC) process and other measures that are being applied at the State and Federal levels.

**Table 1. Local Mitigation Measures for PM<sub>2.5</sub> Sources**

<b>Measure</b>	<b>Responsibility</b>
Open Burning Ban for Ozone Action Days**	North Carolina
Ozone Action Day Program to reduce NOx**	Unifour Governments
Awareness / Outreach**	North Carolina/WPCOG
Energy Conservation Plan*	Unifour Governments
Staff Person for Air Quality*	Unifour Governments
Local Clean Air Policies*	Unifour Governments
Increasing Landscaping Ordinances**	Unifour Governments
Smart Growth Policies*	Unifour Governments
Encourage Bicycle-Pedestrian Usage*	Unifour Governments
Encourage Ridesharing and Flexible Work Schedules*	Unifour Governments
Traffic Management, including signal optimization (e.g. US 321)**	NCDOT, Local Governments
Enhanced Vehicle Inspection and Maintenance Regulations*	North Carolina
Clean Smokestacks Act / Reduce Power Plant Emissions**	North Carolina
Alternative Fuels**	WPCOG / Various
Diesel Retrofit Program*	USEPA
Great American Woodstove Changeout Program**	USEPA
Safe Routes to School*	USDOT

Asterisk (\*) indicates benefit to PM<sub>2.5</sub> reduction (as well as ozone reduction).

Double asterisk (\*\*) indicates PM<sub>2.5</sub> benefit and related to one or more options in Table 2.

Of the measures shown, the most significant in terms of potential of reducing PM<sub>2.5</sub> emissions that are affecting the Hickory Water Tower Site monitoring station are the smokestack controls (specifically, on the Marshall Steam Station coal-fired power plant), low-sulfur diesel fuels, and enhanced vehicle inspection programs. It is less clear if these measures, by themselves, will produce decreases in the PM<sub>2.5</sub> readings at the monitoring site to ensure compliance into the future, especially given the changeable nature of sources and even of the regulatory standards themselves (e.g., USEPA lowering of the daily standard to 35 micrograms/cubic meter in September, 2006). Given this uncertainty, moving forward with a limited package of mitigation measures is advisable.

Table 2 on the following page summarizes the a number of transportation control measures and qualitatively assesses their benefits, acceptance and cost relative to an application at and near the Hickory Water Tower Monitoring site. The table is further broken out into three, broad categories of mitigation strategies: transportation (Table 2A); Major Stationary Source (Table 2B); and Site-Related (Table 2C).

## **Transportation Mitigation Strategies**

### **Voluntary Non-Peak Refueling of Vehicles**

Outreach efforts can reduce vehicle refueling during early morning and late evening.

### **Alternative Fuel Vehicles**

Purchasing policies for public vehicles can favor hybrid and bio-diesel vehicles, and an awareness campaign can do the same for the general public. Alternative fuels greatly reduce emissions and fuel usage.

### **Diesel Truck Anti-Idling & Truck Stop Electrification**

Truck drivers (although not necessarily ATA) tend to oppose anti-idling measures, which have spread to a large number of states and municipalities. Much of this opposition is due to the confusion of complying with varying policies in different jurisdictions, so a statewide policy would be most appropriate. Combining with truck stop electrification helps to offset concerns about cold temperatures and the effects of loss of sleep on drivers.

### **Diesel Retrofit Technologies**

Vehicle volumes near receptor sites have been studied and found to have a contribution to PM<sub>2.5</sub> concentrations (although elemental carbon is highly correlated to site-level diesel traffic). An ancillary benefit is reduction of exposure to other forms of diesel-combustion related pollution. The new Smartway Truck Loan program (USEPA) offers up to \$25,000 collateral-free for five-year loans to purchase oxidation catalysts, for example, which can reduce PM<sub>2.5</sub> emissions from 20% to 50%. For school buses, crankcase filtration systems run about \$450 and a half-day of labor for each installation, and, in conjunction with exhaust filtration systems, can reduce over 90% of diesel emissions.

### **Two-Stroke Engine Restrictions/Buy-Back Program**

Over 20 cities in California have banned or regulated leaf blower use, principally based on noise considerations but Los Angeles has banned their use for air quality reasons ([www.zapla.org/](http://www.zapla.org/)). Emissions are a direct source of PM<sub>2.5</sub>, while the action of the blower stirs up larger particles. Restricting commercial blower use in the vicinity of the monitoring site should be mandatory; a larger program should be a part of any voluntary action measure.

### **Reduce Locomotive Idling**

Since Hickory has a substantial freight train presence in the immediate vicinity of the monitor, reductions in locomotive idling may be important. The limited number of firms engaged in locomotive transport through Hickory would make an outreach campaign relatively simple and cost-effective. Actions may be voluntary or regulatory. Reduced idling reduces noise, fuel usage, engine maintenance in addition to emissions.

### **Transportation Design and Operations**

Since mobile sources comprise a significant contribution to PM<sub>2.5</sub> readings at the Hickory Water Tower Monitoring site, creating transportation systems that produce fewer traffic delays and fewer rapid accelerations can play a role in reducing PM<sub>2.5</sub> (and ozone precursor) emissions. Replacing traffic signals with traffic circles; improving signal timing on US Highway 70; and modifying truck routes on high-alert days are some recommendations.

### **Major Stationary Source Mitigation Strategies**

#### **Best Workplaces for Commuters Campaign**

Reduced commuting reduces emissions, fuel consumption, and traffic congestion; plus employers may need less area for parking. A campaign may bundle various measures that produce commuter benefits and challenge large employers to offer these benefits to employees. Programs can be entirely voluntary, or mandatory for large employers; if mandatory then may require employer to meet an annual emission reduction target (ERT) for their worksite. Provides employers with a menu of emission reduction options including: transit fee subsidization or reimbursement, parking cash-out for employees who don't drive, offering telecommuting and flexible work hour options, old-vehicle scrapping, clean on-road vehicles, and clean off-road vehicles. As an alternative to meeting a worksite ERT, allows employers to implement an employee commute reduction program. Such a program would require large employers to collect survey data on their employee's commute distances and ridesharing participation every two years. Such a program would allow the City to devote resources and efforts in assisting employers with their voluntary trip reduction efforts.

#### **Fuel Switching**

Identified stationary combustion sources that are contributing to the PM<sub>2.5</sub> impacts at the Hickory site may be encouraged to participate in a fuel switching program to fuel types (such as natural gas) that have lower emissions of PM<sub>2.5</sub>. This would involve a permanent fuel switch.

#### **Stationary Controls**

Maximum reductions from stationary sources would occur through the installation of air pollution controls on sources. The cost of installing this equipment may be prohibitive for the smaller businesses in the area.

#### **Voluntary Stationary Source Operations**

Manufacturers and any others using wood- or diesel-fired boilers would voluntarily manage the fuel types and burn rates after being notified of an impending Code Orange Day. This would entail some education on both the part of the private manufacturer and local/state staff to determine the best way of notifying operators and modifying the production processes.

## **Site Control Measures**

### **Wood Stove Changeout**

Some of the data collected indicate that a portion of the PM<sub>2.5</sub> problem at the Hickory Water Tower site is related to wood smoke; however, there is no seasonal fluctuation indicative of home fuel sources. Financial assistance and a strong outreach program are required to implement the wood stove changeout program. Potential strategies include regulations for EPA-Certified wood stoves in new homes, required change to EPA-Certified wood stoves upon sale of a home, and reduced usage during high PM levels. Emission avoidance is 3.7 tons of direct PM<sub>2.5</sub> per 100 stoves changed. Research is underway now by Lenoir-Rhyne College to determine the extent and characteristics of wood stove usage in the study area.

### **Public Awareness/Voluntary Reduction**

Two sources may be readily affected by an awareness program: private industry and public use of wood stoves, traffic diversion, lawn mowers/leaf blowers, etc. Educating the public about proper wood burning techniques, curtailing public off-road and on-road diesel vehicle usage, and other low-cost measures will be the easiest to capture initially.

### **Enhanced Burning Restrictions**

Prohibits outdoor residential open burning on Code Yellow Days for Ozone and PM<sub>2.5</sub> days, instead of the current Code Orange day restriction. May incur more opposition than the current restrictions due to the greater number of days that the ban would be enforced. Recommend removing existing exemptions for Code Orange days as well.

### **LEED for New, Rehabilitated, or Expanded Buildings**

LEED (Leadership in Energy and Environmental Design) standards for new and remodeled/expanded buildings (requiring building permit). New standards for new structures and a more limited set of “retrofit” measures for existing buildings would be created and adopted by local governments. Benefits of green design go beyond the obvious environmental benefits of reduced pollution, and resource consumption. Green design also provides economic benefits of operations and maintenance savings, socio/cultural benefits and worker productivity benefits.

- Maximize the site’s natural conditions and maximize the facility’s east-west axis to exploit solar access and day-lighting. Maximize energy efficiency by using light colors for roofing and wall finishes; high R-value wall and ceiling insulation; and minimal glass and east and west exposures and more glass on south and north.
- Develop strategies to provide day-lighting for at least two-thirds of the day, minimizing the need for artificial light in the learning spaces. Recognize the limitations associated with perimeter day-lighting and the benefits associated with roof monitors.
- Consider use of solar systems to reduce peak electrical demand. Include motion sensors tied to dimmable lighting controls to reduce utility costs. Fiber-optic lighting maximizes efficiency, reduces overheating, and eases lamp replacement in areas that are difficult to reach. Consider low-energy mechanical Systems options

such as solar, absorption cooling or geothermal heat pumps, or Air to Air Heat exchanges.

Develop a commissioning process that helps ensure proper operation of mechanical, electrical and solar systems. Recognize the need to educate visitors and staff so they can make the most of their sustainable facility.

### **Urban Forestry**

Key factors include leaf size (smaller, complex leaf surfaces are better), location relative to source(s), and maintaining dense foliage coverage for both height and length. Other benefits include reduction in coarse particulates, improved aesthetics, and control of urban heat sink effects that lead to ozone formation.

### **Greenscaping**

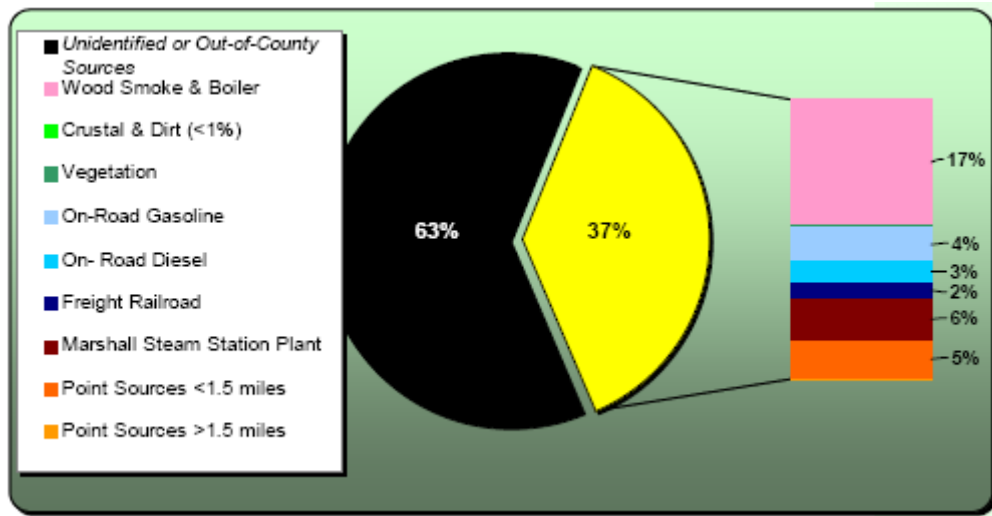
Cost-efficient and environmentally friendly solutions using natural landscaping which requires less mowing, weeding or core aeration and less water. Reduces material use and emissions by reduced mower use. In addition to adopting such practices on public lands, some communities have had success in obtaining EPA grants to sponsor Low Maintenance Landscaping Competitions for homeowners.

### **Encouragement of Best Design Practices**

There are a number of measures that can be incorporated into the site review/design process for local governments that can both reward and encourage best practices, some of which are described in other measures: bicycling/walking, transit ridership, site design/materials that reduce maintenance, and so forth. A Certificate Program for Excellence in Design for these different areas could be developed and granted during the site review process to the developer, signaling to review boards as the project moved forward that this project exceeded the typical standard for new developments. Furthermore, a simple software tool could be developed that rewarded developers of mixed-use properties reductions in parking requirements, lower off-site and on-site mitigation efforts, and perhaps density bonuses for creating a better-designed project. These policies could be applied area-wide or only in certain redevelopment districts that meet specific criteria.

It is highly unlikely that any of these strategies will make a significant impact at the Hickory site in terms of reducing  $PM_{2.5}$  concentrations. In fact, the combination of cleaner fuels; activation of smokestack controls at the Marshall coal-fired power plant, and more stringent inspection/maintenance requirements will prove to be of the greatest benefit and may in fact reduce  $PM_{2.5}$  readings at the monitoring site below the existing annual and daily thresholds set by the US Environmental Protection Agency. Figure 1 indicates the relative percentages of  $PM_{2.5}$  by estimated source type.

**Figure 1. PM<sub>2.5</sub> Source Apportionments**



However, a combination of local mitigation strategies can make a measurable impact that, in turn, would provide an additional surety that Hickory, Catawba County, and the Unifour Region are doing everything possible to reduce PM<sub>2.5</sub> emissions. It is also possible that (a) the existing National Ambient Air Quality (NAAQS) standards will change again, as they have recently for the daily standard; or (b) the existing local and statewide measures listed in Figure 1 will not be sufficient to push the PM<sub>2.5</sub> monitor readings below the attainment threshold. The recommended process for selecting these measures comprises the following four steps:

1. Select the measures that appear to be most easily obtainable, given the availability of funding and likelihood of a high acceptance and penetration rate among stakeholder parties. The mix of packages should include those that have short- and long-term benefits to ensure that a continuous improvement is taking place.
2. Assess each of the mitigation strategies independently in more detail given the known conditions and environmental variables surrounding the Hickory Water Tower Monitoring Site. The result will be an optimal package of implementation measures, as well as setting targets for implementation.
3. Develop an informational brochure describing the issue of PM<sub>2.5</sub> for the Hickory-Catawba area, the preferred voluntary control strategies, and whom to contact for further information.
4. On a quarterly basis, continue to assess and adjust the monitor readings and effectiveness of the selected programs using the implementation targets developed in Step No. 2.