

**SURRY COUNTY**

***COMMUNITY HEALTH  
ASSESSMENT***

**Volume Two:  
Environmental Data**

**Final Technical Report**  
December, 2006



*North Carolina Institute for Public Health*

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by

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## Introduction

This volume presents an overview of data describing major features of the natural environment of Surry County. It is intended to complement Volume I of the Surry County Community Health Assessment, *Socioeconomic and Health Data*, by describing the environmental context in which the people of Surry County are living. An environmental assessment of this type has not been a part of the county's previous community health assessment process. Therefore, it does not serve as a trend document but rather as a baseline for future comparisons.

The information in this report is based on the Center for Disease Control's list of environmental public health indicators (EPHIs). These indicators identify specific areas that should be evaluated in order to track environmental exposures and adverse health effects within a community. The report describes in general terms the quality of water, air, and land in Surry County, using data from the public domain. It lists the major contaminants and pollutants affecting ambient and drinking water quality and outdoor ambient and indoor air quality in the county, and names the sources of the pollutants. It describes chemicals and wastes affecting the county's land and soil, and describes municipal waste management and water and wastewater sanitation practices. The report also describes the effects of disasters on the environment; and identifies community exposure to lead, noise, pesticides, ultraviolet radiation, and toxics. Finally, it contains data on environment-related health issues such as water-, food- and vector-borne diseases.

## **Chapter One: Water Quality**

One measure of a community's environmental health is the status of its waters as described according to the process established by the Federal Clean Water Act of 1972. Water is a renewable resource, but clean water is in limited quantity, and the demand for it rises every year, as the population grows.

The Division of Water Quality (DWQ) in the NC Department of Environment and Natural Resources (DENR) operates the Ambient Monitoring System (AMS) in order to monitor and assess the state's water quality. The AMS consists of a network of stations established to provide site-specific, long-term water quality information on significant rivers, streams, and estuaries throughout the state (1). Program objectives include:

- To monitor water bodies of interest for determination of levels of chemical, physical, and bacterial pathogen indicators for comparison to a selection of the state's water quality standards and action levels.
- To identify locations where exceedances of water quality standards and action levels for physical and chemical indicators occur in more than 10% of samples/measurement (20% for coliforms).
- To identify long-term temporal or spatial patterns.

In response to the stipulations of Section 303(d) of the Clean Water Act, NC DWQ is charged with submitting a biennial report to the US Environmental Protection Agency (US EPA) that assesses water quality in North Carolina according to standards set by the state. This report traditionally describes the quality of surface waters, groundwaters, and wetlands, according to how well they support the designated uses (e.g., swimming, water supply) and what might be causes and sources of impairment for those designated uses.

North Carolina conducts its water quality assessment and planning on a watershed-based schedule, with each of the state's existing 17 watershed basins being monitored once in a five-year rotation (2). Therefore, in order to understand water quality monitoring in North Carolina it is necessary first to understand the terminology and ecological and hydrogeological principles that apply.

### **Surface Water**

A geographic area's surface waters are its fresh flowing water (rivers, streams and creeks), and its fresh standing waters (lakes, ponds and reservoirs). Also included among surface waters are the estuaries, bays and coasts of oceanic environments, which, of course, do not pertain to Surry County. Surface waters serve many purposes that affect the quality of life in a community: sources of water for human and industrial consumption, sources of food, sites for recreation, routes for transportation and commerce, and sites for disposal of byproducts and wastes of manufacturing and sewage treatment.

As of 1998, Surry County ranked among the 20% of counties in the nation with the cleanest surface waters (that is, having a low percentage of waters with threatened or impaired uses). When the percentage of waterbodies in Surry County that are actually impaired are compared to the rest of the nation, the county falls slightly below the national average, indicating it has fewer impaired waterbodies than 60% of the nation (3). A waterbody is considered *impaired* if it does not attain minimum EPA water quality standards. Standards may be violated due to an individual pollutant, multiple pollutants, thermal pollution, or an unknown cause of impairment. A waterbody is considered *threatened* if it currently attains water quality standards but is predicted to violate minimum water quality standards by the time the next assessment is submitted to EPA (4).

According to the 1999 list of impaired waters, which was compiled on the basis of state data from 1997-1998, two percent of the surface waters in Surry County have reported water problems. For comparison, the North Carolina county with the highest percentage (80-90%) of impaired waterbodies in that report was Richmond County, which was also in the top percentile of counties, ranked nationwide, with threatened and impaired waterbodies.

The following table describes the clean water status of Surry County as well as the leading causes of impairment.

<b>Table 1: Surry County Clean Water Act Status, 1998</b>				
	<b>Surface Waters with Reported Problems</b>		<b>Leading Pollutants and Stressors</b>	
	No.	%	<b>% Affected by Pathogens</b>	<b>% of Affected by Sediments</b>
Surry	12	2	8	25

Source:

Environmental Defense Scorecard, Pollution Locator, Water. [http://www.scorecard.org/env-releases/water/cwa-county.tcl?fips\\_county\\_code=371971#source](http://www.scorecard.org/env-releases/water/cwa-county.tcl?fips_county_code=371971#source)

The leading stressor of waterbodies in the county during the reporting period cited in Table 1 was sedimentation, which occurs when soil particles enter the water from eroding land, or sometimes through agricultural production. Because of the high clay content of North Carolina soil, most rivers have a high natural sediment load after a rainfall. Sedimentation is considered a pollutant when it exceeds this natural level and has detrimental effects, such as clogging and abrading fish gills, suffocating fish eggs and aquatic insect larvae, or reducing water clarity and so interfering with recreational activities. Nutrients and chemicals may attach to sediment particles on land and enter the surface waters, where pollutants settle with sediment or detach and become soluble.

Pathogens affected about 8% of the waterbodies in Surry County (Table 1). Pathogens such as waterborne bacteria, viruses and protozoa (causing illnesses from typhoid to dysentery) can enter waters through inadequately treated sewage, storm water drains, septic systems, runoff from livestock pens, and sewage dumped overboard from recreational boats. Regulatory agencies usually measure indicator bacteria, because it is impossible to test waters for every disease causing organism. The presence of indicator bacteria like *E.coli* suggests that the water may be contaminated with untreated sewage and that other dangerous organisms may be present (5).

As noted in Table 2 (following page) in 1997-98 the primary sources of water quality problems Surry County were non-point sources, which affected an average of 92% of the

water bodies in the county, followed by municipal sources, which affected an average of 25% of the county’s waterbodies. Non-point source pollution occurs when rainfall or snowmelt picks up chemicals, biological agents and sediments and carries them to surface and ground waters. These inputs include agricultural and residential fertilizers, herbicides and insecticides; oil, grease and toxic chemicals from urban run-off and energy production; sediment from construction sites, crop and forest lands; and bacteria and nutrients from livestock, pet wastes and faulty septic systems (5).

Municipal point source pollution is discharged from publicly owned waste water treatment plants. Agricultural production involves many activities that lead to the emission of pollutants: confined animal facilities, grazing, plowing, pesticide spraying, irrigation, fertilizing, planting and harvesting. The pollutants may include sediment, nutrients, pathogens, pesticides and salts (5).

	% of Waterbodies Affected		
	Non-point	Municipal	Not Reported
Surry County	92	25	8

Source: Environmental Defense Scorecard, Pollution Locator, Water. Clean Water Act Status. [http://www.scorecard.org/env-releases/water/cwa-county.tcl?fips\\_county\\_code=37193#cause](http://www.scorecard.org/env-releases/water/cwa-county.tcl?fips_county_code=37193#cause)

## Watersheds

As noted previously, North Carolina monitors water quality on a watershed basin basis. A watershed is a geographic region with elevations and topographical features that cause flowing waters (creeks, streams, rivers) to drain into a common destination. Every river, stream and creek belongs to a particular watershed, and smaller watersheds can join together naturally to become larger watersheds, called river basins. North Carolina contains a portion of 58 different smaller watersheds which drain into 17 river basins. Water moves downstream in a watershed, so any activity that affects the water at the head, or anywhere else upstream, can also affect the characteristics of the downstream waters. The most downstream points in a watershed may, in fact, bear and demonstrate the cumulative results of upstream affects.

The majority of Surry County lies in the Yadkin River Basin. Surry County also contains a small portion of the New and Roanoke River Basins, but no waterbodies in these river basins lie in or pass through Surry County.

According to the 1998 EPA Clean Water Act Data, 26 of the 58 small watersheds in North Carolina have “better” water quality and are at low vulnerability for impairment. Nine North Carolina watersheds have “better” water quality but are at high vulnerability for deterioration, which means that designated uses for the rivers are largely met and other indicators show few problems, but that significant pollution and stressors exist in the area and heighten the vulnerability of aquatic health (6). All three of the watersheds in Surry County were evaluated as having “better” water quality and being of “low vulnerability” (7).

The EPA uses nine indicators to profile the vulnerability of aquatic resources to future degradation. The indicators are designed to highlight which activities are expected to put potentially harmful pressure on watersheds. The EPA reports for each watershed how many

waterbodies are considered high, medium or low vulnerability. Two of the watersheds in Surry County are highly vulnerable to agricultural run-off and hydrologic modification. Aquatic and wetland species also are considered to be at high risk in two county watersheds. Agricultural runoff can cause water quality problems due to combinations of pesticides, nitrogen and sediment entering the rivers, creeks and streams. Hydrological modification is perhaps the most damaging human-induced impact in the aquatic environment. The construction of dams and the subsequent impoundment of water resources can compromise the health of the aquatic system in a watershed. Flowing waters become quiescent waters. Carbon, pollutants, and sediments accumulate in the bottom of dams, leading to algal blooms, because there is no way for materials to travel downstream. Oxygen cannot easily enter water that doesn't flow over rocks or riffle and so previously rushing streams turn into fetid ponds. Rivers that are downstream of a dam have controlled, limited or sometimes non-existent flow, which leads to habitat change and deterioration.

### **Water Quality in the Yadkin River Basin**

The following section details the water quality of the Yadkin River Basin as it pertains to Surry County, providing further information on creeks and streams in the basin. This information was gleaned from the pertinent assessment report produced for each of the large watersheds in the State by the Division of Water Quality (DWQ) (8). The most recent assessment of the Yadkin River Basin was conducted in 2001 and completed in the summer of 2002. While nearly all rivers, creeks and watersheds in this area of North Carolina are in fair or good condition, a record-breaking drought from 1998 through 2002 impacted not only the indicator species living in the rivers and creeks but the nature of the flowing water as well. During a drought it is natural for nonpoint source pollution to appear to be reduced because rains aren't falling to wash materials into the streams and creeks. Point source pollution may seem magnified during a drought because water is not there to dilute inputs. The assessments take the unusual situation into account and reflect that the data should be considered in the appropriate context.

The Yadkin River originates in the eastern Blue Ridge Mountains and flows northeast for 100 miles, cutting across the southern half of Wilkes County. It turns southeast and forms the border between Yadkin and Forsyth, and Davie and Davidson counties. The South Fork of the Yadkin River begins in Alexander County and flows east, following the southern border of Yadkin County, before joining the main Yadkin River just above High Rock Lake in Davidson County. The Yadkin River joins the Uwharrie River to form the Pee Dee River south of High Rock Lake and continues toward the North Carolina/South Carolina border. The Yadkin River Basin is the second largest basin in North Carolina. For assessment and monitoring purposes the entire river basin is divided into 17 subbasins; Surry County contains portions of Subbasins 02 and 03.

The Yadkin River flows into Subbasin 02 from a northeast point in Elkin, and then makes a large curve to the south and west at the juncture of Stokes, Surry, and Forsyth Counties. The river continues south in this subbasin to just below I-40 in Davie County. The major tributaries include Mitchell, Fisher, and Little Yadkin Rivers and Deep, Forbush, and Logan Creeks. The Mitchell flows from the top of the Blue Ridge escarpment, and the section of the river above the confluence with the South Fork Mitchell River is classified as ORW (outstanding resource waters).

Subbasin 02 of the Yadkin River is located primarily in the Northern Inner Piedmont ecoregion of the state (more montane characteristics), but the southern part is located in the Southern Outer Piedmont, where streams are characterized by slower flows and sandy substrates. The land is largely forested or used for pasture, with only small residential communities. Elkin is the largest town in this subbasin, followed in size by Yadkinville and Dobson. The three largest dischargers in Subbasin 02 are the Elkin wastewater treatment plant (1.8 million gallons per day (MGD) into the Yadkin River), Chatham Manufacturing (4.0 MGD into the Yadkin River at Elkin), and the Yadkinville wastewater treatment plant (1.0 MGD into North Deep Creek).

Subbasin 03, which contains the Ararat River and its tributaries, originates in the mountains of Virginia. Small western and northwestern sections of this subbasin fall within the mountain ecoregion. However, the vast majority of this subbasin is in the Piedmont ecoregion. The major tributaries to the Ararat River include Stewarts, Lovills, and Flat Shoal Creeks. The Ararat River flows generally south and empties into the Yadkin River east of Elkin. Land use in the area is mostly forest and pasture. The Ararat River and its tributaries have moderate to swift flow throughout the year and turbidity can become a problem after rainfall. This subbasin contains the towns of Mount Airy and Pilot Mountain, both of which have wastewater treatment plants that discharge into the Ararat River at 7 MGD and 1.5 MGD, respectively.

### Impaired Water Bodies in the Yadkin River Basin

In Subbasin 02, one creek in Surry County has been classified as impaired according to section 303(d) of the CWA. In Subbasin 03, three creeks in Surry County have been classified as impaired. These creeks are listed below in Table 3. All impairments were connected with the biological integrity of the waterbody.

Sub-Basin	Waterbody	Impaired Use	Year listed	Reason for listing	Potential Source	Miles
02	Endicott Creek, from dam at Raven Knob Lake to Fisher River	Overall	1998	Impaired biological integrity	Agriculture	0.5
03	Faulkner Creek from source to Ararat River	Aquatic life	1998	Impaired biological integrity	Unknown	6.1
03	Heatherly Creek from NC 268 to Toms Creek	Aquatic life	1998	Impaired biological integrity	Major municipal point source	1.4
03	Lovills Creek from town of Mount Airy Water Supply Dam to Ararat River	Aquatic life	1998	Impaired biological integrity	Urban runoff/storm sewers; minor industrial point source.	4.2

Source: NC Department of Environment and Natural Resources. Division of Water Quality. North Carolina Water Quality Assessment and Impaired Waters List (2006 Integrated 305(b) and 303(d) Report). Public Review Draft. [http://h2o.enr.state.nc.us/tmdl/General\\_303d.htm](http://h2o.enr.state.nc.us/tmdl/General_303d.htm).

The DWQ gives each creek, stream, lake and river a bioclassification, based on the number of intolerant, or sensitive species, particularly macroinvertebrates, present in the water. The presence of intolerant species indicates higher quality water than can support such sensitive organisms, while their absence signifies possible water quality or habitat problems.

Excellent, good and good-fair waters are fully supportive of benthic macroinvertebrates; fair waters are partially supportive; poor waters are not supportive of such life. Loss of canopy, increase of stream temperature, increased nutrients, toxicity or sedimentation all affect the benthic (bottom dwelling) community. Table 4 shows the bioclassifications for the Yadkin River subbasins that pertain to Surry County for both 1996 and 2001

**Table 4. Bioclassification of Subbasin 02 and 03 Waterbodies located in Surry County, 1996 and 2001**

Subbasin	Waterbody	Location	1996	2001
02	Yadkin River	SR 1003	Good-Fair	Good
02	Elkin Creek	NC 268	Good-Fair	Good-Fair
02	Mitchell River	SR 1330	Good	Good
02	Mitchell River	SR 1001	Good	Excellent
02	Snow Creek	SR 1121	Good	Good-Fair
02	Fisher River	US 601	Good	Good
02	Fisher River	NC 268	Good	Good
02	L Fisher River	SR 1480	Good	Good-Fair
02	Fisher R	SR 1331	---	Excellent
02	L Fisher R	SR 1480	Good-Fair	Good
03	Ararat River	NC 104	Good-Fair	Good-Fair
03	Ararat River	SR 2026	Fair	Good-Fair
03	Ararat River	SR 2080	Good-Fair	Good
03	Lovills Creek	SR 1700	Good-Fair	Good-Fair
03	Lovills Creek	SR 1371	Fair	Fair
03	Stewarts Creek	NC 89	Good-Fair	Fair
03	Stewarts Creek	SR 2258	Good-Fair	Good
03	Flat Shoals Creek	SR 1827	Good-Fair	Good-Fair
03	Stewarts Creek	SR 1622	Excellent	Excellent
03	Toms Creek	SR 2034	---	Excellent

Source: NC Department of Environment and Natural Resources. Division of Water Quality. Basinwide Assessment Report Yadkin River Basin, June 2002. <http://www.esb.enr.state.nc.us/bar.html>.

Although no monitoring sites in Subbasins 02 or 03 were rated as Fair or Poor in 2001, three streams declined in classification between the 1996 and 2001 assessments. Five stream waterbodies improved in quality over the same period, and four were rated excellent in 2001.

There are no lakes in Surry County to be assessed.

### Ambient Monitoring System Data

There are 46 DWQ Ambient Monitoring System (AMS) stations in the Yadkin River Basin, three of which are in Surry County. One county site is on the Yadkin River where US 21 Business crosses; two are on the Ararat River, one at SR 2019 at Ararat and the other at SR 2080 near Siloam. The following data describe the results of AMS monitoring for the five year period from September 1, 1996 through August 31, 2001 (9).

**Water Chemistry.** According to data from the AMS, there were no significant or actionable exceedances of water quality standards for dissolved oxygen at the three fixed monitoring sites in Surry County during the period from September 1996 through August 2001. Dissolved oxygen is an important parameter of water quality because sufficiently high levels are required to sustain aquatic life, and the more desirable aquatic species (e.g. trout) require the highest levels. Although eight AMS stations elsewhere in the Yadkin River Basin

had more than 10 percent of the measurements for dissolved oxygen below the minimum standard of 5.0 mg/L, the monitors could not discern any temporal patterns in the exceedances.

The monitoring site on the Ararat River at SR 2080 was one of eleven stations in the Yadkin River Basin that had more than 10 percent of the samples registering turbidity greater than the standard of 50 NTU (National turbidity units): 12 percent of 56 samples at this site exceeded the standard.

Dissolved metals (arsenic, cadmium, chromium, copper, lead, manganese, mercury, nickel and zinc) can be toxic to living organisms, sometimes in very low concentrations, so they are included in water quality testing regimes. Generally speaking, elevated concentrations of metals, especially copper, are common but not a problem in the Yadkin River Basin: only 90 results (<1%) of 12,984 results for six trace metals (arsenic, cadmium, chromium, lead, mercury and nickel) exceeded the reporting level. Eight (two for chromium, three for nickel and three for lead) of the 90 exceedances occurred at the Surry County AMS sites on the Ararat River, all of them in 1998 or 1999.

**Fecal Coliforms.** Fecal coliforms are usually harmless bacteria that live in soil, water, and the digestive system of animals. Fecal coliform bacteria are present in large numbers in the feces and intestinal tracts of humans and other warm-blooded animals, and can enter waterbodies from human and animal wastes.

Swimming in waters with high levels of fecal coliform bacteria increases the chance of developing illness (fever, nausea or stomach cramps). Diseases and illnesses that can be contracted in water with high fecal coliform counts include typhoid fever, hepatitis, gastroenteritis, dysentery and ear infections.

During the five year period cited above, 13 of the 46 AMS sites in the Yadkin River Basin had fecal coliform counts exceeding the plate count reference standard of 200 colonies/100 ml; none of those occurred at stations classified for organized swimming activities and none of the sites was in Surry County.

**Nutrients.** The introduction of nutrients, especially nitrogen and phosphorus, into waterbodies can stimulate the growth of algae and aquatic weeds, which can in turn impart unpleasant appearance and taste to the water and, more importantly, deplete dissolved oxygen and imperil other aquatic life. While there were widespread variances in nutrient concentrations reported at the various AMS sites in the Yadkin River Basin, few statistically significant long-term patterns could be discerned. It did appear that the stations with high concentrations of nutrients were all located below wastewater treatment plants. The three stations in Surry County were not among those stations.

## Fish Kills

There were two fish kill events reported in Surry County between 1997 and 2004. In 2001 a fish kill of approximately 1,000 fish (catfish, sunfish, and suckers) was observed at Lovills Creek at SR 1371. The cause of this fish kill was not determined. In 2003 another fish kill was reported in 2003 in a private pond near Dobson, where approximately 2,000 carp, sunfish and largemouth bass were killed. The cause of the kill was unknown, but the pond owner suspected that the pond was poisoned by vandals (10).

## Fish Consumption Advisories

The Epidemiology Section of NC Division of Public Health maintains an Internet website listing current fish consumption advice and advisories across the state (11). As of September 2006 the section listed a statewide advisory against women of childbearing age, pregnant women, nursing mothers and children under age 15 eating any fish high in mercury; the section further advises all other persons to consume fish high in mercury no more than once a week. While the fish with high mercury levels are primarily ocean species, there are five freshwater species on the “avoid” list: blackfish (bowfin), catfish (caught wild), jack fish (also called chain pickerel), largemouth bass, and warmouth. Freshwater fish with the highest mercury levels have been found primarily downstream of Surry County, south and east of Interstate 85.

In addition, the website also lists site-specific advisories regarding consumption of species with high levels of other chemicals such as polychlorinated biphenyls (PCBs) and dioxins. None of the referenced sites is in Surry County or in the northwest region of North Carolina.

## Groundwater

Much less is known generally about groundwater than surface waters. Groundwater is the water basin beneath the soil surface that can be collected by wells and pumps and other man-made devices, or that flows naturally to the surface via seeps or springs. Groundwater is the primary source of water for 50% of the population in the US, with heavier dependency in rural areas. Despite the visual prominence of surface waters, the vast majority of the earth’s freshwater - 97% - is located underground.

## Bacteria in Well Water

The North Carolina State Laboratory for Public Health analyzes samples of drinking water from wells and other sources for the presence of microorganisms and chemicals. Samples from private wells must be submitted through a local health department. In 1999 (the most recent year for which data is reported for Surry County), the State Laboratory conducted microbiological analyses 306 water samples from the county (Table 5, following page). Of these, 76 (25%) showed the presence of bacteria according to analysis for “total coliforms,” and six of the samples positive for total coliforms were also positive for *E. coli* (13%)(12).

<b>Table 5: Surry County Private Wells Testing Positive for Total Coliforms or <i>E. coli</i>, 1999</b>					
<b>Year</b>	<b>No. Samples</b>	<b>No. Positive Total Coliforms</b>	<b>% Positive Total Coliforms</b>	<b>No. Positive <i>E.coli</i></b>	<b>% Positive <i>E. coli</i></b>
1999	306	76	25%	6	8%

Source: NC State Laboratory for Public Health, available at: <http://slph.state.nc.us/EnvironmentalSciences/Microbiology/frmMainSearch.aspx>

## Groundwater Incidents

The NC Division of Water Quality Incident Management Office keeps track of leaks and spills of chemicals that present risks to health. The list of such incidents reported recently in Surry County is shown in Table 6 (following page). Of the 19 reported incidents in 2004, 2005 and 2006 (through July 31), ten (53%) appeared to be underground storage tank (UST) leaks, four (21%) were surface spills, and two (10%) were above ground storage system (AST) leaks. Three incidents (16%) were of unknown origin (Table 6, following page).

<b>Table 6: Surry County Groundwater Incidents, 2004-2006</b>			
<b>Location</b>	<b>Nature of Site</b>	<b>Nature of Incident</b>	<b>Material</b>
<b>2006 (through July 31)</b>			
Siloam	Store	Unknown	Pesticide/herbicide
<b>2005</b>			
Mount Airy	Car dealership	Underground storage tank	Gasoline
Dobson	Convenience store	Underground storage tank	Gasoline
Mount Airy	Gas station	Underground storage tank	Gasoline
Mount Airy	Convenience store	Underground storage tank	Gasoline
Mount Airy	Convenience store	Underground storage tank	Gasoline
Mount Airy	Convenience store	Underground storage tank	Gasoline
Mount Airy	Convenience store	Underground storage tank	Gasoline
Elkin	Gasoline distributor	Underground storage tank	Gasoline
Pilot Mountain	Automotive repair garage	Surface spill	Other
Mount Airy	Convenience store	AST system	Gasoline
Dobson	Tanker truck	Surface spill	Other
Mount Airy	Car dealership	Unknown	Other organics
<b>2004</b>			
Siloam	Store	Underground storage tank	Gasoline
Mount Airy	Convenience store	Underground storage tank	Gasoline
Mount Airy	Private residence	AST system	Heating oil/kerosene
Mount Airy	Business	Surface spill	Other
Dobson	Tanker truck	Surface spill	Other organics
Mount Airy	Manufacturing plant	Unknown	Other petroleum products

Source: NC DENR, Groundwater Section, Database Download website. Query Incident Management Database. Surry County. <http://its.enr.state.nc.us/gwi/>

## Chapter Two: Air Quality

### Outdoor Ambient Air

The US EPA categorizes outdoor air pollutants as “criteria air pollutants” (CAPs) and “hazardous air pollutants” (HAPs).

#### Criteria Air Pollutants

Criteria air pollutants (CAPS) are six chemicals that can injure human health, harm the environment, or cause property damage: carbon monoxide, lead, nitrogen oxides, particulate matter, ozone, and sulfur dioxide. The EPA has established National Ambient Air Quality Standards (NAAQS) that define the maximum legally allowable concentration for each criteria air pollutant, above which human health may suffer adverse affects (13). Table 8 (following page) lists the current NAAQS.

Nationwide 77% of carbon monoxide (CO) emissions are from transportation sources, primarily highway motor vehicles, but other sources include wood-burning stoves, incinerators and industrial outputs. Lead (Pb) enters the atmosphere primarily from gasoline additives, non-ferrous smelters, and battery plants. The proportion of atmospheric lead from cars and trucks has decreased dramatically over a generation due primarily to a shift to lead-free gasoline. Nitrogen oxides (NO<sub>x</sub>) are formed when fuels are burned at high temperatures, such as in transportation vehicles and stationary combustion sources like electric utilities and industrial furnaces. They play an important role in the reactions that create ozone and acid rain. Particulate matter (PM) pollutants, usually categorized on the basis of size, include dust, dirt, soot, smoke, and liquid droplets emitted directly into the air by factories, power plants, construction activity, fires and vehicles. Ozone (O<sub>3</sub>), the major component of smog, is not usually emitted directly but is formed through chemical reactions in the atmosphere. Precursor compounds like volatile organic compounds (VOC) and oxides of nitrogen (NO<sub>x</sub>) react to form O<sub>3</sub> when stimulated by ultraviolet radiation and temperature, so peak O<sub>3</sub> levels typically occur during the warmer times of the day and year. Volatile organic compounds (VOCs) are chemicals that play a role in forming ozone and are emitted from a variety of sources, including automobiles, chemical and paint manufacturing plants, dry cleaners, and other facilities that use solvents and paint. Sulfur dioxide (SO<sub>2</sub>) is released primarily by burning sulfur-containing fuels like coal, oil and diesel fuels, and is emitted from power plants, steel mills, refineries, pulp and paper mills and smelters. Table 7 lists some of the environmental and health effects of the criteria air pollutants.

<b>Pollutant</b>	<b>Effect</b>
CO	Reduces delivery of oxygen to the body’s organs and tissues
Pb	Affects nervous, reproductive, digestive, cardiovascular systems and the kidney
NO <sub>x</sub>	Effects ecosystems on land and in water; plays a role in the formation of acid rain
PM	Affects breathing, aggravates existing respiratory and cardiovascular disease; damages lung tissue
O <sub>3</sub>	Damaged lung tissues, reduces lung function and sensitizes lungs to other irritants
VOC	Contributes to ozone formation; may cause cancer and have reproductive toxicity
SO <sub>2</sub>	Affects breathing and may aggravate existing respiratory and cardiovascular disease

Source: Environmental Defense, Scorecard. Pollution Locator. Description of Criteria Air Pollutants. Available at: <http://www.scorecard.org/env-releases/cap/pollutant-desc.tcl>

<b>Table 8. National Ambient Air Quality Standards</b>			
<b>Pollutant</b>	<b>Primary Standard</b>	<b>Averaging Times</b>	<b>Notes</b>
Carbon monoxide (CO)	9 ppm (10 mg/m <sup>3</sup> )	8-hour	Not to be exceeded > 1/year
	35 ppm (40 mg/m <sup>3</sup> )	1-hour	Not to be exceeded > 1/year
Lead	1.5 µg/m <sup>3</sup>	Quarterly average	
Nitrogen dioxide	0.053 ppm (100 µg/m <sup>3</sup> )	Annual mean	
Particulate matter (PM <sub>10</sub> )	150 µg/m <sup>3</sup>	24-hour	Not to be exceeded > 1/year on average over 3 years
Particulate matter (PM <sub>2.5</sub> )	15.0 µg/m <sup>3</sup>	Annual mean	To attain this standard, the 3-year average of the weighted annual mean PM <sub>2.5</sub> concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m <sup>3</sup>
	35 µg/m <sup>3</sup>	24-hour	To attain this standard, the 3-year average of the 98 <sup>th</sup> percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m <sup>3</sup>
Ozone (O <sub>3</sub> )	0.08 ppm	8-hour	To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm
	0.12 ppm	1-hour (applies only in limited areas)	This standard has been revoked in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) Areas (which include the Fayetteville, Greensboro/Winston-Salem/High Point, and Hickory/Morganton/Lenoir regions in North Carolina)
Sulfur Oxides (SO <sub>x</sub> )	0.03 ppm	Annual mean	-----
	0.14 ppm	24-hour	Not to be exceeded > 1/year

Source: US EPA. Air and Radiation. National Ambient Air Quality Standards (NAAQS). <http://www.epa.gov/air/criteria.html>

### Annual CAP Maxima

Annual high levels of criteria air pollutants are not available for Surry County but are available for North Carolina as a whole. In 2005 North Carolina’s annual maxima for 1-hour and 8-hour ozone and large particulate matter were higher than the respective NAAQS standards (Table 9, following page).

<b>Table 9: North Carolina Annual High Levels of Criteria Air Pollutant Emissions 2005</b>		
<b>Pollutant</b>	<b>NAAQS Standard</b>	<b>Highest Recorded Concentration</b>
<b>Carbon monoxide</b>		
1-hour average max	35ppm	10.0ppm
8-hour average max	9ppm	2.8ppm
<b>Ozone</b>		
1-hour average max	0.12ppm	0.146ppm
8-hour average max	0.08ppm	0.111ppm
<b>PM-25</b>		
24-hour average max	65µg/m <sup>3</sup>	70µg/m <sup>3</sup>
<b>PM-10</b>		
24-hour average max	150ug/m <sup>3</sup>	69µg/m <sup>3</sup>
<b>Sulfur Dioxide</b>		
3-hour average max	0.5ppm	0.106ppm
24-hour average max	0.14ppm	0.030ppm

Source: US EPA. Air and Radiation. Air Data. <http://www.epa.gov/air/data/geosel.html>

North Carolina ranks 10th in the nation for CO emissions; 14th for NO<sub>x</sub> emissions; 13th for PM-2.5 emissions; 13th for SO<sub>2</sub> emissions; and 8th for volatile organic compound emissions. Surry County does not rank in the top 25 counties for tons of emissions of any of the six criteria air pollutants (14).

### Air Quality Index

The impact of criteria air pollutants on the environment is described on the basis of exposure, emissions and health risks. One useful measure that combines these parameters is the Air Quality Index (AQI), which formerly was called the Pollutant Standards Index (PSI). The AQI is an information tool to advise the public and it is often presented in the media along with local weather reports. The AQI describes the general health effects associated with different pollution levels, and public AQI alerts (often heard as part of local weather reports) include precautionary steps that may be necessary for certain segments of the population when air pollution levels rise into the unhealthy range. The AQI measures concentrations of five of the six criteria air pollutants and converts the measures to a number on a scale of 0-500, with 100 representing the national Ambient Air Quality Standard established under the Clean Air Act. An AQI level in excess of 100 on a given day means that a pollutant is in the unhealthy range that day; an AQI level at or below 100 means a pollutant is in the “satisfactory” range (15). The AQI levels are defined in Table 10, following page.

**Table 10: General Health Effects and Cautionary Statements, Air Quality Index**

Index Value	Descriptor	General Health Effects	Cautionary Statements
Up to 50	Good	None for the general population	None required
50 to 100	Moderate	Few or none for the general population	None required
100 to 200	Unhealthy	Mild aggravation of symptoms among susceptible people, with irritation symptoms in the general population.	Persons with existing heart or respiratory ailments should reduce physical exertion and outdoor activity. General population should reduce vigorous outdoor activity
200 to 300	Very Unhealthy	Significant aggravation of symptoms and decreased exercise tolerance in persons with heart or lung disease; widespread symptoms in the healthy population.	Elderly and persons with existing heart or lung disease should stay indoors and reduce physical activity. General population should avoid vigorous outdoor activity.
Over 300	Hazardous	Early onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in health persons. At AQI levels above 400, premature death of ill and elderly persons may result. Health people experience adverse symptoms that affect normal activity.	Elderly persons with existing diseases should stay indoors and avoid physical exertion. At AQI levels above 400, general population should avoid outdoor activity. All people should remain indoors, keeping windows and doors closed, and minimize physical exertion.

Source: NC Department of Environment and Natural Resources, Division of Air Quality, 2000 Ambient Air Quality Report, available at: <http://daq.state.nc.us/monitor/reports/2002-01.pdf>

According to the EPA, there is no AQI monitoring site in Surry County and so county-specific AQI data are not available (16). Non-AQI air pollution data for Surry County are available, however. These data – total categorical CAP emissions – are dated but do offer a picture of the relative importance of each category of pollutant. Table 11 details the total tons of emissions of the six criteria air pollutants for the county, and the amount of each pollutant coming from the typical source categories, for 1999.

**Table 11: Surry County Criteria Air Pollutant Emissions, in Tons, 1999**

Source Category	CO	NO <sub>x</sub>	PM -2.5	PM-10	SO <sub>2</sub>	VOC	TOTAL
Mobile Sources	21,291	4,278	493	1,692	282	2,106	30,142
Area Sources	4,595	70	814	1,479	306	3,139	10,406
Point Sources	1,112	365	219	354	886	1,372	4,308
All Sources	26,998	4,713	1,526	3,525	1,474	6,618	44,856

Source: Environmental Defense, Scorecard. Pollution Locator, County Reports. Available at: [http://www.scorecard.org/env-releases/cap/county.tcl?fips\\_county\\_code=37171#emissions\\_summary](http://www.scorecard.org/env-releases/cap/county.tcl?fips_county_code=37171#emissions_summary)

Mobile sources include both onroad vehicles like cars, trucks and busses as well as offroad equipment like airplanes, construction and agricultural equipment. Such sources contribute significantly to air pollution, as nationwide mobile sources are responsible for 75% of carbon monoxide emissions and more nitrogen oxide emissions than either area or point sources (17). Surry County generally follows the national trend, with mobile sources producing more carbon monoxide (79%) and nitrogen oxide (91%) than any other source (as calculated from

data in Table 11). Mobile sources are usually, but not always, the primary source of criteria air pollutants in this county (67% of the total tonnage) (17).

Area sources are defined as sources that emit less than 10 tons per year of a criteria or hazardous air pollutant or less than 25 tons per year of a combination of pollutants. Such sources include dry cleaners, gas stations and auto body paint shops, residential and commercial buildings (heating and cooling units, fire places). Waste disposal in the form of open burning, landfills and wastewater treatment are significant area sources (17). In Surry County, area sources account for 23% of all criteria air pollution and produce primarily carbon monoxide, but emit more small particulate matter (53%) and volatile organic compounds (47%) than mobile sources (as calculated from data in Table 11).

Point sources are those facilities that emit 10 tons a year of any of the criteria or hazardous air pollutants or 25 tons per year of a mixture of air toxics. Such sources include major industrial facilities like chemical plants, steel mills, oil refineries, power plants and hazardous waste incinerators. Nationwide point sources contribute the majority (90%) of sulfur dioxide emissions, and account for about 40% of total nitrogen oxide releases (17). In Surry County point sources emit primarily volatile organic compounds and are the least important sources of criteria air pollutants (10% of the total) (from Table 11).

For comparative purposes, in Mecklenburg County, the county in North Carolina with the highest emissions of criteria air pollutants, mobile, area and point sources emitted a total of over 365,000 tons of pollutants, more than eight times the tons of air pollutants generated in Surry County (18).

### **EPA Air Quality Non-Attainment Areas**

As of June, 2005, the EPA designated 32 North Carolina counties as “non-attainment” counties regarding ozone standards. The determination was based on air quality monitoring data that shows ozone levels exceed the 8-hour ozone standard in parts of North Carolina during the warmer months (19). The state is required to develop remediation plans for the non-attainment counties that include proposals for curbing ozone by reducing emissions from vehicles, industries and power plants (20). Surry County is not on the current list of non-attainment counties.

### **Vehicle Emission Inspection Mandates**

As of January 1, 2006 48 of the 100 North Carolina counties have mandatory vehicle emission testing; Surry is among them. Most of the counties under the mandate are in major population centers or along the major Interstate Highway corridors spanning the state (21).

### **Vehicle Miles Driven**

Since most criteria air pollutants are emitted by mobile sources, it is instructive to examine the patterns and trends in vehicle miles traveled (VMT) per capita in North Carolina and Surry County. Table 12 (following page) provides a description of the annual vehicle miles

traveled in the United States and in urban and rural areas of North Carolina for 2004. Comparable data for Surry County is not available.

	Rural		Urban		Total per Capita
	Annual VMT	% Trucks	Annual VMT	% Trucks	
<b>North Carolina</b>	47,183	12.6	48,720	9.1	11,222
<b>US Average</b>	20,985	15.6	37,103	7.7	10,077

Source: Federal Highway Administration. Highway Statistics 2004. Selected Measures for Identifying Peer States. [www.fhwa.dot.gov/policy/ohim/hs04/hm/ps1.htm](http://www.fhwa.dot.gov/policy/ohim/hs04/hm/ps1.htm)

According to data from the Energy Center at Appalachian State University, growth in energy consumption for the transportation sector has been outpacing overall energy consumption in the state. One of the primary causes of this growth in energy consumption has been the rapid growth in VMT. VMT figures in North Carolina have grown 3.9% per year over the past 21 years, and VMT per capita have increased 2.2% annually over approximately the same period (22).

### Vehicles Powered by Alternative Fuels

One way to overcome air pollution from the combustion of gasoline is to power automobiles by alternative, lower-polluting fuels.

According to data from the US Census Bureau, the number of vehicles in the US powered by alternative fuels has increased every year between 2002 and 2004 (Table 13).

Fuel Type	Number of Alternative Fueled Vehicles		
	2002	2003	2004
Liquefied petroleum gasses (LPG)	187,680	190,438	194,389
Compressed natural gas (CNG)	120,839	132,988	143,742
Liquefied natural gas (LNG)	2,708	3,030	3,134
Methanol, 85 percent (M85)	5,873	4,917	4,592
Ethanol, 85 percent (E85)	120,951	133,776	146,195
Electricity	33,047	45,656	55,852
<b>Total</b>	<b>471,098</b>	<b>510,805</b>	<b>547,9094</b>

Note: The category "electricity" excludes gasoline-electric hybrids.

Source: US Census Bureau. Publications. Statistical Abstract of the US: 2006. Section 23, Transportation. Table 1079, Alternative Fueled Vehicles in Use by Fuel Type: 2002-2004. <http://www.census.gov>

Given the recent influx of hybrid vehicles on the automotive market, it may be necessary to provide an accounting of these types in future counts of alternative fueled vehicles.

### Mass Transportation

Each year, North Carolina's public transportation systems operate more than 1,900 vehicles and transport more than 40 million passengers. Through cooperative planning, efficient use of resources, new technologies and visionary leadership, public transportation systems in

North Carolina are working with intercity passenger rail services, ferries, land-use planners and community leaders to create an intermodal, seamless transportation network linking all areas of the state.

Currently, public transportation operates in all 100 North Carolina counties. Nearly half of these counties are predominantly rural, while others are almost completely urbanized or suburban. Seventeen city transit systems and one metropolitan regional transit system also operate in the state (23).

Surry County is served by Yadkin Valley Public Transportation, operated by the Yadkin Valley Transportation Authority located in Booneville.

## Hazardous Air Pollutants

Hazardous air pollutants (HAPs) refer to over 188 chemicals that can cause adverse effects on human health and the environment. They include substances that can cause cancer, neurological, respiratory and reproductive effects in humans. HAPs are ranked by a method that combines exposure data from the US EPA National Scale Air Toxics Assessment with toxicity data to estimate the health risks posed by chemical pollutants in ambient air (24). The exposure estimates used in determining risk are based on 1996 emissions data, although they are generally consistent with current air monitoring data. The resulting risk estimates are based on models, and therefore are useful for relative ranking but not for predicting any individual's risk of suffering health effects from exposure (25).

Risk due to HAPs is estimated by two measures: added lifetime cancer risk for carcinogenic HAPs, and cumulative hazard indices for chemicals with noncancer effects. Added cancer risk is the estimated individual risk of getting cancer due to a lifetime exposure to outdoor hazardous air pollutants. The goal of the Clean Air Act is to reduce lifetime cancer risk from HAPs to 1 in 1,000,000, so added cancer risk is expressed as a multiple of this measure (26).

According to EPA data accessed via Environmental Defense, Mecklenburg County is the North Carolina county with the highest risks (cancer and non-cancer) from hazardous air pollutants. It also has the greatest population living in proximity to such risk. Of the 100 counties in North Carolina, Surry ranks 42<sup>nd</sup> in terms of an individual's added cancer risk. The estimated added cancer risk for the Surry County population is 360, more than 350 times the goal set by the Clean Air Act. An individual living in Hyde County, ranked best in North Carolina, has an added cancer risk of 130 (27).

The vast majority of the cancer risks (91%) in Surry County come from mobile sources, primarily diesel emissions from on road vehicles such as cars, buses and trucks, and off-road equipment, such as airplanes and agricultural and construction equipment (28). Diesel emissions are a *recognized* carcinogen, and *suspected* to be a cardiovascular or blood toxicant, and a respiratory toxicant (29)

Noncancer hazards are measured by the cumulative hazard index (CHI), which is determined by the ratio of a hazardous air pollutant concentration divided by its safe exposure level. Therefore, if a hazard index exceeds 1, the resulting exposure level may

pose noncancer risks such as neurological, respiratory, reproductive, developmental or other adverse health effects. The goal of the Clean Air Act is to attain an “ample margin of safety to protect public health”, or an index of less than one (26).

According to data from Environmental Defense, Surry County ranks 49<sup>th</sup> out of all North Carolina counties, with a cumulative hazard index (1.4) almost one-and-a-half times greater than the Clean Air Act goal. Mecklenburg County, which is ranked as the county with the highest risks of any kind, has a cumulative hazard index of 3.5, while Hyde County has the lowest CHI of 0.38, well below the Clean Air Act goal of one (27).

The sources of the pollutants that contribute to non-cancer health risks are not as easy to pinpoint as those leading to higher cancer risks, and they vary much more from county to county. However the most significant non-cancer hazardous air pollutant in Surry County is acrolein (28). This chemical, ranked among the worst 10% of compounds hazardous to ecosystems and human health, is produced in high volume in consumer products, building materials or furnishings, and pesticide products, and contributes to indoor air pollution. Acrolein is *suspected* of being a carcinogen, a cardiovascular or blood toxicant, a developmental toxicant, a gastrointestinal or liver toxicant, a neurotoxicant, a respiratory toxicant, and a skin or sense organ toxicant (30). In Surry County, area sources contribute 45% to the cumulative hazard index while mobile sources contribute 41% to the CHI (28).

## Indoor Ambient Air

The quality of the air inside buildings has received greater attention in recent years. Indoor ambient air pollutants may cause both short-term and long-term health effects. Immediate effects may show up after a single exposure or after repeated exposures. Health effects from indoor air pollutants include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-term and treatable. Sometimes the treatment is simply eliminating the person's exposure to the source of the pollution, if it can be identified. Symptoms of some diseases, including asthma, hypersensitivity pneumonitis, and humidifier fever, may also show up soon after exposure to some indoor air pollutants.

Other health effects may show up either years after exposure has occurred or only after long or repeated periods of exposure. These effects, which include some respiratory diseases, heart disease, and cancer, can be severely debilitating or fatal. It is prudent to try to improve the indoor air quality in homes and other structures even if symptoms are not noticeable.

The primary cause of indoor air quality problems in homes is sources that release gases or particles into the air, including sources of combustion (oil, gas, kerosene, coal and wood as well as tobacco products), wet, damp or deteriorated insulation or carpet, cabinetry and furniture made of certain pressed wood products, chemical products for cleaning, personal care, or hobbies, and central heating and cooling systems and humidification devices. Also of concern are gasses from the outside such as radon, pesticides and outdoor air pollution that seep into homes. Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the home (31)

## Environmental Tobacco Smoke

In 1992, the EPA completed its risk assessment on *The Respiratory Health Effects of Passive Smoking: Lung Cancer and Other Disorders* and concluded that the widespread exposure to environmental tobacco smoke (ETS) in the United States presents a serious and substantial public health impact. Children are particularly susceptible to the effects of passive smoking. Their bronchial tubes are smaller and their immune systems are less developed, making them more likely to develop respiratory and ear infections when exposed to environmental tobacco smoke. Because they have smaller airways, children breathe faster than adults and consequently breathe in more harmful chemicals per pound of their weight than an adult would in the same amount of time (32).

A review by the World Health Organization concluded that passive smoking is a cause of bronchitis, pneumonia, coughing and wheezing, asthma attacks, middle ear infection, cot death, and possibly cardiovascular and neurobiological impairment in children (33). Asthma is the most common chronic disease of childhood. There is now compelling evidence that passive smoking is a risk factor for the induction of new cases of asthma as well as for increasing the severity of disease among children with established asthma. Infants of mothers who smoke have almost five times the risk of dying from Sudden Infant Death Syndrome compared to those whose mothers do not smoke. Parental smoking is also responsible for a 20%-40% increased risk of middle ear disease in children (32)

A massive University of North Carolina at Chapel Hill survey showed that childhood smoking and exposure to environmental tobacco smoke were responsible for about 15 percent of asthma cases in the youngsters surveyed and resulted in an estimated \$1.34 million in excess medical costs. Statewide, there are an estimated 2,659 cases of asthma attributable to environmental tobacco smoke and 198 cases attributable to current childhood cigarette use in this survey. Since the annual cost of treating a single active asthma case in North Carolina in that age group is \$471 (in 2001 dollars), parents and others spend \$1.34 million a year to provide care for the excess asthma cases resulting from tobacco exposures (34).

According to CDC data (35), in 1996 25.7% of adults responding to the North Carolina BRFSS self-identified as “current smokers”. In that same year, 10.1% of North Carolina households had an adult smoker and children living in the home. According to CDC estimates, 23.1% of all children under 18 in the United States were exposed to ETS in the home; in North Carolina the comparable exposure figure was 26.1% (Table 14).

	Current Smoker % of Adults ≥18	Current Smoker and Children in the Home	Smoking Allowed in All or Some Areas of the Home	Children Exposed to ETS in the Home	
				No. Children	% Children
<b>NC</b>	25.7%	10.1%	87.5%	416,544	26.1%
<b>US Median</b>	23.6%	9.8%	87.5%	229,446	23.1%

Source: Centers for Disease Control and Prevention. MMWR. Weekly Report. Volume 46, No. 44, November 7, 1997. State-Specific Prevalence of Cigarette Smoking among Adults, and Children’s and Adolescents’ Exposure to Environmental Tobacco Smoke – United States, 1996. Page 1038

According to the 2005 Behavioral Risk Factor Surveillance System Survey, 22.6% respondents statewide self-identify as “current smokers”. No comparable county-specific BRFSS data exist for Surry County, but according to *regional* BRFSS data (which includes respondents from Davie, Rockingham, Stokes, Yadkin and Surry counties, 30.3% of respondents self-identified as “current smokers” in 2005 (36).

As noted in Table 14 above, in 1996, 87.5% of households in North Carolina and the United States allowed smoking in all or some areas of the home. According to 2004 BRFSS data (37), the percent of North Carolina households allowing smoking in all or some areas of the home had decreased dramatically to 27.1%; the percent dropped even further by 2005, to 24.9%. The percentage of households allowing smoking in the BRFSS region including Surry County was 43.0% in 2004 and 35.1% in 2005 (Table 15).

	Not Allowed Anywhere		Allowed in Some Places		Allowed Anywhere		No Rules About Smoking	
	2004	2005	2004	2005	2004	2005	2004	2005
<b>Surry Region</b>	57.0	64.8	9.9	10.4	13.6	8.9	19.5	15.8
<b>North Carolina</b>	72.3	75.1	8.1	8.6	7.0	5.1	12.6	11.2

Source: NC State Center for Health Statistics. BRFSS Survey Results: North Carolina, 2004, 2005. Second Hand Smoke Policy. NC Statewide; Davie/Rockingham/Stokes/Surry/Yadkin Counties. <http://www.schs.state.nc.us/SCHS/brfss/2005/index.html>

## Carbon Monoxide

Carbon monoxide (CO) is called the silent killer because it cannot be seen, smelled or tasted, and it does not irritate the skin, eyes or lungs. Most accidental carbon monoxide poisonings occur from CO released by heaters or cars. People exposed to the gas are unaware they are breathing in the CO until they get sick. About 600 accidental deaths due to CO poisoning occur each year in the United States (38).

### Carbon Monoxide Poisoning Deaths

In North Carolina in 2004, there were 10 deaths due to *accidental* exposure to non-organic gases and vapors (including carbon monoxide) and an additional 30 deaths due to *intentional* self-poisoning; one death was due to an assault with gases and vapors. In 2005 there were 20 accidental deaths and 34 intentional deaths attributable to these causes (39).

According to the NC State Center for Health Statistics, in 2004 there were 37 deaths statewide due to CO poisoning, 8 of which were unintentional. In Surry County in 2004, there was one death due to intentional self-poisoning by CO poisoning. No other deaths in Surry County were attributed to CO in 2004 (40).

There were three visits to the emergency room among Surry County residents due to CO exposure in 2004 and 2005.

## Indoor Air Quality Regulations and Policies

### Smoke-Free Workplaces

According to information catalogued by WorkingSmokeFree.com, the only workplace in Surry County on record as being officially smoke free was the local health department, the Surry County Health and Nutrition Center (41).

Data summarized by the American Lung Association (42) indicates that as of August 3, 2006 North Carolina had no overarching state laws regulating clean indoor air in public places or in private workplaces. Legislation passed in 2006, however, effectively regulates the use of tobacco products in government buildings. NC General Statute §§ 143-595 et seq. (2006) stipulates:

*The following areas may be designated as non-smoking areas in buildings owned, leased, or occupied by the state government. A library or museum open to the public; an area established as a non-smoking area, as long as at least 20 percent of the interior area, of equal quality, is required to be designated as a smoking area; any indoor space in an auditorium or arena except a designated smoking area shall be established in the lobby; any educational buildings primarily involved in health care instruction, and certain buildings/areas in University of North Carolina schools. Existing physical barriers and ventilation systems shall be used for non-smoking areas. All areas of any buildings occupied by the General Assembly are also smokefree. Exempt from this law are primary or secondary schools or day care centers -- except for a teacher's lounge, enclosed elevators, public*

*school buses, hospitals, nursing homes and other rest homes, local health departments and the grounds of local health departments, local departments of social services and the grounds of local departments of social services, tobacco manufacturing, processing or administrative facilities, indoor arenas with a seating capacity greater than 23,000 people, state correctional facilities operated by the Department of Correction, community colleges and nonprofit organizations whose primary purpose is to discourage the use of tobacco products by the general public. Individuals who continue to smoke in a non-smoking area, despite notice by the person in charge, will be guilty of an infraction and be fined no more than \$25. This law does not supersede any local law, rule, or ordinance enacted prior to October 1, 1993. After this date, local laws, rules, or ordinances shall not be amended or enacted to contain restrictions regulating smoking, which exceed those in this law.*

In addition, according to NC General Statute § 148-23.1 (2006):

*No person may use tobacco products inside of a state correctional facility, except for authorized religious purposes. Inmates in violation of this section are subject to disciplinary measures to be determined by the department, including the potential loss of sentence credits earned prior to that violation. Employees in violation are subject to disciplinary action by the department. Visitors in violation are subject to removal from the facility and loss of visitation privileges.*

The state has had enabling legislation on the books since 2003 (NC General Statute §§ 115C-407) permitting local boards of education to adopt and enforce policies prohibiting the use of all tobacco products in public school buildings, in school facilities, on school campuses, or at school-related or school-sponsored events, and in or on other school property.

## **School-Focused Policies**

An issue of growing importance these days is the air quality in our nation's schools. A study published by the US Government Accounting Office and the Department of Health and Human Services estimates that 8.4 million students attend schools with poor indoor air quality. Poor air quality can affect children's desire and ability to learn and can cause them to miss valuable days of school (43). According to the National Association of State Boards of Education, the State of North Carolina does not have any statutes specifically addressing indoor air quality in schools; however, North Carolina general Statute §130A-236 (1998) requires the Commission for Health Services to adopt rules establishing sanitation requirements, which include cleanliness, adequate lighting, ventilation, and waste disposal, for public, private, and religious schools, and requires the Department of Environmental and Natural Resources to conduct an annual inspection of schools (44).

## **Tobacco-Free Schools**

One factor greatly affecting indoor air quality in schools is the school district's or Board of Education's school tobacco policies. Having a tobacco-free school environment is important in achieving physical, mental, and social health goals for students, staff, the school and the district. North Carolina is at a pivotal point as community and school teams work towards this goal. There is much support for schools to adopt comprehensive tobacco policies. As of

May 2006, 78 of North Carolina's 115 School districts had adopted 100% Tobacco-Free policies, including Elkin City Schools. However, as of July, 2006 Surry County Schools and Mount Airy Schools were among the 37 school districts in North Carolina yet to adopt this policy (45).

## Health Effects of Air Pollution

Air pollution poses many health risks and different pollutants can lead to respiratory problems, exacerbated allergies, asthma, and increased incidence of cardiovascular disease. This is especially true for vulnerable populations such as children, the elderly, pregnant women, those with heart or lung disease, and people with weakened immune systems.

## Sick Building Syndrome/Building Related Illness

According to the US EPA (46), the term "sick building syndrome" (SBS) is used to describe situations in which building occupants experience acute health and comfort effects that appear to be linked to time spent in a building, but for which no specific illness or cause can be identified. The complaints may be localized in a particular room or zone, or may be widespread throughout the building. In contrast, the term "building related illness" (BRI) is used when symptoms of diagnosable illness are identified and can be attributed directly to airborne building contaminants.

A 1984 World Health Organization Committee report suggested that up to 30 percent of new and remodeled buildings worldwide may be the subject of excessive complaints related to indoor air quality (IAQ). Often this condition is temporary, but some buildings have long-term problems. Frequently, problems result when a building is operated or maintained in a manner that is inconsistent with its original design or prescribed operating procedures. Sometimes indoor air problems are a result of poor building design or occupant activities.

Indicators of SBS include:

- Building occupants complain of symptoms associated with acute discomfort, e.g., headache; eye, nose, or throat irritation; dry cough; dry or itchy skin; dizziness and nausea; difficulty in concentrating; fatigue; and sensitivity to odors.
- The cause of the symptoms is not known.
- Most of the complainants report relief soon after leaving the building.

Indicators of BRI include:

- Building occupants complain of symptoms such as cough; chest tightness; fever, chills; and muscle aches
- The symptoms can be clinically defined and have clearly identifiable causes.
- Complainants may require prolonged recovery times after leaving the building.

It is important to note that complaints may result from other causes. These may include an illness contracted outside the building, acute sensitivity (e.g., allergies), job related stress or

dissatisfaction, and other psychosocial factors. Nevertheless, studies show that symptoms may be caused or exacerbated by indoor air quality problems (46).

A number of factors have been cited as causing or contributing to SBS, among them:

- Inadequate ventilation
- Chemical contaminants from indoor sources (adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides, and cleaning agents, especially those emitting volatile organic compounds; environmental tobacco smoke; respirable particulate matter; and combustion products such as carbon monoxide and nitrogen dioxide from unvented kerosene and gas space heaters, woodstoves, fireplaces and gas stoves)
- Chemical contaminants from outdoor sources (pollutants from motor vehicle exhausts; plumbing vents, and building exhausts that enter buildings through poorly located air intake vents, windows, and other openings or garages)
- Biological contaminants (bacteria, molds, pollen, and viruses that may breed in stagnant water in ducts, humidifiers and drain pans, or where water has collected on ceiling tiles, carpeting, or insulation; also in insect or bird droppings)

In order to establish a cause and effect relationship between the symptoms of an illness and a contaminant of an indoor environment it is necessary to conduct an investigation that demonstrates both (a) the presence of a contaminant in the environment and, and (b) that the physical or mental complaint is actually caused or exacerbated by that contaminant. Proving such relationships is exceedingly difficult.

The Occupational and Environmental Epidemiology unit in the Epidemiology Section of the NC Division of Public Health keeps city and county level data on indoor air quality complaints, including the type of facility, the type of complaint and the complainant. As of press time, representatives of the agency had not returned calls of inquiry made by the researchers.

## **Asthma**

Asthma is a chronic respiratory disease characterized by episodes or attacks of inflammation and narrowing of small airways in response to asthma “triggers.” Asthma attacks can vary from mild to life-threatening and involve shortness of breath, cough, wheezing, chest pain or tightness, or a combination of these symptoms.

Sources of indoor and outdoor air pollution can trigger asthma attacks. Some of the most common indoor asthma triggers include secondhand smoke, dust mites, mold, cockroaches and other pests, and combustion byproducts (47). Outdoor triggers include high levels of ozone and particulate pollution, which have been associated with 10-20% of all respiratory hospital visits and admissions (48).

### **Asthma Mortality**

According to data from the CDC (49), in 2002, 4,261 people died from asthma in the United States. Among children, asthma deaths are rare. Nationwide, 187 children aged 0-17 years

died from asthma in 2002. That indicates a mortality rate of 0.3 deaths per 100,000 children, compared to 1.9 deaths per 100,000 adults aged 18 and over. Non-Hispanic blacks were the most likely to die from asthma, and had an asthma death rate over 200% higher than non-Hispanic whites and 160% higher than Hispanics. National estimates for Hispanic subgroups, such as Puerto Ricans and Mexicans, are not available. Females had an asthma death rate about 40% higher than males.

In 2002, there were 7,147 deaths due to diseases of the respiratory system in North Carolina, 103 of which are attributed specifically to asthma. In Surry County in 2002, there were 60 deaths due to diseases of the respiratory system, none of which were attributed specifically to asthma. According to the most recent data, in 2005 there were 7,617 respiratory disease deaths statewide, 107 of which were attributed to asthma. In Surry County in 2005 there were 78 deaths due to respiratory diseases, one of which was attributed to asthma (50).

### **Asthma Morbidity**

**Prevalence.** The prevalence of asthma in the U.S. increased by more than 73% between 1980 and 1999, during which interval children and certain racial groups, especially African Americans, experienced relatively greater increases in asthma prevalence (51).

According to CDC data based on the national BREF Survey, in 2002, 12.9% of the adult respondents in North Carolina reported having been diagnosed with asthma at some point in their lifetime, compared to a national average of 10.1% (52). The five-county region that includes Surry County was not sampled in 2002, but according to the results of the 2005 BRFSS Survey, the lifetime prevalence of asthma in the Surry region was 7.1%; statewide, the comparable figure for lifetime asthma prevalence was 10.1%.

According to the National Survey of Children's Health, in 2003 9.0% of North Carolina children currently suffered from asthma, compared to 8.9% of children nationwide (53). In School Year 1999-2000 the North Carolina School Asthma Survey was conducted statewide in North Carolina by a group of researchers from the School of Public Health at the University of North Carolina in Chapel Hill. The purpose of the survey was to assess the prevalence of asthmatic symptoms and risk factors in children in the seventh and eighth grades. According to the results of that survey, the prevalence of asthma among school-aged children in Surry County is 9.9%, while the prevalence of undiagnosed wheezing is 21.6%. Based on these findings, Surry County ranks 50th of all NC counties for prevalence of diagnosed asthma, and 90th for undiagnosed wheezing (54).

The burden of asthma in a community can also be assessed by reviewing rates of hospitalizations and emergency department admissions and discharges for acute asthma events. In 2004, there were 145 asthma-related hospital discharges among the total population in Surry County, equaling a hospitalization rate of 200.6 per 100,000, compared to a rate of 125.9 per 100,000 for the state as a whole. Among children aged 0-14, the 2004 Surry County hospitalization rate was 148.6 per 100,000, compared to a statewide hospitalization rate of 180.2 per 100,000 (55).

## **Cardiovascular and Respiratory Events**

During the last decade, epidemiological studies conducted worldwide have shown a consistent, increased risk for cardiovascular events, including heart and stroke deaths, in relation to short- and long-term exposure to outdoor air pollution, especially particulate matter. Elderly patients, people with underlying heart or lung disease, lower socioeconomic populations and diabetics may be at particularly increased risk. Investigations of adverse effects of particulate air pollution have found a 1% increase in total mortality for each 10 mg/m<sup>3</sup> increase in particulate matter, with respiratory mortality increasing 3.4% and cardiovascular mortality increasing 1.4% (56).

Rates of cardiovascular and respiratory disease in Surry County are discussed thoroughly in Volume 1 (Demographic, Socioeconomic and Health Data) of the Surry County Community Health Assessment. At the present time there is no simple mechanism for linking cardiovascular or respiratory events to air pollution at the county level.

## Chapter Three: Toxic Chemical Releases

### Toxic Release Inventory

Over 6.5 billion pounds of toxic chemicals are released into the nation’s environment each year. The US Toxic Releases Inventory (TRI), created in 1986 as part of the Emergency Planning and Community Right to Know Act, is the tool the US EPA uses to track these releases. Certain industrial facilities are required to report estimates of their environmental releases and waste generation annually to the TRI. Their reports estimate the facilities’ releases of any of approximately 650 toxic chemicals to air, water, and land, as well as the quantities of chemicals they recycle, treat, burn or dispose of in any way on-site or off-site. These reports do not cover all toxic chemicals, and they omit pollution from motor vehicles and small businesses. Because TRI facilities in North Carolina and most other states are not required to report the quantities of toxic chemicals actually *used* (inputs), and report only *estimates* of emissions rather than actual outputs, TRI data may not be totally realistic (57).

In 2002, North Carolina ranked among the 20% dirtiest states in the US in terms of total major chemical releases to the environment, ranking 12<sup>th</sup> out of 56 US states and territories (58). Of the 80 North Carolina counties ranked in 2002, Surry is listed as 28<sup>th</sup> and it ranks among the 30% dirtiest counties in the nation. Davie County was considered the best county in the state in terms of total environmental releases while Person County was considered the worst (59). Table 16 compares the releases among these three counties. Total Surry County TRI releases decreased 29% between 1988 and 2002.

**Table 16: Comparison of TRI Pollution, 2002**

County	Ranking in NC (out of 80)	Pounds Released	Top Pollutant Released	Pounds of Top Pollutant Released	Primary Method of Release
Person	1	19,125,859	Hydrochloric Acid	14,802,518	Air/Land
Surry	28	846,233	Nitrate Compounds	396,792	Water
Davie	80	1	Lead Compounds	1	Air

Source: Scorecard, Pollution Locator, Toxic Chemical Releases: [http://www.scorecard.org/ranking/rank-counties.tcl?fips\\_state\\_code=37&type=mass&category=total\\_env&modifier=na&how\\_many=100](http://www.scorecard.org/ranking/rank-counties.tcl?fips_state_code=37&type=mass&category=total_env&modifier=na&how_many=100)

North Carolina ranks fourth out of 56 US states, territories and protectorates which release chemicals to the air, seventh out of 54 for chemical releases to water, and 18<sup>th</sup> out of 55 with regards to chemical releases to land. Eighty-one percent of the state’s total emissions were air releases, which include all TRI chemicals emitted by a plant from its smoke stacks and from “fugitive sources” such as leaking valves, spills and evaporative losses (58). The majority (53%) of TRIs in Surry County are released into the air (60). Water releases, which include discharges to streams, rivers, lakes, oceans and other bodies of surface water, account for approximately 7% of the total in North Carolina (58), but 46% of the total in Surry County (60). Land releases, which include all the chemicals disposed on land in landfills, via farming, in surface impoundments, and via accidental spills or leaks, comprise the second most important category of releases in North Carolina (11%) (58) but are not numerically significant in Surry County (60). The following section identifies the primary point sources and health risks associated with the most abundant pollutants emitted in Surry County.

In 2002 the Surry County facilities releasing the most TRI chemicals were, in decreasing order of significance, Wayne Farms LLC in Dobson (396,792 pounds of nitrate compounds), Weyerhaeuser Company, Elkin Plant in Elkin (192,673 pounds of primarily methanol), Vaughan-Bassett Furniture Company, Elkin Division in Elkin (178,333 pounds, approximately 45% toluene and 33% methyl ethyl ketone) and Bassett Furniture Industries in Mount Airy (64,762 pounds, approximately 58% toluene and 22% methyl ethyl ketone) (61). It should be noted that while total TRI chemical releases had been reduced at the latter two facilities between 1988 and 2002, total environmental releases *increased* by 1,184% at the Weyerhaeuser facility between 1989 and 2002, and by 1,869% at the Wayne Farms facility between 1993 and 2002 (61).

Surry County ranks 49th in the state (out of 81 ranked counties) in terms of production related waste – 1,230,443 pounds compared to the worst county, New Hanover with almost 174 *million* pounds of total production-related waste (59). Total production-related waste is the sum of all non-accidental chemical waste generated at a facility, and includes on-site environmental releases, on-site waste management (recycling, treatment and combustion for energy recovery) and off-site transfer for any purpose). The Surry County facilities generating the most production-related waste include, in decreasing order of significance, the same four facilities cited above: Wayne Farms LLC (713,275 pounds of nitrate compounds), Weyerhaeuser Company (241,541 pounds of primarily methanol), Vaughan-Bassett Furniture Company (182,037 pounds of primarily toluene and methyl ethyl ketone) and Bassett Furniture Industries in Mount Airy (67,404 pounds of primarily toluene) (61). Of these facilities, only the Bassett facility reduced its production-related waste – by 62% -- from 1991-2002. During this period, production waste *increased* at Wayne Farms by 3,440%, at Weyerhaeuser by 157%, and at Vaughan-Bassett by 1,480% (61).

For purposes of relating chemical releases to the health of the public, TRI chemicals are categorized as having “cancer risks” or “noncancer risks”. The ranking system, based on pounds of releases, uses a weighting factor so chemical releases can be compared on a common scale that takes into account both exposure and toxicity. The weighted result, referred to as a Toxic Equivalency Potential (TEP), is a relative measure of human health risk associated with a release of one pound of subject chemical compared to the risk posed by the release of one pound of a reference chemical. All releases of carcinogens are converted to pounds of benzene equivalents; all releases of chemicals that cause noncancer health effects are converted to pounds of toluene equivalents. Each chemical’s TEP is multiplied by its release quantity (in pounds) to determine the chemical’s local risk score (62).

Surry County ranks 52<sup>nd</sup> in North Carolina in overall cancer risk score (63) and 51<sup>st</sup> in overall non-cancer risk score (64). Tables 17 and 18 (following page) list the cancer (65) and non-cancer risk scores (66) and sources of the major chemical releases in Surry County.

Table 19 (following page) details the health effects of the chemicals contributing most to the cancer and non-cancer risk scores of TRI releases in Surry County (67).

Chemical	Cancer Risk Score (pounds of benzene-equivalents)	Major Source	Cancer Risk Score from Major Source
Formaldehyde	860	Weyerhaeuser, Elkin	860
Lead Compounds	550	Weyerhaeuser, Elkin	360
Acetaldehyde	64	Weyerhaeuser, Elkin	64

Sources: Scorecard, Pollution Rankings, Toxic Chemical Releases, Ranked by Cancer Risk Score. [http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips\\_county\\_code=37171&cancer\\_p=1](http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips_county_code=37171&cancer_p=1)

and: Scorecard. Pollution Locator. Facilities Contributing to Cancer Hazards: [http://www.scorecard.org/env-releases/county-facility-ranks.tcl?fips\\_county\\_code=37171&type=tep&category=cancer&modifier=NA](http://www.scorecard.org/env-releases/county-facility-ranks.tcl?fips_county_code=37171&type=tep&category=cancer&modifier=NA)

Chemical	Noncancer Risk Score (Pounds of toluene-equivalents)	Major Source	Cancer Risk Score from Major Source
Lead Compounds	12,000,000	Weyerhaeuser, Elkin	7,500,000
Formaldehyde	680,000	Weyerhaeuser, Elkin	680,000
Toluene	120,000	Vaughan-Bassett, Elkin	79,000
Acetaldehyde	60,000	Weyerhaeuser, Elkin	60,000
Methanol	14,000	Weyerhaeuser, Elkin	13,000
Xylene	7,100	Vaughan-Bassett, Elkin	3,700
Methyl ethyl ketone	3,900	Vaughan-Bassett, Elkin	3,200

Source: Scorecard, Pollution Rankings, Toxic Chemical Releases, Ranked by Noncancer Risk Score. [http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips\\_county\\_code=37171&cancer\\_p=0](http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips_county_code=37171&cancer_p=0)

and: Scorecard: Pollution Locator. Facilities Contributing to Non-cancer Hazards. [http://www.scorecard.org/env-releases/county-facility-ranks.tcl?fips\\_county\\_code=37171&type=tep&category=noncancer&modifier=NA](http://www.scorecard.org/env-releases/county-facility-ranks.tcl?fips_county_code=37171&type=tep&category=noncancer&modifier=NA)

<b>Lead Compounds</b>	Recognized carcinogen and developmental and reproductive toxicant; suspected cardiovascular, gastrointestinal, kidney and neuro- and immuno-toxicant.
<b>Formaldehyde</b>	Recognized carcinogen; suspected gastrointestinal, liver, reproductive, respiratory, skin/sense organ and neuro- and immuno-toxicant
<b>Toluene</b>	Recognized developmental toxicant; suspected cardiovascular, gastrointestinal/liver, kidney, reproductive, respiratory, skin or sense organ, and neuro- and immuno-toxicant
<b>Acetaldehyde</b>	Recognized carcinogen; suspected developmental, kidney, respiratory, skin/sense organ, and neuro- and immuno-toxicant.
<b>Methanol</b>	Suspected developmental, gastrointestinal, kidney, respiratory, skin/sense organ, and neuro-toxicant.
<b>Xylene</b>	Suspected cardiovascular, developmental, gastrointestinal/liver, kidney, reproductive, respiratory and skin or sense organ and neuron- toxicant
<b>Methyl ethyl ketone</b>	Suspected cardiovascular, developmental, gastrointestinal, kidney, reproductive, respiratory, skin or sense organ and neuron-toxicant

Source: Scorecard, Chemical Profiles. <http://www.scorecard.org/chemical-profiles/index.tcl>

## Land Contamination

### Superfund Sites

Surry County currently does not have any sites on EPA's National Priorities List (NPL), commonly known as the Federal "Superfund" Program List. Superfund sites are some of the nation's worst toxic waste sites, made eligible by law for long-term remediation. North Carolina currently has 31 superfund sites, just above the national average for all states. The North Carolina Superfund Sites are scattered statewide in 20 counties and of those, only Iredell County is even close to Surry County (68).

### Brownfields

The US EPA began the Brownfields Initiative in 1995 to encourage the clean-up and reuse of abandoned contaminated properties. A Brownfields site is any real property that is abandoned, idle or underutilized where environmental contamination, perceived or real, hinders redevelopment. Loans are very difficult to obtain when property comes with potential environmental cleanup liability; the NC Brownfields program aims to alleviate that liability for possible developers. As of September 30, 2006, 87 Brownfields Agreements had been negotiated in North Carolina; there were 107 active eligible projects and 27 more pending. One of the active eligible projects was in Surry County: Chatham Park, in Elkin (69).

### Inactive Hazardous Sites

In 1987 the North Carolina General Assembly enacted The North Carolina Inactive Hazardous Sites Response Act, establishing a program to protect the public and the environment from uncontrolled and unregulated hazardous waste sites that are not addressed by other environmental programs. The Inactive Hazardous Site Branch (IHSB) of DENR can deal with any site where hazardous substance or waste contamination exists that isn't already under the jurisdiction of another program. IHSB assesses sites, maintains the list of current sites and oversees the remediation process. There are nine such sites in Surry County, including five in Elkin, three in Mount Airy and one in Pilot Mountain (70).

## Hazardous Substances Emergency Events

Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system to describe the public health consequences associated with the release of hazardous substances. The North Carolina Division of Public Health has participated in the system since 1991, collecting information on acute hazardous substances emergency events.

Through this program, public health professionals study and describe the public health effects associated with releases of hazardous substances such as ammonia, chlorine, acids, pesticides, paints, and dyes, but *not* petroleum products (71).

Although the data presented below is dated, it is included here as a baseline for comparison with data in future assessments.

## **HSEES Events in North Carolina**

A total of 1,087 statewide hazardous substances emergency events were reported to the HSEES system between 1998 and 2001 by the N.C. Division of Public Health, Occupational and Environmental Epidemiology Branch. Approximately 2% of these events were threatened releases. Thirty-four percent of the events occurred at fixed facilities, and 66% were transportation-related events.

Fixed-facility events occur in various areas of the facilities; approximately 27% occurred in above-ground storage areas, 22% in piping, 13% in material handling, and 10% in process vessels. In transportation-related events, 92% occurred during ground transport (for example, truck, van, or tractor), and 7% involved transport by rail. The remaining transportation-related events involved water, air, or pipeline transport. Human error was a contributing factor in 41% of the events, 23% involved equipment failure, 16% involved improper filling or loading, and the remaining events were attributable to other factors. (Information on factors contributing to transportation events was not collected until 2000.) The most commonly reported hazardous substances released were in the category "Other" (24%); 19% of the events involved volatile organic compounds, 9% involved acids, and 13% involved other inorganic compounds. During this reporting period 106 events resulted in a total of 417 victims, four of whom died. The most common adverse health effects experienced among the survivors were respiratory irritation (264 victims), eye irritation (100 victims), gastrointestinal problems (68 victims) and trauma (42 victims). One-hundred thirty-eight, or almost 13% of the 1087 events required evacuation (72).

## **HSEES Events in Surry County**

In Surry County, a total of nine events reported between 1998 and 2001. Of these, five were fixed-facility events, and four were transportation-related. The proportion of fixed-facility to transportation-related events in Surry County is higher than that of the state as a whole (56% vs. 34%) (72). No injury data is available for these events.

## Chapter Four: Lead Hazards

Lead is a highly toxic metal that was used for many years in products found in and around the home. Elevated exposure to lead can cause serious health effects, particularly by disrupting normal neurological development in young children. Lead exposure typically occurs in and around the house as a result of deteriorating lead-based paint, lead-contaminated dust, and lead-contaminated soil.

### Housing Units at Risk

One way to estimate the potential burden of lead hazards is to examine local housing and demographic indicators to identify areas with housing at high risk of lead hazards. Studies have demonstrated that housing built prior to 1950 and households with income below the poverty threshold have an elevated risk of lead contamination. The 2000 U.S. Census provides data for both of these risk factors to help estimate potential lead hazards in housing (73). Table 20 shows census data for Surry County related to lead hazard risk.

Housing Units at High Risk for Lead Hazards		Housing Units Built Before 1950		Housing Units with Low Income		Children < 5 Living Below Poverty Level	
No.	%	No.	%	No.	%	No.	%
630	2	4,800	n/a	3,800	13	1,300	31

Source: Scorecard, Pollution Rankings. Lead Hazards by County, [http://scorecard.org/env-releases/lead/rank-counties.tcl?fips\\_state\\_code=37](http://scorecard.org/env-releases/lead/rank-counties.tcl?fips_state_code=37)

In 1999, Surry County ranked among the 30% of US Counties with the highest *number* of housing units with a high risk of lead hazards. However when the *percentage* rankings of US counties are considered, Surry is among the 40% of US counties with the lowest *percentage* of housing units with high risk of lead hazards (74). When Surry County is compared to other North Carolina counties: it ranks among the 27<sup>th</sup> among of counties for the *number* of at-risk housing units but 43<sup>rd</sup> in terms of the *percentage* of at-risk homes (75).

### Childhood Blood Lead Levels

According to statistics provided by the state, the percentage of Surry County children screened for lead has been above the state average for children aged one and two years for the four most recent reporting periods (Table 21, following page). Of those children screened during this period, a higher percentage of children in the county tested positive for elevated lead levels than in the state as a whole in three of the four years cited. When the screening results for children ages six months to six years are considered (Table 22, following page), the percentages of children with high (10-19 µg/dL) and the highest (>20 µg/dL) the same pattern emerges, with rates higher in the county than in the state overall (76).

**Table 21: Surry County Childhood Lead Screening Results, Ages 1 and 2 years**

Year	Location	Target Population	No. Screened	% Screened	% Screened among Medicaid	No. >10 µg/dL	% >10 µg/dL
2005	Surry	1,779	971	54.6	61.6	17	1.8
	NC	238,065	96,623	40.6	56.1	873	0.9
2004	Surry	1,836	1,036	56.4	n/a	21	2.0
	NC	235,599	92,057	39.1	n/a	1,167	1.3
2003	Surry	1,875	965	51.5	62.4	30	3.1
	NC	235,419	87,993	37.4	55.9	1,716	2.0
2002	Surry	1,924	997	51.8	61.5	19	1.9
	NC	238,359	86,212	36.2	54.5	1,614	1.9

Source: NC Division of Environmental Health, Children’s Environmental Health Branch  
[http://www.deh.enr.state.nc.us/ehs/Children\\_Health/Lead/Surveillance\\_Data\\_Tables/surveillance\\_data\\_tables.html](http://www.deh.enr.state.nc.us/ehs/Children_Health/Lead/Surveillance_Data_Tables/surveillance_data_tables.html)

**Table 22: Surry County Childhood Lead Screening Results, Ages 6 Months to 6 years**

Year	Location	No. Screened	No. Confirmed 10-19 µg/dL	% Confirmed 10-19 µg/dL	No. Confirmed >20 µg/dL	% Confirmed > 20 µg/dL
2005	Surry	1,201	1	<0.1	0	---
	NC	128,249	299	0.23	53	0.04
2004	Surry	1,325	7	0.53	0	---
	NC	124,486	349	0.28	52	0.04
2003	Surry	1,156	5	0.43	0	---
	NC	121,697	467	0.38	38	0.03
2002	Surry	1,360	2	0.15	1	0.07
	NC	120,966	461	0.38	68	0.06

Source: NC Division of Environmental Health, Children’s Environmental Health Branch  
[http://www.deh.enr.state.nc.us/ehs/Children\\_Health/Lead/Surveillance\\_Data\\_Tables/surveillance\\_data\\_tables.html](http://www.deh.enr.state.nc.us/ehs/Children_Health/Lead/Surveillance_Data_Tables/surveillance_data_tables.html)

## Hospitalizations Due to Lead Poisoning

No hospitalizations due to lead poisoning were reported among children or adults in Surry County in 2004 or 2005.

## Chapter Five: Agricultural Pollution

Growing crops successfully involves the application of a variety of chemicals, some of which have environmental effects beyond their intended use. Unfortunately, most of these effects are deleterious. Livestock production also requires chemicals, mostly in the form of food additives and antibiotics. The major environmental issue connected with livestock production is the generation of animal waste. In order to understand the effect of a county’s agricultural production on the environment, it is first necessary to understand the nature of the crops being grown and livestock being raised.

### Surry County Agricultural Census

In 2002 Surry County was home to 1,268 farms, totaling 129,090 acres, 39,888 of which is harvested cropland. The average farm size in Surry County is 102 acres. Crops in Surry County include tobacco, soybeans, corn, wheat, barley, and hay. Livestock raised in the county includes chickens, cattle, and hogs (77). A summary of agricultural crop production in Surry County for 2004 is shown in Table 23; livestock production is summarized in Table 24.

**Table 23. Crops Grown in Surry County, 2004**

Crop	Acres Harvested	Yield per Acre	Production	State Rank
Tobacco, lbs.	3,740	2,200	8,227,000	18
Cotton, 480 lb. bales	---	---	---	---
Soybeans, bu.	8,600	37	320,000	49
Corn, bu.	5,300	145	770,000	34
Corn for silage, tons	1,550	22	33,500	13
Peanuts, lbs.	---	---	---	---
Wheat, bu.	2,400	51	122,000	51
Barley, bu.	1,500	59	88,000	3
Oats, bu.	---	---	---	---
Sweet potatoes, Cwt.	---	---	---	---
Irish potatoes, Cwt.	---	---	---	---
All hay, tons	19,000	2.32	44,000	9
Sorghum, bu.	---	---	---	---

Note: Harvests of less than 15 acres tobacco, 100 acres peanuts, and 200 acres other crops are not shown in table.

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. County Estimates. County Estimates by Commodities. [http://www.agr.state.nc.us/stats/cnty\\_est/cnty\\_est.htm](http://www.agr.state.nc.us/stats/cnty_est/cnty_est.htm).

**Table 24. Livestock Raised in Surry County, 2004**

Stock	Number	State Rank
Hogs and pigs	18,400	39
Cattle	21,000	10
Beef cows	10,200	10
Milk cows	500	27
Broilers	21,000,000	11
Turkeys raised	---	---
All chickens	500,000	11

Note: Stock of fewer than 1,000 hogs, 500 total cattle, 200 beef or milk cows, 500,000 broilers of turkeys, or 50,000 other chickens not shown in table.

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. County Estimates. County Estimates by Commodities. [http://www.agr.state.nc.us/stats/cnty\\_est/cnty\\_est.htm](http://www.agr.state.nc.us/stats/cnty_est/cnty_est.htm).

## Pesticides

A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Though often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests. Under United States law, a pesticide is also any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant (78)

By their very nature, most pesticides create some risk of harm to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms.

## Pesticide Usage

Tables 25 (this page), and Tables 26, and 27 (following page) list the agricultural chemicals applied to the three major crops (in terms of acres grown) in Surry County in 2002 according to the NC Department of Agriculture and Consumer Services (79). The Department does not list agricultural chemicals applied to tobacco.

In 2002, there were 17,114 pounds of pesticides applied to soybean crops, with glyphosate being the most heavily applied pesticide. There were 88,228 pounds of pesticide applied to corn in 2003, with alchlor being the most heavily applied pesticide. In 2000, there were 3,048 pounds of pesticides applied to wheat crops, with 2,4-D being the most heavily applied.

Chemical	Rate per Application	Rate per Crop Year	Pounds per Year
	Pounds per Acre		
<b>Herbicides</b>			
Glyphosate	0.71	0.98	8,428
Imazethapyr	0.04	0.04	344
Paraquat	0.39	0.39	3,354
Pendimethalin	0.53	0.53	4,558
<b>Total herbicides</b>			<b>16,684</b>
<b>Insecticides:</b>			
Esfenvalerate	0.03	0.03	258
Lambda-cyhalothrin	0.02	0.02	172
<b>Total insecticides</b>			<b>430</b>

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. Environmental Statistics. Agricultural Chemical Applications. <http://www.agr.state.nc.us/stats/otherept.htm#county>

**Table 26. Corn: Agricultural Chemical Applications, Surry County, 2003**

Chemical	Rate per Application	Rate per Crop Year	Pounds per Year
	Pounds per Acre		
<b>Herbicides:</b>			
2,4-D	.36	0.40	2,740
Alachlor	1.82	1.82	12,467
Ametryn	1.12	1.12	7,672
Alazine	1.18	1.22	8,357
Dichlorprop	0.26	0.31	2,124
Glyphosate	0.69	1.00	6,850
Linuron	0.80	0.80	5,480
Metolachlor	1.35	1.35	9,248
Nicosulfuron	0.02	0.02	137
Paraquat	0.50	0.52	3,562
Rimsulfuron	0.01	0.01	69
S-Metolachlor	1.10	1.10	7,535
Simazine	1.14	1.14	7,809
<b>Total herbicides</b>			<b>74,048</b>
<b>Insecticides</b>			
Chlorpyrifos	1.06	1.06	7,261
Terbufos	1.01	1.01	6,919
<b>Total insecticides</b>			<b>14,180</b>

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. Environmental Statistics. Agricultural Chemical Applications. <http://www.agr.state.nc.us/stats/otherept.htm#county>

**Table 27. Wheat: Agricultural Chemical Applications, Surry County, 2000**

Chemical	Rate per Application	Rate per Crop Year	Pounds per Year
	Pounds per Acre		
<b>Herbicides:</b>			
2,4-D	0.66	0.66	1,584
Diclofop-methyl	0.58	0.58	1,392
Thifensulfuron	0.02	0.02	48
Tribenuron-methyl	0.01	0.01	24
<b>Total herbicides</b>			<b>3,048</b>

Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. Environmental Statistics. Agricultural Chemical Applications. <http://www.agr.state.nc.us/stats/otherept.htm#county>

## Health Effects of Pesticides

The health effects of pesticides depend on the type of pesticide. Some, such as the organophosphates and carbamates, affect the nervous system. Others may irritate the skin or eyes. Some pesticides may be carcinogens. Others may affect the hormone or endocrine systems in the body (80).

Below in Table 28 (following page) is the EPA’s assessment of the health risks and health effects of the seven herbicides and two insecticides applied most heavily (by weight) on Surry County crops as listed in the agency pesticide re-registration database (81).

<b>Table 28. Characteristics of Pesticides in Highest Use (by weight) in Surry County</b>				
<b>Pesticide</b>	<b>Lbs/Year</b>	<b>Class</b>	<b>Toxicity</b>	<b>Health Risks/Effects</b>
<b>Herbicides</b>				
Glyphosate	15,278	Non-selective herbicide; growth regulator	III	Relatively acute toxicity (eye and skin contact irritation); non-carcinogenic, minimal dietary risk
Alachlor	12,467	Non-residential weed control; "restricted" due to groundwater and surface water contamination concerns	III (oral) or IV (dermal)	Protection required for handling liquid formulation; toxic to fish; established tolerances for residues on food
Metolanchlor	9,248	Broad-spectrum weed control, including residential uses; incorporates into soil	III	Livestock may not be grazed in treated areas; possible human carcinogen and developmental toxicant; possible systemic toxicity from immediate exposure; established tolerances for residues on food; protection required for handlers due to dermal sensitization
Simazine	7,809	Selective systematic pre-emergent herbicide applied to soil	III (oral) or IV (dermal)	Not an eye or skin irritant, or a dermal sensitizer; neuron-endocrine mechanism of toxicity; possible reproductive and developmental toxicant; minimal drinking water or dietary risk
Ametryn	7,672	Herbicide for non-residential use	III (oral) or IV (dermal)	Established tolerances for residues on food; low drinking water or dietary risk; protection recommended for handlers
S-Metolachlor	7,535	Broad-spectrum herbicide in crops, turf and ornamentals; incorporated into the soil	III (oral) or IV (dermal)	Slightly toxic by the oral, dermal and inhalation routes; non-irritating to the eyes and skin; possible carcinogen and developmental toxicant; dermal sensitizer; established tolerances for residues on food; protection required for handlers
Paraquat	6,916	Pre- and post-emergent herbicide of weeds and grasses; desiccant; wide-spread non-crop use	I (inhalation), II (oral) or III (dermal)	High acute inhalation toxicity; moderate to severe eye irritation and minimal dermal irritation; probably non-carcinogenic; established tolerances for residues on food; minimal chronic dietary risk; high exposure risk to handlers and re-entry workers, with 12-hour restricted entry interval
<b>; Insecticides</b>				
Chlorpyrifos	7,261	Organophosphate used on food and feed crops; not for residential use		Can cause cholinesterase inhibition and at very high exposures can cause respiratory paralysis and death; low drinking water and food risk; protection required by handlers; multiple exposures increase risks to wildlife
Terbufos	6,919	Insecticide for controlling soil insects; not for residential use		Can cause cholinesterase inhibition and at very high exposures can cause respiratory paralysis and death; low drinking water and food risk; high acute risks for wildlife species (a leading cause of fish kills)

Note: There are four classes of acute toxicity, ranging from I (very highly or highly toxic) to IV (practically non-toxic).  
 Source: US Environmental Protection Agency. Pesticides. Regulating Pesticides. Re-registration. Re-registration Status. <http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg>

## Pesticide Residues in/on Food

According to an employee of the NC Department of Agriculture’s Product Testing unit (82) in 2005 four food samples tested were in violation of regulations for pesticide residues for safe consumption. According to the contact, these positive samples represented less than 1% of all samples tested.

## Pesticide-Related Poisonings

There was one accidental death due to pesticide poisoning in North Carolina in 2005. None occurred statewide between 2000 and 2004, but one occurred in 2000 (83).

## Agricultural Animal Waste

In 1997 North Carolina had the dubious distinction of being among the 20% of all states with the highest levels of animal waste, with especially high rates of waste production from hogs and poultry and comparably high amounts of nitrogen and phosphorus released to the environment (84). Of the 98 North Carolina counties ranked for animal waste generation, Surry County is ranked 25th, with an output of 320,000 tons, yet is still far from the worst in the state. Animal waste generation of between 1.5 and 4.5 *million* tons occurs in the North Carolina counties at the top of the list: Duplin, Sampson, Bladen and Wayne. Table 29 details the animal waste production in the county.

County	Total Waste (in Tons)	Total No. Animals	Percent of Total			
			Primary Animal	Waste generated	Secondary Animal	Waste generated
Surry	320,000	3,808,262	99% Poultry	38%	0.6% Cattle	53%

Source: Scorecard, Pollution Locator, Animal Waste. County Report. Surry County [http://www.scorecard.org/env-releases/aw/county.tcl?fips\\_county\\_code=37171](http://www.scorecard.org/env-releases/aw/county.tcl?fips_county_code=37171)

As of 1997, there were over 3 million head of poultry and just over 24,000 head of cattle in Surry County. There is over 150 times more poultry in Surry County than cattle, yet the cattle produce more than half of all the animal waste generated in the county. Waste from animals whose digestive system more closely resembles the human digestive system is considered more of a threat to human health. Cattle are herbivores and so their digestive system is dramatically different from a human’s. Likewise with chickens, whose digestive system is slightly more like a human’s than a cow’s. Hogs, like humans, are omnivores, and so their digestive system is more like that of a human; therefore hog waste is considered more dangerous to humans than either cattle or poultry waste. In 1997 there were 15,500 hogs being raised in Surry County, making it the third most common class of livestock (85).

During the last decade livestock farming in Surry County has changed considerably, and as a result so has animal waste production (Table 30, following page). Cattle production as increased slightly, and hog production has increased slightly. Poultry production, on the other hand, has increased by a factor of 5.7.

Year	No. of Head		
	Cattle	Hogs	Poultry
<b>2004</b> <sup>1</sup>	21,000	18,400	21,500,000
<b>1997</b> <sup>2</sup>	24,230	15,598	3,768,049

<sup>1</sup> Source: NC Department of Agriculture and Consumer Services. Agricultural Statistics Division. County Statistics. <http://www.agr.state.nc.us/stats/cntysumm/surry.htm>

<sup>2</sup> Source: Environmental Defense. Scorecard. Pollution Locator. Animal Waste. County Report, Surry County. [http://www.scorecard.org/env-releases/aw/county.tcl?fips\\_county\\_code=37171](http://www.scorecard.org/env-releases/aw/county.tcl?fips_county_code=37171)

## Chapter Six: Waste Management

### Solid Waste Management

#### County Solid Waste Management

In FY 2004-2005 Surry County managed 90,567 tons of solid waste for a rate of 1.25 tons *per capita*. This figure represented an increase of 6% from the comparable *per capita* rate for 1991-1992. It is significant to note that during this same period the overall state *per capita* solid waste management rate increased 21% from 1991-1992 to 2003-2004 (86).

#### Landfill

Surry County operates a Subtitle D landfill located at 419 Landfill Road, Mt. Airy and a transfer station located off of Joe Layne Mill Road, Elkin. Both locations are available for the disposal of residential and commercial waste. Waste from the transfer station is delivered to the Subtitle D landfill for final disposal. Each of these two locations has a construction and demolition disposal area for the disposal of any building material (wood, metal, drywall, vinyl, etc) or demolished buildings, plus cement and paving waste. An area is provided at the Mt. Airy landfill for the disposal of tires, appliances (white goods), and yard waste (87).

According to a capacity analysis dated June 2005, the municipal landfill has a remaining permitted capacity of approximately 2,400,000 tons, sufficient to last the county 34 more years at the 2005 disposal rate (88).

#### Waste Drop-Off and Recycling

Surry County operates thirteen recycling/convenience centers. These centers are available for residential drop-off of household waste and provide an outlet for recycling. These centers are *not* available to commercial business waste disposal. All centers accept household waste for disposal. Household waste consists of trash and food waste from the daily activities of a home. Anything other than household waste such as wood, metal, or in general "spring or basement" cleaning must come to the landfill at Mt. Airy or the transfer station at Elkin.

Recycling facilities at each center are available for newspaper, magazines, aluminum cans, glass bottles, cardboard, and auto batteries. The Mt. Airy center has facilities for all paper types, including envelopes, color paper, plain paper, and paper with black or color ink; computer paper is acceptable, but must be segregated from other paper.

No liquids or hazardous waste are accepted at any of the County's disposal areas. Disposal methods of liquids and hazardous waste are available from the source of purchase or the manufacturer of the product (87).

## **City/Town Solid Waste Management and Recycling**

### **City of Mount Airy**

The Mount Airy Sanitation Department offers residential garbage pick-up one time per week, at the curb only, from the city-furnished roll-cart. The city accepts bulk items placed at the curb beside the cart on collection day. City crews do NOT collect paint, building materials, carpet, automobile parts, chemicals, dirt, rocks, stumps or white goods (appliances).

Leaves and yard waste must be bagged or boxed and placed at the curb in or with cart for regular collection. The City also will collect brush cut by the homeowner. This service is free for brush less than 5' in length and less than 3 "diameter and stacked neatly at the curb. Small amounts of clippings or trimmings may be included in trash cart for curbside collection with regular trash. City crews will not pick up any brush cut by professional tree trimmers or landscapers. From October 1 thru December 31 the City uses a leaf machine to collect leaves raked to the street. All other times leaves must be placed in a tied bag or sealed box, and placed in or with cart for regular collection.

The City operates a manned recycling drop off center on Range Road. Items accepted are: plastic containers # 1 & 2, corrugated containers, newspaper, glass containers, white paper, aluminum cans, and magazines (89)

### **Town of Elkin**

The Elkin Public Works Department is responsible for sanitation service, leaf collection, brush collection, snow removal, street maintenance, parking lot maintenance, sidewalk repair, street & traffic sign maintenance and maintenance of all town vehicles (90).

The Town of Elkin offers roll-out curbside trash pickup for all residential customers. The first roll cart will be placed at the residence free of charge. Trash pick-up for residential customers is offered once per week. Pick-up for commercial customers in the downtown district is offered twice a week; for other commercial customers the schedule is once-per-week. The Town offers once-per-week cardboard pickup for downtown customers. Residential customers that have cardboard may drop it off at the Town Garage.

The Town provides yard waste pickup on an as requested basis but has very specific requirements for the kind and size and/or quantity of debris it accepts.

Until 2002, bulk item disposal use to be a no-fee service available upon request, unfortunately the loss of state shared revenues, loss of personnel, and lack of homeowner participation, has forced the Town to limit this service. Bulk item pick up is now a user fee service. Bulk items are considered to be any items that do not fit in the standard issue 96-gallon roll-out cart. Some of these items include household furnishings, household appliances (blender, toaster, etc.), mattresses, box springs, and lawn equipment (mowers, wheelbarrows, etc.). Bulk item pickup is for residential use only. The service is unique in that it involves the homeowner using a town truck, which is dropped off at the residence to be loaded and delivered by the homeowner; the fee for the service is \$50.00 (91).

The Town of Elkin offers a fee-for-service recycling program through Waste Management of the Piedmont, with pick-ups twice a week. The program, which involves curbside bin pickup, costs residential and commercial customers \$2.70 per month.

### **Town of Pilot Mountain**

Pilot Mountain Public Works is responsible to the Town and its citizens for the operation and maintenance of the water distribution & wastewater collection systems. It maintains the grounds and right-of-ways and is responsible for the maintenance of the streets as well as the storm drainage system. The unit also is responsible for clearing the snow & ice, brush, leaf & yard waste removal, meter reading, service connections and responding to work requests from citizens (92).

## **Wastewater Management**

According to 1990 Census data (data not available for the 2000 Census), 5,942 Surry County housing units were on a year-round public sewer system and 19,485 residences had septic tanks or cesspools. An additional 595 housing units had some other form of sewage disposal, including individual sewer pipes into creeks, rivers and streams (straight pipes) or outhouses (93).

## **County Wastewater Management**

Surry County has currently has two water and sewer districts created by the Surry County Board of Commissioners (94).

The Flat Rock/Bannertown Water and Sewer District is located on the eastern side of Surry County with Flat Rock lying east and Bannertown lying south of the City of Mount Airy. Surry County, the City of Mount Airy, and the District agreed to extend public water and sewer, which will facilitate development and provide needed services to existing and future residents, allow for planned economic development, and bring health benefits to the citizens in those areas. The District has obtained a financing commitment from the US Department of Agriculture to begin construction.

The Interstates Water and Sewer District is located on the northwestern side of Surry County west of the City of Mount Airy at the interchanges of I-77 and I-74 and NC Highway 89. This district was created because of its location and economic potential. The county and District are currently exploring funding sources to assist with the costs to provide public water and sewer facilities to serve the local businesses and residences in the area.

## **City/Town Wastewater Management**

### **City of Mount Airy**

The City of Mount Airy has one wastewater treatment plant, which is located just south of the intersection of U.S. Highway 52 and the Ararat River. The plant has a permitted capacity of 7.0 million gallons per day (MGD). Approximately 90% of the average daily flow from the water plants is treated at the wastewater plant and is discharged into the Ararat River at a rate of 3.5 MGD (95).

### **Town of Elkin**

The one Town sewage plant is currently treating an average of 800,000 gallons of sewage per day, and discharging it into the Yadkin River. The plant is permitted at a capacity of 1.8 MGD. The Town maintains 95 miles of water and sewage lines leading to the plant (96)

## **On-Site Wastewater Management**

Although the county's long-range plan includes extension of public water and sewer lines to more parts of the county, it is clear that at the present time only people living in municipalities have access to a public waste management system. According to 1990 Census data cited above, only approximately 23% of the county's residences were connected to year-round public sewer, meaning 77% had septic tanks or cesspools or some other mechanism of sewage disposal. In addition, the lack of an extensive public sewer system means that some commercial and government facilities outside of the sanitary sewer district must depend on on-site wastewater treatment systems, or "package plants" for wastewater treatment.

The Surface Water Protection Section of NC DENR levies civil penalties for discharges from wastewater treatment plants (WWTPs), including package plants, which exceed limits for particular chemical or biological parameters. In 2006 (January through August) five package WWTPs in Surry County received fines, some of them several times: Central Care, Inc. WWTP (seven times); Blyth Homescents International (once); Wayne Farms LLC, Dobson Plant (three times); Surry County Schools, Flat Rock Elementary (once), Mountain Park Elementary (twice) (97).

Local health departments are charged with inspecting and permitting on-site wastewater facilities. During FY 03-04, the Environmental Health division of the Surry County Health and Nutrition Center made a reported 2,106 site visits, and issued 42 citations for violations; no permits were revoked or suspended, but 12 inspections resulted in denied construction or improvement permits (98).

## Chapter Seven: Drinking Water

According to the 2000 Census, 7,580 Surry County year-round housing units were on a water source supplied by a city or county water department, a water district, a private water company, or a well serving six or more housing units. Another 18,007 units had an individual well as the primary source of water. A smaller number of units – 435 – obtained water from some other source, such as springs, creeks, rivers, lakes, ponds or cisterns (99).

### Water Usage

Table 31 details the annual average rate of water usage in Surry County based on data from the 2000 US Census. Domestic water usage includes withdrawal of fresh water from individual wells for domestic uses. Municipal/community water usage is defined as the withdrawal of fresh water from surface and ground water sources by public water supply systems for municipal and commercial uses. Industrial usage is the withdrawal of fresh water from surface and ground water sources or purchases from a water supplier for industrial uses. Irrigation usage refers to water withdrawn from surface and ground sources for agricultural and golf course irrigation, and livestock usage refers to use of surface and groundwater for watering livestock. The total water use is the average annual rate of withdrawal of fresh water from surface and ground water sources for all uses. All figures are reported in millions of gallons per day (99).

As illustrated in Table 31 below, total water usage in Surry County decreased dramatically – by 30% – from 1995 to 2000, due mainly to an 83% decrease in industrial usage. The reasons for this decrease are unclear, but may be related to the closing of industrial and manufacturing plants during the period cited.

Domestic usage decreased slightly over the same period, but municipal/community, irrigation and livestock usage all increased.

	<b>Domestic Usage</b>	<b>Municipal and Community Usage</b>	<b>Industrial Usage</b>	<b>Irrigation Usage</b>	<b>Livestock Usage</b>	<b>Total Usage</b>
<b>2000</b>	2.95	8.11	1.70	2.83	2.33	17.92
<b>1995</b>	3.29	7.60	10.26	2.05	2.08	25.52

Source: Log Into North Carolina (LINC) Database Search. Surry County. Topic Group: Environment, Recreation and Resources. Mineral, Water Resources 1995 and 2000:

[http://data.osbm.state.nc.us/pls/linc/dyn\\_linc\\_main.show](http://data.osbm.state.nc.us/pls/linc/dyn_linc_main.show)

## Drinking Water Systems

Currently, the EPA lists 1989 water systems in Surry County (100). Forty are *community water systems* that together serve almost 25,696 people (Table 32). A community water system is one that serves at least 15 service connections used by year-round residents or regularly serves 25 year-round residents. This category includes municipalities, subdivisions and mobile home parks.

**Table 32. Surry County Water Systems (October, 2006)**

Water System Name	Number Served	Primary Water Source Type
ALLEN WOODS VILLAGE	81	Groundwater
BAILEY MHP NO 1	94	Groundwater
BANNERTOWN HILLS S/D	71	Groundwater
BRITISH WOODS	51	Groundwater
BROOKDALE S/D	43	Groundwater
COLONIAL WOODS WATER SYSTEM	206	Groundwater
CROSS CREEK S/D	234	Groundwater
DEARON VILLAGE S/D	25	Groundwater
DEERFIELD S/D	46	Groundwater
DOBSON, TOWN OF	1981	Surface water
E-MUN-TALEE BOYS CAMP	100	Groundwater
ELKIN, TOWN OF	4409	Surface water
FARM WATER SYSTEM (THE)	102	Groundwater
GREEN HEIGHTS WATER SYSTEM	36	Groundwater
GREENFIELD WATER SYSTEM	241	Purchased surface water
HAZELNUT PLANTATION	33	Groundwater
HICKORY CREEK S/D	25	Groundwater
HILLCREST/MCBRIDE HEIGHTS S/D	488	Groundwater
HOLLOWS WATER SYSTEM (THE)	378	Groundwater
INGLEWOOD WATER SYSTEM	150	Groundwater
MEADOW VIEW ESTATES S/D	48	Groundwater
MITCHELL BLUFF	58	Groundwater
MOUNT AIRY, CITY OF	12891	Surface water
ORCHARD VIEW PARK	109	Groundwater
PILOT MOUNTAIN, TOWN OF	1947	Surface water
PINE LAKES S/D	142	Groundwater
REEVES WOODS	102	Groundwater
SNOW HILL WATER SYSTEM	71	Groundwater
SOUTH RIDGE S/D	135	Groundwater
SPRINGFIELD WATER SUPPLY	74	Groundwater
SUNBOW S/D	56	Groundwater
TIMBERLAKE WATER SYSTEM	56	Groundwater
TTJF MOBILE HOME PARK	71	Groundwater
WALNUT TREE S/D	109	Groundwater
WEDGEWOOD/TOWN & COUNTRY WOODS	510	Groundwater
WESTRIDGE WATER SYSTEM	25	Groundwater
WINDGATE S/D	155	Groundwater
WOODBIDGE S/D	175	Groundwater
WOODCREEK S/D	122	Groundwater
WOODVILLE ACRES - (PARK A)	46	Groundwater

Source: US EPA. Envirofacts. Safe Drinking Water Information System (SDWIS). Safe Drinking Water Query, County Search. <http://www.epa.gov/safewater/dwinfo/nc.htm>

The city of Mount Airy and the Towns of Elkin, Dobson and Mount Airy use surface water from W. Kerr Scott Lake, while community systems in the suburbs and more rural areas use groundwater.

## Drinking Water Standards Violations

The US EPA records violations of drinking water standards reported to it by states in its Safe Drinking Water Information System (SDWIS). It records violations as either *health-based* (contaminants exceeding safety standards or water not properly treated) or *monitoring- or reporting-based* (system failed to complete all samples or sample in a timely manner, or had another non-health related violation) (100). Five of the systems cited above had reported health-based violations in the period from 2000 through September of 2006 (Table 33).

System Name	Dates	Type of Violation	Contaminant	Population Served
Sunbow S/D	2003	MCL, Monthly (TCR)	Coliform TCR	56
Springfield Water supply	2000-2015	OCCT Study recommendation	Lead, copper	74
Pine Lakes S/D	2000-2002	OCCT Study recommendation	Lead, copper	142
Greenfield Water System	2005-2006	MCL, average	Trihalomethanes	241
Town of Elkin	2005	MCL, average	Trihalomethanes	4,312

Source: US EPA. Envirofacts. Safe Drinking Water Information System (SDWIS). Safe Drinking Water Query, County Search. <http://www.epa.gov/safewater/dwinfo/nc.htm>

Six schools, one child care facility and seven businesses in Surry County are each served by ground water from *non-transient, non-community water systems*, which are systems that serve the same people, but not on a year-round basis. Together these non-transient, non-community systems serve a total of 4,109 people (100).

*Transient non-community water systems* do not consistently serve the same people, and include sites like rest stops, churches, hotels, restaurants, campgrounds and gas stations. There are 136 such systems in place in Surry County, primarily campgrounds/park areas, churches, and restaurants, serving an estimated 11,700 people (100).

## Municipal Water Systems

### City of Mount Airy

The City of Mount Airy operates two surface water treatment facilities withdrawing water from both Stewarts and Lovills Creeks. Both water treatment facilities were upgraded between 1991 and 1995 and are equipped with the latest technologies, which help ensure the quality of the water supply (101).

The F.G. Doggett Water Treatment Plant began operation in 1970 and was upgraded in 1991. It has a treatment capacity of 6.0 Million Gallons per Day and withdraws approximately 2.5 Millions Gallons per Day from Stewarts Creek. Stewarts Creek, the largest water source for Mount Airy, has a watershed classification of WS-IV, a 20- year safe yield of 14.0 MGD, and a 7Q10 of 15.9 MGD.

The S.L. Spencer Water Treatment Plant began operation in late 1920's and was last upgraded in 1993. It has a treatment capacity of 2.5 Million Gallons per Day and withdraws approximately 1.0 Million Gallons per Day from Lovills Creek. Lovills Creek has a watershed classification of WS-IV, a 20-year safe yield of 1.3 MGD, and a 7Q10 of 5.9 MGD.

NC DENR Public Water Supply Section's Source Water Assessment Program (SWAP) conducts assessments for all drinking water sources in the state to determine the susceptibility of each source (well or surface water intake) to Potential Contaminant Sources (PCS). The relative susceptibility rating for each source for the City of Mount Airy was determined by combining the contaminant rating (number and location of PCS within the assessment area) and the inherent vulnerability rating (i.e. characteristics or existing conditions of the watershed and its assessment area). The resulting possible Susceptibility ratings are "higher", "moderate", or "lower". According to the 2005 Mount Airy Water Quality Report, both Stewart's Creek and Lovills Creek have susceptibility rating of "moderate" (101).

### **Town of Elkin**

The Town water plant is currently producing an average of 1.2 million gallons of water per day with a capacity of producing 3 million gallons per day. Elkin also has a 60 million gallon reservoir and three storage tanks that hold a total of 1.4 million gallons of water. The plant draws from the Big Elkin Creek, an excellent raw water source that should serve the Town well into the future (102)

### **Town of Pilot Mountain**

The Town of Pilot Mountain water supply is provided by a surface water filtration plant located at 953 West Hwy 52 bypass. The source water for the treatment plant is taken from Toms Creek. The facility, constructed in 1963 and last renovated in 2003, uses the most modern techniques in water treatment. It has the capacity to produce 1.5 MGD but due to recent industrial closings and reduced demand is producing only 0.2 MGD (103).

## Chapter Eight: Food-, Water-, and Vector- Borne Diseases

A number of human diseases and syndromes are caused or exacerbated by contamination of the natural environment with microbes or chemicals, or by animal vectors. Several of these conditions are among the illnesses that must be reported to health authorities. A number of food-, water-, and vector- borne diseases are of increasing importance because they are either rare but becoming more prevalent, or spreading in geographic range, or becoming more difficult to treat. Among these diseases are Shiga toxin producing *E.coli*, salmonellosis, Lyme disease, West Nile virus infection, Eastern equine encephalitis, and rabies. Table 34 lists the number of cases of major reportable food-, water- and vector-borne diseases reported in Surry County during the past four years. Comparable data for North Carolina are provided for 2004 only.

	2002	2003	2004	2005	NC (2005)
Campylobacter	1	11	9	6	672
Cryptosporidiosis	0	0	0	2	92
E. coli O157	1	0	0	0	---
E. coli (Shiga toxin-producing)	0	0	0	1	64
Encephalitis, California group	0	0	0	0	23
Encephalitis, Eastern equine	0	0	0	0	1
Encephalitis, West Nile Virus	0	0	0	0	2
Erlchiosis (monocytic)	0	0	0	0	29
Hepatitis A	0	0	0	1	84
Listeriosis	0	0	1	0	34
Lyme disease	0	0	0	0	49
Rocky Mountain spotted fever	6	3	0	12	625
Salmonellosis	10	10	7	9	1,701
Shigellosis	0	0	49	7	202

Source: NC Division of Public Health, Epidemiology Section, General Communicable Disease Branch. Communicable Disease Control. *Communicable Diseases in North Carolina*. [State and county level data] <http://www.epi.state.nc.us/epi/gcdc.html>

### Arboviral Diseases

Arboviral diseases are viral diseases transmitted from an animal host to humans (and sometimes other animals) by the bite of an arthropod, usually a tick or biting fly such as a mosquito. Mosquito-borne diseases are of particular significance in communities where there is a lot of water, since that is the environment in which they breed.

Historically, mosquito-transmitted diseases, most notably Eastern Equine Encephalitis (EEE) and LaCrosse Encephalitis (LAC) are endemic in North Carolina. West Nile Virus (WNV), however, is relatively new. It first appeared in the US in 1999, but by 2001 it had spread to 28 states. The first North Carolina appearance of WNV was in 2000 in Chatham County,

where it was detected in a dead crow. The virus is believed to be carried by migrating flocks of birds and transmitted to other vertebrates and humans via mosquito bites.

The NC Division of Environmental Health’s Public Health Pest Management Section manages the state’s WNV surveillance program, which is focused on mosquitoes, wild birds and other animals. Because the reservoir for WNV appears to be avian, “sentinel” flocks of birds, primarily chickens, are used as a kind of early warning system. The public also plays a role in surveillance by submitting dead birds for testing.

According to the NC Public Health Pest Management Section, North Carolina reported five positive human case of WNV in 2005, 2 cases in 2004 and 23 cases in 2003, none of which occurred in Surry County. In 2005 there was one veterinary case in Yadkin County, which is adjacent to Surry County (104).

Eastern Equine Encephalitis is a disease of the central nervous system that affects horses and humans. It is transmitted by a species of mosquito that lives in marshes and swamps and feeds on birds in which the virus multiplies. The presence of the disease is monitored by the sentinel flock method. In 2005 there were no positive human cases in North Carolina; there was one in 2004 and one in 2003. In 2005 all positive sentinel flock cases (36) and veterinary cases (14) were located in the eastern part of the state (104).

Both WNV and EEE are considered emerging infectious diseases because their incidence is growing dramatically in the US. There are vaccines for both for horses, but not for humans.

**Rabies**

The Communicable Disease Control Branch reports cases of rabies (105). Table 35 lists the number of cases of rabies in animals in Surry County from 2001 through 2005. (Animal hosts for which there were no reported cases are not shown) In recent years raccoon typically have been the animals found to be infected with rabies most often in Surry County, followed by skunk and fox ().

	<b>Bat</b>	<b>Cat</b>	<b>Cow</b>	<b>Dog</b>	<b>Fox</b>	<b>Skunk</b>	<b>Raccoon</b>
2005	0	1	1	0	1	2	2
2004	1	0	0	0	1	12	22
2003	1	0	1	0	2	15	38
2002	0	1	0	0	0	17	12
2001	0	0	0	0	0	8	13

Source: NC DPH, Epidemiology, Communicable Disease Control, Rabies  
<http://www.epi.state.nc.us/epi/rabies/state.html>

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