

**HARNETT COUNTY**  
***COMMUNITY HEALTH***  
***ASSESSMENT***

**Volume Two:**  
**Environmental Data**

**Final Technical Report**  
**December 11, 2006**



*North Carolina Institute for Public Health*

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## Executive Summary

This document presents an overview of data describing major features of the natural environment of Harnett County. The information in this report is based on the Center for Disease Control's (CDC) 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 Harnett County, using data from the public domain. It lists the major contaminants and pollutants affecting outdoor ambient air quality and indoor air quality; the effects of disasters on the environment; community exposure to lead, noise, pesticides, ultraviolet radiation, and toxics; and contaminants and pollutants affecting ambient and drinking water quality.

## Water Quality

The North Carolina Department of Environment and Natural Resources operates the Ambient Monitoring System (AMS). 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 for physical and chemical indicators occur in more than 10% of samples/measurement (20% for coliforms).
- To identify long-term temporal or spatial patterns.

## Ambient Water

### Contaminated Waterbodies

Harnett County lies in the Cape Fear River Basin. Subbasin 07 and 13 of the Cape Fear River Basin run through Harnett County. In Subbasin 07, five creeks have been classified as impaired according to section 303(d) of the Clean Water Act (CWA). No fish community or lake assessments were performed in subbasin 13 in 2003.

Harnett County contains a portion of two watersheds in the Cape Fear River Basin: Black and Upper Cape Fear. Black ranks 44<sup>th</sup> of all watersheds in North Carolina for percentage of surface waters classified as impaired or threatened use with 1.3% of waters affected, and 26<sup>th</sup> for number of water bodies classified as impaired or threatened, with two affected. Upper Cape Fear ranks 39<sup>th</sup> of all watersheds in North Carolina for percentage of surface waters classified

as having impaired or threatened use with 2.6% of waters affected, and 16<sup>th</sup> for number of water bodies classified as impaired or threatened, with 12 affected.

Harnett County ranks in the bottom 20% of all counties in North Carolina for percent of impaired or threatened water bodies, with less than 6.6%. One hundred percent of impairments were for overall use.

## **Water Contaminants**

The leading sources of water quality problems for ambient water bodies in Harnett County include non-point sources (57% of affected waters) and municipal sources (43%). Non-point pollution occurs when runoff from rainfall or snowmelt picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and underground sources of drinking water. These pollutants include: excess fertilizers, pesticides, oil, sediment from construction sites, and bacteria and nutrients from livestock, pet wastes, and faulty septic systems. Municipal sources include discharges from publicly owned wastewater treatment plants.

Sediments are reported as the major cause of impairment in 43% of Harnett County waterbodies classified as impaired. Metals are the second most frequently reported cause of impairment (7%). Fifty percent of contaminated waterbodies do not list a cause of impairment.

## **Levels of Fecal Coliform**

Fecal coliform, a mostly harmless bacteria, 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 water bodies from human and animal waste.

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. Fecal coliform, like other bacteria, can usually be killed by boiling water or by treating it with chlorine. Washing thoroughly with soap after contact with contaminated water can also help prevent infections.

Twenty-nine stations in the Cape Fear River Basin exceeded the geometric mean of 200 colonies/100 ml reference level. One of these (Rockfish Cr at SR 1432 near Raeford) was a Class B station (stations classified for organized swimming activities). Of these 29 stations, none were located in Harnett County.

## **Drinking Water**

### **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 2005, the State

Laboratory conducted microbiological analyses of 70 water samples from Harnett County. Of these, 16 (23%) showed the presence of bacteria according to analysis for “total coliforms” and one of the samples positive for total coliforms was also positive for *E.coli*.

## Ground Water

Harnett County has a total of nine active community water systems, using purchased surface water, surface water, and ground water. These systems serve a population of 103,718 residents. Community water systems are those serving the same people year-round (e.g., in homes or businesses).

Between 1994 and 2006 there were two health-based violations in Harnett County drinking water systems for failure to meet water quality regulations and guidelines. These include the Town of Erwin, in violation of maximum contaminant levels of trihalomethanes, and Harnett County Department of Public Utilities, in violation for Surface Water Treatment Rules.

Of the nine active community water systems, three had significant monitoring and reporting violations recorded by the EPA between 1993 and 2006. These systems include the town of Angier; Harnett County Department of Public Utility; and Shawtown Water System. A monitoring and reporting violation is given when a system fails to complete all samples or sample in a timely manner, or had another *non*-health-based violation. A significant monitoring violation means the system failed to take a large percentage of the required samples.

There were two Harnett County facilities that received fines for Clean Water Act violations between April 2003 and May 2006. These facilities included the Town of Erwin, which received four fines between June 2003 and November 2003, and the Dunn wastewater treatment facility, which received one fine in June 2003.

## Air Quality – Outdoor Ambient Air

The United States Environmental Protection Agency (EPA) categorizes outdoor ambient air pollutants as “criteria air pollutants” (CAPs) and “hazardous air pollutants” (HAPs).

### Criteria Air Pollutants

Criteria air pollutants are six chemicals that can injure human health, harm the environment, or cause property damage. They are: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM), and sulfur dioxide (SO<sub>2</sub>). Harnett County is not a particularly “dirty” county in terms of CAP emissions relative to other North Carolina counties: total CO emissions by weight in Harnett County are only 10% of the level in Mecklenburg County, the locale with the highest CO emissions in the state, and 16% of the level of PM-10 emissions by weight.

Annual high levels of criteria air pollutants are not available for Harnett County but are available for North Carolina as a whole. Annual high levels of criteria air pollutants in North Carolina exceed National Ambient Air Quality Standards (NAAQS) for 1-hour ozone levels (0.146 ppm

versus the 0.12 ppm standard) and 8-hour ozone levels (0.111 ppm versus the 0.08 ppm standard). The statewide average maximum for small particulate matter (PM-2.5) also exceeded the NAAQS standard ( $70\mu\text{g}/\text{m}^3$  versus  $65\mu\text{g}/\text{m}^3$ ).

North Carolina ranks 10<sup>th</sup> in the nation for CO emissions; 14<sup>th</sup> for nitrogen oxide (NO<sub>x</sub>) emissions; 13<sup>th</sup> for small particulate matter (PM-2.5) emissions; 13<sup>th</sup> for sulphur dioxide (SO<sub>2</sub>) emissions; and 8<sup>th</sup> for volatile organic compound (VOC) emissions. Harnett County does *not* rank in the top 25 counties for tons of emissions of any of the six criteria air pollutants (2).

## Air Quality Non-Attainment Areas

As of June, 2005, the Environmental Protection Agency (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. 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. No part of Harnett County was classified as a non-attainment area (3).

## Hazardous Air Pollutants

Hazardous air pollutants (HAPs) include over 188 chemicals that can cause adverse effects on human health and the environment. They include substances that can cause cancer, or have neurological, respiratory and reproductive effects. Risk due to HAPs is estimated by two measures: added lifetime cancer risk for carcinogenic HAPs, and cumulative hazard indices for chemicals with non-cancer effects.

Of the 100 counties in North Carolina, Harnett ranks 39<sup>th</sup> in terms of an individual’s added cancer risk. The estimated added cancer risk for the Harnett County population is 360, more than 300 times the goal set by the Clean Air Act (4).

The vast majority (82%) of the cancer risk in Harnett County comes 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. Diesel emissions are a *recognized* carcinogen, and *suspected* to be a cardiovascular or blood toxicant, and a respiratory toxicant.

## Motor Vehicle Emissions

Motor vehicle emissions are the major “mobile source” of criteria air pollution. Nationwide, mobile sources are responsible for 75% of carbon monoxide emissions and more nitrogen oxide emissions than either area or point sources. Mobile sources are usually, but not always, the primary source of criteria air pollutants in Harnett County, comprising 68% of the total tonnage of CAPs emitted in the county (5).

The Centers for Disease Control (CDC) recommends monitoring certain emission measures employed by counties as core indicators of outdoor air quality. These include vehicle miles

traveled, the proportion of population residing in jurisdictions that have vehicle emission mandates, the proportion of registered vehicles powered by alternative fuel, and the proportion of the population for whom mass transit is available.

**Vehicle miles driven per capita.** At the national level, annual vehicle miles driven per capita in 2005 were 10,077. In North Carolina, this figure was 11,222. In Harnett County, the total annual vehicle miles driven by residents was estimated at 144,000,000.

**Vehicle Emission Mandates:** As of January 1, 2006 the following counties had mandatory vehicle emissions testing: Alamance, Brunswick, Buncombe, Burke, Cabarrus, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Cumberland, Davidson, Durham, Edgecombe, Forsyth, Franklin, Gaston, Granville, Guilford, **Harnett**, Haywood, Henderson, Iredell, Johnston, Lee, Lenoir, Lincoln, Mecklenburg, Moore, Nash, New Hanover, Onslow, Orange, Pitt, Randolph, Robeson, Rockingham, Rowan, Rutherford, Stanly, Stokes, Surry, Union, Wake, Wayne, Wilkes, Wilson

**Alternately Fueled Vehicles.** The following table summarized the number of alternatively fueled vehicles by type in the US for three years in the early 2000s. Comparable data for North Carolina are not yet available.

**United States Alternative Fueled Vehicles by Fuel Type, 2002 to 2004 (in 1000s)**  
 North Carolina Department of Transportation, Gazetteer of Intermodal Transportation

Fuel type	Alternative fueled vehicles		
	2002	2003	2004
<b>Total</b> . . . . .	<b>471,098</b>	<b>510,805</b>	<b>547,904</b>
Liquified petroleum gases (LPG) . . . . .	187,680	190,438	194,389
Compressed natural gas (CNG) . . . . .	120,839	132,988	143,742
Liquified natural gas (LNG) . . . . .	2,708	3,030	3,134
Methanol, 85 percent (M85) <sup>1</sup> . . . . .	5,873	4,917	4,592
Ethanol, 85 percent (E85) <sup>1</sup> . . . . .	120,951	133,776	146,195
Electricity <sup>2</sup> . . . . .	33,047	45,656	55,852

**Proportion of population for whom mass transit is available.** 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 (6).

## 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.

### 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. Outdoor triggers include high levels of ozone and particulate pollution, which have been associated with 10-20% of all respiratory hospital visits and admissions (7).

The incidence of asthma in Harnett County can be estimated using hospitalization data, survey self-reports, and screenings in school-age children. Data like these are discussed in Volume I of the Harnett County Community Health Assessment.

### Cardiovascular and Respiratory Disease

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.

Mortality due to cardiovascular and respiratory disease is discussed fully in Volume I of the Harnett County Community Health Assessment. The 2000-2004 Harnett County mortality rates for heart disease and respiratory disease each exceed the state average (8). No system exists at the present to attribute deaths due to these causes to air pollution events.

### Air Quality: Indoor Ambient Air

Indoor ambient air pollutants may cause both short-term and long-term health effects. Immediate effects may show up after a single exposure or repeated exposures. These 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 to eliminate the source of the person's exposure, 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.

The primary cause of indoor air quality problems in homes is sources that release gases or particles into the air, including carbon monoxide and environmental tobacco smoke. 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 (9).

## 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. Childhood exposure to ETS can cause bronchitis, pneumonia, coughing and wheezing, asthma attacks, middle ear infection, and possibly cardiovascular and neurobiological impairment in children.

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 (10).

According to the 2004 North Carolina Center for Health Statistics Behavioral Risk Factor Surveillance System, 27.7% of all children in North Carolina reside in households with adult smokers, compared to 30.2% in Harnett County (11).

## 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 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 (12).

In North Carolina in 2004, there were 10 deaths due to accidental exposure to gases and vapors; 30 deaths due to intentional self-poisoning by other gases and vapors, and one death due to assault by gases and vapors. There were 37 deaths statewide due to CO poisoning, eight of which were unintentional (13).

In Harnett County in 2004, there were no deaths due to unintentional or intentional poisoning by CO gasses and vapors (14).

## Indoor Air Quality Regulations in Schools and in the Workplace

An issue of growing importance these days is the air quality in our nation's schools. A study published by the Government Accounting Office and the Department of Health and Human Services estimates that 8.4 million students attend schools with poor indoor air quality.

North Carolina does not have any policies addressing indoor air quality, 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 (15).

One factor greatly affecting indoor air quality in schools is the school's tobacco policy. As of May 2006, 72 of North Carolina's 115 School districts had adopted 100% Tobacco-Free policies (16). Harnett County is one of the 43 school districts in North Carolina that have not yet adopted this policy.

## Lead Hazards

Lead is a highly toxic metal that was used for many years in products found in and around our homes. Lead exposure typically occurs as a result of deteriorating lead-based paint, lead-contaminated dust, and lead-contaminated soil. 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.

In 2005, 936 children between the ages of 1-2 were screened in Harnett County, reaching 47.5% of the target population. 0.2% of the children screened had blood lead levels over 10µg/dl. At the state level, 40.6% of the target population was screened, with 0.9% of children screened showing a blood lead level of over 10µg/dl (17).

## 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. Pesticides can cause harm to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms (20).

In 2002 Harnett County was home to 730 farms, totaling 380,826 acres of farmland. The average farm size in Harnett County is 175 acres. Crops in Harnett County include tobacco, cotton, soy beans, corn, wheat, sweet potatoes, and hay.

In 2003, there were 230,225 pounds of pesticides applied to cotton crops, with Monocarbamide dihydrate being the most heavily applied pesticide by weight. There were 58,705 pounds of

pesticide applied to soy bean crops in 2002, with Glyphosate being the most heavily applied pesticide. There were 28,336 pounds of pesticide applied to corn crops in 2003, with Alchlor being the most heavily applied pesticide. There were 5,608 pounds of pesticides applied to wheat crops in 2000, with Diclofop-methyl being the most heavily applied.

In 2005, the North Carolina state lab reported a total of four food samples statewide with residual pesticide levels that failed to meet safe consumption guidelines. This represented less than 1% of all samples analyzed (21).

No accidental deaths due to pesticide-related poisoning were reported in Harnett County in 2004, the most recent year for which data are available.

## Sun and Ultraviolet Light

Since the appearance of an ozone hole over the Antarctic in the early 1980s, Americans have become aware of the health threats posed by ozone depletion, which decreases our atmosphere's natural protection from the sun's harmful ultraviolet (UV) rays.

The most significant health problem linked to overexposure to unsafe levels of UV radiation is melanoma. In 2004, there were 320 deaths in North Carolina attributed to malignant neoplasms of the skin. North Carolina melanoma mortality rates are higher than the nation's and are especially high in rural counties. In Harnett County in the same year, there were two deaths attributed to malignant melanoma of the skin, both among white females (24).

## Land Contamination

Land contamination presents a threat to the environment and/or poses a risk to human health. Superfund sites and Brownfields are types of contaminated land that are found in the nation. None have been found in Harnett County. The Town of Lillington has an *inactive hazardous site* where hazardous substance or waste contamination exists but isn't under the jurisdiction of another program (25).

Of the 98 North Carolina counties ranked for animal waste generation, Harnett County was ranked 23rd (26).

## Solid Waste Management

In FY 2002-2003 Harnett County was listed as having accumulated 70,201 tons of waste (27). Harnett County did not receive any penalties or compliance orders by the state's Solid Waste Program for 2000-2006 (28).

## Food-, Water- and Vector-Borne Diseases

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.

The North Carolina Division of Environmental Health's Public Health Pest Management Section manages the state's West Nile Virus (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.

North Carolina reported two positive human case of WNV in 2004 (in Mecklenburg and Onslow counties) and 22 positive human cases in 2003, none of which occurred in Harnett County. In 2003 the presence of WNV was confirmed in from between three to six wild birds in Harnett County. In 2004 no dead birds were confirmed positive for WNV in the county (29).

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. In 2003, Harnett County was listed in the Veterinary category as having 5 to 11 positive cases and in 2004 one case was listed as positive. No sentinel flocks or human cases were confirmed in Harnett County in 2002-2005 (30).

The Communicable Disease Control Branch reports cases of rabies from 1990 forward; however, not all years are available for all counties, so statewide totals are likely unrepresentative of an actual number of cases. In recent years, raccoons typically have been the animals found to be infected with rabies most often in Harnett County (31).

## Sentinel Events

### Hazardous Substance Emergency Events

Between 1998 and 2001 a total of 1,087 hazardous substance emergency events were reported to the Hazardous Substances Emergency Events Surveillance (HSEES) system by the North Carolina Division of Public Health, Occupational and Environmental Epidemiology Branch. About 23 (2.1%) of these events were threatened releases. Three hundred seventy-two (34.2%) of the events occurred at *fixed facilities*, and 715 (68.8%) were *transportation-related* events (32).

Fixed-facility events can occur in various areas of the facilities; 27.3% of events statewide occurred in above-ground storage areas, 22.0% in piping, 13.4% in material handling, and 10.0% in process vessels. In transportation-related events, 92.1% occurred during ground transport (for example, truck, van, or tractor), and 6.8% involved transport by rail. The remaining transportation-related events involved water, air, or pipeline transport.

In Harnett County, there were a total of five hazardous substance emergency events reported between 1998 and 2001. Of these, three were fixed-facility events, and two were transportation-related. The proportion of fixed-facility to transportation-related events in Harnett County is higher than that of the state as a whole.

Location	Type of Event				Total No. of Events
	Fixed Facility		Transportation		
	No. of Events	Percent	No. of Events	Percent	
Harnett County	3	60	2	40	5
NC	375	34.4	716	65.6	1087

## Toxic Chemical Releases

Harnett County ranks 71<sup>st</sup> in the state for volume of reported releases of toxic release inventory (TRI) chemicals to the environment, with 6,200 pounds in 2002. The only chemical listed on the TRI for Harnett County in 2002 was lead compounds, of which 250 pounds were released (Table 2) (33).

Harnett County facilities charged with releasing Toxic Release Inventory (TRI) chemicals to the environment include: Capital Marble Creations, Inc., City of Lillington, and Morganite, Inc., in Dunn (Table 3) (33).

Chemical Name	Cancer Risk Score Pounds of Benzene-Equivalents
Lead Compounds	250

Facility	Pounds
Capital Marble Creations, Inc, City of Lillington	4,428
Morganite Inc., City of Dunn	1,772

## Ground Water Events

In the past two years, there have been eight reports of groundwater contamination in Harnett County. Of these incidents, three were from underground storage tanks; one was from an Aquifer Science and Technology system; one was from pit, pond, or lagoon; two were surface spills; and one was from a nonpoint source.

## **Heat Attributed Deaths**

In 2004, there were four deaths in North Carolina due to exposure to excessive natural heat. In Harnett County, there were no deaths attributed to excessive natural heat (13).

## **Chemical Spills**

No spills have been reported in Harnett County (34 and 35).

## Introduction and Methods

This volume of the Harnett County Community Health Assessment presents an overview of major features of the natural environment of Harnett County as well as data on environmental parameters that affect health.

It is intended to complement the Socioeconomic and Health Data by describing the environmental context in which the people of Harnett County are living. This document can serve as a baseline for future comparisons.

Using data from the public domain, mostly the World Wide Web, it describes in general terms the quality of water and air relative to North Carolina counties. It lists the major contaminants and pollutants affecting water, air and land in the county and names some of the major sources of pollution. It describes waste management and wastewater sanitation practices in the county as well as several local municipalities. Finally, it contains data on environmental-related health issues such as noise and lead hazards.

# Water Quality

## Ambient Water

### Levels of Contaminants

Section 303(d) of the Clean Water Act (CWA) requires states to develop a list of waters not meeting water quality standards or which have impaired uses (36).

Harnett County lies in the Cape Fear River Basin. Subbasin 07 and 13 of the Cape Fear River Basin run through Harnett County. Subbasin 07 contains the lowermost reach of the Haw River (below Jordan Reservoir and before it joins the Deep River to form the Cape Fear River) and approximately 25 miles of the Cape Fear River from near the confluence of Lick Creek in Lee County to near Buies Creek in Harnett County.

The most recent land use coverage showed more than 70% of the subbasin forested. However, due to accelerated urban growth especially around the Towns of Holly Springs, Fuquay-Varina, and Sanford, the amount of lands in pasture or cultivated drops, and forest cover has probably decreased as the percentage of urban land use has increased.

Subbasin 13 includes the entire Upper Little River watershed from its source to the confluence with the Cape Fear River; major tributaries include Juniper and Barbeque Creeks. The headwaters of the Upper Little River lie in the Triassic Basins ecoregion in Lee County southwest of the City of Sanford. The river flows east into the Northern Outer Piedmont ecoregion where it is joined by Juniper Creek. The river turns southeast near the Harnett County border, and is eventually joined by Barbeque Creek, where it enters the Rolling Coastal Plain ecoregion. Just before entering the Cape Fear River, the Upper Little River enters the Southeastern Floodplains and Low Terraces ecoregion.

The City of Sanford is the only urban area in the subbasin. The Towns of Lillington and Erwin lie just outside the subbasin. Almost two-thirds of the subbasin is forested. There is one National Pollutants Discharge Elimination System permitted discharger in this subbasin. Carolina Trace Utilities discharges 0.3 millions of gallons per day into the Upper Little River.

No fish community or lake assessments were performed in this subbasin in 2003. Ambient water quality data were collected from the Upper Little River near Lillington. Data were within water quality standards for nitrate+nitrite nitrogen, dissolved oxygen, most metals, fecal coliform bacteria, and chlorophyll *a*. However, violations of water quality standards were recorded for turbidity, pH, and manganese.

Table 4 (following page) lists the monitored waterbodies located in Harnett County in subbasins 07 and 13 in the Cape Fear River Basin in 1996-2001.

Subbasin	Waterbody	Location	1996	2001
07	Parkers Creek	SR 1405	Good	Good
07	Neills Creek	SR1441	Good-fair	Poor
07	Kenneth Creek	SR 1441	Poor	Poor
07	Avents Creek	SR 1418	Good	Good-fair
07	Hector Creek	SR 1412	Good	Excellent
07	Kenneth Creek	SR 1441	Good-fair	Good
07	Buies Creek	off SR 1519	--	Not Rated
13	Upper Little River	SR 1222	Good-fair	Good-Fair

In Subbasin 07, five creeks have been classified as impaired. These creeks are listed below in Table 5. (No fish community or lake assessments were performed in the subbasin.)

Subbasin	Waterbody	Impaired Use	Year Listed	Reason for Listing	Potential Source	Miles
07	Kenneth Creek, From Wake-Harnett County line to Neills Creek	Aquatic life	1998	Impaired biological integrity	Impervious surface, WWTP NPDES	3.9
07	Neills Creek, from source to a point 0.3 miles upstream of Wake-Harnett County line	Aquatic Life	2006	Impaired biological integrity	Pasture, agriculture, MS4 NPDES, impervious surface	2.6
07	Neills Creek, from a point 0.3 miles upstream of Wake-Harnett County line to SR 1441	Aquatic life	2006	Impaired biological integrity	Pasture, agriculture, MS4 NPDES, impervious surface	2.0
07	Neills Creek, from SR 1441 to Kenneth Creek	Aquatic life	2006	Impaired biological integrity	Pasture, agriculture, MS4 NPDES, impervious surface	1.3
07	East Buies Creek, from a point 0.2 miles downstream of NC HWY 42 to NC HWY 42 (Sanford water supply intake).	Aquatic life	2006	Standard violation: Low dissolved oxygen	Unknown	6.2
13	No fish community or lake assessments were performed in this subbasin in 2003. However, violations of water quality standards were recorded for turbidity, pH, and manganese.					

Table 6 below shows levels of contaminants for each river basin (37).

AMS Location	Contaminant	Ug/L
Cape Fear River at US 401 at Lillington	Copper	14.7 (% over 7 µg/L)
Cape Fear River at NC 217 at Erwin	Copper	15.3 (% over 7 µg/L)
Upper Little River at SR 2021 near Lillington	Manganese	<b>23.1 (Statistically exceeded the standards or action levels.)</b>

## Surface Waters Impaired or Threatened

Harnett County contains a portion of two watersheds in the Cape Fear River Basin: Black and Upper Cape Fear. Black ranks 44<sup>th</sup> of all watersheds in North Carolina for percentage of surface waters classified as impaired or threatened use with 1.3% of waters affected, and 26<sup>th</sup> for number of water bodies classified as impaired or threatened, with two affected. Upper Cape Fear ranks 39<sup>th</sup> of all watersheds in North Carolina for percentage of surface waters classified as impaired or threatened use with 2.6% of waters affected, and 16<sup>th</sup> for number of water bodies classified as impaired or threatened, with 12 affected.

Harnett County ranks in the bottom 20% of all counties in North Carolina for number of impaired or threatened water bodies, with less than 6.6%. One hundred percent of impairments were for overall use (38). Table 7 describes the major kinds of impairment in Harnett County waterbodies.

Leading pollutants/stressors of surface water	Percent affected	Leading source of water quality problems	Percent affected
Sediments	43	Nonpoint sources	57
Metals	7	Municipal sources	43
Not reported	50	Source not reported	7

## Levels of Fecal Coliform

Fecal coliform bacteria concentrations are measured by the geometric mean or the median. The standard specified in the North Carolina Administrative Code (NCAC) rules used by the Division of Water Quality (DWQ) in 2002 is as follows, "Organisms of the coliform group: fecal coliforms shall not exceed a geometric mean of 200/100ml (MF count) based upon at least five consecutive samples examined during any 30 day period, nor exceed 400/100ml in more than 20 percent of the samples examined during such period."

Twenty-nine stations in the Cape Fear River Basin exceeded the geometric mean of 200 colonies/100 ml reference level. One of these, Rockfish Cr at SR 1432 near Raeford, was a Class B station (stations classified for organized swimming activities). Of these 29 stations, none were located in Harnett County.

Table 8 presents the highest levels of fecal coliforms measured at several sampling sites in Harnett County.

Location	# Samples	% Over 400	Geometric Mean
Avents Cr at SR 1418 near Cokesbury	63	20.6	155.1
Cape Fear R at US 401 at Lillington	63	25.4	104.9
E Buies Cr at SR 2054 at Buies Creek	45	26.7	156.4
Buies Cr at Keith Hills Golf Course	2	50	247.4
Cape Fear R at NC 217 at Erwin	63	20.6	83.6

## Drinking Water

In 2002, there were 11 disease outbreaks due to contaminated drinking water recorded nationwide; an additional 10 outbreaks were attributed to contaminated recreational water.

In 2005 there were no swimming advisories posted in Harnett County (39) and there were no drinking water systems that failed to meet water quality regulations and guidelines by type of water supply (40).

## Public Drinking Water Systems

There are nine active *public* drinking water systems in Harnett County, two of which have had health-based violations for Safe Drinking Water Act (SDWA) maximum contaminant levels (Table 9) (41). Note that neither of the violations was recent.

System Name	Dates	Type of violation	Contaminant	Maximum Contaminant Level	Population Served
Town of Erwin	10/1/2000 - 12/13/2004	Maximum Contaminant Level Violations	Trihalo-methanes	0.1	4,533
Harnett Co Dept Of Public Utility	12/1/1994 - 12/31/1994	SWTR	--	Not reported	74,525

Table 10 (following page) lists drinking water systems in Harnett County that had significant SDWA monitoring and reporting violations in the past 13 years (44). These violations are primarily procedural and none was recent.

System Name	Dates	Type of Violation	Contaminant	Water Source	Population Served
Town of Angier	01/18/2004 - 08/19/2004	Initial tap sampling	Lead and Copper	Purchased surface water	4,516
Harnett County Dept of Public Utility	01/1/2004 - 12/31/2004	Monitoring	Nitrate	Surface water	74,525
Shawtown Water Sys	07/1/1993 - 12/31/1995	Initial tap sampling	Lead and Copper	Purchased surface water	625

Table 11 (following page) lists citations of operations for noncompliance with *local* water quality regulations or guidelines (45).

Facility	Type of Action	Date	Penalty
Dunn WWTP	CWA Penalty AO PA	6/25/2003	\$1,563
Town of Erwin	CWA Penalty AO PA	06/25/2003	\$1,563
Town of Erwin	CWA Penalty AO PA	07/15/2003	\$1,563
Town of Erwin	CWA Penalty AO PA	10/27/2003	\$563
Town of Erwin	CWA Penalty AO PA	11/25/2003	\$563

## 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 (42).

In 2005, the State Laboratory conducted microbiological analyses from 70 water samples from Harnett County. Of these, 16 (23%) showed the presence of bacteria according to analysis for “total coliforms” and one of the samples positive for total coliforms was also positive for *E.coli* (%).

## Ground Water Contamination

In the past two years, there have been eight reports of groundwater contamination in Harnett County. Of these incidents, three were from underground storage tanks; one was from an AST system; one was from pit, pond, or lagoon; two were surface spills; and one was from a nonpoint source (Table 12, following page) (43).

Incident Location/ Name	Address	City/Town	Source	Type	Submitted
BP And Mini Mart	201 S 13th St	Erwin	Underground Storage Tank	Gasoline	4/6/2005
Motoguzz1	455 W Depot St	Angier	Underground Storage Tank	Gasoline	5/24/2005
G&M Citgo	1208 Denim Dr	Erwin	Underground Storage Tank	Gasoline	11/5/2004
Kidde Fire Fighting	141 Junny Rd	Angier	Nonpoint Source	Other	2/2/2006
Energy Conversion Systems	1 Morganite Dr	Dunn	Surface Spill	Metals	5/5/2005
Armtec	608 E Mcneil St	Lillington	AST System	Other	6/2/2004
Southeastern Transformer Co	405 E Edgerton St	Dunn	Surface Spill	Other	3/8/2005
Erwin Mills/Burlington Ind.	S Burlington St.	Erwin	Pit, Pond, Lagoon	Sludge	4/27/2005

## Air Quality

### Outdoor Ambient Air

#### Air Pollutants

Table 13 details the annual high levels of criteria air pollutants of the six criteria air pollutants for North Carolina as a whole. Specific data is not available for Harnett County (45).

Pollutant	NAAQS Standard	Highest Recorded Concentration
Carbon monoxide		
1-hour average max	35ppm	10.0ppm
8-hour average max	9ppm	2.8ppm
Ozone		
1-hour average max	.12ppm	.146ppm
8-hour average max	.08ppm	.111ppm
PM-25		
24-hour average max	65ug/m3	70ug/m3
PM-10		
24-hour average max	150ug/m3	69ug/m3
Sulfur Dioxide		
3-hour average max	.5ppm	.106ppm
24-hour average max	.14ppm	.030ppm

Table 14 details the total tons of emissions for five of the six criteria air pollutants for Harnett County and the amount of each pollutant coming from the typical source categories.

Source Category	CO	NO <sub>x</sub>	PM-10	SO <sub>2</sub>	VOC	TOTAL
Mobile Sources	18,656	3,553	1,727	254	1,826	26,016
Area Sources	6,388	223	2,266	223	2,314	11,414
Point Sources	80	194	100	532	214	1,120
All Sources	25,114	3,970	4,093	1010	4,353	38,540

Table 15 (following page) lists tons per year of hazardous/toxic substances released in Harnett County (45).

<b>Table 15. Harnett County Hazardous/Toxic Substances Released, 1996</b>		
<b>Hazardous Air Pollutants</b>	<b>Emissions from Point Sources (tons/yr)</b>	<b>Emissions from Area Sources (tons/yr)</b>
Diesel Emissions	0	0
Carbon Tetrachloride	0	0.022
Benzene	0.010	17
Chromium	0.98	0.021
Polycyclic Organic Matter (Pom)	0.0014	3.2
Formaldehyde	0.014	33
1,3-Butadiene	0	5.1
Quinoline	0	0.0000018
1,2-Dichloroethane	0.00059	0.0075
Acetaldehyde	0.0084	5.2
Tetrachloroethylene	0.00063	6.9
Arsenic	0.16	0.0055
1,2-Dibromoethane	0.000018	0.000029
Chloroform	0.00087	0.16
1,3-Dichloropropene (Mixed Isomers)	0	6.3
Dichloromethane	0.0043	12
Nickel	0.44	0.054
Trichloroethylene	0	1.3
Ethylene Oxide	0	0.14
Acrylonitrile	0	0.057
Beryllium	0.020	0.00083
Hexachlorobenzene	0	0.000018
Cadmium	0.010	0.0020
Vinyl Chloride	0	0.077
Lead	0.20	0.038
1,1,2,2-Tetrachloroethane	0	0.027
Hydrazine	0	0.00000076
1,2-Dichloropropane	0	0.0032
Acrolein	0.0043	5.7

## Air Quality Non-Attainment Areas

As of June, 2005, the Environmental Protection Agency (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. 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. No part of Harnett County is currently classified as a non-attainment area.

## 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. Common indoor asthma triggers include the following: secondhand smoke, dust mites, moldcockroaches and other pests, and combustion byproducts (46). Outdoor triggers include high levels of ozone and particulate pollution, which have been associated with 10-20% of all respiratory hospital visits and admissions. Data related to asthma deaths at the county level are not available, but can be assessed by reviewing respiratory deaths.

In 2004, there were 7147 deaths due to diseases of the respiratory system in North Carolina, 103 of which are attributed specifically to asthma. In Harnett County, there were 89 deaths due to diseases of the respiratory system, two of which were attributed specifically to asthma (47). At the national level, there were 3,910 deaths attributed specifically to asthma in 2002 (48).

According to the 2004 BRFSS survey, the life-time prevalence of asthma in the Duplin/Greene/Harnett/Jones/Lenoir/Sampson/Wayne area is 13.2%, compared to 12.9% at the state level. The current prevalence of asthma is 4.5% in Harnett County, compared to 7.6% in North Carolina as a whole (49).

According to the 1999-2000 School Asthma Survey, the prevalence of asthma among school-aged children in Harnett County is 11%, while the prevalence of undiagnosed wheezing is 18%. Based on these findings, Harnett County ranks 73<sup>rd</sup> of all North Carolina counties for prevalence of diagnosed asthma, and 61<sup>st</sup> for undiagnosed wheezing (50).

In 2000, there were 38 asthma-related hospital discharges in Harnett County, equaling a rate of 180.4 per 100,000 population. At the state level, there were 3364 asthma-related discharges, equaling a rate of 201.3 per 100,000 (51 and 52).

## Cardiovascular and Respiratory Disease

Table 16 (following page) shows Harnett County hospitalizations for cardiovascular and circulatory disease and for respiratory diseases, although no data exist for linking a hospitalization episode with a particular cause (e.g. air pollution).

Table 17 (following page) presents recent Harnett County and NC mortality rates for heart disease, cerebrovascular disease and chronic lower respiratory disease. The mortality rate for each of these conditions is higher in Harnett County than in NC as a whole.

**Table 16. Cardio Vascular and Respiratory Events. Inpatient Hospital Utilization and Charges by Principle Diagnosis, Harnett County, 2004**

DIAGNOSTIC CATEGORY	TOTAL CASES	DISCHARGE RATE PER 1,000 POP	AVG DAYS STAY	DAYS STAY RATE PER 1,000 POP	TOTAL CHARGES	AVG CHARGE PER DAY	AVERAGE CHARGE PER CASE
<b>CARDIOVASCULAR &amp; CIRCULATORY DISEASES</b>	2,111	21.2	5.0	106.1	\$53,966,715	\$5,105	\$25,565
-- Heart Disease	1,476	14.8	4.9	73.2	\$42,976,898	\$5,890	\$29,117
-- Cerobrovascular Disease	336	3.4	4.8	16.2	\$4,893,745	\$3,040	\$14,565
<b>RESPIRATORY DISEASES</b>	1,168	11.7	5.9	69.1	\$18,166,590	\$2,640	\$15,554
-- Pneumonia/Influenza	418	4.2	5.8	24.5	\$6,104,065	\$2,499	\$14,603
-- Chronic Obstructive Pulmonary Disease	389	3.9	4.5	17.7	\$4,173,168	\$2,372	\$10,728

**Table 17. Detailed Mortality Statistics, North Carolina and Harnett County 2000-2004**

DIAGNOSTIC CATEGORY	North Carolina		Harnett County	
	Number	Rate	Number	Rate
<b>Diseases of the Heart</b>	93,024	233.9	990	252.9
<b>Cerebrovascular Diseases</b>	26,461	67.4	281	74.1
<b>Chronic Lower Respiratory Diseases</b>	18,350	46.0	247	63.0

## Vehicle Emission Mandates

As of January 1, 2006 the following counties have mandatory vehicle emissions testing:  
Harnett County is included in the list.

Alamance, Brunswick, Buncombe, Burke, Cabarrus, Caldwell, Carteret, Catawba, Chatham, Cleveland, Craven, Cumberland, Davidson, Durham, Edgecombe, Forsyth, Franklin, Gaston, Granville, Guilford, **Harnett**, Haywood, Henderson, Iredell, Johnston, Lee, Lenoir, Lincoln, Mecklenburg, Moore, Nash, New Hanover, Onslow, Orange, Pitt, Randolph, Robeson, Rockingham, Rowan, Rutherford, Stanly, Stokes, Surry, Union, Wake, Wayne, Wilkes, Wilson.

## Indoor Ambient Air

### Indoor Smoking

The following tables show indoor smoking data. Table 18 describes how Harnett County and North Carolina householders establish and enforce smoking “rules” in their homes. Table 19 provides a broader view of smoking using national and state data (53).

	<b>Not Allowed Anywhere</b>	<b>Allowed in Some Places</b>	<b>Allowed Anywhere</b>	<b>No Rules About Smoking</b>
North Carolina	72.3%	8.1%	7.0%	12.6%
Harnett County	69.8%	8.9%	5.4%	15.9%

	<b>Current Smoker &amp; Children in the Home</b>	<b>Smoking Allowed in All or Some Home Areas</b>	<b>Children Exposed to ETS in the Home</b>
North Carolina	10.1%	87.5%	26.1%
National average	9.8%	87.5%	23.13%

According to the 2004 BRFSS, 27.7 percent of all children in North Carolina reside in households with adult smokers, versus 30.2% in Harnett County (Table 20). Based on data reported to the CDC by states, 26.1% of children in North Carolina are exposed to environmental tobacco smoke in the home, versus 23.13 percent of children at the national level.

	<b>Current Smoker in House</b>	<b>Former Smoker</b>	<b>Never Smoked</b>
North Carolina	22.5%	23.3%	54.2%
Harnett County	24.7%	22.2%	53.1%

### School Smoking Policies

As of May 2006, 72 of North Carolina's 115 School districts had adopted 100% Tobacco-Free 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. In a time of increased knowledge about the risks of tobacco use and the need to protect our health, it is important that North Carolina's public schools join other public institutions that have established no smoking regulations in order to safeguard our students and school community (54).

Harnett County is one of the 43 school districts in North Carolina that have not yet adopted a 100% Tobacco-Free school policy.

## Building Air Quality

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 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 (55).

Currently there is no compiled data on either SBS or BRI at the state or local level.

## Gas and Vapor Poisoning

In North Carolina in 2004, there were 10 deaths due to accidental exposure to gases and vapors; 30 deaths due to intentional self-poisoning by other gases and vapors, and one death due to assault by gases and vapors (56). In Harnett County in 2004, there were no deaths due to intentional or unintentional poisoning by gases and vapors.

Carbon monoxide (CO) is a gas that can build up to dangerous levels indoors when fuel-burning devices are not properly operated, vented, or maintained. In 2004 there were 37 deaths statewide due to CO poisoning, eight of which were unintentional.

## School Air Quality

An issue of growing importance these days is the air quality in our nation's schools. A study published by the 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.

North Carolina does not have any policies addressing indoor air quality, 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 (57).

Data specific to Harnett County schools was not available.

## Lead Hazards

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. Studies have demonstrated that housing built prior to 1950 and households with income below the poverty threshold have an elevated risk of lead contamination (58).

Table 21 presents childhood blood lead screening data for one- and two-year-old children in Harnett County and NC.

	<b>Target Population</b>	<b>Number Screened</b>	<b>Percent Screened</b>	<b>Number with Lead &gt;10</b>	<b>Percent &gt;10</b>
Harnett County	2,865	1,107	38.6	11	1.0
North Carolina	238,065	96,623	40.6	873	0.9

There were no hospitalizations from lead poisoning in children in 2004-2005 in Harnett County.

## 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.

By their very nature, most pesticides create some risk of harm - Pesticides can cause harm to humans, animals, or the environment because they are designed to kill or otherwise adversely affect living organisms (50).

Different kinds of crops require different kinds of pesticides. Table 22 shows a summary of agriculture found in Harnett County. Tables 23-26 illustrate chemical applications for a sampling of crops grown in Harnett County.

<b>Table 22. Harnett County Census of Agriculture, 2002</b>				
Total Area in County, Acres	380,826			
Number of Farms	730			
Total Land in Farms, Acres	114,361			
Average Farm Size, Acres	157			
Harvested Cropland, Acres	53,128			
Average Age of Farmers	55			
Average Value of Farm and Buildings	\$579,018			
Average Market Value of All Machinery and Equipment	\$73,725			
Average Farm Production Expenses	\$121,279			
<b>Crops - 2004</b>	<b>Acres Harvested</b>	<b>Yield</b>	<b>Production</b>	<b>Rank Within State</b>
Tobacco, lbs.	4,780	2,430	11,626,000	9
Cotton, 480 lb. bales	14,200	801	23,700	24
Soybeans, Bu.	29,500	29	860,000	24
Corn, Bu.	2,200	116	255,000	50
Corn for Silage, Tons	*	*	*	*
Peanuts, lbs.	*	*	*	*
Small Grains:				
Wheat, Bu.	4,000	37	147,000	43
Barley, Bu.	*	*	*	*
Oats, Bu.	800	75	60,000	7
Sweet potatoes, Cwt.	1,200	170	202,000	10
Irish Potatoes, Cwt.	*	*	*	*
All Hay, Tons	4,500	3.11	14,000	48
Sorghum, Bu.	*	*	*	*
<b>LIVESTOCK</b>	<b>Number</b>	<b>Rank Within State</b>		
Hogs and Pigs (Dec. 1, 2004)	75,000	20		
Cattle (Jan. 1, 2005)	7,900	44		
Beef Cows (Jan. 1, 2005)	3,500	43		
Milk Cows (Jan. 1, 2005)	*	*		
Broilers Produced (2004)	26,500,000	8		
Turkeys Raised (2004)	*	*		
All Chickens (Dec. 1, 2004)	*	*		

<b>Table 23. Cotton Agricultural Chemical Applications, Harnett County, 2003</b>			
<b>Agricultural Chemicals</b>	<b>Rate per application</b>	<b>Rate per crop year</b>	<b>Pounds per year</b>
	Pounds per Acre		
<b>Herbicides:</b>			
2,4-D	0.43	0.43	6106
Carfentrazone-ethyl	0.03	0.03	426
Fluometuron	0.97	0.98	13916
Glyphosate	0.70	1.72	24424
MSMA	1.39	1.47	20874
Pendimethalin:	0.68	0.68	9656
Prometryn	0.80	0.88	12496
Pyraflufen ethyl	0.003	0.003	42.6
Pyriithiobac-sodium	0.03	0.04	568
S-Metolachlor	0.95	0.95	13490
<b>Insecticides:</b>			
Acephate	0.28	0.33	4686
Aldicarb	0.67	0.68	9656
Cyfluthrin	0.03	0.04	568
Cypermethrin	0.07	0.09	1278
Dicrotophos	0.21	0.30	4260
Lambda-cyhalothrin	0.02	0.03	426
Phorate	0.80	0.80	11360
Zeta-cypermethrin	0.03	0.03	426
<b>Fungicides:</b>			
Etridiazole	0.13	0.13	1846
Mefenoxam	0.13	0.13	1846
PCNB	0.55	0.58	8236
<b>Other Chemicals:</b>			
Cyclanilide	0.15	0.15	2130
Ethephon	1.15	1.16	16472
Mepiquat chloride	0.07	0.12	1704
Monocarbamide dihyd.	3.32	3.35	47570
Paraquat	0.32	0.40	5680
Thidiazuron	0.05	0.05	710
Tribufos	0.66	0.66	9372

<b>Table 24. Soybeans Agricultural Chemical Applications, Harnett County, 2002</b>			
<b>Agricultural Chemicals</b>	<b>Rate per application</b>	<b>Rate per crop year</b>	<b>Pounds per year</b>
	Pounds per Acre		
<b>Herbicides:</b>			
Glyphosate	0.71	0.98	28910
Imazethapyr	0.04	0.04	1180
Paraquat	0.39	0.39	11505
Pendimethalin	0.53	0.53	15635
<b>Insecticides:</b>			
Esfenvalerate	0.03	0.03	885
Lambda-cyhalothrin	0.02	0.02	590

<b>Table 25. Corn: Agricultural Chemical Applications, Harnett County, 2003</b>			
<b>Agricultural Chemicals</b>	<b>Rate per application</b>	<b>Rate per crop year</b>	<b>Pounds per year</b>
	Pounds per Acre		
<b>Herbicides:</b>			
2,4-D	.36	0.40	880
Alchlor	1.82	1.82	4004
Ametryn	1.12	1.12	2464
Altazine	1.18	1.22	2684
Dichlorprop	0.26	0.31	682
Glyphosate	0.69	1.00	2200
Linuron	0.80	0.80	1760
Metolachlor	1.35	1.35	2970
Nicosulfuron	0.02	0.02	44
Paragat	0.50	0.52	1144
Rimsulfuron	0.01	0.01	22
S-Metolachlo	1.10	1.10	2420
Simazine	1.14	1.14	2508
<b>Insecticides</b>			
Chlorpyrifos	1.06	1.06	2332
Terbufos	1.01	1.01	2222

<b>Table 26. Wheat: Agricultural Chemical Applications, Harnett County, 2000</b>			
<b>Agricultural Chemicals</b>	<b>Rate per application</b>	<b>Rate per crop year</b>	<b>Pounds per year</b>
	Pounds per Acre		
<b>Herbicides:</b>			
2,4-D	0.66	0.66	3168
Diclofop-methyl	0.58	0.58	2320
Thifensulfuron	0.02	0.02	80
Tribenuron-methyl	0.01	0.01	40

## 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 system in the body (59).

No accidental deaths due to pesticide-related poisoning in Harnett County in 2004.

## Pesticide Residues in Food

In 2005, the state lab reported four food samples statewide in violation of safe levels of pesticide residues, representing less than 1% of all samples analyzed

## Sun and Ultraviolet Light

In 1998, there were 573 cases of melanoma among males in North Carolina, indicating a rate of 17.1 per 100,000 population. There were 462 cases of melanoma among females in North Carolina in 1998, indicating a rate of 11.2 per 100,000 population (60).

Interpretations of melanoma data should be treated with caution, since the thoroughness of case-finding is suspect due to the likelihood that cases may be treated outside of hospitals and not reported to the Central Cancer Registry (CCR). Data on basal and squamous cell skin cancers are not collected by the CCR unless they have spread to tissue beyond the original site. Malignant melanoma may occur at many different body sites; however, CCR focuses on melanoma of the skin (61).

Incidence rates for skin cancers are ten times higher among whites than African Americans. Nationally, over one million cases of the highly curable basal and squamous cell skin cancers occur annually. The most serious skin cancer is melanoma, and 1,445 North Carolinians will be diagnosed with this form of skin cancer in 2004. During the 1970s, the national incidence rate for melanoma increased about 6% per year. Since 1981, the melanoma incidence rates have increased an average of 3% each year. Other forms of skin cancer include Kaposi sarcoma and cutaneous T-cell lymphoma. An estimated 220 North Carolinians are likely to die in 2004 from malignant melanoma. North Carolina melanoma mortality rates are higher than the nation's and are especially high in rural counties (62).

In 2004, there were 320 deaths in North Carolina attributed to malignant neoplasms of the skin, 202 among white men, 108 among white women, five among minority males, and five among minority females. Most of the deaths (245) were reported as malignant melanoma. In Harnett County in the same year, there were two deaths attributed to malignant melanoma of the skin, both among white females (63).

# Land Contamination

## Chemicals

*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; none of them is in Harnett County.

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 North Carolina Brownfields program aims to alleviate that liability for possible developers. As of March 31, 2005 there were no brownfields sites in Harnett County.

An *inactive hazardous site* is any site where hazardous substance or waste contamination exists that isn't already under the jurisdiction of another program. There is one such site in the county in the Town of Lillington (25),

## Animal Waste

Animal waste generation of between 1.5 and 4.5 *million* tons occurs annually in North Carolina counties. 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. Of the 98 North Carolina counties ranked for animal waste generation, Harnett County was ranked 23rd (26).

## Solid Waste Management

In FY 2002-2003 Harnett County was listed as having collected 70,201 tons of solid waste destined for landfills in the county's name (27).

No solid waste penalties or compliance orders have been issued to Harnett County by the state's Solid Waste Program for 2000-2006 (28).

The North Carolina Department of Environment and Natural Resources, Division of Waste Management currently lists the following solid waste facilities in Harnett County (Table 27) (64):

<b>Facility Type<sup>1</sup></b>	<b>Status</b>	<b>Name</b>	<b>Address</b>
MSWLF	Closed	HARNETT CO LANDFILL	Dunn/Erwin
CDLF	Open	HARNETT CO CDLF	Dunn/Erwin
CDLF	Open	HARNETT CO ANDERSON CRK C&D LANDFILL	Lillington
MSWLF	Closed	HARNETT CO ANDERSON CREEK LANDFILL	Lillington
TIRELF	Open	CENTRAL CAROLINA TIRE MONOFILL	Cameron
TRANSFER	Open	HARNETT CO TRANSFER STATION	Spring Lake
TIRETP	Closed	ENVIROTIRE RECYCLING	Lillington
TRANSFER	Open	HARNETT CO-DUNN/ERWIN TRANSFER STA	Dunn
TIRETP	Open	CENTRAL CAROLINA TIRE PROCESSING	Cameron
DEMO	Closed	CAMPBELL UNIVERSITY	Buies Creek
LCID	Closed	HARNETT CO LCID LANDFILL	Lillington/Anderson Creek
LCID	Open	BLAYLOCK GRADING LCID LANDFILL	Johnsonville
LCID	Open	BRYANT GRADING LCID LANDFILL	Fuqua-Varina
LCID	Open	MCARTAN MINE LCID LANDFILL	Bunnlevel

<sup>1</sup> MSWLF = Municipal Solid Waste Landfill, CDLF = Construction and Demolion Landfill, LCID = Landclearing and Inert Debris, TRANSFER = Transfer station, TIRETP = Tire Treatment & Processing

## 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 28 lists the number of cases of major reportable food-, water- and vector-borne diseases reported during the past four years. Comparable data for North Carolina are provided for 2004 only (65).

	2001	2002	2003	2004	NC (2004)
California group encephalitis	0	0	0	0	0
Cryptosporidiosis	0	2	0	0	76
Eastern equine encephalitis	0	0	0	0	0
E.coli (Shiga toxin-producing)	0	0	0	1	152
Ehrlichiosis (monocytic)	0	0	0	0	35
Hepatitis A	6	1	1	4	106
Lyme disease	0	2	0	2	123
Rocky Mountain spotted fever	2	7	6	7	535
Salmonellosis	12	7	14	30	1,648
Shigellosis	1	1	11	1	476
West Nile virus	0	0	0	0	4

## Arboviral Diseases

Arboviral diseases are viral diseases transmitted from an animal host to humans (and 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 North Carolina 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.

North Carolina reported two positive human case of WNV in 2004 (in Mecklenburg and Onslow counties) and 22 positive human cases in 2003, none of which occurred in Harnett County. In 2003 the presence of WNV was confirmed in the three to six category for wild birds in Harnett County. In 2004 no dead birds were confirmed positive for WNV in the county (29).

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 2003, Harnett County was listed in the Veterinary category as having 5 to 11 positive cases and in 2004 one case was listed as positive. No sentinel flocks or human cases were confirmed in Harnett County in 2002-2005 (30).

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 from 1990 forward; however, not all years are available for all counties, so statewide totals are likely unrepresentative of an actual number of cases.

Table 29 shows the number of cases of rabies in animals in Harnett County from 2001 through 2004. In recent years, raccoons typically have been the animals found to be infected with rabies most often in Harnett County (31).

	<b>Bat</b>	<b>Bobcat</b>	<b>Dog</b>	<b>Fox</b>	<b>Skunk</b>	<b>Raccoon</b>	<b>Total</b> <sup>1</sup>
<b>Harnett</b>	0	2	0	2	0	10	12
<b>North Carolina</b>	123	11	29	247	414	1,697	2,628

<sup>1</sup> The State figure is total for all animal hosts. Some animals with no incidence of rabies in Harnett County are not listed in this table.

## References

1. North Carolina Division of Water Quality, <http://h2o.enr.state.nc.us/ams.html> (accessed February, 2006).
2. Scorecard, The Pollution Information Site, [http://www.scorecard.org/env-releases/cap/county.tcl?fips\\_county\\_code=37085](http://www.scorecard.org/env-releases/cap/county.tcl?fips_county_code=37085) (accessed February, 2006).
3. United States Environmental Protection Agency, <http://oaspub.epa.gov/enviro/> (accessed March, 2006).
4. United States Environmental Protection Agency, <http://oaspub.epa.gov> (accessed March, 2006).
5. United States Census Bureau, <http://www.census.gov/prod/2005pubs/06statab/trans.pdf> (accessed March, 2006).
6. North Carolina Department of Transportation, Gazetteer of Intermodal Transportation in North Carolina, <http://www.ncdot.org/transit/transitnet/PublicInfo/Gazetteer.html> (accessed January 2006).
7. United States Environmental Protection Agency, Outdoor Air Quality, <http://www.epa.gov/asthma/outdoorair.html> (accessed, January, 2006).
8. North Carolina Center for Health Statistics, County Level Data, County Health Data Book, <http://www.schs.state.nc.us/SCHS> (accessed February, 2006).
9. United States Environmental Protection Agency, An Introduction to Indoor Air Quality, <http://www.epa.gov/iaq/ia-intro.html> (accessed March, 2006).
10. University of North Carolina Health Care, [http://www.unchealthcare.org/site/newsroom/news/2004/Feb/passive\\_smoking](http://www.unchealthcare.org/site/newsroom/news/2004/Feb/passive_smoking) (accessed March, 2006).
11. North Carolina Center for Health Statistics, Behavioral Risk Factor Surveillance System, <http://www.schs.state.nc.us/SCHS/brfss/2004/> (accessed February, 2006).
12. University of North Carolina Health Care, [http://www.unchealthcare.org/site/healthpatientcare/goodmedicine/carbon\\_monoxide\\_poisoning.htm](http://www.unchealthcare.org/site/healthpatientcare/goodmedicine/carbon_monoxide_poisoning.htm) (accessed March, 2006).
13. North Carolina State Center for Health Statistics, Detailed Mortality Statistics, <http://www.schs.state.nc.us/SCHS/deaths/dms/2004/> (accessed February, 2006).
14. Information provided by Kathleen.Jones-Vessey, North Carolina Department of Health and Human Services, State Center for Health Statistics.
15. National Association of State Boards of Education, Healthy Schools, <http://www.nasbe.org/HealthySchools/States/> (accessed February, 2006).
16. North Carolina Tobacco-Free Schools, <http://www.nctobaccofreeschools.com/why/index.shtm> (accessed March, 2006).

17. North Carolina Department of Environment and Natural Resources, Environmental Health Services Section, Children's Environmental Health, [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)
18. Healthy People 2010 Midcourse Review, Noise-induced Hearing Loss in Adults <http://www.healthypeople.gov/Data/midcourse/comments/faobjective.asp?id=28&subid=18> (accessed March, 2006).
19. Center for Disease Control, National Institute for Occupational Safety and Health, Noise and Hearing Loss Prevention, <http://www.cdc.gov/niosh/topics/noise/aboutnlp/workerhl.html> (accessed March, 2006).
20. United States Environmental Protection Agency, Pesticides, <http://www.epa.gov/pesticides/about/index.htm> (accessed March, 2006).
21. North Carolina Department of Agriculture and Consumer Services, <http://www.agr.state.nc.us/stats/otherept.htm> (accessed April, 2006)
22. United States Environmental Protection Agency, <http://www.epa.gov/sunwise/uvandhealth.html> (accessed April, 2006).
23. National Weather Service, Climate Prediction Service, [http://www.cpc.ncep.noaa.gov/products/stratosphere/uv\\_index/uv\\_archive.shtml](http://www.cpc.ncep.noaa.gov/products/stratosphere/uv_index/uv_archive.shtml) (accessed April, 2006).
24. North Carolina State Center for Health Statistics, <http://www.schs.state.nc.us/SCHS/CCR/FactsFigures2004.pdf> (accessed April, 2006).
25. North Carolina Department of Environment and Natural Resources, Division of Waste Management, Inactive Hazardous Sites Inventory By County, [http://www.wastenotnc.org/SFHOME/IHS\\_County\\_List.pdf](http://www.wastenotnc.org/SFHOME/IHS_County_List.pdf) (accessed April, 2006).
26. Scorecard, The Pollution Information Site, Animal Waste, [http://www.scorecard.org/env-releases/aw/county.tcl?fips\\_county\\_code=37085#trends](http://www.scorecard.org/env-releases/aw/county.tcl?fips_county_code=37085#trends) (accessed April, 2006).
27. North Carolina Department of Environment and Natural Resources <http://wastenot.enr.state.nc.us/swhome/AnnualReport02-03/countydisposal02.pdf> (accessed April, 2006).
28. North Carolina Department of Environment and Natural Resources, Solid Waste Program, <http://www.wastenotnc.org/sw/swpenalties.asp> (accessed April, 2006).
29. North Carolina Department of Environment and Natural Resources, Division of Environmental Health, Public Health Pest Management, <http://www.deh.enr.state.nc.us/phpm/html/wvnv.html> (accessed June, 2006).
30. North Carolina Department of Environment and Natural Resources, Division of Environmental Health, Public Health Pest Management, <http://www.deh.enr.state.nc.us/phpm/html/wvnv.html> (accessed June, 2006).

31. North Carolina State Laboratory Public Health Virology, <http://slph.state.nc.us/VirologySerology/Rabies/PositiveCountBySourceCounty.asp> (accessed June, 2006).
32. Surveillance of Hazardous Substance Emergency Events in North Carolina, <http://www.epi.state.nc.us/epi/oii/pdf/HSEES1998-2001.pdf> (accessed April, 2006).
33. Scorecard, The Pollution Information Site, [http://www.scorecard.org/env-releases/county.tcl?fips\\_county\\_code=37085#major\\_chemical\\_releases](http://www.scorecard.org/env-releases/county.tcl?fips_county_code=37085#major_chemical_releases) (accessed April, 2006).
34. United States Environmental Protection Agency, Pollution Reports for Chemical Emergency and Removal Cleanups, <http://www.epa.gov/region4/waste/errb/polreps.htm> (accessed April, 2006).
35. Scorecard, The Pollution Information Site, [http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips\\_county\\_code=37085&cancer\\_p=1](http://www.scorecard.org/env-releases/county-health-impact-detail.tcl?fips_county_code=37085&cancer_p=1) (accessed April, 2006).
36. North Carolina Division of Water Quality, Ambient Monitoring, Basin Assessment Reports, <http://h2o.enr.state.nc.us/> (accessed January, 2006).
37. North Carolina Division of Water Quality, Ambient Monitoring, Station Locations, <http://h2o.enr.state.nc.us/> (accessed January, 2006).
38. Scorecard, The Pollution Information Site, <http://www.scorecard.org/env-releases/water/> (accessed January, 2006).
39. North Carolina Recreational Water Quality Program, [http://www.deh.enr.state.nc.us/shellfish/Water\\_Monitoring/RWQweb/2005swimadv.htm](http://www.deh.enr.state.nc.us/shellfish/Water_Monitoring/RWQweb/2005swimadv.htm)
40. U.S. Environmental Protection Agency, Ground Water and Drinking Water, Violation and Enforcement History, <http://www.epa.gov/safewater/dwinfo/nc> (accessed February, 2006).
41. North Carolina State Laboratory Public Health Environmental Sciences - Microbiology, <http://slph.state.nc.us/EnvironmentalSciences/microbiology/> (accessed January, 2006).
42. North Carolina Division of Water Quality, <http://gw.ehnr.state.nc.us/PirfPublic1.ASP> (accessed January, 2006).
43. United States Environmental Protection Agency, Enforcement and Compliance, [http://oaspub.epa.gov/enviro/echo\\_test.call\\_url?p\\_idea\\_county=harnett&p\\_idea\\_state=NC](http://oaspub.epa.gov/enviro/echo_test.call_url?p_idea_county=harnett&p_idea_state=NC) (accessed February, 2006).
44. United States Environmental Protection Agency, Enforcement and Compliance, [http://oaspub.epa.gov/enviro/echo\\_test.call\\_url?p\\_idea\\_county=harnett&p\\_idea\\_state=NC](http://oaspub.epa.gov/enviro/echo_test.call_url?p_idea_county=harnett&p_idea_state=NC) (accessed February, 2006).
45. Scorecard, The Pollution Information Site, [http://www.scorecard.org/env-releases/cap/county.tcl?fips\\_county\\_code=37085](http://www.scorecard.org/env-releases/cap/county.tcl?fips_county_code=37085) (accessed February, 2006).
46. Center for Disease Control, National Center for Health Statistics, [http://www.cdc.gov/nchs/data/dvs/mortfinal2002\\_workipt2.pdf](http://www.cdc.gov/nchs/data/dvs/mortfinal2002_workipt2.pdf) (accessed February, 2006).

47. North Carolina Department of Health and Human Services, Division of Public Health, Women's and Children's Health Section, Asthma, <http://wch.dhhs.state.nc.us/Asthma/surveillance.htm> (accessed February, 2006).
48. North Carolina Department of Health and Human Services, Division of Public Health, Women's and Children's Health Section, Asthma, <http://wch.dhhs.state.nc.us/Asthma/surveillance.htm> (accessed February, 2006).
49. North Carolina Center for Health Statistics, Behavioral Risk Factor Surveillance System, <http://www.schs.state.nc.us/SCHS/brfss/2004/nc/all/housesmk.html> (accessed February, 2006).
50. North Carolina Center for Health Statistics, Behavioral Risk Factor Surveillance System, <http://www.schs.state.nc.us/SCHS/brfss/2004/nc/all/housesmk.html> (accessed February, 2006).
51. Center for Disease Control, Public Publications, <ftp://ftp.cdc.gov/pub/Publications/mmwr/wk/mm4644.pdf> (accessed February, 2006)
52. North Carolina Center for Health Statistics, Behavioral Risk Factor Surveillance System, <http://www.schs.state.nc.us/SCHS/brfss/2004/nc/all/housesmk.html> (accessed February, 2006).
53. North Carolina Center for Health Statistics, Behavioral Risk Factor Surveillance System, [http://www.schs.state.nc.us/SCHS/brfss/2004/nc/all/\\_rfsmok2.html](http://www.schs.state.nc.us/SCHS/brfss/2004/nc/all/_rfsmok2.html) (accessed February, 2006).
54. North Carolina Tobacco-Free Schools, <http://www.nctobaccofreeschools.com/> (accessed February, 2006).
55. United States Environmental Protection Agency, Indoor Air Quality, <http://www.epa.gov/iaq/pubs/sbs.html> (accessed February, 2006).
56. North Carolina Center for Health Statistics, Detailed Mortality Statistics Report, 2004 North Carolina Resident Deaths, <http://www.schs.state.nc.us/SCHS/deaths/dms/2004/northcarolina.pdf> (accessed February, 2006).
57. Environmental Health Center, Indoor Air Quality and Schools, <http://www.nsc.org/EHC/indoor/schools.htm> (accessed February, 2006).
58. North Carolina Department of Environment and Natural Resources, Environmental Health Services Section, Children's Environmental Health, [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)
59. United States Environmental Protection Agency, Pesticides, <http://www.epa.gov/pesticides/health/human.htm> (accessed March, 2006).
60. North Carolina Center for Health Statistics, State Center for Health Statistics, Central Cancer Registry, <http://www.schs.state.nc.us/SCHS/pdf/incidence1998.pdf> (accessed March, 2006).
61. North Carolina Center for Health Statistics, State Center for Health Statistics, Cancer Profiles, <http://www.schs.state.nc.us/SCHS/CCR/cp2005/NorthCarolina2005Profiles.pdf> (accessed March, 2006).

62. North Carolina Center for Health Statistics, State Center for Health Statistics, Cancer Profiles, <http://www.schs.state.nc.us/SCHS/CCR/cp2005/NorthCarolina2005Profiles.pdf> (accessed March, 2006).
63. North Carolina Center for Health Statistics, State Center for Health Statistics, <http://www.schs.state.nc.us/SCHS/deaths/dms/2000/> (accessed March, 2006).
64. North Carolina Department of Environment and Natural Resources, Solid Waste Program, <http://www.wastenotnc.org/sw/swfacilitylist.asp> (accessed April, 2006).
65. Epidemiology in North Carolina, Disease Tables, <http://www.epi.state.nc.us/epi/gcdc/pdf/> (accessed April, 2006).